Indian Minerals Yearbook 2011

(Part- I)

50th Edition

INDIAN MINERAL INDUSTRY & NATIONAL ECONOMY

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 001

PHONE/FAX NO. +91712 - 2565471
PBX : +91712 - 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

1 Indian Mineral Industry & National Economy

NATIONAL ECONOMY

The Indian economy was estimated to grow by 6.9% in 2011-12 after having grown at the rate of 8.4% in each of the two preceding years. Despite this slowdown, India remains among the front-runners by any cross-country comparison. With agriculture and services continuing to perform well, India's slowdown can be attributed almost entirely to weakening industrial growth.

Gross Domestic Product (GDP) is an important key indicator by which a nation's economic performance is gauged. Economic policies bring about pronounced changes in the industrial climate, foreign trade, domestic and international taxation policies, monetary exchange rates, etc., that have overarching effects on the overall growth of an economy. As per advance estimates in India's Economic Survey, 2011-12, GDP growth rate at factor cost (at constant 2004-05 prices) touched 6.9% in 2011-12 as against 6.7% in 2008-09, 8.4% in 2009-10 and 8.4% in 2010-11 also as per Quick Estimates.

Economic parameters as per advance estimates published in Economic Survey 2011-12 reveal that the GDP in 2011-12 at current market prices and at factor cost at constant 2004-05 prices was ₹ 89,12,178 crore and ₹ 52,22,027 crore, respectively. At sectoral level, growth is estimated to be 2.5% for 2011-12 for agriculture and allied sectors, a little lower than expected compared to 7% achieved in 2010-11. Growth in the services sector is likely to be 9.4% in 2011-12 as against 9.3% in 2010-11. Thus, it is primarily the dip in growth in industry to 3.9% in 2011-12 that has led to the slowdown in real gross domestic product (GDP) growth. The industrial sector performed poorly this year and the share of industry in the GDP which had peaked at 28.7% has now retreated to 27%.

Industrial growth, measured in terms of the index of industrial production (IIP), shows fluctuating trends. Growth had reached 15.5% in 2007-08 and then started decelerating. Initial deceleration in industrial growth was largely on account of the global economic meltdown. There was, however, a recovery from 2.5% in 2008-09 to 5.3% in 2009-10 and 8.2% in 2010-11. Overall growth during April-December 2011 reached 3.6% compared to 8.3% in the corresponding period of the previous year. There was a contraction in production in the mining sector, particularly the coal and natural gas segments. Contraction in output also resulted in its contribution to growth turning negative. The electricity sector witnessed an improvement in growth in the current year. This sector contributed 22.6% to overall industrial growth, which was more than twice its weight in the IIP. Growth moderated in the manufactring sector, from 9% in April-December 2010 to 3.9% in April-December 2011, which, given its large share in the IIP, led to a slowdown in the industry sector as a whole.

Performance of eight core industries during 2011-12 (April-December 2011) was mixed compared to that during 2010-11. Power generation registered a growth of 9.3%, while growth in finished steel and cement industries was 5.7% and 5.1%, respectively. Refinery production and crude oil also recorded a growth of 4.1% and 1.9% during the said period over 2010-11. However, negative growth rate was recorded in natural gas (-8.8%), coal (-2.7%), and fertilizer (-0.5) industries during the same period. During 2011-12 (April-December 2011), power generation, cement and refinery production industries recorded higher growth rate as compared to 2010-11. In the infrastructure segment, revenue-earning freight traffic handled by the Railways posted a 4.7% growth rate in 2011-12 (April-December) as compared to 3.8% in 2010-11. Growth rate of cargo handled at major ports during the said period was 0.4% compared to 1.6% in the preceding year. Export cargo and import cargo handled by the civil aviation sector recorded -1.1% and 1.4% growth rate, respectively, during the same period compared to 13.4% and 20.6% growth rate during the preceding year.

India's exports and imports registered a five to seven fold increase in the last decade from US$ 44.6 billion and US$ 50.5 billion, respectively, in 2000-01 to US$ 251.1 billion and US$ 369.8 billion in 2010-11, respectively. The compound annual growth rates (CAGR) of India's exports and imports (in US dollar terms) were 19.5% and 25.1% during 2000-01 to 2008-09. The resilience of India's trade can be seen from the fact that its export and import growth, which fell to -3.5% and -5% in 2009-10 as a result of the shock from the 2008 global economic crisis, rebounded to 40.5% and 28.2% in 2010-11. India not only reached pre-crisis level in exports,but surpassed pre-crisis trends in export growth rate unike many other developing and even developed countries. India's share in global exports and imports also increased from 0.7% and 0.8%, respectively, in 2000 to 1.5% and 2.2% in 2010 (1.4 and 2.1% as per WTO). Its ranking in the leading exporters and importers improved from 31 and 26 in 2000, to 20 and 13 in 2010, respectively.

Despite difficult conditions in the global economy, exports continued to be robust in the current year and registered a growth rate of 14.3% in real terms over and above 22.7% growth achieved in the previous year (2010-11), as per Advance Estimates. Imports are likely to end the year with a real growth rate of 17.5% as against 15.6% in 2010-11. It is noteworthy that international trade (exports and imports) as per national accounts is now around 53% of GDP, up from a level of 37% in 2004-05.

Trade deficit (on customs basis) increased by 8.2% to US$ 118.6 billion in 2010-11 from US$ 109.6 billion in 2009-10. However, trade deficit for 2011-12 (April-January) at US$ 148.7 billion was 40.4% higher than the US$ 105.9 billion in 2010-11 (April-January). Low export growth and moderate import growth which have led to the high trade deficit in 2011-12 (April-January) have raised the alarm of a possible unmanageable current account deficit. Net POL import growth, which has been positive since 2002-03 and became negative at -8.9% in 2009-10 turned positive again in 2010-11 with a growth of 9.8%. In the first half of 2011-12 the growth was 34% reflecting higher international crude oil price affected the dominent import side more than the export side.

Foreign Direct Investment (FDI), being a non-debt capital flow, is a leading source of external financing, especially for the developing economies. It is expected to bring not only capital and technical know-how but also increase the competitiveness of the economy. Overall, it supplements domestic investment, much required for sustaining the high growth rate. Since 2000, significant changes have been made in the FDI policy regime by the government to ensure that India becomes an increasingly attractive and investor-friendly destination. Cumulative amount of FDI inflows from April 2000 to December 2011 stood at US$ 240.06 billion, out of which FDI equity inflows amounted to US$ 157.97 billion. While FDI inflows declined globally in 2009 and 2010, India was able to largely insulate itself from the decline in global inflows. FDI flows moderated in 2010-11and rose to US$ 24.19 billion during April-December 2011, an increase of 50.8% as compared to the corresponding period of the previous year.

MINING INDUSTRY

Mineral production in the country maintained an upward swing. The index of mineral production (base 1993-94=100) for all minerals (excluding atomic minerals) stood at 204.95 points in 2010-11 as against 193.36 points in 2009-10 registering an increase of 6%.

In the mineral fuel sector, index for coal mining (including lignite) and petroleum & natural gas increased by 1.44 points (0.68%) and 18.4 points (11.16%), respectively, over 2009-10. Index for metallic and non-metallic minerals also rose by 7.19 points (2.47%) and 17.73 points (7.41%) respectively.

The total value of mineral production (including minor minerals but excluding atomic minerals) showed an increase of about 17% in 2010-11 at ₹ 2,32,021crore over that recorded in 2009-10 at ₹ 1,98,093 crore. This was due to overall rise in the production of lignite, natural gas (utilised), petroleum crude, chromite, copper concentrate, lead concentrate, zinc concentrate, barytes, diamond, garnet (abrasive), limestone, gypsum, wollastonite, etc. as also due to higher average value recorded by chromite, iron ore, copper concentrate, coal, diamond, gold and bauxite (Table-1).

In metallic ore, production increased in respect of chromite (24%), manganese ore (16%), copper concentrate (10%), lead concentrate (8%) and gold (7%). However, drop in production was observed in case of bauxite (11%) and iron ore (5%).

Among the important non-metallic minerals, rise in production in 2010-11 was observed in phosphorite/rock phosphate (34%), gypsum (29%), talc/soapstone/steatite and limestone (2% each) while substantial fall in production was noticed in the case of magnesite (24%), dolomite (14%) and kaolin (10%).

The value distribution of mineral production in 2010-11 showed that fuels accounted for about 66%, metallic minerals about 20%, non-metallic minerals about 2% and minor minerals about 12%. In the production value of metallic minerals, iron ore accounted for about 83%, chromite 5%, lead (conc.) and zinc (conc.) together 4%, manganese ore 3% and copper (conc.), primary gold, silver and bauxite 1% each. Value of tin concentrates production was nominal.

Table – 1 : Indian Mineral Industry : Value of Production*
2008-09 to 2010-11

(In ₹ million)

Sector	2008-09 (R)	2009-10 (R)	2010-11 (P)	% change between		Sectoral contribution to the total value in %	
				2008-09 and 2009-10	2009-10 and 2010-11	2009-10	2010-11
Total : All Sectors	**1788997**	**1980929**	**2320214**	**+10.73**	**+17.13**	**100.0**	**100.0**
Fuels	1147173	1336584	1539422	+16.51	+15.18	67.47	66.35
(a) Solid fuel	492248	550938	663517	+11.92	+20.43	27.81	28.60
(b) Liquid & gaseous fuels	654925	785646	875905	+19.96	+11.49	39.66	37.75
Metallic minerals	350760	317338	451564	-9.53	+42.30	16.02	19.46
Non-metallic minerals	40670	46700	48922	+14.83	+4.76	2.36	2.11
Minor minerals**	250394	280306	280306	+11.95	–	14.15	12.08

Figures rounded off individually.
** Excluding the minerals declared as prescribed substances under Atomic Energy Act, 1962.*
*** Earlier year's figure has been taken as estimate for 2010-11 because of non-receipt of data.*

Amongst the non-metallic minerals, about 96% value was shared by 12 minerals namely, limestone (66%), phosphorite/rock phosphate (11%), barytes (5%), dolomite & gypsum (3% each), garnet (abrasive) (2%) and kaolin, talc/soapstone/steatite, magnesite, marl, sillimanite & silica sand (about 1% each). The remaining 4% value was contributed by other non-metallic minerals. The production in respect of emerald, corundum (ruby and sapphire), garnet (gem) and pyrites was not reported.

India produced as many as 89 minerals which included 4 fuel minerals, 10 metallic minerals, 50 non-metallic (industrial minerals) including ilmenite, rutile and zircon which were atomic minerals earlier and 25 minor minerals (building and other materials) in 2010-11.

Indian Mining Industry is characterised by a large number of small operational mines. The total number of working mines, (excluding atomic minerals, minor minerals, crude petroleum and natural gas) in the country was 2,928 in 2010-11 as against 3,056 in 2009-10. Among them, 573 mines belonged to coal and lignite, 687 mines to metallic minerals and 1,668 mines to non-metallic minerals (Table-2). There were 778 mines in public sector and the remaining 2,150 mines in private sector.

The public sector continued to play a dominant role in mineral production in 2010-11 accounting for 58% or ₹ 1,34,227 crore in the total value. Small mines, which were mostly in the private sector, continued to be operated manually either as proprietary or partnership ventures. The minerals which were wholly mined/recovered by the public/joint sector during 2010-11 were copper ore, diamond, dunite, fluorite (conc. and graded), phosphorite/rock phosphate, rock salt, selenite and sulphur. By and large, almost the entire production of gold (primary), barytes, gypsum and sand (others) was from public sector. In 2010-11, the public sector accounted for sizeable 97% production of lignite, 91% of coal, 82% of tin (conc.), 74% of petroleum (crude), 69% of kyanite and 65% of magnesite.

Table – 2 : Number of Operating Mines 2009-10 and 2010-11

Sector	2009-10 (R)	2010-11 (P)
All Minerals*	**3056**	**2928**
Public sector	767	778
Private sector	2289	2150
Coal (including lignite)	573	573
Metallic minerals	701	687
Non-metallic minerals	1782	1668

** Excluding atomic minerals, petroleum (crude), natural gas (utilised) and minor minerals.*

In 2010-11, the mining and quarrying sector accounted for about 2.67% of the total GDP. The contribution of Mining and Quarrying sector in the total GDP in 2010-11 was ₹ 1,91,207 crore indicating an increase of 21.48% over that in the preceding year. This was mainly due to rise in the value of coal, lignite, petroleum (crude), chromite, copper conc., gold, iron ore, lead & zinc conc., manganese ore, among metallic minerals and barytes, diamond, dolomite, garnet (abrasive), gypsum, kaolin, limestone, magnesite, dunite, ochre and phosphorite/rock phosphate among non-metallic minerals in 2010-11.

The contribution of minerals covered under MCDR, 1988 (which include metallic and non-metallic minerals but exclude petroleum, natural gas, coal lignite, sand for stowing, atomic minerals and minor minerals) was ₹ 44,016 crore, i.e., about 23%, to the GDP accrued from Mining & Quarrying sector in 2010-11. Of this, share of metallic minerals was 21% and that of non-metallic minerals was about 2%. Among metallic minerals, iron ore accounted for 18% while chromite, lead & zinc concentrates and manganese ore accounted for about 1% each in 2010-11. Among the non-metallic minerals, the share of limestone was about 1%. The share contributed by the remaining minerals was nominal.

In 2010-11, production of minerals covered under MCDR, 1988 was reported from 20 States. Accrual to GDP from Mining & Quarrying sector by minerals covered under MCDR, 1988 was accounted for mainly by Odisha (36%), Chhattisgarh (18%), Goa (15%), Karnataka (14%), Rajasthan (7%), Jharkhand (3%), Andhra Pradesh & Madhya Pradesh (2% each) and Maharashtra, Tamil Nadu & Gujarat (1% each).

The average daily employment in mining sector in 2010-11 was estimated at 5,18,419 persons. The public sector accounted for 4,17,206 persons (80%) and the private sector the remaining 1,01,213 persons (20%) .

India's ranking in 2010 in world production was 2nd in barytes and talc/steatite/ pyrophyllite; 3rd in chromite, coal & lignite and zinc; 4th in iron ore, kyanite/sillimanite and steel (crude); 5th in manganese ore; 6th in bauxite & aluminium; 10th in refined copper; and 11th in magnesite. The statistics on indigenous and world production of principal minerals and metals are given in Table-3.

Table – 3 : Contribution and Rank of India in World Production of Principal Minerals & Metals, 2010

Commodity	Unit of quantity	Production		Contribution (Percentage)	India's rank in order of quantum of production
		World	India*		
Mineral Fuels					
Coal & lignite	Million tonnes	7153	570	8.0	3rd
Petroleum (crude)	Million tonnes	3901	38	1.0	25th
Metallic Minerals					
Bauxite	'000 tonnes	219000	12641	5.8	6th
Chromite	'000 tonnes	30000	4262	14.2	3rd
Iron ore	Million tonnes	2611	208	8.0	4th
Manganese ore	'000 tonnes	42800	2881	6.7	5th

(Contd.)

Table – 3 : (Concld.)

Commodity	Unit of quantity	Production		Contribution (Percentage)	India's rank in order of quantum of production
		World	India*		
Industrial Minerals					
Barytes	'000 tonnes	8500	2334	27.5	2nd
Kyanite, andalusite & sillimanite	'000 tonnes	439[(e)]	53	12.1	4th
Magnesite	'000 tonnes	21800	230	1.1	11th
Apatite & rock phosphate	'000 tonnes	182000	2156	1.2	13th
Talc/steatite/ pyrophyllite	'000 tonnes	7400	1130	15.3	2nd
Mica (crude)	tonne	330000	1293	0.4	14th
Metals					
Aluminium	'000 tonnes	41500	1621	3.9	6th
Copper (refined)	'000 tonnes	19000	512	2.7	10th
Steel (crude/liquid)	Million tonnes	1418	70@	4.9	4th
Lead (refined)	'000 tonnes	9700	57	0.6	25th
Zinc (slab)	'000 tonnes	12900	740	5.7	3rd

Source: *World mineral production data compiled from World Mineral Production, 2006-2010; British Geological Survey.*
* *Figures relate to 2010-11*
@ *Ministry of Steel, Annual Report, 2010-11.*

MINERAL-RELATED POLICIES

The significant developments relating to National Mineral Policy and other mineral-related policies that took place in 2010-11 are given below:

The Mines and Minerals (Development and Regulation) Bill, 2011

To reflect the objects and reasons emanating from the new National Mineral Policy (NMP), 2008, the Mines and Minerals (Development & Regulation) Bill, 2011 was prepared by Ministry of Mines after several rounds of consultation and workshops with all stakeholders to replace the existing Mines & Minerals (Development & Regulation) Act, 1957. The Bill has been introduced in Lok Sabha on12th December, 2011 after approval of the Cabinet. Presently, it has been referred to the Parliamentary Standing Committee on Coal & Steel for consideration.

The Bill seeks a complete and holistic reform in the mining sector, with provisions to address issues relating to sustainable mining and local area development, especially those of the habitat population impacted by mining operations. The Bill also aims to ensure transparency, equity, elimination of discretions, effective redressal and regulatory mechanisms along with incentives encouraging good mining practices, which will also lead to technology absorption and exploitation of deep-seated minerals.

The Bill also provides for establishment of a National Mining Regulatory Authority, State Mining Regulatory Authority, National Mining

Tribunal and State Mining Tribunals to exercise jurisdiction, powers and authority conferred on them under the proposed legislation.

The notable feature of the Bill is to empower the Central Government to institutionalise a statutory mechanism for ensuing sustainable mining with adequate concerns for environment and socio-economic issues in the mining areas, through a National Sustainable Development Framework.

Internal Committee for Drafting Sub-legislation

An Internal Committee was constituted in the Ministry of Mines under the Chairmanship of Joint Secretary (M&R) for drafting Sub-legislation for inclusion in the draft Mines and Mineral Development & Regulation Act, 2011. As decided in the meeting of the committee, sub-committees were constituted in IBM to prepare following seven legislative Rules, the drafting of which is currently in progress.

1. Mineral Concession (Grant and Management) Rules
2. Scientific Mining and Sustainable Development Rules
3. Mineral Royalties and Cess Rules
4. District Mineral Fund Rules
5. Mining Regulatory Authority Rules
6. Mining Tribunal Rules
7. Mines and Minerals (Special Court) Rules

Mining Tenement System

The scheme has been taken up by IBM during 2009-10 with an objective to develop an online National Mineral Information System for investors by linking Central and State organisations engaged in administration of mineral resources in the country. The project is being implemented in mineral-rich states i.e. Andhra Pradesh, Chhattisgarh, Goa, Gujarat, Jharkhand, Karnataka, Kerala, Maharashtra, Madhya Pradesh, Odisha, Rajasthan and Tamil Nadu.

GIS component of the project was demonstrated by ISRO incorporating limited data in Bellary (Karnataka) and Durg (Chhattisgarh). The GIS component was also linked to Registry component as per TMIS database in a very limited way.

In respect of Registry component of the project, the job for preparation of Detailed Project Report (DPR) has been assigned by the NICSI to the consultant M/s Earnest & Young. DPR has been prepared and is at final stage for its submission. The statewise inception reports prepared by M/s Ernst & Young have been examined by IBM and comments of the respective state Governments are sent. The Software Development Agency will be finalised based on Request for Proposal and the initial trials will be conducted in 2013-14.

Sustainable Development Framework for Mineral Sector

A meeting regarding “Sustainable Development Framework (SDF) for Mineral Sector” was held at Parliament House, New Delhi on 7th September, 2011 by the Consultative Committee attached to the Ministry of Mines.

The SDF would reduce environmental and social conflicts in mining areas; ensure clarity for stakeholders on risk level in mining lease areas, reduce delays in obtaining clearances, cluster small operators to become more competitive and compliant, result in strong monitoring and assurance system and ensure reporting on governance and ethical practices. IBM has generated awareness about SDF in mining industry through organising various workshops.

Working Group for Twelfth Five Year Plan

Working Groups for formulation of the XII Five Year Plan were constituted by various Ministries. IBM represented Working Groups on Mineral Exploration and Development; Cement Industry and Occupational Health and Safety.

Group to Evolve Model Guidelines on Environmental Aspects of Quarrying of Minor Minerals

Ministry of Environment & Forests had constituted a Group of State Secretaries of both the Environment and Mining Departments of major States under the chairmanship of Secretary (E&F), Government of India to evolve model guidelines on environmental aspects of quarrying of minor minerals. The Group submitted its report in

March 2010. As a follow up, Controller General, IBM constituted a Committee to draft the documents on (i) Mining framework for minor minerals, (ii) Framework for cluster of mines, and (iii) Guidelines for reclamation and rehabilitation. Report of the committee was submitted to the Ministry and uploaded on IBM's website for perusal and obtaining views/comments of stakeholders and State Governments. Taking into consideration the feedback received from stakeholders and State Governments the draft was modified by the Committee and the modified guidelines have been submitted to the Ministry.

Offshore Areas

The Controller General, IBM has been notified as administering authority as well as authorised officer for the purpose of the Offshore Areas Mineral (Development and Regulation) Act, 2002 (17 of 2003) vide order dated 11.2.2010. Subsequently, the Controller General, vide notification dated 7.6.2010 has notified a total of 62 blocks (26 mineral-bearing Offshore blocks in Bay of Bengal and 36 mineral-bearing Offshore blocks in Arabian Sea). In response to the above notification a total of 377 applications have been received by the date stipulated for the purpose. Based on the recommendations of the Screening Committee, Exploration Licences were granted to 16 applicants for 62 mineral-bearing blocks in the offshore waters of Bay of Bengal and Arabian Sea on 5th April 2011.

Further progress in executing the Exploration Licence is stalled as the matter is sub judice and all subsequent actions have been kept in abeyance. Meanwhile, process for framing of UNFC Guidelines in Offshore Mining is in progress.

Coordination-cum-Empowered Committee

The Ministry of Mines has set up Coordination-cum-Empowered Committee in order to monitor and minimise the delays in grant of various approvals by the Ministries/Departments concerned in the Central Government for grant of mineral concessions. Further, the Ministry has reconstituted the CEC as 'Coordination-cum-Empowered Committee on Mineral Development and Regulation" on 20th December, 2011. The Terms of Reference (TOR) have also been broadened, so as to bring within its ambit other important matters, viz, Sustainable Development Framework Coordination/review of steps for prevention of illegal mining, issues arising out of the National Mineral Policy and legislation governing mineral development, etc. All the State Governments have also been requested to review the composition and TOR of their State Empowered Committees and effect suitable changes therein. The Committee has so far held eight rounds of meetings till 27.3.2012 wherein important decisions aimed at minimising delays for processing of mineral concession applications at various levels and improving the overall mineral concession regime and controlling illegal mining were taken.

Interim Report of the Justice M.B. Shah Commission of Inquiry for illegal Mining of Iron Ore and Manganese Ore

Central Government has appointed a Commission of Inquiry consisting of Shri Justice M.B. Shah, Retd. Judge of the Supreme Court of India, vide Notification S.O. 2817 dated 22 November, 2010 to inquire into the large-scale illegal mining of iron ore and manganese ore.

The Commission, has submitted its first Interim Report on 14.7.2011 recommending some urgent remedial measures to prevent further illegal mining, its trade, transportation and export, which include amendments proposed in the MMDR Act, 1957, amendments to Mineral Concession Rules, 1960, amendments in Guidelines issued by the Indian Bureau of Mines (IBM) and policy changes and measures for strengthening the State Government machinery.

The recommendations of the Shah Commission have been considered in the Ministry of Mines and actions are being implemented.

Study Group on Revision of Rate of Royalty and Dead Rent

In order to review the royalty rates and dead rent, the Ministry of Mines has constituted a Study Group on revision of rates of royalty and dead rent for minerals (other than coal, lignite and sand for stowing) and to make appropriate recommendations to the Government on 13th September 2011. Apart from other terms of reference, the Study Group has also been mandated to recommend revision of rates and in case, if necessary, give an additional conditional recommendation on what should be the royalty rate and the mechanism for computation of royalty rates after taking into account the liabilities on the lease holder as envisaged in the draft MMDR Bill, 2011, in the event the Parliament approves the new draft Bill.

Other terms of reference of the Study Group are: to consider the feasibility of allowing incentivised royalty rates for base metals, noble metals, REE and precious stones to encourage exploration; to suggest incentivised royalty rates on ad valorem basis for beneficiated or concentrated ore; to consider and recommend policies relevant to mineral development and administration of royalty regime; and to suggest appropriate revision in the existing rates of dead rent given in the Third Schedule to the Mines and Minerals (Development and Regulation) Act, 1957.

Rule 45 of MCDR, 1988 and Compulsory Registration with IBM

Rule 45 of Mineral Conservation & Development Rules, 1988 has been amended with a view to allow end-to-end accounting of the minerals. With the gradual implementation of the provisions of Rule 45 by IBM, efficiency in accounting of minerals/ores produced will increase manifold and it will be easy to isolate and monitor areas of illegal mining effectively. The State Governments have also been advised to ensure that any automation in the reporting system developed at the State levels should be compliant with the amended Rule 45 of the MCDR. Accordingly, IBM in association with NIC has developed online registration forms and forms for statutory monthly and annual returns.

The online registration system is already in place and so far 4,898 lease holders (covering 9,390 mines), 2,345 traders, 476 exporters, 1,033 stockists and 1,653 end-users have registered their details with IBM. Further, IBM has issued circular that the ore cannot be sold without registration with IBM. This would help to trace the source of mineral till its end-use stage and would prove as an effective tool for prevention of illegal mining.

The reporting system has been developed to facilitate online submission of returns. Initially, the focus will be on submission of monthly returns for iron and manganese ore mines throughout the country and all other minerals would be covered by September 2012. In future, the system will be linked to Railways and Port Authorities to check the correctness of the reporting made under the Rule.

New Scheme on Capacity Building of State Government – Development & Implementation of Ore Accounting Software by NIC

With the implementation of the provisions of Rule 45, increasing the efficiency in accounting minerals, State Government may find it easy to isolate and monitor areas of illegal mining effectively. This requires implementation of Rule 45 by developing uniform ore accounting software with interface links with Railways, Ports and Customs. The software for registration and concessions, MIS, is to be developed by NIC. For designing, developing and for implementation of such software, Sub Group III has proposed a new scheme in the 12th plan, which is to be implemented through IBM.

International Co-operation

During 2010-11, Ministry of Mines signed Memoranda of Understanding with Afganistan, Province of British Columbia (Canada), Colombia and Republic of Malawi to enhance the bilateral co-operation in the field of Geology and Mineral Resources.

New Exploration Licensing Policy (NELP)

Sixteen oil and gas exploration blocks were awarded contracts on 28th March, 2012 under the ninth exploration licensing round. Contracts for 16 out of the 33 oil and gas blocks that were bid for in the ninth round of New Exploration Licensing Policy (NELP) were signed. A total of $582.3 million has been committed in the 16 blocks that were awarded. Under the present round, the government had offered 34 areas — eight deepwater blocks, seven shallow-water blocks, 11 on-land blocks, and 8 Type-S (or small) on-land blocks, in NELP-IX. Of these, bids were received for 33 on close of auction on March 28, 2011. Bids for seven deep-sea blocks and three shallow-water blocks were rejected as bidders offered "very low" profit share to the government.

ONGC got operating rights for four blocks, while a consortium led by Oil India won two blocks. Gail India-led consortium was awarded one onshore block in the Cambay basin. Other companies that were awarded blocks were Sankalp Oil and Natural Resources, which won three, while one block each was won by Focus Energy, Pratibha Oil and Natural Gas, and Pan India

Consultants & Frost International Ltd. India is currently producing around 763,000 barrels per day (bpd) of oil, mostly from fields awarded decades ago, which is less than a quarter of its 3.878 million bpd refining capacity.

Foreign Trade Policy

In the Union Budget of 2012-13, the basic customs duty on cooling material for manufacture of electrical steel, ammonium metavanadate (used in manufacture of ferro-vanadium) was reduced while that on non-alloy steel and flat-rolled products (HR and CR), standard gold bar and platinum bars, non-standard gold, gold ores/ concentrates and dore bars for refining were increased. Nickel oxide/hydroxide, nickel ore/ concentrates, natural gas/liquefied natural gas (imported for power generation), etc. have been fully exempted from basic customs duty. Full exemption from basic customs duty is also provided to uranium concentrate, sintered natural uranium dioxide and sintered uranium dioxide pellets for generation of nuclear power. Basic customs duty has been imposed on cut and polished coloured gemstones. Export duty on iron ore was hiked while that of chromium ore was changed from ₹ 3,000 per tonne to 30% ad valorem.

Allocation of Coal Blocks

The Government has notified 'the Auction by Competitive Bidding of Coal Mines Rules, 2012' on 2.2.2012 in the Gazette of India.

The 54 coal blocks with total geological reserves of about 18.22 billion tonnes are identified for allocation, out of which 16 blocks with 7.27 billion tonnes reserves are earmarked for alloction for Government companies, 16 blocks with 8.16 billion tonnes reserves for power sector companies selected through tariff-based bidding and 22 blocks with 2.79 billion tonnes reserves for companies selected through auction.

Proposal to Revise the Existing Rates of Royalty on Coal and Lignite

The existing royalty rates of coal and lignite had been notified by the Government on 1.8.2007 as per the recommendations of a Committee, constituted by the Ministry of Coal.

The Government has constituted a Study Group on 4.2.2010 for revision of royalty rates for coal & lignite. Taking into consideration the submissions made by all stakeholders, the interests of the coal producing States, the consumers and the national economy as a whole, the Study Group recommended switching over to a full-fledged ad valorem regime of royalty for coal and lignite.

In place of the present hybrid formula for charging royalty on coal and lignite at the rate of 14% and 6%, respectively, the Cabinet Committee on Economic Affairs has approved the proposal for adoption of ad valorem regime as per the recommendations of the Study Group.

A Gazette Notification for amendment to the Second Schedule of the Mines and Minerals (Development and Regulation) Act, 1957 for revision in the rates of royalty for coal and lignite was yet to be issued.

LEGISLATION

MMDR Act, 1957

Vide Notification dated 13th February, 2012, the Central Government has notified the 13th February 2012 as the date on which the provisions related to new section 11A about procedure in respect of coal or lignite of the said Act shall come into force.

EXPLORATION & DEVELOPMENT

GSI, AMD, DGMs of various States, public sector companies like NMDC, MECL, MOIL, etc. continued their efforts for surveying, mapping and exploration of new deposits and reassessment of old deposits/mines during 2010-11. In oil sector, ONGC, OIL and a few joint venture and private companies were engaged in exploration of onshore and offshore areas in 2010-11. Exploration conducted by various organisations during 2010-11 is highlighted below:

Geological Survey of India (GSI)

The GSI is vested with the responsibility of maintaining broad-based and uniform national approach to data generation in respect of mineral resources. With the near exhaustion of resources to the proximity of surface, it has become imperative to have multidisciplinary approach to mineral exploration which comprises large-scale and detailed geological mapping aided by interpretative analysis of aerogeophysical and remotely sensed data, ground geophysical survey, geochemical prospecting and surface and subsurface exploration through pitting, trenching and drilling. During 2010-11, about 2,425 sq km large-scale mapping, 32.21 sq km detailed mapping and 57,961 m drilling were carried out in comparison to 1,659 sq km large-scale mapping, 35.75 sq km detailed mapping and 55,988 m drilling carried out in the previous year. Out of the total mappable areas of 3.146 million sq km of the country, 3.094 million sq km has been covered so far by systematic mapping bringing the total coverage to 98.34%. Additional resources were estimated for coal, gold, base metal, iron ore and manganese ore. The highlights of the resources assessed are given below in brief:

During 2010-11, GSI estimated about 2,642 million tonnes of coal resources in various coalfields of Chhattisgarh, Jharkhand, Madhya Pradesh, Odisha and West Bengal; about 0.9946 million tonnes of inferred (333) gold ore resources (2.17 g/t Au) in Anjanhalli Block C, Tumkur district; about 0.36 million tonnes gold ore resources (1.35 g/t Au) and 0.12 million tonnes gold ore (2.71 g/t Au) in Anjanhalli East Block, Chitradurga district, Karnataka; 0.98 million tonnes of Zn ore indicated (332) resources (1.10% Zn) in Jagaldehri Block, Chhindwara district, about 1.91 million tonnes of Zn ore resources (1.14% Zn) in Bislakhan Block, Betul district, Madhya Pradesh; about 10.01 million tonnes of inferred (333) iron ore resources at an average grade of 62.28% Fe in Aridongri area, Kanker district, Chhattisgarh; about 8.20 million tonnes of iron ore (hematite) resources (334) with 57.37% Fe in Bellary district, Karnataka; about 0.152 million tonnes of manganese ore resources (333) in Damurda (South) block, Keonjhar district, Odisha; about 2.74 million tonnes inferred (333) resources of molybdenum ore (average grade 0.102% Mo) in Dharmapuri district, Tamil Nadu; 0.84 million tonnes of reconnaissance resources of PGE (0.50 g/t to 2.93 g/t Pt+Pd) in Davangere district, Karnataka; about 0.252 million tonnes of PGE reconnaissance resources (average grade 1.44 ppm of Pt + Pd) in Chettiyampalayam Block, Sitampudi Complex, Tamil Nadu. Besides, 180 million tonnes of tentative inferred resources of lignite have been estimated in Tamil Nadu.

GSI continued its offshore geo-scientific studies both in Exclusive Economic Zone (EEZ) and Territorial Waters (TW) along the East and West Coasts of India. During 2010-11, a total of 20 cruises were undertaken using three vessels; six cruises aboard R.S. Samundra Manthan within EEZ, eight cruises aboard R.V. Samundra Kaustubh within the TW off the East Coast and six cruises aboard R.V. Samundra Shaudhikama within the TW off the West Coast. Surveys in the near shore zones were carried out using hired small mechanised boats.

GSI pursued its airborne geophysical surveys for generating database employing magnetic and gamma ray spectrometric techniques.The proposed survey operations over Chandrapur-Brahmapuri area could not be taken up due to the late arrival of the aircraft and as proposed during 2010-12 also due to major break down in the navigational units of the data aquisition system.

MECL

During 2010-11, MECL established about 3,246 million tonnes of coal resources. Promotional & contractual drilling was carried out in Andhra Pradesh, Chhattisgarh, Jharkhand, Maharashtra, Madhya Pradesh and Odisha. About 19.11 million tonnes, lignite resources were established in Rajasthan. MECL assessed about 2.56 million tonnes of base metal resources (1.09% Cu, 168 ppm Ni, and 161 ppm Co in Wari (B &C) block in Chittorgarh district, Rajasthan.

State Directorates of Geology and Mining

DGM, Chhattisgarh, established about 6.70 million tonnes of cement-grade and 50 million tonnes of cement grade (blendable & beneficiable)limestone resources in Raipur and Bastar districts; about 75000 cu m black granite (dolerite) in Bastar and Kanker districts.

DGM, Maharashtra, estimated about 249.28 million tonnes of coal resources in Chandrapur, Nagpur, Wardha and Yavatmal districts; and about 0.40 million tonnes resources of pyrophyllite/sillimanite in Chandrapur district.

DGM, Kerala estimated about 0.33 million tonnes of china clay resources in Kollam district.

DMM, West Bengal established 60,000 tonnes of talc/steatite resources in Darjeeling district.

DMG, Rajasthan, estimated about 1 million tonnes gypsum resources in Bikaner & Ganganagar districts; about 8.34 lakh tonnes of gypsum resources (inferred) in Jalore district; about 18.28 million tonnes of marginal cement grade and 155.60 million tonnes of geological reserves of limestone resources in Baran, Jhalwar and Nagaur districts; about 3.37 million tonnes resources of masonry stone in Alwar district; about 15.55 million tonnes of sandstone resources in Dhaulpur and 37.5 million tonnes of sandstone resources for masonry purpose in Baran and Kota districts; about 3 million tonnes resources of bajri in Bikaner district; and about 1.64 lakh tonnes of clay reserves (inferred) in Karauli district.

Oil and Natural Gas Corporation Ltd (ONGC)

ONGC continued its operations for exploration of oil and gas and acquired a total of 13,116 GLK/ LK of 2D and 19,355 sq km of 3D seismic data during 2010-11. A total of 125 exploratory wells with cumulative metreage of 3,79,660 m and 256 development wells with cumulative metreage of 5,00,094 were drilled. ONGC established 24 new hydrocarbon discoveries in 2010-11 in Assam, Assam Arakan basin, oil prospects in Western onland and offshore, Krishna-Godavari onland and offshore, Cauvery onland and MBA basin. The ultimate reserve accretion of oil & oil equivalent gas (O+OEG) in 2010-11 in domestic assets of ONGC was 83.56 million tonnes. The total ultimate reserve of O+OEG as on 31.3.2011 was 2,594.92 million tonnes.

Oil India Ltd (OIL)

OIL continued its operations for exploration of crude oil and natural gas in 2010-11 and acquired a total of about 992 GLK of 2D and 473 sq km 3D seismic data. Exploration resulted in significant discoveries of oil/gas within Tipam and Barail Formation, Lakadong & Therria and Langpar Formation, Kopili Formation, Mahakali Structure, Hugrijam ML (Girujan resorvoir).

Indian Bureau of Mines (IBM)

IBM as a facilitator to mineral industry (a) provided technical consultancy services in feasibility study, environmental impact assessment, environmental management plan, etc.; (b) carried out mining research on need-based aspects of mining; (c) conducted mineral beneficiation studies, including mineralogical testing and chemical analysis; and (d) prepared mineral maps. Besides, preparation of National Inventory of mineral resources is IBM's designated responsibility. The National Mineral Inventory (NMI) is brought out by IBM on a quinquennial basis. UNFC system has been adopted by IBM for resource classification. Updating of NMI of mineral resources in respect of 70 minerals based on UNFC system, as on 1.4.2010, has been completed in March, 2012.

IBM is entrusted with preparation of multimineral maps. About 100 multimineral maps with forest outlays on 1:50,000 scale were prepared in respect of Madhya Pradesh, Uttarakhand and Uttar Pradesh during 2010-11 in collaboration with Forest Survey of India. IBM has also conducted 60 ore dressing investigations, 41,925 chemical analysis, 2060 mineralogical studies and one in-plant studies during the year.

Other Agencies

GMDC estimated a total of 107.54 million tonnes of lignite resources in Bhavanagar district, Gujarat; about 1.90 lakh tonnes and 10.93 million tonnes bauxite resources in Jamnagar district and Kachchh district, respectively.

Hindustan Copper Ltd (HCL) has estimated a total of 56.98 million tonnes (1.37% Cu) and 17.70 million tonnes (1.32% Cu) copper ore reserves in Khetri mine so far and Kolihan-copper deposits in Jhunjhunu district, Rajasthan.

Hindustan Zinc Ltd (HZL) has estimated about 49.37 million tonnes of lead and zinc ore resources (1.65 to 2.21% Pb and 6.47 to 7.76% Zn) in Rajpura Dariba mines, Rajsamand district.

Mysore Minerals Ltd (MML) estimated about 17.1 million tonnes of iron ore resources in Bellary district, Karnataka.

Jayaswal Neco Industries Ltd (JNIL) reported about 6.52 million tonnes of iron ore reserves in proved and probable category in Rajnandgaon district, Chhattisgarh.

Chowgule and Company Pvt Ltd estimated 0.50 million tonnes iron ore resources in North Goa district, Goa.

V.M. Salgaocar & Bro. Pvt Ltd established 29.49 million tonnes of iron ore resources in their leasehold area at Velguem/Surla mines and Sigao mine in Goa.

Exploration by HGML has established 12.21 million tonnes gold ore reserves (2.50 - 5.26 g/t Au) in Hutti and Hira-Buddini and Uti ML areas in Raichur district of Karnataka.

Singareni Collieries Company Ltd (SCCL) proved 51.66 million tonnes of coal reserves in Godavari Valley Coalfield, Andhra Pradesh, during 2010-11.

Reliance Industries Ltd (RIL)

RIL made 6 discoveries of hydrocarbons during the year. These comprised 5 discoveries in the exploration block of onland Cambay Basin and one discovery in a deepwater block in Krishna Basin. Currently, RIL had 28 blocks under exploration.

Coal Bed Methane

A total of 30 CBM blocks have been awarded in various states under four rounds of CBM bidding held so far. In addition to this, three more blocks were earlier awarded on nomination basis. The total area awarded so far for CBM exploration is about 17,303 sq km. Gas in-place of about 8.92 trillion cu ft has been established in five CBM blocks. Field Development Plan has already been approved for four blocks and is under review for another one block.

RESEARCH & DEVELOPMENT

The Science and Technology (S&T) programmes of the Ministry of Mines, Government of India, cover the disciplines of Geology, Exploration, Mining and Environment, Bioleaching, Beneficiation, Rock Mechanics, Ground Control and Non-ferrous Metallurgy. During 2010-11, a total of eight new projects have been approved by the Standing Scientific Advisory Group (SSAG) of the Ministry of Mines.

The highlights of the work carried out by various research organisations and industries relating to mineral beneficiation and mining & environment during 2010-11 are furnished below:

Bauxite

Process Development to reduce iron from bauxite for preparation of calcined bauxite (IMMT): The objective was to develop suitable process flow sheet for the removal of iron from bauxite, with Fe_2O_3 content of 6-8% in the ROM sample. The results of the study indicated that it was possible to remove iron to the desired level of less than 3.0% as Fe_2O_3 in the non-magnetic fraction at a yield of 38%. The final process scheme developed recommends processing of raw bauxite lumps through roasting followed by crushing and dry high intensity magnetic separator (85 wt%) at particles of -1 mm to + 0.15 mm.

Copper Ore

Upgradation of composite copper ore from Banwas, Khetri and Kolihan Mines for HCL(IBM): The as-received composite sample assayed 0.96% Cu, 59.01% SiO_2, 2.52% S, 12.82% Fe and 71.65% acid insolubles. Flotation at 62.5% minus 200 mesh grind and subjecting the rougher float to re-grinding and cleaning in three stages yielded a concentrate assaying 24.26% Cu, 33.91% Fe and 5.95% acid insoluble with 90.8% copper recovery (wt% yield 3.6) against the objective of 18-20% Cu grade conc. with 90-92% recovery.

Upgradation of a Copper Ore (Core) sample from Chittorgarh, Rajasthan for M/s MECL (IBM): The as-received sample assayed 1.20% Cu, 46.71% SiO_2, 7.65% Fe(T) and 74.48% acid insolubles. Flotation Test at 66.5% minus 200 mesh grind could yield a concentrate assaying 20.94% Cu, 30.56% Fe, 5.66% SiO_2, 11.54% acid insolubles with 87.2% copper recovery (wt% yield 4.9).

Gold

Recovery of Gold from Bhukia (East) Block, Banswara, Rajasthan for MECL, Nagpur (IBM): The as-received sample contained 2 g/t gold and 51.0 g/t silver with other major constituents assaying 29.66% SiO_2, 25.92% Fe_2O_3, 8.94% CaO, 11.88% S(T), 4.34% MgO, 3.13% Na_2O and 6.86% LOI. By employing bottle role cyanidation, cyanide leach concentrate with 96% Au and 40% Ag values could be extracted by cyanide leaching followed by Carbon - In - Leach (CIL) process. The consumption of sodium cyanide would be 2.72 kg per tonne.

Iron Ore

Bench Scale Beneficiation studies on Iron Ore Fines Sample from Ghatkuri Iron Ore mines for M/s Orissa Manganese & Minerals Limited (IBM): The as-received sample assayed 51.13% Fe(T), 12.75% SiO_2, 6.53% Al_2O_3, 0.23% CaO, 0.01% MgO, 0.05% P, 0.41% TiO_2, 0.06% Mn and 5.48% LOI. Tabling on as received sample reduced to all -65 mesh could produce table concentrate assaying 63.90% Fe(T), 2.87% SiO_2, 2.36% Al_2O_3 & 2.68% LOI with weight percent yield of 23.4 & Fe(T) recovery of 29.2%. Composite of table concentrate & table middling could produce table concentrate assaying 60.85% Fe(T), 5.04% SiO_2, 3.76% Al_2O_3 & 3.82% LOI with overall weight per cent yield of 48.5% & overall Fe (T) recovery 57.7%.

Stub cyclone of the as-received sample reduced to all -100 mesh yielded a concentrate (Underflow) assaying 58.23% Fe(T), 6.55% SiO_2, 3.90% Al_2O_3 and 3.75% LOI with weight per cent yield of 68.5% & Fe(T) recovery of 78.0%. Wet High Intensity Magnetic Separation (20,000 gauss) on Stub Cyclone Underflow (concentrate) could produce a concentrate (magnetic) assaying 62.98% Fe(T), 3.00% SiO_2, 2.73% Al_2O_3 and 2.70% LOI with overall weight per cent yield of 53.8% (overall Fe(T) recovery of 66.2%).

Beneficiation studies of BHQ ore by magnetic separation techniques to prepare pellet grade concentrate (IMMT): The lean-grade BHQ ore sample received from MSPL contained ~38.0% Fe and 42% SiO_2. The mineralogical studies indicated that the sample contains hematite, magnetite and quartz as major minerals and the liberation of these minerals is around 75 microns. Beneficiation consisting mainly of size reduction followed by low and high intensity magnetic separation has yielded concentrate with 64% Fe at 40% yield. Alternate process flow sheets with different combinations have been suggested to recover the iron values suitable for pellet making.

Beneficiation of a low-grade iron ore sample from Thakurani Iron Ore Mines, Noamundi, District West Singhbhum, Jharkhand (IBM): The as-received sample assayed 37.33% Fe(T), 0.13% FeO, 45.43% SiO_2, 0.40% Al_2O_3, 0.046% CaO, 0.004% MgO, 0.018% TiO_2 and 0.30% LOI. By adopting gravity concentration, the composite table concentrate (Conc. I + Conc.II) obtained at minus 150 mesh size assayed 59.50% Fe(T) & 13.73% SiO_2 with 43.2% Fe(T) recovery (wt% yield 43.2). The upgradation of low-grade iron ore to 59.50% Fe(T) from 37.33% Fe(T) is appreciable.

Upgradation of Iron Ore sample from BBH Mines for M/s Voltas Limited, Bengaluru (IBM): As-received sample assaying 52.11% Fe(T), 7.16% SiO_2, 3.16% Al_2O_3, 5.33% Mn was upgraded to a concentrate assaying 60.30% Fe(T), 4.99% SiO_2 and 4.09% Mn with 87.0% recovery(wt% yield 75.2) by reduction roasting at -48 mesh followed by magnetic separation.

Beneficiation of Composite iron ore sample from Bellary district, Karnataka of M/s Allum Prashanth, Mine Owner, Bengaluru (IBM): The as-received sample assayed 36.31% Fe(T), 5.08% FeO, 42.70% SiO_2, 0.40% Al_2O_3, 0.84% CaO, 1.44% MgO and 0.16% LOI. The beneficiation flow sheet comprised following routes for obtaining desired iron concentrate:

(a) Tabling of the as-received sample ground to all minus 200 mesh yielded an iron concentrate assaying 67.84% Fe(T), 2.99% SiO_2 and 0.18% Al_2O_3 with Fe(T) recovery of 72.2% (wt % yield 38.1).

(b) Alternative route is that minus 200 mesh sample when subjected to tabling followed by ferrous wheel magnetic separation, the combination of table and cleaner magnetic concentrate yielded a concentrate assaying 65.25% Fe(T), 9.47% FeO, 7.01% SiO_2 and 0.18% Al_2O_3 with Fe(T) recovery of 83.9% (wt% yield 46.0).

Upgradation of low-grade Iron Ore fines to Pellet-grade concentrate (IBM): The as-received sample assayed 58.15% Fe(T), 7.05% SiO_2, 4.39% Al_2O_3, 0.07% Mn, 0.05% CaO and 4.30% LOI. By adopting gravity separation after grinding at 95% minus 50 mesh in rod mill, a concentrate assaying 65.83% Fe(T), 1.83% SiO_2, 1.37% Al_2O_3, 0.05% Mn with 62.5% Fe(T) recovery with wt% yield of 55.5 could be obtained.

Limestone

Beneficiation studies on a limestone sample from Sahedpur, district Morena (MP) for M/s Abhijeet Cement Ltd, Nagpur (IBM): The as-received sample assayed 42.12% CaO, 1.83% Fe_2O_3, 14.83% SiO_2, 3.88% Al_2O_3, 0.63% MgO, 0.26% TiO_2, 1.43% K_2O, 0.21% Na_2O and 34.50% LOI. By adopting dry screening at -40 mm size, a concentrate of -40+4 mm fraction assaying 44.10% CaO, 1.47% Fe_2O_3, 13.28% SiO_2, 3.0% Al_2O_3, 0.56% MgO and 35.49% LOI with wt% yield of 88.8 and CaO recovery of 90.5% was obtained. Whereas by adopting flotation route at a grind of 87.2% -200 mesh, a concentrate assaying 48.11% CaO, 1.12% Fe_2O_3, 8.31% SiO_2, 2.80% Al_2O_3, 0.43% MgO and 36.59% LOI with wt% yield 71.7 and CaO recovery of 80.9% was obtained.

Bench scale beneficiation studies on Limestone sample from M/s Prism Cement Limestone Mines Ltd, Satna, M.P. (IBM): The as received sample assayed 35.47% CaO, 22.41% SiO_2, 2.21% Fe_2O_3, 3.81% Al_2O_3, 2.27% MgO and 31.52% LOI. By adopting flotation route, a limestone concentrate assaying 45.87% CaO, 9.83% SiO_2, 1.39% Fe_2O_3, 2.02% Al_2O_3, 1.60% MgO, 0.09% TiO_2, 0.42% K_2O, 0.3% Na_2O and 38.09% LOI with 80.1% CaO recovery (wt% yield of 62.2) was obtained.

Manganese Ore

Beneficiation of low-grade manganese ore by wet high intensity magnetic separator (IMMT): The objective of the project for Tata Steel was to carry out beneficiation studies on low-grade ferrugenous manganese ore of Joda region to reduce iron content to improve Mn/Fe ratio. Four different types of samples were subjected to WHIMS at 14000 gauss & 10000 gauss to separate iron-rich minerals. The Mn/Fe ratio could be increased to 1.5 to 3 with Mn content 35-42% by this technique.

Quartzite

Recovery of float glass concentrate from Quartzite sample, Pohara, Bhandara district, Maharashtra (IBM): The as-received sample assayed 97.99% SiO_2, 0.68% Fe_2O_3, 0.60% Al_2O_3, 0.05% CaO, 0.01% MgO, 0.09% K_2O, 0.07% TiO_2 & 0.11% LOI. After scrubbing followed by wet high intensity magnetic separation, the composite concentrate (-30 +70 mesh and -70 +120 mesh) non-magnetic assaying 99.16% SiO_2, 0.13% Fe_2O_3, 0.25% Al_2O_3 and 0.11% LOI with 63.5% silica recovery (wt% yield 62.7) was obtained.

Rock Phosphate

Upgradation of sub-grade Rock Phosphate sample for M/s RSMM Ltd, Rajasthan (IBM): The as received sample from Jhamarkotra Mines, Rajasthan assayed 13.43% P_2O_5, 49.48% SiO_2, 5.66% Fe_2O_3, 6.87% Al_2O_3, 20.13% CaO, 0.46% MgO and 2.68% LOI. By adopting flotation route, a phosphate concentrate assaying 32.02% P_2O_5, 13.33% SiO_2, 3.22% Fe_2O_3, 1.25% Al_2O_3, 14.22% acid insolubles with P_2O_5 recovery of 81.9% and weight % yield of 33.8 was obtained.

Upgradation of low-grade Rock Phosphate from Hirapur for M/s Madhya Bharat Agro Products Ltd, Madhya Pradesh (IBM): The as received sample assayed 15.66% P_2O_5, 43.46% SiO_2, 8.54% Fe_2O_3, 5.19% Al_2O_3 and 2.02% LOI. By adopting flotation route, a phosphate concentrate assaying 34.28% P_2O_5, 47.9% CaO, 7.79% SiO_2, 1.23% Al_2O_3 with P_2O_5 recovery of 58.2% (wt% yield 26.3) ws obtained.

Development of process flow sheet for Rock Phosphate from Jhamarkotra for RSMML, Udaipur (IBM): The as-received sample assayed 14.20% P_2O_5, 36.91% CaO, 11.12% MgO, 0.54% Fe_2O_3, 2.98% SiO_2. A composite phosphate concentrate assaying 33.57% P_2O_5, 1.42% MgO, 7.11% SiO_2, was obtained with 83.5% P_2O_5 recovery (wt% yield 35.6) by adopting flotation route.

Silica Sand

Beneficiation of silica sand for Reduction of Fe_2O_3 content (IBM): The original sample from overburden of GMDC, Rajpardi Lignite Mine assayed 96.5% SiO_2, 0.64% Fe_2O_3, 0.42% TiO_2, 1.13% Al_2O_3 and 1.03% LOI. IBM developed a beneficiation process that included scrubbing, tabling, magnetic separation and attrition scrubbing. The process yielded a silica sand concentrate assaying 99.3% SiO_2, 0.079% Fe_2O_3, 0.15% Al_2O_3, 0.04% TiO_2 with wt.% yield of 60.

Others

In addition to the above, significant R&D work was carried out by IMMT on beach sand, limestone and Platinum Group Elements and by NML on iron ore and limestone

Mining & Environment

National Institute of Rock Mechanics (NIRM)

National Institute of Rock Mechanics (NIRM) is a premier research centre in the field of applied and basic Rock Mechanics & Rock Engineering.

It provides specialised technical services to several industrial sectors like mining – coal & non-coal; civil-hydroelectric & tunneling projects, nuclear power projects, underground storage cavern projects and to other construction industries within India and abroad, stressing upon the need to achieve improved production and productivity, with utmost safety and economy.

During 2010-11, NIRM was involved in projects from construction projects in power sector (hydel, nuclear), communication sector (metros, rails) and mining sector. This institute undertakes investigations at various stages of the projects, i.e., feasibility report (FR), detailed project report (DPR), construction and post-construction stages.

Indian Bureau of Mines (IBM)

During the year 2010-11, Indian Bureau of Mines carried out techno-economic evaluation study and studies on ground vibration due to blasting in mines and also environment quality monitoring of mine sites.

Techno-economic Evaluation of Balaghat Holem's Shaft Deepening Project at Balaghat Mine, Balaghat District, Madhya Pradesh, was carried out for examination of techno-economic evaluation and financial justification of proposed vertical deepening of shaft on the basis of financial models. In order to maintain the leading status, development of mine to exploit the ore reserves below the 12th level to 16.5th level was essential for the Mine management.

Status Report on Availability of Manganese Ore over an area of 26.97 ha in Village: Shannkerpipariya, Taluka: Kherlangi, District: Balaghat, Madhya Pradesh, for M/s M.V.P. Minerals (P) Ltd, Hyderabad, IBM was prepared.

Ground vibration studies to asess the impact of blasting at Thandiberi Limestone Mines (Lease Area 254.125 Hect.) and Amli Limestone Mines (Lease Area 468.68 Hect.) were carried out to study the effect of blast-induced ground vibrations on the nearby structures and human settlements and also to suggest control measures to minimise the adverse impact of the same.

Similar Ground Vibration study was carried out at Chargao Gotadi Stone Quarry, Taluka Bhivapur, near Umred, district Nagpur (Maharashtra) over a lease area of 2.45 ha to study the impact of blast induced ground vibrations on the nearby structures, human settlement and to suggest control measures to minimise the adverse impact of the same.

INFRASTRUCTURE

One of the major requirements for sustainable and inclusive economic growth is an extensive and efficient infrastructure network. It is critical for the effective functioning of the economy and industry.

Infrastructure has direct bearing on sustainability of growth and overall development and enable generation of considerable background and forward linkages. Hence its development is central to the growth of other sectors of the economy. The prospects of our country's socio-economic development depend crucially on the performance of infrastructure, such as, power, roads, railways, ports, irrigation and telecommunications.

The Eleventh Five Year Plan emphasized the need for removing infrastructure bottlenecks for sustained growth. There are proposals for investment of US$ 500 billion in infrastructure sectors through a mix of public and private sectors to reduce deficits in identified infrastructure sectors. As a percentage of the gross domestic product (GDP), investment in infrastructure was expected to increase to around 9%. For the first time the contribution of the private sector in total investment in infrastructure was targeted to exceed 30%. Total investment in infrastructure during the Eleventh Plan is estimated to increase to more than 8% of GDP in the terminal year of the Plan–higher by 2.47 percentage points as compared to the Tenth Plan. The private sector is expected to be contributing nearly 36% of this investment. The Planning Commission, in its approach paper has projected an investment of over ₹ 45 lakh crore (for about US$1 trillion) during the Twelfth Plan (2012-17).

Performance of broad sectors and subsectors in key infrastructure areas in the current year presents a mixed picture. There was an improvement in growth in power, petroleum refinery, cement, railway freight traffic, passengers handled at domestic terminals, and upgradation of highways by the National Highways Authority of India (NHAI). Coal, natural gas, fertilizers, handling of export cargo at airports showed negative growth. Steel sector witnessed moderation in growth.

The performance in core and infrastructure sectors is still to a large extent dependent on public sector projects. Ministry of Statistics and Programme Implementation (MOSPI) has been monitoring the progress of all central-sector projects costing ₹ 150 crore and above. The flash report for the month of October 2011 tracks the progress of 583 projects in different sectors. Of these, 7 were ahead of schedule, 166 on schedule and 235 projects were delayed.

Coal

Coal production at about 533 million tonnes in 2010-11 was higher by 0.1% from that of 532 million tonnes in 2009-10. In 2010-11, out of the total production of coal, 9.3% (49.6 million tonnes) was of coking coal and the remaining 90.7% (483.2 million tonnes) was of non-coking coal. Of the 523 million tonnes despatches of raw coal in 2010-11, about 73% despatches were to electricity sector, 3.2% to sponge iron industry, 3.3% to the steel industry and 2.7% to cement industry.

Electricity

Electricity generation by power utilities during 2011-12 was targeted to increase by 5.4 % to reach 855 billion units. Growth in power generation during April-December 2011 was 9.2% as compared to 4.6% during April-December 2010. Nuclear, hydro and thermal power generation registered a growth of 33.2%, 19.2% and 6.7% respectively. In the first nine months 76% of the generation target has been achieved.

The Eleventh Five Year Plan initially envisaged a capacity addition of 78,700 MW, of which 19.9% was hydro, 75.8 % thermal and the rest nuclear. At the time of the Mid Term Appraisal of the Eleventh Plan, the target was revised to 62,374 MW with thermal, hydro and nuclear segments contributing 50,757 MW, 8,237 MW and 3,380 MW respectively. A capacity addition of 46,669.7 MW has so far been achieved until 15 January 2012. Projects with a capacity of 7,645 MW are under construction for commissioning during the remaining period. Capacity addition during the Eleventh Plan is, therefore, expected to be about 50,000 to 52,000 MW.

The Ministry of Power launched an initiative for development of coal-based super critical UMPPs, each of about 4000 MW capacity, under Case II bidding route. Four UMPPs at Sasan in Madhya Pradesh, Mundra in Gujarat, Krishnapatnam in Andhra Pradesh and Tilaiya in Jharkhand have already been transferred to the identified developers and are at different stages of implementation. One unit of 800 MW of the Mundra UMPP is expected to be commissioned in the Eleventh Plan. The remaining units of Mundra and other awarded UMPPs, except for the last unit of Tilaiya UMPP, are expected to be commissioned in the Twelfth Plan.

Transport

Railways

Indian Railways consist of an extensive network spread over 63,221 route km (Rkm) comprising broad guage (46,807 Rkm), metre guage (13,290 Rkm) and narrow guage (3,124 Rkm). During 2011 (April-November), the total revenue-earning freight traffic moved by Indian Railways grew at 4.1% to 618.0 million tonnes as compared to 593.4 million tonnes in 2010 (April - November). This was short of the proportionate target of 644.6 million tonnes by 26.6 million tonnes. The low growth was primarily on account of relatively slow growth in core sectors of the economy. This was further compounded by negative growth in iron ore after the imposition of a ban on export of iron ore in Karnataka and the procedural problems in obtaining clearance from state governments. Major portion of this traffic in April to November 2011 was accounted by coal (288.5 million tonnes or 46.7%), iron ore (69.8 million tonnes), cement (68.4 million tonnes), fertilizers (33.1 million tonnes), POL (27.2 million tonnes) and raw material (excluding iron ore) for steel plants (9.4 million tonnes).

Ports

India's coastline of 7,517 km, spread on the western and eastern shelves of the mainland and also along the islands is studded with 12 major ports and about 200 non-major ports. Approximately 95% of the India's trade by volume and 70% by value moved through Maritime Transport. Twelve major ports of the country handle about 75% traffic.

Cargo handling capacity at major ports was 616.73 million tpy as on 31.3.2010. Traffic handled by major ports was 561.09 million tonnes in 2009-10 as compared to 569.91 million tonnes in 2010-11. Traffic handled at major ports relating to minerals/mineral products during 2010-11 was: POL - 180.4 million tonnes, iron ore - 87.3 million tonnes, coal - 72.8 million tonnes and fertilizer & raw materials - 20.0 million tonnes.

Roads

India has more than 3.34 million km road network making it one of the largest in the world, comprising 66,754 km National Highways, 128,000 km State Highways, 470,000 km major district roads and about 2,650,000 km other district and rural roads. National Highways are the prime arterial routes throughout the country and cater to about 40% road transport traffic although they comprise only 2% of the total road length. About 22% of the total length of National Highways (NHs) is single lane/ intermediate lane, about 53% is two lane standard, and the balance 25% is four lane standard or more. In 2011-12, the achievement under various phases of the NHDP up to December, 2011 has been about 1,250 km and projects have been awarded for a total length of about 4,374.9 km.

The Eleventh Plan had envisaged accelerated efforts to bring the NH network up to a minimum two-lane standard by the end of the Twelfth Plan and for removing existing deficiencies. The Ministry of Road Transport & Highways (MoRTH) has proposed a World Bank loan and budgetary allocations to reach this goal by December 2014. Consultants have been engaged for preparation of a DPR for about 3,800 km road length proposed to be developed under World Bank assistance. The MoRTH has also initiated action for improvement of the remaining 2,500 km of single- intermediate-lane NHs through budgetary resources. In order to make a visible impact, the work would be taken up for upgradation on a corridor concept. These corridors would include strengthening (in adjoining reaches) in addition to widening to two-lane/two-lane with paved shoulder standards in order to have better facility over long continuous stretches.

The government approved the Road Requirement Plan (RRP) for development of 1,126 km NHs and 4,351 km state roads (total 5,477 km) to two-lane at a cost of ₹ 7,300 crore in 34 LWE-affected districts in the states of Andhra Pradesh, Bihar, Chhattisgarh, Jharkhand, Madhya Pradesh, Maharashtra, Odisha, and Uttar Pradesh. As of now detailed estimates for 5,339 km length have been sanctioned at an estimated cost of ₹ 7,273 crore,out of which, works on 4,288 km length costing ₹ 5,390 crore have been awarded. Development in 848 km length has been completed up to December 2011 and cumulative expenditure incurred so far is ₹ 1,363 crore.

PERFORMANCE OF SELECTED MINERAL-BASED INDUSTRIES

Steel

Production of finished steel (including C.R. sheets) in 2010-11 at 66.01 million tonnes was higher by about 8.9% from 60.62 million tonnes achieved in 2009-10. The total production of pig iron was 5.9 million tonnes and 5.5 million tonnes in 2009-10 and 2010-11, respectively. Exports of finished steel (including C.R sheet) was 5.08 million tonnes in 2010-11 as compared to 3.14 million tonnes reported in 2009-10. Also, 1.5 million tonnes and 0.6 million tonnes pig & cast iron including spiegeleisen was exported in the corresponding periods.

Cement

Production of cement in 2010-11 estimated at 216 million tonnes (including mini cement plants) registered an increase of about 5.5% over the previous year's production of 205 million tonnes. Cement industry was going ahead with modernisation and upgradation of technology in particular to conserve energy. The country is self-sufficient in cement. India exports cement including white cement and clinker. The exports in 2009-10 and 2010-11 including clinker were about 2.7 million tonnes and 3.6 million tonnes, respectively.

Petroleum Oil and Refineries

Crude oil production in 2011-12 at 38.19 million tonnes was about 1.3% higher than 37.7 million tonnes produced in the previous year. The projected production for natural gas including coal bed methane (CBM) was at 51.17 billion cubic metres in 2011-12, 1.05% lower than 52.22 billion cubic metres in 2010-11. The refinery crude throughput of 206.15 million tonnes in 2010-11 was 7% higher than 192.77 million tonnes processed in 2009-10. The total refining capacity in the country at around 193.39 million tpy as on 1.4.2011 was about 5.5% higher from that of the preceding year and it is expected that it will reach 214.07 tpy by the end of 2011-12. Production of petroleum products (including LPG production from natural gas) was 192.53 million tonnes in 2010-11 as compared to 182.01 million tonnes reported in 2009-10.

SELF-RELIANCE IN MINERALS & MINERAL-BASED PRODUCTS

India continued to be wholly or largely self-sufficient in minerals which constitute primary mineral raw materials that are supplied to industries, such as, thermal power generation, iron & steel, ferro-alloys, aluminium, cement, various types of refractories, china clay-based ceramics, glass, chemicals like caustic soda, soda ash, calcium carbide, titania white pigment, etc. India is, by and large, self-sufficient in coal (with the exception of very low ash coking coal required by the steel plants) and lignite among mineral fuels; bauxite, chromite, iron ore, ilmenite and rutile among metallic minerals; and almost all the industrial minerals with the exception of chrysotile asbestos, borax, fluorite, potash, rock phosphate and elemental sulphur. Despite high degree of self-sufficiency, some quantities of flaky and amorphous graphite of high fixed carbon, kaolin and ball clay for special applications, very low silica limestone, dead-burnt magnesite and sea water magnesia, battery-grade manganese dioxide, manganese ore, etc. were imported to meet the demand for either blending with locally available mineral raw materials and/or for manufacturing special qualities of mineral-based products. To meet the increasing demand of uncut diamonds, emerald and other precious & semi-precious stones by the domestic cutting and polishing industry, India is dependent on imports of raw uncut stones for their value-added re-exports. The degree of self-sufficiency in respect of various principal minerals and metals/ferro-alloys in 2010-11 is given in Table-4.

Table – 4 : Degree of Self-sufficiency in Principal Minerals & Metals, 2010-11(P)

Sl. No.	Commodity	Demand/Domestic consumption ('000 tonnes)	Supply/Domestic supply ('000 tonnes)	Order of self-sufficiency (%)
Minerals				
1	Asbestos (chrysotile)	103	++	++
2	Barytes	192	2334	100
3	Bauxite	11,768	12641	100
4	Chromite	2708	4262	100
5	Dolomite	5942	5065	85
6	Felspar	405	472	100
7	Fireclay	518	571	100
8	Fluorite	69	8	12
9	Gypsum	7145	8128[1/]	100
10	Ilmenite	190	663	100
11	Iron ore	104054	207998	100
12	Kyanite	5	6	100
13	Limestone & other calcareous minerals	213119	238188[2/]	100
14	Magnesite	241	230	95
15	Manganese ore	3478	2881	83
16	Rock phosphate (including apatite)	3676	2156	59
17	Rutile	19	27	100
18	Sillimanite	15	48	100
19	Silica minerals	1791	3656	100
20	Sulphur	1670	619[3/]	37
21	Talc/steatite/pyrophyllite	389	1130	100
Metals[4/]				
22	Aluminium	2074	1621	78
23	Copper (refined)	159	512	100
24	Lead (primary)	200	57	28
25	Zinc	572	740	100
Ferro-alloys[5/]				
26	Ferro-chrome	273	1032	100
27	Ferro-manganese	123	404	100
28	Ferro-silicon	43	117	100

Note: *Even in cases where almost entire domestic demand is satisfied by domestic supplies, some quantities of certain special quality/types of minerals and metals/ferro-alloys are imported to meet the requirement in certain specific end-uses.*

1/ *Includes mineral gypsum, by-product marine gypsum and estimated production of by-product phospho-gypsum, based on available information besides selenite.*

2 *Excludes production of limestone as a minor mineral, calcite and chalk.*

3/ *Relates to recovery of by-product sulphur from petroleum refineries and sulphur equivalent of by-product sulphuric acid recovered from copper & zinc smelters consuming indigenous ores and concentrates.*

4/ *Apparent demand.*

5/ *Excludes production in small-scale sector.*

FOREIGN TRADE

The world economy and trade that was recovering with output and trade in many developed and emerging economies reaching pre-2008 global economic crisis levels, with some countries even achieving pre-crisis trends, suffered the second shock in the form of the crisis in the euro area and slowdown in the US. The structural sovereign debt crisis in the euro zone area and the fiscal imbalance in the US which led to the present setback to some extent emanated from the earlier crisis. The tumultuous recession-ridden years of 2008 and 2009 seem to be re-emerging with fall in world trade to levels steeper than the decline in real gross domestic product (GDP). India's exports which had surpassed not only pre-crisis levels but also pre-crisis trends have started feeling the heat of this second global downturn which has come in quick succession to the first, though the country is in a better position than many others to weather the crisis.

Exports

According to the data available, the total exports (including re-exports) of all merchandise in 2009-10 and 2010-11 were ₹ 8,45,534 crore and ₹ 11,42,649 crore, respectively. The ores and minerals group (including diamond, precious and semi-precious stones) earned foreign exchange worth ₹ 1,27,831 crore and ₹ 1,65,080 crore in 2009-10 and 2010-11 thereby posting an increase of about 29.14%. Contribution of cut diamonds in 2009-10 & 2010-11 was ₹ 85,126 crore and ₹ 1,17,643 crore while that of iron ore was ₹ 28,366 crore and ₹ 21,416 crore, respectively.

The principal ores and minerals exported from India in order of value contribution are diamond (mostly cut), iron ore, alumina, granite and zinc ores and concentrates. Rough diamonds imported into the country are cut and re-exported and these diamonds contributed 71.43% to the total exports of ores and minerals in 2010-11. Iron ore contributed 12.97%, followed by alumina 5.57%, granite 3.26% and zinc ores & concentrates 1.11%. The individual share of remaining minerals was less than 1% in the total value of exports of ores and minerals from India in 2010-11.

The export of selected mineral-based products during 2009-10 and 2010-11 was valued at ₹1,46,867 crore and ₹ 1,99,953 crore, respectively. The exports of petroleum products, e.g., light distillates (naphtha and others), middle distillates and heavy ends, earned foreign exchange of ₹ 1,44,037 crore and ₹ 1,96,112 crore in 2009-10 and 2010-11, respectively, with 98% share in both the years in the export of selected mineral-based products.

India also exported metals and alloys valued at ₹ 59,975 crore and ₹ 1,29,023 crore during 2009-10 and 2010-11, respectively. Iron and steel with a share of about 46.4% in the total value of exports of metals and alloys in 2010-11, followed by copper & alloys (including brass & bronze) 28.5%, ferro-alloys 10.4%, aluminium, alloys & scrap 5.5%, zinc & alloys (including scrap) 3.0%, pig & cast iron (including spiegeleisen) 2.5%, lead & alloys (including scrap) 1.7% and precious metals/metal clad with precious metal 1.3% were the principal metals/alloys exported from India.

Imports

The total imports of all merchandise in 2009-10 and 2010-11 were ₹ 13,63,736 crore and ₹ 16,83,467 crore, respectively. The value of imports of ores and minerals in 2010-11 increased by 27% to ₹ 6,69,010 crore from ₹ 5,24,830 crore in 2009-10. Petroleum (crude) continued to be the largest constituent item of mineral imports with a share of 63% in 2010-11. Its imports in 2010-11 at ₹4,21,616 crore rose by more than 15% over 2009-10. Next in descending order was diamond with a share of about 22.8%, followed by coal (excluding lignite) 6.2%, copper ore & concentrates 3.0% and natural gas 2.2%.

The import of selected mineral-based products during 2009-10 and 2010-11 was valued at ₹ 56,459 crore and ₹ 73,797 crore, respectively. The imports of petroleum products in 2010-11 rose by 65% in value over the preceding year to ₹ 55,812 crore and had a share of 75.6% in the value of import of selected mineral-based products during 2010-11.

The value of imports of metals and alloys at ₹ 2,86,835 crore showed an increase of 33.8% in 2010-11 from ₹ 2,14,425 crore in 2009-10. Share of gold imports was about 64.4% in terms of value, followed by iron & steel (21.5%), aluminium alloys & scrap (3.5%), silver (3.1%), copper & alloys (3.0%) and nickel and alloys & scrap (1.1%).

VALUE-ADDED EXPORT TRADE

India's foreign trade includes exports of minerals, both in the raw form and semi-processed & processed forms like mineral-based primary manufactured products.

Minerals contributed significantly to India's exports trade in 2010-11 with a share of about 15% (i.e., ₹ 1,65,080 crore) in the total value of all merchandise. The contribution of minerals in exports in raw/unprocessed forms was about ₹ 28,964 crore and in semi-processed/processed forms was about ₹ 1,36,115 crore. The manufactured mineral-based products contributed about ₹ 3,28,020 crore in 2010-11 to the total value of exports of all merchandise. The value-added semi-processed/processed minerals figuring in India's foreign trade included cut and polished diamond/emerald, etc., pulverised barytes, steatite, felspar (cut), garnet, calcined magnesite, magnesia (fused), magnesite (dead-burnt), magnesium oxide, slate (worked), processed mica and manufactured mica products, coke, cut and polished dimension stones, alumina, etc. The manufactured mineral-based commodities included metals and alloys and products thereof, cement, firebricks and other refractory materials, clay-bonded graphite crucibles and silicon carbide crucibles, manganese dioxide, asbestos-cement products, inorganic chemicals like lime and fluorine chemicals, refined borax and borates, elemental phosphorus and phosphoric acid, titanium dioxide, petroleum products, phosphatic and potash fertilizers, etc. Table-5 provides data on contribution of various value-added minerals and mineral-based products to India's exports during 2008-09 to 2010-11.

Table – 5 : Contribution of Value-added (Processed) Minerals & Mineral-based Products in India's Export* Trade, 2008-09 to 2010-11

Sl. No.	Commodity group	Value of exports (₹ million)			Contribution (percentage)		
		2008-09	2009-10	2010-11	2008-09	2009-10	2010-11
1.	All Merchandise	8407550	8455336	11426489	100.00	100.00	100.00
2.	Minerals	1092964	1278311	1650796	13.0	15.1	14.4
	2.1 Raw/Unprocessed form	282519	354175	289644	3.4	4.2	2.5
	2.2. Semi-processed/ processed forms (preliminary and intermediate stages of processing)	810445	924136	1361152	9.6	10.9	11.9
3.	Manufactured Mineral-based Commodities (final stage of transformation)	2055167	2039239	3280200	24.4	24.1	28.7
	3.1 Metals/Alloys	822391	579754	1290231	9.8	6.8	11.3
	3.2 Others	1232776	1459485	1989969	14.6	17.3	17.4

Figures rounded off.
** Including re-exports.*

Indian Minerals Yearbook 2011

(Part- I)

50th Edition

MINERAL POLICY & LEGISLATION

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. +91712 - 2565471
PBX : +91712 - 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

2 Mineral Policy & Legislation

POLICY

The Mines and Minerals (Regulation and Development) Bill, 2011

1. The Mines and Minerals (Regulation and Development) Act, 1957 was enacted so as to provide for the regulation of mines and development of minerals under the control of the Union. The aforesaid Act was amended in the years 1958, 1972, 1986, 1987, 1994 and 1999.

2.The National Mineral Policy enunciated by the Central Government in 1993 was for liberalisation of the mining sector. With the passage of time and the economic development of the country, which requires a vibrant energy, metal and commodities sector to meet the infrastructure, manufacturing and other sectoral demands, nature and requirements of the mineral sector has changed. Based on the recommendations of a High Level Committee set up in the Planning Commission, Government of India, in consultation with State Governments, the National Mineral Policy, 1993 was replaced with a National Mineral Policy, 2008 on 13th March, 2008. The new National Mineral Policy provides for a change in the role of the Central Government and the State Governments, particularly in relation to incentivising private sector investment in exploration and mining and ensuring level-playing field and transparency in the grant of concessions and promotion of scientific mining within a sustainable development framework as also to protect the interest of local population in mining areas. This necessitated a new legislation for harmonisation with the new National Mineral Policy.

3. Since the existing law had already been amended several times, and as further amendments may not clearly reflect the objects and reasons emanating from the new National Mineral Policy, it is considered necessary to reformulate the legislative framework in the light of the new National Mineral Policy, 2008 by repealing the Mines and Minerals (Regulation and Development) Act, 1957.

4. The Mines and Minerals (Development and Regulation) Bill, 2011 prepared by the Ministry of Mines to replace the existing Mines and Minerals (Development and Regulation) Act, 1957 has been approved by the Cabinet and the bill has been introduced in Lok Sabha on 12th December, 2011, and the same has been referred to Standing Committe on Coal & Steel. The bill has been prepared after several rounds of consultation and workshop with all the Stakeholders. The Bill seeks a complete and holistic reform in the mining sector, with provisions to address issues relating to sustainable mining and local area development, especially families impacted by mining operations. The Bill also aims to ensure transparency, equity, elimination of discretions, effective redressal and regulatory mechanisms along with incentives encouraging good mining practices, which will also lead to technology absorption and exploitation of deep seated minerals.

5. The salient features of the Mines and Minerals (Development and Regulation) Bill, 2011, *inter alia*, are as follows :—

(a) it provides for a simple and transparent mechanism for grant of mining lease or prospecting licence through competitive bidding in areas of known mineralisation and on the basis of first-in-time in areas where mineralisation is not known;

(b) it enables the mining lease holders to adopt the advanced and sophisticated technologies for exploration of deep-seated and concealed mineral deposits, especially of metals in short supply through a new mineral concession;

(c) it enables the Central Government to promote scientific mineral development through Mining Plans and Mine Closure Plans enforced by a central technical agency, namely, the Indian Bureau of Mines, as well as the Regulatory Authorities and Tribunals;

(d) it empowers the State Governments to cancel the existing concessions or debar a person from obtaining concessions in future for preventing illegal and irregular mining;

(e) it empowers the Central Government and State Governments to levy and collect cess;

(f) it provides establishment of the Mineral Funds at National and State level for funding the activities pertaining to capacity building of regulatory bodies like Indian Bureau of Mines and for research and development issues in the mining areas;

(g) it provides for reservation of an area for the purpose of conservation of minerals;

(h) it enables the registered co-operatives for obtaining mineral concessions on small deposits in order to encourage tribals and small miners to enter into mining activities;

(i) it empowers the Central Government to institutionalise a statutory mechanism for ensuring sustainable mining with adequate concerns for environment and socio-economic issues in the mining areas through a National Sustainable Development Framework;

(j) it provides for establishment of a National Mining Regulatory Authority, which consists of a Chairperson and not more than nine members to advise the Government on rates of royalty, dead rent, benefit sharing with District Mineral Foundation, quality standards and also conduct investigation and launch prosecution in cases of large scale illegal mining;

(k) it provides for establishment of State Mining Regulatory Authority consisting of such persons as may be prescribed by the State Government to exercise the powers and functions in respect of minor minerals;

(l) it provides for establishment of a National Mining Tribunal and State Mining Tribunals to exercise jurisdiction, powers and authority conferred on it under the proposed legislation;

(m) it empowers the State Governments to constitute Special Courts for the purpose of providing speedy trial of the offences relating to illegal mining;

(n) it empowers the Central Government to intervene in the cases of illegal mining, where the concerned State Government fails to take action against illegal mining;

(o) it provides for stringent punishments for contravention of certain provisions of the proposed legislation; and

(p) to repeal the Mines and Minerals (Development and Regulation) Act, 1957.

6. A notable feature of the Bill is to provide a simple mechanism which ensures that revenues from mining are shared with local communities at individual as well as community level so as to empower them, provide them with choices, enable them to create, maintain and better utilise local infrastructure and other services provided for their benefit.

Internal Committee for drafting Sub-legislation

An Internal Committee was constituted in the Ministry of Mines under the Chairmanship of Joint Secretary (M&R) for drafting Sub-legislation in terms of draft Mines and Mineral Development & Regulation Act, 2011. As decided in the meeting of the committee, sub-committees were constituted in IBM to prepare following seven rules and their work is in progress to prepare draft rules.

1. Mineral Concession (Grant and Management) Rules.
2. Scientific Mining and Sustainable Development Rules.
3. Mineral Royalties and Cess Rules.
4. District Mineral Fund Rules.
5. Mining Regulatory Authority Rules
6. Mining Tribunal Rules
7. Mines and Minerals (Special Court) Rules.

Committee for Review and Restructuring of the Functions and Role of IBM

A committee was constituted on 23rd July, 2009 by the Ministry of Mines for reviewing and restructuring of functions and role of IBM in terms of the policy directions given in the National Mineral Policy, 2008. Based on the deliberations of the stakeholders' meeting held on 20th December, 2010 under the Chairmanship of Secretary (Mines), the Committee had modified the report. Subsequently, a meeting with industry personnel was held under the Chairmanship of Secretary (Mines) on 30th August, 2011 on the issue of continuance of Ore Dressing Division in IBM. It was decided in the meeting that IBM's role should be restricted to be a Regulator in the field of mineral beneficiation rather than as commercial organisation for development of flow sheets. Based on the decisions taken in the meeting held on 30th August, 2011, certain chapters of the Report were re-drafted. The modified draft report of the Committee is ready for submission.

Mining Tenement System

The scheme has been taken up by the IBM during the programme year 2009-10. The objective of the Scheme is to develop an online National Mineral Information System for investors by linking Central and State organisations engaged in administration of mineral resources in the country. The project is being implemented in mineral rich states i.e. Andhra Pradesh, Chhattisgarh, Goa, Gujarat, Jharkhand, Karnataka, Kerala, Maharashtra, Madhya Pradesh, Odisha, Rajasthan and Tamil Nadu.

GIS component of the project was demonstrated by ISRO incorporating limited data in Bellary (Karnataka) and Durg (Chhattisgarh). The GIS component was also linked to Registry component as per TMIS database in a very limited way.

In respect of Registry component of the project, the job for preparation of Detailed Project Report (DPR) has been assigned by the NICSI to the consultant M/s Earnest & Young. DPR has been prepared and is at final stage for its submission. The statewise inception reports prepared by M/s Ernst & Young have been examined by IBM and comments of the respected state Governments are sent. A training programme cum workshop had been organised on 17th & 18th November, 2011 at IBM HQ, Nagpur for online register for Mining Tenement System. The Software Development Agency will be finalised based on Request for Proposal and initial trials will be conducted in the year 2013-14.

Sustainable Development Framework for Mineral Sector.

The Consultative Committee attached to the Ministry of Mines conducted its meeting that discussed "Sustainable Development Framework (SDF) for Mineral Sector" on 7th September, 2011 at Parliament House, New Delhi.

The National Mineral Policy, 2008 has provided for development of framework for sustainable development, and accordingly, the Ministry has brought out a Draft Sustainable Development Framework (SDF) document for Mineral Sector. The SDF has not only incorporated regulatory requirements, but also gone beyond to recommend practices and best in class aspects for addressing the challenges of sustainable development more fully. It provides a path towards achieving sustainable development aided by guidance measurable outcomes and reporting assurance.

The SDF would reduce environmental and social conflicts in mining areas; ensure clarity for stakeholders on risk level in mining lease areas, reduce delays in obtaining clearances, cluster small operators to become more competitive and compliant, result in strong monitoring and assurance system and ensure reporting on governance and ethical practices. IBM has generated awareness about SDF in mining industry through organising various workshops.

Working Group for Twelfth Five Year Plan

The 2011-12 is the terminal year of the XIth Five Year Plan, and therefore, various Ministries constituted Working Groups for formulation of the XII Five Year Plan. IBM represented on the following Working Groups constituted by the Planning Commission:

1. Working Group on Mineral Exploration and Development.
2. Working Group on Cement Industry.
3. Working Group on Occupational Health and Safety constituted by Labour, Employment & Manpower Division of the Planning Commission.

Group to Evolve Model Guidelines on Environmental Aspects of Quarrying of Minor Minerals

Ministry of Environment & Forests had constituted a Group of State Secretaries of both the Environment and Mining Departments of major States under the chairmanship of Secretary (E&F), Government of India to evolve model guidelines on environmental aspects of quarrying of minor minerals. IBM represented Ministry of Mines as a member of the Group. The Group submitted its report in March 2010. As a follow up of the recommendations of the Group, on the direction of Ministry of Mines, Controller General, IBM constituted a Committee to draft the documents on (i) Mining framework for minor minerals, (ii) Framework for cluster of mines, and (iii) Guidelines for reclamation and rehabilitation. Report of the Committee has been submitted to the Ministry and uploaded on the IBM's website for perusal of stakeholders and State Governments to seek their views/comments. Taking into consideration the feed back received from stakeholders and State Governments, the draft was modified by the Committee and modified guidelines have been submitted to the Ministry.

Off-shore Areas

The Controller General, IBM has been notified as administering authority as well as authorised officer for the purpose of the Offshore Areas Mineral (Development and Regulation) Act, 2002 (17 of 2003) vide order dated 11.02.2010. Subsequently, the Controller General, vide notification dated 7.6.2010 has notified a total 62 blocks (26 mineral bearing Offshore blocks in Bay of Bengal and 36 mineral bearing Offshore blocks in Arabian Sea). In response to the above notification, a total of 377 applications have been received till the last date, i.e. 14.9.2010 stipulated for the purpose. Based on the recommendations of the Screening Committee, Exploration Licences were granted to 16 applicants for 62 mineral bearing blocks in the off-shore waters of Bay of Bengal and Arabian Sea on 5th April 2011.

Further progress in executing the Exploration Licence is stalled as the matter is subjudice. All subsequent actions have been therefore kept in abeyance. Meanwhile process for framing of UNFC Guidelines in Offshore Mining is in progress.

Coordination-cum-Empowered Committee

As suggested by the High Level Committee (HLC), a Central Coordination-cum-Empowered Committee (CEC) was constituted by the Ministry of Mines on 4.3.2009 under the chairmanship of Secretary (Mines) to monitor and minimise delays in grant of approvals for mineral concessions. The Committee consists of the Central Ministries/Departments concerned and the Secretaries in charge of Mining & Geology in the States and holds meeting once in 3 months.

Subsequently, considering the need for having more effective coordination among the Central Ministries/Departments and the State Governments for grant of mineral concessions as well as for dealing with other important matters relating to mineral development and regulation in the country, the Ministry has reconstituted the CEC as 'Coordination-cum-Empowered Committee on Mineral Development and Regulation' on 20th December, 2011. The Terms of Reference (TOR) have also been broadened, so as to bring within its ambit other important matters, viz, Sustainable Development Framework Coordination/review of steps for prevention of illegal mining, issues arising out of the National Mineral Policy and legislation governing mineral development, etc. All State Governments have also been requested to review the composition and TOR of their State Empowered Committees and effect suitable changes therein.

So far, eight meetings of the Centrtal Coordination-cum-Empowered Committee have been held on 24th July, 2009, 22nd December, 2009, 18th June, 2010, 22nd December, 2010, 3rd May, 2011, 20th September, 2011, 16th January, 2012 and 27th March, 2012 wherein important decisions aimed at minimising delays for processing of mineral concession applications at various levels; finding ways to deal with issues facing the mineral sector and improving the overall mineral concession regime were taken, which are being regularly followed up by the Ministry with the State Governments and other offices/agencies concerned.

Interim Report of the Justice MB Shah Commission of Inquiry on Illegal Mining of Iron Ore and Manganese Ore

1. The Government of India has set up Shri Justice M. B. Shah Commission of Inquiry to probe Illegal Mining of Iron Ore and Manganese Ore vide Notification No. S.O. 2817(E) dated 22nd November, 2010. The Shah Commission has been set up with various terms of reference:

2. The Commission, has submitted its first Interim Report on 14.7.2011 recommending some

urgent remedial measures to prevent further illegal mining, its trade, transportation and export, which include amendments proposed in the MMDR Act, 1957, amendments to Mineral Concession Rules, 1960, amendments in Guidelines issued by the Indian Bureau of Mines (IBM) and policy changes and measures for strengthening the State Government machinery.

3. The recommendations of the Shah Commission have been considered in the Ministry of Mines and actions in respect of the recommendations of the Shah Commission are being implemented.

Study Group on Revision of Rate of Royalty and Dead Rent

In order to review the royalty rates and dead rent, the Ministry of Mines has on 13th September 2011 constituted a Study Group on revision of rates of royalty and dead rent for minerals (other than coal, lignite and sand for stowing) and to make appropriate recommendations to the Government. The terms of reference of the Study Group for revision of rates of royalty and dead rent are as under:

(a) To review the existing rates of royalty on minerals (other than coal, lignite and sand for stowing) given in Second Schedule to the Mines and Minerals (Development and Regulation) Act, 1957 and to recommend revision of rates and in case, if necessary, give an additional conditional recommendation on what should be the royalty rate and the mechanism for computation of royalty rates after taking into account the liabilities on the lease holder as envisaged in the draft MMDR Bill, 2011, in the event the Parliament approves the new draft Bill.

(b) to consider the feasibility of allowing incentivised royalty rates for base metals, noble metals, REE and precious stones to encourage exploration;

(c) to suggest incentivised royalty rates on ad-valorem basis for beneficiated or concentrated ore;

(d) to consider and recommend policies relevant to mineral development and administration of royalty regime;

(e) to suggest appropriate revision in the existing rates of dead rent given in the Third Schedule to the Mines and Minerals (Development and Regulation) Act, 1957.

The Study Group will submit its report within a period of six months.

Rule 45 of MCDR, 1988 and Compulsory Registration with IBM.

Rule 45 of Mineral Conservation & Development Rules, 1988 has been amended with a view to allow end-to-end accounting of the minerals. With the gradual implementation of the provisions of Rule 45 by IBM, efficiency in accounting of minerals/ores produced will increase manifold and it will be easy to isolate & monitor areas of illegal mining effectively. The State Governments have also been advised to ensure that any automation in the reporting system developed at the State levels should be compliant with the amended Rule 45 of the MCDR. Accordingly, IBM in association with NIC has developed online registration forms and forms for statutory monthly and annual returns. The online system of registration and submission of statutory returns was inaugurated by Hon'ble Minister of State for Mines, Shri Dinsha Patel on 29.3.2012 at New Delhi.

As per the amended rule 45 of MCDR, 1988, the owner, agent, mining engineer or manager of every mine, or any person or company engaged in trading or storage or end-use or export of minerals mined in the country, is required to be registered with the Indian Bureau of Mines. The registration number so allotted by the Indian Bureau of Mines is required to be used for all purposes of reporting and correspondence connected therewith.

The online registration system is already in place and so far 4,898 lease holders (covering 9,390 mines), 2,345 traders, 476 exporters, 1,033 stockists and 1,653 end-users have registered their details with IBM. Further, IBM has issued circular that the ore cannot be sold without registration with IBM. This would help to find out the source of mineral till its end-use stage and would prove as an effective tool for prevention of illegal mining.

The reporting system has been developed to facilitate submission of returns on-line. Initially, the focus will be on submission of monthly returns for iron and manganese ore mines throughout the country and all other minerals would be covered by September 2012. In future, the system will be linked to Railways and Port Authorities to check the correctness of the reporting made under the Rule.

New Scheme on Capacity Building of State Governments - Development & implementation of ore accounting software by NIC

Sub Group III on Infrastructure and Financing of Twelfth Five Year Plan and Working Group on Mineral Exploration of Ministry of Mines have completed an in depth study on the mineral movement in the sector. The amended Rule 45 of MCDR 1988 largely covered the area of accounting of mineral production and movement of minerals legally mined. With the implementation of the provisions of Rule 45, increasing the efficiency in accounting minerals, State Government may find it easy to isolate and monitor areas of illegal mining effectively. This requires implementation of Rule 45 by developing uniform ore accounting software with interface to Railways, Ports and Customs. The software for registration and concessions, MIS is to be developed by NIC. For designing, developing and for implementation of such software Sub Group III has proposed a new scheme in the 12th plan, which is to be implemented through IBM.

Further, the draft report of the Committee for Review & Restructuring of the functions and Role of IBM has recommended that the IBM would evolve as a consultant for creation and improvement of State level regulatory mechanisms and to assure suitable support. In the developmental role, IBM would assist State Government to ensure adherence to standards and parameters by leveraging technology to ensure scientific mining.

International Co-operation

Cooperation with Afghanistan

India and Afghanistan bilateral relations which are underpinned by a long history of friendship and cultural affinity have attained new level of intensity and cooperation. India has undertaken, in partnership with the Afghan government, projects in virtually all parts of Afghanistan and a whole range of sectors including hydro-electricity, road construction, agriculture, industry, telecommunications, information & broadcasting, education and health. In the next phase of Indian assistance programme, focus would be on development of the infrastructure sector, including road construction, hydroelectricity and power transmission. Afghanistan has significant amounts of undiscovered non-fuel mineral resources. Estimates for copper and iron ore resources were found to have the most potential for extraction in Afghanistan. Scientists also found indications of abundant deposits of coloured stones and gemstones, including emerald, ruby, sapphire and peridot. Other examples of mineral resources available for extraction in Afghanistan include gold, mercury, sulphur, chromite, talc-magnesite, potash, graphite and sand & gravel. Minister of Mines, Afghanistan emphasised the need of India’s assistance in training of geosciences personnel of Afghanistan. Accordingly, Geological Survey of India (GSI) organised “Special Course for Officials of Government of Afghanistan on Application of Remote Sensing (Aster & Landsat) and GIS for Mineral Exploration” from 5th July, 2010 to 16th July, 2010.

Co-operation with Quebec Province, Canada

His Excellency Mr Clement Gignac, Minister of Economic Development, Innovation and Export Trade, Quebec Province, Canada met Hon’ble Minister of State for Mines (IC) Shri Dinsha Patel on 3rd February, 2011. The discussions were focused on possibility of entering into a memorandum of understanding for cooperation between India and Quebec province in the field of Geology and Mineral Resources.

Memorandum of Understanding with Colombia

The Ministry of Mines has signed a Memorandum of Understanding (MoU) with the Ministry of Energy and Mines of Colombia for cooperation in the field of Geology & Mineral Resources on 4th May, 2011 at the Colombian Capital Bogota. The MoU will facilitate transfer of technology in mining and beneficiation plants and devise exchange programme at Government level involving training of personnel and exchange of information by counterpart agencies. Keeping in view the rich endowments of Colombia and the potential for co-operation and investment, the MoU provides an umbrella framework for cooperation in the field of geology and mineral resources between the two countries.

Memorandum of Understanding with British Columbia, Canada.

The Ministry of Mines, Government of India and the Ministry of Energy & Mines, Government of British Columbia Province, Canada have signed a Memorandum of Understanding (MoU) on cooperation in the field of Geology and Mineral Resources on 17th November, 2011.

Memorandum of Understanding with Mali

The Ministry of Mines, Government of India and the Ministry of Mines of Republic of Mali signed a Memorandum of Understanding (MoU) on cooperation in the field of Geology and Mineral Resources on 11th January, 2012.

The objectives of the MoU, inter-alia, include 'Development of geological and mineral resources; Promotion of investment in the area of mining and mining related activities; and Encouragement of transfer of technology between the Parties.

New Exploration Licensing Policy (NELP)

The 16 oil and gas exploration blocks awarded contracts on 28th March, 2012 under the ninth exploration licensing round have been won by state firms including ONGC, Oil India and GAIL.

Under the present round, the Government had offered 34 areas — eight deepwater blocks, seven shallow water blocks, 11 on-land blocks, and 8 Type-S (or small) on-land blocks, in NELP-IX. Of these, bids were received for 33 on close of auction on 28th March, 2011.

Bids for seven deep sea blocks and three shallow water blocks were rejected as bidders offered “very low” profit share to the government.

ONGC got operating rights for four blocks, while a consortium led by Oil India won two blocks. Gail India-led consortium was awarded one onshore block in the Cambay basin. Other companies awarded blocks were Sankalp Oil and Natural Resources, which won three, while one block each was won by Focus Energy, Pratibha Oil and Natural Gas, and Pan India Consultants & Frost International Ltd. Deep Energy, a subsidiary of the US-based Deep Industries, in consortium with other companies, secured operatorship of three onshore blocks.

Foreign Trade Policy

In the Union Budget 2012-13, the following Customs duties and Export duties were imposed.

Customs Duty

Metals

Basic customs duty on coating material for manufacturing of electrical steel is being reduced from 10% to 5% subject to actual user condition.

Basic customs duty on ammonium meta-vanadate used in the manufacture of ferro-vanadium is being reduced from 7.5% to 2.5%.

Nickel oxide/hydroxide and nickel ore/ concentrate are being fully exempted from basic customs duty.

Exemption from SAD currently available to CRGO steel is being restricted to prime quality of such steel.

Basic customs duty on flat rolled products (HR and CR) on non-alloy steel is being increased from 5% to 7.5%.

Precious Metals and Gemstones

Basic customs duty on standard gold bars and platinum bars is being increased from 2% to 4%.

Basic customs duty on non-standard gold is being increased from 5% to 10%.

Basic customs duty on gold ore/concentrate and dore bars for refining is being increased from 1% to 2%.

Basic customs duty of 2% is being imposed on cut and polished coloured gemstones.

Capital Goods/Infrastructure

Basic customs duty on capital goods, plants and equipment imported for setting up or substantial expansion of iron ore pellet plants or iron ore beneficiation plants is being reduced from 7.5% to 2.5%. Steam coal is being fully exempted from basic customs duty. CVD is also being reduced from 5% to 1% on such coal. The dispensation would be valid up to 31.3.2014.

Natural Gas/ Liquified Natural Gas imported for power generation by a power generation company is being fully exempted from basic customs duty.

Full exemption from basic customs duty is being provided to uranium concentrate, sintered natural uranium dioxide, sintered uranium dioxide pellets for generation of nuclear power.

Full exemption from basic customs duty is being extended to coal mining projects.

At present machinery and instruments for surveying and prospecting of mines attract basic customs duty of 10% and 7.5%, respectively. These rates are being reduced and unified at 2.5%.

Export duty

The Government has hiked the export duty on iron ore on 30th December 2011.

Export duty on chromium ore is being charged from ₹ 3,000 per tonne to 30 per cent ad valorem.

Tax Collection at Source (TCS) on sale of certain minerals

Mining Sector is an important segment of Indian Economy, but the trading of mineral remained largely unregulated resulting in non- reporting or under-reporting of trading in minerals. Therefore, in order to collect tax at the earliest point of time and also to improve mechanism of transcations in mining sector, it is proposed that tax at the rate of 1% shall be collected by the seller from the buyer for coal, lignite and iron ore. However, the seller shall not collect tax on sale of said minerals if the same are purchased by the buyer for personal consumption. Further, the seller of these minerals shall not collect tax if the buyer declares that these minerals are to be utilised for the purpose of manufacturing, processing or producing articles or things. This amendment will take effect from 1st July 2012.

Excise Duty

Cement

The excise duty structure on cement manufactured and cleared in packaged form is being rationalised. The graded RSP slabs for the purpose of charging of duty on cement manufactured and cleared in packaged form are being done away with. The rates on cement and cement clinkers are also being revised as under:

Cement manufactured and cleared in packaged form

a) From mini cement plants 6% ad valorem + ₹ 120 per tonne

b) from other than mini cement plants 12% ad valorem + ₹ 120 per tonne

Cement cleared other than packaged form 12% ad valorem

Cement Clinker 12% ad valorem.

Cement is also being notified under section 4A of the Central Excise Tarrif Act, 1985, that is retail sale price (RSP) based assessment with an abatement of 30% from RSP.

Precious Metal

1) At present, branded jewellery of precious metals attracts excise duty of 1%. The scope of the levy is extended to include unbranded jewellery within its ambit. However, the duty on such unbranded jewellery would be charged on 30% of transaction value declared in the invoice.

2) Unbranded silver jewellery is already exempt. Branded silver jewellery is being exempted from excise duty.

3) Excise duty on gold jewellery sold from EOUs into domestic tariff area (DTA) is being increased from 5% to 10%.

4) Excise duty on refined gold is being increased from 1.5% to 3%.

5) Excise duty on gold produced from copper smelting is being increased from 2% to 3%.

6) Excise duty on silver produced from copper smelting is being reduced from 6% to 4%.

7) Full exemption from excise duty is being provided on articles of goldsmith and silversmith wares of precious metals or of metals coated with precious metals, not bearing brand name.

8) Gold coins of purity 99.5% and above and silver coins of purity 99.9% and above are being fully exempted from excise duty.

9) As a measure to rationalise the business of jewellery & to simplify its operation and minimise its impact on small artisans and goldsmiths following measures are taken :

- Small-scale exemption up to annual turnover not exceeding ₹ 1.5 crore for units having a turnover below ₹ 4 crore in the previous year is being exended;
- Turnover on the basis of tariff value is being computed; and
- The onus of registration and payment is being placed on the person who gets jewellery manufactured on job-work.

Allocation of coal block

The Government has notified 'the Auction by Competitive Bidding of Coal Mines Rules, 2012'on 2.2.2012 in the Gazette of India.

The 54 coal blocks with total geological reserves of about 18.22 billion tonnes (BT) are identified for allocation, out of which 16 blocks with 7.27 BT reserves are earmarked for allocation for Government companies, 16 blocks with 8.16 BT reserves for power sector companies selected through tariff based bidding and 22 blocks with 2.79 BT reserves for companies selected through auction.

Proposal to revise the existing rates of royalty on coal and lignite

Section 9(3) of the Mines and Minerals (Regulation and Development) Act, 1957 (MMDR, Act, 1957) provides that the Central Government shall not enhance the rate of royalty in respect of any mineral more than once during any period of three years. The existing royalty rates had been notified by the Government on 1.8.2007.

The Government constituted a Study Group on 4.2.2010 for revision of royalty rates for coal & lignite. Taking into consideration the submissions made by all stakeholders, the interests of the coal producing States, the consumers and the national economy as a whole, the Study Group recommended switching over to a full-fledged ad-valorem regime of royalty on coal and lignite.

The Cabinet Committee on Economic Affairs has approved the proposal for adoption of ad-valorem regime, in place of the present hybrid formula for charging royalty on coal and lignite at the rate of 14% and 6%, respectively, as per the recommendations of the Study Group.

The Cabinet Committee on Economic Affairs has also approved the following:

a) introduction of an ad-valorem royalty on coal @14% of price as reflected in the invoice excluding taxes, levies and other charges.

b) The proposed royalty revision not to be extended to the State of West Bengal unless the cesses imposed are withdrawn. For States other than West Bengal that levy cess or other taxes specific coal bearing lands, the revision of royalty allowed shall be adjusted for the local cesses or such taxes so as to limit overall revenue to the ad-valorem royalty yield.

c) Introduction of an ad-valorem royalty on lignite @ 6%.

d) For the purpose of calculating the royalty for captive coal mines, the price of coal produced from captive coal mines shall mean the basic pithead price of Run of Mine (ROM) coal and lignite, as reflected in the invoices, excluding taxes, levies and other charges of Coal India Limited (CIL), Neyveli Lignite Corporation Limited (NLC) and Singareni Collieries Company Limited (SCCL) for similar grades of coal/lignite in the mine nearest to the captive mines.

A Gazette Notification for amendment to the Second Schedule of the Mines and Minerals (Development and Regulation) Act, 1957 for revision in the rates of royalty on coal and lignite is yet to be issued.

LEGISLATION

MMDR Act, 1957

MMDR Act, 1957 was amended vide notification No.43 dated 8.9.2010 notifying MMDR Amendment Act, 2010. The amendment has introduced a new Section 11A relating to selection of a company for grant of Reconnaissance Permit/ Prospecting Licence/ Mining Lease in respect of coal or lignite through auction by competitive bidding. The amendment was to take effect from a date to be notified later.

Vide Gazette of India, Ministry of Mines, S.O. 263(E), dated 13th February, 2012, in exercise of the power conferred by sub-section (2) of the Section 1 of MMDR Amendment Act, 2010, the Central Government has notified the 13th February 2012 as the date on which the provisions related to new section 11A of the said Act about procedure in respect of coal or lignite shall come into force.

Indian Minerals Yearbook 2011

(Part- I)

50^{th} Edition

STATUS OF RECONNAISSANCE PERMITS, PROSPECTING LICENCES AND MINING LEASES IN INDIA

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. +91712 - 2565471
PBX : +91712 - 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

3 Status of Reconnaissance Permits, Prospecting Licences and Mining Leases in India

INTRODUCTION

Under the Mines & Minerals (Development & Regulation) Act, 1957 and Mineral Concession Rules, 1960, the State Governments accord grant/ renewal of reconnaissance permits, prospecting licences and mining leases. Also, the State Governments are required to submit a copy of every permit/licence/lease granted/renewed to the Controller General, IBM, under Rule 57 (1) of Mineral Concession Rules, 1960. Additionally, the State Governments also have to submit a consolidated Annual Return of all reconnaissance permits, prospecting licences and mining leases granted or renewed to the Controller General, IBM, in a prescribed format under Rule 57 (2) of Mineral Concession Rules, 1960 not later than 30th day of June of each year, for the previous financial year.

RECONNAISSANCE PERMITS

Reconnaissance Permit is a permit granted for the purpose of undertaking "reconnaissance operations" which means any operation undertaken for preliminary prospecting of a mineral through regional, aerial, geophysical or geochemical surveys and geological mapping, but does not include pitting, trenching, drilling (except drilling boreholes on a grid specified from time to time by the Central Government) or subsurface excavation.

The provision of Reconnaissance Permits (RP) was introduced in 1999 under the Mines & Minerals (Development & Regulation) Act,1957 and in 2000 under the Mineral Concession Rules, 1960 and Mineral Conservation & Development Rules,1988 made under the Act.

During 2010-11, the Government has approved/ granted 30 Reconnaissance Permits covering a total area of 35,913.72 sq km. Out of these, the maximum number of RPs were in Madhya Pradesh (16), Karnataka (7), Rajasthan (3) and Chhattisgarh & Uttar Pradesh (2 each). The details of the RPs approved / granted during 2010-11 are given in Table - 1.

Table-1: Reconnaissance Permits Approved / Granted during 2010-11

State	Mineral	No.	Area (sq km)
India		**30**	**35913.72**
Chhattisgarh	Diamond, Gold & Associated minerals	2	3435.00
Karnataka	Gold	1	46.00
	Diamond, Gold & Associated minerals	6	7146.12
Madhya Pradesh	Diamond, Gold, Iron ore, Manganese ore,	3	6192.00
	Diamond, Gold, Copper, Lead Zinc & Associated minerals	13	11981.73
Rajasthan	Diamond, Gold, Copper Lead, Zinc & Associated minerals	3	4456.12
Uttar Pradesh	Diamond, Gold & Associated minerals	2	2656.75

PROSPECTING LICENCES

Under the Mines & Minerals (Development & Regulation) Act, 1957, "Prospecting Licence" (PL) means a licence granted for the purpose of undertaking “prospecting operations” with a view to exploring, locating or proving mineral deposits. The State Governments and Union Territories are empowered to grant/renew/revoke Prospecting Licence (PL) under provisions of Mineral Concession Rules, 1960.

As per information received from the State Governments/Union Territories, 131 prospecting licences were granted covering an area of 35,682 ha during 2010-11 as compared with 81 prospecting licences covering 21,386 ha area during 2009-10.

The states where prospecting licences were granted during 2010-11 include Madhya Pradesh (66), Maharashtra (14), Uttarakhand (13), Rajasthan (11), Jharkhand (10), Andhra Pradesh (9), Chhattisgarh (5), Gujarat (2), Tamil Nadu (1). Areawise, Madhya Pradesh covered 25,637 hectares, Andhra Pradesh 3,364 hectares, Maharashtra 3,282 hectares and Jharkhand 2,587 hectares. The remaining area of 812 hectares was accounted for by rest of the states. The statewise distribution of prospecting licences granted during 2008-09 to 2010-11 is given in Table-2.

Mineralwise, in 2010-11, prospecting licences granted were for limestone (27), manganese ore (18), iron ore (14), soapstone/ steatite (10) , silica sand (6) and dolomite (5). Thirty nine PLs were granted in respect of group of minerals. Limestone accounted for an area of 17,778 hectares out of the total area of 35,682 hectares covered by the Prospecting Licences granted during 2010-11 followed by iron ore (3,803 ha) and manganese ore (3,308 ha). Group of minerals covered an area of 10,381 hectares. The mineralwise distribution of prospecting licences granted during 2008-09 to 2010-11 is given in Table-3.

Table – 2 : Prospecting Licences Granted, 2008-09 to 2010-11
(By States)

State	2008-09		2009-10		2010-11	
	No.	Area (ha)	No.	Area (ha)	No.	Area (ha)
India	**21**	**1623**	**81**	**21386**	**131**	**35682**
Andhra Pradesh	6	140	9	4854	9	3364
Arunachal Pradesh	-	-	2	42	-	-
Chhattisgarh	-	-	1	5	5	71
Gujarat	-	-	-	-	2	25
Jharkhand	-	-	-	-	10	2587
Karnataka	2	728	-	-	-	-
Madhya Pradesh	11	710	50	11182	66	25637
Maharashtra	-	-	5	2802	14	3282
Rajasthan	2	45	12	2499	11	652
Tamil Nadu	-	-	2	2	1	2
Uttarakhand	-	-	-	-	13	62

Area figures rounded off.

Table – 3 : Prospecting Licences Granted, 2008-09 to 2010-11
(By Minerals)

Mineral	2008-09		2009-10		2010-11	
	No.	Area (ha)	No.	Area (ha)	No.	Area (ha)
India	**21**	**1623**	**81**	**21386**	**131**	**35682**
Barytes	1	3	-	-	1	4
Calcite	1	25	-	-	-	-
Dolomite	1	9	3	10	5	23
Garnet (abrasive)	-	-	1	26	-	-
Gold	2	728	-	-	-	-
Iron ore	1	22	6	460	14	3803
Jaspar	-	-	1	185	-	-
Laterite	-	-	11	2392	4	75
Limestone	2	482	17	11159	27	17778
Magnesite	-	-	-	-	2	9
Manganese ore	7	210	16	3156	18	3308
Mica	-	-	1	30	1	4
Moon Stone	-	-	1	1	-	-
Pyrophyllite	-	-	1	5	-	-
Quartz	1	9	-	-	-	-
Quartzite	-	-	-	-	1	4
Red ochre	-	-	1	5	2	14
Soapstone/steatite	-	-	-	-	10	49
Shale	-	-	1	18	-	-
Silica sand	2	40	-	-	6	225
White Clay	-	-	-	-	1	5
Group of minerals	3	95	21	3939	39	10381

Area figures rounded off.

MINING LEASES

Section 3 (c) of the Mines & Minerals (Development & Regulation) Act 1957 defines "Mining Lease" (ML) as a lease granted for the purpose of undertaking mining operations and includes a sub-lease granted for such purpose. The Act defines "mining operations" as any operation undertaken for the purpose of winning any mineral.

The status of mining leases as on 31.3.2011 indicates that 11,003 mining leases were in force in the country in 23 states covering an area of 547,814 ha for 65 metallic and non-metallic minerals excluding lignite, coal, petroleum, natural gas, atomic minerals and minor minerals.

During 2010-11, the statewise break up of leases as reflected in Table-4 indicates Rajasthan was leading with 2,696 leases followed by Andhra Pradesh (1,999), Gujarat (1,152), Madhya Pradesh (1,100), Tamil Nadu (945), Karnataka (754), Odisha (532), Goa (336), Jharkhand (332), Chhattisgarh (316), and Maharashtra (251). These eleven states together accounted for about 95% of the total mining leases in force.

Of the total mining lease area covered by different States, Rajasthan accounted for 20% followed by Odisha (14%), Andhra Pradesh (12%),Karnataka (11%), Tamil Nadu & Jharkhand (7% each), Madhya Pradesh (6%), Gujarat (5%), Goa & Chhattisgarh (4% each) and Maharashtra (3%). These eleven states accounted for about 93% of the total mining lease area granted and the remaining 7% was accounted for by the rest of the twelve states.

Scheduled minerals are those listed in the First Schedule to the MM(DR) Act, 1957. There are 10 minerals under Scheduled Minerals for which mining leases were in existence as on 31.3.2011. The number of existing mining leases are 1,596, i.e., 14% of the total mining leases accounting for an area of 1,87,016.82 hectares which is 34% of the total mining area in the country. Out of the ten scheduled minerals, the total number of mining leases for iron ore is placed at 800 followed by bauxite (343), manganese ore (340), chromite (35), asbestos (34), copper ore (17), lead and zinc ores (12), gold (11) , diamond (2) ruby and sapphire (1 each).

During 2010-11, mining leases in force were in both Private and Public sectors including Central and State Government Undertakings. Out of the total 11,003 mining leases in force in the country, 10,467 (95%) mining leases with an area of 3,64,181.14 ha (67%) are in the Private Sector and the remaining 536 (5%) leases are in the Public Sector extending over an area of 1,83,633.17 ha (33% of the total mining lease area). Most of the scheduled minerals, namely copper ore, lead & zinc ores, gold, iron ore, manganese ore, chromite, asbestos and non-scheduled minerals like limestone, dolomite, pyrite, fluorite, apatite, barytes, kyanite & magnesite, etc. are being exploited by both Public and Private Sectors.

In the metallic minerals, ferrous group of minerals include iron ore, manganese ore, chromite, while non-ferrous group of minerals comprises bauxite, copper-lead-zinc, molybdenum, nickel, tin and the noble metals include gold, silver and platinum group of metals. There were no mining leases for molybdenum, nickel, silver and platinum group of metals in the country. In 2010-11 for 8 metallic minerals, existing mining leases were 1,573 (14%) covering an area of 1,84,751.66 ha (34%). On the other hand, existing leases for non-metallic minerals/industrial minerals were 9,430 (86%) covering an area of 3,63,062.65 ha (66%).

The statewise summary of mining leases during 2008-09 to 2010-11 is given in Table-4. The mineral-wise summary of existing mining leases as on 31.3.2011 is given in Table-5. Sectorwise distribution of mining leases as on 31.3.2011 is given in Table-6.

Table - 4 : Existing Mining Leases, 2008-09 to 2010-11
(By States)

State	2008-09		2009-10		2010-2011	
	No.	Area (ha)	No.	Area (ha)	No.	Area (ha)
India	**9415**	**491445.64**	**10488**	**507403.84**	**11003**	**547814.31**
Andhra Pradesh	1578	54470.79	1948	71072.74	1999	68047.13
Assam	8	929.50	8	929.50	8	929.50
Bihar	10	2030.16	11	2074.72	11	2074.72
Chhattisgarh	312	17650.66	314	20143.54	316	23551.77
Goa	422	31457.43	337	24445.88	336	24393.26
Gujarat	1228	27962.54	1125	30817.62	1152	30035.65
Himachal Pradesh	54	2027.18	54	2665.09	54	3440.41
Haryana	108	11471.52	110	11638.53	118	12255.12
Jammu & Kashmir	55	1814.75	57	2671.84	57	2671.84
Jharkhand	323	36974.67	330	37059.58	332	37071.32
Karnataka	693	57398.26	615	46784.85	754	59204.59
Kerala	109	3042.12	85	2943.33	82	2878.62
Manipur	2	610.17	2	610.17	2	610.17
Meghalaya	19	1433.97	22	1448.53	21	1297.63
Madhya Pradesh	948	28442.41	963	28524.20	1100	30930.93
Maharashtra	280	17703.21	254	16312.35	251	16093.72
Odisha	387	67212.90	528	76356.67	532	77743.91
Rajasthan	2167	105607.10	2587	106479.18	2696	107102.01
Sikkim	3	96.30	3	96.32	3	96.32
Tamil Nadu	482	6652.01	925	11180.67	945	37780.11
Uttar Pradesh	88	9290.11	88	9290.11	95	7608.54
Uttarakhand	69	3077.78	69	3077.78	89	1276.76
West Bengal	70	4090.10	53	780.64	50	720.28

Table - 5 : Existing Mining Leases as on 31.3.2011 (By Minerals)

Mineral	No. of Leases	Lease area (ha)
India	**11003**	**547814.31**
Agate	3	59.62
Amethyst	6	74.42
Apatite	2	20.17
Asbestos	34	1632.75
Ball clay	54	28281.41
Barytes	164	2587.75
Bauxite	343	30032.74
Borax	1	159.00
Calcareous sand	14	151.54
Calcite	80	1620.02
Chalk	162	650.75
China clay	514	17386.17
Chromite	35	9432.57
Clay (Others)	106	1280.61
Copper ore	17	10007.01
Corundum	17	240.62
Diamond	2	275.96
Diaspore	12	94.38
Dolomite	542	8124.63
Dunite	1	14.28
Epidote	1	5.00
Felsite	6	102.29
Felspar	862	11653.41
Fireclay	272	6507.87
Fluorite	16	1670.71
Garnet	96	938.88
Garnet (Gem)	1	12.08
Gold	11	6441.71
Graphite	121	3787.65
Gypsum	89	15255.15
Iolite	11	104.35

(Contd.)

Table - 5 (Concld.)

Mineral	No. of Leases	Lease area (ha)
Iron ore	800	98082.70
Jasper	5	211.70
Kyanite	32	3217.74
Laterite	186	2293.10
Lead & Zinc ore	12	7175.19
Lime kankar	19	648.17
Limeshell	35	4879.47
Limestone	2073	153926.94
Magnesite	40	3015.53
Manganese ore	340	23258.72
Marl	8	1729.08
Mica	311	7511.74
Moulding sand	62	1380.64
Ochre	158	3405.40
Perlite	1	144.88
Phosphorite	12	2750.76
Pyrites	1	647.50
Pyrophyllite	97	2259.98
Pyroxenite	10	90.84
Quartz	1892	16696.91
Quartzite	88	2016.35
Ruby	1	4.07
Sand (Others)	57	13547.01
Sapphire	1	673.40
Shale	46	570.11
Silica sand	545	17797.48
Sillimanite	6	2847.06
Slate	18	683.31
Steatite	474	16609.18
Tin	15	321.02
Vermiculite	16	285.94
White clay	24	212.16
White shale	16	74.90
Wollastonite	7	239.86

Table - 6 : Existing Mining Leases as on 31.3.2011

(By Sectors)

Sector	No. of leases	%	Area (ha)	%
India	**11003**	**100**	**547814.31**	**100**
Public	**536**	**5**	**183633.17**	**33**
Central Government Undertakings	197	2	110246.53	20
State Government Undertakings	339	3	73386.64	13
Private	**10467**	**95**	**364181.14**	**67**

Indian Minerals Yearbook 2011

(Part- I)

50th Edition

EXPLORATION & DEVELOPMENT

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. +91712 - 2565471
PBX : +91712 - 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

4 Exploration & Development

GOVERNMENT'S POLICY

The National Mineral Policy, 2008 for non-fuel and non-coal minerals introduced by the Government in replacement of the National Mineral Policy 1993 lay enormous thrust on the various aspects of mineral industry, such as regulation of minerals, role of State in mineral development, survey and exploration, database of mineral resources and tenements, strategy of mineral development, etc. Among other things, strong emphasis is laid on the following:

* To judiciously exploit and utilise the country's mineral potentialities, systematic regional and detailed exploration will be carried out using state-of-the-art techniques in a time bound manner. Zero-waste mining will be the national goal and mining technology will be upgraded to ensure exploration and utilisation of entire run-of-the-mine.
* To make regulatory environment conducive to private investment, procedures for grant of mineral concessions, such as Reconnaissance Permits, Prospecting Licences and Mining Leases shall be transparent and seamless with security of tenure guaranteed. Prospecting and mining shall be recognised as independent activities with transferability of concessions playing a key role in mineral development.
* To attract large investments and high technology, a new concession, namely, Large Area Prospecting Licence (LAPL) will be introduced. Duration of all concessions will be rationalised and areas of operations enlarged suitably within each State.
* IBM will maintain a digitised database comprising a Resource Inventory and a Tenement Registry. The Tenement Registry will give information of leasehold and freehold areas in terms of greenfield, brownfield and relinquished areas, etc. Data filing will be rigorously applied and concession holders will be monitored. Lock-in arrangement will be assured and the data will be released to prospectors after integration.
* Prospecting being a high-risk venture, access to risk funds from capital markets will be facilitated.

This policy initiative is expected to encourage greater involvement of private sector in survey and exploration of minerals.

The High-Level Committee constituted by the Government of India which brought out the National Mineral Policy, 2008 has recommended amendments to the MMDR Act, 1957 with the purpose of providing necessary initiatives to attract investment and participation of private and public sectors in areas of exploration and exploitation of minerals. In a latest development, MMDR Bill, 2011 has been introduced in Lok Sabha on 12.12.2011, which has been referred to Standing Committee on Coal & Steel.

ORGANISATIONS INVOLVED

GSI, AMD, DGMs of various states, public sector companies like NMDC, MECL, MOIL, etc. continued their efforts in respect of surveying, mapping and exploration of new deposits and re-assessment of old deposits/mines during 2010-11.

In oil sector, ONGC, OIL and a few joint ventures and private companies were engaged in exploration of on-shore and off-shore areas.

IBM

IBM, as a facilitator to the Mineral Industry (a) provides technical consultancy services for conducting feasibility studies, environment impact assessments, environment management plans, etc; (b) carries out mining research project on need-based aspects of mining; (c) conducts mineral beneficiation studies including mineralogical testing and chemical analysis and (d) prepares mineral maps.

During 2010-11, IBM prepared 100 multi-mineral leasehold maps with forest overlays on 1:50,000 scale in respect of Madhya Pradesh, Uttarakhand and Uttar Pradesh. Forest overlays are prepared in collaboration with Forest Survey of India.

During 2010-11, IBM conducted 60 ore dressing investigations, 41,925 chemical analysis, 2,060 mineralogical studies and one in-plant study.

Indian Bureau of Mines undertakes preparation of National Inventory of mineral resources on a quinquennial basis. Under this programme, implementation of UNFC system was adopted in 2002 replacing the earlier resource classification based on Indian system. Subsquently, NMI as on 1.4.2005 was updated. Updation of the NMI of mineral resources in respect of 70 minerals based on UNFC system as on 1.4.2010 has also been completed in March, 2012.

GSI

GSI pursued its systematic geological mapping in 2010-11 and had completed 2,425 sq km large-scale mapping, 32.215 sq km detailed mapping and 57,961 m drilling as against preceding year's achievement of 1,659 sq km large-scale mapping, 35.75 sq km detailed mapping and 55,988 m drilling. Out of the total mappable areas of 3.146 million sq km of the country, 3.094 million sq km has been covered so far by systematic mapping bringing the total coverage to 98.34%.

Reserves Established

Reserves/resources established in the course of mineral exploration during 2010-11 are furnished below:

i) About 2,642 million tonnes resources of coal in various coalfields of Chhattisgarh, Jharkhand, Madhya Pradesh, Odisha and West Bengal were estimated.

ii) In Karnataka, an inferred resource (333) of 0.9946 million tonnes gold ore with average grade of 2.17 g/t Au at 1 g/t cut off was estimated in Ajjanahalli Block C, Tumkur district. In Ajjanahalli East Block (B-Block - south of A-Block), Chitradurga district an indicated resource (332) of 0.36 million tonnes of gold ore with 1.35 g/t Au at 0.5g/t cut off and alternatively, 0.12 million tonnes gold ore with 2.71 g/t Au at 1.0 g/t cut off have been estimated.

iii) In Madhya Pradesh, an indicated resource (332) of 0.98 million tonnes Zn ore with 1.10% Zn in Jangaldehri Block, Chhindwara district and in Bishkhan Block, Betul district an indicated resource of 1.91 million tonnes of Zn ore with 1.14 % Zn have been estimated.

iv) A total inferred resource (333) of 10.01 million tonnes iron ore with a grade of 62.28% Fe has been estimated in Aridongri area, Kanker district, Chhattisgarh under a sponsored item of CMDC Ltd. In Devadaribetta Range (NMDC block), Bellary district, Karnataka a reconnaissance resource (334) of 8.20 million tonnes of iron ore (Hematite) with 57.37% Fe have been estimated.

v) In Damurda South Block, Keonjhar district, Odisha, the inferred manganese ore resource (333) estimated from boreholes drilled at 20% Mn cut off is about 0.152 million tonnes.

vi) In Vallampatti area, Dharmapuri district, Tamil Nadu, an inferred resource (333) of 2.74 million tonnes of molybdenum ore with an average grade of 0.102% Mo has been estimated.

vii) In Hanumalapura Block-A, Davangere district, Karnataka a reconnaissance resource (334) of 0.84 million tonnes PGE with 0.50 g/t to 2.93 g/t Pt+Pd has been estimated. Similarly, a reconnaissance resource (334) of about 0.252 million tonnes of PGE ore with an average grade of 1.44 ppm of Pt+Pd has been estimated in C1 sector of Chettiyampalayam Block, Sittampudi Complex, Tamil Nadu.

Survey

Marine Survey

GSI continued its offshore geoscientific studies both in Exclusive Economic Zone (EEZ) and Territorial Waters (TW) along the East and West Coasts of India. Surveys in the near-shore zones (0 m - 10 m isobaths) were carried out using hired small mechanical boats.

During 2010-11, a total of twenty cruises were undertaken using three vessels.

The following marine geoscientific surveys were carried out during 2010-11 (October, 2010 to April, 2011) Field Season :

1. Six cruises aboard R.V. Samudra Manthan within EEZ conducted the following:

a) Search for possible occurrence of phosphatic sediments in the outer shelf and upper continental margin off Kollam, Kerala (SM-213).

b) Multibeam bathymetric survey to the east of Nicobar Islands between West Andaman Fault and Sewell Rise (SM-214).

c) Study of the sea bed morphology and magnetic anomaly pattern across the arc-trench gap off Great Nicobar Island (SM-215).

d) Studies on geomorphological configuration of Barren Island along with acquaintance of Multibeam echosounder (SM-215A).

e) Systematic magnetic survey in Bay of Bengal over 85^{O}E Ridge and Multibeam bathymetric survey of the three submarine valleys off Puducherry (SM-216).

f) Search for possible occurrence of phosphatic sediments off Ratnagiri, Maharashtra (SM-217).

2. Eight cruises aboard R.V.Samudra Kaustubh within the Territorial Waters (TW) off the east coast conducted:

a) Parametric Survey within TW off Porto Novo and south of Karaikal, Tamil Nadu (ST-207).

b) Mapping of seabed within TW off Nagapattinum,Tamil Nadu (ST-208).

c) Placer mineral resource evaluation in the TW off north of Bhimunipatnam, Andhra Pradesh (ST-209).

d) Placer mineral resource evaluation in the TW off Palur-Malud, Odisha (ST-210).

e) Geotechnical surveys off Harichandi-Puri, Odisha (ST-211).

f) Parametric surveys between Gopalpur and Dhamara areas off Odisha coast (ST-212).

g) Parametric survey within TW off Porto Novo and North of Puducherry (ST-213).

h) Mapping of seabed within TW north-east of Point Calimere, Tamil Nadu (ST-214).

3. Six cruises aboard R.V. Samudra Shaudhikama within the TW off the West Coast conducted:

a) Placer mineral resource evaluation in the TW off Paravur, Kollam district, Kerala (SD-225).

b) Mapping of the seabed off Okha, Gujarat (SD-230).

c) Swath bathymetric survey of part of Gulf of Cambay, off Valsad, Gujarat (SD-231).

d) Parametric (seismic and magnetic) survey in the shelf area off Vizhinjam-Kanyakumari, Kerala & Tamil Nadu Coast (SD-232).

e) Evaluation of relict sand body off Shertallai, Kerala . (SD-233).

f) Geotechnical appraisal off Kulai, Karnataka, (SD-234).

Airborne Survey

GSI pursued airborne geophysical surveys for generating database by employing magnetic and gamma ray spectrometric techniques. The surveys followed up by data processing, preparation of aerogeophysical maps and interpretations help in ground evaluation and add information to geological maps that would aid prospecting and exploration for minerals. The data from the aerial surveys thus form an important backup for refining the geological understanding of an area, with focus on identification of favourable locales of mineralisation, crystal structure, etc.

The proposed survey operations over Chandrapur - Brahamapuri area for 2009-10 could not be taken up due to the late arrival of the aircraft and as proposed during 2010-12, the work saw a major breakdown in the navigational unit of the data acquisition system.

Since the acquisition and induction of TOASS, a total of 490,923 line km over an area of 286,040 sq km was covered by multisensor surveys involving magnetic, spectrometric, radiometric and electromagnetic methods till the field season 2009-10, in the following areas: Mamandur (Tamil Nadu), Aladahalli, Gadag, Wajrakarur-Vedavathi basin (Karnataka and Andhra Pradesh), Agartala-Silcher (for ONGC in Tripura and Assam), Ratnagiri (Maharashtra), Siliguri-Guwahati (for ONGC in West Bengal and Assam), Tosham-Singhana (Haryana and Rajasthan), Sukinda-Baripada (Odisha), Bundi-Bharatpur (Rajasthan), Agucha-Malpura-Chaksu (Rajasthan), Moradabad -Bareilly (for OIL in Uttar Pradesh), Gorakhpur-Muzaffarpur (for OIL in Uttar Pradesh and Bihar), Satyamangalam (Tamil Nadu), Hindoli (Rajasthan), Bhilwara (Rajasthan), Gangapur-Nasirabad (Rajasthan), Chhattisgarh basin (Chhattisgarh and Odisha), Betul-Chhindwara (Madhya Pradesh), Narayanpet-Raichur (Andhra Pradesh), Hungund-Mudhol (Karnataka), Lalitpur (Uttar Pradesh), Mahoba-Panna (Uttar Pradesh and Madhya Pradesh), Nalgonda-Mahbubnagar (Andhra Pradesh), Bangalore-Penukonda (Karnataka and Andhra Pradesh), Mulbagal-Tambalpalle (Karnataka and Andhra Pradesh), Nagpur-Wardha valley area (Maharashtra), Baihar-Katru area (Madhya Pradesh and Chhattisgarh), Kanker area, Chhattisgarh, Mauranipur-Sarila area (Madhya Pradesh and Uttar Pradesh) and Hosadurg-Vengurla area over Western off-shore.

Ground evaluation of aerogeophysical data is carried out with the help of aerial photos and imageries, mostly by detailed mapping, sampling, pitting and trenching, and wherever necessary, by drilling.

MECL

The highlights of exploration carried out by MECL during 2010-11 are given below:

i) A total of 29,918 m of promotional drilling on behalf of Ministry of Coal in the states of Andhra Pradesh, Chhattisgarh and Maharashtra was carried out. Similarly, a total of 133,047 m contractual drilling on behalf of NTPC, CMPDI, CMDCL, Mahatamil, APMDC and APMDC-OMC was carried out in Chhattisgarh,Jharkhand, Madhya Pradesh and Odisha. About 3,246 million tonnes of coal resources were estimated.

ii) A total of 51,796 m of promotional drilling on behalf of Ministry of Coal for lignite was carried out in the states of Rajasthan and Tamil Nadu. About 19.11 million tonnes lignite resources were established in Rajasthan .

iii) Exploration for base metals was carried out in promising areas of Ajmer and Chittorgarh, districts, Rajasthan. A total of 5,820 m drilling was carried out in 31 boreholes. Resources of 2.56 million tonnes with Cu- 1.09 %, Ni - 168 ppm and Co -161 ppm were estimated in Wari (B&C) block, Chittorgarh district, Rajasthan .

MINERALWISE EXPLORATION ACTIVITIES

PETROLEUM AND NATURAL GAS

The Government of India has formulated a New Exploration Licensing Policy (NELP) to accelerate and expand exploration of oil and gas in the country. A total of 235 blocks have been awarded so far in eight rounds of NELP during 2000-2010. Exploration under NELP has shown positive results, in both inland and off-shore areas.

ONGC

ONGC continued its operations for exploration of oil and gas. Out of 26 identified sedimentary basins in on-shore and off-shore areas of the country, exploration was continued in Cambay Basin, Gujarat; Jaisalmer in Rajasthan; Upper Assam, Tripura, Mizoram in Assam-Arakan; Himalayan foothills, Himachal Pradesh; Vindhyan/Gondwana (Madhya Pradesh); Krishna-Godavari (Andhra Pradesh); Cauvery (Tamil Nadu); West Bengal and in East Coast and West Coast off-shore areas.

During 2010-11, ONGC acquired a total of 13,116 GLK/LK of 2D seismic data which included 4,501 GLK inland and 8,615 LK off-shore data. During the same period, 19,355 sq km of 3D seismic data was also acquired which included 3,331 sq km inland and 16,024 sq km off-shore areas. ONGC's 125 exploratory wells comprised 84 wells to a total depth of 235,490 m inland areas and 41 wells to a total depth of 144,170 in off-shore areas.

During 2010-11, ONGC reported 24 new hydrocarbons discoveries, namely, Virgovindpura -3, Vemardi-1, Karnnagar-1, Vedatal-1, Limbodra East-1, Vedatal-3, Matar-12 and Aliabet-2 in Western Onland basin; West Kesavadasupalem-1, Lakshminarasimhapuram-1, Malleswaram-1 and Vygreswaram Southwest in KG Onland basin; Pundi-2, North Kovilkallappal-1 & Kuthanallur-12 in Cauvery Onland basin; AD-30(ADAK) in Assam & Assam-Arakan basin; C-23-9, C-1-6, GK-28-2 and GK-28-3 in Western Offshore basin; GS-KV-1,GS-21-3 and GS-29-6 in KG Offshore basin and MDW-10 in MBA basin. As a result of these exploratory efforts, ONGC accreted 83.56 million tonnes reserves during 2010-11, leading to 2,594.92 million tonnes ultimate reserves of oil and oil- equivalent gas (0+OEG) at the end of the year in areas under its operations.

OIL

Significant discoveries of oil/gas struck by OIL at various districts in Assam during 2010-11 are as below :

i) The Well Jengoni-2 (Loc.HVO) is located to the south of Makum North- Hapjan area on the upthrown side of Hapjan main fault and at the crestal part of Jengoni structure at Tipam-40 level. The well was drilled as a deviated well from Jengoni-1 plinth to probe the hydrocarban prospects within Tipam and Barail Sand reservoirs. The well was spudded in on 1.3.2010 and reached final depth of 2,932.3 m within Barail Formation on 29.03.2010. The well has encountered three gas bearing sands within Tipam Formation and one oil bearing sand (tested) in Barail Formation. The 2,821 m Barail Sand was tested and found to be oil bearing (API :28.5^{o} PP: 24^{o}C). This discovery has thrown open a new area for exploration within Hugrijan ML area. It has helped in accretion of in-place reserve and EUR volume of O+OEG.

ii) The Well Makum - 33 (Loc. HUI) is located in the West Makum Structure and lies about 800 m West of well Makum - 29. The well was drilled as a deviated well to probe the presence of hydrocarbon prospects within the Paleocene, Eocene and also Barail Formation. The well was spudded in on 7.3.2010 and reached final depth of 4,218 m within Basement on 4.5.2010. The well has encountered three possible hydrocarbon bearing sands within Barail, five hydrocarbon possible oil bearing sand within Lakadong+Therria Formation and one gas bearing sand (tested) in Langpar Formation. The discovery of presence of gas in this well has opened a new area for oil and gas production from West Makum area.This discovery has opend a new area for exploration within Hugrijan ML area. Drilling of this well has helped in accretion of in-place reserve and EUR volume of O+OEG.

iii) The Well Madhakali-1 (Loc. MFB) lies on Madhakali structure and is located at a distance of about 3.6 km to the southwest of well Khowang-11. This location was proposed to probe Madhakali structure at its structurally highest position both at Barail and Lakadong+Therria top level. The well was drilled as a vertical well to probe the hydrocarbon prospects within the Barail Sands and Eocene-Paleocene Formation. The well was spudded in on 19.8.2010 and reached final depth of 4,214 m within Basement on 24.10.2010. The well has encountered one oil bearing sand (tested) within Lakadong+Therria Formation. The 4,088 m Lakadong+Therria Sand was tested and found to be oil bearing (API : 34.8^o, PP: 33^{o}C). The discovery of presence of commercial oil in this well has opened a new area for exploration within Moran ML. It has helped in accretion of in-place reserve and EUR volume of O+OEG.

iv) The Well Balimara-1 (Loc. DGF) lies on Balimara structure and located about 7 km to the east of Well Umatara-1. The well was drilled to probe the hydrocarbon prospects within Tipam, Barail and Kopili reservoirs in the southern part of Upper Assam Basin at the proximity to the Belt of Schuppen. The well was spudded in on 2.8.2010 and reached the final depth of 4,985 m within Kopili on 14.12.2010. The well has encountered four possible hydrocarbons bearing sand ranges within Kopili Formation, two possible hydrocarbon bearing and one hydrocarbon possibly oil bearing sand ranges within Barail Formation. On testing the 4,716 m Kopili Sand, the well gave inflow of oil (API; 37.4^o, PP: <9^{o}C). The discovery of oil in this well within Kopili reservoir for the first time has opened a new area for oil exploration within Dumduma ML. It has helped in accretion of in-place and EUR volume of O+OEG.

v) The Well Mahakali-1 (Loc. HSX) lies on Mahakali structure and is located at a distance of about 2.5 km towards north-west of well Kasomari-1. This well was drilled as a deviated well to prove hydrocarbon prospects within Paleocene-Lower Eocene Formation. The well was spudded in on 8.8.2010 and reached final depth of 4,258 m within basement on 5.1.2011. The well had encountered a number of hydrocarbon, possibly oil bearing sand ranges within Lakadong+Therria Formation. The 4,128 m Lakadong+ Therria Sand was tested and produced oil (API : 23.2-29.38^o, PP: >9-36^o). The discovery of oil in this well has opened a new area for exploration within Hugrijan ML. It has helped in accretion of in-place reserve and EUR volume of O+OEG.

vi) The Well NHK-292 (Loc. HCS) was proposed with the objective of investigating the hydrocarbon prospects in the fault block between the well NHK 279 and NHK 274. During workover in December, 2010, the 2,123 m Girujan Sand was tested and it produced gas. This discovery of gas by workover operation has led to a new area for exploration within Hugrijan ML within Girujan reservoir. It has helped in accretion of in-place reserve and EUR volume of O+OEG.

The physical achievements of exploration activities pursued by ONGC and OIL during 2010-11 are detailed in Table-1.

Reliance Industries Ltd. (RIL)

RIL made five oil discoveries in the on-land exploratory block CB-ONN-2003/1 (CB-10 A & B) in Cambay basin, awarded under NELP-V round of exploration bidding. The block covers an area of 635 sq km in two parts, A & B. The company also made a gas discovery in the exploration block KG-DWN-2003/1 (KG-V-D3) of NELP-V, which is a deep-water block located in the Krishna basin, about 45 km off the coast in the Bay of Bengal. The block covers an area of 3,288 sq km. During the period six discoveries, viz, Dhirubhai–47 in Well AF1 in CB-10 block; Dhirubhai– 8 in Well AJ1 in CB-10 block; Dhirubhai –49 in Well AT1 in CB-10 block; Dhirubhai-50 in Well AN1 in CB-10 block; Dhirubhai–51 in Well AR1 in CB-10 block and Dhirubhai-52 in Well W1 in KG-V-D3 block were notified to the Directorate General of Hydrocarbons (DGH), Government of India. The company has also submitted initial proposal for commercial use to DGH for the blocks, namely, Discovery D 33 in GS-01 block; Discoveries D 39 and D 41 in KG –V – D 3 block and Discovery D 36 in KG – D 4 block. RIL has submitted an integrated appraisal programme for all discoveries in Part A of CB-10 block. RIL has relinquished CB-ON/1 block due to their poor prospectivety. Currently, RIL's portfolio consists of 28 exploration blocks.

Table – 1 : Exploration for Petroleum & Natural Gas by ONGC and OIL, 2010-11

Agency/location/State	Seismic Survey		Drilling			
			Exploratory		Development	
	2D(GLKM)	3D(SQKM)	Wells	Meterage	Wells	Meterage
ONGC: Total	**13116**	**19355**	**125**	**379660**	**256**	**500094**
Inland: Total	**4501**	**3331**	**84**	**235490**	**223**	**420004**
Andhra Pradesh	–	406	10	40260	13	23356
Assam	_	162	15	52680	26	74031
Bihar	357	_	–	–	–	–
Gujarat	431	523	42	74000	173	295958
Himachal Pradesh	_	_	_	4050	_	_
Madhya Pradesh	_	_	1	3150	_	_
Mizoram	_	_	_	1890	_	_
Rajasthan	508	43	1	3420	_	_
Tamil Nadu	600	31	8	27980	10	24729
Tripura	43	50	6	25050	1	1930
Uttar Pradesh	_	168	_	_	–	–
West Bengal	2562	1948	1	3010	_	_
Off-shore: Total	**8615**	**16024**	**41**	**144170**	**33**	**80090**
East Coast Off-shore	8615	9246	19	74940	–	–
West Coast Off-shore	_	6778	22	69230	33	80090
OIL *						
Inland: Total	**992**	**473**	–	_	–	_
Andhra Pradesh	_	103	_	_	_	_
Assam & Arunachal Pradesh	645	370	–	–	–	–
Mizoram	347	_	–	–	–	–

** During 2010-11, OIL carried out 1,17128 m drilling in 37 wells in on-shore areas of Assam (31 wells - 104,635 m drilling), Arunachal Pradesh (2 wells - 5,333 m drilling) and Rajasthan (4 wells - 7,160 m drilling).*

Drilling of six wells in Panna-L is expected to commence soon and oil production is expected in the later part of financial year 2012. Its reserves are estimated at 7.0 MMBL. The estimated production from all six wells is approximately 3,000 BOPD.

RIL holds three Coal Bed Methane (CBM) blocks in Sohagpur (East), Sohagpur (West), and Sonhat. So far, works completed in Sohagpur (East) and Sohagpur (West) include, over 40 core holes drilled, logged and tested for gas content, permeability and coal properties; 31 wells air drilled and tested for productivity; 75 hydraulic fracturing jobs completed; five cavitation completion wells and two sets of in-seam horizontal wells.

Foreign Collaboration in Hydrocarbons Exploration

Under Production Sharing Contract (PSC), exploration blocks and producing fields have been awarded through international competitive bidding to private, foreign and National Oil Companies. Currently, 27 foreign companies (17 as operators and 10 as non-operator consortium partners), including a few major Exploration and Production companies are operating under the PSC regime. The following benefits have been accrued due to participation of foreign companies in Exploration & Production Sector, under the PSC regime.

i) Cumulative investment of US$ 6.2 billion have been made so far by foreign companies for carrying out exploration and development activities in awarded blocks.

ii) Considerable increase in oil and gas production level was achieved in several producing fields like Pannna, Mukta & Tapti, Ravva, Hazira,NSA- Bheema, Dholka, Cambay and Amguri awarded to foreign companies.

iii) Use of advanced technological know-how in the fields of exploration, drilling, well completion and reservoir management by foreign companies have paid rich dividends in terms of exploration success and sustainability of production.

iv) One of the largest oil discoveries has been made in Mangala Field of Rajasthan by Cairn India Ltd., a foreign company. Presently, oil at the rate of 1,25,000 BOPD is being produced and will be augmented further in future.

Exploration of Coal Bed Methane (CBM)

So far, a total of 30 CBM blocks have been awarded in various states under four rounds of CBM bidding held. In addition to this, three more blocks were earlier awarded on nomination basis. The total area awarded so far for CBM exploration is about 17,303 sq km. Gas in-place of about 8.92 trillion cu ft has been established in five CBM blocks. Field Development Plan has already been approved for four blocks and is under review for another one block. Commercial CBM production has commenced from Raniganj (South) block in West Bengal, operated by M/s. GEECL since July, 2007. Further, incidental sale of CBM gas has also commenced from Raniganj (East) block of M/s. Essar Oil and Jharia block of M/s ONGC. Current CBM gas production in the country is about 2,38,000 m^3/day and it is estimated that the CBM production in the country is likely to touch 7.4 MMSCMD during 2014-15.

COAL

The agencies engaged in exploration for coal during 2010-11 were mainly GSI, CMPDI, MECL and State Directorates of Geology & Mining.

GSI

The GSI continued its operations for search and assessment of coal resources in the country through regional exploration in coalfields of Andhra Pradesh, Assam, Chhattisgarh, Madhya Pradesh, Maharashtra, Odisha and West Bengal. An additional resource of 2,641.63 million tonnes of coal have been assessed from the data generated from regional exploration during 2010-12.

In Andhra Pradesh, Reconaissance stage (G-4) exploration by scout drilling was taken up during 2010-12 in Vutasamudram-Venkatapuram area, Southern sub-basin of Godavari Valley Coalfield, Khammam and West Godavari districts to explore and evaluate coal potentiality of Barakar and Lower Kamthi Formations already established in northern adjoining Naraynapuram-Pattayagudem and Sitanagaram areas and to decipher the structural and stratigraphic set up of the area. Two boreholes were drilled so far in the area. The boreholes intersected Upper Kamthi Formation comprising of yellowish brown to grey colour, ferruginous, coarse grained to pebbly sandstone, friable, at places massive, feldspathic, micaceous cross-bedded, at places garnetiferous, with few lilac colour clay galls. Prospecting stage (G-3) regional exploration for coal by drilling was taken up during 2010-12 in Bugga- Khammamtogu sector, Southern Part of main basin of Godavari Valley Coalfield in Khammam district to explore and evaluate coal resource potentiality of Barakar coal seams already established in the adjoining Manuguru Mining Block located to the northeast. The borehole drilled so far intersected lithounits belonging to Barakar Formation and Talcher Formation. Two regional interbanded coal-carbonaceous shale zones with cumulative thickness of 2.30 m and 7.31 m were recorded at very shallow depth between 23.40 m and 39.41 m. Three local seams of 0.70 m to 0.76 m thickness between 97.64 m and 103.00 m depths have been identified. Spillover work of exploration for coal has been carried out by scout drilling in Narayanapuram-Pattayyagudem area, Southern sub-basin of Godavari coalfield in West Godavari and Khammam districts to explore and evaluate the coal potentiality of Lower Gondwana already established in adjoining Sattupalli and Siddavaram-Alipalli areas and to decipher the structural and stratigraphic set up of the area. During the period, drilling was continued in two boreholes, viz. GNPG-7 (325.25 m to 620.50 m) and GNPG-8 (313.75 m to 647.50 m). In GNPG-7, only uppermost coal/carbonaceous shale zone, namely C-zone of Lower member of Kamthi Formation was intersected at 557.55 m depth. The cumulative coal content is about 4.98 m in 10 splits (ranging from 0.30 m to 1.00 m). Borehole GNPG-8 intersected Lower Kamthi Formation (coal /carbonaceous shale zone-C of 40.00 m thick and zone-B 26.55 m thick) and Seam zone-A of Barakar Formation (72.60 m thick) having cumulative coal thickness of 25.50 m in 6 split sections between 414.00 m and 641.40 m depth. The investigation was completed on 4.3.2011.

In Assam, Prospecting stage (G-3) regional exploration was taken up during 2010-12 in Sukchar-Singrimari Block, Singrimari Coalfield in Dhubri district at the border of Assam and Meghalaya (in place of the FSP item 'Regional exploration for coal in Nongplu-Nongiong area of Langrin coal field, West Khasi Hills District, Meghalaya) to explore the behaviour and the northward extension of the coal bands established during 1985-88 and to establish the coal resource potentiality of the area. An area of 1.15 sq km, which is mostly under alluvium cover was mapped to the north of the explored block (field season - 1985-88). The area forms a part of the Precambrian Gneissic Complex comprising of migmatites, biotite gneiss, granite gneiss, porphyritic granite and Tertiary sedimentary rocks. Thinly laminated rocks belonging to the Talcher Formation (greenish coloured shale, siltstone, sandy clay, light greenish coloured sandstone) and Karharbari Formation (coarse grained, gritty to pebbly sand-stone, medium to fine grained sandstone, siltstone, light grey to black carbonaceous shale) occur in Hallidayganj. These formations of the Gondwana Group overlie the Precambrian Gneissic Complex with an unconformity. Borehole point DS-1 was fixed in the area to find out the northern continuity of the coal seam that was intersected in the Borehole HG-9 drilled during the field season 1985-86 to 1987-88.

In Chhattisgarh, regional exploration under G-2 stage initiated during 2009-10 was continued in Nawagaon Block, Raigarh district, Mand – Raigarh Coalfield to establish the developmental pattern and continuity of the regional Barakar coal seams already established in the Chainpur area in the west, Ongana-Potiya area in the north and Sithra–Kurekela sector in the southwest and to assess coal resources potentiality as well as to carry out appraisal of CBM content.Ten regional Barakar coal seams/ zones (Seam I to X, in ascending order) have been intersected between the depths of 45.37 m and 457.18 m. The important seams are Seam – I, IV, VI, VII and VIII with cumulative thickness of coal ranging from less than a metre to 10.46 m. Seam IV is the thickest seam and was intersected between the depths of 24.43 m and 425.04 m. Cumulative coal thickness of Seam I and IV varies from 2.35 m to 10.46 m. Regional exploration under G-2 stage was taken up during 2010-12 in Teram Block, Raigarh district, Mand–Raigarh Coalfield to establish the developmental pattern and continuity of the regional Barakar coal seams intersected in explored adjacent Kurumkela Blocks in the north-central part of Mand–Raigarh Coalfield and to evaluate additional coal resource in the area. In borehole MRT-2 formational contact between Barren Measures and Barakar Formation was intersected at 162.22 m depth. In Barakar Formation, ten regional coal seams (Seam III to XII in ascending order) with thickness ranging from less than 0.50 to 13.74 m (cumulative) were intersected between the depths of 202.88 m and 477.50 m. Among these, the important seams are Seam – V, VI and XI. The thickest seam, Seam VI, was intersected between the depths of 328.72 m and 424.54 m. The seam is highly banded in nature and its cumulative thickness ranges from 11.90 m to 13.74 m. Regional exploration under G-2 stage was taken up during 2010-12 in Korja Block, Hasdo - Arand Coalfield in Surguja district to establish the developmental pattern and continuity of the regional Barakar coal seams established in previously explored Pendrakhi Block in the west, to assess coal resource potentiality of the area as well as to generate CBM baseline data. The formational contact between Barakar and Talchir Formations is recorded at the depth of 365.60 m in borehole HAKJ–1. Four regional Barakar coal seams / zones (Seam III to VI in ascending order) have been intersected between depths of 97.10 m and 188.65 m within Barakar Formation. Coal Seam /Zone IV and V are considered to be significant because of their cumulative coal thickness which ranges from 6.20 m to 7.75 m. Seams/Zones IV and V are represented by Composite Section with coal split varying in thickness from 0.30 m to 4.10 m. Four local coal seams (Seam L1 to Seam L4 in ascending order) have been recorded between depths of 258.95 m and 341.85 m within Lower Member of Barakar Formation. Thickness of individual split section varies from 0.15 m to 4.10 m. Regional exploration for coal (G-2) was carried out in the Reonti (West) Block, Tatapani–Ramkola Coalfield in Surguja district to establish the continuity of Barakar coal seams beneath the younger Raniganj and Barren Measures Formations along with deciphering subsurface structural disposition as well as to appraise its resource potentiality. Subsurface data revealed the presence of Raniganj, Barren Measures and Barakar Formations. Six regional (I to VI in ascending order) and few local coal seams of Barakar Formation ranging in thickness from less than a metre to 29.78 m have been recorded between depths of 491.77 m and 841.20 m. Seams I to V are important for their thickness and regional persistency. The seams IV and V are represented by four to five split sections with the cumulative thickness being 29.78 m and 12.22 m, respectively. Regional exploration for coal in Vijaynagar-Giddhi Block (renamed later on), Tatapani–Ramkola Coalfield, Surguja district in 2010-2012 was scheduled to be taken up from October, 2011 (a) to establish the structural disposition of the Lower Gondwana sequences, (b) to establish the continuity of Barakar coal seams beneath the cover of Barren Measures and Raniganj Formation, (c) to appraise the resource potentiality of Barakar coal seams.

In Madhya Pradesh, Reconnaissance stage (G-4) exploration by scout drilling was taken up during 2010-12 in Sarai (East) area, Singrauli Coalfield, Singrauli district to assess the coal development pattern and resource potentiality, establishing stratigraphic set up of the area and to generate CBM baseline data. Contact between Barren Measures and Barakar Formation has been intersected at 202.38 m depth in borehole SSE-1. Seven regional coal seams of Barakar Formation ranging from 1.05 m to 3.35 m were intersected at relatively shallow depth (between 259.69 m and 493.13 m). Out of these, Seam VI and Seam VII are relatively thick (3.35 m and 2.15 m, respectively). Regional exploration under G-2 stage initiated during 2008-09, was continued in Devanitola block, Sohagpur Coalfield in Shahdol district to establish developmental pattern of superior grade Barakar coal seams at shallow depth, to decipher major structural set-up of the area; and to evaluate additional coal resources. A total of 1,508.25 m was drilled in six boreholes (four completed and two in progress) and an area of 2 sq km has been mapped on 1:10,000 scale. The area is mainly covered with rocks of lower part of Barren Measures. Exploration in this block reveals occurrence of four regional (I to IV in ascending order) and two local seams (L1 and L2) within Barakar Formation varying from 0.63 m to 7.25 m in the depth range from 101.90 m to 285.15 m. Cumulative thickness of the regional and local seams ranges from 11.90 m to 16.31 m. Out of these four seams, Seam III is the thickest (maximum cumulative thickness 7.25 m) and composite in nature and characteristically shows two split sections. Seam III, being the most persistent, thickest and composite in nature is very much significant and is used as a key horizon for correlation purpose. Regional exploration under G-2 stage initiated during 2009-10, was continued in Amiliha Block in Sohagpur Coalfield in Umaria district to establish developmental pattern of superior grade Barakar coal seams at moderate depth, to evaluate additional coal resources and to assess CBM potentiality. The area of exploration is covered mostly by rocks of Raniganj Formation associated with frequent basic intrusives (dolerite) and partly by Barren Measures occurring in southern and western parts. Subsurface data reveals that the thickness of Raniganj Formation ranges between 36.75 m to 89.66 m and are underlain by Barren Measures having a maximum thickness of 117.88 m. Four regional Barakar coal seams ranging in thickness from 0.30 m to 3.75 m have been intersected between 178.45 m and 343.70 m depth. Coal Seam III is the thickest (2.56 m to 3.75 m) and composite in nature and was intersected between 145.75 m and 285.95 m depth. Seam III is used as a key horizon for correlation of coal seams. Cumulative thickness of the seams so far recorded in two boreholes (SAL-6 and 7) varies from 4.52 m to 9.79 m and occurs between 178.45 m and 351.55 m depth. Regional exploration under G-2 stage initiated during 2009-10, was continued in Pachri Block, Sohagpur Coalfield in Shahdol district to establish developmental pattern of superior grade Barakar coal seams at shallow depth, to decipher major structural set-up of the area and to evaluate additional coal resources. Exploration in Pachri Block revealed occurrences of four regional Barakar coal seams at shallow depth (145 m -170 m) under the cover of younger lithopack of Barren Measures. Coal seams (I to IV with few local seams) vary in thickness from 0.35 m to 3.30 m and occur between 138.60 m and

328.70 m. Seam III is the thickest with two split sections having a cumulative thickness ranging from 2.47 m to 3.30 m. Cumulative thickness of all the coal seams vary from 7.00 m to 8.50 m and coal resource of 200 million tonnes from this block is prognosticated. Seam III being thickest and composite in nature, generally occurs 80 m–100 m below the contact between Barren Measures and Barakar Formation. It is being used as a tool for coal seam correlation. Regional exploration under G-2 stage for coal in Maiki (North) Block, Sohagpur Coalfield, Shahdol district was scheduled to be taken up during August, 2011 a) to establish developmental pattern of superior grade Barakar coal seams at shallow depth; b) to decipher major structural set-up of the area; and c) to evaluate additional coal resources. Reconnaissance stage (G-4) exploration, initiated in 2008-09 by scout drilling, was continued during 2010-12 in Nowrozabad (North) area, Johilla Coalfield in Umaria district to delineate potential area of high rank superior grade coal, evaluation of additional coal resources, to decipher structural set up of the area and to assess CBM potentiality. The drilling indicated litho assemblages akin to Barren Measures (?). Based on the subsurface data obtained from boreholes JNN-1 and 2, efforts are made to differentiate unclassified Supra Barakar into Barren Measures, Raniganj, Pali (= Panchet) and Parsora Formations. Updating of geological map on 1: 50,000 scale revealed the occurrence of sub-horizontally disposed Parsora rocks, which abut against older Gondwana sequence occurring in the southern part along a fault trending roughly E-W. Prospecting stage (G-3) regional exploration initiated during 2009-10 was continued in Payalidhana sector, Pench Valley Coalfield in Chhindwara district to establish the strike continuity of Barakar coal seams below the Deccan Traps under favourable structural set up already recorded in Bagbardiya sector to the southwest and Dhankasa area in the southeast and to assess the coal resource potentiality of the area. The work led to the establishment of about 4 km strike extension of regional coal seams. Five regional Barakar coal seams with individual seam thickness ranging from 1.00 m to 3.05 m were intersected between 282.24 m and 319.44 m depth. Total cumulative coal thickness of coal is 13.79 m in PP-2. Coal petrographic study revealed gradual increase in rank character (VRo%) of the seams from 0.72% to 1.13% along depth suggesting normal coalification trend in this part of the basin. Coals can be categorized under ‘High Volatile Bituminous B’ to ‘Medium Volatile Bituminous’ rank.

In Maharahstra, Prospecting stage (G-3) regional exploration initiated during 2008-09 was continued during 2010-12 in Dewala-Mangali Block of Wardha Valley Coalfield in Yavatmal district to establish the strike continuity of Barakar coal seams already recorded in Asthona-Kothurla-Mangali area in the northwest below the Deccan Traps and to assess the coal resource potentiality of the area. During this period, two boreholes were drilled, but due to drilling problems the borehole could not reach the Barakar Formation which is coal bearing.

In Odisha, Regional exploration under G-2 stage for coal in Khariaparha block, Ib-River Coalfield in Jharsuguda district initiated in 2009-10 was continued during 2010-12 with an objective: (a) to explore the possible continuity of the regional coal seam zones of Raniganj and Barakar Formations of already explored Kuraloi (A) North Block, (b) to establish structural set up and stratigraphy of the area, (c) to assess the coal resource potentiality of the area and d) to have a preliminary appraisal of CBM potentiality. In the first two boreholes, (IBKH-1 and 2), four regional Barakar coal seam zones, namely Belpahar, Parkhani, Lajkura and Rampur seam zones were intersected from 12.10 m to 488.76 m depth. Lajkura seam zone is the thickest having cumulative coal thickness of 55.40 m intersected at roof depth of 305.66 m. Belpahar, Parkhani and Rampur seam zones are 12.51 m, 21.16 m and 13.05 m thick, respectively with multiple split sections. Spill over work has been carried out in Piplimal-Khairkuni Block in Ib-River coal field of Jharsuguda distict to explore the possible continuity of the regional Barakar coal seam zones towards south east of already explored Kuraloi(B) and Kuraloi(A) North Blocks and to establish structural set up and stratigraphy of the area and to assess the coal resource potentiality of the area. In the last borehole IBPK-11, two regional Barakar coal seam zones, namely Rampur and Ib seam zones with cumulative coal thickness of 35.40 m and 4.47 m have been intersected at 410.54 m and 472.00 m roof depths, respectively. Regional exploration for coal in Grindola Block, Ib-River Coalfield, Jharsuguda district (2010-12) was scheduled to be taken up from October, 2011. Objective of the work is (a) to explore the possible continuity of the regional coal seam zones of Raniganj and Barakar formation of already explored Kuraloi (A) North block, (b) to establish structural set up and stratigraphy of the area and (c) to assess the coal resource potentiality of the area. Regional exploration under G-2 initiated during 2008-09 was continued during 2010-12 in Simlisahi-Kunjabiharipur Block, Talcher Coalfield in Angul district to explore the westward continuation of regional coal seams of Barakar Formation already intersected in the adjacent Jalatap Block and to appraise the coal resource potentiality of the area. Thick coal seams have been intersected at shallow to moderate depths. In the boreholes TSK-7, 8 and 9, ten regional Barakar coal seams (II to XI in the ascending order) were intersected within depth range from 278.70 m to 638.78 m. Cumulative thickness of the individual coal seams varies from 2.65 m to 56.09 m. Seam IX and III are most prominent and Seam-III is the thickest seam with cumulative thickness varying from 38.36 m to 56.09 m. Reconnaissance stage (G-4) regional exploration by scout drilling was taken up during 2010-12 in Nuagaon North area in Talcher Coalfield of Angul district to explore the downdip continuation of regional coal seams of Barakar and Karharbari Formations already explored in Nuagaon-Telisahi Block and Kudanali NE Blocks and to assess the resource potentiality of the area. Continuation of the regional coal seams has been established in Nuagaon North Block. In borehole TNN-1, seam zones of II, III and VI-VIII belonging to Barakar Formation and Seam Zone-I of Karharbari Formation have been intersected between depth range of 161.49 m and 363.60 m. The Seam-III is the thickest having cumulative coal thickness of 19.94 m. Cumulative coal thickness of Seam –II is 15.78 m and Seam-I (Karharbari) is of 3.21 m, respectively. Prospecting stage (G-3) regional exploration was taken up during 2010-12 in Korara-Danara sector, Talcher Coalfield in Angul district to establish the updip continuity of Karharbari coal seam at shallow to quarriable depth and to assess the coal potentiality of the area. The first borehole TKD-1 drilled upto a depth of 313.50 m intersected the basal Barakar conglomerate zone. The Karharbari coal seam (Seam-1) has not been intersected within upper Karharbari Formation. Regional exploration under G-2 work has been carried out in Harichandrapur Block to establish the northward continuity of regional coal zones of Barakar and Karharbari formation already intersected in the adjacent Tribira Block and to assess coal resources of the area. In boreholes THC-3 and 4, all the ten regional Barakar coal seams (II to IX in ascending order) were intersected within the depth range from 13.95 m to 386.89 m with cumulative thickness of individual seams varying from 0.92 m to 56.19 m. Seam-II is the thickest having cumulative coal thickness ranging from 26.52 m to 56.19 m.

In West Bengal, Reconnaissance stage (G-4) regional exploration for coal initiated during 2009-10 by scout drilling in East of Bhabaniganj area, Raniganj Coalfield, Birbhum district was continued during 2010-12 to examine the continuity of Barakar coal seams to the east of Nabasan and Binodpur-Bhabaniganj Blocks and to appraise the development pattern and regional persistence of the coal seams in the Barakar Formation. The area lies in the eastern adjacent part of Binodpur-Bhabaniganj Block and south of Kasta area in the Trans-Ajay part of Raniganj Coalfield. Borehole REB-2 progressed from 328.50 m to 497.20 m and intersected the Barren Measure/Barakar and Barakar/basement contacts at 402.30 m and 486.90 m depths, respectively. In this borehole, one coal seam of 5.60 m thickness has been intersected at 464.30 m depth. The coal seam belongs to Salanpur-A Group of seams. Borehole REB-3 progressed up to 341.70 m and intersected the Raniganj Formation/Barren Measure contact at 83.55 m depth. Reconnaissance stage (G-4) regional exploration by scout drilling was initiated during 2010-12 in South of Hingla River area in Raniganj Coalfield, Birbhum district to establish the development pattern and structural disposition of Barakar coal seams at depth under the cover of Barren Measures along with appraisal of the coal resource potentiality and to establish strike-wise continuity of the regional Barakar coal seams already established in Nabasan and Binodpur-Bhabaniganj Blocks located towards west in order to generate CBM baseline data. The investigation in the area south of Hingla River covering 20 sq km was taken up for two years and commenced on 10.11.2010. The first borehole RSH-1 intersected the Barren Measure/ Barakar and Barakar/ basement contacts at 202.60 m and 266.05 m depths, respectively. One coal seam of 1.85 m thickness was intersected at 254.95 m depth. The second borehole RSH-2 progressed upto 363.65 m depth and intersected Barren Measure/Barakar contact at 323.95 m depth. Prospecting stage (G-3) regional exploration for Gondwana coal under the cover of Tertiary sedimentaries in Dhobbanpur sector, Birbhum Coalfield in Birbhum district initiated during 2009-10 was continued in 2010-12 with an objective (a) to establish continuity of coal bearing Barakar Formation below the cover of Tertiary sediments to the south and east of Makhdumnagar and south of allotted CBM block (BB-CBM-2005/III of DGH), Birbhum Coalfield (b) to examine the development pattern of coal seams and (c) generation of baseline data related to CBM. Two boreholes have been completed during this period. The first borehole located in the central part of the sector intersected five Barakar coal seams (0.70 m to 4.70 m thick) with a cumulative thickness of 11.65 m at depths ranging from 440.75 m to 512.45 m.The second borehole located in the southwestern part on the northern bank of Dwarka river intersected Tertiary claystone and fine grained sandstone followed downwards by Rajmahal and Barakar Formations. CBM desorption study of core samples collected from the coal seams has indicated a mere presence of desorbed gas(0.12 cc/gm). Reconnaissance stage (G-4) regional exploration by scout drilling initiated during 2009-10 was continued during 2010-12 in and around Gazipur area to the south of Mahalla, Rajmahal Master Basin in Birbhum district to examine the extent of coal bearing Barakar and other Gondwana formations below the cover of Tertiary sedimentaries around Gazipur, south of Mahalla, to appraise the coal development and for generating CBM baseline data. A total of 737.70 m of drilling has been completed in two boreholes (BGZ-2 and BGZ-3). The second borehole located in the southwestern corner of the area has intersected ten Barakar coal seams ranging in thickness from 0.50 m to 2.50 m (cumulative thickness 10.30 m) in the depth range from 479.95 m to 615.65 m. CBM desorption study (0.19cc/gm to 0.23 cc/gm) of coal core samples collected from the seam zones has been completed and residual CBM study is under progress. The third borehole (BGZ-3) located in the central part has recorded 235.15 m of Tertiaries and 180.70 m of Rajmahal Trap so far. A Tertiary lignite seam of 0.50 m thickness has been intersected at 226.30 m depth in this borehole.

Additional resources estimated by GSI in various coalfields during 2010-12 are given in Table -2 .

Table – 2 : Additional Resources Estimated by GSI in Various Coalfields, 2010-12 (as on 1.4.2011)

(In million tonnes)

State/Coalfield/Block	Additional resources
Chhattisgarh	
(A) Mand-Raigarh Coalfield	
(i) Phutamura	85.82
(B) Tatapani-Ramkola Coalfield	
(i) Reonti	279.46
C) Hasdo Arand Coalfield	
(i) Saidu	157.42
Jharkhand	
(A) South Karanpura Coalfield	
(i) Binja	126.76
(B) East Bokaro Coalfield	
(i) Muditoli	61.472
Madhya Pradesh	
(A) Sohagpur Coalfield	
(i) Merkhi	81.08
(B) Singrauli Coalfield	
(i) Tendudol	271.37
Odisha	
(A) Talcher Coalfield	
(i) Jamujhari- Brahmanbil	1476.17
West Bengal	
(A)Raniganj Coalfield	
(i) Nabasan	102.08
Total	**2641.63**

CMPDI

CMPDI continued its coal exploration activities in 2010-11, mainly in CIL and Non-CIL/Captive Mining Blocks. Exploration in CIL blocks was taken up to cater to the project planning/production support needs of subsidiaries of CIL whereas exploration in Non-CIL/Captive Mining Blocks was undertaken to facilitate allotment of coal blocks to prospective entrepreneurs for captive mining. A total of 100 to 123 drills were deployed in 2010-11, out of which 55 were departmental drills.

CMPDI deployed its departmental resources for exploration of CIL/Non-CIL/Promotional blocks, whereas State Governments of Madhya Pradesh and Odisha deployed resources in CIL blocks only. Besides, four contractual agencies have deployed its own resources for detailed drilling/exploration in 31 blocks.

In 2010-11, CMPDI and its contractual agencies took up exploratory drilling in 96 blocks/mines spread over 22 coalfields. These coalfields with no of blocks/mines are: Raniganj (7), Jharia (4), West Bokaro (5), Ramgarh (2), Tawa Valley/Patharkhera (6), Pench-Kanhan (1), Kamptee (2), Nand-Bander (1), Wardha (8), Singrauli (7), Sohagpur (10), Mand Raigarh (13), Rajmahal (1), Sendurgarh (1), Johilla (1), Korba (4), Hasdo-Arand (1), Bisrampur (5), Talcher (9), Ib Valley (5), Sonhat (1) and Makum (2). Out of 96 blocks/mines, 18 were Non-CIL/Captive blocks, 2 promotional blocks, 01 consultancy block and 75 CIL blocks/mines. Departmental drills of CMPDI took up exploratory drilling in 65 blocks/mines whereas contractual agencies drilled in 31 blocks/mines.

A total of 268,059 m of exploratory drilling was carried out by CMPDI in 2010-11 through departmental drills and it includes 1,318 m in Promotional blocks, 201,016 m in CIL blocks and 64,685 m in Non-CIL/Captive Mining blocks and 1,040 m in consultancy blocks. Similarly, 223,732 m of drilling was carried out through outsourcing.

During 2010-11, against a target of 184,555 m drilling (departmental 74,555 m and outsourcing 110,000 m), the departmental drills of CMPDI have carried out 64,685 m exploratory drilling whereas contractual parties have carried out 182,858 m drilling. The block-wise achievement of drilling in 2010-11 was as follows:

Exploratory Drilling by CMPDI (Departmental and Outsourcing) in 2010-11

Sl. No.	Agency		Target (m)	Exploratory drilling achieved (m)	Achieved (%)
1.	Departmental		240,000	268,059	112
2.	Outsourcing				
	i)	State Govts	5,000	7,206	144
	ii)	MECL (MoU)	42,500	28,160	66
	iii)	Tendering (CIL Blocks)	16,000	14,581	91
	iv)	Tendering (Non-CIL Blocks)	96,500	173,785	180
		Total	**400,000**	**491,791**	**123**

Drilling in Non-CIL Blocks in 2010-11

Agency/command area	Coalfield	Block	Drilling (m)
A. CMPDI (Departmental)			
WCL	Kamptee	Bharatwada	5,707
	Nand-Bander	Mandwa	6,529
	Wardha Valley	Rajur Manikgarh	4,422
		Bhivkund	3,262
MCL	Talcher	Sakhigopal 'B'	12,382
		Mahanadi	20,609
	Ib Valley	Prajapara & Dip Extension	11,774
	Sub-total : A (Departmental)		**64,685**
B. Outsourcing through open tendering			
ECL	Rajmahal	Kayda-Chaudhar-Gariapani	23,571
NCL	Singrauli	Makri Barka West	9,074
SECL	Mand-Raigarh	Syang Central 'A'	4,053
		Syang East 'A'	3,268
		Syang East 'B'	8,045
		Syang North West	24,505
		Syang South	34,543
		Chirra North	45,843
		Chirra NE 'A'	4,655
		Chirra NE 'B'	9,687
	Hasdo-Arand	Morga South	15,614
	Sub-total B (Outsourcing)		**182,858**
	Grand Total of Drilling in Non-CIL Blocks		**247,543**

The achievement of drilling in 2010-11 also includes Promotional (regional) drilling by departmental drills. CMPDI continued the promotional drilling in Chimri and Bishnupur blocks of Tawa Valley Coalfield and a total of 1,318 m has been drilled in these blocks in 2010-11.

CMPDI has also carried out technical supervision of Promotional Exploration carried out by MECL in Coal Sector (9 blocks) and monitored Promotional Exploration conducted by GSI in 11 blocks.

MECL

During 2010-11, MECL carried out regional exploration for coal on promotional as well as contractual basis in different parts of the country. For Ministry of Coal, promotional work for coal was carried out in areas in Andhra Pradesh, Chhattisgarh, and Maharashtra. About 29,918 m promotional and 133,047 m contractual drilling was carried out during 2010-11. The details are given in Table-3.

MECL estimated 3,246 million tonnes resources of coal in various coalfields as per the geological reports submitted during 2010-11. The details are given in Table-4.

Table – 3 : Exploratory Drilling for Coal by MECL, 2010-11

State/District	Block/Coalfield	Drilling (m)
A. Promotional-on Behalf of Ministry of Coal		
Andhra Pradesh	Dip side of Venkatapuram Godavari Valley Coalfield	9638
Chhattisgarh	Bhalumura, Mand-Raigarh Coalfield	1270
-do-	Dolesara Mand-Raigarh Coalfield	4749
-do-	Basin Pathepura (SE) Mand- Raigarh coalfield	4914
-do-	Karichapar Mand- Raigarh coalfield	3338
Maharashtra		
	Khapri Umrer Coalfield	689
-do-	Gumgaon Umrer Coalfield	2929
-do-	Sukli Umrer Coalfield	607
-do-	Temurda Wardha Valley Coalfield	1784
B. Contractual-on Behalf of CMDCL		
Chhattisgarh	Gare Pelma Mand-Raigarh Coalfield	12179
C. Contractual-on Behalf of CMPDI		
Chhattisgarh	Sayang (C) A Mand-Raigarh Coalfield	4054
	Sayang (E) A Mand-Raigarh Coalfield	3803
	Chirra NE A Mand- Raigarh Coalfield	4120
	Boro- Sayang (E) Mand- Raigarh Coalfield	9861
	Chirra NE B Mand- Raigarh Coalfield	7870
	Ghugra Bisrampur Coalfield	11486

(Contd.)

Table - 3 (Concld.)

State/District	Block/Coalfield	Drilling (m)
Jharkhand	Kapuriya Jharia Coalfield	6842
	Singra Jharia Coalfield	7204
	Nagda Jharia Coalfield	520
	Production Support Jharia Coalfield	3068
Madhya Pradesh	Dongrital Singrauli Coalfield	2076
	Patpaharia Singrauli Coalfield	1936
	Makri Burka Singrauli Coalfield	9074
D. Contractual-on Behalf of NTPC		
Jharkhand	Pakri-Burwadi Jharia Coalfield	2872
E. Contractual-on Behalf of Mahatamil		
Chhattisgarh	Gare Pelma Sec. II Mand- Raigarh Coalfield	29503
F. Contractual-on Behalf of APMDC		
Madhya Pradesh	Suliyari Singrauli Coalfield	15975
G. Contractual-on Behalf of APMDC-OMC		
Odisha	Nuagaon-Teleshahi Talcher Coalfield	604
	Total	**133047**

Table – 4 : Additional Resources Estimated by MECL in Various Coalfields, 2010-11

(In million tonnes)

State/Coalfield/Block	Additional resources
Chhattisgarh	
Mand-Raigarh Coalfield	
Banai block	628.72
Gare-Pelma Sec-1	1122.28
Madhya Pradesh	
Sohagpur Coalfield	
Chaka North block	144.77
Maharashtra	
Umrer - Katol Sub - basin	
Khapri block	48.41
Sukli block	59.81
Gumgaon block	52.49
Odisha	
Talcher Coalfield	
Nuagaon - Taleshahi block	904.60
West Bengal	
Raniganj Coalfield	
Kulti block	172.98
Sitarampur block	112.15
Total	**3246.21**

Singareni Collieries Company Ltd. (SCCL)

During 2010-11, SCCL carried out detailed explorations in Godavari Valley coalfield, Andhra Pradesh. A total of 101,903 m drilling was achieved against a target of 100,000 m and coal reserves of the order of 51.66 million tonnes were proved in 2010-11. The total proved geological reserves of Godavari Valley Coalfield are placed at 9,487.44 million tonnes as on 1.4.2011.

West Bengal Mineral Development & Trading Corporation Ltd (WBMDTCL)

In 2010-11, WBMDTCL carried out exploration for coal in three blocks-Kulti, Sitarampur and Ichhapur, all in Bardhaman district. In total 10.75 sq km area was mapped on 1:2,000 scale with drilling in 55 boreholes and 880 samples were collected for analysis.

State Directorates

The details of exploration for coal carried out by the State Directorate of Geology & Mining of various states during 2010-11 are given in Table-5.

LIGNITE

GSI, MECL, DMG, Rajasthan and GMDC conducted investigation for lignite during 2010-11.

GSI

GSI continued exploration for lignite in the East Coast lignite fields of Tamil Nadu and at the Tertiary sequence in Palana and Nagaur basins, Rajasthan to identify and assess lignite potentiality.

The search for lignite resources has been accorded priority in the states of Tamil Nadu and Rajasthan which are devoid of any coal deposit.

In Tamil Nadu, Prospecting stage (G-3) exploration for lignite in Bogalur East sector, Ramnad sub-basin, Ramanathapuram district was continued to delineate lignite bearing areas and to assess the resource potentiality of the area. Two regionally persistent lignite seams viz. Seam-I of maximum thickness of 17.5 m and Seam-II of maximum thickness of 4.6 m were identified. The seams are of " Lignite A" grade. Investigation established the lignite potentiality over an area of 45 sq km in this sector of which about 15 sq km was proved. A tentative inferred resource (333) of 180 million tonnes of lignite has been estimated within 400 m depth.

Table – 5 : Exploration for Coal by Various State Directorates of Geology & Mining, 2010-11

State/ District	Location	Geological mapping		Drilling		Remarks
		Area (sq km)	Scale	Boreholes	Meterage	
Chhattisgarh						
Korba	Saila block, Saila Pali area	250.00 2.00	1:50,000 1:4,000	08	1191.85	The geological reserves of coal remain same as for previous year i.e. 51.15 million tonnes.
Raigarh	Dhaurabhata block, Gare Sector - 1A,	50.00	1:50,000	06	1535.25	Total 29 million tonnes of coal resources of C to G grades were estimated.
Maharashtra						
Chandrapur	Nandori	-	-	-	2,179.50	Middle workable seam ranges in thickness from 7.25 to 18.60 m up to the depth of 378.15 m. About 170.95 million tonnes proved reserves of coal were estimated, out of 180 million tonnes of in-situ resources.
-do-	Takli	-	-	-	1,416.00	Two coal seams encountered in the block. Top seam - 0.95 m to 3.10 m thick and middle composite seam-5.50 to 17.00 m thick. The depth range of middle coal seam is from 198.00 to 347.56 m So far, 37.39 million tonnes coal reserves are proved.
-do-	Wislon block	-	-	-	1,102.50	Borehole drilled up the depth 448.20 m. Top seam ranges from 341.70 to 344.70 m while middle seam from 427.20 to 445.20 m. So far. 9.49 million tonnes proved reserves are estimated out of 21.30 millon tonnes in-situ coal resources.
-do-	Panwadala block	-	-	-	242.10	Thickness of top seam ranges from 1.16 to 3.70 m and middle seam ranges from 6.25 to 13.50 m . Depth of coal seam ranges from 172.65 to 365.50 m. So far,14.19 million tonnes of coal reserves are proved.
-do-	Chalbardi	-	-	-	343.00	Top seam of thickness 5.20 m intersected at the depth of 355.05m. So far, 1.28 million tonnes of coal resources are estimated.
Nagpur	Makardhokda-V (Dawa-Phukeshwar)	10.00 2.00	1:25,000 1:5,000	- -	900.70	Six coal seams ranging in thickness from1.10 to 6.65 m are explored. The depth of coal seam ranges from 30 to 420 m. About 1.23 million tonnes coal reseves proved. (8.97 million tonnes so far).

Contd.

Table - 5 (Concld.)

State/ District	Location	Geological mapping		Drilling		Remarks
		Area (sq km)	Scale	Boreholes	Meterage	
Nagpur	Nand Panjrepar	4.00 2.40	1:25,000 1.5,000	- -	3,261.41	Six coal seams were established ranging from 0.30 to 5.82 m in thickness. The depth range is from 50.25 to 435.60 m. About 5.10 million tonnes coal reserves proved (24.98 million tonnes so far).
Yavatmal	Dara - Parsoda	11.00	1:25,000	-	1,310.80	Depth of top coal seam ranges from 18.30 to 139.08 m and middle seam from 27.56 to 56.43m. Workable coal thickness is ranging from 1.00 to 1.64 m . About 0.50 million tonnes of coal reserves are proved (8.56 million tonnes so far).
-do-	Ashtona, Kothurna	22.00 1.00	1:25,000 1:5,000	- -	677.35	One workable coal seam is intersected within a depth range of 139.69 to 237.00 m.Total 0.99 million tonnes of coal resources estimated.
Wardha	Shekapur block	-	-	-	738.00	Two composite coal seams ranges from 71.00 to 195.80 m with thickness of workable coal seam from 1.01 to 2.5 m was established. About 8.16 million tonnes of coal reserves were proved.

Table – 6 : Exploratory Drilling for Lignite by MECL, 2010-11

Lignite field/Block	Drilling (m)
Promotional-on Behalf of Ministry of Coal	
Neyveli Lignite Field	
Sattanur	678
Ramnad (Rajsingamangalam)	9,467
Sikkal	4,937
Barmer Lignite Field	
East of Kurla	9,447
North Kurla - Magni- ki- Dhani	3,877
Bikaner Lignite Field	
Kolasar Gravity Block	11,834
Bangarsar-Jaimalsar	1,108
Jaisalmer Lignite Field	
Jaisalmer	10,448
Total	**51,796**

Table – 7 : Exploration for Lignite by State DMG and State Undertaking, 2010-11

Agency/State/ District/Location	Mapping		Drilling		Sampling (No.)	Result
	Area (sq km)	Scale	No. of boreholes	Meterage		
DMG, Rajasthan						
Barmer						
Bandra	5.5	1:2,000	-	-	-	It is a continuation of search for mining and underground gasification in Barmer dstrict.
Bikaner Surpura	-	-	01	24	02	Lignite was not encountered in SBH-6 borehole.
Kenya-ki-Basti	250	1:50,000	01	162	60	About 0.06 million tonnes of geological reserves of lignite on the basis of visual estimation of core has been done.
GMDC, Gujarat						
Bharuch Amod	-	-	-	-	-	Surface contour map with boreholes locations, local grid pattern, Pit plan (working plan), Surface plan, Water danger plan, cross sections in required scale were made.
Bhavnagar Surka (North)	-	-	15	2,553	30	Total geological reserves of lignite have been estimated at 107.54 million tonnes. Out of this, Block-A accounts for 84.88 million tonnes and Block-B accounts for 22.66 million tonnes.
Surat	-	1:5,000	-	-	30	-
Tadkeshwar	-	1:3,000				

In Rajasthan, Reconnaissance stage (G-4) exploration for lignite by scout drilling was conducted in Phalki North area in the Nagaur South sub-basin in Nagaur district to locate the lignite bearing blocks and to establish the stratigraphic set up in the Nagaur South sub-basin. GP survey in the area indicated a significant residual gravity low of the order of - 0.3 m -77 Gal extending for a strike length of 2.4 km in N-S direction. Few residual lows have been interpreted in the north and east of Badgaon village. Based on the resuts of GP survey, the Phalki North block has been taken for search of lignite. In the first barehole RNPN - I, three lignite seams varying in thickness from 0.20 m to 3.50 m were intersected between 176.50 m and 205.50 m depths. The grade belongs to lignite "B" category.

During coal exploration , a Tertiary lignite seam of 0.50 m thickness has been intersected at 226.30 m depth in borehole BGZ-3 around Gazipur area, south of Mahalla, Rajmahal Master Basin in Birbhum district, West Bengal.

MECL

MECL carried out exploration for lignite in Rajasthan and Tamil Nadu and established 19.11 million tonnes resources during 2010-11 with average CV (calorific value) at 1103 kcal/kg.

Promotional drilling was carried out in Tamil Nadu and Rajasthan. The details of exploratory drilling during 2010-11 are given in Table- 6.

State Directorates

Particulars of exploration carried out by State Directorate of Mines & Geology, Rajasthan during 2010-11 are given in Table-7.

GMDC

GMDC carried out exploration for lignite in its Amod, Tadkeshwar and Surka (North) lignite mines. Particulars of exploration carried out by GMDC are given in Table-7.

NON-FERROUS METALS

BASE METALS

GSI, MECL, HCL, HZL and State Directorates conducted investigations for copper, lead and zinc ores in different parts of the country during 2010-11.

GSI

The details of exploration activities carried out by GSI during 2010-11 are given in Table-8.

MECL

MECL carried out detailed exploration for base metals in promising areas in the state of Rajasthan. Details of exploration carried out by MECL during 2010 -11 are given in Table-9.

HCL

During 2010-11, HCL carried out 267.40 m drilling in two boreholes and collected 225 samples in Khetri mine, Jhunjhunu district, Rajasthan. Total reserves estimated in Khetri mine are placed at 56.978 million tonnes with 1.37% Cu.

HZL

In Rajpura-Dariba mines, Rajsamand district, Rajasthan, HZL conducted underground mapping in 1,551.10 linear m on 1:200 scale; 798 m drilling in 15 boreholes; undertook collection of 391 samples and estimated 49.37 million tonnes of ore resources with 1.65 to 2.21% Pb and 6.47 to 7.76% Zn. A total of 1,158 m underground mapping on 1:200 scale; 1,728.80 m drilling in 41 boreholes (in Balaria mine only) and collection of 6,913 samples were carried out by HZL in Zawar Group of Mines (Mochia, Balaria, Zawarmala and Baroi), Udaipur district, Rajasthan. In addition,in Balaria mine 2,475 samples were collected and 11,778.1 m of surface drilling in 14 boreholes were carried out. Total resources of lead - zinc ore in Zawar Group of Mines as on 1.4.2011 are placed at 65.86 million tonnes.

State Directorates

Investigation of base metals as carried out by State Directorates of Geology of Odisha and Rajasthan during 2010-11 are given in Table-10.

Table - 8 : Exploration for Base Metals by GSI, 2010-11

State/District/	Name of block	Details of exploration	Results
Gujarat			
COPPER			
Banaskantha	Amlimal area	Geophysical survey	A reconnaissance stage investigation (G-4) was taken up during 2010-12 in South Delhi Fold Belt in Amlimal area for copper and associated minerals. Indications of mineralisation in the Amlimal area is recorded in the form of malachite and azurite stains, specks and stringers of pyrite with occasional chalcopyrite in the cherty quartzite and amphibolite. Skarn zone, identified in the calc-silicates shows development of andradite garnet in association with calc-silicate minerals. 3m to 5m thick brecciated and limonitised metavolcanic chert reef is delineated which corresponds to the geophysical anomaly axes picked up in the area. The metavolcanic chert is very fine grained and comprises microcrystalline silica.

Contd.

Table -8 (Contd.)

State/District/	Name of block	Details of exploration	Results
Haryana			
COPPER			
Mahendragarh	West of Bakrija village	Drilling, sampling and chemical analysis	Prospecting stage investigation (G-3) was taken up during 2010-12 in North Delhi Fold Belt in the unexplored parts of west of Bakrija with an emphasis on demarcation of the host rock for copper mineralisation in Mahendragarh district and to assess the potential of copper mineralisation to the west of Bakrija. Detailed geological mapping has been carried out in and around Bakrija village. The area is mostly soil covered with few scanty outcrops. The lithounits exposed are amphibole marble occasionally inter-banded with calcareous quartz biotite schist which trends in NW-SE direction. The first Borehole BBH-1 was closed at 203.15 m depth. Analytical results of 34 core samples of BBH-1 from the calc quartz biotite schist and amphibole marble did not indicate any significant values of copper.
Jammu & Kashmir			
LEAD- ZINC			
Reasi	Bakkal, Serasandhu and Khairikot area	Reconnaissance stage investigation	Reconnaissance stage investigation (G-4) initiated during 2009-10 was continued in Reasi inlier in Bakkal-Serasandhu-Khairikot area to reassess the potentiality of Pb-Zn mineralisation and other associated metals. The area exposes lithounits belonging to Sirban Group (Proterozoic age) which is classified into two distinct formations viz. Trikuta Formation and Khairikot Formation having unconformable contact. The contact is marked by chert breccia. Surface indications of sulphide mineralisation are seen in the form of gossans, slag pieces, ferruginisation, limonitisation, malachite staining in quartzite and presence of old workings. Presence of old workings and slag pieces near Serasandhu village indicates ancient mining activity in the area. Galena in association with chalcopyrite and pyrite occur in the form of disseminations, sporadic veins, stringers and fracture filling which are hosted in chert breccia and cherty dolomite mostly near the contact of Trikuta Formation and Khairikot Formation.

Contd.

Table -8 (Contd.)

State/District/	Name of block	Details of exploration	Results
Madhya Pradesh			
LEAD- ZINC			
Chhindwara	Jangaldehri block	-	In Jangaldehri block, explored during 2008-09 an indicated resource (332) of 0.98 million tonnes of zinc ore with 1.10% Zn has been estimated.
Betul	Bishkhan Khari block	-	In Bishkhan Khari block, explored during 2006-09, an indicated resource (332) of 1.91 million tonnes of zinc ore with 1.14% Zn has been estimated.
Maharashtra			
COPPER			
Chandrapur	Nai-Dilli- Dighori and Lal Heti Dugula	Geochemical, geophysical, geological, mapping, pitting and trenching	Reconnaissance stage investigation (G-4) was taken up during 2010-12 in Archaean Gneissic terrain in the area between Nai Dilli-Dighori and Lal Heti Dugula to establish northern strike continuity of Thanewasana copper and associated basemetal mineralisation. The investigation was carried by way of geochemical sampling on grid pattern (100x 50m) followed by detailed geophysical and geological mapping and pitting/trenching. Soil samples from Dugula area were analysed by cold extraction techniques which indicated presence of sulphide mineralisation. Hydrothermal breccias and quartzchloritic vein with boxwork development is recorded in this area. Surface indication in the form of suphide disseminations in pyroxenite was recorded in Nai- Dilli area.
Gadchiroli	Ghanpur- Mudholi block	Drilling and Chemical analysis	A prospecting stage investigation (G-3) in West Bastar Craton for copper and associated mineralisation initiated during 2008-09 was continued as spill over item in 2010-12 in Ghanpur-Mudohli Block to establish potential zones of copper mineralisation. The target of spill over drilling has been achieved.
Meghalaya			
BASE METAL			
East Garo Hills	Simsang Diwa village	Delineation of potential area	Reconnaissance stage investigation (G- 4) was taken up during 2010-12 in Archaean Gneissic Complex near Simsang Diwa village to assess basemetal potential in the area. During mapping different varieties of granites viz. porphyritic granites and homophanous granites were delineated. The granite contains various proportions of biotite and feldspar and is intrusive into the banded gneiss. Lamprophyre dykes are exposed near Simsang Diwa. Three major dioritic intrusions are recorded in the area between Simsang Diwa and Gambil. No significant sulphide mineralised zone could be delineated in the area so far.

Contd

Table - 8 (Contd.)

State/District	Name of block	Details of exploration	Results
Rajasthan BASE METAL Alwar	Khera block, Mundiyawas-Khera area	Mapping, pitting / trenching, scout drilling etc.	Reconnaissance stage investigation (G-4) was taken up during 2010-12 in North Delhi Fold Belt in Khera block, Mundiyawas- Khera area to evaluate potential of copper and precious metal mineralisation. The area has been investigated by detailed mapping, pitting/trenching, scout drilling and sampling.
Bhilwara	Karoi-Rajpura area, Pur-Banera belt	Delineation of copper minera-lised zones	Reconnaissance stage investigation (G-4) initiated in 2009-10, was continued in Pur-Banera belt in Karoi- Rajpura area, to assess the basemetal potential of the area. The calcbiotite gneiss present in the mapped area is the dominant host rock for copper mineralisation. Evidences of mineralisation are manifested in calcbiotite gneiss in the form of malachite stains and as specks, pods, stringers and veins of chalcopyrite, bornite and covellite. The dominant copper sulphide minerals are chalcopyrite and bornite and oxide mineral is hematite. Based on available analytical data of bedrock and channel samples, a copper mineralised zone having a strike length of about 300 m and width varying from 80 m to 130 m with an average grade of 0.34% copper was delineated. This zone warrants further probing by scout drilling.
-do-	Salampura block, Pur-Banera belt	Drilling and chemical analysis	Prospecting stage investigation (G-3) was taken up during 2010-12 in Pur-Banera Belt in the northern part of the Salampura Block to assess the basemetal potential between Pur-Dariba copper prospect and Gurla basemetal prospect. The dominant rock unit is quartz-mica schist (± garnet) with bands of calc silicate. The boreholes drilled intersected eight mineralised zones having about 5% to 6% total sulphides (VE). Zone II, IV, VI and VII are rich in sphalerite and galena with minor chalcopyrite. The other zones are rich in pyrite and pyrrhotite. The sulphides are seen along the foliation and fracture planes.
do-	Rampuriya and Gadariyakhera	Geophysical, geological and geochemical surveys	Reconnaissance stage investigation (G-4) initiated during 2009-10 was continued in Pur-Banera Belt between Rampuriya and Gadariyakhera villages to identify the target areas for basemetal and gold mineralisation by ground evaluation of airborne geophysical anomalies through integrated geological and geochemical surveys. The area is mostly soil covered and minor outcrops of BIF bands are present. A total of 489 soil samples were collected and results of 119 samples are received. Soil samples collected on 500 m x 100 m grid indicated Pb values ranging from >10 ppm to 460 ppm and Zn from 20 ppm to 1,100 ppm. Statistical analysis of soil samples for Pb and Zn indicated that the background and threshold values of Pb are 17.9 ppm and 214 ppm, respectively, while those of Zn are 80 ppm and 461 ppm, respectively.

(Contd.)

Table - 8(Contd.)

State/District	Name of block	Details of exploration	Results
Bhilwara	Kamalpura and Devepura blocks	Revaluation of aerogeophysical anomalies	Reconnaissance stage investigation (G-4) was taken up during 2010-12 in Pur-Banera Belt for integrated revaluation of multisensor aerogeophysical anomalies in Kamalpura Block and Devpura Block to identify target areas for basemetal mineralisation.
Jaipur	Dholpura area	Mapping, photo geological interpretation, etc.	Reconnaissance stage investigation (G-4) initiated during 2009-10 was continued in North Delhi Fold Belt in Dholpura area to assess the extent and potential of basemetal and associated gold mineralisation in the Raialo Group of rocks in Dholpura area. The work involves mainly large scale geological mapping on 1:25,000 scale with photo geological interpretation and geochemical evaluation. The litho units exposed in area belong to the Raialo Group and Rajgarh Group of Delhi Supergroup. The Raialo rocks are mainly represented by dolomite, banded hematite quartzite/ brecciated quartzite and quartz mica schist. Photogeological studies define three sets of lineaments, resulting in dome and basin structure. Ground evaluation of the lineaments has not indicated any significant association with basemetal mineralisation. A major fault trending ENE-WSW has been inferred which has brought the Raialo and Rajgarh rocks in juxtaposition. The rocks in the area exhibit evidences of three phases ofdeformation. Analytical results of the channel/ bedrock samples collected during. 2009-10 indicated Cu values ranging from < 5 ppm to maximum 686 ppm. Only three samples from the old workings with malachite stains have recorded 0.1% to 0.18% Cu. The Pb values range from < 25 ppm to maximum of 100 ppm and Ag values are <5 ppm. The area appears to be promising for iron ore mineralisation.
Pali	Trans-Aravalli area	Reconnaissance stage investigation	Reconnaissance stage investigation (G-4) was taken up during 2010-12 in Trans-Aravalli area to assess the polymetallic mineral potential of the Dhani granite. Analytical results so far available yielded 35% Fe and >2% REE for the Dhani granite. The unusual abundance of REE forms the basis for taking up the present investigation.
Sikar	Mahawa block	Drilling	Prospecting stage investigation (G-3) was taken up during 2010-12 in North Delhi Fold Belt in Mahawa Block to assess the depth continuity of basemetal mineralisation within the Kushalgarh Formation on the western flank of the Kundla Dhani- Baniwala ki Dhani- Dokan Copper Belt. The first borehole of the second level drilling (MBH-7) was put along the profile of MCS-1and earlier drilled borehole MBH-1 (drilled during 2009-10). The borehole intersected sulphide mineralisation. The second borehole MBH-8 was located along the profile MCS-2 and earlier borehole MBH-2 (drilled during 2009-10). The boreholes intersected sulphide mineralisation in the form of disseminations, streaks, stringers, veins and fracture fillings. Sulphides are pyrite,chalcopyrite, with minor bornite and is associated with specularite. Dusty chalcopyrite was also noticed.

(Contd.)

Table - 8 (Contd.)

State/District	Name of block	Details of exploration	Results
Sikar	Mahawa east block	Channel sampling	Reconnaissance stage investigation (G-4) was taken up during 2010-12 in North Delhi Fold Belt to assess extent and potential of copper mineralisation in the Mahawa East block located on the western flank of the Kundla ki Dhani-Baniwala ki Dhani- Dokan copper belt. The exposures are scanty in the area and surface indication of mineralisation is observed as ferruginous/limonitised (calcareous) zone in the northern part of the area and in the well cuttings within sheared and ferruginised zone. Malachite stains are rarely seen. The sulphide mineralisation in the well is represented by pyrite, chalcopyrite, bornite and covellite, associated with specularite. Thick ferruginous calcite vein and thin gossanised calcite vein are emplaced along E-W direction in the eastern part of the block. Fifty channel samples from the channel ECH-1 have been collected across the ferruginised zone exposed in the northern part of the block. Pitting and trenching will be carried out in the soil covered southern portions of the mapped area to delineate the sulphide zones.
-do-	West of Nanagwas	Geochemical analysis	Reconnaissance stage investigation (G-4) was taken up during 2010-12 in North Delhi Fold Belt in the west of Nanagwas area to delineate the zones of basemetal mineralisation and associated precious metals. Surface indications of mineralisation are manifested in the form of malachite stains and specks of unaltered sulphides of pyrite, bornite in amphibole marble and in thin quartz veins within amphibole marble.
-do-	Dariba North block	Geochemical analysis	Reconnaissance stage investigation (G-4) was taken up during 2010-12 in North Delhi Fold Belt in Dariba North Block to delineate the zones of basemetal mineralisation and associated precious metals in Dariba – Baleshwar area. Surface indications of sulphide mineralisation are manifested in the form of malachite stains and specks of unaltered sulphides in amphibole marble and dolomitic marble.
Tonk	Between Janula-Danota	Mapping and geochemical sampling	Reconnaissance stage investigation (G-4) was taken up during 2010-12 in Mangalwar Supergroup between Janula-Danota in Agucha-Malpura-Chaksu flown belt for ground evaluation of airborne geophysical anomalies by detailed geological mapping and systematic geochemical sampling to identify target areas for basemetal mineralisation.

(Contd.)

Table - 8 (Concld.)

State/District	Name of block	Details of exploration	Results
Sikkim			
BASE METAL			
West Sikkim	Chakung- Jugdum area	Reconnaissance stage investigation	Reconnaissance stage investigation (G-4) initiated during 2009-10 was continued in Lesser Himalayan zone in Chakung-Jugdum area covering parts of West district, to assess the basemetal and gold potentiality of the area. Sulphide mineralisation in the area is associated with Gorubathan and Buxa Formations. In Gorubathan Formation, the mineralisation is recorded within remobilised quartz veins traversing greenish/ greenish gray phyllite unit. Sulphide minerals are mainly pyrite and chalcopyrite which occur as fine dissemination within the quartz veins. In Buxa Formation, mineralisation occurs in the form of malachite stains in the lower unit which consists of phyllite and thinly bedded quartzite. Near the contact of Rangit Pebble Bed, profuse malachite stains are recorded.

Table – 9 : Exploration for Base Metals by MECL, 2010-11

State/ District	Block	Mapping		Samples collected	Drilling		Remarks
		Scale	Area (sq km)		Bore-holes	Mete-rage	
Rajasthan							
Ajmer	Tikhi Extension South block	1:1,000	0.20	100	8	1,826	Three lodes have been intersected in boreholes. Thickness vary form 2-4 m with grade 3-4 % TMC . Few individual samples analysed lead ranging from 15 % - 30%.
Chittorgarh	Wari (B&C) block	1:1,000	1.5	1,121	23	3,994	Nine mineralised zones have been deciphered in the blocks with total resources of 2.56 million tonnes X 1.09 % Cu, besides ore contain Ni-168 ppm and Co - 161 ppm.

Table – 10 : Exploration for Base Metals by State Directorates of Geology & Mining, 2010-11

State/ District	Block	Mapping		Samples collected	Drilling		Remarks
		Scale	Area (sq km)		Bore-holes	Mete-rage	
Dte. of Geology, Odisha							
Mayurbhanj	North of Kesharpur	1:25,000 1:2,000	115 1	53	-	-	Twenty seven nos of pitting with 79 cu m excavation, two nos of trenching and 27 nos of geochemical sampling were carried out.
DMG, Rajasthan							
Ajmer	N/v Kirap, Ratangarh, Rajpura etc.	1:50,000 1:10,000 1:1,000	100 10 1	29	–	–	Gossan zone was located at the contact of limestone and quartzite in about 300 m x 1-3 m area near Bhairukheda village. It is reddish brown to cherry red in colour and highly ferruginous.
Bhilwara	N/v Thadiya	1:2,000	0.50	13	_	–	Mapping has been completed and drilling may be taken up later on.
Rajsamand	N/v Sunarkui	-	-	10	01	72	Results of chemical analysis are awaited.
Sikar and Jhunjhunu	N/v Bamrara, Saladipura and Niranka-ki-Dhani-Chapoli	-	-	575	-	-	RGM-20 sq km, DGM- 10 sq km and 5.0 sq km geochemical survey have been carried out.
Udaipur	N/v Kun and Punja-ki-Bhagal	-	-	47	01	90	In the borehole stringers and specks of pyrite and chalcopyrite were observed.

BAUXITE

GSI

In Gujarat, Reconnaissance stage investigation (G-4) was carried out during 2010-12 to search for titaniferous bauxite in order to appraise potential for high titanium bauxite occurrences and to study its mineralogy in the area around Ukheda, Daban, Wamoti Nani and Khanpur of Kachchh district. The area is characterised by presence of laterite and basaltic flows of Deccan trap. Bauxite occurs as a tabular body and in the form of pockets within thick laterite capping. Both massive and pisolitic varieties of bauxite are recorded in the area. The thickness of the massive bauxite is about 2.10 m, whereas that of the pisolitic bauxite is about 3.00 m, as measured in trench section. The visual estimate of bauxite samples indicates that the alumina percentage may range between 20% and 30%.

In Madhya Pradesh, Reconnaissance stage investigation (G-4) was taken up during 2010-12 in Deccan trap domain for bauxite ore in Tantar and Tainchi Blocks in Dindori district to assess the resource and grade of bauxite ore. The litho units, exposed in the area is characterised by laterite cappings and basaltic flows of Deccan trap. Bauxite occurs as a tabular body within thick laterite capping and also in the form of pockets. Two types of bauxite, e.g. massive variety and pisolitic variety are recorded in the area. The massive bauxite is exposed near Bharra (Maharani) Tantar area. It is hard and compact in nature. It is massive and vesicular and vesicles are filled by limonitic and siliceous material. The pisoliticbauxite is well exposed near Silpiri (Teklukheru)village and is about 30 m to135 m wide. It is primarily hard and compact but occasionally soft variety is also recorded. Rounded, subrounded to elliptical pisolites are present with size varying from less than 1mm to 2 cm. These alumina rich pisolites are set in alumina and clay rich matrix. The alumina content ranges between 20% to 40% in bauxite by visual estimation. At places, high grade of bauxitic ore is also recorded. The thickness of the massive bauxite is about 2.10 m and of the pisolitic bauxite is about 3.00 m as measured in trench section.

In Maharashtra, Reconnaissance stage investigation (G-4) was taken up during 2010-12 in Sindhudurg belt in the lateritic terrain adjoiningeither sides of Voghotan river in parts of Ratnagiri and Sindhudurg Districts to search for bauxite potential. The area comprises laterite on the surface and the Upper Cretaceous to Lower Eocene Deccan basalts occur along the deep nala beds and in low lying areas. The saprolite often retains the relict structures of basalt. The Deccan basalt flows overlie the Proterozoic sandstones belonging to Kaladgi Supergroup. The laterite exhibits altered vermicular features with iron oxide rich rims and clay rich central portions. The 8 m vertical section of the Nanarwadi laterite quarry exposes 1 m to 1.5 m thick hard and compact limonitised laterite in the top followed by 4 cm to 5 cm thick reddish soil with rare lenses and pockets of white aluminous laterite. In the bottom zone, 1-2 m thick lateritic bauxite/bauxite lenses occur. A total of fifty nine (59) samples were collected from the bottom sidewall portions of trenches excavated (dimension nearly 1 m x 1.5 m x several km) for laying out BSNL cables in the study area all along the main track of the plateau.

State Directorates

During 2010-11 , Directorate of Geology & Mining, Chhattisgarh conducted exploration for bauxite in Darai area, Kabirdham district (Mapping on 1:50,000 and 1:4,000 scales in 514 sq km and 2.16 sq km, respectively ; 75.20 cu m pitting ; 873.10 m drilling in 93 boreholes; 1013 sample collections and estimation of 2,36,000 tonnes of bauxite); Sarbhanja area, Mainpat plateau, Surguja district (Mapping on 1:4,000 scale in 0.30 sq km; 36 cu m pitting; 390.65 m drilling in 32 boreholes ; 100 nos of sample collection and estimation of 1,00,000 tonnes of metal grade bauxite); and in Dandkeshra area, Mainpat plateau, Surguja district (Mapping on 1:50,000 and 1:4,000 scales in 150 sq km and 2 sq km areas, respectively; 53 cu m pitting; 848 m drilling in 83 boreholes; 593 nos. of sample collection and estimation of 3,00,000 tonnes of metal grade bauxite).

In 2010-11, Directorate of Mining & Geology, Kerala conducted primary field investigation by systematic reconnaissance traverse in Cheemeni village, Hosdurg Tq, Kasaragod district over an area of 1.5 sq km for demarcating the occurrences of bauxite. Since the results are encouraging a detailed investigation by exploratory drilling is recommended. Investigation for bauxite by using remote sensing techniques was initiated. The preliminary arrangements pertaining to the procurement of imageries and toposheets in 1:25,000 are in progress.

During 2010-11, Directorate of Geology & Mining, Maharashtra carried out general survey for bauxite in Guhaghar area, Ratnagiri district. Laterite above 80 to 100 m contour level covers 80% of the area which shows existence of low grade bauxite.

During 2010-11, Directorate of Geology, Odisha carried out exploration for bauxite around Kaniguma and Lingapadar areas, Kalahandi district. Exploration include: 1: 50,000 - 60 sq km / 1: 2,000- 1.4 sq km mapping and collection of 418 rock / grab / channel samples in Kaniguma area and 1: 50,000 - 101 sq km / 1: 25,000 - 1.5 sq km mapping and collection of 377 grab/channel samples in Lingapadar area. Seven bauxite bearing plateaus have been located in Kaniguma area and in Lingapadar area extension of the bauxite bearing plateaus has been delineated.

GMDC

During 2010-11, GMDC carried out 1,100 m core drilling in 42 boreholes for bauxite in Mevasa mines, Jamnagar district. Total 52 samples were collected and 1.90 lakh tonnes bauxite resources were estimated. Similarly, in 2010-11, GMDC has also in total drilled 348 new boreholes with 5,056 m drilling in its Balachod, Daban, Goniasar, Naredi -2, Ratadia, Roha - Kotada, and Wandh I & II bauxite mines in Kachchh district. Total 345 nos sampling and 10.93 million tonnes bauxite resources (332) were estimated .

Chhattisgarh Mineral Development Corporation Ltd (CMDC)

During 2010-11, CMDC has conducted exploration for bauxite in Barima (Mainpat) mines in Surguja district by 6 nos pitting (2mx 3m x 5m) ; 12 nos chemical analysis and 135 m core drilling in 16 boreholes.

FERROUS MINERALS

CHROMITE

GSI

In Andhra Pradesh, Reconnaissance stage investigation (G-4) was taken up during 2010-12 in Eastern Ghat Supergroup in the area between Kondapalli and Gangineni area in Krishna and Khammam districts to assess the potential of the area for chromite mineralisation. The rock types encountered in Kondapalli and surrounding areas are pyroxene granulite and charnockite with enclaves of pyroxenite. The general trend of the foliation is NW-SE with moderate to steep southwesterly dip. In the area to the north of Koduru village, a mappable pyroxenite body, which is 28 m in length and 17 m in width is recorded that shows chromite mineralisation. The chromite mineralisation is confined to ultramafic rocks in the area. In Kondapalli area the chromite occurs as lenses, bands, pockets and disseminations within steeply dipping and pitching lenticular bodies of pyroxenite. Insitu chromite mineralisation was recorded in all old chromite opencast quarries present in the area. The chromite ore is massive in character, black in colour with sub -metallic to metallic luster. It shows granular texture with high specific gravity. At places, stringers of chromite with 5 cm in length and 1cm in width are observed within charnockite unit. The petrographic studies indicate that the chromite occurs in the form of disseminations in association with sulphides in pyroxenites. The analysis of 24 nos of chromite bearing bedrock samples collected from old workings, 30 m to 75 m length × 0.5 m to 2.5 m width in dimensions around Kondapalli village, indicated Cr_2O_3 value ranging from 20.82% to 43.04%.

In Odisha, Reconnaissance stage investigation (G-4) was taken up with scout drilling to the south of Raibola-Kanheipal in Dhenkanal district to search for chromite bodies in the transition zones of Eastern Ghat Mobile Belt (EGMB) and Iron Ore Supergroup (IOSG) of rocks south of Sukinda ultramafic complex. The ultramafics are mainly exposed in the old mining pits. However, a few small patches of intensely silicified serpentinite are exposed in western part of the mapped area. The old mining pits are scattered within a strike length of 1.5 km and width of 100 m in NW-SE direction. Chromite is present in weathered and silicified serpentinite as discrete grains, laminae and bands upto 70 cm width.

State Directorate

During 2010-11, Directorate of Geology, Odisha carried exploration for chromite in south of Mahagiri hill, Jajpur district by mapping on 1:2,000 scale in 1.125 sq km area, 94.265 cu m excavation and 482 nos of geochemical sampling. To locate the chromite occurrences, the Directorate has collected magnetic data in 50m x 10 m grid in 1.25 sq km area around Kakudia, south of Mahagiri hills, Jajpur district. A specific high contour closure in NE-SW direction has been deciphered. In addition, the Directorate has also conducted 100.25 m core drilling with 200 nos core and 4 nos rock sampling in Tailangi chromite mine of M/s IDCOL in Jajpur district.

FACOR

During 2010-11 M/s. FACOR carried out exploration in Boula chromite mine, Keonjhar district, Odisha by 1,229.8 m drilling in 84 boreholes and collecting 268 samples; in Kathpal chromite mine, Dhenkanal district, Odisha by 4,992.10 m drilling in 93 boreholes and collecting 162 samples and in andOstapalchromite mine, Jajpur district, Odisha by 214 m drilling in 10 boreholes and collecting 68 samples.

IRON ORE

GSI

In Chhattisgarh, Prospecting stage (G-3) investigation initiated during 2007-08 for assessment of iron ore in Aridongri area, Kanker district as a sponsored item of Chhattisgarh Mineral Development Corporation Limited was completed after getting necessary forest clearance for drilling in the month of December, 2010. BIF bands are present within a sequence of amphibolite, metapelite and quartzite. The mapping revealed three iron ore bands in BIF of strike lengths 1,383 m (northern), 130 m (Central) and 880 m (Southern), respectively. A total inferred resource (333) of 10.01 million tonnes with a grade of 62.28% Fe has been estimated.

In Jharkahnd, Reconnaissance stage (G-4) investigation was taken up during 2010-12 in Iron Ore Supergroup in West Singhbhum district at the request of DMG, Jharkhand as a collaborative item to assess the iron and manganese ore potentialities in and around Siulpunji-Kantoria Block. The block area falls within the Upper Shale Formation in Jamda- Koira synformal belt. Lithounits include intraformational conglomerate, BIF, quartzite, shale and ferruginous brecciated chert. Iron ore bodies with dimension varying from 85 m to 1,000 m in length and width from 2.5 m to 4 m were delineated in the area to the west of Kantoria. Iron ore bodies were also identified in Mereralgara area. A few lenses of manganese ore occur to the north of Diriburu and west of A 521 hillock.

In Karnataka, Reconnaissance stage investigation (G- 4) was initiated during 2010-12 in selected freehold areas in Kenkeri, Melanahalli, Guruvapura, Kempanahalli, Dasudi, Kandikere Blocks and adjacent areas in Hosadurga Taluk, Chitradurga district for preliminary assessment of the iron ore occurrences in parts of Chitradurga Schist Belt as a follow up of decisions taken in SGPB of Karnataka and CGPB meetings. Large scale mapping in Melanahalli Guruvapura Blocks has brought out three bands of BIF. The analytical results of four samples collected from trench nos T3/CSB and T5/CSB in Guruvapura Block analysed 33.23 to 34.01 wt% Fe. A higher value of 55.01 % Fe was obtained near a fold closure indicating a structural control for the ore concentration. Bed rock samples have given value range of 20.11 wt % to 46.91 wt% Fe. In Devadaribetta Range (NMDC block), Bellary district, which was explored during 2005-08, a Reconnaissance resource (334) of 8.20 million tonnes of iron ore (hematite) with 57.37% Fe has been estimated.

In Odisha, Prospecting stage (G-3) investigation in Bonai-Kendujhar belt was taken up during 2010-12 in Sagasahi East Block of Sundergarh district to assess iron ore potential in the northern contiguous area of Ghoraburhani block. The iron ore bodies contain hematite and occur as bands, lenses and pockets with varying dimensions and are covered by laterite. The strike length of iron ore bands is 600 m with width of about 200 m. The boreholes have been planned at 200 m × 200 m grid pattern. All the boreholes intersected iron ore varying in thickness from 11.00 m to a maximum of 80 m. In course of drilling, the continuity of iron ore bodies below lateritic cover is established and the thickness of ore zone is as good as Ghoraburhani-Sagasahi Block explored earlier during 2007-08. Prospecting stage investigation (G-3) in Bonai-Kendujhar belt was taken up during 2010-12 in Damurda- Champuasahi area in Kendujhar district to assess the potential of low grade iron ore associated with BHJ and ferruginous laterites in the area. The iron ore is hematite and occurs as lenses and as narrow bands within ferruginous shale and BHJ. It is mainly powdery, soft and hard laminated type. The trend of ore bodies in Damurda-Lasarda ridge is NE-SW and extends over a strike length of 2.5 km with surface width varying from 50 m to 300 m. The iron content ranges from 35 to 65%. Two boreholes CBH-1 and 2 were drilled at a strike interval of 200 m. The first borehole CBH- 1, planned to intersect the ore body at 50 m depth, intersected the BHJ between 41.55 m and 67.55 m with occasional shale parting and iron ore bands. The iron ore band (hematite) was intersected from 51.50 m to 53.60 m depth.

In Rajasthan, Reconnaissance stage investigation (G-4) for ferrous and associated metallic minerals was initiated during 2010-12 in Aravalli Fold Belt and adjoining BGC to evaluate and delineate the iron ore occurrences in parts of south Rajasthan. Two moderately dipping BIF bands trending NE-SW have been delineated within Banded Gneissic Complex. The BGC comprises granite gneiss, leucogranite and migmatite. The eastern BIF band is prominent with strike length of about 4.5 km and width varying from 200 m to 500 m. The western BIF band occurring in northwestern part is about 1.5 km in length and 25 m to 150 m in width. The BIF is reddish brown in colour and shows well developed compositional banding. The BIF bands in association with banded amphibolite are also reported from west of Ghatol in south Rajasthan . The BIF bands have been sampled and submitted for chemical analysis.

State Directorates

During 2010-11, Directorate of Geology and Mining, Chhattisgarh carried out exploration for iron ore in Raoghat area, Bastar district by 514 sq km mapping on 1:50,000 scale and 54 nos of sample collection. During the year, 11 million tonnes of iron ore with 35-65% Fe was inferred making it 41.174 million tonnes of iron ore resources in the area so far.

Department of Mines & Geology, Karnataka in 2010-11 carried out exploration for low grade iron ore in Ameengarh village, Bagalkot district by mapping 85 sq km area on 1: 50,000 scale and collected 20 samples. Samples were analysed with 42.05 -58.75 % Fe content.

In 2010-11, Directorate of Geology, Odisha carried out exploration for iron ore around Haramutu, Gamlei, Rugudihi and Panduliposi areas, Keonjhar district by mapping on 1: 25,000 scale in 50 sq km area, pitting (100 m x 50 m x 5 m), (500 m x 100 m x 10 m) & (300 m x 25 m x 10 m) and collected 47 rock and 10 iron ore samples.

DMG, Rajasthan in 2010-11 conducted detailed geological mapping on 1: 2,000 scale in 0.50 sq km area around Thadiya village in Bhilwara district as a continuation of prospecting for iron ore.

During 2010-11 DMM , West Bengal carried out exploration for magnetite alongwith apatite in Chirugora area, Purulia district by mapping on 1: 500 scale in 1.072 sq km area, collection of 43 nos litho and soil samples and 40 nos pitting (av. 1m x 1m x 1.14 m). The DMM has also conducted investigation for magnetite and associated minerals in area around Pathardihi, Bankura district by geological traverse in 7 sq km area and five nos of trenching (15 m x 1.65 m x 1.83 m).

NMDC

During 2010-11, NMDC carried out exploration in Bailadila iron ore deposit nos 14 and 11C in Dantewada district, Chhattisgarh by undertaking 6,320.50 m core drilling in 50 bore-holes in 50 m grid pattern. Drill samples are being prepared for chemical analysis. Similarly, in deposit nos 11 & 11A in total 997 m core drilling in 12 boreholes and in deposit no 5 too, 69 m rotary drilling were carried out . In Donimalai Iron Ore Mine, Bellary district, Karnataka, 717.50 m drilling in 8 boreholes and collection of 320 samples were carried out in 2010-11.

SAIL

During 2010-11, SAIL carried out exploration for iron ore in Kiriburu and Meghatuburu mines Singhbhum (West), Jharkhand. In Kiriburu, 1,017m drilling in 14 boreholes with estimation of 24 . 62 million tonnes reserves (111) in North Block as on 1.4.2011 have been carried out while in Meghatuburu, 750 samples were chemically analysed and 51.42 million tonnes of iron ore resources were estimated as on 1.4.2011 .

M/s V.M. Salgaocar & Bro. Pvt. Ltd

During 2010-11, the company carried out detailed mapping on 1:2,000 scale in their leasehold areas at Velguem/Surla mine and Sigao mine, Goa. During exploration, a total of 85.65 hectares area was mapped, 2,524.50 m drilling was done in 39 boreholes and 506 samples were collected .The total iron ore reserves estimated were 11.62 million tonnes in Velguem/Surla mine, 10.37 million tonnes in Sancordem-Malpona mine and 7.5 million tonnes in Sigao mine.

Mysore Minerals Ltd (MML)

During 2010-11, MML carried out 2,768 m drilling in 37 boreholes and 2,585 nos of sample collection in Thimmappanagudi Iron Ore Mines, Bellary district. Total 17.1 million tonnes of iron ore resoures were estimated as per UNFC.

Jayaswal Neco Industres Ltd (JNIL)

During 2010-11, JNIL conducted exploration for iron ore in Sonadehi iron ore deposit Kanker district and Devepura iron ore deposit, Rajnandgaon district both in Chhattisgarh. In Sonadehi deposit, mapping in 250 hectares area on 1:2,000 scale, collection of 50 nos samples and 15.5 m drilling while in Devepura deposit, mapping in 76 hectares area on 1:2,000 scale, collection of 182 nos samples and 182 m drilling in nine boreholes were carried out. In total 6.52 million tonnes of iron ore reserves in proved and probable categories were estimated in Devepura deposit.

Chowgule and Company Pvt. Ltd

During 2010-11, M/s Chowgule and Company Pvt. Ltd has conducted exploration for iron ore in Pale and Onda iron ore deposits, North Goa district, Goa. In Pale deposit, 341.9 m drilling in nine boreholes, analysis of 209 nos samples with estimation 0.40 million tonnes iron ore resources and in Onda deposit, 152.6 m drilling in four boreholes, analysis of 64 nos samples with estimation of 0.10 million tonnes iron ore resources were carried out.

MANGANESE ORE

GSI

In Madhya Pradesh, Reconnaissance stage investigation (G-4) was taken up during 2010-12 in Aravalli belt in parts of Meghnagar Tehsil in Jhabua district to delineate the manganese ore bearing quartzite-phyllite sequence through LSM, pitting-trenching, sampling, geophysical survey and scout drilling.

In Maharashtra, prospecting stage investigation (G-3) initiated during 2009-10 was continued in Sausar fold belt in Parseoni extension area of Nagpur district to establish manganese ore horizons west of Parseoni mines. The area is covered by highly folded and faulted manganese bearing sediments associated with the Tirodi Gneiss of Archaean age. During 2010-12, detailed mapping was carried out over an area of 0.6 sq km around Savali old working and Mohgaon area along with pitting, trenching and geophysical magnetic and gravity surveys. The Savali old working has a length of 54 m; width varies from 1 m to 7.5 m and depth of 5 m. Manganese ore body in the old working occurs within the marbles as irregular bands and lenses varying in thickness from 0.5 m to 1 m and plunges 350 towards northwest. The manganese ore is braunite with subordinate psilomelane / pyrolusite. Manganese band of 160 m length and width varying from 1 m to 1.5 m is delineated by digging pits in soil covered Savali Block. In trench No. T2/S alternate, fresh and weathered ore body is exposed for a width of 8 m. Chemical analysis of pit samples so far received indicated low phosphorous manganese ore ranging from 0.02% to 0.37% Mn. Out of 21 pit samples analysed for Mn, values in 5 samples range from 20.83% to 41.44% and the remaining samples yielded <3.39% Mn. Out of 46 bed rock samples analysed for manganese, values in 4 samples range from 18.79% to 42.23% and the remaining samples contain <5.40% Mn. In Mohgaon area, 10 manganese bands varying in length from 30 m to 75 m and width of 0.5 m to 2.5 m were delineated within pink and white marbles. Drilling will be taken up after the interpretation of geological and geophysical work, the latter was in progress.

In Odisha, Prospecting stage investigation (G-3) initiated during 2009-10 was continued in Bonai-Kendujhar belt, Kendujhar district in the identified Damurda South Block, Bolani South block and Bolani NE continuous block for resource assessment of manganese ore. The manganese ore in the area occurs with duricrusted laterite near to the surface, with brecciated chert and with the ferruginous shale, saprolitic clay and shale. The nature of the ore is lumpy, friable and powdery. Mineralisation is controlled by lithology and structure and is commonly seen along fractures, joints and fissile planes in shale and brecciated chert. Altogether twenty four boreholes are drilled, fifteen nos in 2009-10 and nine numbers in 2010-12. Out of nine boreholes, drilled in 2010-12, seven boreholes were completed by 31st March, 2011 in Damurda South Block and two boreholes were in progress. All the seven boreholes drilled intersected mineralised zones. The sub surface exploration so far carried out has identified mineralised zones over a strike length of 300 m. Individual thickness of ore zones varies from 0.20 m to as thick as 12 m with Mn >10 % (VE). Analytical data of the samples received so far show Mn content varying from 10.44% to 42.16% and Fe from 11.17% to 22.61%. The phosphorus content varies from 0.12% to 0.18%. The inferred ore resource estimated from boreholes drilled during 2009-10 at 20% Mn cut off is about 0.152 million tonnes (333) with an average grade of 18.98% Mn (Resource figure with 30 m strike length). Reconnaissance stage investigation (G-4) initiated during 2009-10 was continued in the Balagorha-Champuasahi area belonging to Bonai-Kendujhar Belt in Kendujhar district to search for potential manganese ore bodies. Manganese ore body occurs as lenses and pockets within the manganiferrous laterite on the dip slope of the hills. The manganese ore is of both hard and soft nature. Mineralisation is also recorded along the fracture planes of brecciated chert as cavity fillings and within the porous and cavernous laterite. On the basis of the surface indications, a potential Mn mineralised zone over 300 m strike length and 30-40 m width has been delineated in the area.

State Directorates

During 2010-11, DGM, Maharashtra carried out general survey for manganese ore in Parseoni area of Nagpur district . Manganese ore exposures are noticed near Savali and Mohgaon villages with E-W trend and 55^0 dip due south. Reconnoitery mapping on 1:25,000 scale in 7 sq km area, 39 cu m trenching and sampling have been carried out .

Directorate of Geology, Odisha conducted exploration in 2010-11 for manganese ore around Haramutu, Gamlei, Rugudihi and Panduliposi area, Keonjhar district by mapping on 1:25,000 scale in 50 sq km area; pitting (100 m x 50 m x 5 m, 500 m x 100 m x 10 m & 300 m x 25 m x 10 m) and collected 10 manganese ore and 47 rock samples for analysis.

GMDC

During 2010-11, GMDC carried out mapping in 424.20 ha area on 1:1,000 scale and 1,200 m drilling in 10 boreholes in Manganese Project, Shivrajpur, Panchmahals district.

MOIL

During 2010-11, MOIL carried out 4,920 m exploratory drilling involving 13 boreholes in two mines Tirodi and Bharweli situated in Balaghat district, Madhya Pradesh; five mines Dongri Buzurg & Chikla in Bhandara district and Gumgaon, Kandri & Mansar in Nagpur district, all in Maharashtra. The reported resources of manganese ore as on 1.4.2011 were in Bharweli (24.58 million tonnes), Tirodi (1.61 million tonnes), Gumgaon (4.34 million tonnes), Beldongri (0.40 million tonnes), Kandri (3.50 million tonnes), Mansar (4.66 million tonnes), Chikla (4.22 million tonnes) and Dongri Buzurg (11.22 million tonnes).

STRATEGIC METALS

MOLYBDENUM

GSI

Prospecting stage (G-3) investigation was taken up during 2010-12 for molybdenum in Harur-Uttangarai molybdenum belt in Vellakkal Central Block of Dharmapuri district, Tamil Nadu. Three boreholes AVLC-1 to 3 have been drilled in Vellakkal Central Block. The maiden borehole AVLC-1 intersected the shear zone between 80.70 m and 108.50 m depths. Visible molybdenite mineralisation was rarely noticed in the shear zone. A total of 42 core samples collected from this borehole have analysed Mo values up to 220 ppm. Borehole AVLC-2 intersected sheared quartzo-felspathic gneiss, sheared epidote-hornblende gneiss and quartz vein. The shear zone is characterised by sericitisation in quartzo-felspathic portions and chloritisation in mafic rich portions of the country rock. A total of 128 core samples collected from this borehole have analysed Mo values up to 200 ppm. In borehole AVLC- 3 molybdenite specks with galena and pyrite are noticed at 74.75 m depth. Random samples from borehole cores analysed for rhenium during the earlier phase of investigation has indicated average Re value of 6 ppm for 16 samples.In Vellampatti area, Dharmapuri district, Tamil Nadu, which was explored during 2009-10, an inferred resource (333) of 2.74 million tonnes of molybdenum ore with an average grade of 0.102% Mo has been estimated.

Rare Metals & Rare Earths

GSI

In Jharkhand, a Reconnaissance stage investigation (G- 4) has been taken up during 2010-12 in Chhotanagpur Gneissic Complex around Kotam-Kutru area of Ranchi district to assess rare metal and REE potentials. The investigation was taken up based on the higher content of Cs, Li and Rb in trench and BRS samples from pegmatite bodies during earlier surveys. The area forms a part of the Chhotanagpur gneissic terrain. The dominant litho units consist of metamorphic assemblages with metasedimentary enclaves. The gneisses and granitoids are intersected by metabasic intrusive along with quartz and pegmatite veins. The ENE-WSW trending North Purulia Shear Zone (NPSZ), which cuts across the area is the potential domain for REE mineralisation. The Kotam-Kutru Block is mostly soil covered. Sampling has been carried out in pegmatite bodies and sent for chemical analysis.

In Meghalaya, Reconnaissance stage investigation (G-4) was taken up during 2010-12 in the peripheral part of Sung ultramafic-alkaline carbonatite complex of East Khasi Hills district to evaluate REE potential. The Sung Valley intrusive is an oval-shaped body covering about 30 sq km area within Precambrian Shillong Group. The body is strongly discordant to the envelope rocks and its walls appear to dip steeply inwards. The major rock types comprising the Sung Ultramafic Complex are serpentinite, pyroxenite, uncompahrite, ijolite, syenite, carbonatite and apatite-magnetite rock. The inferred contact between quartzite and pyroxenite has been delineated for two km north and northwest of Tryshong village. The quartzite contains plenty of magnetite near the northernmost part of investigation area. It is presumed that during the emplacement of Sung Ultramafic into the quartzite of the Shillong Group, the magnetite is localised into the quartzite as influx.

BEACH SAND MINERALS

AMD

During 2010-11, AMD carried out reconnaissance survey (253.8 sq km) and detailed survey (8.28 sq km) in coastal tracts and inland areas, in parts of West Bangal, Odisha, Andhra Pradesh, Tamil Nadu, Karnataka and Gujarat for delineating the potential heavy mineral (HM) concentrations.

(i) Very narrow beaches with surfacial heavy mineral concentration of 5 to 20% were recorded in Ghoga and Gopnath coast, Bhavnagar district, Gujarat.

(ii) Heavy mineral concentration up to 10% in Digha-Birampur coast, Midnapore district, West Bengal and beetween 5-10% in inland palaeo placers of this coast were recorded.

(iii) Heavy minerals between 5-15% were recorded in beach sand between Gimagaria and Subarnarekha rivers, Balsore district, Odisha.

(iv) In beach sand between Ennore and Pulicat Lake, Tiruvallur district, Tamil Nadu 3-30% heavy mineral concentration were recorded.

(v) 2 to 8% heavy minerals were recorded along Bengre-Mulki coast, Mangalore & Dakshin Kannad districts, Karnataka.

In addition, detailed survey was carried out in Malikipuram deposit, East Godavari district, Andhra Pradesh to upgrade the resources from inferred to indicated category.

State Directorate

During 2010-11, Directorate of Geology, Odisha carried out investigation for heavy minerals (ilmenite, rutile, garnet, zircon, sillimanite, monazite, etc.) in beach sand ESE of Hunda village, Puri district. It comprised 1.04 sq km geomorphological /land use/land cover mapping on 1:2,000 scale and 2,060 m auger drilling with collection of 2,060 samples. The Directorate has also carried out 39 line km survey, 1,229 m auger drilling in addition to collection of 659 samples for heavy minerals study in Balikuda block along coastal tract of Jagatsinghpur district.

PLATINUM GROUP OF METALS

GSI

In Andhra Pradesh, reconnaissance stage (G-4) investigation for PGE mineralisation has been initiated in Ramagiri Schist Belt during 2010-12. An area of 67 sq km was mapped on 1:12,500 scale in NW and SW of Ramagiri. NNW-SSE trending narrow linear ultramafic bodies are traced for a strike length of 13 km from Konda Motu in the north to Enamurala Gutta in the south that varies from 10 m to 100 m in thickness. The bands are not continuous and show pinching and swelling characteristics. EPMA study of talc–tremolite–magnesite schist shows that the core of the magnesite grains is rich in Mg while the rim is rich in Fe. The opaques are magnetite and chrome-spinel (core rich in Cr and rim rich in Fe).

In Karnataka, a reconnaissance (G-4) stage investigation for PGE in mafic-ultramafic rocks of Nuggehalli Schist Belt has been taken up during 2010-12. A total 36 sq km has been mapped on 1:12,500 scale from Nuggehalli in the south to Bakhtarahalli in the north along with 110 cu m of trenching and sampling. The mapped area comprises both meta-sedimentaries and meta-ultramafites. An area around Ranganabetta is selected for detailed mapping on 1: 2,000 scale on the basis of selective field traverses in Nuggehalli Schist Belt. In Hanumalapura Block-A, Davangere district, which was explored during 2005-08, a Reconnaissance resource (334) of 0.84 million tonnes of PGE ore with 0.50 g/t to 2.93 g/t Pt+Pd has been estimated.

In Kerala, a reconnaissance (G-4) stage investigation for PGE mineralisation in the Attapadi valley of Palakkad district has been initiated during 2010-12. Sampling of mafic/ ultramafic lithounits was carried out for the analysis of PGE. An area of 115 sq km was covered by large scale mapping on 1:12,500 scale. Chromitite bearing ultramafics have been identified in Kalkandi and Narasimukku areas. Quartz rich auriferous lithounits containing a steel grey coloured metallic mineral have been noticed in Bhuthuvazhi, Attapadi valley, Palakkad district and Maddalapara, Malappuram district. The XRD analysis has indicated the presence of graphite, stibnite, pyrite, arsenopyrite and sillimanite. On panning, these samples have yielded a few grains of gold.

In Kankvali-Janoli area, Sindhudurg district, Maharashtra, reconnaissance stage investigation (G-4) was taken up to delineate zones of PGE, Ni and Cr mineralisation within the mafic-ultramafics sequence of Sindhudurg belt. Chromiferous metapyroxenite/ chromitite with exposed width of nearly 8 m in association with tschermakite amphibole schist, serpentinite schist, actinolite-tremolite schist and anorthositic gabbro has been delineated during large scale mapping at Dewalwadi in the southeastern strike extension. A few more ultramafic suites of rocks occurring in gneissic country have been brought out in the northwestern strike extension. Chromiferous tremolite actinolite schist and a sericitised chromite bearing quartz vein have been located near Harkul Budruk. Samples of talc tremolite schist collected from an abandoned old pit (Vagde chromite mine working) yielded 650 ppb of total PGE. A total PGE content of 235 ppb has been obtained from chromiferous pyroxenite and a total PGE content of 85 ppb is obtained from serpentinite schist collected from Vagde area. The chromiferous bands normally show more PGE concentration (520 and 805 ppb) than talc tremolite schist (515, 395 and 375 ppb). Prospecting stage investigation (G-3) was taken up during 2010-12 in Western Bastar craton in the maficultramafics of Heti area in Chandrapur district to assess the economic potentiality of the earlier delineated PGE and Ni zones within gabbro-noritepyroxenite bodies. Surface occurrences of pyrite, pyrrhotite, pentlandite and chalcopyrite dissemination have been recorded at the contact of gabbro and pyroxenite near Ganeshpipri. Two parallel mineralised gabbro-noritepyroxenite bodies with anomalous PGE values have been mapped intermittently for a stretch of 600 m in Heti Block. Bedrock samples from Heti Block have also indicated Ni value up to 900 ppm and chromium value up to 1500 ppm, PGE content varies from 28 ppb to 973 ppb in gabbro, 18 ppb to 25 ppb in charnockite, and 657 ppb to 1,042 ppb in pyroxenite. Three different phases of PGM were identified in SEM-EDX study, e.g. Moncheite, Pd-Moncheite, Pt-Au, and unidentified alloy phase. Minor associated mineral with PGM were identified in SEM-EDX i.e. barytes-sphalerite-cassiterite- LREE. In trench samples, PGE content varying from 100 ppb to 205 ppb is recorded. Bedrock samples, so far analysed, from noritic anorthosite dyke indicated PGE values ranging from 45 ppb to 445 ppb. The borehole MHCH- 1 intersected 8 thin mineralised zones of disseminated sulphide in gabbroic variants from 15.30 m to 66.35 m depth. The borehole MHCH-2 has intersected 8 disseminated sulphide zones from 12.00 m to 55.75 m depth within gabbroic unit. Presence of mineral phases of nickel - cobalt i.e. pentlandite- Fe Ni S-millerite-Ni S–Seigenite-Ni CO_3 S_4 from two stubs from the BH-MHCH-1 at depth of 41 m and 65 m has been confirmed by the preliminary EPMA studies.

In Manipur, reconnaissance stage investigation (G-4) initiated during 2009-10 was continued during 2010-12 for platinum group of elements in ophiolite belt to assess the potential of PGE mineralisation in the favourable host rocks in ultramafic suite comprising chromiferous dunite, peridotite and pyroxenite. Reconnoitory geological traverse mapping on 1:50,000 scale have been carried out in the ophiolite belt of Manipur and an area of 100 sq km was covered in parts of Siruhi, Gamnom and Pushing areas in Ukhrul district. Ultramafic clan of rocks with chromitite layers were identified. The ultramafic suites were emplaced into the pelagic-sediments of Tertiary age. A total of eighteen chromite bands/lenses containing massive chromite with maximum dimension of 20 m x 2 m have been delineated within the serpentinised peridotite which are parallel to the regional trend. Chromite is medium to coarse grained, subhedral to euhedral and dark grey in colour showing metallic lustre. The chromite samples analysed 44% to 59% Cr_2O_3 and is akin to the Alpine Type Podiform Chromite.

In Odisha, a prospecting stage investigation (G-3) was taken up in March, 2010 as a sponsored item of Orissa Mining Corporation Ltd (OMC Ltd) in its leasehold areas in Bangur and Banaipank areas of Kendujhar district. The objective was to delineate PGE bearing horizons in the Bangur chromite mining areas and to search for possible extension of potential ultramafic units in the Banaipank area under lease of OMC Ltd's southern extension areas. The mapping in the area indicated that the ultramafic brecciated zone is the host rock for PGE. Petrological samples were collected and studied to characterise different lithotypes exposed in the area which belongs to Baula-Nuasahi ultramafics complex. Petro-mineragraphic and SEM-EDX study of breccia zone indicated the presence of PGE minerals associated with basemetal sulphides and ferritchromite. In Baniapank OMC leasehold area, soil sampling was carried out in grid pattern in the areas covered with soil and laterite to identify the possible extension of potential ultramafics. Geochemical soil samples were collected from the B and C horizons of the *in situ* soil profile at a depth of around 0.75 m. The preliminary analysis indicated an anomalous zone of high Cr and Ni with maximum value up to 7,910 ppm and 362 ppm, respectively. The work has been completed in June, 2011.

In Tamil Nadu, a Reconnaissance (G-4) stage investigation for platinum group of elements initiated during 2009-10 in Solavanur and Karappadi blocks and in Mallanayakanpalaiyam block, Mettuppalaiyam Mafic-Ultramafic Complex is being continued during 2010-12. Scout drilling and detailed mapping along with pitting and trenching were carried out in Solavanur, Karappadi and Mallanayakanpalaiyam blocks. Out of the ten scout boreholes proposed in these blocks, 6 boreholes have been drilled. One borehole SBH-4 has been drilled along SLT-15, 15A and 15B trench profile in F segment of Solavanur block up to a depth of 87.95 m. Two boreholes have been drilled in Karappadi block; KBH- 4 has been drilled to a depth of 91.25 m along the positive profile of KPT 3A. A total of 42 samples have been processed and sent for PGE analysis. The other borehole KBH-5 has been drilled along KPT-3D trench profile to a depth of 75.10 m. Seven meta-pyroxenite bands with a cumulative thickness of 18.5 m have been delineated. Three boreholes (MBH-1, 2 and 3) have been drilled in Mallanayakanpalaiyam block to intersect the meta-pyroxenite±chromitite band. The first borehole MBH-1 was drilled along the MT-1 trench profile to intersect the main chromitiferous metapyroxenite / meta pyroxenite band. Band–I metapyroxenite ± chromitite contains 238 ppb of Pt and 451 ppb of Pd over a width of 2.9 m. Samples from Band–II meta-pyroxenite have yielded 373 ppb of Pt and 380 ppb of Pd over a width of 0.75 m. Band–III meta-pyroxenite shows an average grade of 388 ppb of Pt and 683 ppb of Pd over a width of 2 m at 30 m vertical depth (RL 228.89m). The second borehole MBH-2 was drilled along the MT-2 trench profile to intersect the main meta-pyroxenite band. The borehole has intersected mainly incipiently gneissic anorthositic gabbro / gabbroic anorthosite with ± garnet along with 12 meta-pyroxenite bands with a cumulative width of about 14.57 m. The third borehole MBH- 3 was drilled along the MNT-21 trench profile to intersect the main meta-pyroxenite band. The borehole has intersected mainly anorthositic gabbro / gabbroic anorthosite with ± garnet along with 6 meta-pyroxenite bands with a cumulative width of about 18.35 m along the borehole. A reconnaissance (G-4) stage investigation for PGE in Mettuppalaiyam Ultramafic belt, Tamil Nadu was taken up during 2010-12.Area totalling 163 sq km has been mapped on 1:12,500 scale. Meta-pyroxenite bands have been demarcated. A total of 64 samples for petrography and 53 samples for petrochemical studies have been collected as also18 samples each for SEM-EDX, EPMA and ore microscopic studies. Reconnaissance stage (G-4) investigation for PGE initiated during 2009-10 by scout drilling was continued in 2010-12 in Tasampalaiyam Block of Sittampundi layered mafic- ultramafic complex,Tamil Nadu. Close spaced trench work totalling 340 cu m has been carried out in T3 and T4 sectors of Tasampalaiyam Block in the western part of Sittampundi Complex to trace the strike continuity as also to assess the grade of PGE mineralised chromitite/chromiferous meta-pyroxenite bands . Based on the closed spaced trenching work, the T3 sector extending for about 2 km in WNW-ESE direction is divided into six segments, viz, Segment A to F. Two zones of chromitite/chromiferous meta-pyroxenite were delineated, viz, the Northern and Southern Zones. The Northern Zone is traceable in all the six segments whereas the Southern Zone is traceable only in Segment B and Segment E. The Northern Zone, delineated discontinuously for a strike length of 700 m, has given PGE values ranging from 0.95 ppm to 3.68 ppm of Pt+Pd. The Southern Zone prominently exposed in the Segment E has analysed 22.89 ppm of Pt+Pd. Trench work has been carried out in T4 sector of Tasampalaiyam Block lying in the western part of Sittampundi Complex to trace the strike continuity as well as the grade of PGE mineralised chromitite/ chromiferous metapyroxenite bands. This sector covering 1.5 km strike length has been divided into five segments, viz, A, B, C, D and E from east to west for the correlation of mineralised bands. A anomalous Segment C covering 230 m delineated west of Segment B exposes five to seven bands of chromitite/ chromiferous meta-pyroxenite with width of individual bands varying from 0.25 m to 1.00 m and the PGE values ranging from 161 ppb to 495 ppb of Pt and 142 ppb to 1,294 ppb of Pd. Scout drilling has been carried out in Karungalpatti Block lying in the eastern part of Sittampundi Complex which exposes eight to ten bands of chromitite/ chromiferous meta-pyroxenite. Three scout boreholes (KBH/1, 2 and 3) were drilled in this block along positive trench profiles. Sampling of all the boreholes has been completed and the analytical results were awaited. Scout drilling has also been carried out in T3 sector of Tasampalaiyam Block along positive trench profiles. Two boreholes (TBH/9 and TBH/ 10) have already been completed and the third borehole TBH/11 was in progress. Location for five more boreholes to be drilled in T3 sector have been identified. Analytical results of boreholes TBH-1,TBH-3 and TBH/4 drilled in T1 sector of Tasampalaiyam Block show high values of PGE in core samples. Based on the analytical results significant zones of mineralisation were delineated and correlated with the trench data. PGE ore resource has been estimated for C1 sector of Chettiyapalaiyam Block in Sittampundi Complex in Tamil Nadu, where G-4 stage exploration by scout drilling was completed in 2006-08. Based on the surface and subsurface data, a reconnaissance resource (334) of about 0.252 million tonnes of PGE ore with an average grade of 1.44 ppm of platinum + palladium (Pt+Pd) over an average width of 1.37 m has been estimated in the 1.1 km long C1 sector of Chettiyampalayam Block.

State DMG

To indentify the PGE mineralisation zones during 2010-11, DMG, Karnataka carried out mapping on 1:50,000 scale in 75 sq km areas northeast of Srirangapatna town, Karighatta schist belt in Mandya district.

DIAMOND

GSI and Directorate of Geology, Odisha continued with their engagement in exploration for diamond in 2010-11.

GSI

In Andhra Pradesh, Reconnaissance stage investigation (G-4) was taken up during 2010-12 in granite-greenstone terrain in Amangal and Bhimanapali block in parts of Mahaboobnagar, Nalgonda and Rangareddy districts to search for kimberlite rock, the host rock for diamond. The work was taken up through REC mapping 1:50,000 (550 sq km), sampling and laboratory studies. The study area is a part of the Eastern Dharwar Craton known for emplacements of several kimberlite pipes and forms the catchment for the ancient alluvial diamond workings of the river Krishna. It is therefore, a suitable target area for indicator mineral surveys. Around 80-100 kg of stream sediment samples were collected from suitable trap sites from 4th and 5th order streams for regional sampling and from 1st, 2nd and 3rd order streams for detailed sampling. Besides, 112 nos of samples were collected from 550 sq km area covered by regional sampling. The samples were processed in a Garytz jig and the heavies were examined under stereomicroscope for kimberlite indicator minerals.

In Chhattisgarh, Reconnaissance stage investigation (G-4) was taken up during 2010-12 in Raigarh- Bilaspur Belt in Bilaspur district to locate Kimberlite clan rocks in the granitic basement along the high permeable zone characterised by mafic dykes. The area is predominantly occupied by Palaeoproterozoic granitic rocks. Psamopelitic units comprising sandstone and shale are exposed in Dullapur area along nala section of Agar river. A suspected kimberlitic/ lamproitic rock is reported from parts of T.S.No. 64F/11, Bilaspur district. The rock is dominated by altered olivine, mica and opaques. The top soil below the bouldery rock outcrop has pink, purple and orange red garnets (pyrope?), spinels and ilmenites. Further work was in progress for confirmation. Ground checks for interpreted PGRS map was carried out in the area. A number of mafic dykes were observed along E-W, NW-SE and NE-SW directions. Around Patpara and Anwarpani area, boulder beds are overlain by sandstone and shale. Boulders of basic rock lying over the Gondwana rocks and along the nala sections were recorded. At Patpara, kimberlitic/lamproites (?) boulders indicate that these may presumably be related to Deccan Trap occurring in the north. Few grains of garnet, spinel and ilmenite were selected for SEM-EDX / EPMA studies. Regional ground evaluation of aero-geophysical anomalies (G-4) initiated during 2009-10 was continued to delineate KCR bodies and other types of mineralisation. A number of small faults off setting the Kansapather sandstone were observed near Agasmai and Bargarh villages, Chhattisgarh. A fault scarp with slickensides in Lohardih sandstone towards NW of Barra village was observed. In suitable trap sites of nalas/ streams, flowing along the fault zone/ cutting across the contact of the basement and Gondwana/ Chhattisgarh Supergroup of rocks, stream sediment samples were collected. Carbonaceous shale was observed along the Kataranganala. Opencast and underground coal mines of SECL are present near Chhal. A total of 33 grains of ilmenite and garnet have been separated from stream sediment samples and sent for confirmation by SEM-EDX.

In Madhya Pradesh, Regional ground evaluation of aerogeophysical anomalies (G-4) in parts of Chhattarpur, Sagar, Tikamgarh (M.P) and Lalitpur (U.P.) initiated during 2009-10 was continued to delineate priority block to locate possible KCR bodies and other type of mineralisation. No specific signature of interpreted lineaments and magnetic breaks has been found during ground evaluation. The stream sediment samples have been collected from down streams of the catchment area of all these magnetic breaks and lineaments. The area is mostly covered by cultivated land and bouldary outcrops of Deccan Trap. Sulphide mineralisation is noticed near the Nainaghir village in dump material within the sandstone/shale. The intersection of magnetic breaks and lineaments are being checked for any mafic rocks and also for collection of stream sediment samples.

In Karnataka, Reconnaissance stage investigation (G-4) was taken up during 2010-12 in Dharwar craton in parts of Raichur district to locate kimberlites in the area based on the previous finds of kimberlites (Raichur Kimberlite Field). The area is well traversed by a network of several dykes mostly trending E-W, NW-SE. Emphasis was also given to identify the surface indication of possible ultramafic bodies/ kimberlite from calcrete and tonal variations in the soil. Stream sediment samples were collected from the best possible trap sites near natural obstacles. It is found that most of the 1st order streams are partially or completely disturbed by the cultivation. The higher order streams are mostly aggrading thereby giving rise to the thick sediment fill in the stream course. Two suspected Cr-diopside grains were recovered from one stream sediment sample. The anomaly zones from the aeromagnetic data obtained from RSAS were under investigation. Regional Ground Evaluation of aeromagnetic and aeroradiometric data in Bengaluru-Penukonda Block was taken up during 2010-12 in parts of Kolar district of Karnataka and Dharmapuri district of Tamil Nadu to search for kimberlite bodies and for gold and any other mineralisation. Lithounits belonging to Older Metamorphics (hornblende schist, ambhibolite, chlorite schist and quartzite) occur as narrow bands south of Tapanhalli and Karvanhalli as enclaves within PGC. Most of the area is covered by PGC and is represented by grey granite gneiss, tonalite-tronjhemite gneiss and hornblende biotite gneiss. The pegmatite is kaolinised near southwest of Masti near Rampur. Laterite capping of 1-8 m thickness is present over granite near Nandagudi. Ground evaluation of aero geophysical and PGRS data was carried out in and around Mutehalli, Bommaganhalli, Balamnde, Kamasandra, Chik Kalavanch and Berikai villages. Regional ground Evaluation of aeromagnetic and aeroradiometric data in Bengaluru-Penukonda Block in Kolar district was carried out during 2010-12 to search for kimberlite bodies, gold and any other mineralisation. Geological traverses using scintillometer were taken in anomalous zones picked up from aerogeophysical maps on 1: 50,000 scale. North of Masalahalli in a leocogranite quarry within a pegmatite intrusion, a high radiometric value of >1mR/hr compared to 0.2 mR/hr bgc was observed. West of Kachanayakkanahalli, a pegmatite vein within granite gneiss yielded high radiometric value of 1mR/hr. West of Chellammakotikonda, pegmatite vein with grey granite yielded high radiometric value of 1 mR/hr. Suspected uranite/thorianite crystals were found within the pegmatite body.

StateDirectorate

In 2010-11, Directorate of Geology, Odisha conducted exploration for diamond around Supuli valley area, Nuapada district by carrying out 19 pitting (1 m x 1 m x 4 m with 72 cu m excavation), 4 trenching (5 m x 1 m x 4 m) operations and 29.5 tonnes of bulk sampling for DIM study. Scanning for any Diamond Indicator Mineral (DIM) within suspected ultrabasic rock was in progress. The Directorate has also carried out mapping on 1:25,000 scale in 10 sq km area, 1:2,000 scale in 0.15 sq km area, nine pitting with 68 cu m excavation and 27 nos of rock/soil sampling for diamond exploration in north of Sunsuniya Chhak of Darlimunda village in Nuapada district.

GOLD

The GSI, HGML and DMG, Rajasthan were engaged in the exploration for gold during 2010-11. An account of exploration work done by GSI is given in Table-11. The details of exploration carried out by HGML and DMG, Rajasthan are given in Table - 12.

INDUSTRIAL MINERALS

The details of exploration work carried out for industrial minerals by GSI, State Governments and Central/State Under takings during 2010-11 are given in Table - 13.

DECORATIVE DIMENSION STONES
State Directorates

The details of exploration work carried out for granite, sandstone and decorative dimension stones by State DGMs during 2010-11 are furnished in Table - 14.

Table - 11: Exploration for Gold by GSI, 2010-11

State/District	Location	Details of work done	Results obtained/Remarks.
Andhra Pradesh			
Cuddapah	Tellakonda block	Pitting, trenching, geochemical analysis	Prospecting stage investigation (G-3) was taken up during 2010-12 in Tellakonda block within Veligallu Greenstone belt for gold on the basis of encouraging results of earlier large scale mapping and geochemical studies. In Tellakonda block, an area of 1.3 sq km was mapped on 1:2,000 scale. One major quartz reef is emplaced along the NE-SW trending shear zone. The quartz reef is sheared and brecciated and contains sulphide mineralisation and this quartz reef extends farther southwards for 1km into Veligallu South Block. Pitting and trenching was carried out in Veligallu South Block. Five numbers of trenches VLST-1 to 5 have been made on the NE–SW trending quartz reef. Analytical results of the three trenches were received. Two samples of VLST-1 trench indicated 295 ppb and 45 ppb Au. One bedrock sample of the quartz reef near the canal indicated 65 ppb Au. A few bedrock samples from ultramafic rock in Veligallu South Block indicated 205 ppm to 920 ppm Ni. Sulphide mineralisation is noticed in a metagabbro body of 60 m to 80 m wide having strike length of 100 m. EPMA studies of the samples indicated presence of Ag. The first borehole AKT-1 was drilled to intersect the mineralised zone exposed in trench TLT-2 at 60 m vertical depth where the samples have indicated gold value of 0.78 g/t x 5 m and 0.298g/t x 2 m. The borehole intersected mineralised zone having mainly pyrite, pyrrhotite and arsenopyrite occurring in the form of veinlets and stringers within hornblende-biotite schist. The second borehole AKT-2 is planned to drill 100 m south of borehole AKT-1 to intersect the mineralisation established in Trench TLT-6. The analytical results so far received have not indicated encouraging results.
Mahaboobnagar and Kurnool	West of Rameta	Large scale mapping, sampling and geochemical analysis	Reconnaissance stage investigation (G-4) was taken up during 2010-12 in Gadwal Schist Belt for gold and other associated elements in the area west of Remeta belonging to Mahaboobnagar and Kurnool districts. An area of 68 sq km has been covered by large scale mapping on 1:12,500 scale in the areas around Polukallu and Cheruvupalli and from Nagaldinne in the north to Kanakavidu in the south and Peta in the west to Chamalaguduru in the east. A prominent quartz reef of 10 m to 40 m width extending for about 300 m trending along NW-SE direction without any sulphide mineralisation has been traced in the area east of Sanjivapuram village within metabasalt. Pegmatite veins east and south of Sanjivapuram and Mittasomapuram areas have been mapped and bedrock samples have been collected. Samples have been submitted to chemical division for REE analysis. Bedrock and stream sediment samples have been collected mainly around Mittasomapuram, Peta, Sanjivapuram areas. The analytical results, so far received, do not show any encouraging gold values.

(Contd.)

Table - 11 (Contd.)

State/District	Location	Details of work done	Results obtained/Remarks.
Bihar			
Gaya and Nalanda	Bathani area	Mapping	Reconnaissance stage investigation (G-4) was taken up during 2010-12 in Munger-Rajgir Group of rocks in Bathani area of Gaya and Nalanda districts to assess the gold mineralisation associated with Bathani volcano-sedimentary sequence and Munger –Rajgir metasediments. The mapped area comprises phyllitic tuff, BIF, brecciated BIF which suffered deformation resulting in fault gauge and slickenside. Phyllite–quartzite association is dominant in Rajgir metasediments. An old working has been noticed at the contact of BIF and phyllitic tuff to the NE of Majhauli village. Presence of yellow weathered ochre is noticed near Majhauli. Extensive carbonatisation of host rock at places has been noticed. Manganese stains and presence of botroidal psilomelane within quartzite along with perfectly developed hexagonal quartz crystals were noticed to the south of Saren village.
Jamui	Gosari-Ghutwe block,Sono area	Trenching, sampling and drilling	Prospecting stage investigation (G-3) was taken up during 2010-12 in Sukhnar basin in Gosari-Ghutwe block of Sono area to assess the gold potentiality. The borehole GOS-1 has intersected schistose amphibolite between 2.8 m and 20.75 m depth and is underlain by mica gneiss upto 30.29 m depth. It is proposed to drill 9 boreholes at 100 m spacing along cumulative strike length of 1,200 m to intersect the mineralised zones at 60 m / 90 m vertical depth. So far, three trenches have been excavated and sampling have been completed. The T-2 trench situated east of borehole GOS-1 is located in soil covered area. It has exposed a few lenses of ferruginous quartzite having specks of sulphide minerals, especially arsenopyrite, within schistose amphibolites.
Chhattisgarh			
Raipur	Sonakhan belt, Palasapali area West of Bhanwarpur	Large scale mapping, trenching and sampling	Reconnaissance stage investigation (G-4) was taken up during 2010-12 in Sonakhan belt in Palasapali area, West of Bhanwarpur to delineate new prospect block for gold mineralisation. Large scale mapping was carried out around Kandadongri-Palasapali-Rupapali-Urela-Laharipur-Sanbahali-Naugheri-Bijrabhata areas. A silicified metabasic was identified where panning activity is going on. A trench of 14 m length was made across the silicified metabasic rock. A total of 14 trench samples and 5 bedrock samples were collected from it. A smoky quartz vein with width varying from 2 m to 3 m is exposed north of Sheetalpur village. It is brecciated and intersected by thin veinlets of quartz. It is exposed as discontinuous bodies over a strike length of about 100 m and is flanked on either side by milky white quartz

(Contd.)

Table - 11 (Contd.)

State/District	Location	Details of work done	Results obtained/Remarks.
			vein. A milky white quartz vein at Urela contains clots of fresh pyrite. Trench samples in silicified metabasics south east of Pandkipali and channel samples across quartz veins in granite were collected from Chapiya. Near east of Bijrabhata, small bouldery exposure near the contact of anorthositic gabbro contains sulphides which includes pyrrhotite, pyrite and minor chalcopyrite. Along its northern continuity, metabasic rocks exposed in a pit, contain sulphides and gives a pitted look.
Jharkhand East & West Singhbhum	Tilaitanr-Sobhapur area	Prospecting stage investigation	Prospecting stage investigation (G-3) initiated during 2009-10 was continued in Archaean greenstone belt in Tilaitanr-Sobhapur area of East and West Singhbhum districts to assess the gold, nickel and chromium potentiality in the area. The mapped area falls in the southern vicinity of Singhbhum Shear Zone (SSZ), west of Ramchandra Pahar. The lithounits belong to Gourumahisani-Badampahar greenstone belt of Archaean age. The northern part of the mapped area is along the contact with Chaibasa Formation while southern contact is in juxtaposition with Singhbhum Granite. The rock types exposed in the area include interbanded sequence of phyllite, tuffaceous phyllite, banded iron formation and chlorite schist which are occasionally sheared. The phyllitic unit is occasionally profusely intruded by thin veinlets of quartz. The trend of the lithopackage is ENE-WSW with dips towards north. The sulphide mineralisation is present in the form of pyrite and chalcopyrite within the quartz veins and veinlets which intrude the phyllitic unit along foliation.
Ranchi	Sindauri-Ghanshyampur block	Drilling and geo-chemical analysis	Prospecting stage investigation (G-3) was taken up during 2010-12 in Dalma volcanics and Singhbhum metasedimentary domain in Sindauri-Ghanshyampur Block to assess the gold potentiality in Lungtu- Parasi-Sindauri-Ghanshyampur area. The domain consists of a volcano-sedimentary sequence comprising of quartz-chlorite-sericite schist, quatrzite and phyllite in which foliation varies from ENE-WSW with steep dip on either side along with laterites. The associated sheared smoky/grey quartz vein is abundant and found to be unmineralised but the thin white coarse grained quartz vein which is limonitic in nature are gold bearing. Wall rock alterations in the form of chloritisation, carbonatisation silicification, epidiotisation, etc. are noticed.

(Contd.)

Table - 11 (Contd.)

State/District	Location	Details of work done	Results obtained/Remarks.
			The geochemical samples (BRS) indicated gold values ranging from 50 ppb to 1.5 ppm. In the borehole, sulphide mineralisation is massive to disseminated with network of quartz stringers, veinlets and veins forming stockworks. Sulphide minerals are arsenopyrite, pyrite, chalcopyrite, pyrrhotite. Fluid inclusion studies indicate a low temperature hydrothermal condition of formation in which the minimum temperature of entrapment of the fluid is found to be from 150°C to 200°C. The approximate pressure of the fluid during entrapment is inferred to be between 490 bars (0.49 Kb) and 1,000 bars (1 Kb).
Saraikela-Kharswan	Rudia-Largadih-Balidih block	Prospecting stage investigation	Prospecting stage investigation (G-3) was taken up during 2010-12 in North Singhbhum Mobile Belt in Rudia–Largadih–Balidih Block of Saraikela-Kharswan district to assess the gold potentiality. The area represents Proterozoic Dalma Volcanic Belt, which is flanked by the metasedimentaries of the Singhbhum Group. The Rudia Block comprises lithopackages of carbonaceous phyllite, acid volcanics, siliceous tuff, mafic (metabasalt)/ ultramafic (pyroxenite), breciated quartzite belonging to the Upper Dalma Formation (Dalma volcanics) and the etasedimentaries of the Chandil Formation. The lithounits are intensely sheared and is manifested by silicification, brecciation, ferrugination and is traversed by quartz veins/ reefs. Sulphides occur in the form of stringers and disseminations in brecciated Ferruginous quartzite and the associated volcanogenic siliceous tuffs. The sulphides comprise pyrite, pyrrhotite, arsenopyrite, sphalerite and chalcopyrite with the first two constituting 70% of the total sulphides. Occasional visible gold specks are associated with sulphides.
Karnataka			
Chitradurga	Ajjanahalli East block	Resource estimation	In Ajjanahalli East block (B-block-south of A-Block), which was explored during 2006-08, an indicated resource (332) of 0.36 million tonnes of gold ore with 1.35 g/t Au at 0.5 g/t cut off and alternatively, 0.12 million tonnes with 2.71 g/t at 1.0 g/t cut off has been estimated.
Chitradurga and Tumkur	Adivala-Obalapura and Mavinamadu area	Large scale mapping and sampling	Reconnaissance stage investigation (G-4) was taken up during 2010-12 in Chitradurga Schist Belt between Adivala-Obalapura and Mavinamadu in Chitradurga and Tumkur districts to assess the auriferous nature and locales of possible gold mineralisation in the eastern shear of the Chitradurga Schist Belt. Large Scale Mapping over an area of 78 sq km as carried out. A total of six BIF bands were delineated during LSM. These bands are mineralised and strike in NE-SW to NW-SE with steep dips towards east. The width of the band varies from 2 m to 6 m. Surface manifestation of mineralisation is noticed in

(Contd.)

Table - 11 (Contd.)

State/District	Location	Details of work done	Results obtained/Remarks.
			the form of alteration, silicification, shearing, limonitisation, sulphide dissemination, carbonitisation and leaching within BIF and carbonated metabasalt. Fine disseminations of pyrite, arsenopyrite, chalcopyrite and pyrrhotite have been noticed within the lithounits. So far, 105 bedrock samples and 149 trench samples were collected from these BIF bands and the samples have been submitted for analysis by AAS. Auriferous zones have been identified in the western-most and central BIF bands.
Shimoga Schist Belt	Bhairapura and Hosahalli area	Trenching and sampling	Reconnaissance stage investigation (G-4) for gold mineralisation in Shimoga Schist Belt has been initiated during 2010-12. The Shimoga Schist Belt is one of the important schist belt in Western Dharwar Craton and investigation for gold in southern part of the Shimoga Schist Belt in Bhairapura and Hosahalli is of great significance. The most important prospects in the southern part of the schist belt having gold potentiality are Jalagaragundi, Siddarahalli, Honnahatti and Singanamane areas. Auriferous zone has been identified at the contact of granite gneiss and metabasalt in the central portion of Kenchapura hill which is located 1.5 km north of Kenchapura village. Trench samples analysed gold values up to 11.26 ppm. A total of 6 samples collected from old dumps have analysed gold values ranging from 0.86 ppm to 2.19 ppm. Surface manifestations of auriferous sulphide mineralisation is noticed in the form silicification, limonitisation, sulphide dissemination, carbonitisation and leaching within quartz-chlorite schist and quartz carbonate rock associated with talc-chlorite schist.
Tumkur	Ajjanahalli block - D and block- E	Mapping, trenching, drilling, geochemical analysis etc.	Prospecting stage investigation (G-3) in Chitradurga Schist Belt for gold in Ajjanahalli Block-D and Block-E in Sira Taluk, Tumkur district was taken up in the Ajjanahalli sector which constitutes several gold prospects including the present Block-D, where earlier investigation identified mineralisation in BIF and adjacent country rocks. Drilling has been taken up to study the subsurface nature, behaviour, depth persistence and gold content of the auriferous Banded Iron Formation (BIF) bands. In Block–D, six boreholes (ADG-7 to ADG-12) have been completed and two boreholes ADG-13 and ADG-14 were in progress. All the boreholes have intersected the targeted mineralised zones at anticipated depths. A total of 407 drill core samples have been collected. The gold assay values for ADG-5, 6, 7 and part of 8 have been received. The gold assay value of ADG-5 (Zone-V is 0.58 g/t / 2.00 m); for ADG-6, the average assay values are 1.16 g/t / 1.5 m (Zone-IV) and

(Contd.)

Table - 11 (Contd.)

State/District	Location	Details of work done	Results obtained/Remarks.
			1.17 g/t / 1.00 m (Zone-V), respectively. The maximum value recorded in Zone-VI is 0.45 g/t over a width of 0.50 m. In ADG-7 (Zone-IV) the average assay value is 0.87 g/t over width of 1.5 m (the maximum value recorded is 1.19 g/t/0.50 m) and part of analytical result received for ADG-8 (Zone –VIII) is 0.30 g/t Au x 1.00 m. The electrical resistivity and magnetic susceptibility have demarcated the shear zones, which are significant locales of gold mineralisation. The study of anomalies of various geophysical parameters confirms five mineralised zones. The mineralised zones well collaborates with the drill core logging and geophysical logging.An area of 9 sq km has been mapped on 1:12,500 scale in and around Dasudi, .779 hillock,Karebalanahatti and Marenadupalya in Block-E. Four parallel to sub-parallel potential auriferous BIF bands have been delineated. A total 103 bedrock samples have been collected from all the four BIF bands.In Block-E, an area of 0.5 sq km has been mapped on 1:1,000 scale and six BIF bands were delineated. The BIF is sheared, with quartz carbonate veins/veinlets, highly limonitised, having oxidised sulphides often noticed in the form of vugs and cavities. There are sheared quartz veins, of which some are boudinaged. Detailed mapping and trenching led to establishing a cumulative strike length of 4,900 m. A total of 180 cu m of trenching has been carried out on Band-I, IV, V and VI to access the width, strike continuity and gold potentiality of BIF bands.
Tumkur	Ajjanahalli Block C	Resource estimation	Gold ore resource has been estimated for Ajjanahalli Block C Tumkur district, Karnataka, where Prospecting stage (G-3) exploration was completed during 2009-10. An inferred resource (333) of 0.995 million tonnes with average grade of 2.17 g/t at 1 g/t cut off was estimated.
Rajasthan			
Banswara	Jagpura block, Bhukia gold belt	Channel sampling and geochemical analysis.	Prospecting stage investigation (G-3) was taken up during 2010-12 in Bhukia gold belt in Jagpura block to delineate the potential zones for gold and associated basemetal mineralisation. Favourable geological setup, old working structure, surface manifestations and the encouraging analytical results of earlier work formed the basis for taking up this investigation. The gold analysis of the samples from 2 channels indicated average gold values of 1.72 ppm x 16 m and 5 ppm x 5 m, respectively.

(Contd.)

Table - 11 (Contd.)

State/District	Location	Details of work done	Results obtained/Remarks.
Banswara	Gundelapara NW block, Bhukia gold belt	Drilling	Prospecting stage investigation (G-3) was taken up during 2010-12 based on favourable geological setup, structure, surface manifestat- ions and encouraging analytical results from previous work in Bhukia Gold Belt for gold and copper mineralisation in Gundelapara NW Block. The investigation helped in delineation of two sub-parallel surface mineralised zones in impure marble and keratophyre. The maximum dimensions of mineralised zones are 600 m x 50-100 m and 450 m x 40-60 m, respectively. The surface evidences of mineralisation are in the form of gossans, malachite stains, sulphide disseminations and presence of ore grinding implements and slag heap in and nearby areas. In borehole GNW-1, three mineralised zones were intersected from 24.0 m to 48.0 m (24.0 m x 5-10% sulphides in visual estimates); 50.75 m to 54.90 m (4.15 m x 4-5% sulphides in visual estimates) and from 68.10 m to 106.0 m (37.90 m X 5-10% sulphides in visual estimates). Within third mineralised zone, a 10.20 m zone of massive to semi-massive (> 60 to 30%) sulphide zone was intersected from 85.70 m to 95.90 m depths.
Uttarakhand			
Rudraprayag	Lameri-Ratura area	Sampling and geochemical analysis	Reconnaissance stage investigation (G-4) was taken up during 2010-12 in Garhwal Group based on the encouraging results of previous work and on the proposal from Directorate of Geology and Mining, Uttarakhand in Lameri-Ratura area of Rudraprayag district to delineate and assess the auriferous mineralised zones in the area. The mapping revealed presence of dolomite, limestone with carbonaceous slate, quartzite, phyllite, volcano-sedimentary sequence of Pithoragarh Formation and quartzite, quartz-mica schist, dolomite lenses and metavolcanics with basic intrusive of Berinag Formation. The general strike of the bedding is NW-SE with moderate dips. Three sulphide mineralised zones have been delineated. In Lameri area, zone having old workings and sulphide disseminations extends for 150 m X 300 m. In Tilni area, carbonaceous slate having pyrite specks forms a rich zone of 9 m. In Tilni-Koteshwar area the sulphide mineralised zone extends up to 1.2 m discontinuously over an average width of 8 m. The control of mineralisation have been recorded from stream sediment samples. Bedrock and stream sediment samples indicated gold values up to 475 ppb and 200 ppb, respectively.

(Contd.)

Table - 11 (Concld.)

State/District	Location	Details of work done	Results obtained/Remarks.
Uttar Pradesh Sonbhadra	Chakoriya-Charka area	Large scale mapping, sampling and analysis	Reconnaissance stage investigation (G-4 stage) was taken up during 2010-12 in Mahakoshal Group for search of gold and associated mineralisation in Chakoriya-Charka area . The earlier studies in the area established auriferous nature of quartz veins intruding the metasediments of Mahakoshal Group. The large-scale mapping reveals that the area mapped around Chakoriya-Charka comprises phyllite, chlorite phyllite with impersistent bands of chert and basic rocks of Agori Formation of Mahakoshal Group and are intruded by quartz/ quartz-carbonate veins having sulphide disseminations. The general strike of the rocks varies N60°W to N75°W with vertical to steep dips towards south. Field evidences reveal that mineralisation is associated with sheared quartz vein. The sulphides occur as fracture filling in quartz vein which are parallel to the regional trend of phyllite. In the Chakoriya area, 17 old workings are seen spread over a strike length of 700 m and width of 2-3 m. In the Amriniyan area, brown, green, orange oxidation along with arsenopyrite are seen in sheared quartz vein over a strike length of >1km and width varying 2-7 m. Further, galena rich zone as detached bodies having width varying from 2 m to 5 m has been identified along >1 km strike length in the Machohi area. An auriferous mineralised zone has been located 500 m south of Parsoi village. The mineralised zone, trending N70°-80°E - S70°-80°W to E-W has been traced over a strike length of about 1km with width varying between 1.5 m and 4.0 m. The surface manifestations are marked by brown, black, orange green and turquoise green oxidation material. The green to turquoise green coloured scorodite ($FeAsO_4 \cdot 2H_2O$) and orange coloured mansfieldite ($FeAlAsO_4 \cdot 2H_2O$) are formed due to oxidation of arsenopyrite. Scorodite occurs as lumps (10 to 70 cm) within phyllite as well as in the quartz veins as fracture filling. They also contain unoxidised sulphides, viz, arsenopyrite and pyrite. Sericite, chlorite and apatite occur as other hydrothermal alteration minerals. At places, the mineralised zone is intruded by quartz-sulphide veins. The mineralisation appears to be shear controlled. Four grab samples from the mineralised zone have indicated gold values ranging between 2.65 ppm and 5.48 ppm and arsenic between 29.9% and 33.5%.

Table – 12 : Exploration for Gold by HGML and State Directorates, 2010-11

State / District	Location	Agency	Details of work done	Results obtained
Karnataka				
Raichur	Hutti	HGML	Underground mapping-2,530 m on 1:400 scale, surface drilling-5,684 m, underground drilling-1,460m and collection of 12,035 samples.	A total of 9.25 million tonnes of resources of gold ore with 5.26 g/t Au were estimated.
- do -	Hira-Buddini	HGML	Exploratory mining - 136.10 m and samples collected - 1,164	About 0.78 million tonnes resources of gold ore with 3.99 g/t Au were computed.
- do -	Uti	HGML	Mapping in 3 sq km area on 1:2,000 scale, exploratory mining -212.80 m and samples collected - 1,435	Total mineable reserves are estimated at 2.18 million tonnes ore with 2.50 g/t to 2.91 g/t Au.
Rajasthan				
Rajsamand	Sunarkui	DMG	In total 72 m drilling in one borehole and 10 core samples were collected.	Results of geochemical analysis were awaited.
Sirohi	Parts of Pindwara Teh.	DMG	Regional Mineral Survey in 100 sq km, Regional Geological Mapping in 10 sq km, Detailed Geological Mapping in 1 sq km and 20 nos of sampling were carried out.	A total eight core samples were prepared from old Pipela base metal drilling core for detection of noble metals.
Udaipur	N/v Kun, Punja-ki -Bhagal, etc.	DMG	Total 90 m drilling in one borehole and 45 nos of sample collection were done.	Results of geochemical analysis were awaited

Table - 13: Exploration for Industrial Minerals by GSI, DGMs and Central/State Undertakings, 2010-11

Agency/ Mineral/ State/District	Location	Geological mapping		Drilling		Sampling	Remarks
		Scale	Area (sq km)	Boreholes	Meterage		
Geological Survey of India							
APATITE AND ASSOCIATED MINERALS							
West Bengal							
Purulia	Panrkidih	-	-	-	-	-	Apatite-magnetite bearing cherty rock having 1 m average width and approx. 600 m strike length has been established in Panrkidih area. The apatite-magnetite bearing rocks occur as small discontinuous lensoidal bodies near Panrkidih a curvilinear fashion. The second borehole PBH-2 planned to intersect the apatite-magnetite body in the central part of the mineralised zone at

(Contd.)

Agency/ Mineral/ State/District	Location	Geological mapping: Scale	Geological mapping: Area (sq km)	Drilling: Boreholes	Drilling: Meterage	Sampling	Remarks
							30 m vertical depth intersected weathered pegmatite down to 8 m depth.
FULLERENE							
Andhra Pradesh							
Cuddapah	Mangampet	-	-	-	-	-	Reconnaissance Stage (G-4) investigation was taken up at the request of DMG, Andhra Pradesh for possible occurrence of fullerene within carbonacous tuff of Mangampet barytes prospect in Cuddapah district. Mapping and sampling of the carbonaceous tuff shale has been carried out and analytical results so far received have not indicated any significant value of fullerene.
GLASS SAND							
Himachal Pradesh							
Shimla & Kullu	Rampur group of rocks	-	-	-	-	-	Occurrences of pillow structure have been recorded in Banjar meta-volcanics near Darshai village in Satluj valley. Large outcrops of white, grey and lavender quartzite belonging to Manikaran Formation of Rampur group is exposed in the Parbati valley of Kullu district in northwest to the Sutluj valley in Shimla and Kinnaur districts in the southeast. Six blocks of white quartzite with average SiO_2 > 96% have been dilineated. White quartzite near Sunda village have a strike length of more than 1 km with width varying from 50 m to 250 m and white fine grained quartzite near Darshai village has a dimension of 400 m in length and width of around 200 m.
GYPSUM							
Haryana							
Hissar and Bhiwani	Chhapar Jogiyan, Garanpura Naya Balacharan-ki-Dhani etc.	-	-	-	-	-	Reconnaissance stage (G-4) investigations for gypsum in parts of Hissar and Bhiwani districts in western part of Haryana exhibits mild ndulating topography with dense aeolian land forms, viz, sand dunes, sand sheets and inter-dune depressions with reported gypsum occurrences. Three new gypsum occurrences have been located at Chhapar Jogiyan, Garanpura, Naya and Balacharan-ki-Dhani.

(Contd.)

Table - 13 (Contd.)

Agency/ Mineral/ State/District	Location	Geological mapping		Drilling		Sampling	Remarks
		Scale	Area (sq km)	Boreholes	Meterage		
							Three samples have been collected from a quarry west of Saharwa village for TL/OSL dating from sandy horizons below and above the gypsum bands to ascertain the age of gypsum formation. Assay results indicated 67% - 85% $CaSO_4$ content in eight samples, 41% - 58% $CaSO_4$ in five and 25% - 34% in four samples.
LIMESTONE							
Andhra Pradesh							
Kurnool	West of Nandikotkur	1:12,000	107	-	-	280	Trenching of 20 cu m 260 bed rock and 20 trench samples have been collected. The analytical results of eleven samples of Narji limestone show CaO content more than 43% which is suitable for cement industry. Two samples analysed with more than 50% CaO which can be used in chemical industry, however two samples from Koilakuntla limestone showed
Meghalaya							
Jaintia Hills	Umphyrluh block	-	-	-	-	-	Prospecting stage (G-3) investigation for the peripheral area of the Litang valley was taken up to explore limestone resources. The limestone is bedded type striking NNE-SSW with horizontal to sub-horizontal dip of about 3^0 to 5^0 towards ESE.
Karnataka							
Bagalkot	Jalikatti, Lokapur and adjoining areas	-	-	-	-	-	As per request of DMG, Karnataka, reconnaissance (G-4) stage investigation has been taken up in Kaladgi basin to assess SMS grade limestone for alkali content. Dark grey limestone belonging to Yendigere Formation tentatively confirms to specifications of flux and SMS grade limestone. Evidences of stromatolites have been noted in Petlur limestone near Venkatapur, Nagnapur (Jalikatti) of Muddapur Formation and Chitrabanukot dolomite (Varchagal) of Yargatti Formation.

(Contd.)

Table - 13 (Contd.)

Agency/ Mineral/ State/District	Location	Geological mapping		Drilling		Sampling	Remarks
		Scale	Area (sq km)	Boreholes	Meterage		
Rajasthan							
Jaisalmer	Jiraj-ka-Toba, Asu-Tar area	-	-	-	-	-	To locate low silica SMS (LD-grade) limestone prospecting stage (G-3) investigation was taken up in Jaisalmer basin. The borehole JRA-2 has intersected hard and massive fossiliferous/ limestone, moderately hard limestone, gritty limestone and fragmentary ironstone in the ascending order. Decrepitating test of two samples were carried out.
PHOSPHORITE							
Madhya Pradesh							
Chhatarpur & Sagar	Lukri-Akrotha-Raipura- Surajpura areas	-	-	-	-	-	To assess the extent and grade of phosphorite in Bijawar Group , Reconnaissance stage (G-4) investigation was taken up. In Akrotha - Raipura block , phosphatic ferruginous chert breccia occurs as lensoidal body with more than 30 m strike length and width of 8 m to 10 m at about 1.5 km east of Akrotha. Brecciated phosphorite is tested with 25% P_2O_5 in northern slope of the Jhalautar Pahar and P_2O_5 content varies from 20-25% (VE) from a phosphorite body located southwest of Rajghat. In Lukri block a lensoidal body of ferruginous phosphatic chert breccia of nearly 200 m strike length and 20 m to 30 m width showing more than 20% P_2O_5 is exposed.
Jhabua	Piploda and-Dhanpura-Khatamba blocks	-	-	-	-	-	Reconnaissance stage (G-4) investigation for phosphatic bands has delineated a phosphorite bearing zone of about 300 m strike length with 8-10 m width in Khatamba block. The analysis by Shapiro's kit indicated 1% to 12% P_2O_5. Representative samples covering 10 m width has indicated 10% to 17.44 % P_2O_5 content. In Piploda block a zone of 340 m length and 50 m width has been identified with P_2O_5 value between 6%

(Contd.)

Table - 13 (Contd.)

Agency/ Mineral/ State/District	Location	Geological mapping		Drilling		Sampling	Remarks
		Scale	Area (sq km)	Boreholes	Meterage		
							and >20% . A new phosphatic stromatolite bearing zone with strike length of 1 km and cummulative width of about 100 m has been located southwest of Dhanpura- Khatamaba block. Three grab samples indicated P_2O_5 content varying from 10% to 17% .
Rajasthan Banswara	Kalinjara, East of- Sallupet	-	-	-	-	-	One persistent band of dolomite with 5 km strike length and width varying from 20 m to 500 m has been delineated between Pargisath to Mahuri. The dolomite band contains chert lenses var;ying in length from 5 m to 30 m and width from 10 cm to about 3m. Discontinuos thin bands / lenses of brecciated stromatolite are confined to the brecciated unit(15 to 20% VE) Pitting and trenching with samples collection have been carried out. Two inter- trappean horizons (10m - 15m thick) having signifcant Phos- phatic concentration (5 -10 % VE) has been traced for 3 km. However, chemical result of seven samples indicated P_2O_5 ranging between 0.43 and 0.72%.
TALC- STEATITE **West Bengal** Darjeeling	Lapcha, Basti- and Singla area	-	-	-	-	-	Reconnaissance stage (G-4) investigation has located talc deposit in the northeastern part of the area at Darjeeling Gorkha Hill Council forest beside Singla village on a hill slope. The talc impure the surface with thick ferruginous stains and it is platy, friable, white coloured and sandwitched between an overlying Daling quartzite and Daling phyllite. Its approx. width is about 100 cm . Grab samples so far analysed yielded MgO: 34.56%, SiO_2: 54.03%, Al_2O_3: 3.34% and Fe_2O_3: 1.41% . Exact dimension of the deposit will be ascertained after the trenching.

(Contd.)

Table - 13 (Contd.)

Agency/ Mineral/ State/District	Location	Geological mapping		Drilling		Sampling	Remarks
		Scale	Area (sq km)	Boreholes	Meterage		
State Directorates of Geology & Mining							
APATITE							
West Bengal							
Purulia	Chirugora	1:500	1.072	-	-	40	Forty nos of pitting (1mx1mx1.14m) have been carried out.
BENTONITE							
Rajasthan							
Barmer	Pusad	-	210	-	-	-	Bentonite seen to occur in nalla near Pusad village. It is grey to off white in colour and having length -30 m, width - 2 m and thickness -1.5 m.
		-	16 2				
CHINA CLAY							
Kerala							
Kannur	Pazhayangadi area	-	-	04	83.5	-	Four boreholes were drilled to a cumulative meterage of 83.5m in mine site of M/s KCCP clay mine Pazhayangadi. The average thickness of china clay encountered is 2 m.
Kasaragod	N/v Cheemeni	-	-	-	-	-	The primary field investigation by systematic reconnaissance traverses have been carried out over an area of 1.5 sq km for demarcating the occurrence of china clay.
Kollam	Kanjiramkode area	-	-	07	340	-	The average thickness of china clay horizon is 8 m. A tentative resource of about 0.33 million tonnes of china clay is estimated over an area of 2.5 hectares.
West Bengal							
Bankura	N/v Siarbada	-	-	-	-	-	Reconnaissance in 1.5 sq km area and 8 nos pitting have been carried out for china clay exploration.

(Contd.)

Table - 13 (Contd.)

Agency/ Mineral/ State/District	Location	Geological mapping		Drilling		Sampling	Remarks
		Scale	Area (sq km)	Boreholes	Meterage		
CLAY							
Rajasthan							
Bikaner	N/v Kenya-ki-Basti	1:50,000	250	01	162	60	Borehole intersected grey black clay from 132 m to 144 m (12 m).
-do-	N/v Modia-Mansar, Golari, etc.	1:50,000 1:10,000 1:2,000	200 02	- 10	-	08	New clay occurrences were located and mapped in the area.
-do-	N/v Nuvagaon	1:50,000 1:10,000 1:2,000	250 02 02	-	-	02	New clay occurrences of horizontal extension below overburden 31 m at Nuvagaon and 4 m at Kalamagra having thick-ness of 18 m and 1 m, repectively were observed.
Karauli	N/v Khaoda & Gajjupura	1.50,000 1.10,000 1.2,000	55 11 01	-	-	14	Inferred reserves of clay are estimated at 70,200 tonnes n/v Khaoda and 93,600 tonnes n/v Gajjupura.
DOLOMITE							
Rajasthan							
Udaipur	N/v Iswal, Piprach, etc.	1:50,000 1:10,000 1:2,000	50 20 04	-	-	60	Traverses were taken in the area and chemical analysis results were awaited.
GARNET, QUARTZ, FELSPAR & BERYL							
Rajasthan							
Tonk	N/v Tordi, Mandolai etc.	1:50,000 1:10000 1:2,000	115 11.5 1.15	-	-		Garnetiferous mica schist of light grey to brownish grey colour, highly foliated, comprising quartz, biotite, muscovite, garnet, etc. was located due south of Tordi village. Garnet crystals are of size up to 2-3 cm.
GYPSUM							
Rajasthan							
Barmer	N/v Purwa Daboi & Piprali	1:50,000 1:10,000 1:2,000	250 11 03	-	-	-	-
Bikaner & Sri Ganganagar	Parts of Kajuwala-Anupgarh teh.	1:50,000 1:10,000 1:2,000	325 11 02	-	-	20	New gypsum occurrences of 200 m to 500 m horizontal extension with 1m to 2 m thickness were located and mapped in the area. About one million tonnes resources of gypsum were estimated.

(Contd.)

Table - 13 (Contd.)

Agency/ Mineral/ State/District	Location	Geological mapping		Drilling		Sampling	Remarks
		Scale	Area (sq km)	Boreholes	Meterage		
Jalore	Parts of Sanchore Teh.	1:50,000 1:10,000 1:2,000	100 10 01	-	-	20	Occurrences of gypsum/ gypsite were seen near village Hemaguda(500 x 200 m) Sangarva (500 x 300 m), Khirodi (700 x 600 m), Sewara (400 x 200 m), Lalji-ki- Dungri (1 x 0.5 km), Kalgi- ki-Beri (200 x 300 m) and Sutharon-ki-Dhani (400 x 300 m). Total 8.34 lakh tonnes of gypsum resources were estimated under inferred category.
LIMESTONE							
Chhattisgarh							
Bastar	Bastar area	1:50,000 1:4,000	1150 01	-	-	205	Total 6.70 million tonnes of cement grade limestone has been inferred during 2010-11 (so far 13.00 million tonnes).
Raipur	Deogaon-Kurra area	1:50,000 1:4,000	415 2.68	-	866.50	968	Total 50 million tonnes of cement (blendable/beneficiable) grade limestone has been estimated during 2010-11 (so far 80 million tonnes of all grades).
Karnataka							
Gulbarga	Malkhed area	-	-	05	588	403	Investigation continued to assess the depth continuity and quality of limestone.
Odisha							
Nabarangpur	Around Mokia and Jamuguda area	1:25,000	110	-	-	72	A small occurrence of secondary ore float zone (250 m x 50 m) has been noticed to the 2 km east of Kohiagura.
Rajasthan							
Baran	N/v Ladwara, Raipura, Baldara & Nagda	1:50,000 1:10,000 1:2,000	115 12.5 1.35	-	-	16	Inferred reserves of marginal cement grade limestone are calculated about 3.43 million tonnes n/v Dungarpur, 2.29 million tonnes n/v Raipura -Ladwara , 1.56 million tonnes n/v Baldara and 1.118 million tonnes n/v Nagda.
Jaipur	N/v Bithloda, Mandha, Karoi, etc	1cm=500m 1cm=40m	15	- 01	-	-	On the basis of tube well cattings the limestone can be inferred as spread over around villages, Yadvon-ki-Dhani (800 m x 350 m), Sanwalon-ki-Dhani (600 m x 400 m) and Gujron- ki-Dhani (350 m x 150 m).

Contd.

Table - 13 (Contd.)

Agency/ Mineral/ State/District	Location	Geological mapping		Drilling		Sampling	Remarks
		Scale	Area (sq km)	Boreholes	Meterage		
Jhalawar	N/v Dungarpur, Sarola Khurd, Bariya.	1:50,000 1:10,000 1:2,000	50 15 1.5	-	-	18	Inferred reserves of marginal cement grade limsetone are calculated about 7.59 million tonnes n/v Dungarpur and 2.29 million tonnes n/v Sarola Khurd & Bariya.
Nagaur	N/v Harima & Pitasar	1:10,000	25 1:2,000	38 2.5	1193	37	Total 129.60 million tonnes of geological reserves of limestone were estimated.
-do-	N/v Shivpura (Madpura) & Berathal	1:10,000 1:2,000	20 1.50	13	351	37	Bands of high grade limestone were located n/v Shivpura (Madpura) in 8.96 sq km area by drilling. Total 26 million tonnes of geological reserves of limestone were estimated.
Rajsamand	N/v Lassaria & Dand	1:10,000 1:2,000	20 02	03	137	104	Results of chemical analysis were awaited.
Sikar & Jhunjhunu	N/v Chajna, Kairpura, Khothari, etc.	1cm=100 m 1cm=40m		20	- 01	-	Exploration involved geochemical survey in 5 sq km and geochemical analysis of 572 samples. Several bands of impure limestone 150-560 m in length and 15-60 m in width were recorded.
LIMESTONE & DOLOMITE							
Odisha							
Sundergarh	Around Orangtoli, Udarma, etc. area	1:50,000	112	-	-	61	Exploration involved pitting with 8 cu m excavation.
-do-	Around Mundagaon, Jarangloi & Lahandabad area	1:50,000	122	-	-	25	Pitting with 6 cu m excavation has been done.
Bargarh	Around Jharaband area	1:50,000	125	-	-	20	Pitting with 24 cu m excavation has been carried out to know the extension.
Karnataka							
Tumkur	N/v Melanahalli	-	-	07	642	-	CaO in the samples ranges from 28.30% to 40.40%.

Contd.

Table - 13 (Contd.)

Agency/ Mineral/ State/District	Location	Geological mapping		Drilling		Sampling	Remarks
		Scale	Area (sq km)	Boreholes	Meterage		
Rajasthan							
Ajmer	N/v Dhanar, Kalora, Rajpura, etc.	1:50,000 1:10,000 1:2,000	50 10 02	-	-	13	Four intermittantly exposed bands of dolomitic limestone trending NE-SW are
PYROPHYLLITE /SILLIMANITE							
Maharashtra							
Chandrapur	N/v Walni Khatgaon	-	-	-	538.95	-	About 0.40 million tonnes resources of pyrophyllite/ sillimanite have been estimated in the area.
QUARTZ							
West Bengal							
Bankura	N/v Kenduadihi	1:4,545	0.5	-	-	08	Exploration also involved 4 sq km reconnoitary survey and two nos of
QUARTZ & FELSPAR							
Rajasthan							
Rajsamand	N/v Tikhi & Haliakheda	1:10,000	20	-	-	17	Chemical analysis of five samples were carried out.
ROCK PHOSPHATE							
Rajasthan							
Udaipur	N/v Kaya, Dakankotra, etc.	1:10,000	20	-	-	36	Traverses were taken in the area and chemical analysis result was yet to
TALC/STEATITE							
West Bengal							
Darjeeling	Gok-Karmi area	1:25,000	10	-	-	51	Total 46.40 cum excavation were made from four trenches and one pit. Study of 25 petrological samples have also been done. About 60,000 tonnes resources
-do-	Lepeha Basti & Singla areas	1:25,000	30	-	-	31	Three trenches have been made with excavation of 42.42 cu m where talc is encountered. Thirty petrological sampling have been done and one sample analysed with 34% MgO.

(Contd.)

Table - 13 (Concld.)

Agency/ Mineral/ State/District	Location	Geological mapping		Drilling		Sampling	Remarks
		Scale	Area (sq km)	Boreholes	Meterage		
Mineral Exploration Corporation Ltd							
DOLOMITE							
Arunachal Pradesh							
West Kemang	Rupa block	1:5,000	1.0	4	266.50	147	Boreholes have intersected at various vertical depths ranging from 79-105 m. Available chemical analysis indicate MgO:19.50 - 22.20%, CaO: 28.42-32.20% and SiO_2: 0.36-6.64%.
LIMESTONE							
Meghalaya							
Jaintia Hills	Western part of Tongnub sub-block	1:50,000	0.50	8	1148.50	488	Boreholes have intersected high grade limestone bands with thickness 30-160 m with grade: CaO-51.26%, MgO-1.82% and SiO_2-1.96% as per available analytical data.
PHOSPHORITE							
Rajasthan							
Udaipur	Dhol-ki-Pati area.	1:1,000	1.0	19	1784	714	Three nos of trenching has been done with 150 cu m excavation. Two phosphorite zones have been intersected in the boreholes. Thickness ranges from 2-11 m with grade from 4.18% P_2O_5. to 11.51% P_2O_5.
ULTRAMAFIC ROCK							
Odisha							
Sundergarh	Rajabasa block	1:5,000	0.20	5	441.50	84	Boreholes have intersected ultramafic bodies like dunite, hartburgite and pyroxenite having thickness ranging from 7-16 m.
Rajasthan State Mines & Minerals Ltd							
ROCK PHOSPHATE							
Udaipur	Jhamarkotra	-	-	-	-	-	Exploratory mining has been carried out in A-Extension and G-Block.

Table - 14 : Exploration for Granite and Other Dimension Stones by State Directorates in 2010-11

Agency/ Mineral/ State/District	Location	Geological mapping		Drilling		Sampling	Remarks
		Scale	Area (sq km)	Boreholes	Meterage		
DMG, Rajasthan							
BAJRI							
Bikaner	N/v Modia-Mansar, Golari Gajner, etc.	1:50,000 1:10,000 1:2,000	200 10 02	-	-	08	New occurrences of bajri were located and mapped n/v Modia-Mansar, Bandia-ki-Dhani, Gajner and Golari.
Dausa	N/v Shalawas Khurd, Bhandera, Barial Kalan,etc.	1:10,000 1:4,000	20	-	-	18	Coarse grained brown coloured bajri marked in 2000 x 80-100 m area n/v Pamari, Shalawas Khurd, Khera and 500 x 80-100 m area n/v Barial Kalan. About 3 million tonnes resources of bajri have been estimated.
DGM, Maharashtra							
CONSTRUCTION MINERAL							
Aurangabad	Around Gangapur	-	-	-	-	-	Suitable areas for construction minerals are located around villages Gurudhanora, Dhamori & Mangrul-Nangi-Khurd.
DGM, Chhattisgarh							
GRANITE							
Baster/Kanker	Murvend-Guruvandi area	1:50,000	290	-	-	10	Total 75,000 cu m black granite (dolerite) suitable for cutting/polishing has been estimated.
DMG, Rajasthan							
GRANITE							
Jalore	Parts of Bhinmal & Raniwara Teh.	1:10,000 1:4,000	10 01	-	-	-	The area suitabale for blockable granite was seen n/v Borta, Tavab, Nasoli-Kot Kasta, Ledarmar in Bhinmal Teh and n/v Panseri, Malwara & Chitrodi in Raniwara Teh. Granite n/v Gaseri, Bhadarda, Thorbi Hill in Bhinmal Teh. and n/v Chatwara,Lakhawas Tavider etc. in Raniwara Teh. can be used as masonry stone.
Jodhpur	N/v Gangani, Sevki Kalan, Khurd, etc	1:10,000	10	-	-	27	Occurrences of sub-surface granite was inferred on the basis of wells and pits. Occurrences of quartz felspar was noted in the form of pegmatite bodies near Olvi & Bina was having 150 x 150 m area. Volcanic ash beds were also located n/v Kaparda in 200 x 100 m area.
GRANITE/MASONRY STONE							
Jhunjhunu & Sikar	N/V Nand, Rijani, Jaitpura, Jintala,etc.	1 cm = 500 m 1 cm = 100 m 1 cm = 40 m	165 20 01	-	-	-	Mostly white to greyish reddish pink, greyish coloured, medium to coarse grained granite with possibilities to extract small sized blocks are exposed.

(Contd.)

Table - 14 (Concld.)

Agency/ Mineral/ State/District	Location	Geological mapping		Drilling		Sampling	Remarks
		Scale	Area (sq km)	Boreholes	Meterage		
MASONRY STONE							
Rajasthan							
Alwar	N/v Guwalda Murli, Bagore, etc	1:10,000 1:4,000	10 0.5	-	-	18	Masonry stone area was located in 450 x 100 m n/v Guwalda and about 3.375 million tonnes resources were estimated.
RHYOLITE							
Rajasthan							
Barmer	N/v Nevri Trisingri & Meghawas	1:50,000 1:10,000 1:2,000	260 16 3.5	-	-	-	The exposed rhyolites are black, grey, brownish red coloured, fine grained and can be used in masonry and crusher stone.
SANDSTONE							
Dhaulpur	N/v Badaria,, Vijaipura, etc.	1:10,000 1:4,000	20 3	-	-	24	Blockable sandstone in 600 x 300 m area n/v Badaria and splittable sandstone in 1000 x 800 m and 500 x 200 m areas n/v and Vijaipura, respectively, were delineated. Total 2.59 million tonnes of blockable and 12.96 million tonnes of splittable stone resources were estimated.
Jodhpur	N/v Halodi, Suveri, Sasan, etc.	1:50,000 1:10,000 1 :2,000	150 10 02	-	-	-	Massive sandstone having 1.5 to 4 m thickness was observed near Mandiyai, Halodi, Suveri,etc 10 to 15 cm thick Jasper veins were also located near Ujaliya and Mandiyai.
Kota & Baran	N/V Khan-ki-Jhonpariya & Nagda	1:50,000 1:10,000 1:2,000	115 12.5 1.35	-	-	02	N/v Nagda in Baran district total 37.5 million tonnes of sandstone (masonry stone) resources were calculated.

Indian Minerals Yearbook 2011

(Part- I)

50th Edition

RESEARCH & DEVELOPMENT

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. +91712 - 2565471
PBX : +91712 - 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

5 Research & Development

The Science and Technology programmes (S&T) of the Ministry of Mines, Government of India, cover the disciplines of Geology, Exploration, Mining, Bioleaching, Beneficiation, Rock Mechanics, Ground Control and Non-ferrous Metallurgy and environmental issues related to mining and metallurgy. During 2010-11, 2 meetings were held by Project Evaluation and Review Committee (PERC). Based on its scrutiny report, Standing Scientific Advisory Group (SSAG) considered and recommended for Grant-in-Aid under S & T programme of the Ministry of Mines. The SSAG also approved eight projects in the 41st meeting held on 7 June 2011.

The highlights of work carried out during 2010-11 by various research organisations and industries relating to mineral beneficiation and mining & environment are given below:

1. BENEFICIATION

1.1 Bauxite

Process Development to reduce iron from bauxite for preparation of calcined bauxite (IMMT):

The sponsor, M/s Gokul Minex Pvt. Ltd, Ahmedabad, has plans to utilise the bauxite deposit of Udgeri region in Kolhapur district of Maharashtra for making calcined bauxite. The objective of the project was to develop suitable process flow sheet for the removal of iron from the bauxite, with Fe_2O_3 content of 6-8% in the ROM sample, through roasting-magnetic separation process to prepare the quality of bauxite suitable for preparation of calcined bauxite. Various process schemes for removal of iron to the desired level were tried by treating raw bauxite by both dry and wet magnetic separation. The investigation also includes study on the effect of roasting of bauxite followed by magnetic separation on iron removal to meet specifications of calcined bauxite. The results of the study indicated that it was possible to remove iron to the desired level of less than 3.0% as Fe_2O_3 in the non-magnetic fraction at a yield of 38%. The final process scheme developed recommends processing of raw bauxite lumps through roasting followed by crushing and dry high intensity magnetic separator (85 wt%) at particles of -1 mm + 0.15 mm. The scheme minimises energy and water requirements while economising the processing costs.

1.2 Beach Sand

Studies on heavies from beach and dune sands of South-eastern coast of India with special reference to recovery and in depth characterisation of zircons (IMMT):

The main objective of the study was separation of differenet heavies by using different physical beneficiation techniques and characterisation of heavies in beach sands with special reference to zircon. Zircon ($ZrSiO_4$) is found usually as a constituent in heavy mineral sand assemblages which include ilmenite, rutile, leucoxene, monazite and garnet in varying proportions. Investigations were carried out to enrich zircon from beach sands of Odisha coast. Recovered zircons are used for making zircon bricks and are fired at different temperatures in an industrial tunnel kiln. Physical, chemical and thermo-mechanical properties are evaluated. Mineralogical properties are correlated with the thermo-mechanical properties. The developed bricks were compared with the standards and found suitable for refractory industrial applications.

Similar studies were carried out to recover zircons from red sediment samples from Bad Lands topography of Odisha (Basanputti village, Ganjam district) and Andhra Pradesh (Srikakulam). Physical, chemical and minerological properties were studied. The product achieved from red sediment sands containing 95% total heavy minerals (THM) through mineral separator indicated 94% recovery. A product obtained by stage spirals containing 98.9% total heavy minerals achieved 98.6% recovery. The THM achieved from spiral concentrator was subjected to high tension roll separator to recover titaniferrous minerals (ilmenite and rutile).

1.3 Copper Ore

Upgradation of composite copper ore from Banwas, Khetri and Kolihan Mines for HCL(IBM):

A composite copper ore sample from Khetri, Kolihan and Banwas mines was sent at RODL, IBM, Ajmer with an objective to achieve a concentrate of 18-20% Cu with 90-92% recovery. The as received composite sample assayed 0.96% Cu, 59.01% SiO_2, 2.52% S, 12.82% Fe and 71.65% acid insolubles. Flotation at 62.5% minus 200 mesh grind and subjecting the rougher float to re-grinding and cleaning in three stages yielded a concentrate assaying 24.26% Cu, 33.91% Fe and 5.95% acid insoluble with 90.8% copper recovery (Wt% yield 3.6). The copper concentrate meets all the specifications stipulated by HCL.

Upgradation of a Copper Ore (Core) sample from Chittorgarh, Rajasthan for M/s MECL (IBM):

A core sample of copper ore from Wari Copper Project, district Chittorgarh, Rajasthan was sent by M/s MECL, Nagpur at RODL, IBM, Ajmer to establish the amenability of the sample to produce a copper concentrate suitable for Indian smelters. The as received sample assayed 1.20% Cu, 46.71% SiO_2, 7.65% Fe(T) and 74.48% acid insolubles.

Flotation Test at 66.5% minus 200 mesh grind could yield a concentrate assaying 20.94% Cu, 30.56% Fe, 5.66% SiO_2, 11.54% acid insolubles with 87.2% copper recovery (wt% yield 4.9). The copper concentrate meets the specifications stipulated by M/s MECL.

1.4 Gold

Reovery of Gold from Bhukia (East) Block, Banswara, Rajasthan for MECL, Nagpur (IBM):

A gold ore from Bhukia (East) Block, Banswara district, Rajasthan sent by MECL Ltd, Nagpur contained 2 g/t gold and 51.0 g/t silver with other major constituents assaying 29.66% SiO_2, 25.92% Fe_2O_3, 8.94% CaO, 11.88% S(T), 4.34% MgO, 3.13% Na_2O and 6.86% LOI. The sample was sent at RODL,IBM, Bengaluru with an objective to optimise a process for gold recovery. By employing bottle role cyanidation, cyanide leach concentrate with 96% Au and 40% Ag values could be extracted by cyanide leaching followed by Carbon – In – Leach (CIL) process. The consumption of sodium cyanide would be 2.72 kg per tonne. The results achieved appear to be encouraging.

1.5 Iron Ore

Bench Scale Beneficiation studies on Iron Ore Fines Sample from Ghatkuri Iron Ore mines for M/s Orissa Manganese & Minerals Limited (IBM):

An Iron ore fine sample was received in the Modern Mineral Processing Laboratory and Pilot Plant, IBM, Nagpur from Ghatkuri iron ore mines, Odisha for carrying out bench scale beneficiation studies and to develop a process flow sheet, for producing an iron concentrate with maximum grade and recovery.

The as received sample assayed 51.13% Fe(T), 12.75% SiO_2, 6.53% Al_2O_3, 0.23% CaO, 0.01% MgO, 0.05% P, 0.41% TiO_2, 0.06% Mn and 5.48% LOI.

Tabling on as received sample reduced to all -65 mesh could produce table concentrate assaying 63.90% Fe(T), 2.87% SiO_2, 2.36% Al_2O_3 & 2.68% LOI with weight percent yield of 23.4 & Fe(T) recovery of 29.2%.

Composite of table concentrate & table middling could produce table concentrate assaying 60.85% Fe(T), 5.04% SiO_2, 3.76% Al_2O_3 & 3.82% LOI with overall weight per cent yield of 48.5% & overall Fe(T) recovery 57.7%.

Stub cyclone of the as received sample reduced to all -100 mesh yielded a concentrate (Underflow) assaying 58.23% Fe(T), 6.55% SiO_2, 3.90% Al_2O_3 and 3.75% LOI with weight per cent yield of 68.5% & Fe(T) recovery of 78.0%.

Wet High Intensity Magnetic Separation (20,000 gauss) on Stub Cyclone Underflow (concentrate) could produce a concentrate (magnetic) assaying 62.98% Fe(T), 3.00% SiO_2, 2.73% Al_2O_3 and 2.70% LOI with overall weight per cent yield of 53.8% (overall Fe(T) recovery of 66.2%).

The above concentrate produced may find utility in iron & steel industry after pelletisation.

Beneficiation studies of BHQ ore by magnetic separation techniques to prepare pellet grade concentrate (IMMT):

Considering the availability of huge resources of banded iron ores in our country, IMMT, Bhubaneswar has explored the possibility of producing suitable iron concentrate for pellet making from these lean ores. As the high grade ores are dwindling sharply and to meet the future needs of iron and steel industries, it is essential to develop a cost effective process for the beneficiation of lean ores like BHQ to produce quality iron concentrate. In this connection, MSPL Limited, Karnataka has come forward to set up a commercial beneficiation plant to produce an iron concentrate suitable for the iron and steel making. The lean grade BHQ ore sample received from MSPL contains ~38.0% Fe and 42% SiO_2. The mineralogical finding of the sample indicated that the sample contains hematite, magnetite and quartz as major minerals and the liberation of these minerals is around 75 microns. The beneficiation studies consisting mainly of size reduction followed by low and high intensity magnetic separation have indicated that an iron concentrate with 64% Fe at 40% yield could be obtained. Alternate process flow sheets with different combinations have been suggested to recover the iron values suitable for pellet making.

Beneficiation of iron ore fines for Finex process of iron making (IMMT):

The objective of the studies was to develop a suitable beneficiation scheme to upgrade the low grade iron ore fines (-10.0 mm) to generate concentrate for Finex process of iron making. The low grade iron ore fines sample on an average contained 58.4% Fe, 4.3% SiO_2 and 4.7% Al_2O_3. The various minerals associated in this ore are hematite, vitreous goethite, ochreous goethite, gibbsite, kaolinite and quartz. The average hematite content in the bulk sample is 46.30%. Various beneficiation techniques such as scrubbing, jigging, spiraling and magnetic separation have been used to recover the iron values. Different alternative flow-sheets have been suggested to recover the iron values suitable for Finex process for steel making. The investigations have indicated that iron concentrate with 64% Fe at 69% yield could be obtained by combination of screening, jigging hydro-cyclone and magnetic separation techniques. The settling studies of both concentrate and tailings and the mineralogical findings of the sample are also incorporated in the report.

Beneficiation of low grade iron ore fines to produce quality concentrate (IMMT):

The main objective of the studies was to develop a suitable beneficiation scheme to beneficiate low grade siliceous iron ore fines (-10.0 mm) with 50-52% Fe to prepare quality raw material for sintering and pelletisation and to suggest optimum flow sheet which can generate concentrate with more than 60-63% Fe with appreciable yields & recoveries for both the purposes. Detailed characterisation and beneficiation studies were carried out on low-grade siliceous iron ore of C.N. Halli sector containing around 50% Fe and limited studies were carried on low grade iron ore of BBH Chitradurga with 51.0% Fe. The characterisation studies of C.N. Halli sample indicated the presence of hematite as major mineral with minor amount of goethite, limonite and quartz. The low grade iron ore of BBH showed the presence of manganese minerals. The optimum liberation of both the samples was found to be below 150 micron. Beneficiation studies were carried out by conventional beneficiation techniques such as scrubbing, hydrocyclone, spiral, magnetic separation by WHIMS/HGMS and their combinations. Different schemes have been suggested to get a good grade and yield by adopting classification, jigging, magnetic separation. The other combination yielded higher Fe content with low weight recoveries.

Development of Commercial Flow sheet for Beneficiation of Low Grade Ore Fines for Pelletisation (IMMT):

Three types of low grade fine samples having below 10 mm size particles were received. Detailed size and chemical analysis and mineralogical studies were carried out. Two of these samples contained 55-56% Fe. After beneficiation, the grade of concentrate could be improved to 63-64% with yield of 65-67% using combination of gravity and magnetic separation processes including the desliming of the ore by scrubbing at the beginning. Another sample contained 61.89% Fe. After beneficiation, the grade of concentrate could be improved to 65-65.5% with yield of 81-82%.

Processing of Low Grade Iron Ore Resources (NML):

A CSIR network research programme was undertaken at CSIR-NML, Jamshedpur with IMMT, Bhubneswar as the nodal laboratory NEIST, Jorhat and CEERI, Pilani as participating laboratories towards developing technology for gainful utilisation of low grade iron ores, through systematic studies involving characterisation, beneficiation and agglomeration.

Low grade iron ore samples were collected from Gua and Meghtaburu mines of SAIL and a low grade siliceous iron ore sample from Goa. Detailed charcterisation and beneficiation studies involving gravity, magnetic and flotation techniques were carried out on low grade iron ore and the flowsheet was developed which indicated an overall yield of about 75% inclusive of sinter fines with +63% Fe and pellet fines of 65% Fe. A product with +63% Fe and 5.8% SiO_2 is obtainabale from BHQ from Meghahatuburu through WHIMS and flotation. The flowsheet developed for iron ore samples from Goa indicated that a sinter fines of +63% Fe and a pellet fines with 65% Fe is obtainable through jigging, spiralling, hydrocyclone and WHIMS.

Studies were carried out on sintering of concentrate obtained from processing of dump fines sample from Gua. The effect of process variables namely basicity, bed height, vertical speed of sintering (VSS), MgO content of sinter, on the productivity and quality parameters of sinter was investigated. The study shows that an acceptable RDI of 28% could be achieved at 2.6 sinter basicity and at lower bed height. Coke breeze at 5% of the raw mix and moisture content in between 5.5% to 5.8% seems to be optimum for an acceptable strength (TI) of siner and in relation to RDI of sitner.

Beneficiation of a low grade iron ore sample from Thakurani Iron Ore Mines, Noamundi, District West Singhbhum, Jharkhand (IBM):

A low grade iron ore sample from Thakurani Iron Ore Mines, Noamundi, District West Singhbhum, Jharkhand was received through IBM, Kolkata office at Modern Mineral Processing Laboratory and Pilot Plant, IBM, Nagpur for conducting bench scale beneficiation studies.

The as received sample assayed 37.33% Fe(T), 0.13% FeO, 45.43% SiO_2, 0.40% Al_2O_3, 0.046% CaO, 0.004% MgO, 0.018% TiO_2 and 0.30% LOI.

By adopting gravity concentration, the composite table concentrate (Conc. I + Conc.II) obtained at minus 150 mesh size assayed 59.50% Fe(T) & 13.73% SiO_2 with 43.2% Fe(T) recovery(Wt% yield 43.2).

The upgradation of low grade iron ore to 59.50% Fe(T) from 37.33% Fe(T) is appreciable. This concentrate may find application in iron industry after blending.

Baseline audit (Phase I) of M/s BMM Ispat Ltd of an iron ore processing plant, Danapur, Karnataka (IBM):

M/s. BMM Ispat Ltd is operating an iron ore beneficiation plant at Danapur, Hospet, Bellary District, Karnataka using sub-grade iron ores of the region. BMM observed that the concentrate productivity and recovery were below design levels. Based on the in-plant technical auditing studies carried out by RODL, IBM, Bengaluru, the throughput of the plant was increased from 120 TPH to 162 TPH i.e. 35% increase from baseline data. Also the iron ore recovery was increased from 75 to 82% and the tailing losses reduced from 47.68% to 40.62% Fe. The studies helped in cost benefit i.e. approx. 10% reduction in operating cost.

Upgradation of Iron Ore sample from BBH Mines for M/s Voltas Limited, Bengaluru (IBM):

An iron ore sample from BBH Mines, Bheema Samudra, Chitradurga, Karnataka was received at RODL, IBM, Bengaluru so as to upgrade iron content economically. Various beneficiation techniques including washing and screening, scrubbing and sizing, gravity separation, magnetic separation and reduction roasting followed by magnetic separation were adopted to upgrade iron content.

As received sample assaying 52.11% Fe(T), 7.16% SiO_2, 3.16% Al_2O_3, 5.33% Mn was upgraded to a concentrate assaying 60.30% Fe(T), 4.99% SiO_2 and 4.09% Mn with 87.0% recovery(Wt% yield 75.2) by reduction roasting at -48 mesh followed by magnetic separation. The concentrate obtained finds industrial application after blending.

Beneficiation of Composite iron ore sample from Bellary district, Karnataka of M/s Allum Prashanth, Mine Owner, Bengaluru (IBM):

A composite iron ore sample from Bellary district, Karnataka was sent by M/s Allum Prashanth, Mine Owner, Bengaluru for beneficiation studies at RODL, Bengaluru to develop the flow sheet so as to achieve a iron concentrate assaying Fe >65% with maximum recovery.

The as received sample assayed 36.31% Fe(T), 5.08% FeO, 42.70% SiO_2, 0.40% Al_2O_3, 0.84% CaO, 1.44% MgO and 0.16% LOI.

The beneficiation flow sheet comprised following routes for obtaining desired iron concentrate:

(a) Tabling of the as received sample ground to all minus 200 mesh yielded an iron concentrate assaying 67.84% Fe(T), 2.99% SiO_2 and 0.18% Al_2O_3 with Fe(T) recovery of 72.2% (wt % yield 38.1).

(b) Alternative route is that minus 200 mesh sample when subjected to tabling followed by ferrous wheel magnetic separation, the combination of table and cleaner magnetic concentrate yielded a concentrate assaying 65.25% Fe(T), 9.47% FeO, 7.01% SiO_2 and 0.18% Al_2O_3 with Fe(T) recovery of 83.9% (Wt% yield 46.0).

The above concentrates may find application in pelletisation.

Upgradation of low grade Iron Ore fines to Pellet grade concentrate (IBM):

A low grade iron ore fines sample from Barbil Region, Odisha was sent by M/s Jaganathpur Steel Limited, Ranchi, Jharkhand at RODL, IBM, Bengaluru with an objective to evolve a flow sheet to produce a pellet grade concentrate. The as received sample assayed 58.15% Fe(T), 7.05% SiO_2, 4.39% Al_2O_3, 0.07% Mn, 0.05% CaO and 4.30% LOI. By adopting gravity separation after grinding at 95% minus 50 mesh in rod mill a concentrate assaying 65.83% Fe(T), 1.83% SiO_2, 1.37% Al_2O_3, 0.05% Mn with 62.5% Fe(T) recovery with Wt% yield of 55.5 could be obtained. The concentrate meets the specifications of the party.

1.6 Limestone

Beneficiation studies on a limestone sample from Sahedpur, district Morena (MP) for M/s Abhijeet Cement Ltd, Nagpur (IBM):

The limestone sample from M/s Abhijeet Cements Ltd, Nagpur was sent at Modern Mineral Processing Laboratory and Pilot Plant, IBM, Nagpur to develop a suitable process flow sheet to produce a concentrate, which may find application in cement industry.

The as received sample assayed 42.12% CaO, 1.83% Fe_2O_3, 14.83% SiO_2, 3.88% Al_2O_3, 0.63% MgO, 0.26% TiO_2, 1.43% K_2O, 0.21% Na_2O and 34.50% LOI .

(a) By adopting dry screening at -40mm size a concentrate of -40+4mm fraction assaying 44.10% CaO, 1.47% Fe_2O_3, 13.28% SiO_2, 3.0% Al_2O_3, 0.56% MgO and 35.49% LOI with wt% yield of 88.8 and CaO recovery of 90.5% could be obtained.

(b) By adopting flotation route at a grind of 87.2% -200 mesh a concentrate assaying 48.11% CaO, 1.12% Fe_2O_3, 8.31% SiO_2, 2.80% Al_2O_3, 0.43% MgO and 36.59% LOI with wt% yield 71.7 and CaO recovery of 80.9% could be obtained.

The concentrate produced above meets the specification stipulated by the party for utilisation as a sweetener in cement making.

Bench scale beneficiation studies on Limestone sample from M/s Prism Cement Limestone Mines Ltd, Satna, M.P. (IBM):

A limestone sample assaying 35.47% CaO, 22.41% SiO_2, 2.21% Fe_2O_3, 3.81% Al_2O_3, 2.27% MgO and 31.52% LOI was sent at Modern Mineral Processing Laboratory and Pilot Plant, IBM, Nagpur by M/s Prism Cement Limestone Mines Ltd, district Satna, Madhya Pradesh with an objective to develop a flow sheet to produce a concentrate suitable for user industry.

By adopting flotation route a limestone concentrate assaying 45.87% CaO, 9.83% SiO_2, 1.39% Fe_2O_3, 2.02% Al_2O_3, 1.60% MgO, 0.09% TiO_2, 0.42% K_2O, 0.3% Na_2O and 38.09% LOI with 80.1% CaO recovery (wt% yield of 62.2) could be obtained.

The concentrate obtained above meets the specifications stipulated by the party.

Beneficiation Studies of Lean grade Limestone for Removal of Silica (IMMT):

The limestone sample roughtly contain ~44.5 - 45.3% CaO and 13.5-14.3% SiO_2 as the major chemical constituents. The alumina, magnesia and iron content in the given sample are present in very low concentrations. The sample consists of calcite ($CaCO_3$) and quartz (SiO_2) as major mineral phases. The objective of the project was to enhance the CaO value and reduce the silica content of the sample through physical beneficiation techniques. Several studies were therefore undertaken by both dry and wet beneficiation techniques to achieve the objective. Froth flotation technique was found to be the most suitable method to enhance the CaO content after grinding the material to below 50 micron size. The results of the flotation studies have indicated that it is possible to achieve a concentrate of 48.4% CaO at 71.5% yield using oleic acid as the collector, MIBC as the frother and sodium silicate as the dispersing reagent. The silica content in the beneficiated concentrate could be brought down to below 7%. Although the calcium component of the sample is very finely disseminated, it was possible to achieve the desired concentrate after fine grinding followed by one or two stages of cleaning. The investigations on the commercial grade reagents were also proved to be efficient to float the calcite values present in the sample.

Synthetic Flux for Basic Oxygen Steel Making through Micro-pelletisation and Sintering of Waste Oxides (NML):

Ultrafine waste oxides generated in steel plant were subjeted to micro-pelletisation followed by sintering to develop a CaO-FeOx type pre-fused flux material through an innovative way. The developed flux material dissolves in hot metal bath at faster rate owing to its low softening point and favourable chemistry forming basic and oxidising slag. The material will find application in BOF steel making for faster refining and partial replacement of high melting lump lime.

1.7 Manganese Ore

Beneficiation of low grade manganese ore by wet high intensity magnetic separator (IMMT):

The objective of the project for Tata Steel was to carry out beneficiation studies of low grade ferrugenous manganese ore of Joda region to reduce iron content to improve Mn/Fe ratio. Four different types of samples were subjected to WHIMS at 14000 Gauss & 10000 Gauss to separate iron rich minerals. The Mn/Fe ratio could be increased to 1.5 to 3 with Mn content 35-42% by this technique.

1.8 Nickel

Enrichment of Nickel in Chromite Overburden Materials by dry beneficiation (IMMT):

Chromite Overburden Material from different mining sites of Sukinda was collected for dry beneficiation studies. As received Chromite Overburden sample was size analysed for both wet and dry process to find out the nickel concentration. The material was subjected to stage crushing using jaw crusher, roll crusher, where it was crushed to below 2 mm size. The overburden sample was subjected to VSK separator for separation of coarse and fine fractions. The effect of different operating parameters, viz, cage wheel speed (rpm) and vibrating tube feed (rpm) were studied at constant air rate. The feed sample of COB containing 0.9% Ni has been enriched to 0.95% Ni in -45 microns fraction.

1.9 Platinum Group Elements

Waste to Wealth: Noble metal Platinum Group Elements recovery from low grade chromite ores of Odisha (IMMT):

Platinum group elements are very rare in nature and their occurrence is also very limited. In India, Boula Nausahi Igneous complex is the only proven PGE deposit but with a very low tenor. In this set up, PGE occurs in oxide (chromite) and sulfide (Cu-Fe-S) facies as very tiny grains of around 20 micron. Recovery of PGE of such fineness from the host rocks is a very challenging task. The major focus of research will be (i) Recovery of PGE values from the low tenor hosts by adopting suitable beneficiation tests and (ii) Development of process flow sheet for recovery of PGE from Indian ores.

Throughout the world, PGE are recovered by a combination of different beneficiation techniques such as gravity and flotation depending on the nature of association, mineralogy and size of PGE phases. The PGE mineralisation at BNIC is totally different from most of the PGE deposits of world in (i) PGE are very fine (ii) PGE are present as inclusions & exsolution in the host chromite and Cu-Fe-S (iii) and very complex geological set up of this deposit. So the methods adopted elsewhere are not be suitable for processing this ore. For the first time an attempt will be made to recover PGE from the low grade Indian chromite ores.

1.10 Quartzite

Recovery of float glass concentrate from Quartzite sample, Pohara, Bhandara district, Maharashtra (IBM):

A quartzite sample from Gadpendri (east), district Bhandara, Maharashtra, assaying 97.99% SiO_2, 0.68% Fe_2O_3, 0.60% Al_2O_3, 0.05% CaO, 0.01% MgO, 0.09% K_2O, 0.07% TiO_2 & 0.11% LOI was sent by M/s Maharashtra State Mining Corporation Ltd, Nagpur at the Modern Mineral Processing Laboratory and Pilot Plant, IBM, Nagpur. The objective of the investigation was to produce a quartzite concentrate suitable for use in the float glass industry. After scrubbing followed by wet high intensity magnetic separation, the composite concentrate (-30 + 70 mesh and -70 + 120 mesh) non-magnetic assaying 99.16% SiO_2, 0.13% Fe_2O_3, 0.25% Al_2O_3 and 0.11% LOI with 63.5% silica recovery (wt% yield 62.7) could be obtained. The composite concentrate meets the specifications stipulated by the party.

1.11 Rock Phosphate

Upgradation of sub-grade Rock Phosphate sample for M/s RSMM Ltd, Rajasthan (IBM):

A sub-grade rock phosphate sample from Jhamarkotra Mines, Rajasthan was sent by RSMM Ltd with an objective to develop a flow sheet to obtain phosphate concentrate which may be used in fertilizer industry. The as received sample assayed 13.43% P_2O_5, 49.48% SiO_2, 5.66% Fe_2O_3, 6.87% Al_2O_3, 20.13% CaO, 0.46% MgO and 2.68% LOI. By adopting flotation route a phosphate concentrate assaying 32.02% P_2O_5, 13.33% SiO_2, 3.22% Fe_2O_3, 1.25% Al_2O_3, 14.22% acid insolubles with P_2O_5 recovery of 81.9% and weight % yield of 33.8 could be obtained. This concentrate may find application in fertilizer industry.

Upgradation of low grade Rock Phosphate from Hirapur for M/s Madhya Bharat Agro Products Ltd, Madhya Pradesh (IBM):

A low grade rock phosphate sample from Hirapur mines, Madhya Pradesh sent by Madhya Bharat Agro Products Ltd. At Modern Mineral Processing Laboratory and Pilot Plant, IBM, Nagpur assayed 15.66% P_2O_5, 43.46% SiO_2, 8.54% Fe_2O_3, 5.19% Al_2O_3 and 2.02% LOI.

By adopting flotation route, a phosphate concentrate assaying 34.28% P_2O_5, 47.9% CaO, 7.79% SiO_2, 1.23% Al_2O_3 with P_2O_5 recovery of 58.2% (Wt% yield 26.3) could be obtained.

The concentrate obtained meets the specifications stipulated by the party.

Development of process flow sheet for Rock Phosphate from Jhamarkotra for RSMML, Udaipur (IBM):

A rock phosphate sample from Jhamarkotra, district Udaipur, Rajasthan sent by RSMM Ltd at RODL, IBM, Bengaluru with an objective to

1) Upgrade the ore to +32% P_2O_5 by ore dressing techniques with maximum possible P_2O_5 recovery.
2) Develop a process flow sheet keeping in view the present unit operation at RSMML.
3) Optimise and to reduce the reagent consumption.

The as received sample assayed 14.20% P_2O_5, 36.91% CaO, 11.12% MgO, 0.54% Fe_2O_3, 2.98% SiO_2. A composite phosphate concentrate assaying 33.57% P_2O_5, 1.42% MgO, 7.11% SiO_2, was obtained with 83.5% P_2O_5 recovery (wt% yield 35.6) by adopting flotation route. The concentrate obtained meets the requirement as stipulated by the party. Also, for obtaining same grade and recovery of phosphate concentrate the throughput can be improved by increasing the pulp density of feed to 50% solids from the initial 34% solids used in this investigation. By this the phosphoric acid consumption can also be reduced.

1.12 Sea Nodules

Recovering metallic values from sea nodules (NML):

A direct smelting process was developed on 20 kg scale for recovering Cu, Ni & Co (as an alloy) from polymetallic sea nodules containing 1 - 1.2% Cu & Ni and 0.01% Co. About 90% Cu & Ni and 88% Co recovery was achieved. The slag generated through this process was further treated to recover Mn as standard grade Fe-Si-Mn with overall 80% Mn recovery. A modified reduction roast-ammonia leach process was also developed for processing of polymetallic sea nodules, with 94% Cu & Ni and 70% Co recoveries. The process was tested under continuous mode (10 kg/batch scale recycle leaching) & the residues generated were smelted to recover Mn.

1.13 Silica Sand

Beneficiation of silica sand for Reduction of Fe_2O_3 content (IBM):

M/s. Asahi Glass India Ltd approached Indian Bureau of Mines with a request to explore the possibility of utilising the silica sand available as overburden of GMDC, Rajpardi Lignite Mine for manufacturing glass. The original sample assayed 96.5% SiO_2, 0.64% Fe_2O_3, 0.42% TiO_2, 1.13% Al_2O_3 and 1.03% LOI. Ore Dressing Division of IBM has developed a beneficiation process for the said sand which comprises scrubbing, tabling, magnetic separation and attrition scrubbing. The process yielded a silica sand concentrate assaying 99.3% SiO_2, 0.079% Fe_2O_3, 0.15% Al_2O_3, 0.04% TiO_2 with wt.% yield of 60. The industrial application of the above can convert the overburden, dumped as waste, into a useful industrial product for glass making.

2. MINING

National Institute of Rock Mechanics (NIRM)

NIRM is a premier centre of research in applied and basic Rock Mechanics. During 2010-11, NIRM was involved in projects from construction projects in power sector (hydel, nuclear), communication sector (metros, rails) and mining sector. This institute undertakes investigations at various stages of the projects, i.e., feasibility report (FR), detailed project report (DPR), construction and post-construction stages. The following studies have been undertaken.

- Geological and geotechnical investigations for preparation of DPR for 2 x 350 MW Malshej Ghat Storage Scheme. Maharashtra, Project No. EG0901.

- Geological investigations for underground storage caverns at Vishakapatnam, Project No. EC0902.

- Seismotectonic evaluation of Kudankulam-Atomic Power Plant within 30 km area, NPCL, EG0903.

- Cross-hole seismic tomography at Sainj HEP, Himachal Pradesh, Project No. GP1001.

- Laboratory Rock Mechanics investigations - underground rock cavern for storage of crude oil at Padur (part B SKE&C-KCT), Project No. RF1001.

- Deformation monitoring of Underground Powerhouse Cavern of Sardar Sarovar Project, Project No. NM0803C.

- 3D Numerical Modelling of Powerhouse Complex of TapovanVishnugad HE Project and Desilting Chamber and Power house Complex of Lohari-Nag pala Hydroelectric Project, Project No. NM0704.

- Analysis of instrumentation data of machine hall and desilting complex of Nathpa Jhakri hydro power station, Project No. NM0904C.

- Controlled blast design for rock excavation close structures and green concrete and ground vibration measurement near Unit 7 & 8, Nuclear plant, RAPP, Kota Hindustan Construction Company Limited, Mumbai - Project No. RB 1004C.

- Slope stability studies at Iron Ore Mines of M/s Mysore Minerals Ltd, Hospet, Project No.SS 1001.

- Slope stability studies at Iron ore Mines of M/s SMIL, Goa Project No. SS0701.

- Strata Monitoring during Development in No. 3 Seam at KTK-2 Incline, Bhupalpalli Area, SCCL Project No. GC 0903.

- Project entitled "Study on blasting dust management system in an opencast coal mine", Coal S &T Project (Code: EE/35), Ministry of Mines, Govt. of India.
- Preliminary Report on "Possible causes of rock fall from sides at Hamsa Minerals & Exports Granite Mine and Suggestions for remedial measures".

Indian Bureau of Mines (IBM):

Mining Research Cell of TMP Division, IBM conducted a techno-economic evaluation and prepared a status report on availability of manganese ore.

Techno-economic Evaluation of Balaghat Holem's Shaft Deepening Project at Balaghat district of Madhya Pradesh for MOIL Ltd.

On the request of MOIL, Nagpur, study of Techno-economic Evaluation of their Balaghat Holem's Shaft Deepening Project at Balaghat Mine, Balaghat District, Madhya Pradesh, was carried out for examination of techno-economic evaluation and financial justification of proposed vertical deepening of that shaft on the basis of financial models. In order to maintain the leading status, development of mine to exploit the ore reserves below the 12th level to 16.5th level which is essential for them. The MOIL has prepared the proposal to estimate the anticipated in & out cash-flow of the project. The same has been examined by IBM.

The IBM team re-estimated the recoverable reserves of 3.14 million tonnes for which operating cost was considered as ₹ 1953/- per tonne with annual increment factor of 5%. After examining the cash-flow statement, IBM has stated in the report that all the capital investment incurring in the project will be recovered within 6-month period as cash flow in any year before depreciation and income tax is more than ₹ 42 crore. Considering the calculated IRR 94% and NPV ₹ 576 crore, IBM concluded that the project of deepening of shaft between 12.5th level to 16.5th level is viable and beneficial to MOIL.

Status Report onAvailability of Manganese Ore over an area of 26.97 ha In Village: Shannkerpipariya, Taluka: Kherlangi, district:Balaghat, Madhya Pradesh, for M/s M.V.P. Minerals (P) Ltd, Hyderabad (IBM):

On the request of M/s M.V.P. Minerals (P) Ltd, Hyderabad (Andhra Pradesh), an assignment of preparation of Status Report on Availability of Manganese Ore over an area of 26.97 ha. In Village: Shannkerpipariya, Taluka: Kherlangi, District: Balaghat, Madhya Pradesh has been carried out. The area shows mineralisation of manganese at two places only, i.e. in old pits/trenches. The ore available in the area is medium grade in manganese content with low phosphorous. The reconnaissance survey shows that the area appears to be manganese ore prospect with proper prospecting/exploration.

3. ENVIRONMENT

Indian Bureau of Mines (IBM):

During 2010-11, Mining Research Cell of T.M.P. Division, IBM has carried out four studies, one for Environmental Quality Monitoring, and three for Ground Vibration due to Blasting in Mines. The salient features of the studies and activities are as follows:

Study of Ground Vibrations due to Blasting in Amil and Thandiberi Limestone Mines of M/s Binani Cements Ltd, district: Sirohi, Rajasthan (IBM):

On the request of M/s Binani Cements Ltd, district Sirohi, Rajasthan, study of ground vibrations due to blasting at their Thandiberi Limestone Mines (Lease Area 254.125 Hect.) and Amli Limestone Mines (Lease Area 468.68 Hect.) was carried out to study the impact of blast induced ground vibrations on the nearby structures, human settlements and to suggest control measures to minimise the adverse impact of the same. Under this study, eight blasts at the Amli Limestone Mine area and one blast at Thandiberi Limestone Mine were carried out and monitored at various points in the area.

In the Amli Limestone Mine, the charge weight per delay of 600 kg, which is presently under practice, was kept and monitored. It was found that the ground vibration intensity and air over pressure (sound level) due to blasting is well within the safe limit and therefore, no danger to any structures in the nearby area.

In the Thandiberi Limestone Mine, normally the charge weight per delay is kept below 500 kg. The peak particle velocity for the charge weight for 500 kg for a distance of 700 m is found to be 10.18 mm/sec which was above the safe limit. Therefore, for Thandiberi Mine, it was suggested that the charge weight should be restricted to 450 kg for which calculated peak particle velocity is 9.50 mm/sec which is well within the safe limit as per DGMS Circular. The air over pressure (sound level) due to blasting is also well within the limit. The frequencies below 8 Hz are 'Nil' and so there will not be any danger to nearby structures of the mine.

Study of Ground Vibration Monitoring due to blasting in Chargao – Gotadi Stone Quarry in Bhivapur Tehsil, Near Umred, district Nagpur, for M/s Modern Mineral Industries, Nagpur (IBM):

On the request of M/s Modern Mineral Industries, Nagpur (Maharashtra), a study of Ground Vibrations due to blasting at their Chargao Gotadi Stone Quarry, Taluka, Bhivapur, near Umred, district Nagpur (Maharashtra) over a lease area of 2.45 ha was carried out to study the impact of blast induced ground vibrations on the nearby structures, human settlement and to suggest control measures to minimise the adverse impact of the same. Under this study, six blasts were carried out at Chargao Gotadi Stone Quarry site and monitored at three different points in the area.

Normally, in Chargao Gotadi Stone Quarry, the charge weight per delay is 55.60 kg (i.e. less than 60 kg). The observed peak particle velocity for this charge weight of 55.60 kg for a distance of 100 m is 3.11 mm/sec which is well within the safe limit. The ground vibration intensity estimated for even maximum charge weight per delay of 200 kg, presently not practised, is also well within the safe limit. The Mine Office and labour hutments which are at a distance of 100 m, the calculated PPV is 46.5 mm/sec for a maximum charge per delay of 25.0 kg which is outside the safe limit. The frequencies below 8 Hz are considered serious for potential structural damage. During the study, it has been found that the frequencies below 8 Hz are 'Nil' and hence there will not be any danger to nearby structures. The air over pressure (sound level) due to blasting is also well within the limit. Some safety measures have also been suggested for minimising further blast vibrations effects in the report submitted to the party.

National Institute of Rock Mechanics (NIRM):

The following projects were undertaken by NIRM:

- Study on ground vibration and air overpressure due to blasting at HRT of Parbati hydroelectric project (Stage-III) Behali, Kullu, Himachal Pradesh, NHPC Ltd, Project No. RB 1005, August 2010.
- Ground vibration and air overpressure study at Mangampet Barytes Project using different explosives, APMDC Ltd, Mangampet Cuddapah, Andhra Pradesh, Project No. RB 1003C.
- Technical guidance for rock blasting and monitoring of ground vibration, air over pressure and fly rock during excavation at underground stations of Bangalore Metro (BMRCL).

Indian Minerals Yearbook 2011

(Part- I)

50th Edition

PORT FACILITIES

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. +91712 - 2565471
PBX : +91712 - 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

6 Port Facilities

1. GENERAL

1.1 Growth

Port provides an interface between ocean transport and land-based transport. India has a long coastline of about 7,517 km spread across the western and eastern shelves of the mainland and also along the islands. It is a strategic geographical asset for country's trade. India has 12 major ports and 200 non-major ports. Out of 12 major ports, six are located on the East Coast and six on the West Coast. Approximately, 95% of India's trade by volume, and 70% by value moves through Maritime Transport. Maritime Transport is a critical infrastructure for the economic development of the country. The Ministry of Shipping was formed in 2009 by bifurcating the erstwhile Ministry of Shipping, Road Transport and Highways into two independent Ministries. The Ministry encompasses within its fold major ports and inland water transport, among others.

India is among the 20 leading maritime users in the world. All major ports in the country are at present having both rail and road connectivity.

1.2 National Maritime Development Programme (NMDP)

The Ministry of Shipping has finalised a National Maritime Development Programme (NMDP) to implement specific programmes/ schemes for the development of Port Sector. Under the programme, specific projects to be taken up for implementation over a period up to 2011-12 have been identified. Total investment involved under the programme is ₹ 1,00,339 crore. Out of this, ₹ 44,535 crore is for the Shipping and Inland Water Transport (IWT) sector and balance of ₹ 55,804 crore is for Port Sector. In major port, 276 projects have been identified. Out of these, ₹34,505 crore is expected from private sector. The objective is to upgrade and modernise the port infrastructure in India and benchmark its performance against global standards.

1.3 Sethusamudram Ship Channel Project

The Sethusamudram ship channel project envisages dredging of a ship channel in the shallow portion of sea to connect the Gulf of Mannar and Bay of Bengal through Palk Strait and Palk Bay, so that ships moving between east and west coast of India could have a continuous navigable sea route within her territorial waters. The project reduces the east-west route by 424 nautical miles and saves 29.9 hours travel time. The project gives a boost to movement of cargo. The project was inaugurated on 2nd July 2005 by the then Prime Minister. The entire dredging work for the project was awarded to the Dredging Corporat-ion of India (DCI) on nomination basis. However, the work is presently suspended. A Committee of experts will examine the feasibility of alternative alignments suggested by the Hon'ble Supreme Court for the Sethusamudram Ship Channel between Dhanushkodi and Land's End on Rameswaram Island, keeping in view the technical aspects and cost benefit analysis, social and cultural impact, environmental impacts, etc. Environmental Impact Assessment (EIA) of the proposed alternative alignment has been assigned to National Institute of Oceanography (NIO).

1.4 Private Sector Participation in Major Ports

Investments undertaken at ongoing projects at Major Port are shown in Table-1.

The following PPP projects have been awarded for development and construction of berths/mechanisation in respect of Kandla, Paradip and V.O.Chidambaranar Ports.

Table - 1 : Investments Undertaken at the Major Ports

	Estimated Cost (₹ Million)	Capacity (million tpy)
Jawaharlal Nehru Port		
Container Terminal, NSICT	6000.00	13.20
BPCL Jetty	2000.00	5.50
Third Container Terminal	9000.00	15.60
Mumbai Port		
Construction of two new offshore container berths and development of container terminal on BOT basis in Mumbai Harbour	14600.00	9.60
Mormugao Port		
Bulk Cargo Berths No. 5A & 6A	2500.00	5.00
Kandla Port		
Fifth Oil Jetty (IFFCO)	215.00	2.00
Oil Jetty related facilities at Vadinar (ESSAR)	7500.00	12.00
Oil Jetty awarded to M/s IOCL	207.00	2.00
Container Freight Station	410.70	3.00
Container Terminal (Phase I & II)	4465.40	7.20
V.O. Chidambaranar (Tuticorin Port)		
Container Terminal (Berth No. 7)	1000.00	5.00
Construction of Coal Berth at NVW for NLC – TNEB	490.00	6.30
Visakhapatnam Port		
Container Terminal, Outer Harbour	1080.00	1.60
Multipurpose Berths – EQ-8 & EQ-9	1960.00	6.00
Paradip Port		
Captive Fertilizer Berth	261.70	4.00
Mechanisation of Cargo Handling Project-1	373.20	2.00
Mechanisation of Cargo Handling Project-2	251.30	2.00
Construction of Single Point Mooring Captive Berth	5000.00	15.00
Chennai Port		
Container Terminal	4690.00	8.00
Development of Second Container Terminal	4950.00	9.60
Ennore Port		
Marine Liquid Terminal	2490.00	3.00
Coal Terminal	3990.00	8.00
Iron Ore Terminal	4800.00	12.00
Kolkata (HDC)		
Multipurpose Berth No. 4A	1500.00	3.00
Multipurpose Berth No. 12	300.70	0.45
Mechanisation at HDC berth no. 2	750.00	4.00
Mechanisation at HDC berth no. 8	750.00	4.00
Cochin Port		
Crude Oil handling facility	7200.00	7.50
International Container Transshipment Terminal (ICTT)	21180.00	36.00
LNG Re-gasification Terminal	31950.00	2.50
New Mangalore Port		
Construction of Captive Jetty for handling Coal by M/s NPCL	2300.00	3.00

Sl. No.	Project Development	Estimated Cost (₹ Crore)	Capacity (Million tonnes)
1.	Development of Container Terminal at Ennore	1407.00	15
2.	Multi purpose berth at Paradip Port	387.31	5
3.	Construction of North Cargo Berth No.II at V.O.Chidambaranar	332.16	7
4.	Development of 14th Multi-purpose cargo berth at Kandla	188.87	2
5.	Development of 15th multi-purpose cargo berth at Kandla	188.87	2
6.	Development of 15th multi-purpose cargo berth at Kandla	188.87	2

1.5 Inland Water Transport

Inland water transport mode is cost effective, fuel efficient and climate-friendly mode of transport for bulk cargo and over dimensional cargo. It has been a neglected sector. Efforts are being made to develop this mode.

Waterways declared as National Waterways by the Act of Parliament come under the purview of Central Government, while other waterways remain under the respective State Government's domain.

Inland Waterways Authority of India (IWAI) came into existence on 27.10.1986 for development and regulation of inland waterways for shipping & navigation. The authority primarily undertake projects for development and maintenance of IWT infrastructure on National waterways.

1.5.1 Inland Water ways

Earlier, Government of India had declared three waterways as National Waterways, namely,
i) Allahabad - Haldia stretch (1,620 km) of the Ganga-Bhagirathi-Hooghly river system (NW1);
ii) Sadiya-Dhubri stretch (891 km) of Brahmaputra river (NW-2); and
iii) Kottapuram-Kollam stretch of the West Coast Canal alongwith Champakara canal and Udyogmandal canal (205 km) (NW-3).

Two new waterways have been declared by Government of India in November, 2008 as National Waterway 4 & 5.

National Waterway 4 : Kakinada - Puducherry canals with Godavari and Krishna Rivers have stretches of 1,095 km waterway.

National Waterway 5: East Coast Canal alongwith Brahmani river and Mahanadi Delta, stretches of waterways of 623 km.

In addition, declaration of Barak river from Lakhipur to Banga (121 km) as the sixth NW is under consideration of the Government.

2. MAJOR PORTS

There were twelve major ports in the country; viz, Kolkata-Haldia, Paradip, Visakhapatnam, Chennai, Ennore and Tuticorin on the East Coast and Cochin (Kochi), New Mangalore, Mormugao, Jawaharlal Nehru, Mumbai and Kandla on the West Coast. Of these, Paradip, Visakhapatnam, Chennai, New Mangalore and Mormugao ports were the five leading iron ore handling ports having mechanical ore handling system. Out of total 570 million tonnes traffic handled at major ports, Kandla Port is the top traffic handler during 2010-11. Except Ennore Port being Public Sector Undertaking, all the major ports are administered by Port Trusts which are autonomous bodies.

2.1 Tariff Authority for Major Ports

The Authority was constituted by the Government of India in 1997 to provide for an independent Authority to regulate all tariffs (vessel related and cargo related) as also the rates for lease of properties in major Port Trusts and private operators located therein and conditions governing application of rates. The jurisdiction of the Authority is restricted to major port trusts and private terminals operating therein.

2.2 Cargo Handling Capacity and Cargo Handled

The capacity of Indian Ports including major and non-major ports have crossed one billion tonne per annum land mark on 28.1.2011. The aggregate capacity of major ports as on 31.3.2010 was 616.73 million tpy. The major ports, therefore, continued to maintain a favourable capacity-cargo equation during the year.

The major ports handled a total traffic of 569.91 million tonnes during 2010-11 against 561.09 million tonnes during 2009-10. Traffic handled by major ports during 2009-10 and 2010-11 is as below:

Traffic Handled at Major Ports

2009-10 & 2011-11

(In million tonnes)

Sl. No.	Ports	2009-10	2010-11
1A.	Kolkata	13.05	12.54
1B.	Haldia	33.79	34.89
2.	Paradip	57.01	56.03
3.	Vizag	65.50	68.04
4.	Ennore	10.70	11.01
5.	Chennai	61.06	61.46
6.	V.O.Chidambarnar (Tuticorin)	23.79	25.73
7.	Cochin	17.43	17.87
8.	New Mangalore	35.53	31.55
9.	Mormugao	48.85	50.02
10.	Mumbai	54.54	54.56
11.	JNPT	60.76	64.30
12.	Kandla	79.50	81.88
	Total	**561.09**	**569.91**

Figures rounded off.

Source:*Indian Ports Association.*

The commoditywise traffic handled at twelve major ports during 2009-10 and 2010-11 is as below :

(In '000 tonnes)

Sl. No.	Commodity	2009-10	2010-11
1.	P.O.L	175081	180363
2.	Iron ore	100333	87306
3.	a) Fertilizer (Final)	10939	12413
	b) Fertilzer (Raw)	6778	7620
4.	a) Thermal coal	43375	44257
	b) Coking coal	28334	28498
5.	Containerised cargo	101242	114040
6.	Other	95008	95411
Total		**561090**	**569908**

Source:*Indian Ports Association.*

3. PORTWISE REVIEW OF MAJOR PORTS

EAST COAST

3.1 Kolkata - Haldia

Kolkata Port is the oldest (established in 1870) and the only riverine major port in India. The port was catering to the entire Eastern India and two landlocked neighbouring countries, Nepal and Bhutan. Kolkata Port Trust (KPT) has twin dock system, viz, Kolkata Dock System (KDS) on Eastern bank of river Hoogly and Haldia Dock Complex (HDC) started in 1971 on the Western bank of the river Hoogly.

During 2010-11 the break up of traffic handled is as under:

Kolkata: 12.54 million tonnes, and

Haldia: 35.00 million tonnes.

Handling capacity of the port as on 31.3.2011 was as below:

Kolkata: 20.86 million tonnes, Haldia 50.70 million tonnes. The largest size of the empty vessel that can be received at the Kolkata Port is 484,276 dwt. At Haldia Dock Complex, an empty vessel having up to 1,50,000 dwt can enter the dock.

Salient Features of Kolkata - Haldia Port

Port	Draft (m)		No. of berths	No. of moorings	No. of wharves	Stacking area provided (sq m)
	min	max				
Kolkata	5.1	8.5	33	24	4	134722 (Transit Shed) + 10794 (Warehouse)
Haldia	6.1	8.1	17*	–	–	25040 (Transitshed) 892840 (open area)

** Including three oil jetties and 2 barge jetties*

Following two scheme at Kolkata Dock System (KDS) were physically completed during 2010-11.

1. Replacement/ Refurbishment/Acquisition of various Cargo Handling equipment.
2. Upgradation of Navigational facilities and associated systems.

Both Kolkata Dock System and Haldia Dock Complex of Kolkata Port have been awarded ISO-9001:2000 certification. The port is also ISPS compliant. For promotion of Inland Water Traffic and River Tourism, New Inland Water Transport Terminal (IWT) and renovation of port-owned riverside jetties are underway.

The traffic in mineral/ore/mineral-based commodities handled in 2009-10 and 2010-11 was as under:

(In '000 tonnes)

Commodity	Exports		Imports	
	2009-10	2010-11	2009-10	2010-11
Thermal coal	1489	2173	_	_
Coking coal	–	–	6075	6010
Iron ore	8709	6215	_	_
Rock phosphate	–	–	97	144
Sulphur	–	–	65	45
Mica	82	_	_	_
Metallurgical coke	_	12	173	21
Limestone	–	–	499	754
Petroleum coke	–	–	99	_
Bauxite	_	-	–	1
Ferro-chrome	107	58	–	–
Non-coking coal	–	–	1766	1818
Manganese ore	–	–	607	665
Carbon black	24	1	7	_
Silicon/ Silicon Manganese	_	19	1	1

Wharfage

Wharfage on foreign Cargo landed/shipped at Kolkata Port Trust w.e.f. 17.3.2011.

(₹ per tonne)

Sl. No.	Item	Rate
1.	Crude oil	76.50
	Cargo handled through Mechanical system	
2.	Export Iron ore	38.88
3.	Export Thermal Coal	43.74
4.	All other types of coal not specified, Fertilizer, Fertilizer raw materials, soda ash, and all other dry bulks	87.48
	Cargo handled through other than Mechanical system	
1.	Salt, Fly ash	19.44
2.	Iron ore, sand	19.44
3.	Limestone, Bitumen, Pig iron, sponge iron and other ferrous metals, All types of coal/coke/ore/other dry bulk cargo not specified	38.88
4.	Cement, Clinkers, Gypsum, Slag	48.60
5.	Magnesite, granite, all types of Scraps, fire bricks and other refractory materials, mica block/flake/splittings/waste/scrap/ powder mica, non-ferrous metals of all kinds except ingot of zine/aluminium/copper, lead,c.i. goods, rock phosphates, sulphur, other fertilizer raw materials, fertilizers, lead conc., asbestos.	68.04
6.	Iron & steel, pipes & tubes	58.32
	Wharfage on coastal cargo landed/shipped at/ from Kolkata Port Trust	
1.	Crude oil, Thermal coal, Iron ore and Iron ore pellets	Same as Foreign cargo.
2.	All other cargo	60% of the rate for foreign cargo as specified for foreign cargo.

3.2 Paradip

The only major sea port in Odisha is Paradip serving eastern and central part of the country. It's hinterland extends across Odisha, Jharkhand, West Bengal, Madhya Pradesh and Bihar.

Salient Features of Paradip Port

Draft (m) min	Draft (m) max	No. of berths	No. of moorings	No. of wharves	Stacking area provided (sq m)
11.0	13	14	1	–	–

The port handled 54.25 million tonnes of cargo during 2011-12 and during 2010-11, it was 56.03 million tonnes, respectively.

The largest vessel that can be handled is of 70,000 dwt. The following developmental projects were ongoing:-

1. Deepening of existing entrance and approach channel to handle 1,25,000 dwt vessels. Work is under progress. The depth of the entrance channel and approach channel will be increased from 13.00 metres to 17.00 metres and 15.00 metres to 18.70 metres, respectively. Anticipated date of completion of this project was 31.3.2012.
2. Construction of Deep Draught Iron Ore berth on BOT Basis-10 million tpy capacity:
   Concession agreement has been signed in 2009 with M/s. Blue Water Iron Ore Terminal Pvt. Ltd. The project is expected to be completed by 30th June, 2014.
3. Construction of Deep Draught Coal Berth on BOT Basis - 10 million tpy capacity:

   Concession agreement has been signed on 10.11.2009 with M/s. Essar Paradip Terminal Pvt. Ltd. The project is expected to be completed by 30th June, 2014.
4. Construction of New Haridaspur-Paradip railway line:

   The work is under progress. A joint venture company RVNL is taking up construction of this railway link beween Haridaspur and Paradip which is 82 km in length. There will be a considerable reduction of the distance from Banspani to Paradip and freight will be reduced by 50%. (Contd.)
5. Construction of concrete road from Paradip to Cuttack (SH-12):

   Work is under progress.
6. Development of multipurpose berth to handle clean cargo including container on BOT basis 5 million tpy.

3.3 Visakhapatnam

It is a natural harbour. Visakapatanam port handled 65.50 million tonnes traffic in 2009-10 and 68.04 million tonnes traffic in 2010-11. The largest size of vessel that can be handled in the inner harbour is 11 m draft and in the outer harbour 150,000 dwt. This is the only port having three international accreditations; viz, ISO 14001; 2004 (EMS)/OHSAS/8001 and ISO 9001; 2000 (QMS).

Salient Features of Visakhapatnam Port

	Draft (m) min	Draft (m) max	No. of berths	No. of moorings	No. of wharves	Stacking area provided (Sq. m.)
Inner harbour	10.90	11.00	18	–	–	NA
Outer harbour	–	17.00	6	2	–	NA

Commodities handled by Visakhapatnam port in 2009-10 and 2010-11were as follows:

(In tonnes)

Commodity	Exports 2009-10	Exports 2010-11	Imports 2009-10	Imports 2010-11
Anthracite Coal	7832	-	123180	148324
Bentonite	-	-	22900	61500
LAM coke	-	-	555428	190607
Granite	153291	144036	-	-
Limestone	140568	-	412076	493520
Manganese ore	-	139200	801191	235736
Coking coal	515407	582471	7435641	7343803
POL (crude)	-	-	11837132	11567790
Ilmenite sand	115280	288455	-	-
Steam coal	-	-	2718374	2614787
Chrome ore	-	-	15651	15549
Bauxite	-	-	684270	323415
Iron ore	14384168	14415237	729138	63500

Following development plans of port were undertaken during 2010-11:

1. Deepening of inner harbour entrance channel and turning circle, 12.5 m draft and 14 m draft to facilitate navigation of Panamax vessels.
2. Various schemes of development of roads/ improvement of port railway system at various operational areas have been taken up and are in progress.
3. Modernisation of Railway Sidings facilities are under progress.
4. Strengthening of 5 berths EQ5, EQ6, WQ1 in the inner harbour to cater to 12.5 m draft vessels is in progress.

3.4 Ennore

Ennore port is situated on the Coromandal coast about 24 km north of Chennai port along the coastal line in Tamil Nadu. Ennore port has been endowed with large chunks of land. The facilities available at Ennore port are as below:

1.	Berth	2 (Thermal Coal)
	Max permissible Length	280 metres each
	Max permissible Draught	15 metres (BCD)
	Capacity Other berth	8 MTPA
2.	Size of vessels that can be accommodated	65000/70,000 DWT
3.	Break water	
	South	1070 metres
	North	3080 metres
	Type	Rubble mound with accropode armour protection.
4.	Approach Channel	
	Length	3775 metres
	Width	250 metres
	Depth	16 metres BCD
5.	Connectivity	Excellent road connectivity to NH4, NH5, NH45 linked to Chennai-Kolkata BG main line. Connectivity to Chennai airport.

Wharfage

Cargo related charges w.e.f. 21.8.2010 are as below:

S.No.	Nomenclature	Unit	Rate
1.	Coal and Coke	1 tonne	₹ 130.00
2.	Other goods	1 tonne	₹ 60.00
3.	Other goods	Advalorem	₹ 0.5%

Traffic handled during 2009-10 and 2010-11 is as below:

(In million tonnes)

S.No.	Mineral	2009-10	2010-11
1.	Coal	9.279	9.37
2.	Iron ore	0.936	0.40
3.	POL	0.488	0.59
4.	Other cargo	-	0.65

The Ennore port handled 11.01 million tonnes traffic in 2010-11 compared to 10.70 million tonnes during 2009-10.

The Ennore port was originally conceived as a satellite port to the Chennai port, primarily to handle thermal coal to meet the requirement of Tamil Nadu Electricity Board (TNEB). The scope was expanded to set up (i) 1,880 MW LNG Power Project; (ii) a large Petro Chem Park and (iii) A Naptha Cracker Plant.

This was the rationale behind planning of berths for coal (for users other than TNEB), iron ore, LNG, POL, chemicals and other liquids and crude to serve various industries that would come up on the proposed Petro Chem Park. These factors have contributed to the evolution of Ennore port as a multi-functional energy port of the millenium.

In order to equip the port to handle the traffic forecast stated above, the port initiated in 2008 the Second Stage Development consisting of Marine Liquid Terminal - I, Coal Terminal for non-TNEB coal, Iron Ore Terminal, Container Terminal-Phase-1, LNG Terminal, Car Export Terminal, and Deepening the Port to handle cape size vessels (150,000 dwt).

Subsequently, based on the demand in the trade and potential of the port, EPL has planned further development of facilities like :Additional coal berths for handling additional coal requirement of TNEB/JV of TNEB; Second and Third container terminal in a dock basin that can be created to the east of General cargo berth; and Second Marine Liquid Terminal to the south of the first terminal.

All the above developments are included in the Master Plan and it is envisaged that Ennore Port will be able to handle an annual traffic of 126 million tonnes plus 2 lakh cars.

3.5 Chennai

The port at Chennai is an artificial harbour situated on the Coromandal coast in south-east India. The handling capacity of the port in 2010-11 was 79.72 million tonnes. The largest size of the vessel that can be received at the port is 175,000 dwt, having a maximum 17.4 m draft and maximum 280 m overall length.

Salient Features of Chennai Port

Draft (m)		No. of berths	No. of moor-ings	No. of wharves	Stacking area provided (Sq.m.)
min	max				
8.5	17.4	24	–	–	46100

Ongoing projects:

Elevated Port Link road, modernisation of the Chennai Port, additional open storage area by reclamation, development of additional open storage yard, Chennai Ennore Port road connectivity, development of Chennai Mega Terminal, deepening of channels, basins and berths are ongoing projects.

The total traffic handled by the Chennai port during 2010-11 was 61.46 million tonnes. The traffic in mineral/ore/ mineral-based commodities handled by this port (excluding commodities handled in containers) during 2009-10 and 2010-11 is given below:

(In tonnes)

Commodity	Exports		Imports	
	2009-10	2010-11	2009-10	2010-11
Barytes	746011	571000	-	-
Coal	-	-	7967976	7109000
Coke & briquettes	-	-	1789954	606000
Fluorite	-	-	19940	26000
Iron ore	7130652	2115000	-	-
Iron ore lumps	896309	198000	-	-
Manganese ore	95000	11000	-	-
Non-ferrous metals	-	-	5106	-
Bauxite	-	-	7362	2000
Dolomite	-	-	-	618000
Limestone	-	-	-	1048000

Wharfage

Wharfage levied by Chennai Port Trust in 2009-10 were as follows:

(In ₹ per tonne)

Item	Rate
1. Manual handling	
i) Ores and minerals in bulk handled by importers for foreign & coastal vessels	28.60
ii) Ores and minerals in bulk handled by exporters for foreign & coastal vessels	16.50
2 Mechanical handling	
i) Iron ore handled mechanically or through handling system at Bharathi Dock	85.00
ii) Charges for cleaning the ore handling system for receiving the shipment of iron ore fines/calibrated iron ore	2.00

Note: *The rates specified at item 2(i) are inclusive of all operations from the time of tippling the iron ore from the wagon by the wagon tippler to putting it into the holds of the vessel, cleaning the system, cleaning the spillages, dust and trimming operations of the ship, if any, required and wagon damages; but exclusive of all the railway operations connected with the movement of iron ore for which charges are leviable as per the Scale of Rates.*

3.6 V.O.Chidambaranar (Formerly, Tuticorin)

Tuticorin Port Trust has been renamed V.O. Chidambaranar Port trust w.e.f. 19.2.2011. Tuticorin port is situated on the eastern coast in Tamil Nadu.

It has two operating wings viz, Zone A, comprising new major port, and Zone B, representing old anchorage port. The largest size of vessel that can be received at the port is 73,879 dwt with length of 245 m at Berth No. VIII. Handling capacity of the port in 2010-11 was 23.72 million tonnes. Zone B can handle lighterage vessels.

Salient Features of Tuticorin Port

Draft (m) min	Draft (m) max	No. of berths	No. of moor-ings	No. of wharves	Stacking area provided (Sq.m.)
5.85	10.90	14	–	–	553000

The total traffic handled by the V.O.C port during 2010-11 was 25.73 million tonnes and during 2009-10, it was 23.79 million tonnes. The traffic in mineral commodities handled in 2009-10 and 2010-11 was as under:

(In tonnes)

Commodity	Exports		Imports	
	2009-10	2010-11	2009-10	2010-11
Copper conc.	-	19528	1182742	1194245
Garnet sand	23473	38378	-	-
Ilmenite sand	204834	313320	-	-
Iron ore	41135	63575	-	-

Development projects undertaken by the V.O.C port during 2010-11 and under progress include deepening the channel and basin to cater to 12.80 m draught vessels, construction of North Cargo Berth-I for captive use of NTPL, construction of North Cargo Berth-II for handling bulk cargoes on DBFOT basis, construction of 2 shallow water berths for handling cement and construction material, conversion of Berth No. 8 as container Terminal, providing mechanical handling equipment for bulk handling at Berth No.1 to 6 and 9, development of passenger Terminal for ferry services between Tuticorin to Colombo.

WEST COAST

3.7 Kandla

This port is a natural harbour situated on the western coast of Gujarat. The handling capacity in 2010-11 was 81.88 million tonnes. The largest size of vessel that can be received at this port is 80,170 dwt during 2010-11.

Salient Features of Kandla Port

	Draft (m) min	Draft (m) max	No. of berths	No. of moor-ings	No. of wharves	Stacking area provided (sq.m.)
Dry cargo	9.10	12.00	2*	–	12	There is no special stacking area for mineral commo-dities
Liquid cargo	10.00	10.70	6	5	6	–

** Included 2 cargo berth operated by private operator.*

In additon, there was maintenance jetty for floating dry docks and maintenance of port craft, three single buoy moorings to handle very large crude carriers for import of crude oil, two Essar product jetties to handle POL carriers for export at Vadinar and a minor port Tuna 24 km south of Kandla for handling country crafts. Barges handling operations for coal and fertilizer vessels have commenced from July, 2009. A Bunder basin for handling through barges and country crafts also operates.

The total traffic handled by the Kandla port during 2010-11 was 81.88 million tonnes as against 79.50 million tonnes in 2009-10. The traffic in mineral/ore/mineral-based commodities handled in 2009-10 and 2010-11 was as under :

(In tonnes)

Commodity	Exports		Imports	
	2009-10	2010-11	2009-10	2010-11
Bentonite	140102	141122	-	-
Fertilizer	-	-	4911994	5806780
Rock phosphate	-	-	656000	483967
Salt	2079301	2846918	-	-
Sulphur	-	-	131951	98800
Zinc conc.	242984	123421	-	-
Copper conc.	-	-	5255	10200
Lead conc.	27113	-	-	-

Wharfage

Wharfage levied by Kandla Port Trust as on 31.3.2011 were as follows:

(In ₹ per tonne)

Commodity	Coastal Rate	Foreign Rate
Liquid cargo		
i) Crude oil	12.00	12.00
ii) LPG (per cu m)	60.00	100.00
iii) POL products (bulk)	26.20	26.25
Fertilizer and raw material including sulphur	14.40	24.00
Cement & clinker	10.80	18.00
Ores and minerals (in all forms)	8.10	13.50
Granite and marbles	10.80	18.00
Metal (ferrous/non-ferrous) (including pipes, plates, pig iron, coil, sheet)	18.00	30.00
Metal scrap	21.60	36.00
Construction materials and sand	8.10	13.50
Coal and coke	10.80	18.00
Salt	1.80	3.00
Dry chemicals including soda ash	10.80	18.00

Note: *In addition to above rates, cargoes other than bulk; i.e., break-bulk and non-containerised shall be charged @ ₹ 18.00 per tonne for foreign and ₹ 10.80 per tonne for coastal cargo supply of port labour.*

3.8 Mumbai

Mumbai port is a natural deep water multi-purpose port handling all types of cargo-liquid bulk, dry bulk, break bulk and container. The handling capacity of this port in 2010-11 was 48.70 million tonnes, including 6 million tonnes at anchorage. Salient features of Mumbai port are as follows:

Salient Features of Mumbai Port

Draft (m) min	Draft (m) max	No. of berths	No. of moorings	No. of wharves	Stacking area provided (sq m)
8	10.5	27	–	Berths have wharves of different lengths	No special facility for handling minerals

The total traffic handled by the Mumbai port during 2010-11 was 54.59 million tonnes compared to 54.54 million tonnes in 2009-10. The traffic in mineral/ore/mineral-based commodities handled in 2009-10 and 2010-11 was as under :

(In tonnes)

Commodity	Exports		Imports	
	2009-10	2010-11	2009-10	2010-11
Other ores	8713	1529	105609	136868

Wharfage

Wharfage levied by the Mumbai Port Trust in 2010-11 was ₹ 34.50 per tonne of mineral/ore for import and export by foreign & coastal vessels. Loading and unloading is done by the consignees/consigners and therefore, no charges are recovered by Mumbai Port Trust.

3.9 Mormugao

Mormugao port is one of the country's old ports on the west coast of India with modern infrastructural facilities and one of the finest natural harbours in the world.

The entire output of iron ore from Goa and considerable quantity of iron ore from Bellary-Hospet is exported through this port. Maximum exports of iron ore take place through this port.

The total handling capacity of this port in 2010-11 was 28.30 million tonnes for iron ore and other ores and 5.00 million tonnes for coal/coke. The largest vessel that can be received at Berth No. 9 of this port is about 275,000 dwt.

Salient Features of Mormugao Port

Draft (m) min	Draft (m) max	No. of berths	No. of moorings	No. of wharves	Stacking area provided (sq m)
-	14.0	3	3	–	80000 (attached to Berth No. 9) &, approx. 30000 (to berth 5 & 6)

The demand for Mooring Dolphins particularly during monsoon period is heavy and also for export of iron ore through this facility.

Ore ships are loaded in mid-stream by transhippers. There are five such transhippers and one floating crane owned and operated by private parties and their aggregate assessed loading capacity is 11.50 million tonnes per annum. Ore ships are also loaded by ships Gears. At West of Break Water (WOB), there is no draft restriction. At times large size vessels requiring higher drafts are initially loaded at MOHP (Berth No.9) up to permissible limit and then at outer anchorage (WOB) by transhippers. Ore loaded at these facilities is brought by barges from hinter land through inland waterways.

Development of the port was undertaken during 2010-11, as per following details:

i) Construction of 4 lane road from Verna Junction on NH-17 to Sada Junction including flyover from Gate No. 9 to NH-17B near Ravindra Bhavan Baina Bay.

ii) Construction of additional 3 numbers of Mooring Dolphin.

iii) Construction of a Jetty for relocation of port crafts and small boats.

iv) Strengthening of the Break water mole.

v) Development of coal import Terminal at Berth No.7 of Mormugao Port on DBFOT basis.

vi) Construction of non-cargo berth alongside break water.

The total traffic handled by the Mormugao port during 2010-11 was 50.02 million tonnes compared to 48.85 million tonnes in 2009-10. The traffic in mineral/ore/mineral-based commodities handled in 2009-10 and 2010-11 was as follows:

(In tonnes)

Commodity	Exports 2009-10	Exports 2010-11	Imports 2009-10	Imports 2010-11
Iron ore	40039835	40119049	253846	275881
Iron ore pellets	280496	229609	-	-
Bauxite	105276	25200	-	-
Coke	20554	20370	878791	345047
Coal	29000	-	4712365	6566056

Wharfage

Wharfage (wharf dues including unloading, stacking, plot rent and loading charges, etc.) rate levied by Mormugao Port Trust in 2010-11 was as below:

Mineral /ore	Rate (₹/tonne)	Remarks
1. Bauxite	30.00	At Berth
2. Coal/coke	18.00 30.00	At Mooring Dolphin At Berth

Iron Ore and pellets handling charges (exported through MOHP at Berth No. 9) are as below:

Sr. No.	Description Goods	Import/ Export rate per tonne or part thereof (in ₹)
1.	Iron ore	84.24
2.	Iron ore pellets	
(i)	During the period June to August each	90.08
(ii)	During the fair season beginning from September to May each year	158.99

3.10 New Mangalore

The port has a modern all weather artificial lagoon situated at Panombur, Mangalore in Karnataka on the west coast of India.

The handling capacity of this port in 2010-11, was 31.55 million tonnes. The largest vessel that can be received at this port is 90,000 tonnes.

Salient Features of New Mangalore Port

Draft (m) min	Draft (m) max	No. of berths	No. of moorings	No. of wharves	Stacking area provided (sq m)
7.0	14.0	13	–	1	58391 open area

Development of coal handling facilities for captive user under BOT basis was undertaken during 2010-11.

The traffic in mineral/ore/mineral-based commodities handled in 2009-10 and 2010-11 was as follows:

(In tonnes)

Commodity	Exports		Imports	
	2009-10	2010-11	2009-10	2010-11
* Bentonite	-	-	23400	45735
Bauxite	14935	-	-	-
Coal	19000	26367	2790973	2830244
Granite	18052	34843	-	-
Crude oil	-	-	12753748	12392779
Iron ore/fines/ pellets	6715743	3114977	345693	628811
Limestone	-	-	1127539	326039
Slag	4009	-	-	-
Gypsum	-	-	-	84888
Rock powder	19772	-	-	-

** Relates to coastal ports of origin.*

Wharfage

Wharfage (wharf dues including unloading, stacking, plot rent and loading charges, etc.) levied by New Mangalore Port in 2010-11 was as follows:

Commodity	Rate (₹ per tonne)
Iron ore pellets	50.00
Iron ore fines	35.00
Crude oil	70.00
Coal	25.00
Limestone	35.00
Bauxite	21.00
Granite stones	45.00
Bentonite	20.00
Slag	25.00
Gypsum	30.00

3.11 Cochin

The handling capacity of this port in 2010-11 was 40.98 million tonnes. The largest size of vessels that can be received at this port is 3,00,000 dwt.

Salient Features of Cochin Port

Draft (m) min	Draft (m) max	No. of berths	No. of moorings	No. of wharves	Stacking area provided (sq m)
9.14	12.5	20	2	2	48838.31

The total traffic handled by the Cochin port during 2010-11 was 17.87 million tonnes. The traffic in mineral/ore/mineral-based commodities handled during 2009-10 and 2010-11 was as under:

(In '000 tonnes)

Sl. No.	Mineral/ore	Export		Import	
		2009-10	2010-11	2009-10	2010-11
1.	Coal	-	-	148	40
2.	Crude	118	102	8291	8761
3.	Zinc concentrate	-	-	76	77
4.	Clay	-	25	-	1
5.	Gypsum	-	-	54	-
6.	River sand	-	-	51	3
7.	Sulphur	-	-	156	194
8.	Rock phosphate	-	-	55	158
9.	Salt	-	-	69	63
10.	Bauxite	-	-	-	2
11.	Slag	-	-	4	-
12.	Ilmenite sand	-	-	9	-
13.	Granite	1	17	18	-
14.	LPG	23	-	23	-

Figures rounded off.

Wharfage

Wharfage levied by the Cochin Port were as follows:

(In ₹ per tonne)

Sl. No.	Commodity	Foreign	Coastal
1.	Asbestos	84.00	50.40
2.	Construction and building materials-		
	(a) Sand, stones	52.00	31.20
	(b) Granites & marbles	67.00	40.20
	(c) Cement, clinker, clay, chalk	72.80	43.70
3.	(a) Coal/coke	56.00	33.60
	(b Thermal coal	56.00	56.00
4.	Fertilizer and fertilizer raw material at Q 10 Berth		
	(a) Sulphur	62.00	37.20
	(b) Rock phosphate	57.00	34.20
	(c) Finished fertilizers	57.00	34.20
5.	Metals and metal product	112.00	67.20
6.	Metal scrap	90.00	54.00
7.	Liquid Cargo, acids-		
	(a) Phosphoric acid	109.20	65.50
	(b) Liquid ammonia	119.00	71.40
	(c) POL & POL products	65.00	65.00
8.	Minerals & ores	72.80	43.70
9.	Salt	14.00	8.40
10.	Fertilizer and fertilizer raw material at Other Berth		
	(a) Sulphur	86.80	52.10
	(b) Rock phosphate	79.80	47.90
	(c) Finished ferilizer	79.80	47.90

3.12 Jawaharlal Nehru Port (JNPT), Nhava-Sheva, Navi Mumbai

JNPT does not have any facility to handle ore/minerals, separately. JNPT has become a world class international container handling port. The largest size of the vessel that can be received at the port is 100,000 dwt. The handling capacity of JN Port as on 31.3.2009 was 57.96 million tonnes.

The total traffic handled by the port during 2010-11 was 64.31 million tonnes and during 2011-12, it was 65.75 million tonnes. Port has not handled any mineral/ore cargo during 2010-11 & 2011-12.

Salient Features of Jawaharlal Nehru Port

Draft (m)		No. of berths	No. of moorings	No. of wharves	Stacking area provided (sq m)
min	max				
–	12.5	12	3 Tugs 7 Launches	5	1422614

4. NON-MAJOR PORTS

The available information on traffic handled by non-major ports during 2008-09 to 2010-11 is furnished in Table-2 and that on facilities for handling and transporting minerals from selected non-major ports is given in Table-3.

There are 200 non-major ports in the country controlled by State Governments and Union Territories. These are in Gujarat (42), Maharashtra (48), Goa (5), Karnataka (10), Kerala (17), Tamil Nadu (15), Andhra Pradesh (12), Odisha (13), West Bengal (1), Daman & Diu (2), Lakshadweep (10), Puducherry (2) and Andaman & Nicobar Islands (23). Traffic at non-major ports and private ports is growing at 11.74% and their share is expected to grow from 26.30% in 2005-06 to 30% during 2011-12.

Minor Port Survey Organisation (MPSO), a subordinate office of Ministry of Shipping, Government of India, located at Mumbai, carries out the task of Hydrographic Survey in minor and major ports and inland waterways. The Governments of Gujarat, Maharashtra and Andhra Pradesh have taken several initiatives for developments of their ports through private investments.

Gujarat Maritime Board (GMB) is a Government of Gujarat Undertaking. Along the 1600 km of coastline of Gujarat, there are 41 ports of which Kandla is a major port. Out of remaining 40 ports, 11 are intermediate ports and 29 are minor ports under the control of Gujarat Maritime Board. Those ports can be broadly classified into three categories:-

1. Three all wheather ports viz. Porbandar, Okha and Sikka with all weather direct berthing facilities.

2. Seven ports are all weathered lighterage ports.

3. The remaining thirthy ports are fair weather lighterage ports for sailing vessels and fishing boats.

The minor and intermediate ports of Gujarat handled about 8.5% of national Shipping Cargo. Neverthless, Gujarat ports handle about 16 million tonnes of cargo which accounts for 70% of the total cargo handled by all major ports of India.

GMB has handled traffic of 205.51 MMT during 2009-10 . GMB has attained a considerable growth rate of 34% during 2008-09 compared to previous year.

The Government of Maharashtra has encouraged development of port sector and adopted an investor-friendly port policy. To develop the port sector for meeting the requirements of India's growing economy and to address the need of its industry, Maharashtra Maritime Board (MMB) has entered into six concession agreements for development of minor ports namely Rewas-Awaare Port, Dighi Port, Jaigad Port (Lavgan), Vijaydurg Port, Redi Port, etc.

Besides, Andaman Lakshdweep Harbour Works (ALHW) is a subordinate office of Department of Shipping, Government of India. It has the responsibility for providing port and harbour facilities in Andaman & Nicobar Islands and Lakshdweep Islands.

Table-2: Traffic Handled at Non-major Ports

2008-09 to 2010-11

(In '000 tonnes)

Commodity	2008-09	2009-10	2010-11
i. POL	97816	137720	145378
ii. Iron ore	35863	48813	38266
iii. Building Material	13259	13142	12327
iv. Coal	21457	41276	58462
v. Fertilizers (including Raw Materials)	8855	9501	12725
vi. Others	35972	38485	48200
Total	**213222**	**288937**	**315358**

Source: *Update on Indian Port Sector (31.3.2012), Transport Research Wing, Ministry of Road Transport & Highways, Government of India.*

Table – 3 : Facilities for Handling & Transporting and Mineral Commodities Handled at Selected Non-major Ports, 2009-10 and 2010-11

State/ Port	Facilities for Handling & Transporting						Mineral Commody Handled (in tonnes)				
	Handling capacity ('000t)	Draft max (m)	No. of wharves	No. of berths	Stacking capacity (sq m)	Largest vessel received ('000 dwt)	Commodity	Export 2009-10	Export 2010-11	Import 2009-10	Import 2010-11
WEST COAST											
GUJARAT											
Bhavnagar	700 to 800	12	2	1	249039	-	Coal	-	-	52154	200738
							Limestone	-	-	-	101985
Bedi, Jamnagar	-	14	-	-	-	-	Bauxite	206561	-	-	-
Dahej Harbour and Infrastructure Ltd	3500	13.0	-	1	16500	76.75	Coal	-	-	463816	315091
							Rock phosphate	-	-	469876	371603
							Copper concentrate	-	-	1221061	1266257
Jafarabad	40	9	-	1	-	46.75	Cement clinker	4886231	4073974	-	-
							Coal	-	-	393578	388988
							Gypsum	-	-	26931	-
							Limestone	-	-	34800	-
Magdalla Surat	–	3.5	–	11	30129	175.85	Coal	-	-	2957239	4141207
							Iron ore	-	-	5289027	6970266
							*Limestone	18500	-	369805	844700
							*Iron ore fines	948593	4989	165530	108660
Navalakhi	4500	5.0	5	5	172550	151.330	Gypsum	-	-	-	37700
							Salt	120000	204685	-	-
							Coal	-	-	4344358	4244147
							Cement	-	-	-	32850
Okha	1150.74	8.0	2	2	50000	-	Bauxite	411112	-	-	-
							Limestone	-	-	-	420420
							Coal	-	-	545554	681189
							Gypsum	-	-	25412	-
Pipavav	4000	14.5	-	5	-	90.0	Rock phosphate	-	-	-	36300
							Limestone	19506	-	171376	541046
							Gypsum	2099	-	156326	123814
							Bauxite	-	-	79625	50821
Porbandar	4700	9.5	NA	2	243000	55.7	Coal	-	-	285334	395395
							Cement	395974	148631	-	-
							Clinker	140698	214213	-	-

(Contd.)

Table - 3 (Contd.)

State/ Port	Facilities for Handling & Transporting: Handling capacity ('000t)	Draft max (m)	No. of wharves	No. of berths	Stacking capacity (sq m)	Largest vessel received ('000dwt)	Mineral Commodity Handled (in tonnes): Commodity	Export 2009-10	Export 2010-11	Import 2009-10	Import 2010-11
Sikka	-	-	-	-	-	-	-	-	-	-	-
Veraval Port	73.55	3.5	-	2	30000	-	-	-	-	-	-
Mandri Port	-	4.0	1	1	-	-	Bentonite	-	97370	-	-
							Bauxite	-	80766	-	-
							China clay	-	36750	-	-
Jakhau Port	-	6.0	-	3	-	-	Coal	-	-	359434	386513
MPSEZ LTD Mundra	36287	15.5	-	7	30000	176838	Bentonite	176000	332057	-	-
							Kaolin	105093	61300	-	-
							Clay	-	-	17570	23844
							Bauxite	166490	307821	-	-
							Gypsum	-	-	31179	-
							Salt	-	32200	-	-
							Cement	-	50	-	-
							Clinker	-	39412	-	-
KARNATAKA											
Belikori	60.9	No restriction	2	60000 (Iron ore) 20000 (Mn ore)	–	–	NA	NA	NA	NA	NA
Karwar	–	3.5	1	2	50 (acre)	60	–	–	–	–	–
Kundapura	200	4.50	-	2	12000	2	–	–	–	–	–
MAHARASHTRA											
Dahanu	445	6.0	-	1	-	-	NA	NA	NA	NA	NA
Dharamtar	5088	5	-	2	-	-	NA	NA	NA	NA	NA
Dighi	2	10	–	1	–	–	NA	NA	NA	NA	NA
Jaigad	371	5.5	–	–	–	–	NA	NA	NA	NA	NA
Kelshi	305	3.0	1	1	–	0.8	NA	NA	NA	NA	NA
Ratnagiri	365	5	–	1	–	–	NA	NA	NA	NA	NA
Redi	529	4.0	–	2	–	–	NA	NA	NA	NA	NA
Revdanda	1029	8.0	–	–	–	–	NA	NA	NA	NA	NA

(Contd.)

Table - 3 (Concld.)

State/ Port	Facilities for Handling & Transporting: Handling capacity ('000t)	Draft max (m)	No. of wharves	No. of berths	Stacking capacity (sq m)	Largest vessel received ('000dwt)	Mineral Commodity Handled (in tonnes): Commodity	Export 2009-10	Export 2010-11	Import 2009-10	Import 2010-11
EAST COAST											
ANDHRA PRADESH											
Kakinada # (Anchorage Port)	819502	Open road-sted-port, no separate stacking yard for minerals					Cement (million tonne)	54.29	NA	NA	NA
							Rock Phosphate (million tonne)	NA	NA	8.5	NA
							Non Coking (million tonne)	NA	NA	154.5	NA
(Kakinada 3 ships deep water port)	NA	9.5	–	–		NA	NA	NA	NA	NA	NA
Krishnapat-anam	10000	14.2	–	4	277548	120	Iron ore	NA	NA	NA	NA
							Gypsum	NA	-	NA	NA
							Rock phosphate	NA	-	NA	NA
Rawa	2500	–	–	–	–	–	–	NA	NA	NA	NA
TAMIL NADU											
Cuddalore	2000 t/day	@	–	–	80000	@@	–	-	-	-	-

** Relates to Indian coastal destinations/port of origin.*
@ not applicable being a roadstead port
@@ Any size being an anchorage port
 # Two ports namely 1. Kakinada Anchorage Port working under Govt. of Andhra Pradesh and 2. Kakinada deep water port working under private organisation M/s Kakinada Sea Port Ltd in East Godavari district, Andhra Pradesh. are working at Kakinada. Two more ports namely, 1. Gangavaram Port in Visakhapatnam district owned by M/s Gangavaram Port Ltd and 2. Krishnapatnam Port in Nellore district owned by Krishnapatanam Port Ltd.

5. PRIVATE PORTS

5.1 Major Development Projects

International Container Transhipment Terminal (ICTT) at Vallarpadam

The International Container Transhipment Terminal (ICTT), Vallarpadam India's first dedicated International Container Transhipment Terminal. It was developed by Cochin Port Trust and M/s India Gateway Terminal Terminal Pvt. Ltd (IGT), a subsidiary of M/s Dubai Port Wrold (DPW) through a Public Private Partnership on Build, Operate and Transfer (BOT) basis. It was dedicated to the nation by the Hon'ble Prime Minister of India on 11th February, 2011. This is a major miletone achieved in maritime sector in the development of the country's logistics infrasructure. The ICTT has been developed in with facilities for handling mother container ships of 8000 - plus TEUs capacities and is a state-of-the-art terminal with modern cargo handling equipment and related super-structures to have an annual throughput of 3 million TEUs. The BOT operator has completed the construction of phase-1 of the Terminal with an investment of approximately ₹ 1,600 crore. The first phase has a quay length of 600 m, with a handling capacity of one million TEUs. This will be increased to 1,800 m in the final phase.

5.2 Mundra Port and Special Economic Zone Limited (MPSEZL)

The largest private port and special economic zone of India was incorporated as Gujarat Adani Port Limited (GAPL) at inception in 1998 to develop a private port at Mundra, on the west coast. The company commenced commercial operations in October 2001. Mundra Special Economic Zone Limited (MSEZL) was later incorporated in November 2003, to set up an SEZ at Mundra. MSEZL was subsequently merged with GAPL in April 2006 and the company was renamed as Mundra Port and Special Economic Zone Limited. Mundra Port provides cargo handling and other value-added port services. Mundra SEZ is India's first port-based multi-product SEZ.

Mundra Port is strategically located for global trade on the northern coast of the Gulf of Kachchh in Gujarat on the west coast of India. Mundra Port provides a convenient international trade gateway to Europe, Africa, America and the Middle East. Mundra has a deep draft (12.5 m – 17 m) which enables large vessels like Panamax and Super Post Panamax carriers to dock alongside its berth. It also has a large land area available for development, part of which is now the Mundra SEZ which proposes to attract port-led industrial development.

Mundra Port is well connected to the Indian railway network. The port has 7 railway sidings and two dedicated diesel locomotives which can handle double stack container trains. A 64 km private railway line has been developed which connects the port with the national network at Adipur. Adipur falls on the broad gauge route from Mumbai to Bhuj.

The storage facilities are as follows:

1. Closed godowns measuring 1,37,000 sq m for wheat, rice, sugar, de-oiled cakes (DOC), fertilizer, fertilizer raw materials (FRM), etc.

2. Well demarcated open storage space of 8,80,000 sq m for steel sheets, plates, coils, scrap, clinker, salt, coal, coke, bentonite, etc.

3. Open storage alongside rail siding of 26,000 sq m.

Highlights of Overall Performance:

- Cargo volumes have improved across all segments. Cargo handled was 40.29 million tonnes in 2009-10 and 51.68 million tonnes in 2010-11 which shows a growth of 27.97% year on year).

Railway:

- A total of 8,121 rakes were handled in 2010-11.
- Commissioning of four lines at R&D Yard with RRI (Route Relay Interlocking) type of signaling system.

Works on the anvil:

Doubling of 64 km railway track from Adipur to Mundra has commenced in 2010-11 and expected to be completed by second quarter of 2012-13.

Dry Cargo:

- 22.66 million tonnes of dry cargo handled during 2010-11.

Adani Mundra Container Terminal (AMCT):

- Mundra Port has crossed one million TEU's mark during the financial year 2010-11 and ended handling total 1.23 million TEU's. Thus, becoming third port in country to reach one million TEU throughout.
- Largest container ship to call to India so far, the MSC's operated 8,400 TEU vessel M V. Northern Jaguar called at AMCT on October 12, 2010.

5.2 Essar Ports

Essar Ports is India's second-largest private sector port and terminal company by capacity and throughput. It develops, owns and operates ports and terminals.

Essar Ports provides port and terminal services for liquid, dry bulk, break bulk and general cargo, with an existing aggregate capacity of 88 million tpy across two facilities located at Vadinar and Hazira in the state of Gujarat on the west coast of India. The company is in the process of expanding its existing aggregate ports capacity to 158 million tpy, besides, a new port at Salaya in Gujarat and two terminals at Paradip in the state of Odisha on the east coast of India.

The company's sites at Vadinar, Hazira and Salaya are strategically located on the western coast of India in the state of Gujarat to cater the growing demand from the land-locked northern, north-western and central regions of India and are well connected to the state highways and will have connectivity to the railway network in future. It's sites at Paradip are located on the eastern coast of the state of Odisha to serve mineral and metal-rich eastern India and are well positioned to serve cargo for the steel and power industries.

FUTURE OUTLOOK

As per the Report of the Working Group for Ports Sector for the 12th Plan Period (2012-2017), Planning Commission, the estimated traffic by the end of 12th Plan (31.3.2017) is projected at 1758.26 million tonnes against the projected annual capacity of 2686.66 million tonnes. The capacity of major ports is pegged at 1229.24 million tonnes and that of non-major ports at 1457.42 million tonnes while the traffic is projected at 943.06 million tonnes and 815.20 million tonnes, respectively.

The total proposed outlay for the 12th Plan Period, excluding the Private Sector investment is ₹ 22757.39 crore. The outlay comprises ₹ 13416.18 crore from internal resources, ₹ 3046.22 crore from budgetary support and the balance ₹ 6294.99 crore from EBR & others.

Indian Minerals Yearbook 2011

(Part- I)

50th Edition

MINERAL BASED INDUSTRIES

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. +91712 - 2565471
PBX : +91712 - 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

7 Mineral-based Industries

Minerals are vital raw materials for many basic industries and are major inputs in industrial development. The management of mineral resources, hence, has to be closely integrated with the overall strategy of development and exploitation of minerals, which is to be guided by the long-term national goals. In tune with the Economic Liberalisation Policy, adopted in July 1991, the new National Mineral Policy was announced in March 1993, fully opening up the mineral sector for private entrepreneurs, both domestic and foreign. Keeping in view the changing global scenario, the National Mineral Policy is revised in 2008 to spell out the different elements of policy for the development of mineral resources of the country. However, the recent global financial recession certainly had impacted the Indian Mineral-based Industries as well.

Capacity and production of important mineral-based products are given in Table-1.

FERROUS METALS

India is poised for brownfield expansion of existing steel plants, backward integration of re-rollers, forward integration of DRI or pig iron producers and emergence of few greenfield projects. The National Steel Policy (NSP) was announced in 2005. The NSP has set up a target of 110 million tonnes of domestic steel production by 2020.

Total production of finished steel for sale during 2010-11 stood at 66.01 million tonnes as against 60.62 in the previous year. Total finished steel exports in 2010-11 increased to 3.46 million tonnes from 3.25 million tonnes in 2009-10. The import of total finished steel was at 7.13 million tonnes which was lower compared to 7.82 million tonnes in 2009-10.

In view of the long-term demand projection of steel, the Government adopted a two-pronged strategy for increasing steel production in the country through modernisation and expansion of existing public sector steel plants in the country and encouraging creation of new steel capacities in private sector.

Pig Iron

Pig iron is the intermediate product of smelting of iron ore with a high-carbon fuel such as coke and charcoal and is the basic raw material in foundry and casting industry for the manufacture of various types of castings required for engineering sector. Pig iron usually has very high carbon content of 3.5 to 4.5%. The main sources of pig iron have traditionally been the integrated steel plants of SAIL besides plants of Tata Steel and Rashtriya Ispat Nigam Ltd. The domestic production of pig iron did not keep pace with the demand. Efforts were, therefore, made to increase pig iron manufacturing facilities in the secondary sector.

As a result of various policy initiatives taken by the Government, private sector showed considerable interest in setting up new pig iron units especially in the post-liberalised period. Of the total 5.54 million tonnes production, in 2010-11, the 4.96 million tonnes was reported by the private sector. This has resulted in drastic change in the contribution of private/secondary sector units from merely 8% in 1991-92 to more than 89% in 2010-11. M/s Usha Martin Industries Ltd, M/s Jindal Steel & Power Ltd and M/s Ispat Industries Ltd have integrated mini-blast furnaces (MBF) for manufacture of steel through Electric Arc Furnace (EAF). M/s Hospet Steel (a joint venture of Kalyani and Mukand) and M/s Southern Iron & Steel Co. Ltd had integrated their MBF with energy optimising furnace to produce steel. Besides MBF, M/s JSW Steel Ltd (formerly Jindal Vijaynagar Steel Ltd) had commissioned a Corex Plant (alternate to conventional MBF/BF) along with downstream basic oxygen furnace (BOF) for steel making to supplement production of pig iron. The KIOCL is now in the process of setting up a 100,000 tpy capacity ductile iron spun pipe plant. The pig iron industry is facing problem of rising production cost due to price-escalation of imported metallurgical coke.

In 2010-11, about 5.54 million tonnes pig iron was produced against 5.88 million tonnes in 2009-10. Location and capacity of principal pig iron units in private sector are furnished in Table-2.

Sponge Iron

During early 1990s, sponge iron industry had been specially promoted so as to provide an alternative to steel melting scrap which was increasingly becoming scarce. Due to combined use of hot metal and sponge iron in electric arc furnace for production of liquid steel during the last few years, sponge iron production went up substantially. Now, India has emerged as the largest producer of sponge iron in the world with the coal based route. The installed capacity of sponge iron increased from 1.52 million tonnes per annum in 1990-91 to 34.9 million tonnes per annum in 2010-11. The production also increased from 0.9 million tonnes in 1990-91 to 26.71 million tonnes in 2010-11.

Production of sponge iron in the country has also resulted in providing an alternative feed material to steel melting scrap which was hitherto imported in large quantities by the Electric Arc Furnace units and the Induction Furnace units for steel making. This has resulted in considerable saving in foreign exchange as well as alternate route for production of steel through EAF in the country. Out of the total sponge iron units, 3 are gas-based hot briquetted iron (HBI) units covering a capacity of 9.3 million tonnes per annum. The capacity of gas-based sponge iron plant of Essar Steel Ltd, the world's largest sponge iron producer has gone up to 6.8 million tpy. Plantwise details as available in respect of principal sponge iron units are furnished in Table-3.

Table – 1 : Capacity and Production of Important Mineral-based Products, 2009-10 and 2010-11

Mineral-based product	Unit of quantity	Annual Installed capacity	Production	
			2009-10	2010-11(P)
Ferrous Metals				
Hot metal	'000 tonnes	-	41521	42923
Sponge iron	"	34900	24326	26709
Crude/liquid steel	"	72963	65839	69575
Ferro-alloys				
Ferro-chrome/Charge-chrome	"	1600	893	1032
Ferro-manganese	"	2750	356	404
Silico-manganese	"	-	1116	1299
Ferro-silicon	"	250	98	117
Noble ferro-alloys	"	50	31	33
Non-ferrous Metals				
Aluminium	"	1856.4	1481	1621
Copper #	"	1001.5	533	512
Lead (primary)	"	185	64	57
Zinc Ingots	"	917	614	740
Asbestos-Cement Products				
Asbestos sheets & accessories	'000 tonnes	NA	2435	NA
Asbestos-cement pressure pipes	"	150	150	NA
Refractories	"	2015	1252	NA
Cement	Million tonnes	296.5	205.0	216.3
Ceramic				
Ceramic tile	Million sq m	2100 ('000 tonnes)	340	391
Sanitaryware	'000 tonnes	NA	431	480
Crockeryware	"	343	73	80
H.T. insulators	"	NA	61	NA
Fertilizers				
Nitrogenous	"	12061	11900	12175
Phosphatic	"	5659	4321	4532
Chemicals				
Aluminium fluoride	"	27	11.6	9.8
Sulphuric acid	"	NA	7440	NA
Caustic soda	"	2647	2103	2178
Calcium carbide	"	142.4	22.0	44.7
Soda ash	"	2951	2058	2299
Synthetic rutile	"	243	71	81
Titanium dioxide Pigment	"	75	61	50
Petroleum Refinery Products	"	193390**	179769	190364

Figures rounded off.

Sources:
1. *Ministry of Steel Annual Report, 2011-12 and JPC Bulletins.*
2. *Ministry of Commerce & Industry, Department of Industrial Policy & Promotion and Annual Report, 2011-12.*
3. *Ministry of Chemicals & Fertilizers, Department of Chemicals & Petrochemicals, Annual Report, 2010-11.*
4. *Basic Statistics on Indian Petroleum & Natural Gas, 2010-11.*
5. *Indian Ferro Alloys Producers' Association (IFAPA), Mumbai.*
6. *Cement Manufacturers, Association.*
7. *Indian Refractory Makers' Association, Kolkata.*
8. *Department of Atomic Energy.*
9. *Information received from individual plants in organised sector.*

** *Throughput capacity of refineries.*

\# *Production relates to copper cathodes .ures rounded off.*

Table – 2 : Location and Capacity of Principal Pig Iron Units in Private/Secondary Sector

(In lakh tonnes)

Sl.No.	Unit	Location	Annual capacity
1.	Lanco Industries Ltd	Chittoor, Andhra Pradesh	1.65
2.	Sathavahana Ispat Ltd	Anantapur, Andhra Pradesh	1.20
3.	Jayaswal NECO Industries Ltd (Nagpur Alloy Castings)	Raipur, Chhattisgarh	7.50
4.	Sesa Goa Ltd	Bicholim, Goa	1.80
5.	Usha Martin Industries	Jamshedpur, Jharkhand	1.10
6.	KIOCL Ltd	Mangalore, Karnataka	2.27
7.	Kalyani Ferrous Industries Ltd	Koppal, Karnataka	1.20
8.	Kirloskar Ferrous Industries Ltd	Koppal, Karnataka	2.40
9.	Usha Ispat Ltd	Redi, Maharashtra	3.00
10.	Ispat Metallics India Ltd	Dolvi, Raigad, Maharashtra	20.00
11.	Kalinga Iron Works	Barbil, Keonjhar, Odisha	1.70
12.	Electrosteel Castings Ltd	Khardah, West Bengal	1.10
13.	Tata Metaliks Ltd	Kharagpur, West Bengal	0.90
14.	Kajaria Iron Castings Ltd	Durgapur, West Bengal	1.10
15.	JSW Steel Ltd	Bellary, Karnataka	7.20

Source: *Development Commissioner for Iron & Steel, Ministry of Steel, Kolkata and individual plants.*

Table – 3 : Location and Capacity of Principal Sponge Iron (DRI) Plants

(In lakh tonnes)

Sl. No.	Company	Location	Annual capacity
Gas-based			
1.	Essar Steel Ltd	Hazira, Surat, Gujarat	68.00
2.	Vikram Ispat	Salav, Raigad, Maharashtra	9.00
3.	Ispat Industries Ltd	Geetapuram, Dolvi, Raigad, Maharashtra	16.00
Coal-based			
1.	GSAL (India) Ltd	Srirampuram, Vizianagaram, Andhra Pradesh	2.20
2.	HEG Ltd	Borai, Durg, Chhattisgarh	1.20
3.	Jindal Steel & Power Ltd	Kharsia Road, Raigarh, Chhattisgarh	13.70
4.	Monnet Ispat & Energy Ltd	Chandkhuri Marg, Hasaud, Raipur, Chhattisgarh	3.00
5.	Prakash Industries Ltd	Champa, Jangir Champa, Chhattisgarh	4.50
6.	Sarda Energy & Minerals Ltd	Siltara, Raipur, Chhattisgarh	3.60
7.	Alliance Integrated Metaliks Ltd	Bemta, Raipur, Chhattisgarh	5.00
8.	Godawari Power & Ispat Ltd	Siltara, Raipur, Chhattisgarh	4.95
9.	Shri Bajrang Power & Ispat Ltd	Urla, Raipur, Chhattisgarh	2.10
10.	Ind Agro Synergy Ltd	Kotar, Raigarh, Chhattisgarh	3.00
11.	Nova Iron & Steel Ltd	Dagori, Bilaspur, Chhattisgarh	1.50
12.	Nalwa Sponge Iron Ltd	Taraimal, Raigarh, Chhattisgarh	1.98
13.	Singhal Enterprises Pvt. Ltd	Taraimal, Raigarh, Chhattisgarh	1.94
14.	Global Hi-Tech Industries Ltd.	Gandhihan Gujarat	1.05
15.	SKS Ispat Ltd	Raipur, Chhattisgarh	4.20
16.	Chhattisgarh Steel & Power Ltd	Champa, Chhattisgarh	3.15
17.	MSP Steel & Power Ltd	Jamgaon, Raigarh, Chhattisgarh	3.95
18.	Crest Steel & Power (P) Ltd	Jortarai, Rajnandgaon, Chhattisgarh	1.05
19.	Jagdamba Power & Alloys Ltd	Munrethi, Chhattisgarh	1.50
20.	API, Ispat & Power Tech. (P) Ltd	Siltara, Raipur, Chhattisgarh	2.10
21.	Akshay Investment (P) Ltd	Joratarai, Rajnandgaon, Chhattisgarh	1.05
22.	NMDC	Nagarnar, Bastar, Chhattisgarh	1.00
23.	Vandana Global Ltd	Siltara, Chhattisgarh	2.16
24.	Niros Ispat (P) Ltd	Bhilai, Chhattisgarh	1.8
25.	Sunil Ispat & Power Ltd	Chhattisgarh	1.15
26.	Goa Sponge & Power Ltd	Goa	1.00
27.	Global Hi-Tech Industries Ltd	Gandhidham, Gujarat	1.05
28.	Bihar Sponge Iron Ltd	Chandil, Singhbhum, Jharkhand	1.86
29.	Sunflag Iron & Steel Co. Ltd	Bhandara, Maharashtra	1.50
30.	Lloyds Metals & Engineers Ltd	Ghugus, Chandrapur, Maharashtra	2.70
31.	Orissa Sponge Iron Ltd	Palasapenga, Keonjhar, Odisha	2.50
32.	Tata Sponge Iron Ltd. (Ipitata Sponge)	Joda, Keonjhar, Odisha	3.90
33.	Sree Metaliks Ltd	Loidapada, Keonjhar, Odisha	1.74
34.	Action Ispat & Power Pvt. Ltd	Marakuta & Pandaripathar, Jharsuguda, Odisha	2.50
35.	Adhunik Metaliks Ltd	Chadrihariharpur, Sundergarh, Odisha	1.80
36.	OCL India Ltd	Lamloi, Sundergarh, Odisha	1.20
37.	Scaw Industries Pvt. Ltd	Gundichapada, Dhenkanal, Odisha	1.00
38.	Rungta Mines Ltd	Karakola and Kamando, Sundergarh, Odisha	1.50
39.	Visa Steels Ltd.	KIC, Jajpur Road, Odisha	3.00
40.	Vallabh Steels Ltd	Sahnewal, Ludhiana, Punjab	1.20
41.	Jai Balaji Sponge Ltd	Baktarnagar, Raniganj, West Bengal	1.05
42.	Shyam Sel Ltd	Dewabdighi, Burdwan, West Bengal	1.00

Source: *Sponge Iron Manufacturers' Association (SIMA) and individual plants and Industrial Growth Centres.*

Finished Steel/Saleable Steel

Provisional data indicates a total finished steel consumption during 2010-11 at 65.61 million tonnes, as against 59.34 million tonnes in previous year. China has been an important export destination for Indian steel. Exports and imports are fluctuating.

Some significant facts on Indian steel industry are as follows:

1. The National Steel Policy (NSP) was announced in 2005. The NSP has set up a target of 110 million tonnes of domestic steel production by 2019-20. The working group on steel for the 12th plan has projected that crude steel capacity in the country is likely to be 140 million tonnes by 2016-17. NSP 2005 is presently under review and Ministry of Steel has formulated a Committee in May 2012 to review the existing National Steel Policy.
2. The Indian steel industry recorded a production of 66.01 million tonnes of finished carbon steel in 2010-11 as against 60.62 million tonnes in the preceding year.
3. The total estimated volume of exports of finished steel increased to 3.46 million tonnes from 3.25 million tonnes and the imports decreased to 7.13 million tonnes from 7.82 million tonnes.

The finished steel production for sale has grown from a mere 1.1 million tonnes in 1951 to 66.01 million tonnes in 2010-11. The growth in the steel sector in the initial decades since Independence was mainly in the public sector units set up during this period. The situation changed dramatically in the decade 1990-2000 with growth originating mostly in the private sector. Details about capacity and production of crude steel by main producers are furnished in Table-4.

Public Sector

Steel Authority of India Ltd (SAIL)

SAIL, a public sector company, operates five integrated steel plants at Bhilai in Chhattisgarh, Bokaro in Jharkhand, Durgapur & Burnpur in West Bengal and Rourkela in Odisha. SAIL plants recorded crude steel production during the year 2010-11 at 13.76 million tonnes and 13.51 during the year 2009-10.

SAIL plans to set up 3 million tonnes/year each steel plant in Mangolia & Indonesia aiming to spread its wings beyond the country.

The assets of erstwhile Malvika Steel at Jagdishpur, district Sultanpur, Uttar Pradesh were acquired & registered by SAIL in June 2010 & SAIL is building a high-tech steel making facility at its Jagdishpur unit.

The expansion and modernisation programme of SAIL is underway at all its steel plants to enhance the hot metal production capacity. The proposed production built-up is envisaged to go up to 26.18 million tonnes in a phased manner.

Rashtriya Ispat Nigam Ltd (RINL)

Rashtriya Ispat Nigam Ltd (Visakhapatnam Steel Plant), a public sector company, has the first shore-based integrated steel plant commissioned in 1992 at Visakhapatnam, Andhra Pradesh. The installed capacity for the production of liquid steel and saleable steel was over 3 million tonnes each. The expansion of RINL for enhancing liquid steel capapcity to 6.3 million tonnes is over and commissioning of various project is underway. In 2010-11, the plant produced 3.83 million tonnes of hot metal and 3.24 million tonnes of liquid steel. Production of saleable steel was 3.077 million tonnes. The blast furnace of 3800 cu m capacity was lighted up in December 2011 and was set to commence production.

Neelachal Ispat Nigam Ltd (NINL)

NINL, a joint venture company promoted by MMTC and Government of Odisha is the largest exporter of saleable pig iron from the country and supplier of LAM coke to most of the SAIL's plants. It has set up 1.1 million tpy integrated steel plant at Kalinganagar, Duburi, Jajpur district, Odisha. The first phase is already commissioned and is presently producing pig iron through BF route with 1.1 million tpy hot metal capacity. Other operating facilities include a coke oven battery (0.81 million tpy), a sinter plant (1.71 million tpy), slag granulation plant (0.3 million tpy), a gas-based captive power plant with total 62.5 MW capacity and an ammonium sulphate plant (12,750 tpy). Expansion and addition of facilities in Phase-2 presently under implementation comprise pig iron for sale (153 thousand tpy), a BOF and a ladle furnace of 110 t capacity each, continuous billet caster and a bar & rod mill. The production capacity after Phase-2 will be pig iron for sale (153 thousand tpy), wire rods (0.3 million tpy), billets for sale (175 thousand tpy), and straight, rounds & square bars (0.4 million tpy).

Private Sector

The private sector continued to play a dominant role in the production of steel and growth of steel industry in the country. The contribution of private sector in finished steel production increased substantially since 1992-93. The performance of major private sector producers is summarised below:

The private sector units consist of both major steel producers on one hand and relatively smaller & medium scale units such as sponge iron plants, mini-blast furnace units, electric arc furnaces, induction furnaces, re-rolling mills, cold rolling mills and coating units on the other. They not only play an important role in production of primary and secondary steel, but also contribute substantial value addition in terms of quality, innovation and cost effectiveness.

Table – 4 : Installed Capacity and Production of Finished Steel (for Sale)
(By Principal Producers)

(In '000 tonnes)

Producer	Annual Working capacity (Crude/liquid steel)	Production 2009-10	Production 2010-11(P)
Total Production		**60623**	**66013**
Public Sector			
SAIL			
Bhilai Steel Plant, Bhilai, Dist. Durg, Chhattisgarh	3925	3356	3574
Rourkela Steel Plant, Rourkela, Dist. Sundergarh, Odisha	1900	1963	1994
Durgapur Steel Plant, Durgapur, Dist. Burdwan, West Bengal	1802	666	673
Bokaro Steel Plant, Bokaro, Dist. Bokaro, Jharkhand	4360	3382	3344
IISCO Steel Plant, Burnpur, Dist. Burdwan, West Bengal	500	330	328
Alloy Steel Plant; Durgapur Dist. Burdwan, West Bengal	264	24	51
Salem Steel Plant, Salem, Dist. Salem, Tamil Nadu	320	227	137
Visvesvaraya Iron & Steel Plant, Bhadravati, Dist. Shimoga, Karnataka	118	110	94
Total : SAIL		**10058**	**10195**
RINL			
Visakhapatnam Steel Project, Dist. Visakhapatnam, Andhra Pradesh	3000	2960	2928
Total : Public Sector		**13018**	**13123**
Private Sector			
Tata Steel Ltd, Jamshedpur, Dist. Singhbhum, Jharkhand	6800	5019	5157
Major Steel Plants		16049	18112
Of which:			
JSW Steel Ltd, Vijaynagar, Karnataka	6800	6262	7666
JSW Ispat Steel Ltd, Dolvi, Maharashtra	3000	NA*	NA*
ESSAR Steel Ltd, Hazira, Gujarat	4600	NA	NA
JSPL, Raigarh, Chhattisgarh	3000	1215	1585
Other Producers		35044	39349
Less: Own consumption		8507	9728
Total : Private Sector		**47605**	**52890**

Figures rounded off.
Source: *Annual Reports of Ministry of Steel, 2011-12 and individual producers, 2010-11.*
** As per the Annual Report, 2010-11, JSW Ispat Steel Ltd reported 3958 thousand tones production during April 2009-June 2010 period (15 months) and 2679 thousand tonnes production during July 2010-June 2011 period (12 months).*

Tata Steel Ltd (formerly TISCO)

The company has been rechristened as Tata Steel Ltd (TSL). Tata Steel is the world's 7th largest steel maker and has completed 100 years (10th December 2011) for its Jamshedpur Steel plant.

Tata Steel has an integrated steel plant having an annual crude steel production capacity of 6.8 million tonnes after its brownfield expansion in first phase located at Jamshedpur, Jharkhand. This is slated to increase further to 9.7 million tonnes by 2011-12. Tata Steel had achieved a production of 6.86 million tonnes of crude steel in 2010-11.

The company has embarked upon setting up various greenfield projects too. The project at Kalinganagar in Odisha envisages setting up of a 6 million tpy capacity integrated steel plant in two phases of 3 million tpy each. It is expected to commission the first phase of 3.5 million tonnes plant at Kalinganagar by March 2014. MoUs have been signed with the Government of Chhattisgarh to set up a 7.0 million tpy capacity steel plant at Jagdalpur in Bastar region of Chhattisgarh in 2 phases and with Government of Jharkhand for a 12 million tpy steel plant in 2 phases of 6 million tpy each in Manoharpur- Saraikela area. The plants are to be set up subject to raw material linkages and receipt of all approvals.

JSW Steel Ltd

Erstwhile Jindal Vijayanagar Steel Ltd (JVSL) has conceived a technologically modern and efficient integrated steel plant of 6.8 million tpy capacity. The plant adopts a process route consisting broadly of iron ore beneficiation-pelletisation-sintering-coke making iron making through BF, as well as Corex process which entails steel making through BOF-continuous casting of slabs- hot strip rolling-cold rolling mills. JSW Steel Ltd has an installed crude steel capacity of 6.8 million tpy, which is being expanded to 9.6 million tonnes per year with value added products constituting 1.8 million tpy spread across four locations: Toranagallu (Vijaynagar Works), Salem (Salem Works), Vasind and Tarapur (downstream units). Vijaynagar works has integrated operations from beneficiation plant to 0.9 million tpy Cold Rolling Mill Complex. The slabs and HR coil produced at Vijaynagar works are further processed in downstream units at Vasind and Tarapur into value added facilities: cold rolling (1.0 million tpy), hot dip galvanising (HDG) (0.9 million tpy), colour coating (0.1 million tpy), CRCA products (0.1 million tpy) and hot rolled plates (0.3 million tpy). The Salem works has an integrated manufacturing facility with an overall crude steel capacity of 1 million tpy, comprising of sinter plant, blast furnace, EOF, billet caster, bloom caster and rolling with associated facilities such as coke oven, power plant, oxygen plant, etc. Vijaynagar Works' existing operations produce flat steel products, Salem Works' focus is only on long products and the downstream units produce CR/galvanised, colour coated, value added flat products. During the year 2010-11, JSW Steel Ltd produced 6.86 million tonnes of crude steel.

Two subsidiaries of the company M/s JSW Bengal Steel Ltd and M/s JSW Jharkhand Steel Ltd are incorporated to set up greenfield steel plants with 10 million tpy capacity each in West Bengal and Jharkhand, respectively. The company is in possession of required land in West Bengal while in Jharkhand it has obtained a mining lease for iron ore and also got the mining plan approved. JSW Steel offers the entire gamut of steel products and it is one of the lowest cost steel producers in the world.

SISCOL is merged with JSW Group company producing hot metal and pig iron (foundry and basic grades) through mini blast furnace. For steel making, the company has installed an energy optimising furnace (EOF) and a ladle furnace of 30 t capacity each, besides a continuous casting machine to cast billets/blooms. Additionally, the company also has a bar & rod mill of 300,000 tpy capacity and a captive power plant of 7.7 MW. There is also a 425 tpd sinter plant to feed the blast furnace. The company plans to enhance the capacity of the plant located near Mettur, Tamil Nadu, from existing 0.3 million tpy to one million tpy at an investment of ₹ 1,350 crore and further to 2 million tpy at investment of about ₹ 3,000 crore, on availability of iron ore. The company also intends to set up a one million tpy slag grinding unit.

Jindal Steel & Power Ltd (JSPL), Raigarh

The sponge iron plant at Raigarh, Chhattisgarh has capacity of 1.37 million tpy and 3 million tonnes tpy steel melting shop in addition to 2.5 lakh tpy capacity sinter plant, 8 lakh tpy coke oven plant and 12.5 lakh tpy blast furnace. This is the world's largest coal-based sponge iron facility. The crude steel capacity of JSPL is 3 million tpy with proposed expansion of capacity to 6 million tonnes at Raigarh, Chhattisgarh. A new steel shop (SMS-II) has been set up comprising two EAFs, a continous caster, a billet caster, etc. Capacity expansion to 7 million tpy underway at Raigarh plant includes: 6 million tpy gas-based DRI plant (based on coal gasification), 4000 cu m blast furnace, 3 million tpy steel melting shop with EF route and 4 million tpy through BOF route along with 4 million tpy hot metal. Besides, thin slab caster, hot strip mill, cement plant (to consume BF slag) and additional 540 MW power plant are also planned. As a part of expansion, JSPL is setting up a 6 million tonnes integrated steel plant at Angul in Odisha and 6 million tonnes integrated steel plant at Patratu in Jharkhand. It is planned to implement these projects in phases. JSPL is setting up a 10 million tpy pellet plant at Barbil, Odisha utilising huge iron ore fines lying with various iron ore mines. During 2010-11, JSPL had produced 2.27 million tonnes of crude steel.

Jindal Stainless Ltd

The company has a fully integrated stainless steel plant at Hissar in Haryana with a largest capacity of 800,000 tpy. The ferro-alloys plant of the company is located at Jindalnagar, Kothavasala in district Vizianagaram, Andhra Pradesh. The plant has 40,000 tpy high carbon ferro-chrome capacity and caters to domestic markets and developed countries. The company is also setting up a greenfield integrated stainless steel plant at Kalinganagar in Jajpur district in Odisha for production of ferro-alloys and stainless steel. The project will comprise 1.6 million tpy fully integrated stainless steel plant, a 500 MW captive power plant and a coke oven battery . The production from ferro-chrome furnace has been stabilised.

JSW Steels Ltd is the largest private sector steel manufacturer, in terms of installed capacity and is one of the lowest cost steel produce in the world. By 2020, the company aims to produce 34 million tonnes of steel annually with greenfield integreated steel plants coming up in West Bengal and Jharkhand.

Essar Steel Limited (ESL)

The company has a 6.8 million tpy gas-based sponge iron plant at Hazira, Gujarat. The state-of-the-art hot-rolled coil (HRC) steel plant had a capacity of 10 million tpy. The complex also houses a cold-rolled coil plant of 1.4 million tpy capacity. The company has cold rolling plant of 0.6 million tonnes per annum capacity & 0.5 million tonnes per annum galvanising plant at Pune. It is the largest fully integrated manufacturer of high quality flat steel products in western India. The company enjoys an edge with respect to its port-based location, which helps in bringing in raw materials and rendering better service to domestic and export customers. The company has a captive port capable of handling up to 8 million tpy cargo with modern handling equipment like barges and floating cranes. The combined annual cargo handling capacity of all terminals would be 150 million tonnes.The company has embarked upon procurement of DRI plant equipment, EAF with accessories, corex plant equipment, etc. from global suppliers with a view to expand present capacity. The company has proposed greenfield project capacity of 6 million tonnes, 3.2 million tonnes & 6 million tonnes in the states of Odisha, Chhattisgarh and Jharkhand, respectively. The construction of 12 million tonnes per annum pellet plant at Paradip, Odisha has been completed and the plant has become operational.Post commissioning, the company will have a total pelletisation capacity of 20 million tonnes per annum as it already has 8 million tonnes per annum pellet plant at Vizag in Andhra Pradesh. During the year, pellet production of Vizag and steel production at Hazira continued to be affected due to the suspension of material movement through the slurry pipeline from beneficiation plant at Kirandul to the pellet plant at Vizag for eight months of the year. The company undertook various measures to mitigate the adverse impact by making alternative arrangements of movement of iron ore through railway & road and purchase of iron ore fines and pellets from alternate sources. The company has 8 million tonnes per annum iron ore beneficiation plant at Bailadila in Chhattisgarh, which supplies iron ore slurry through pipe line (267 km) to its pellet plant at Visakhapatnam (8 million tonnes per annum) which in turn supplies pellets to steel plant at Hazira. The company also has 12 million tonnes per annum iron ore beneficiation plant under execution in Joda-Barbil area in Odisha.

In January 2012, the company has completed its expansion project and achieved a production capacity of 10 million tonnes per annum at Hazira. This makes Essar Steel the fourth largest flat steel producer at single location globally & the largest in India.

JSW Ispat Steel Ltd (formerly Ispat Industries Ltd)

JSW Ispat Steel Ltd with its associated companies has set up one of the largest integrated steel plants in the private sector in India at Dolvi, Raigad district in Maharashtra, having a capacity to produce 3 million tpy of hot-rolled coils (HRC). IIL also has sponge iron and pig iron plant of 1.6 million tpy and 2 million tpy capacity, respectively, in the Dolvi Complex. The company had recently commissioned 2.24 million tpy capacity sintering plant at Dolvi complex. The integrated steel plant is based on the electric arc furnace route to produce steel by using modern Twin Shell Electric Arc Furnace and CONARC process. The company has combined the use of hot metal and DRI (sponge iron) in the electric arc furnace for production of liquid steel for the first time in India. For downstream casting and rolling of the liquid steel, it has incorporated state-of-the-art compact strip production (CSP) process installed for the first time in India. The process yields high quality and specifically very thin grades of HRC.

Bhushan Power & Steel Ltd (BPSL)

Bhushan Power & Steel Ltd, is a fully integrated 2.3 million tonnes per annum steel making company with state of the art plants at Chandigarh, Derabassi, Kolkata and at Odisha in the country.It has its first integrated Steel Plant in Sambalpur district of Odisha in operation with a total capacity of 0.68 million tpy DRI kilns; 0.70 million tpy blast furnace; 0.45 million tpy coke oven plant; 1 million tpy sinter plant; 1.2 million tpy steel making facility and 0.9 million tpy HR mill. The company has further plans to add sponge iron capacity of 1.02 million tpy and one million tpy of hot metal production .

The current configuration of Integrated Steel Plant at Odisha is to manufacture 2.30 million tpy steel through Blast Furnaces of 1008 m^3 of 0.70 million tpy, with sinter plant of 1.00 million tpy. DRI Sponge kilns of 1.40 million tpy, one coke oven plant of 0.45 million tpy, CSP plant (HR Mill) of 1.70 million tpy, wire Rod & Bar Mill of 0.45 million tpy and Billet caster. Presently the company is manufacturing Sponge iron, Billets, Pig iron, HR Coils and CR coils/sheets in Odisha plant.

Bhushan Steel Ltd

The company was earlier known as Bhushan Steel and Strips Ltd, is engaged in steel making and processing and allied activities. Currently, the company is implementing an integrated steel plant with 3 million tpy capacity and will further enhance the steel capacity to 6 million tpy. The company is a source for vivid variety of products like cold rolled steel, galvanised coil & sheets, colour coated coils, Galume sheets & coils (Al-Zn coated first time in India), Billets, sponge iron, wire rod etc. The company has three manufacturing units each at Sahibabad in Gaziabad district of Uttar Pradesh, Meramandali in Dhenkanal district, Odisha and at Khopoli in Raigad district of Maharashtra.

Monnet Ispat & Energy Ltd (MIEL)

The company is operating plant at Raipur in Chhattisgarh with 1.0 million tpy of finished steel and at Raigarh with 1.0 million tpy of sponge iron. The company is in the process of expanding its Raigarh Steel Complex to 3 million tpy. The entire facility will be integrated with primary steel manufacturing of one million tpy each of hot metal and DRI. It is setting up a 1.5 million tpy greenfield plant with a combination of plates, wire rods and also for catering to the high end construction sector. It has also plans to set up greenfield projects, viz, a 2 million tpy fully integrated steel plant in Angul, Odisha, where the work for Phase I is already under progress, and another one million tpy steel plant in Bokaro, Jharkhand. These plants will enhance the capacity to 5 million tpy by 2012.

Performance of the EAF/IF industry is summarised below:

Electric Arc Furnace Industry (Mini Steel Plants)

Electric arc furnace industry (mini steel plants) has been playing an important role in overall production of steel in the country. There were 48 working units with 18.596 million tpy capacity. Production of secondary steel reported by the electric arc furnace units during 2009-10 and 2010-11 was 15.97 million tonnes and 16.26 million tonnes, respectively.

Induction Furnace

About 1185 units were in operation during 2010-11 with an installed capacity of 28.8 million tpy. The production reported in 2010-11 was 22.07 million tonnes against 19.82 million tonnes during 2009-10.

Modernisation and Other Capital Schemes

The Board of SAIL has given in principle approval to a proposal for modernisation and capacity expansion of Bhilai Steel Plant to 7.5 million tonnes of hot metal and 7 million tonnes of crude steel per annum. Other proposed expansions of hot metal capacities include : Bokaro - 7.44 million tpy; Rourkela - 4.50 million tpy; Durgapur -3.50 million tpy; IISCO plant - 2.91 million tpy; and VISL - 0.33 million tpy.

New Steel Projects

The National Steel Policy announced in November 2005 is a basic blue print for the growth of a self-reliant and globally competitive steel sector with a long term objective to ensure modern and efficient steel industry of world standards, catering to diversified steel demand. Pohang Steel Company (POSCO) is setting up 12 million tpy capacity steel plant in Odisha. Final clearance and approval from the Environment Ministry was accorded in 2011 to the Government of Odisha to give 1,253 ha

(3100 acres) of forest to POSCO for its plant, with a condition on POSCO to regenerate an equal area of forest in an area decided by Odisha as well as paying for lands and ensuring the project will not be detrimental to ecology & local livelihood. Other new steel plants for which MoUs have been signed, include: Kalinganagar, Odisha (6 million tpy); Bastar, Chhattisgarh (5 million tpy) and Manoharpur/ Saraikella, Jharkhand (12 million tpy) of Tata Steel; Odisha (6 million tpy) and Jharkhand (5 million tpy) of Jindal Steel & Power Ltd. Besides, Bhushan Steel is reported to be setting up a 2 million tpy plant in West Bengal with a likely expansion to 5 million tpy in next five years along with a 500 thousand tpy cold rolling mill and galvanising unit for production of autograde steel. JSW Bengal Steel is in the process of setting up a 3 million tpy steel project in West Bengal. Arcelor Mittal has tentatively selected 3 sites for its ₹ 40,000 crore mega steel project in Jharkhand and a similar project in Odisha. With the setting up of these new steel plants, contribution of private sector units is gradually increasing and this trend is expected to continue in the years to come.

Visa Steel Ltd (VSL) company is operating 0.5 million tpy special steel plant, and 400,000 tpy coke oven plant at Kalinganagar, Jajpur, Odisha. The expansion plans include: 50,000 tpy ferro-chrome plant, a 3 lakh tpy coal-based sponge iron plant using Lurgi technology and an integrated 0.5 million tpy special and stainless steel plant and 425,000 tpy iron plant at Kalinganagar, Jajpur district, Odisha. The company also has chrome ore beneficiation plant and chrome ore grinding plant of one lakh tpy capacity, each. Visa steel has signed an MoU with the Govt. of Chhattisgarh for setting up a 2.5 million tonnes integrated carbon steel plant at Kotarlia in Raigarh district. Land acquisition process is underway.

National Mineral Development Corp. Ltd (NMDC)

Infrastructural works related to NMDC's iron & steel plant (NISP) near Nagarnar, Jagdalpur, Bastar district, Chhattisgarh are in progress. There was no agreement on contractual terms & conditions with TPE, Moscow for construction of Romelt shop based on Romelt technology. Action for selection of suitable alternative technology is on hand. The 3 million tonnes integrated steel plant will be backed by development of iron ore deposits in the same state. NMDC is also considering the techno-economic feasibility of setting up a two million tpy steel plant in Karnataka, through a joint venture with Russia's Severstal. NMDC is in the process of expanding its business through forward integration in both greenfield and brownfield projects by setting up (a) 2.0 million tpy pellet plant at Nagarnar in Chhattisgarh (b) 1.2 million tpy pellet plant at Donimalai in Karnataka (c) 0.36 million tpy BHJ ore beneficiation plant at Donimalai, Karnataka. NMDC is in a process of securing mining leases for iron ore in the states of Jharkhand and Karnataka and also looking forward for leases/buying properties from foreign countries.Sponge Iron India Ltd has been merged with NMDC Ltd with effect from 1.7.2010.

KIOCL Ltd

KIOCL Ltd (formerly Kudremukh Iron Ore Company Limited) was renamed with effect from 22.1.2009. In addition to its present 2.27 lakh tpy pig iron plant at Panambur, New Mangalore port and the Ductile Iron Spun Pipe (DISP) project of 100,000 tpy capacity, the company was also in the process of selecting a joint venture partner for an integrated steel plant to be set up in Karnataka. The pellet plant operated at Mangalore has 3.5 million tonnes capacity and is now exporting iron ore pellets to China and for domestic units such as Ispat Industries Ltd, SAIL, Rashtriya Ispat Nigam Ltd. After the mining was stopped at Kudremukh w.e.f. 31.12.2005, the pellet plant is being operated with hematite iron ore purchased from NMDC. The company also has plans to create permanent railway siding facility at Mangalore.

FERRO-ALLOYS

The Indian Ferro-alloy Industry was established during the second Five-year plan, as an ancillary industry to cater to the growing needs of the domestic steel industry as a de-oxidant and alloying agent. Demand driver of the ferro-alloys is crude steel & alloy steel production.

Bulk ferro-alloys of high carbon category were produced by large-scale industries. The noble ferro-alloys are of low carbon category and include ferro-vanadium, ferro-tungsten, ferro-niobium, ferro-molybdenum and ferro-titanium. There are also a number of units under the small-scale sector for the manufacture of ferro-alloys, particularly ferro-silicon, ferro-chrome and ferro-manganese.

There were about 156 units (including three 100% export-oriented units) having an annual installed capacity of over 4.65 million tonnes, against which the production in 2010-11 was about 2.89 million tonnes. The industry has already surplus capacity against the domestic demand. About 25 to 30% production is usually exported. India is an established regular exporter of silico-manganese and high-carbon ferro-chrome. The capacity and production of ferro-alloys are furnished in Tables - 6 and 7, respectively. The details about ferro-alloys are discussed in Ferro-alloys review.

Table – 6 : Capacity of Ferro-alloys Industry

(In tonnes per annum)

Ferro-alloys	Units (No.)	Installed capacity
Total	**156**	**4650000**
Bulk Ferro-alloys : Total	**119**	**4600000**
Manganese alloys	64	2750000
Chrome alloys	26	1600000
Ferro-silicon	29	250000
Noble Ferro-alloys : Total	**37[(e)]**	**50000[(e)]**

Source: Indian Ferro-alloys Producers' Association (IFAPA), Mumbai.

Table – 7 : Production of Ferro-alloys 2009-10 and 2010-11

(In tonnes)

Product	Production	
	2009-10(R)	2010-11(P)
Total	**2493633**	**2885360**
Bulk Ferro-alloys : Total	**2462775**	**2852000**
Ferro-manganese	356123	404000
Silico-manganese	1116047	1299000
Ferro-silicon	97682	117000
Ferro-chrome/Charge-chrome	892923	1032000
Noble Ferro-alloys : Total	30858	33360
Ferro-molybdenum	2822	3050
Ferro-tungsten	150	150
Ferro-vanadium	1389	1500
Ferro-silico-zirconium	120	120
Ferro-silicon-magnesium	17132	18500
Ferro-nickel-magnesium	209	250
Ferro-aluminium	7017	7600
Ferro-titanium	1929	2100
Ferro-boron	90	90

Source: Indian Ferro-alloys Producers' Association (IFAPA), Mumbai.

Table – 8 : Capacity of Charge-Chrome Plants

Plant	Location	Installed Capacity (tpy)
Ferro-Alloys Corp. Ltd	Randia, Dist. Bhadrak, Odisha.	65,000
Tata Steel Ltd	Bamnipal, Dist. Kendujhar, Odisha.	55,000
Indian Charge Chrome Ltd	Choudwar, Dist. Cuttack, Odisha.	62,500
Total		**182,500**

Bulk Ferro-alloys

Ferro-manganese and Silico-manganese

Ferro-manganese is the most important ferro-alloy used in the steel industry. Total installed capacity of 27.50 lakh tonnes was in operation in the country. Out of these, 11 were major plants. Of late silico-manganese has gained more importance than ferro-manganese.

MOIL has constructed a plant for direct utilisation of manganese ore fines to produce ferro-manganese. The plant having 10,000 tpy capacity is located near Balaghat manganese mines in Madhya Pradesh. The company has signed a Memorandum of Understanding (MoU) for an agglomeration plant to utilise high grade (49% Mn) fines at Balaghat mines on a joint venture basis.

Chandrapur Alloys Ltd (formerly Maharashtra Electrosmelt Ltd), a subsidiary of SAIL, situated in Chandrapur, Maharashtra, is a major producer of ferro-manganese and silico-manganese for captive use of SAIL's plants in the country. It was also diversifying production into other ferro-alloys.

Ferro-chrome and Charge-chrome

The total combined capacity of ferro-chrome and charge-chrome is around 16 lakh tpy producing about 10.32 lakh tonnes of ferro-chrome/charge-chrome in the country. Stainless and alloy-steel industry is the chief consumer of ferro-chrome.

The charge-chrome plants of Tata Steel, FACOR and Indian Charge-chrome Ltd have a total charge-chrome capacity of 182,500 tpy. All the three plants are 100% export- oriented units. FACOR is planning to set up a 500,000 tpy stainless steel plant to further integrate the present ferro-chrome production. Plantwise capacity of charge-chrome is given in Table-8. The charge-chrome contains 50 to 60% chromium and 6 to 8% carbon. While chromium used in some alloy steels can be replaced by nickel, cobalt, columbium, vanadium or molybdenum, it is indispensible in the manufacture of stainless steel. Because of high cost and lower performance standards of nickel, cobalt, columbium, etc., chromium is preferred in alloy units too. VISA steel has entered into a joint venture with Baosteel Resources Co. Ltd forming a joint venture company, VISA BAO Ltd to set up a 100,000 tpy ferro-chrome plant in Odisha in which VISA Steel is to hold 65% stake.

Ferro-silicon

The capacity was 2.50 lakh tpy producing around 117 thousand tonnes of ferro-silicon in the country.

Besides, ferro-alloys are also produced by small-scale units.

Noble Ferro-alloys

Noble Ferro-alloys are one of the vital inputs required for producing special types of steel & alloy. The total capacity was 50,000 tpy of noble ferro-alloys, such as ferro-molybdenum, ferro-vanadium, ferro-tungsten, ferro-titanium, ferro-silico magnesium, ferro-aluminium, ferro-boron etc. Mishra Dhatu Nigam (A Govt. of India Undertaking), with a capacity of 2,729 tpy produced different types of super-alloy, chiefly cobalt, molybdenum, titanium and tungsten-based super-alloys and products. Noble ferro-alloys are mainly produced through alumino thermic process. Most of these units are in unorganised sector.

Electrolytic Manganese Dioxide (EMD)

EMD is consumed along with natural manganese dioxide during manufacturing dry battery cells. There were two units, one owned by MOIL in Bhandara district of Maharashtra, having a capacity of 1,000 tpy and the other by the then Union Carbide Ltd (now Eveready Ltd) at Thane, Maharashtra, having a capacity of 2,500 tpy. Madhya Pradesh. The company has signed a Memorandum of Understanding (MoU) for an agglomeration plant to utilise high grade (49% Mn) fines at Balaghat mines on a joint venture basis. The later one is closed due to uneconomic conditions. MOIL has undertaken capacity expansion of the existing plant to 1,500 tpy, in view of the good demand for EMD in the domestic market. The plant of MOIL Dongri Buzurg had produced 1,150 tonnes EMD in 2009-10 and 805 tonnes EMD in 2010-11. The company has plans to set up 10,000 tpy capacity electrolytic manganese metal (EMM) plant and 5,000 tpy capacity potassium permanganate plant, for diversification of value-added products.

NON-FERROUS METALS

Aluminium

There were five companies with a total installed capacity of 1.856 million tpy in operation. NALCO, the only public sector company in aluminium & alumina segment has an installed capacity of 460,000 tpy at Angul. NALCO has signed an MoU with Odisha Industrial Infrastructure Development Corporation (IDCO) to set up an aluminium park at Angul in Joint Venture (JV) at an estimated cost of ₹ 75 crore. The new JV company has name "Angul Aluminium Park Ltd" and it will set up an aluminium downstream & ancillary complex over an area of 200 acres. BALCO has an installed capacity of

3.5 lakh tpy at Korba. Three companies with four plants in the private sector have a total capacity of 12.56 lakh tpy in operation. One unit at Korba of BALCO and the plant of MALCO were not in operation totalling 1.40 lakh tpy of non-operational capacity.

The production of aluminium in 2010-11 was 16.2 lakh tonnes. The information on installed capacity and production of aluminium in 2009-10 and 2010-11 is given in Table-9.The projected aluminium production at the end of 12th plan period would be 4.7 million tonnes.

Table – 9 : Capacity and Production of Aluminium, 2009-10 and 2010-11

(In '000 tonnes)

Producer	Annual Capacity	Production	
		2009-10	2010-11(P)
Total	**1856.4**	**1480**	**1621**
Public Sector			
National Aluminium Co. Ltd (Angul)	460	396	444
Private Sector			
Bharat Aluminium Co. Ltd	350*	263	253
Hindalco Industries Ltd	506.4	557	539
Madras Aluminium Co. Ltd	40#	-	-
Vedanta Aluminium Ltd (Jharsuguda)	500	264	385

Figures rounded off.
***Source:** Information received from individual plants/ Annual reports*
**Korba Plant-1 (BALCO) capacity of 100 thousand tonnes per year is non-operational.*
 # Plant is lying closed.

Larsen & Toubro Ltd has plans to increase smelting capacity of their proposed aluminium plant in Odisha from 0.22 million tonnes per annum to 0.44 million tonnes per annum. L & T has formed a joint venture with Dubai Aluminium for its project.

Alumina

The information about alumina producers in the country, their capacities and production is given in Table-10. The production of alumina was 35.77 lakh tonnes in 2010-11. NALCO became one of the largest producers of alumina in Asia, with the expansion of alumina refinery capacity to 1.575 million tpy. With the second phase expansion of alumina refinery. by another 525,000 metric tonnes, the total capacity now stands at 2.1 million tpy. By 2014-15, in the 3rd phase of expansion, the capacity will be enhanced to 2.975 million tonnes.

GMDC has planned to set up a 0.75 million tpy alumina plant and a company, namely, Gujarat Alumina & Bauxite Ltd has been formed. The viability report of the project has been prepared and formalities for acquiring land were in progress.The company has 50,000 tpy bauxite calcination at village Gadhshisha in Gujarat.

Hindalco's Renukoot integrated smelter uses alumina produced in their plant for producing aluminium. Expansion of its Muri refinery from 110,000 tpy to 450,000 tpy was completed on schedule. The production of alumina by the end of 12th plan period is projected at 13.3 million tonnes.

Table – 9 : Capacity and Production of Alumina, 2009-10 and 2010-11

(In '000 tonnes)

Producer	Annual Capacity	Production	
		2009-10	2010-11(P)
Total	**4885**	**3433**	**3577**
Public Sector			
National Aluminium Co. Ltd (Damanjodi)	2100	1320	1516
Private Sector			
Bharat Aluminium Co. Ltd	200#	43	-
Hindalco Industries Ltd	1500	1307	1354
Madras Aluminium Co. Ltd	85#	Nil	Nil
Vedanta Aluminium Ltd (Lanjigarh)	1000	762	707

Figures rounded off.
***Source:** Information received from individual plants/ Annual reports.*
 # Plants remained non-operational during the year.

National Aluminium Co. Ltd

The present capacity of bauxite mines of 4.8 million tpy, is being expanded to 6.3 million tpy in 2nd phase expansion. Alumina refinery capacity is augmented to 21 lakh tonnes per annum and smelter to 4.6 lakh tpy. The second phase of expansion of bauxite mines and alumina refinery to 6.325 million and 2.275 million tpy, respectively, is underway. The company also produces special grade alumina and hydrate as also TPA detergent grade zeolite. These plants with 26,000 tpy and 10,000 tpy capacity, respectively, are integrated with the main stream at Damanjodi refinery. The captive power plant is being expanded from 960 MW to 1,200 MW. The company also proposes to set up 1.4 million tpy, alumina refinery near Vizag, Andhra Pradesh based on rights over two bauxite blocks in Andhra Pradesh, with 42 lakh tpy bauxite capacity mines. NALCO proposes to build a 5 lakh tpy aluminium smelter and 1260 MW power plant near Brajarajnagar, Jharsuguda district, Odisha. NALCO is pursuing to set up one million tonne alumina refinery in Gujarat, based on supply of bauxite from Kachchh region by Gujarat Mineral Development Corporation. It has also signed an MoU with Nuclear Power Corporation of India Ltd (NPCIL) for establishment of Nuclear Power Plant in Joint venture mode in Gujarat.

Bharat Aluminium Co. Ltd

The Government of India disinvested its 51% equity in BALCO along with the transfer of management control in favour of M/s Sterlite Industries (India) Ltd. BALCO is now a private sector company with an integrated alumina/ aluminium complex at Korba in Bilaspur district in Chhattisgarh. The company has two captive bauxite mines, one at Mainpat and other at Bodai Daldali. It operates alumina plant with 2 lakh tpy capacity based on Hungarian technology and aluminium smelter of one lakh tpy capacity. The work on expansion from 2.50 lakh tpy to 3.50 lakh tpy smelter capacity was completed along with 810 MW Captive Thermal Power Plant (CPP) with an average unit cost of about ₹ 1.55 which is one of the lowest in the industry. Work on the new 325,000 tpy aluminium smelter was in progress. The downstream production facilities of BALCO included 111,500 tpy wire rods, 72,500 tpy rolled products, 8,000 tpy extrusions, 9,000 tpy other semi-finished products, etc. BALCO has another aluminium semis unit at Bidhanbag near Asansol in West Bengal. It has an installed capacity of 6,400 tpy which includes extruded and rolled products, foils and conductors. The company is in an advanced stage of planning for a brownfield 650,000 tpy smelter project; and a 1,200 MW captive power project is underway.

Hindalco Industries Ltd

Hindalco Industries Ltd is Asia's largest integrated primary producer of aluminium. With the completion of brownfield expansion, the capacity of Renukoot aluminium smelter is raised to 345,000 tpy, alumina refinery to 700,000 tpy. The Company has 55 kg per year capacity of gallium recovery at Renukoot. The Company has two captive power plants at Renusagar & Hirakud with total generation capacity of about 1109 MW. Hindalco is implementing 1.5 million tonnes capacity Alumina Project in Rayagada district, Odisha under the aegis of Utkal Alumina Limited, a joint venture with Alcan of Canada. The land & all the statutory clearances have been obtained and mining lease for bauxite was also obtained at Kodingamali. The 1.5 million tpy alumina refinery in Odisha is in an advanced stage of implementation. The company is planning a 359,000 tpy aluminium smelter near Bargawan in Sidhi district with 900 MW CPP in Mahan, Madhya Pradesh The site work is in full swing. A coal block has already been allotted in joint venture with the Essar Power. The Jharkhand aluminium project with 359,000 tpy capacity smelter and a 900 MW power plant has started and land acquisition & environmental clearance process has begun. The company has applied for a coal block at Latehar. The company's Aditya Alumina & Aluminium Project with 1.5 million tpy alumina refinery at Kansariguda and 359,000 tpy aluminium smelter at Lapanga capacity along with 900 MW CPP is in progress. The commissioning of smelter is expected by end of 2012.

All the business of INDAL, including Aluminium Foils Division at Kollur, Andhra Pradesh has been transferred by way of demerger to Hindalco. The Company has completed expansion of Muri refinery from 110,000 tpy to achieve 450,000 tpy alumina capacity with backward integration of new bauxite mines in Odisha and Jharkhand. The further augmentation of the smelting capacity at Hirakud to 1.61 lakh tpy was completed through Prebake technology. Further expansion to 213,000 tpy will be commissioned by 2012. With the commissioning of the second 100 MW captive power plant at Hirakud, dependence on grid power is eliminated resulting in significant cost savings. Similarly, Belgaum refinery is to be expanded from 350,000 tpy to 650,000 tpy. However, the plans are on hold awaiting government approval relating to bauxite mines. Special alumina capacity at this plant is expanded to 138,000 tpy and is to be further raised to 316,000 tpy. The company produces approximately 120 grades of speciality alumina products.

Vedanta Group

Vedanta Aluminium Ltd has commissioned greenfield alumina refinery at Lanjigarh, district Kalahandi, Odisha, in March 2007, at an investment of ₹ 4,000 crore. The refinery with 1.0 million tpy capacity is located close to bauxite mines in Kalahandi district and expected to reach 5 million tpy capacity in near future. However, further work on the refinery expansion project at Lanjigarh has been put on hold as per the directives of the Ministry of Environment & Forest. The 500,000 tpy capacity smelter with a 9x135 MW coal-based captive power project at Jharsuguda in Sambalpur district was commissioned in May 2008. The company intends to fully integrate the smelting capacity to 2.6 million tonnes per year in near future. Pechiney Aluminium Engineering of France is the technical collaborator. The new 1.25 million tonnes per annum aluminium smelter in Jharsuguda and 325 thousand tonnes aluminium smelter at Korba are in progress.

Ashapura Group

Ashapura group is one of the significant global players in bauxite & bentonite. Ashapura Minchem will set up an alumina complex with an investment of ₹4,200 crore at Ratnagiri, Maharashtra. The project has been granted 'Mega Project' status by Maharashtra Government and the proposed project will have 5 lakh tpy alumina refinery and 1.5 lakh tpy aluminium smelter and a 330 MW captive power plant. The company plans to export alumina to Middle East countries.

Cadmium

Cadmium (99.95 min) is obtained as a by-product from zinc smelters of HZL at Debari, Visakhapatnam, Chanderiya and of BZL, Binanipuram. These together have an annual capacity of 913 tonnes. The capacity and production of cadmium are furnished in Table-11.

Table – 11 : Capacity and Production of Cadmium

(In tonnes)

Producer	Annual capacity	Production	
		2009-10	2010-11(P)
Total	**913**	**553**	**550**
HZL	833	485	493
Binani Zinc Ltd	80	68	57

Source: *Individual companies.*

Copper

HCL, a public sector company, was the only producer of primary refined copper till 1997. The installed capacity for refined copper production at HCL's two integrated smelters is around 51,500 tpy. The other two producers of primary copper now are Hindalco Industries Ltd and Sterlite Industries of Vedanta Group, having annual capacities of 500,000 tonnes and 400,000 tonnes of refined copper, respectively. The total installed capacity is thus 1,001,500 tpy. The other two smelters of Metdist and Jhagadia Copper Ltd (formerly SWIL) had total capacity of 2 lakh tpy Details regarding capacity and production are given in Table-12.

Production of refined copper (cathodes) in 2009-10 and 2010-11 was 532,865 tonnes and 512,124 tonnes (provisional), respectively.

Table – 12 : Capacity and Production of Copper

(In '000 tonnes)

Producer	Annual capacity	Production*	
		2009-10	2010-11(P)
Total	**1001.5**	**532.86**	**512.12**
Hindustan Copper Ltd**	51.5	15.87	13.65
Sterlite Industries (India) Ltd.	400	180.14	162.71
Hindalco Industries Ltd	500	333.36	335.76
Jhagadia Copper Ltd (formerly SWIL)	50	3.49	Nil

** Relates to Copper cathodes.*
*** Metal capacity. However, the cathode capacity of HCL is 49,500 tonnes.*

The future copper demand by 2015-16 is projected at 1.2 million tonnes as against projected production of 1.35 million tonnes of refined copper at GDP growth rate of 8% as per the Working Group report.

Hindustan Copper Ltd

Copper is produced at two smelters of HCL at Indian Copper Complex (ICC), Ghatsila, East Singhbhum district in Jharkhand and Khetri Copper Complex (KCC), Khetrinagar, Jhunjhunu district Rajasthan. The aggregate capacity of the two smelters for copper cathode production is 51,500 tpy. Refinery at ICC also has a Wire Bar Casting Plant with a capacity of 8,400 tpy and a Brass Rolling Mill for manufacturing brass sheets by using copper produced at ICC. The aggregate installed capacity of wire bars is 39,400 tpy and wire rod capacity is 60,000 tpy at HCL. It has also a precious metal recovery plant for the recovery of gold, silver, selenium, tellurium and nickel sulphate and copper sulphate at Ghatsila. Trials are also going on for recovering cobalt, nickel & copper powder from converter slag. A pilot plant with a capacity to produce one tonne nickel cathode per month was also set up at ICC. The plant is currently being scaled up to a production capacity of 5 tonnes per month of nickel cathodes. The company has prepared action plan to expand its mining capacity from existing level of 3.4 million tonnes/annum to 12.4 million tonnes per annum by 2016-17.

The capacity of Khetri Copper Complex (KCC) smelter is 31,000 tpy. KCC has a concentrator plant at Khetri in Jhunjhunu district, Rajasthan, having a capacity of 2.02 million tpy. KCC and Ghatsila, Jharkhand with 1.55 million tpy, Malanjkhand, Madhya Pradesh with two million tpy capacity also has a sulphuric acid plant.

Continuous Cast Copper Wire Rods Project, (TCP) Taloja, Maharashtra: This project has a capacity of 60,000 tpy continuous cast copper wire rods (CCWR). The plant is based on the Southwire SCR-2000 technology of the USA, which uses natural gas as fuel and imported copper cathodes.

Sterlite Industries (India) Ltd (SIIL)

It is India's largest non-ferrous metals and mining company with interests and operations in aluminium, copper, zinc, lead & power. The smelter and refinery of Sterlite Industries (India) Ltd are located at Thoothukudi in coastal belt of Tamil Nadu and Silvassa, Dadra &Nagar Haveli and has a total installed capacity of 4 lakh tpy each. The unit is based on 'ISASMELT' technology from MIM, Australia, using imported concentrates. A Cathode Refinery of 205,000 tpy capacity and 90,000 tpy Copper Rod Plant have been built at Thoothukudi with a view to making exports from the nearby port. The 195,000 tpy copper cathode refinery of Sterlite is located in Chinchpada at Silvassa in the Union Territory of Dadra & Nagar Haveli for catering to domestic market along with a 150,000 tpy rod mill. The total capacity of cathode & anode refineries stands at eight lakh tpy. Out of the total 4 lakh tpy each capacity of copper anodes and cathodes at Sterlite, 195,000 tpy anodes are refined into cathodes at Silvassa for domestic markets, while remaining 205,000 tpy anodes are refined to cathode at Tuticorin itself for exports. The technology for refineries and Continuous Cast Copper Rod Plant is derived from MIM, Australia and Continuous Properzi, Italy, respectively. The imported copper concentrates for smelters are obtained from captive mines in Australia through long-term contracts with producers in Chile and Indonesia, as also through spot purchases. The company is the largest producer of Continuous Cast Copper Rods (CCR) in India. The CCR plants have total annual capacity of 268,000 tpy. The company has sulphuric acid plant of 1.3 million tpy and phosphoric acid plant of 230,000 tpy.

Hindalco Industries Ltd (Birla Copper)

The company’s three copper smelters located at Dahej, Lakhigam, Bharuch district, Gujarat has an installed capacity of 500 thousand tpy. The copper operations consist of producing copper through smelting, refining copper from imported copper concentrates and converting refined copper cathode into continuous cast rod. It is now one of the world's largest smelters at a single location. It is based on Outokumpo technology. The company also produces continuous cast copper rods (CCR) with an annual capacity of 97,200 tonnes. In the process of extraction of copper metal, by-products being recovered and their annual installed capacities are: sulphuric acid (1.67 million tpy), phosphoric acid (180,000 tpy), di-ammonium phosphate (DAP) & complex fertilizers (400,000 tpy), gold (15 tpy), silver (150 tpy) and selenium. The entire requirement of copper concentrates is being met through imports supported by company's two copper mines in Australia.

Jhagadia Copper Ltd (formerly SWIL Ltd)

The company is the largest producer of LME grade 'A' copper cathodes using secondary route. It is located at Jhagadia in Bharuch district, Gujarat. It is a scrap-based electrolytic smelter to make cathodes with a capacity of 50,000 tpy and additional 20,000 tpy of copper anodes. The plant was in technical collaboration with Outokumpu Technology (formely Boliden Contech AB), Sweden. It started operations and had not produced copper cathodes in 2010-11, as against reported production of 3,494 tonnes during 2009-10. The precious metals like gold, silver, platinum, palladium etc. are also recovered as part of anode slime during refinery. The refinery is based on ISA-Technology from Mount ISA Mines Ltd, Australia.

Metdist

This company was in the process of setting up a smelter with a capacity of 150,000 tpy copper cathodes at Rampara-Rajula in district Amreli, Gujarat, in technological collaboration with Mitsubishi, Japan. The projest has been withheld.

Recycling of Copper

As per the estimates made in the recently published Market Survey on Copper by IBM, production of 106,573 tonnes of copper has been reported as secondary copper in the organised sector.

Lead

The total installed capacity of lead smelting was 185,000 tpy excluding secondary lead which was 24,000 tpy. Primary lead was produced entirely by HZL at lead-zinc smelter at Chanderiya, Chittorgarh district, Rajasthan. Tundoo lead smelter, Dhanbad district, Jharkhand with capacity of 8,000 tpy was decommissioned by HZL in May 2003 due to economic non-viability. The total production of primary lead in the country in 2009-10 and 2010-11 was 64,319 tonnes and 57,294 tonnes, respectively.

Secondary lead capacity is held by the Indian Lead Pvt. Ltd at its two units at Thane in Maharashtra and Kalipark in West Bengal. The installed capacity of these two plants was 24,000 tpy. There are a number of other secondary producing units in organised and unorganised sector.

Zinc

India has a total installed zinc capacity of 917,000 tpy distributed between HZL smelters at Debari, Visakhapatnam, Chanderiya, Dariba and Binani Zinc Ltd's (BZL) plant at Alwaye in Kerala. HZL's Dariba hydro-zinc smelter with 210,000 tpy capacity was commissioned in March 2010. BZL has an annual installed capacity of 38 thousand tonnes zinc along with 80 tonnes cadmium and about 53,000 tonnes sulphuric acid.

Debari and Vizag zinc smelters of HZL have a capacity of 88,000 tpy and 56,000 tpy, respectively. The primary product of Debari and Vizag smelter is high grade zinc and recovery of cadmium as by-product. At Chanderiya, the zinc smelter has 525,000 tpy capacity after 80,000 tpy zinc debottlenecking was completed at Chanderiya smelter complex and Debari zinc smelter in April 2008. Chanderiya smelter complex with a total capacity of 525,000 tpy of zinc is the world's largest single location zinc smelting complex. Besides lead and zinc, HZL is also producing silver, cadmium, copper and sulphuric acid as by-products. The annual installed capacities for these by-products are: 168 tonnes silver, 740 tonnes cadmium ingots, 2,100 tonnes copper cathode and 1.34 million tonnes sulphuric acid. The Visakhapatnam zinc smelter, apart from utilising imported concentrates can process sludge, containing about 16% zinc, arising out of the existing zinc smelters at Debari and Alwaye. HZL had undertaken Phase-II expansion projects, which include 170,000 tpy hydro metallurgical zinc smelting plant and matching mine expansion and one 80 MW captive power plant. The domestic production of zinc ingots by HZL in 2009-10 and 2010-11 was 578,412 tonnes and 712,471 tonnes, respectively.

Besides, there are secondary zinc producing units in unorganised sector with capacity of 45,000 tpy. However, production related data from these units is not available.

The data on total capacity and production of primary lead and zinc in 2009-10 and 2010-11 are furnished in Table-13.

As per the Working Group report for 12th Five Year Plan of Planning Commission, the total demand for zinc and lead in India by 2016-17 is projected as 880,000 tonnes and 568,000 tonnes, respectively.

Table – 13 : Capacity and Production of Primary Lead and Zinc

(In tonnes)

Producer	Lead capacity (tpy)	Production		Zinc capacity (tpy)	Production	
		2009-10	2010-11(P)		2009-10	2010-11(P)
Hindustan Zinc Ltd	185,000	64319	57294	879000	578412	712471
Binani Zinc Ltd	–	–	-	38000	35552	27931
Total	**185,000**	**64319**	**57294**	**917000**	**613964**	**740402**

Source: *Annual Report, HZL, 2009-10 and.2010-11*

New Projects

The Government of India had approved setting up a new zinc smelter of 100,000 tpy capacity at Kapasan in Chittorgarh district, Rajasthan by HZL. The 210,000 tpy, hydrometallurgical zinc smelting plant was commissioned in March 2010 while 100,000 tpy lead plant at Rajpura Dariba is on course. The company will also add 2 x 80 MW captive power plants at Rajpura Dariba. Silver production is also expected to increase to 500 tpy.

GMDC executed MoU with M/s Binani Zinc Ltd & M/s Rajasthan State Mines & Minerals Ltd for setting up Beneficiation plant based on deposits of Ambaji, Deri & Basantgarh. JVC to implement the project has already been incorporated in the name of M/s RBG Minerals Industries Ltd.

ABRASIVES

Natural abrasives, which include calcite, emery, diamond, zircon, corrundum, novaculite, pumice, etc. are generally sold as dressed stones. Synthetic abrasives include borazon, ceramic, dry ice, glass powder, silica carbide etc. Commercial abrasives are manufactured in many shapes as bonded or coated abrasives including belts discs, wheels, sheets, blocks, rods & loose grains. A large number of units exist in unorganised sector. However, important producers of coated abrasives are Grindwell Norton Ltd, Mora,Uran, Raigad district, Maharashtra; Flexoplast Abrasives (India) Ltd, Aurangabad, Maharashtra; Associated Abrasives Ltd, Nasik, Maharashtra; Carborundum Universal Ltd, Chennai, Tamil Nadu; Cutfast Abrasives Tools Pvt. Ltd, Chennai, Tamil Nadu; John Oakey and Mohan Ltd, Gaziabad, Uttar Pradesh. Important producers of bonded abrasives (grinding wheels) are Associated Abrasives Ltd, Nasik, Maharashtra; Carborundum Universal Ltd, Chennai, Tamil Nadu; Cutfast Abrasives Tools Pvt. Ltd, Chennai, Tamil Nadu; Industrial Abrasives Co-operative Society Ltd, Mumbai, Maharashtra; and K. L. Thirani & Company Ltd, Kolkata, West Bengal.

Silicon Carbide

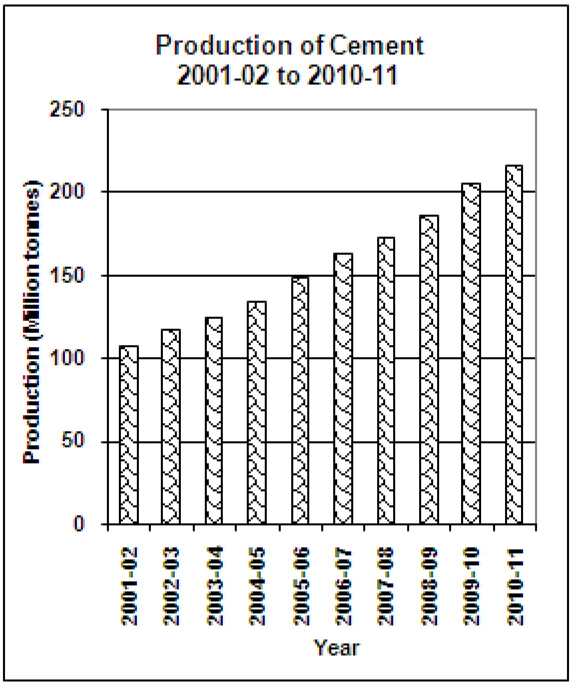
Major producers of silicon carbide are Grindwell Norton Ltd, Renugunta, Andhra Pradesh and Bangalore, Karnataka; Indian Metals & Carbide Ltd, Therubali, Odisha; and Carborundum Universal Ltd, Tiruvottiyur, Chengalput district, Tamil Nadu, Speedfam India Pvt. Ltd, Kabilpore, Gujarat, Anupam Abrasive, Jodhpur, Rajasthan.

CEMENT

Cement, which is a key infrastructure industry, has been growing since the decontrol of price and distribution in 1989 and delicensing of the industry and policy reforms in 1991. India is the second largest manufacturer of cement in the world. In 2010-11, the cement industry comprised 171 large cement plants with an annual installed capacity of about 290.48 million tonnes. There were about 365 operating mini/white cement plants with an estimated capacity of about 6 million tonnes per annum. Thus, total installed capacity of cement in the country is about 296.48 million tonnes per annum. Three cement plants having total capacity of 990,000 tpy producing white cement were also functional. Most of these capacities are modern and based on the energy efficient dry process technology. The number of plants and capacity is more in southern region (Andhra Pradesh, Tamil Nadu, Karnataka and Kerala) of the country, CCI, a Central Public Sector undertaking is operating three units at Bokajan, Rajban and Tandur units, the rest 7 are non-operational due to various reasons. The company was revived in light of public sector policy under National Common Minimum Programme (NCMP) and restructuring/revival plan approved by the Government is under implementation. Technology upgradation of Tandur unit and expansion of Bokajan has been taken up for implementation as a part of the sanctioned scheme. There were 5 large cement plants owned by various State Government Undertakings. There were as many as 112 plants with a million tonnes or more capacity. The total estimated production of cement (all kinds) in 2010-11 was about 216.28 million tonnes, including about 6 million tonnes from mini and white cement plants. The cement industry has thus recorded a positive growth.

The Cement Industry was going ahead with modernisation and upgradation of technology particularly in energy conservation. The country is self sufficient in cement. India exports cement including white cement and clinker.

The growth in construction and infrastructural activities in the country has ushered a fresh wave of consolidation in the industry. The Working Group on Cement Industry constituted by Planning Commission for the 12th Plan period has projected a demand growth for cement at the rate of 10.75% per annum based on expected 9% GDP growth rate. The additional cement capacity requirement during 12th Plan is projected as 139.7 million tpy by 2017. The annual capacity and production of cement by the end of 12th Plan are estimated at 479.3 million tonnes and 407.4 million tonnes, respectively, with 85% capacity utilisation.



ASBESTOS-CEMENT PRODUCTS

The installed capacity of asbestos-cement pressure pipes in the organised sector was 149,640 tpy. Production capacity of asbestos cement sheets was not available. The production of asbestos-cement sheets and accessories in 2009-10 was about 2.43 million tonnes and that of asbestos-cement pressure pipes was about 149.6 thousand tonnes during the same period. Data for 2010-11 was not available.

The operating units comprised four units of Everest Building Products Ltd located at Kymore in Madhya Pradesh, Mulund in Maharashtra, Podanur in Tamil Nadu and Kolkata in West Bengal; three plants of Hyderabad Industries Ltd at Sanatnagar, Ranga Reddi district in Andhra Pradesh, Jasidih in Jharkhand and Ballabhgarh in Haryana; three units of Ramco Industries Ltd at Arakkonam, North Arcot district, Tamil Nadu, Karur in Dharwad district, Karnataka and Maksi in Shajapur district, Madhya Pradesh; two units of Southern Asbestos Cement Ltd at Karur in Dharwad district, Karnataka and Arakkonam, North Arcot district in Tamil Nadu; Shree Pipes Ltd Hamirgarh, Bhilwara district, Rajasthan; Malabar Building Products Ltd, Malakunnathukavu, Thrissur district, Kerala; Konark Cement and Asbestos Industries Ltd at Bhubaneswar in Odisha; Shri Digvijay Cement Co. Ltd, Digvijaynagar, Ahmedabad in Gujarat; Uttar Pradesh Asbestos Ltd, Mohanlalganj, Lucknow district, Uttar Pradesh; Assam Asbestos Ltd, Bonda, Narangi, Guwahati district, Assam; Utkal Asbestos Ltd, Dhenkanal in Odisha and Visaka Asbestos, Pattencheru (Medak) in Andhra Pradesh.

Besides, Swastik Industries, Pune in Maharashtra; Kalani Asbestos, a Division of Kalani Industries Pvt. Ltd, Pitampur, Dhar district in Madhya Pradesh; Tamil Nadu Asbestos (Pipes), a unit of Tamil Nadu Cement Corp. Ltd, Mayanur, Tiruchirapalli district in Tamil Nadu and Ganga Asbestos Cement Ltd, Rae Bareli in Uttar Pradesh produced only asbestos pressure pipes.

REFRACTORY INDUSTRY

Steel industry comprises the biggest group of customers for this industry, which consumes about 70-80% of total refractory production, followed by aluminium, power and cement. Refractory units fall in medium and small-scale sectors. This industry has been facing recession mainly because of shift in demand from conventional refractories to sophisticated refractories. Bharat Refractories Ltd (BRL), a Govt. of India Undertaking, having four units and engaged in the manufacture & supply of various kinds of refractories not only to the integrated steel plants but also to the smaller steel plants is being merged with SAIL with some major relief and concessions.

With the modernisation and renovation of the steel plants, requirements for various types of refractories have undergone revolutionary changes. The stress is now on more sophisticated products like precast monolithics. The domestic refractory industry, anticipating this change, has obtained technical know-how for the production of sophisticated refractories, such as magnesia carbon bricks, new generation sliding-gate plate refractories, for ladles, gunning materials and castables. Manufacture of carbon bonded silicon carbide crucible and clay graphite foundry products continue to be further upgraded for improvement in the products. The use of these special refractories has brought down the consumption of refractories per tonne of steel production. However, the customers are benefited by way of improved performance, lower shut down time and savings on energy. About 30 kg refractory was consumed per tonne of liquid steel a decade ago has now come down to around 7-8 kg per tonne of crude steel by some leading players. The specific consumption of refractories at present in integrated steel plants varies from 8 to 19 kg/tonne of crude steel as compared to 6-8 kg/tonne of crude steel in advanced countries.

The total production of refractory items as per IRMA, in 2009-10 and 2010-11 was static at about 1.25 million tonnes. IRMA has entered into a formal collaboration with JPC for making demand forecast of refractories as well as crude steel as a part of 12th Five Year Plan for Steel & Allied Industries. The estimated annual installed capacity of different kinds of refractories and production is given in Table-14.

The increasing globalisation of refractories business could take an interesting turn in the coming years, as India emerges the most important market only next to China. Competition would intensify from lower end products like fire bricks to high end black refractories with overseas firms entering Indian market with advanced technologies and easier access to raw materials mainly from China.

Table – 14 : Annual Installed Capacity and Production of Refractories, 2009-10 (By Types)

(In '000 tonnes)

Refractory item	Annual capacity	Production 2009-10
Firebricks refractories	560	304
High alumina refractories	554	358
Silica refractories	58	71
Basic refractories	454	233
Special products	46	45
Others (incl.Monolithics)	343	241
Total	**2015**	**1252**

Source: *Indian Refractory Makers' Association (IRMA) Journal.*
Note *: Data for 2010-11 is not available*

CERAMIC & GLASS INDUSTRY

Ceramic Industry

Ceramic industry in India is about 100 years old. India ranks 5th in world in terms of production of ceramics and produced 391 million sq metres of ceramic tiles in 2010-11. It comprises ceramic tiles, sanitaryware and crockery items. It has been growing at the rate of about 12% per annum. Ceramic products are made from clay and felspar and are manufactured in large and small-scale sectors with wide variations in type, range, quality and standard. Ceramic items have properties, such as glassy smooth finish, high thermal shock resistance, poor thermal and electrical conductivity, high abrasion resistance, acid resistance and weather resistance. During the last two decades, there has been a phenomenal growth in the field of ceramics to meet specific demands of industry, such as high alumina ceramics, cutting tools and other structural ceramics. The state-of-the-art ceramic goods are being manufactured in the country and the technology adopted is of international standard. The major industries include Kajaria Ceramics, Somani Ceramics, Asian Granite India, Orient Ceramics & Industries, Nitco, Regency Ceramics, Euro Ceramics, Bell Ceramics, etc. The per capita consumption of ceramic tiles in the country was about 0.3 sq m compared to 2 sq.m in China & 5-6 sq m in Europe. Ceramics Technological Institute (CTI), Bengaluru, a National Level Institute for R & D in BHEL has an objective to support the Indian Ceramic industry in modernising its technology and to develop new products of advanced ceramics. Areas of research are Nano-technology, separation technology, microwave processing, etc.

Ceramic Tiles

Ceramic tile is a common consumer item. Following the development and growth of the building industry, ceramic glazed tiles industry is on the threshold of rapid growth/expansion and its demand has increased considerably during the last decade. India ranked seventh in the world in production of ceramic tiles. India produced 391 million sq m of glazed tiles/ceramic tiles in 2010-11 compared to 340 million sq m in 2009-10. There were 16 units in the organised sector with an installed capacity of 21 lakhs tonnes accounting for about 2.5% world ceramic tile production besides about 200 units in SSI sector. The domestic ceramic tile industry has been growing at about 12% per annum. Indian tiles are competitive in the international market and are being exported to East and West Asian countries. The exports during 2010-11 were worth ₹ 381.99 crore.

Sanitarywares

Sanitarywares are ceramic products used for hygienic services, like wash basins. The basic raw materials for sanitaryware are felspar, ball clay, kaolin and quartz. There were 7 units having an installed capacity of 143 thousand tpy in the organised sector and around 210 plants covering a capacity of 53,000 tpy in small-scale sector. Production of sanitaryware in 2009-10 & 2010-11 was 431 and 480 thousand tonnes, respectively. Some units have either been closed or merged with the existing units. This industry has been showing a growth rate of about 5% per annum. The major industries include Hindustan Sanitary Industries Ltd, Roca Bathroom Products, Cera Sanitaryware, Neycer India, etc. In 2010-11, the exports of sanitaryware were to the tune of ₹ 182.41crore.

Potteryware

Potteryware is an age old handicraft in the country signifying crockery and tableware, produced both in the large-scale and the small-scale sectors. There were 16 units in the organised sector with a total installed capacity of about 43,000 tpy. In the small-scale sector, there were over 1,400 plants with a capacity of 3 lakh tpy. Out of these, over 600 units are located in Uttar Pradesh. Production of crockery in 2009-10 & 2010-11 was 73 & 80 thousand tonnes, respectively. In 2010-11, the exports of potteryware were to the tune of ₹ 64.22 crore.

Glass Industry

Glass industry is delicensed and manufacturing units are spread all over India. The large-scale producers are located mostly at Mumbai, Kolkata, Bangalore, Hyderabad and in Gujarat. They are equipped mostly with modern melting furnace technology, whereas the medium and small-scale industries including cottage industries are still using outdated technology. There is considerable scope in demand for glass fibre products particularly due to growth in petrochemical sector Solar products, packaging industry and allied products. Glass industry in India remained in the form of cottage industry till the beginning of 20th century. First glass plant in India was set up in August 1908 by freedom fighter Lokmanya Bal Gangadhar Tilak at Talegaon in the state of Maharashtra. Glass industry in India has made a steady progress since then, particularly after independence. Firozabad, glass city of India continues to be a place of master craftsmen and entrepreneurs, manufacturing a vast variety of glass items by the traditional process. Side by side, the country has the most modern plants producing glass containers, float glass etc. by the use of latest technology. The major players include Saint-Gobain Glass India, Asahi India Glass, Gujarat Guardian, Alembic glass Industries Ltd etc.

The per capita consumption of glass in India is about 0.4 kg, compared to 3.5 kg in a country like Indonesia. Principal raw materials used in the manufacture of glass are silica sand, soda ash, calcite, dolomite, etc.

The production of glass sheet, toughened glass, fibre glass and glass bottles during 2010-11 were about 96,770 thousand sq m, 2,604,340 sq m, 39,217 tonnes and 1,156,830 tonnes, respectively. The key challenges identified include import from China and recyclability.

The glass industry comprises glass containers and hollow-ware, tableware, flat glass (including float, sheet, figured, wired and safety, mirror glass), vacuum flasks, refills, laboratory glassware, fibre glass, hollow-ware containers, etc.

Glass Container and Hollow-ware

Presently, 43 units in the organised sector are engaged in the manufacture of glass containers and hollow-wares, with an installed capacity of around 15 lakh tonnes per year. Glass containers are ideal packaging medium, but are being replaced by other packaging materials like plastic, PET, aluminium and tetrapack. The per capita consumption of container glass in India is 1.4 kg compared to 27.5 kg in USA & 10.2 kg in Japan. The major producers include Hindustan National Glass & Industries, Piramal Glass, Haldyu Glass Gujarat, La Opala RG, Mohan Meakin, Gujarat glass, Associated glass indistries (AGI) etc. Out of these, there are 8 float glass lines with total installed capacity of 4700 tonnes/day. The major consumers are Architectural (85%), Automotive (10%), per capita consumption of float glass in India is 0.88 kg as against 12 kg in China, 9 kg in Thailand, 13 kg in Malaysia.

Laboratory Glassware

There were six units in this sector which comprises neutral glass tubing, laboratory glassware and chemical process equipment. The installed capacity of neutral glass tubing was 46,600 tpy. The data on production are not available. The demand for natural glass tubing has not picked up due to sizeable switch over from glass items to plastic items.

Flat Glass

Silica sand, dolomite, limestone are some of the mineral ingredients used in flat glass. The term flat glass includes float glass, sheet glass or plate glass, figured and wired glass. These are further processed into mirror, toughened glass, laminated glass, double glazing, etched glass, glass doors, etc. Thirteen units in flat glass sector had a total production capacity of 135 million sq m. Out of these, there are 8 float glass lines with total installed capacity of 4700 t/day. The major consumers are Architectural (85%), Automotive (10%). Per capita consumption of float glass in India is 0.88 kg as against 12 kg in China, 9 kg in Thailand, 13 kg in Malaysia, 4 kg in Indonesia. Both, sheet and float glasses are being exported.

Vacuum Flasks and Refills

There were eight units in the organised sector for the manufacture of vacuum flasks and refills, with an installed capacity of 36 million numbers per annum.

Fibre Glass (Glass-reinforced plastic)

Silica sand, limestone, kaolin, fluorspar, dolomite are some of the important minerals used in manufacturing fibre glass. Fibre glass is highly capital and technology- intensive industry. Fibre glass is lighter than aluminium but stronger than steel. Moreover, being an inorganic material, it does not pose any health hazard. Five units had a production capacity of 55,000 tpy while the production was around 39 thousand tonnes. Presently, India exports 80% glass fibre production.

GRANITE INDUSTRY

Granite is used in monuments, building slabs, tiles, surface plates, etc. Over 160 varieties of granite have been identified for processing as products for exports and the deposits are dispersed widely in all parts of the country.

Granite is a minor mineral as defined in MMDR Act, 1957. Granite Conservation and Development Rules, 1999 were notified separately on 1.6.1999 for ensuring systematic/scientific mining, development and conservation of valuable granite assets of the country.

Granite is a non-scheduled industry and the processing of granite is an age-old phenomenon started in 1930s. The mining and processing techniques of granite adopted in the country have improved over the years. Entrepreneurs are required to submit only Industrial Entrepreneur Memorandum to Secretariat for industrial assistance. Looking at its export potential, the Government of India has been encouraging setting up of 100% EOU in this sector to promote export of value-added granite products. Exports of granite are freely allowed. The total value of granite exports during 2010-11 was ₹ 5384 crore, next to diamond, iron ore and alumina during 2010-11. Aro Granite Industries, Pokarna Tamil Nadu Minerals, Madhav Marbles & Granites Limited are some of the major players.

CHEMICALS

Caustic Soda (Sodium hydroxide)

Caustic soda is a basic inorganic chemical prepared by electrolysis of salt brine and used in the manufacture of pulp and paper, viscose rayon, textile, vanaspati and other chemicals and aluminium extraction. A significant quantity of caustic soda is used in the manufacture of other inorganic chemicals and dyestuffs, in metallurgical operations and in petroleum refining. Capacity and production of caustic soda in 2010-11 were 2.65 million tonnes and 2.18 million tonnes, respectively. The major Indian producers are Gujarat Alkalies & Chemicals, Grasim Industries, DCM Shriram Consolidated, DCW, Reliance Industries, Aditya Birla Chemicals (India), etc.

Soda Ash

Soda ash is an important chemical used widely as a raw material in the manufacture of glass and glassware, sodium silicate, textile, paper and pulp, metallurgical industries and desalination plants and in the preparation of a host of chemicals. Soda ash is an essential ingredient in the manufacture of detergent, soap, sodium salts and dyes. The major soda ash producers are Tata Chemicals, Gujarat Heavy Chemicals Ltd, Nirma, Saurashtra Chemicals, DCW, etc. The manufacture of soda ash in India started in 1932 at Dhrangadhra in Gujarat with installed capacity of 50 tpd. Installed capacity and production of soda ash in 2010-11were 2.95 million tonnes and 2.30 million tonnes, respectively.

Bleaching Powder (Chlorinated lime)

Seven units were engaged in producing stable bleaching powder. There were three units engaged in the manufacture of liquid bleaching powder.

Calcium Carbide

The capacity and production of calcium carbide were reported at 142,350 tonnes and 44,700 tonnes, respectively, in 2009-10 and 2010-11. Calcium carbide is used in the manufacture of acetylene gas for rubber, synthetic and plastic industry. It is also used as a raw material for manufacturing various rubber goods. It is self-reinforcing filler. It is also used for cutting & welding of metals.

Nickel Sulphate

Ghatsila copper smelter of HCL produces nickel sulphate as a by-product from electrolytic copper spent solutions. The annual capacity of HCL smelter for the production of nickel sulphate is 390 tonnes. However, no production has been reported since 2004-05 onwards. Jhagadia Copper Ltd (formerly SWIL Ltd) has plans to recover nickel sulphate at its copper metal plant at Jhagadia, Bharuch district, Gujarat. Tuticorin plant of sterlite has developed innovative method to produce pure commercial grade nickel sulphate from electrolyte by solvent crystallisation. The pilot-scale trials are in progress.

Synthetic Cryolite (Na_3AlF_6)

Navin Fluorine Industries, Bhestan, Gujarat, is an important producer of synthetic cryolite. Other producers are Tanfac Industries Ltd, Cuddalore, Tamil Nadu; (Aditya Birla Group) and Adarsh Chemicals and Fertilizers Ltd, Udhna, Gujarat. GMDC, Gujarat has 500 tpd fluorite beneficiation plant at Village Kadipani to produce 96% CaF_2 Acid grade & 90% CaF_2 metallurgical grade concentrate. The acid grade finds use in Aluminium fluoride, synthetic rutile & fluorine chemicals.

Aluminium Fluoride

Sterlite Industries (I) Ltd's copper division is in the process of setting up a 13,000 tpy aluminium fluoride plant through hydrofluorosilicic acid route with a joint venture partner, in and around Tuticorin, Tamil Nadu. Important units producing aluminium fluoride were Navin Fluorine Industries, Maya Rasayan Ltd, Mumbai, Tanfac Industries Ltd, SPIC and Aegis Chemical Industries Ltd. The total production of aluminium fluoride in 2010-11 was about 9,795 tonnes against an installed capacity of about 27 thousand tpy.

Titanium Dioxide

Four plants have reported an installed capacity of 243 thousand tpy to produce synthetic rutile while four plants have total installed capacity of about 75 thousand tpy to produce titanium dioxide pigment. The production of synthetic rutile in 2010-11 was about 81 thousand tonnes as against 71 thousand tonnes in 2009-10. Production of titanium dioxide pigment was estimated at 61 thousand and 50 thousand tonnes, respectively,

Table –15 : Installed Capacity and Production of Synthetic Rutile/Titanium Dioxide Pigement, 2008-09 to 2010-11

(In tonnes)

Plant	Location	Specification	Installed capacity (tpy)	Production		
				2008-09	2009-10	2010-11
Total			**243000** (Synthetic rutile)	**62169**	**70584**	**80936**
			75300 (TiO_2 Pigment)	**54145**	**61498**	**49586#**
IREL	Orissa Sands Complex, Dist. Ganjam, Odisha.	90.5% TiO_2 (min)	100000 (Synthetic rutile)	-	–	–
KMML	Chavara, Dist. Kollam, Kerala.	92%-93% TiO_2	50000 (Synthetic rutile)	NA	NA	NA
			40000@ (TiO_2-Chloride Process)	35486	35908	36879
DCW Ltd	Sahupuram, Dist. Thoothukudi, Tamil Nadu.	95% TiO_2	48000 (Synthetic rutile)	27566	36384	44761
CMRL	Edayar, Dist. Ernakulam, Kerala.	96.5% TiO_2	45000 (Synthetic rutile)	34603	34200	36175
TTPL	Kochuveli, Dist. Thiruvananthapuram, Kerala.	97.5% TiO_2	17500 (TiO_2-Sulphate Process)	7731	12686	12383
VVTi Pigments Pvt. Ltd* (formerly Kilburn Chemicals)	Thoothukudi, Tamil Nadu.	98% TiO_2 (min)	13000 (TiO_2-Sulphate Process)	10928	12460	NA
Kolmak Chemicals Ltd	Kalyani, Dist. Nadia, West Bengal.	NA	4800 (TiO_2-Sulphate Process)	Nil	444	324

Source: Department of Atomic Energy, Mumbai and individual companies.
Note: *KMML captively consumes synthetic rutile while CMRL and DCW export synthetic rutile.*
** Data relates to calendar year. @ Under expansion to 60,000 tpy capacity.*
 # Excluding VVTi Pigments Pvt. Ltd.

during 2009-10 and 2010-11. IREL has not reported synthetic rutile production in recent years. Production of TiO_2 pigment by VVTi Pigments during 2010-11 is also not available. IREL has now initiated process to set up a 10,000 tpy titanium sponge plant at OSCOM, Odisha. KMML has set up a 500 tpy sponge plant with DMRL technology in 2011. The installed capacity and production of synthetic rutile/ titanium dioxide pigment during 2008-09 to 2010-11 is given in Table-15.

Sulphuric Acid

There were 104 units with an annual capacity of more than 6 million tonnes per annum manufacturing sulphuric acid in the organised sector based on sulphur as a raw material. In addition, it is also recovered during copper smelting by HCL, Hindalco and Sterlite and during lead-zinc smelting by HZL and BZL. Production of by-product sulphuric acid from sulphide ores/ concentrates was reported by the above companies to the tune of 3.18 million tonnes and 3.31 million tonnes during 2009-10 and 2010-11, respectively.

Phosphoric Acid

RSMML has put up a beneficiation plant for processing 9 lakh tonnes of low grade ore per annum at Jhamarkotra, Rajasthan. Important units producing phosphoric acid of various grades such as pharma grade, food grade, technical grade, analytical reagent grade, etc. were Gujarat State Fertilizer Company, Vadodara, Gujarat; Fertilizers and Chemicals Travancore Ltd (FACT), Udyogmandal, Kochi, Kerala; Sterlite Industries India Ltd (Vedanta); HCL, Khetri, Rajasthan; HZL, Udaipur, Rajasthan; Southern Petrochemical Industries Corp. Ltd, Tuticorin, Tamil Nadu; EID Parry (India) Ltd, Ennore, Tamil Nadu; Star Chemical Ltd, Mumbai, Haldia, West Bengal; Ballarpur Industries Ltd, Karwar, Karnataka; Hindalco Industries Ltd, Dahej, Gujarat; and Paradeep Phosphates Ltd, Paradeep, Odisha. Some of the important uses are in the manufacture of phosphatic fertilizers, agricultural feed, waxes, polishes, soaps and detergents, waste water treatment, tea-leaf processing, sugar refining, anodizing & stabilizing agent.

Ferro-phosphorus (FeP)

Ferro-phosphorus is a by-product in the production of yellow phosphorus or is smelt by phosphate rock & ferro-rock in blast furnace. It is used as an ingredient in high strength low-alloy steel, foundry products, de-oxidiser in metallurgy industry & as a brake liner with 23% min. phosphorus and 1% max. carbon. Ferro-phosphorus is also used as a manufacturing drying agent and as additive in metallic paints.

.

Red Phosphorus

Star Chemicals (Bombay) Pvt. Ltd and United Phosphorus Ltd, Gujarat are the leading manufacturers and suppliers of the red phosphorus in the country mainly consumed in the match industry for making strike plate of match box. Besides, it has applications in agriculture industry as fumigant, making pesticides, phosphoric acid, semi-conductors and also as flame retardant for polymers. It is also used in pharmaceuticals for synthesis of drugs. The production level was estimated at 50,000 tonnes in recent years.

Borax

Borax is used as a component of glass, ingredient in enamel glazes, pottery & ceramics. Borax was manufactured by Borax Morarji Ltd, Ambarnath, Maharashtra. The plant has an installed capacity of 25,000 tpy borax and 8,000 tpy boric acid. The plant is based on imported crude sodium borate concentrates (rasorite) and crude calcium borate (colemanite) which are not available indigenously and hence imported. National Peroxide Ltd, Kalyan, Maharashtra, has 1,200 tpy combined installed capacity to produce other boron compounds; namely, sodium perborate - tetrahydrate and monohydrate. Indo-Borax & Chemical Ltd also operates borax and boric acid plants at Pithampur, Madhya Pradesh. The capacity of the plant, however, is not available. As a thumb rule, for one tonne production of boric acid, about 2 tonnes of boro-gypsum is produced. However, boro-gypsum requires ready market for its disposal.

Besides the above listed chemicals, activated bleaching earth, fluorochemicals, alumina ferric and sodium silicofluoride were the other mineral-based products.

CHEMICAL FERTILIZERS

There are 56 large size fertilizer units in the country manufacturing a wide range of nitrogenous, phosphatic and complex fertilizers. The Government of India has been consistently pursuing policies conducive to increase the availability and consumption of fertilizers in the country and, as a result, India became the third largest fertilizer producer in the world. The installed capacity of chemical fertilisers in terms of Nitrogten (N) and phosphatic (P_2O_5) nutrients was 12.06 million tpy and 5.66 million tpy, respectively, as on 31.3.2010 (Table-16) The overall consumption of fertilizers in terms of nutrients (viz, N, P & K) is about 168 lakh tonnes per annum.

Indigenous raw materials are available mainly for nitrogenous fertilizers in the country. Prior to 1980, nitrogenous fertilizer plants were based mainly on naptha as feedstock. During 1978 to 1982, a number of fuel oil/LSHS-based ammonia-urea plants were also set up. A number of gas-based ammonia-urea plants were set up in 1985. The natural gas was obtained from Bombay High and South Basin. Recently, a number of expansion projects have come up with dual feed facility using both naptha and gas.

In case of phosphatic fertilizers, indigenous rock phosphate supplies meet only 5 to 10% of the total requirement of P_2O_5. The domestic requirement is therefore, supplemented by imported rock phosphate and sulphur, as also by imported intermediate products; viz, ammonia and phosphoric acid and to some extent by finished fertilizers.

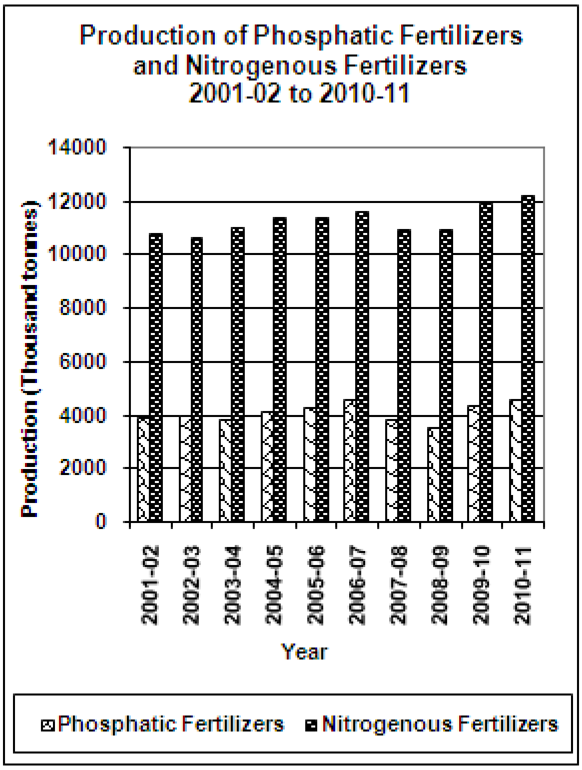
In the absence of commercially exploitable resources of potash in the country, the entire demand of potassic fertilizers is met through imports. The fertilizer plant operators in the country have fully absorbed and assimilated the latest technological developments incorporating environment-friendly process technology and are in a position to operate and maintain the plants at their optimum levels on international standards in terms of capacity utilisation, specific energy consumption and pollution standards. The fertilizer industry is carrying out de-bottlenecking and energy saving schemes in the existing plants to enhance capacity and to reduce specific energy consumption. Companies are also planning to convert existing naptha-based fertilizer plants to liquified natural gas (LNG)/natural gas (NG)-based ones.

Table – 16 : Capacity and Production of Nitrogenous and Phosphatic Fertilizers (By Sectors)

('000 tonnes)

Sector/Nutrient	Capacity as on 31.3.2010	Production 2009-10	Production 2010-11(e)
Nitrogen (N)	**12061**	**11900**	**12175**
Public sector	3498	3118	3088
Co-operative sector	3169	3404	3435
Private sector	5394	5378	5653
Phosphates (P)	**5659**	**4321**	**4532**
Public sector	433	228	237
Co-operative sector	1713	1194	1291
Private sector	3513	2899	3004

Figures rounded off individually.
Source: *Ministry of Chemicals and Fertilizers, Deptt. of Fertilizers, Annual Report, 2010-11.*



Out of the 56 large plants, 30 units produced urea, 21 units produced diammonium phosphate (DAP) and complex fertilizers, 9 units produced ammonium sulphate (AS) as by-product. Besides, 5 units produce calcium ammonium nitrate (CAN) and other low analysis straight nitrogenous fertilizers (Table-17). Besides, there were 72 small and medium-scale units in operation, producing single superphosphate (SSP).

Paper & Paper Board Industry

The Indian paper industry is among the top 15 global players with a projected demand of 14 million tonnes by 2015-16. There are about 666 units manufacturing pulp, paper, paper board and news print. The total installed capacity is nearly 89 lakh tonnes. The Indian paper industry is in a fragmental structure, consisting of small, medium and large paper mills, having capacities ranging from 5 to 800 tonnes per day. Paper industry is based on 30% by wood & chemical based industry, 32% by agro-residue and the remaining by recycled fibre based industry. Use of agro-residues for preparation of pulp also throws up challenges like pollution control, recycling, use of cost-effective technology for utilisation of agro residues etc. As a thumb rule, in paper industry, cost of energy is nearly 25% of cost of production and hence energy management is an important aspect in paper industry. Import of pulp and paper products is likely to show a growing trend. Minerals like china clay, limestone, talc, salt, sulphur etc. besides coal as fuel are used as filler, coating and surface sizing etc., in this industry and also play vital role in quality control.

PAINT & ALLIED PRODUCTS INDUSTRY

The paint & allied products industry comprises paints, enamels, varnishes, pigments, printing inks, etc. Approximately 60% of the production is contributed by the organised sector. The total Indian paint demand by 2013 is projected as 2.7 million tonnes and the main market is expected for decorative coatings. India is self-sufficient in the production of paints. Barytes, bentonite, calcite, china clay, mica powder, rutile, talc/steatite, ochre, silica & dolomite powder are some of the important minerals consumed in paint industry.

Table – 17 : Principal Fertilizer Plants

Sl. No.	Plant	Location
Public Sector		
1.	National Fertilizer Ltd	Nangal-II and Bhatinda (Punjab), Panipat (Haryana), Vijaipur, Vijaipur Expansion (Madhya Pradesh)
2.	Brahmaputra Valley Fertilizer Corp. Ltd	Namrup- II and III (Assam)
3.	Fertilizers & Chemicals Travancore Limited	Udyogmandal and Cochin-II (Kerala)
4.	Rashtriya Chemicals & Fertilizers Limited	Trombay and Trombay IV, V and Thal (Maharashtra)
5.	Madras Fertilizers Ltd	Chennai (Tamil Nadu)
6.	Steel Authority of India Ltd	Rourkela (Odisha)
7.	Hindustan Copper Ltd	Khetrinagar (Rajasthan)
Private Sector Large Units		
8.	Gujarat State Fertilizers Co. Ltd	Vadodara and Sikka I & II (Gujarat)
9.	Shriram Fertilizers & Chemicals	Kota (Rajasthan)
10.	DIL (Duncan Industries Ltd)	Kanpur (Uttar Pradesh)
11.	Zuari Agro Chemicals Ltd	Zuari Nagar (Goa)
12.	Coromandal Fertilizers Ltd	Visakhapatnam and Kakinada (Andhra Pradesh), Ennore (Tamil Nadu)
13.	Mangalore Chemicals & Fertilizers Limited	Mangalore (Karnataka)
14.	Gujarat Narmada Valley Fertilizers Company Limited	Bharuch (Gujarat)
15.	Southern Petrochemicals Industrial Corp.	Tuticorin (Tamil Nadu)
16.	Tata Chemicals Ltd	Haldia (West Bengal), Babrala (Uttar Pradesh)
17.	Punjab National Fertilizers and Chemicals Ltd	Nangal (Punjab)
18.	Deepak Fertilizers & Petrochemicals Corporation	Taloja (Maharashtra)
19.	Tuticorin Alkali	Tuticorin (Tamil Nadu)
20.	Indo-Gulf Fertilizers & Chemicals Corp. Ltd	Jagdishpur (Uttar Pradesh)
21.	Nagarjuna Fertilizers & Chemicals Limited	Kakinada I & II (Andhra Pradesh)
22.	Godavari Fertilizers & Chemicals Ltd	Kakinada (Andhra Pradesh)
23.	Hin. Ind. Ltd	Dahej (Gujarat)
24.	Chambal Fertilizers & Chemicals Ltd	Gadepan I & II (Rajasthan)
25.	KSF Ltd	Shahjahanpur (Uttar Pradesh)
26.	Paradeep Phosphates Ltd	Paradeep (Odisha)
Co-operative Sector		
27.	Indian Farmers' Fertilizers Co-operative Ltd	Kalol and Kandla (Gujarat), Aonla I & II, Phulpur I & II (Uttar Pradesh), Paradeep (Odisha)
28.	Krishak Bharti Co-operative Ltd	Hazira (Gujarat)

PETROLEUM REFINERIES

There were 21 refineries operating in the country (18 in public/joint sector and three in private sector). Out of the 18 public/joint sector refineries, 7 were owned by Indian Oil Corporation Ltd (IOCL), two by Chennai Petroleum Corporation Ltd (CPCL), a subsidiary of IOCL; two each by Hindustan Petroleum Corporation Ltd (HPCL); and Bharat Petroleum Corporation Ltd (BPCL), one by Oil & Natural Gas Corporation Ltd, one each by Bongaigaon Refinery & Petrochemicals Ltd (BRPL),a subsidiary of IOCL; Numaligarh Refineries Ltd (NRL), a subsidiary of BPCL & ONGC. With the merger of RPL with RIL w.e.f. 1st April 2008, RIL is among the top 10 private sector refining companies globally owning about 25% of world's most complex refining capacity.

There are two refineries in the joint venture; viz, Mangalore Refinery & Petrochemicals Ltd (MRPL) and Bharat Oman Refineries Ltd. Installed capacity and crude throughputs of refineries are given in Table-18.

The total refining capacity in the country as on 1.4.2011 is around 193.4 million tpy. The total crude throughput increased to 206.15 million tonnes in 2010-11 from 192.77 million tonnes in 2009-10. Production of petroleum products from crude oil also increased to 190.36 million tonnes in 2010-11 from 179.77 million tonnes in 2009-10. Besides, 2.24 million tonnes and 2.17 million tonnes LPG was produced from natural gas in 2009-10 and 2010-11, respectively. The total exports of petroleum products during 2009-10 and 2010-11 were 50.97 million tonnes and 59.13 million tonnes, respectively. Import of petroleum products during the same period was 14.60 million tonnes and 17.34 million tonnes, respectively. During 2010-11, crude oil production in the country was at 37.71 million tonnes while the natural gas production was at 52.22 billion cubic metres. Imports of crude oil during 2010-11 was 153.12 million tonnes as against 153.63 during 2009-10.

India has a near self-sufficiency in the refinery sector. In the next five years, the following additional refining capacities are reportedly expected to come on stream: (i) 15.0 million - IOCL,Paradeep, (ii) 1.4 million - HPCL, Mumbai, (iii) 7.5 million - HPCL, Vizag, (iv) 9.0 million - Mittal, Bhatinda. There are also reports of the LN Mittal Group signing an MoU with HPCL. Total (of France), GAIL and OIL for jointly developing a 15 million tpy refinery cum petrochemicals complex in Visakhapatnam. Essar's 10.5 million tpy capacity at Vadinar is set to expand to 12 million tpy after debottlenecking. CPCL's capacity at Manali is being expanded to 11.2 million tpy from 9.5 million tpy.

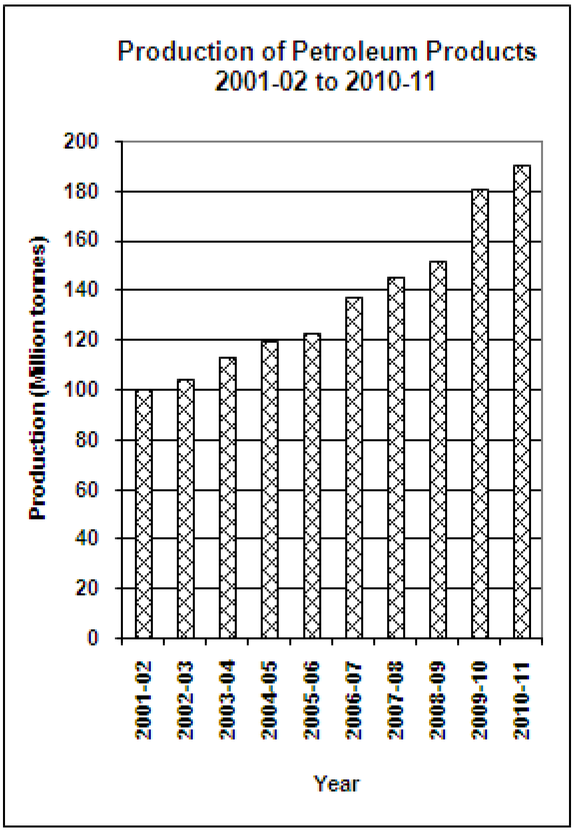


Table – 18 : Installed Capacity and Crude Throughputs in Refineries

(In '000 tonnes)

Refinery	Annual installed capacity (as on 1.4.2011)	Refinery Crude throughput		
		2008-09	2009-10	2010-11(P)
Total	**193390**	**160772**	**192768**	**206154**
Public/Joint Sector	**122890**	**112223**	**112117**	**115461**
IOCL, Guwahati, Assam	1000	1076	1078	1118
IOCL, Barauni, Bihar	6000	5940	6184	6207
IOCL, Koyali, Gujarat	13700	13852	13206	13561
IOCL, Haldia, West Bengal	7500	6042	5686	6878
IOCL, Mathura, Uttar Pradesh	8000	8601	8107	8880
IOCL, Dibgoi, Assam	650	623	600	651
IOCL, Panipat, Haryana	15000	13070	13615	13660
BPCL, Mumbai, Maharashtra	12000	12262	12516	13020
BPCL (formerly KRL), Kochi, Kerala	9500	7739	7875	8732
Bharat Oman Refineries Ltd, Bina @	6000	-	-	-
HPCL, Mumbai, Maharashtra	6500	6652	6965	6752
HPCL, Vizag, Andhra Pradesh	8300	9155	8796	8200
CPCL, Manali, Tamil Nadu	10500	9718	9580	10104
CPCL, Narimanam, Tamil Nadu	1000	418	517	703
BRPL, Bongaigaon, Assam	2350	2163	2220	2008
MRPL, Mangalore, Karnataka	11820	12577	12498	12662
NRL, Numaligarh, Assam	3000	2251	2619	2255
ONGC, Tatipaka, Andhra Pradesh	70	84	55	69
Private Sector	**70500**	**48549**	**80652**	**90693**
RPL, Jamnagar, Gujarat	33000	35636	34415	34517
RPL (SEZ), Jamnagar, Gujarat*	27000	–	32735	41303
Essar Oil Ltd**, Vadinar, Gujarat	10500	12913	13502	14873

Source: *Indian Petroleum and Natural Gas Statistics, 2010-11, Ministry of Petroleum & Natural Gas, Government of India.*

Note: *CPCL and BRPL are subsidiaries of IOC, NRL of BPCL and MRPL of ONGC.*

@ Commissioned on 1.4.2011. BORL is a Joint venture company promoted by BPCL with Oman Oil Company Ltd (OOCL).

** Commissioned on 25.12.2008; production started from January, 2009.*

*** Commissioned on 24.11.2006; production started from December, 2006.*

FOUNDRY

There are more than 5,000 foundry units in India, having an installed capacity of approximately 7.5 million tonnes per annum. However, the majority of the foundry unit falls under the category of small-scale industry.

Typically, each foundry cluster is known to cater to specific end-use markets. The Coimbatore cluster is famous for pump-sets castings; Kolhapur and Belgaum cluster for automotive castings andRajkot cluster for diesel engine castings; Butalu-Jalandhar cluster mainly for machine parts and agricultural implements.

Although, intermediate mineral-based products like pig iron, scrap of metals and ferro-alloys, etc. are main inputs for foundry, minerals like bentonite, coke, coal, fireclay, fluorite, iron ore, limestone, silica sand, zircon flour, etc. are also being consumed in the foundry industry.

Indian Minerals Yearbook 2011

(Part- I)

50th Edition

PRODUCTION

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. +91712 - 2565471
PBX : +91712 - 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

8 Production

MINERALS

The total value of mineral production (excluding atomic minerals) at ₹ 232021 crore during 2010-11 increased by about 17% as compared to the previous year due to increase in the production of lignite, natural gas (utilised), petroleum (crude), chromite, copper concentrate, lead concentrate, zinc concentrate, barytes, diamond, garnet (abrasive), gypsum, limestone, wollastonite, etc. The increase in value of minerals was also due to increase in average value of important minerals like chromite, iron ore, copper concentrate, coal, gold, diamond and bauxite.

In the total value of mineral production, the fuel minerals contributed the major share of about ₹ 153942 crore or 66%. The rest was accrued from metallic minerals (₹ 45156 crore or about 20%), non-metallic minerals (₹ 4892 crore or 2%) and minor minerals (₹ 28031 crore or about 12%) (Table-1).

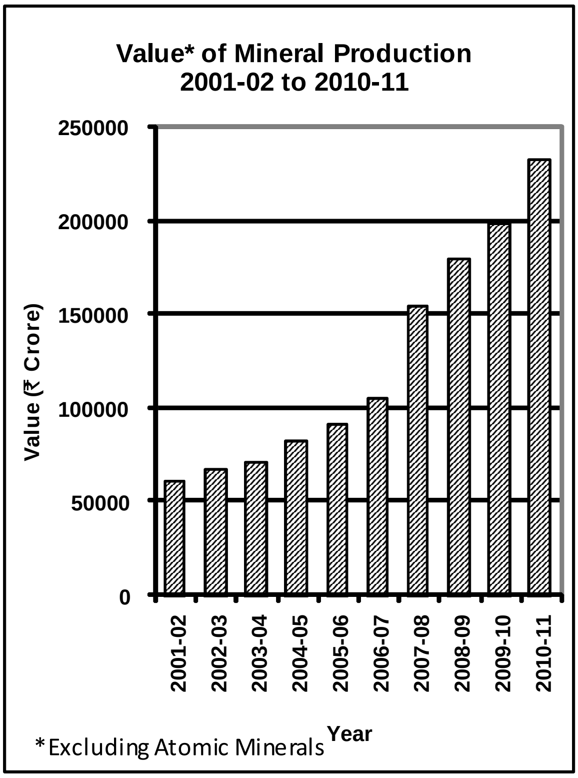
Fuel Minerals

The value of fuel minerals in 2010-11 at ₹153942 crore increased by about 15% as compared to the preceding year. The production of **coal** at 533 million tonnes during 2010-11 remained static compared to previous year. Chhattisgarh, Odisha, Jharkhand, Madhya Pradesh, Andhra Pradesh, Maharashtra, West Bengal and Uttar Pradesh continued to be the principal producing states accounting for 98% of the total production of coal in the country during 2010-11. Meghalaya, Assam, Arunachal Pradesh and Jammu & Kashmir reported remaining production. The production of **lignite** at 38 million tonnes registered an increase of 11% over the previous year. Major quantity of 23 million tonnes or 61% was reported from Tamil Nadu and the rest 15 million tonnes or 39% of lignite from Gujarat and Rajasthan.

The production of **petroleum (crude)** at about 38 million tonnes increased by 12% during 2010-11 as compared to the previous year. The production of petroleum (crude) in Rajasthan increased from 0.45 million tonnes to 5.15 million tonnes registering a manifold increase and accounted for 14% of the total production. However, Offshore region remained the largest producer and contributed 56% of total production followed by Gujarat 16% and Assam about 12%. The remaining 2% was jointly shared by Andhra Pradesh, Tamil Nadu, and Arunachal Pradesh. During 2010-11, production of **natural gas (utilised)** at 52222 m cu m recorded an increase of 10% as against 2009-10. Offshore, which is the largest source for natural gas accounted for 84% production followed by Assam 5%, Gujarat 4% and Andhra Pradesh 3%. The remaining 5% was contributed by Tamil Nadu, Tripura, Rajasthan, Arunachal Pradesh and West Bengal.

Metallic Minerals

The value of metallic minerals in 2010-11 at ₹ 45156 crore increased by 42% over the previous year due to higher production reported in chromite, copper concentrate, gold (total), lead concentrate, zinc concentrate and manganese ore. Among the principal metallic minerals, iron ore contributed ₹ 37534 crore or 83%, chromite ₹ 2296 crore or 5%, lead (concentrate) & zinc (concentrate) together ₹ 1960 crore or about 4%, manganese ore ₹ 1370 crore or 3%, copper (concentrate) ₹ 547 crore, silver ₹ 544 crore, bauxite ₹ 474 crore and gold ₹ 430 crore or about 1% each while a negligible share was from tin concentrates.



The production of **iron ore** at about 208 million tonnes in 2010-11 decreased 5% as against previous year. About 28% of the total production was shared by Public Sector Companies like SAIL (including formerly IISCO), NMDC, OMC etc. The share of Private Sector was 72%. Almost entire production of iron ore (98%) was accrued from Odisha, Karnataka, Goa, Chhattisgarh and Jharkhand during the year. The remaining 2% of production was reported from Andhra Pradesh, Madhya Pradesh, Maharashtra and Rajasthan.

The production of **copper concentrate** at 0.14 million tonnes in 2010-11 increased about 10% as compared to the previous year. Average metal content in copper concentrate was 23.16% Cu. The production of **chromite** at 4.26 million tonnes in 2010-11 also increased 24% as against the previous year. Odisha reported almost entire output of chromite (99.8%) in the country. A nominal production was reported from Karnataka. Mining of chromite was mostly dominated by private sector producers, viz, Tata Steel, IMFAL, Balasore Alloys Ltd, FACOR and Misrilal Mines (P) Ltd jointly accounted for 66% production during 2010-11. Three public sector companies viz. OMC, MML and Industrial Development Corp. of Orissa Ltd (IDCOL) together reported 29% production in 2010-11. The production of **manganese ore** at 2.9 million tonnes in 2010-11 increased by about 16% as against 2009-10. MOIL continued to be the largest producer of manganese ore with a share of 38% of the total production in 2010-11, followed by Tata Steel (11%), SMIOR (9%) and OMM (6%). Of the total production of manganese ore in 2010-11, Madhya Pradesh and Odisha contributed 25% and 23%, respectively, followed by Maharashtra 22%, Karnataka 14% and Andhra Pradesh 10%. The remaining 6% was jointly shared by Gujarat, Rajasthan and Jharkhand with a nominal share from Goa.

The production of **gold** at 2239 kg in 2010-11 (excluding by-product gold recovery from imported concentrates) reported an increase of about 7% as compared to the previous year. Karnataka was the leading producer of gold accounting for 99% production; the remaining was reported from Jharkhand. The production of **bauxite** at 12.6 million tonnes in 2010-11 decreased 11% as compared to the previous year. Five major companies, namely, NALCO, Hindalco, BALCO, Ashapura Minechem Ltd and Gujarat Mineral Development Corporation Ltd engaged in bauxite mining in the country jointly contributed 79% production of bauxite in 2010-11. Odisha accounted for 38% output of bauxite during 2010-11 followed by Maharashtra and Chhattisgarh 17% each, Jharkhand 14%, Gujarat 7% and Madhya Pradesh 5%. The remaining production was reported from Goa, Karnataka and Tamil Nadu. During 2010-11, the production of **lead concentrate** at 0.15 million tonnes increased 8% and that of zinc concentrate at 1.42 million tonnes increased 11% against the previous year. Average metal content in lead concentrate was 57.46% Pb and that in zinc concentrate was 51.16% Zn. Rajasthan accounted for the entire production of lead concentrate and zinc concentrate during 2010-11.

Non-Metallic Minerals

The value of production of non-metallic minerals at ₹ 4892 crore during 2010-11 increased by about 5% as compared to the previous year. Limestone retained its leading position by contributing 66% to the total value of non-metallic minerals in 2010-11. The other non-metallic minerals in descending order of value of production were phosphorite/rock phosphate (11%), barytes (5%), dolomite and gypsum (3% each), garnet (abrasive) (2%), kaolin, magnesite, silica sand, sillimanite, talc/soapstone/steatite and marl (about 1% each). The remaining 4% was from other non-metallic minerals.

The production of **limestone** at 238 million tonnes in 2010-11 registered an increase of 2% over the previous year. Limestone is widely produced in 17 states of the country. As much as 86% output was contributed by seven principal states in 2010-11, viz, Andhra Pradesh (22%), Rajasthan (18%), Madhya Pradesh (13%), Gujarat (9%), Chhattisgarh, Karnataka and Tamil Nadu (8% each). The remaining 14% production was shared by other limestone producing states. About 54% of the total production was reported by principal producers in private sector. They are: Ultra-Tech Cement Ltd (17%), Ambuja Cement (8%), ACC Ltd

(7%), Jaiprakash Associates Limited (5%), Shri Cement Limited & The India Cement Limited (4% each), Kesoram Cement Limited, Binani Cement Limited and Madras Cements Limited (3% each).

The production of **phosphorite/rock phosphate** at 2.15 million tonnes increased 34% in 2010-11 as compared to the previous year. The entire production was from Public Sector. Jhamarkotra mine of Rajasthan State Mines & Minerals Ltd in Rajasthan reported 94% production of phosphorite/rock phosphate during 2010-11. The production of **dolomite** at 5.07 million tonnes in 2010-11, however, decreased 14% as compared to the preceding year. Seven major companies, viz, SAIL (24%), Bisra Stone Lime Co. Ltd (12%), Rashtriya Ispat Nigam Ltd (10%), Tata Steel (9%), South West Mining Ltd (4%) and Manish Singh (3% each) together accounted for 62% of the dolomite produced in 2010-11. Chhattisgarh, Odisha and Andhra Pradesh were the principal producing states of dolomite accounting for 27%, 22% and 21%, production respectively, and the remaining 30% was contributed by Gujarat, Jharkhand, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan and Uttarakhand.

The production of **kaolin** in 2010-11 at 2.5 million tonnes decreased 10% as compared to that in the previous year. Nearly 49% of total output of kaolin in 2010-11 was reported from Gujarat followed by Kerala 27% and Rajasthan 16%. Production of **gypsum** at 4.35 million tonnes in 2010-11 reported increase of 29% as compared to the previous year. Almost the entire production of gypsum was reported from Rajasthan (99%) while nominal output was also reported from Jammu & Kashmir and Gujarat. Two public sector companies, namely, RSMML and Fertilizer Corporation of India Ltd accounted for almost entire production. The production of **magnesite** at 0.23 million tonnes during 2010-11 decreased by 24% as compared to the previous year.

The production of **talc/soapstone/steatite** in 2010-11 at 0.9 million tonnes increased about 2% over the previous year. Rajasthan, the principal state accounted for 74% of the total production in 2010-11. Five principal producers in Rajasthan, namely, Associated Soapstone Distributing Co. (P) Ltd (30%), Udaipur Mineral Development Syndicate (P) Ltd (19%), Rajasthan Mineral and Company, Katiyar Mining and Industrial Corp. and Nalwaya Mineral Industries Pvt. Ltd. (4% each) together accounted for 61% production of talc/soapstone/steatite in 2010-11.

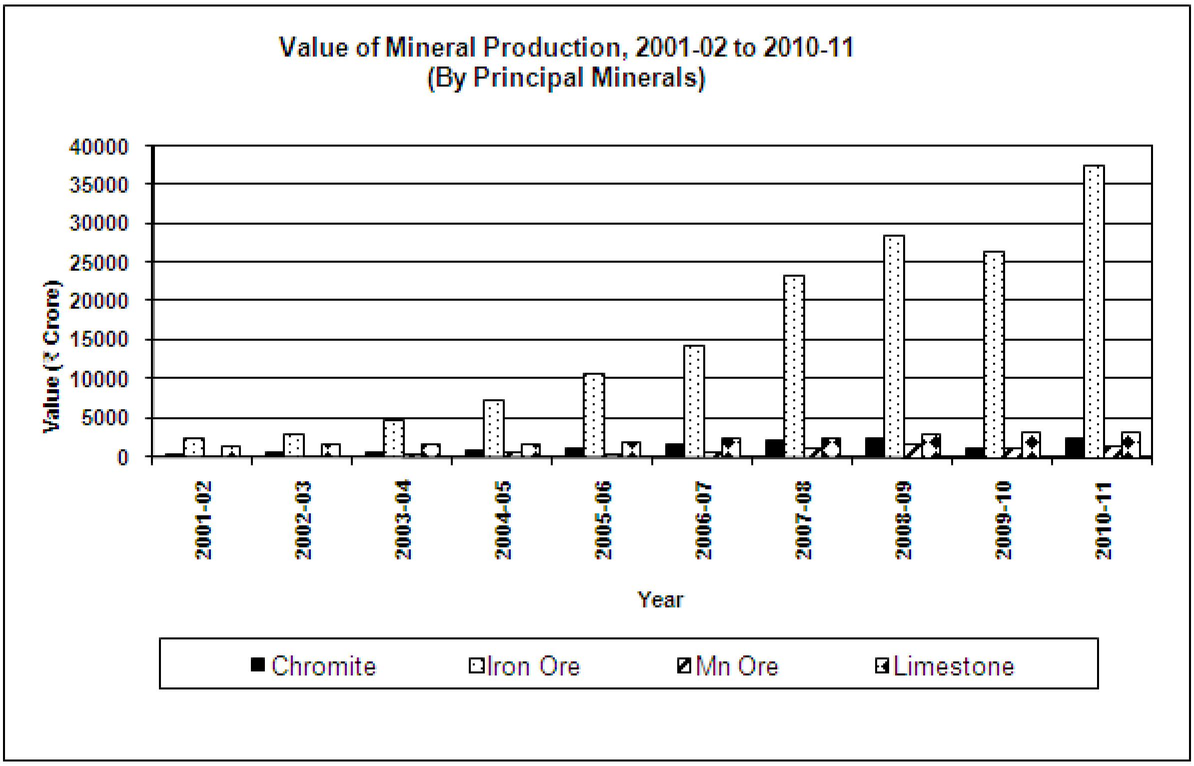
Reporting Mines

Reporting mine is defined as “a mine reporting production or reporting ‘nil’ production during a year but engaged in developmental work such as, overburden removal, underground driving, winzing, sinking work, exploration by pitting, trenching or drilling as evident from the MCDR returns”.

There were 2,928 reporting mines (excluding atomic & minor minerals and petroleum (crude) & natural gas) in India located in 21 states during 2010-11. Among them, 573 mines belonged to coal & lignite, 687 to metallic minerals and 1,668 to non-metallic minerals. There were 778 mines in public sector and the rest of 2150 mines in private sector. The reporting mines concentrated in eleven major states, namely, Andhra Pradesh, Chhattisgarh, Gujarat, Jharkhand, Karnataka, Madhya Pradesh, Maharashtra, Odisha, Rajasthan, Tamil Nadu and West Bengal accounted for 92% of the total reporting mines.

Employment

The estimated average daily employment of labour strength engaged in mining sector was 5,18,419 in 2010-11. Of this, 417,206 or 80% were in public sector and 101,213 or 20% in private sector. Fuel minerals accounted for 76%, metallic minerals 15% and non-metallic minerals 9% of the total labour force during the year.


Value of Mineral Production, 2001-02 to 2010-11
(By Principal Minerals)
Value (₹ Crore)
40000
35000
30000
25000
20000
15000
10000
5000
0
2001-02
2002-03
2003-04
2004-05
2005-06
2006-07
2007-08
2008-09
2009-10
2010-11
Year
Chromite
Iron Ore
Mn Ore
Limestone

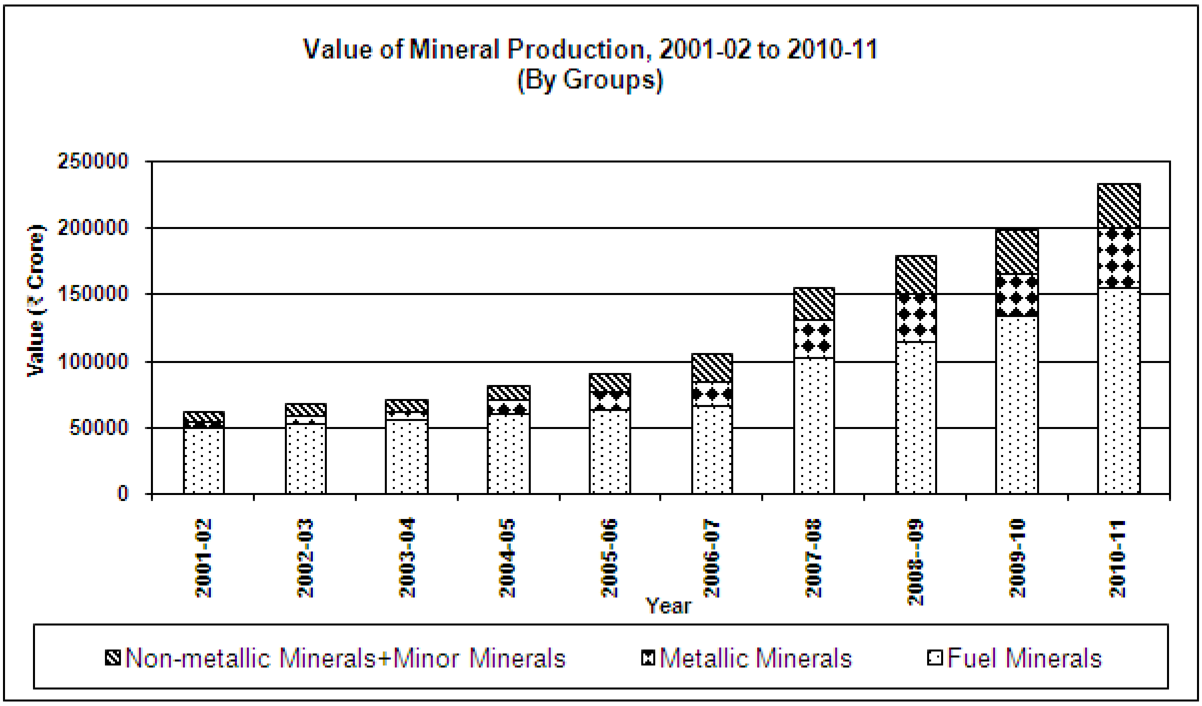

Value of Mineral Production, 2001-02 to 2010-11
(By Groups)
Value (₹ Crore)
250000
200000
150000
100000
50000
0
2001-02
2002-03
2003-04
2004-05
2005-06
2006-07
2007-08
2008--09
2009-10
2010-11
Year
Non-metallic Minerals+Minor Minerals
Metallic Minerals
Fuel Minerals

Table - 1 : Mineral* Production in India, 2008-09 to 2010-11
(By Mineral Groups & Minerals)

(Value ₹'000)

Mineral	Unit	2008-09		2009-10		2010-11 (P)	
		Quantity	Value	Quantity	Value	Quantity	Value
All Minerals			**1788997036**		**1980928721**		**2320214531**
Fuel Minerals			**1147173297**		**1336584326**		**1539422269**
Coal	'000t	492757	455370200	532042	513182500	532694	620210400
Lignite	'000t	32421	36877900	34071	37756000	37733	43307200
Natural Gas (utilised)	m cu m	32845	121073731	47496	177751215	52222	195438015
Petroleum (crude)	'000t	33508	533851466	33690	607894611	37712	680466654
Metallic Minerals			**350759869**		**317337960**		**451564203**
Bauxite	t	15460202	4703221	14124093	4887897	12640785	4737480
Chromite	t	4073479	22633627	3425580	10453620	4262207	22955675
Copper ore	t	3452406	-	3271169	-	3615038	-
Copper conc.	t	137514	4091113	124577	3809462	136856	5469271
Gold ore	t	587215	-	517520	-	727020	-
Gold[1/]	kg	2438	3152620	2084	3425814	2239	4302096
Iron ore	'000t	212960	285444020	218553	264620052	207998	375343429
Lead & zinc ore	t	6680698	-	7101872	-	7489693	-
Lead conc.	t	133768	1362744	133921	1765874	145043	1961805
Zinc conc.	t	1224077	9466647	1279880	13058419	1420105	17633867
Manganese ore	t	2789025	17737032	2491950	11905233	2881080	13695816
Silver	kg	105284	2147578	138780	3388694	148288	5437664
Tin conc.	kg	59778	21267	59016	22895	61355	27100
Non-Metallic Minerals			**40669509**		**46700273**		**48921897**
Agate	t	-	-	11	6	19	10
Apatite	t	6415	13025	5992	12911	3845	7702
Phosphorite/rock phosphate	t	1803954	3087617	1605489	3103095	2152215	5513749
Asbestos	t	315	14521	243	12268	258	12887
Ball clay	t	997676	200778	932993	218174	958454	202616
Barytes	t	1686148	966445	2152552	2601842	2333805	2651360
Calcite	t	67284	22729	49309	16980	39370	13048
Chalk	t	203085	77251	185218	71087	174914	65220
Clay (others)	t	1220783	80499	1056273	71294	590702	44508
Corundum	kg	21000	63	6600	20	-	-
Diamond	crt	536	4537	16891	116279	19774	152651
Diaspore	t	24642	23384	25569	27422	26905	25468
Dolomite	t	5509237	1554731	5911759	1672224	5064875	1504152
Dunite	t	50935	23482	71642	19281	18591	5196
Felspar	t	534032	97651	496997	98648	472041	99377
Fireclay	t	495781	83416	548748	89680	571421	100245
Felsite	t	1238	1367	1337	1608	923	1463
Fluorite (graded)	t	3176	15626	4995	20614	3150	14985
Fluorite (conc.)	t	6814	88715	8786	98855	4394	66412
Garnet (abrasive)	t	1151241	565937	1580617	763377	2058266	1200146
Graphite (r.o.m.)	t	117767	46618	124625	53830	114836	47098
Gypsum	t	3876671	993465	3370322	1004631	4346700	1304004
Selenite	t	15224	12940	14598	12408	6728	5719

(Contd.)

Table - 1 (Concld.)

(Value ₹'000)

Mineral	Unit	2008-09		2009-10		2010-11 (P)	
		Quantity	Value	Quantity	Value	Quantity	Value
Iolite	kg	-	-	758	40862	-	-
Jasper	t	99	51	-	-	-	-
Kaolin	t	2083731	641747	2798340	676728	2522181	627559
Kyanite	t	4620	5184	5495	5812	5569	5916
Sillimanite	t	33702	236871	33687	258779	47671	424964
Laterite	t	1237393	162442	1300772	177376	1158192	120886
Limestone	'000t	221573	29219744	232950	32477596	237774	32254917
Limekankar	t	434332	76167	335067	58754	383816	51124
Limeshell	t	97856	73256	62215	50917	29843	28075
Magnesite	t	252880	363514	301070	435118	229734	341520
Marl	t	4167452	193919	5908226	381599	4374531	256118
Mica (crude)	t	1462	42728	1061	39940	1293	43963
Mica (waste & Scrap)2/	t	5685	-	8098	-	5820	-
Ochre	t	766382	70694	1258207	226881	1169843	149673
Pyrophyllite	t	255699	55831	240747	60425	234487	52129
Pyroxenite	t	281785	139143	279332	152371	240412	121639
Quartz	t	430734	75564	528066	95759	456829	82331
Quartzite	t	97458	31459	112652	37377	118179	35422
Silica sand	t	2836804	366083	2545988	408559	3081468	342351
Sand (others)	t	1808185	106971	2159405	101399	1916366	103969
Salt (rock)	t	2011	3630	1836	4908	1200	3380
Shale	t	3047063	90260	3033948	89288	3018540	81458
Slate	t	8931	5552	-	-	-	-
Sulphur3/	t	269572	-	263124	-	236998	-
Talc/steatite/soapstone	t	888995	598522	876548	713708	895817	592977
Vermiculite	t	12647	9423	11662	7653	22038	13417
Wollastonite	t	111581	125957	132385	111930	182600	150093
Minor Minerals@			**250394361**		**280306162**		**280306162**

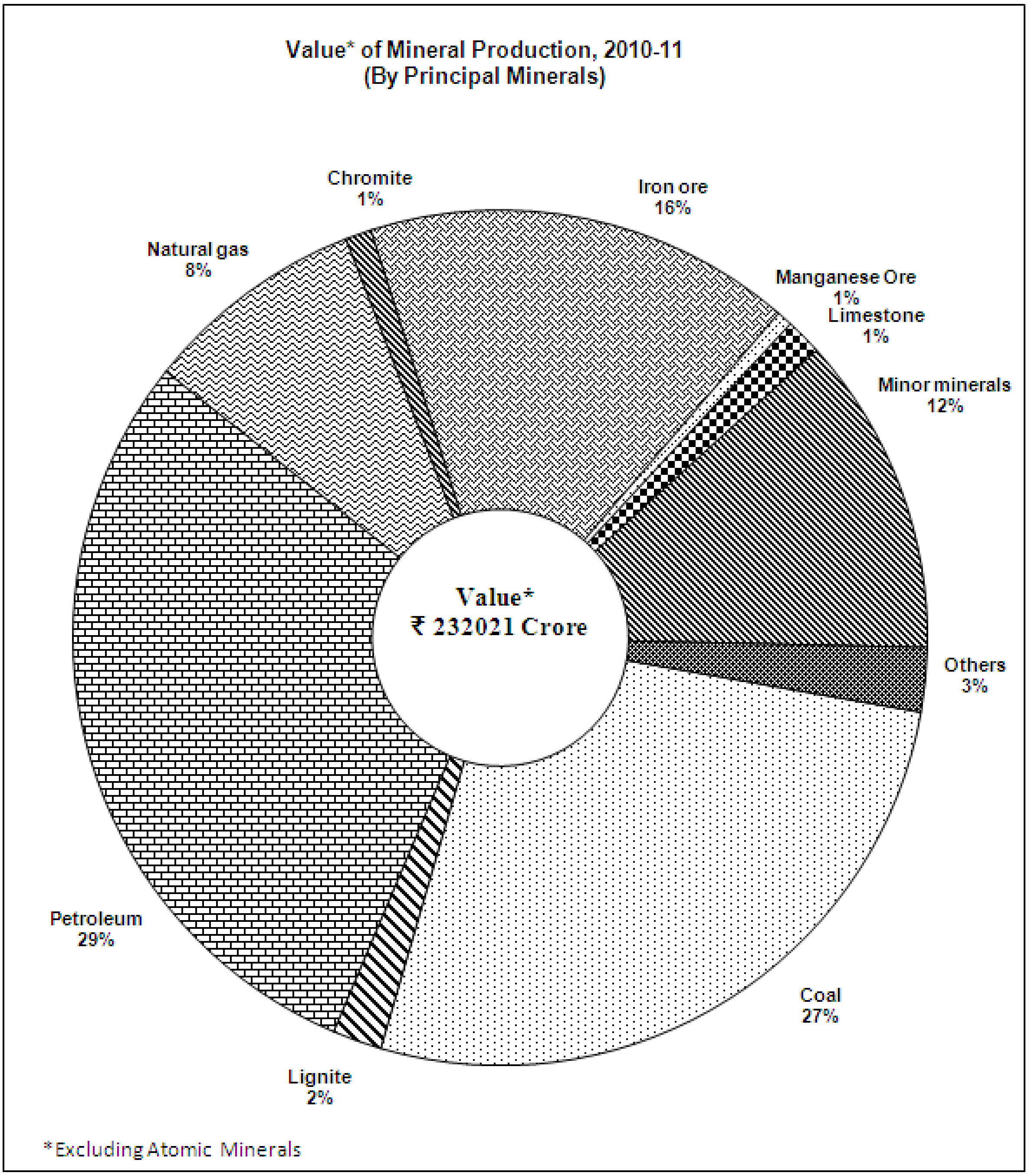
* *Excluding the minerals declared as prescribed substances under the Atomic Energy Act,1962.*

1/ *Excludes by-product gold recovery from imported concentrates.*

2/ *Includes mine waste and waste obtained while dressing of crude mica at the mine site.*

3/ *Obtained as by-product from fertilizer plants and oil refineries.*

@ *Figures for earlier years have been repeated as estimates, wherever necessary, because of non-receipt of data.*


Value* of Mineral Production, 2010-11
(By Principal Minerals)
Chromite
1%
Iron ore
16%
Natural gas
8%
Manganese Ore
1%
Limestone
1%
Minor minerals
12%
Value*
₹ 232021 Crore
Others
3%
Petroleum
29%
Coal
27%
Lignite
2%
*Excluding Atomic Minerals

Role of Public Sector

The value of mineral production (excluding atomic minerals and minor minerals) in public sector was at ₹ 134227 crore or 58% in the overall value of mineral production in 2010-11. The share of public sector in the total value of fuel minerals was 76%, in metallic minerals 35% and 30% in non-metallic minerals during the year.

The entire production of copper ore & conc. among metallic minerals and diamond, dunite, fluorite (conc.), fluorite (graded), phosphorite/rock phosphate, salt (rock), selenite and sulphur in respect of non-metallic minerals was reported from the public sector. By and large, the entire production of gold (total), barytes and gypsum sand (others) came from public sector during 2010-11. Public Sector also had sizeable contribution in production of lignite (97%), coal (91%), petroleum (crude) (74%), tin conc. (82%), kyanite (69%) and magnesite (65%) (Table-2).

Table - 2 : Mineral Production (Quantity), 2009-10 and 2010-11
(By Sectors)

Mineral	Unit	All India		Public sector		Private sector		% share of public sector in total production		Overall increase (+) or decrease (-) in production in 2010-11 over
		2009-10	2010-11	2009-10	2010-11	2009-10	2010-11	2009-10	2010-11	2009-10
Fuel Minerals										
Coal	'000 t	532042	532694	484040	485061	48002	47633	90.98	91.06	0.12
Lignite	'000 t	34071	37733	33760	36780	311	953	99.09	97.47	10.75
Natural Gas (utilised)	m cu m	47496	52222	25511	25448	21985	26774	53.71	48.73	9.95
Petroleum (crude)	'000 t	33690	37712	28427	28030	5263	9682	84.38	74.33	11.94
Metallic Minerals										
Bauxite	tonne	14124093	12640785	6145118	5691234	7978975	6949551	43.51	45.02	-10.50
Chromite	tonne	3425580	4262207	611380	1255798	2814200	3006409	17.85	29.46	24.42
Copper conc.	tonne	124577	136856	124577	136856	-	-	100.00	100.00	9.86
Copper ore	tonne	3271169	3615038	3271169	3615038	-	-	100.00	100.00	10.51
Gold*	kg	2084	2239	2070	2225	14	14	99.33	99.37	7.44
Gold ore	tonne	517520	727020	512454	722985	5066	4035	99.02	99.44	40.48
Iron ore	'000 t	218553	207998	58621	58312	159932	149686	26.82	28.03	-4.83
Lead & zinc ore	tonne	7101872	7489693	-	-	7101872	7489693	-	-	5.46
Lead conc.	tonne	133921	145043	-	-	133921	145043	-	-	8.30
Manganese ore	tonne	2491950	2881080	1180963	1298958	1310987	1582122	47.39	45.09	15.62
Silver*	kg	138780	148288	230	206	138550	148082	0.17	0.14	6.85
Tin conc.	kg	59016	61355	34223	50179	24793	11176	57.99	81.78	3.96
Zinc conc.	tonne	1279880	1420105	-	-	1279880	1420105	-	-	10.96
Non-Metallic Minerals										
Agate	tonne	11	19	-	-	11	19	-	-	72.73
Apatite	tonne	5992	3845	2110	1260	3882	2585	35.21	32.77	-35.83
Phosphorite/rock Phosphate	tonne	1605489	2152215	1605489	2152215	-	-	100.00	100.00	34.05
Asbestos	tonne	243	258	-	-	243	258	-	-	6.17
Ball clay	tonne	932993	958454	71396	115500	861597	842954	7.65	12.05	2.73
Barytes	tonne	2152552	2333805	2111795	2289791	40757	44014	98.11	98.11	8.42
Calcite	tonne	49309	39370	-	-	49309	39370	-	-	-20.16
Chalk	tonne	185218	174914	-	-	185218	174914	-	-	-5.56
Clay (others)	tonne	1056273	590702	-	-	1056273	590702	-	-	-44.08
Corundum	kg	6600	-	-	-	6600	-	-	-	-
Diamond	carat	16891	19774	16891	19774	-	-	100.00	100.00	17.07
All IndiaDiaspore	tonne	25569	26905	138	53	25431	26852	0.54	0.20	5.23
Dolomit	tonne	5911759	5064875	2616918	2448788	3294841	2616087	44.27	48.35	-14.33
Dunite	tonne	71642	18591	57792	18591	13850	-	80.67	100.00	-74.05
Felsite	tonne	1337	923	-	-	1337	923	-	-	-30.96
Felspar	tonne	496997	472041	3100	1030	493897	471011	0.62	0.22	-5.02
Fireclay	tonne	548748	571421	5523	5125	543225	566296	1.01	0.90	4.13
Fluorite (conc.)	tonne	8786	4394	8786	4394	-	-	100.00	100.00	-49.99

(Contd.)

Table - 2 (Concld.)

Mineral	Unit	All India 2009-10	All India 2010-11	Public sector 2009-10	Public sector 2010-11	Private sector 2009-10	Private sector 2010-11	% share of public sector in total production 2009-10	% share of public sector in total production 2010-11	Overall increase (+) or decrease (-) in production in 2010-11 over 2009-10
Flourite (graded)	tonne	4995	3150	4995	3150	-	-	100.00	100.00	-36.94
Garnet (abrasive)	tonne	1580617	2058266	24474	33388	1556143	2024878	1.55	1.62	30.22
Graphite r.o.m.	tonne	124625	114836	50764	49299	73861	65537	40.73	42.93	-7.85
Gypsum	tonne	3370322	4346700	3346281	4331639	24041	15061	99.29	99.65	28.97
Selenite	tonne	14598	6728	14598	6728	-	-	100.00	100.00	-53.91
Iolite	kg	758	-	-	-	758	-	-	-	-
Kaolin (total)	tonne	2798340	2522181	32334	37783	2766006	2484398	1.16	1.50	-9.87
Kyanite	tonne	5495	5569	4660	3831	835	1738	84.80	68.79	1.35
Sillimanite	tonne	33687	47671	23057	27006	10630	20665	68.44	56.65	41.51
Laterite	tonne	1300772	1158192	52849	65036	1247923	1093156	4.06	5.62	-10.96
Limekankar	tonne	335067	383816	-	-	335067	383816	-	-	14.55
Limeshell	tonne	62215	29843	16885	13795	45330	16048	27.14	46.23	-52.03
Limestone	'000 t	232950	237774	18198	20257	214752	217517	7.81	8.52	2.07
Magnesite	tonne	301070	229734	185536	149627	115534	80107	61.63	65.13	-23.69
Marl	tonne	5908226	4374531	-	-	5908226	4374531	-	-	-25.96
Mica (crude)	kg	1061	1293	-	-	1060858	1292717	-	-	21.86
Mica (waste & scrap)	kg	8098	5820	-	-	8098142	5819705	-	-	-28.14
Ochre	tonne	1258207	1169843	-	-	1258207	1169843	-	-	-7.02
Pyrophyllite	tonne	240747	234487	12916	10076	227831	224411	5.36	4.30	-2.60
Pyroxenite	tonne	279332	240412	-	-	279332	240412	-	-	-13.93
Quartz	tonne	528066	456829	5191	9375	522875	447454	0.98	2.05	-13.49
Quartzite	tonne	112652	118179	-	-	112652	118179	-	-	4.91
Salt (rock)	tonne	1836	1200	1836	1200	-	-	100.00	100.00	-34.64
Sand (others)	tonne	2159405	1916366	2159405	1906146	-	10220	100.00	99.47	-11.25
Shale	tonne	3033948	3018540	62495	28800	2971453	2989740	2.06	0.95	-0.51
Silica sand	tonne	2545988	3081468	106925	129169	2439063	2952299	4.20	4.19	21.03
Sulphur	tonne	263124	236998	263124	236998	-	-	100.00	100.00	-9.93
Talc/steatite/ sopstone	tonne	876548	895817	-	-	876548	895817	-	-	2.20
Vermiculite	tonne	11662	22038	1602	2151	10060	19887	13.74	9.76	88.97
Wollastonite	tonne	132385	182600	-	-	132385	182600	-	-	37.93

** Excluding by-product gold recovery from imported concentrates.*

Minor Minerals

The share of minor minerals in the value of mineral production was about 12.6% in 2008-09 & 12.1% in 2009-10 (Table -3).

The value of minor minerals at ₹ 28031 crore in 2009-10 was higher by 12.0% as compared to that in the previous year. Andhra Pradesh with share of 29.6% in the value of minor minerals produced in the country occupied top position. Uttarakhand with a share of 22.7% was at second place. Next in the order were Rajasthan 17.0%, Uttar Pradesh (9.8%), Madhya Pradesh (6.1%), Kerala (4.1%), Gujarat (2.6%), Karnataka 2.1%, Goa (1.1%) and Chhattisgarh (1.0%). The remaining states and Union Territories contributing less than one percent each accounted for about 4.0% together (Table - 4).

Mineralwise analysis revealed that road metal had the largest share of 23.3% in the value of minor minerals, followed by limestone 22.8%, building stone 9%, brick-earth and ordinary sand 8.5% each, granite 6.6%, gravel 4.8%, marble 4.6%, quartzite & sandstone 2.4%, kankar 2.1%, murrum 1.9%, boulder 1.3% and ordinary earth 1.2%. The individual share of remaining minerals was less than one percent and together contributed 3.0% to the value of minor minerals (Table - 5).

Table – 3 : Share of Minor Minerals in Total Value of Mineral Production, 2007-08 to 2009-10

(Value in ₹ '000)

Year	All minerals	Minor minerals	% share of minor minerals
2007-08	1788996685	249858844	13.97
2008-09	1980928721	250394361	12.64
2009-10 (P)	2320214531	280306162	12.08

Table – 4 : Value of Minor Minerals 2007-08 to 2009-10 (By States)

(In ₹ '000)

State	2007-08	2008-09	2009-10 (P)
India	**249858844**	**250394361**	**280306162**
Andhra Pradesh	100541782	75500935	82873369
Arunachal Pradesh	187346	190600	182548
Assam	166578	270986	367860
Bihar	1173623	1173623	2613871
Chhattisgarh	2167553	2611866	2795885
Goa	396590	2919520	3104120
Gujarat	7256688	7256688	7256688
Haryana	1487198	1487198	1487198
Himachal Pradesh	141903	251322	288365
Jammu & Kashmir	380658	459105	649201
Jharkhand	401448	401448	401448
Karnataka	4205476	4122614	5845416
Kerala (1)	5297388	8942838	11593931
Madhya Pradesh	11835512	17025876	17024965
Maharashtra	4079741	4209800	1016862
Manipur	2866	2866	2866
Meghalaya	72075	72075	72075
Mizoram	1712	10902	6268
Nagaland	1774	1774	1774
Odisha	856767	856767	856767
Punjab	219935	607612	392267
Rajasthan	31147316	41671436	47508260
Sikkim	18787	18787	18787
Tamil Nadu	1158541	1231997	1168668
Tripura	7641	10634	14867
Uttar Pradesh	23269185	27495000	27495000
Uttarakhand	51750700	49960400	63636700
West Bengal (2)	1455113	1455113	1455113
Andaman & Nicobar Islands	172786	172786	172786
Chandigarh	3575	1206	1650
Daman & Diu	587	587	587

Source: *State Governments.*

(1) Excluding data in respect of quarrying permits for which royalty does not exceed ₹ 1000 /-

(2) Excluding data in respect of quarry permits issued by district authorities.

Note : *Earlier year's figures have been repeated as estimates, wherever necessary, due to non-receipt of data.*

Table – 5 : Value of Minor Minerals 2007-08 to 2009-10 (By Minerals)

(In ₹ '000)

Mineral	2007-08	2008-09	2009-10 (P)
All minerals	**249858844**	**250394361**	**280306162**
Bentonite	128414	146768	400260
Boulder	3159401	3263916	3610476
Brick earth	19803363	24573365	23931926
Building stones	22007486	25439163	25354968
Chalcedony or impure quartz pebbles (1)	3600	-	10800
Fuller's earth	99174	190745	328037
Granite	17182571	18113989	18505752
Gravel	13385309	11708419	13397322
Kankar (2)	4854190	3756286	5926896
Limeshell (2)	4531	6206	11307
Limestone (2)	51041426	51882162	63989355
Marble	6741120	11506043	12819800
Murrum	5944238	5944283	5191337
Ordinary clay	1036963	1451667	1298167
Ordinary earth (3)	1499377	3204132	3262953
Ordinary sand (4)	15572348	21217355	23840166
Quartzite/ Sandstone (5)	3482070	5377586	6779567
Reh matti	9174	9174	9174
Road metal	78536895	56893602	65371526
Salt petre	3341	3935	3935
Shale (6)	167	167	167
Shingle	35152	71565	79004
Slate (6)	37012	30169	22209
Stone (7)	2247220	2776952	2302787
Other minerals	3044302	2826712	3858271

Source : *State Governments.*

(1) Used for ball mill purposes or filling for bore wells or for decorative purposes in buildings.

(2) Used in kilns for manufacture of lime used as building material.

(3) Used for purposes of construction of embankments, roads, railways and buildings.

(4) Used for purposes other than (i) refractory and manufacture of ceramics, (ii) metallurgical, (iii) optical, (iv) stowing in coal mines, (v) Manufacture of silvicrete cement, sodium silicate, pottery & glass.

(5) Used for purposes of building or for making road metals and household utensils.

(6) Used for building material.

(7) Used for making household utensils.

Index of Mineral Production

During 2010-11, the index of mineral production in respect of mining and quarrying sector (excluding atomic minerals) (base 1993-94=100) at 204.95 displayed a growth of about 6% over the previous year. The positive growth in the index was owing to the upward movement in the index for fuel minerals by 6%, metallic minerals by 2% and non-metallic minerals by 7 % (Table-6).

Table - 6 : Index of Mineral Production, 2008-09 to 2010-11
(Excluding Atomic Minerals)

(Base 1993-94=100)

Year	Index of mineral production (1000)	Coal & lignite (324.63)	Crude petroleum & natural gas (532.55)	Metallic minerals (80.76)	Non-metallic minerals (42.33)	Minor minerals (19.73)
2008-09	175.96	197.28	141.78	302.26	215.48	143.76
2009-10	193.36	212.69	164.90	291.38	239.14	143.76
2010-11 (p)	204.95	214.13	183.30	298.57	256.87	143.76

***Note**: Figures in parentheses indicate the weights attached to respective groups.*

Gross Domestic Product from Mining & Quarrying Sector

The Gross Domestic Product (GDP) accrued from mining and quarrying sector at current prices is estimated by deducting input cost incurred in mining operations from the ex-mine sale value of mineral production.

During 2010-11, the mining and quarrying sector accounted for about 2.67% of the total GDP. The contribution of mining and quarrying sector in GDP during 2010-11 was ₹ 191207 crore indicating an increase of 21.48% over the preceding year. This was mainly due to rise in the value of coal, lignite, petroleum (crude), chromite, copper conc., gold, iron ore, lead & zinc conc., manganese ore, barytes, diamond, dolomite, garnet (abrasive), gypsum, kaolin, limestone, magnesite/dunite, ochre and phosphorite/rock phosphate during 2010-11.

The contribution of MCDR minerals in GDP from mining and quarrying sector during 2010-11 was 23% of which metallic minerals contribute 21% and non-metallic minerals 2%.

As regards the contribution of metallic minerals to the GDP from mining & quarrying sector, iron ore accounted for 18% and chromite, manganese ore and lead-zinc concentrates together shared 1% each. Contribution of other metallic minerals to GDP accrual from mining sector was nominal during the year. Among the non-metallic minerals, the share of limestone was over 1% while a negligible share was jointly contributed by the remaining non-metallic minerals (Table-7).

State-wise analysis reveals that Odisha occupies the top position contributing 36% in the GDP from MCDR minerals during 2010-11 followed by Chhattisgarh 18%, Goa 15%, Karnataka 14%, Rajasthan 7%, Jharkhand 3%, Andhra Pradesh and Madhya Pradesh 2% each and Gujarat, Maharashtra & Tamil Nadu 1% each. Share of other States in the GDP from mining sector was negligible during the year (Table - 8).

Table - 7 : Gross Domestic Product at Current Prices, 2008-09 to 2010-11 (By Principal MCDR Minerals)

(In ₹ '000)

Mineral	2008-09(R)	2009-10(R)	2010-11 (P)	% change in 2010-11 over previous year	% share of the mineral in the GDP from Mining & Quarrying sector in 2010-11
GDP (All sectors) *	**52820860000**	**60914850000**	**71574120000**	**17.50**	**-**
Mining & Quarrying Sector *	**1386490000**	**1574000000**	**1912070000**	**21.48**	**100.00**
MCDR Minerals	**329834194**	**317470658**	**440161761**	**38.65**	**23.02**
Metallic Minerals	**303242207**	**283034342**	**404004344**	**42.74**	**21.13**
Bauxite	3663658	3715636	3481158	-6.31	0.18
Chromite	20902162	8686938	18912206	117.71	0.99
Copper conc.	2626783	1993905	3044127	52.67	0.16
Gold	2516124	2637908	3306996	25.36	0.17
Iron ore	248585767	245740017	349015772	42.03	18.25
Lead & zinc conc.	5851896	8569733	11328006	32.19	0.59
Manganese ore	16935103	8290117	9458098	14.09	0.49
Other metallic minerals	2160714	3400088	5457980	60.52	0.29
Non-metallic Minerals	**22169037**	**26591987**	**28428902**	**5.00**	**1.89**
Ball clay	183848	207958	190012	-8.63	0.01
Barytes	720953	1841861	1876858	1.90	0.10
Diamond	4537	79883	104870	31.28	0.01
Dolomite	899047	1092112	1265923	15.92	0.07
Garnet (abrasive)	429263	682082	1143035	67.58	0.06
Gypsum	999014	979603	1261702	28.80	0.07
Kaolin	507532	553573	406248	-26.61	0.02
Limestone	18540659	24320436	23738905	-2.39	1.24
Magnesite/Dunite	210836	319036	243000	-23.83	0.01
Ochre	32520	36996	133889	261.90	0.01
Phosphorite/rock phosphate	2180950	2170515	3813440	75.69	0.20
Sand (others)	106971	101399	102334	0.92	0.01
Silica Sand	266529	321068	298293	-7.09	0.02
Sillimanite	210775	156439	165979	6.10	0.01
Talc/steatite/soapstone	337628	518645	423547	-18.34	0.02
Wollastonite	120043	100429	126278	25.74	0.01
Other non-metallic minerals	840882	954281	863102	-9.55	0.05

* ***Source*** : CSO.

Table - 8 : Gross Domestic Product from Mining & Quarrying Sector at Current Prices, 2008-09 to 2010-11 (By States/Union Territories)

(In ₹ '000)

State/Union Territory	2008-09(R)	2009-10(R)	2010-11 (P)	% change in 2010-11 over previous year	% share of the State in the GDP from MCDR minerals in 2010-11
GDP (All sectors) *	**52820860000**	**60914850000**	**71574120000**	**17.50**	**-**
Mining & Quarrying Sector *	**1386490000**	**1574000000**	**1912070000**	**21.48**	**-**
MCDR Minerals	**329834194**	**317470658**	**440161761**	**38.65**	**100.00**
Andhra Pradesh	17871146	14823128	7588751	-48.80	1.72
Assam	74330	82398	73108	-11.27	0.02
Bihar	100036	141648	185334	30.84	0.04
Chhattisgarh	57895703	43444235	79699623	83.45	18.11
Goa	44393548	50752456	67350227	32.70	15.30
Gujarat	3022854	3580560	3005481	-16.06	0.68
Himachal Pradesh	518696	708754	1011012	42.65	0.23
Jammu & Kashmir	25079	57235	31586	-44.81	0.01
Jharkhand	1401766	9469037	12960757	36.88	2.94
Karnataka	52628355	48048394	60898198	26.74	13.84
Kerala	487846	338415	306196	-9.52	0.07
Madhya Pradesh	10693275	8154346	9088009	11.45	2.06
Maharashtra	8536484	3225009	3629877	12.55	0.82
Meghalaya	333773	498133	191837	-61.49	0.04
Odisha	112250070	107361776	160417313	49.42	36.45
Rajasthan	16499279	22224404	29184710	31.32	6.63
Tamil Nadu	2854153	4071829	4051027	-0.51	0.92
Uttar Pradesh	47027	247649	252197	1.84	0.06
Uttarakhand	164290	195038	194141	-0.46	0.04
West Bengal	36484	46214	42377	-8.30	0.01

* ***Source*** : CSO.

METALS

Ferrous Metals

As per the provisional data received from the Office of the Joint Plant Committee, Kolkata, India produced 71.8 million tonnes finished steel (including C.R. sheets), 25.3 million tonnes semi-finished steel (including steel ingots), 5.5 million tonnes pig iron, 26.7 million tonnes sponge iron and 0.6 million tonnes steel wires in 2010-11.

The production of finished steel (including C.R.sheets), semi finished steel (including steel ingots), steel wire and sponge iron registered increase of 9.7%, 7.3%, 3.2% and 28.8%, respectively. However, production of pig iron registered a decrease of 3.4% over the previous year. Production of 1.6 tonnes of chromium metal was also reported in 2010-11 (Table - 9).

Table – 9 : Production of Ferrous Metals 2008-09 to 2010-11

(In '000 tonnes)

Ferrous Metal	2008-09	2009-10	2010-11 (P)
Finished steel (including C.R. sheets)	57659	65428	71775
Semi-finished steel (including steel ingots)	21367	23561	25273
Pig iron	5083	5734	5541
Sponge iron	20700	20738	26709
Steel wire	498	571	589
Chromium metal (kg)	NA	NA	1595

Source: *Office of Joint Plant Committee, Kolkata and individul producer of chromium metal.*

Ferro-alloys

The information on production of ferro-alloys was received from Indian Ferro-alloys Producers' Association (IFAPA), Mumbai for the year 2010-11. The production of bulk ferro-alloys and noble ferro-alloys was 2.85 million tonnes and 33,360 tonnes, respectively, in 2010-11. The data on production of ferro-alloys during 2008-09 to 2010-11 are furnished in Table-10.

Table – 10 : Production of Ferro-alloys 2008-089 to 2010-11

(In tonnes)

Ferro-alloy	2008-09	2009-10	2010-11
Total (A) + (B)	**2251737**	**2493633**	**2885360**
A) Bulk Ferro-alloys	**2224502**	**2462775**	**2852000**
HC Ferro-manganese	372286	341883	390000
MC Ferro-manganese	8386	8222	8000
LC Ferro-manganese	5775	6018	6000
Silico-manganese	889434	1066485	1250000
MC Silico-manganese	24087	24108	24000
LC Silico-manganese	22368	25454	25000
Ferro-silicon	110742	97682	117000
HC Ferro-chrome/ charge-chrome	790072	890916	1030000
LC Ferro-chrome	1352	2007	2000
B) Noble Ferro-alloys	**27235**	**30858**	**33360**
Ferro-molybdenum	2112	2822	3050
Ferro-vanadium	1501	1389	1500
Ferro-tungsten	150	150	150
Ferro-silico-magnesium	13400	17132	18500
Ferro-aluminium	8170	7017	7600
Ferro-silico-zirconium	37	120	120
Ferro-titanium	1561	1929	2100
Ferro-boron	83	90	90
Ferro-nickel-magnesium	221	209	250

Note: *HC: High carbon MC: Medium carbon LC: Low carbon*

Source: *Indian Ferro-alloys Producers' Association (IFAPA), Mumbai.*

Non-ferrous Metals

The production of aluminium estimated at 16.21 lakh tonnes in 2010-11 registered an increase of 9.5% as compared to that in the previous year. Smelting and refining of copper is carried out by Hindustan Copper Ltd in their existing plant located at Khetri. Copper metal is also produced from imported copper concentrates at the plants of Sterlite Industries (India) Ltd and Hindalco Industries Ltd. The production of copper blister at 14,245 tonnes in 2010-11 decreased by 20% as compared to 17,864 tonnes in the previous year. The production of copper cathodes at 0.512 million tonnes in 2010-11 decreased by 4% as compared to the previous year. The production of copper electrolytic wire bars was not reported during the last five years. The production of copper continuous cast wire rods at 0.291 million tonnes in 2010-11 decreased by 7% as compared to the previous year.

The production of lead (primary) at 57,294 tonnes in 2010-11 decreased by about 11% as compared to that in the previous year. No production of lead (secondary) was reported in both the years. The production of zinc ingots in 2010-11 was 0.74 million tonnes as against 0.614 million tonnes in the previous year showing an increase of 21%.

Precious Metals

Gold (primary) is produced from gold ore by HGML in the state of Karnataka in addition to a nominal contribution by a private sector company in Jharkhand. Gold is also recovered as by-product from slimes of imported concentrates by Hindalco Industries Ltd in Gujarat. The total production of gold bullion during the year at 9,200 kg decreased by 18% as compared to 11,198 kg in the previous year.

Entire production of silver in India is reported as by-product from copper, lead and zinc concentrates and as a co-product of gold refining. It is also recovered from imported copper concentrates. The total production of silver at 193,361 kg in 2010-11 registered an increase of 5% over the previous year.

Other Metals

Cadmium is a by-product of zinc smelting. Its production at 550 tonnes in 2010-11 decreased nominally as compared to the previous year. Production of selenium has not been reported during the last three years. (Table - 11).

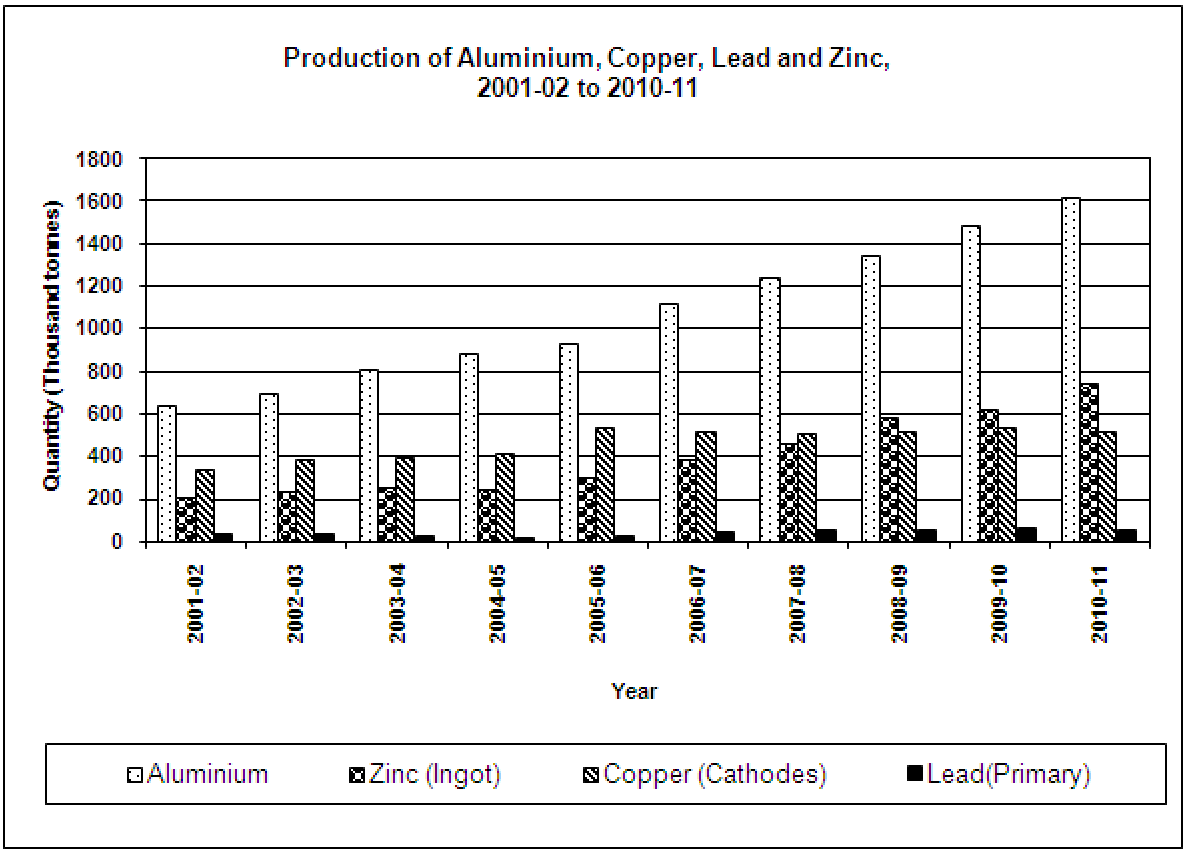


Table – 11 : Production and Value of Non-ferrous Metals, 2008-09 to 2010-11

(Value in ₹ '000)

Metal	Unit of quantity	2007-08		2008-09		2009-10 (P)	
		Quantity	Value	Quantity	Value	Quantity	Value
Aluminium	tonne	1347127	122673933	1480568	123771762	1621035	NA
Cadmium	tonne	507	127919	553	105211	550	104958
Copper (blister)	tonne	29472	-	17864	-	14245	-
Copper (cathode)	tonne	513640	129849338	532865	158204331	512124	190516536
Copper (electrolytic wire bar)	tonne	-	-	-	-	-	-
Copper (continuous cast wire rod)	tonne	314425	83388321	312447	100987199	290734	113580892
Gold*	kg	7309	9277886	11198	17910044	9200	17586827
Lead (primary)	tonne	60323	5418563	64319	7260867	57294	683253
Selenium	kg	-	-	-	-	-	-
Silver*	kg	142590	2895138	183656	4491042	193361	7091986
Tin	kg	26568	18952	27129	15491	24013	25086
Zinc ingot	tonne	579091	47090795	613964	67484136	740402	86758258

Source: *Individual producers/units.*
** Including by-product recovery from imported copper concentrates.*

Indian Minerals Yearbook 2011

(Part- I)

50th Edition

PRICES

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. +91712 - 2565471
PBX : +91712 - 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

9 Prices

1. MINERALS

1.1 Domestic Markets

Fuel Minerals

The f.o.r. colliery railway siding prices of various grades of coking and non-coking coal increased during 2010-11 compared to the previous year. The f.o.r. colliery railway siding prices of different grades of coking coal (run of mine) in respect of Bharat Coking Coal Ltd, Central Coalfields Ltd and Western Coalfields Ltd increased by about 30%. Prices of different grades of non-coking long-flame coal (run of mine) in respect of South Eastern Coalfields Ltd increased by 180.8% for grade A by 189.1% for grade B, by 10.2% for grade C and by 38.8% for grade D. Prices of Northern Coalfields Ltd increased by 147.7% to 167.9% for A & B grades. Prices of Mahanadi Coalfields Ltd increasd by 188.3%, 217.7%, 10.5% and 11.4% for A, B, C & D Grades, respectively. Prices of different grades of non-coking coal non-long-flame coal (run of mine) of South Eastern Coalfields Ltd remained unchanged. The prices of Western Coalfield Ltd increased by 156.3% and 162.5% for A and B grades, respectively. The f.o.r. colliery railway siding prices of all varieties of semi-coking and weakly-coking coal (run of mine) in respect of South Eastern Coalfields Ltd increased by 29.9% and 30.3%, respectively. Prices in respect of semi-coking grade I & II of Eastern Coalfields Ltd (Ranigunj), increased by 30.2 %.

The 2010-11, basic prices of indigenous petroleum (crude) which are exclusive of royalty, cess, sales tax and other charges were on higher side as compared to 2009-10. The rise was about 19.0% in respect of onshore crude prices and about 20.4% in respect of offshore crude prices. The average c.i.f. price of imported petroleum (crude) at Indian ports was quoted at about 15.6% higher level as compared to the preceding year.

The prices of different varieties of coking coal, non-coking coal and semi-coking coal, offshore and onshore prices of domestic petroleum (crude) as well as average c.i.f. price (on Indian ports) of imported petroleum (crude) for the years 2008-09 to 2010-11 are given in Table - 1.

Metallic Minerals

During 2010-11, among the metallic minerals, the ex-mine prices of cement grade and metal grade of Tikuri Road side Bauxite Mine (Madhya Pradesh) increased by 15% and 7%, respectively. Similarly the prices of 40% to 45% Al_2O_3 grades of ex-mine Barima mainpat (Chhattisgarh) increased by 9% and ex-mine Keonjhar (Odisha) prices increased by 14% in 2010-11 as compared to previous year. Ex-mine price of NPG grade, Jamnagar (Gujarat) decreased by 33%, while Refractory grade ex-mine price at Tikuri Road side (Madhya Pradesh), non-metallurgical, less than 40% Al_2O_3 and metallurgical 40% Al_2O_3 and above ex-mine Margao (Goa) and PG grade ex-mine Jamnagar (Gujarat) remained unchanged.

All the ex-mine prices for reporting grades of chromite showed increasing trend in prices as compared to previous year .

The ex-mine/fob prices for various grade of **iron ore** in Odisha, Andhra Pradesh, Jharkhand, Tamil Nadu and Karnataka have shown increase in ex-mine prices of all grades reported by Barbil, Gandhmardan, Koira and Daitary mines except +65% Fe CLO ex-mine Barbil OMC Ltd (Odisha) as compared to previous year.

Ex-mine prices of some grades of **manganese ore** for various grades have increased in current year as compared to the preceding year.

Ex-stock Dantewada (Chhattisgarh) price of 50-60% SnO_2 grade of **tin concentrates** increased by 68.1% during the year.

Average c.i.f. price (on Indian ports) in respect of imported tungsten ore and concentrate have jumped very high as compared to previous year (Table-2).

Table – 1: Prices of Fuel Minerals 2008-09 to 2010-11 (Domestic Markets)

(In ₹ per tonne)

Grade	Market	2008-09	2009-10	2010-11(P)
COKING COAL (run-of-mine)				
Bharat Coking Coal Ltd				
Washery grade I	f.o.r. Colliery Rly. Siding	2020	2020	2630
Washery grade II	"	1680	1680	2180
Washery grade III	"	1240	1240	1610
Washery grade IV	"	1150	1150	1500
Western Coalfields Ltd				
Washery grade I	f.o.r. Colliery Rly. Siding	1710	1710	2220
Washery grade II	"	1410	1410	1830
Washery grade III	"	1290	1290	1680
Central Coalfields Ltd				
Washery grade I	f.o.r. Colliery Rly. Siding	1960	1960	2550
Washery grade II	"	1620	1620	2110
Washery grade III	"	1200	1200	1560
Washery grade IV	"	1120	1120	1460
NON-COKING COAL LONG-FLAME COAL (run-of-mine)				
South Eastern Coalfields Ltd				
Grade A	f.o.r. Colliery Rly. Siding	1450	1460	1190-4100
Grade B	"	1360	1380	1110-3990
Grade C	"	1180	1180	950-1300
Grade D	"	1010	1010	800-1110
Northern Coalfields Ltd				
Grade A	f.o.r. Colliery Rly. Siding	1670	1490	3690
Grade B	"	1520	1340	3590
Grade C	"	1280	1100	1100
Grade D	"	1080	920	920
Mahanadi Coalfields Ltd				
Grade A	f.o.r. Colliery Rly. Siding	1430	1280	3690
Grade B	"	1290	1130	3590
Grade C	"	1080	950	1050
Grade D	"	920	790	880
NON-COKING COAL NON-LONG-FLAME COAL (run-of-mine)				
South Eastern Coalfields Ltd				
Grade A	f.o.r. Colliery Rly. Siding	1610	1610	1610
Grade B	"	1520	1520	1520

(Contd.)

Table – 1 (Concld.)

Grade	Market	2008-09	2009-10	2010-11(P)
Grade C	"	1300	1300	1300
Grade D	"	1110	1110	1100
Grade E	"	870	870	870
Grade F	"	630	630	630
Grade G	"	440	440	440
Western Coalfields Ltd				
Grade A	f.o.r. Colliery Rly. Siding	1600	1600	4100
Grade B	"	1520	1520	3990
Grade C	"	1410	1420	1410
Grade D	"	1330	1330	1330
Grade E	"	1090	1090	1090
Grade F	"	860	860	860
Grade G	"	650	650	650
SEMI-COKING & WEAKLY COKING COAL (run-of-mine)				
South Eastern Coalfields Ltd				
Semi-Coking grade I	f.o.r. Colliery Rly. Siding	1740	1740	2260
Semi-Coking grade II	"	1450	1450	1890
Eastern Coalfields Ltd (Ranigunj)				
Semi-Coking grade I	f.o.r. Colliery Rly. Siding	2150	2150	2800
Semi-Coking grade II	"	1790	1790	2330
PETROLEUM (Crude)				
Indeginous*	Onshore	28354	24233	28829
Indeginous*	Offshore	30507	26187	31525
Indeginous*	Offshore & onshore	29796	25530	30614
Imported	c.i.f. Indian Port (average)	26672	23817	27535

* *Relate to provisional weighted average basic prices of petroleum crude of ONGC, excluding royalty, cess, sales tax and other charges. Prices are Gross (pre-discount) derived figures.*

Sources: 1. *Coal India Ltd, Kolkata (for coal) vide their Notification No. CIL/S&M/GM(F)/Pricing/1124 dated 12.12.2007 and CIL/S&M/GM(F)/Pricing/1181 dated 15.10.2009.for 2008-09 Coal directory of India 2009-10 for the data 2009-10 and website for 2010-11.*

2. *D.G.C.I.&S., Kolkata (for petroleum crude) for average imported prices and Basic Statistics on Indian Petroleum & Natural Gas, 2010-11, Ministry of Petroleum & Natural Gas, for indigenous crude prices.*

Table – 2: Prices of Metallic Minerals, 2008-09 to 2010-11 (Domestic Markets)

(In ₹ per tonne)

Grade	Market	2008-09	2009-10	2010-11 (P)
Bauxite				
40% to 45%	Ex-mine Palakhada (Gujarat)	295-410	295-410	NA
Cement Grade	Ex-mine Tikuri Road side (Madhya Pradesh)	165	165	190
Metal Grade	Ex-mine Tikuri Road side (Madhya Pradesh)	576	611	656
Refractory Grade	Ex-mine Tikuri Road side (Madhya Pradesh)	700	700	700
Grade (Al_2O_3 50% to 55%)	Ex-mine Udgiri (Maharashtra)	325	400	400
Grade (Al_2O_3 45% to 50%)	Ex-mine Udgiri (Maharashtra)	290	350	350
Grade (Al_2O_3 40% to 45%)	Ex-mine Udgiri (Maharashtra)	106	210	210
Grade (Al_2O_3 40% to 45%)	Ex-mine Barima Mainpat (Chhattisgarh)	342.8	351	380.5
PG	Ex-mine Jamnagar (Gujarat)	261.60	286	286
NPG	Ex-mine Jamnagar (Gujarat)	170	277.13	185
Refractory Grade	Ex-mine MML (Jharkhand)	319.79	349.41	349.41
Non-metallurgical less than 40%	Ex-mine Margao (Goa)	75	100	100
Metallurgical 40% and above	Ex-mine Margao (Goa)	200	250	250
+38% Al_2O_3	Ex-mine Keonjhar (Odisha)	614	614	700
Chromite				
+40-52% Cr_2O_3	Ex-Jajpur Road (Odisha)	18250	9950	14500
+52% Cr_2O_3	Ex-Jajpur Road (Odisha)	16540	9878	13344
+24-28% Cr_2O_3	Ex-mine MML (Karnataka)	6700	6580	6580
+40-44% Cr_2O_3	Ex-mine MML (Karnataka)	10975	9580	9580
+44-48% Cr_2O_3	Ex-mine MML (Karnataka)	11475	15300	15300
54% & above Cr_2O_3	Ex-mine OMC Ltd (Odisha)	5254-18250	4956-9331	10532-12410
52-53.99% Cr_2O_3	Ex-mine OMC Ltd ((Odisha)	5064-17675	4776-8993	10151-11961
50-51.99% Cr_2O_3	Ex-mine OMC Ltd (Odisha)	4859-17200	4592-8646	9760-11500
48-49.99% Cr_2O_3	Ex-mine OMC Ltd (Odisha)	4676-16353	4409-8329	9505-11200
46-47.99% Cr_2O_3	Ex-mine OMC Ltd (Odisha)	4240-15505	3999-8011	9251-10900
44-45.99% Cr_2O_3	Ex-mine OMC Ltd (Odisha)	3804-14284	3363-4677	7418-8741
42-43.99% Cr_2O_3	Ex-mine OMC Ltd (Odisha)	3566-13062	3363-4677	5585-6701
40-41.99% Cr_2O_3	Ex-mine OMC Ltd (Odisha)	3395-12440	3202-4453	5318-6381
-40% Cr_2O_3	Ex-mine Cuttack (Odisha)	2076	1230	1230
40-52% Cr_2O_3	Ex-mine Cuttack (Odisha)	7372	4576	8258
Copper				
Copper concentrate	Ex-mine Malanjkhand (Madhya Pradesh)	35119	35119	NA
Iron ore				
50-57% Fe Lumps	Ex-mine Khursapar (Maharashtra)	950-1100	903	993-1005
48-51% Fe Fines gr. II	Ex-mine Khursapar (Maharashtra)	400	300	330-350
Fines 0 to -5 mm	Ex-mine Khursapar (Maharashtra)	240	180	198-300
-65% Fe Lumps	Ex-mine Keonjhar (Odisha)	850	1066	2015
-62% Fe Lumps	Ex-mine Keonjhar (Odisha)	-	850	1594
-65% Fe Blue Dust	Ex-mine Keonjhar (Odisha)	-	779	1701
63.5% Fe	Ex-mine Bellary (Karnataka)	1000	1200	1500
Iron Ore	Ex-mine Macherla (Andhra Pradesh)	789.5	695	786.08
Blue Dust 61% Fe	Ex-mine Gandhigram (Madhya Pradesh)	400	450	550
+65% Fe Lumps	Ex-mine OMDC Ltd (Odisha)	2619	5420	5420
62-65% Fe Lumps	Ex-mine OMDC Ltd (Odisha)	2402	2402	2402
-62%Fe Lumps	Ex-mine OMDC Ltd (Odisha)	1800	1650	1650
62-65% Fe Fines I	Ex-mine OMDC Ltd (Odisha)	1449	1200	1200
-62% Fe Fines	Ex-mine OMDC Ltd (Odisha)	715	910	910
Baila r.o.m 65.5% (10-150mm)	f.o.r. Kirandul (Andhra Pradesh)	2200-2930	2052-2322	3157-3635
Baila Lump 65% Fe (6-40mm)	f.o.r. Kirandul (Andhra Pradesh)	2650-3510	2458-2728	3781-4353

(Contd.)

Tabel - 2 (Contd.)

Grade	Market	2008-09	2009-10	2010-11 (P)
Baila Fine 64% Fe(-10mm)	f.o.r. Kirandul (Andhra Pradesh)	1500-1970	1666-1936	2924-3366
DRCLO Fe 67% (10-40mm)	f.o.r. Bacheli (Andhra Pradesh)	3500-4653	3258-3528	4803-5529
Doni Lump 65% Fe (6-30mm)	f.o.r. Ranjitpura basis	2550-3371	2360-2630	3421-3939
Doni Fine 64% Fe (-10mm)	f.o.r. Ranjitpura basis	1500-1970	1666-1936	2924-3366
Kumarswamy Lumps 64.5% (6-30mm)	f.o.t. Kumarsway mine basis	2400-3158	2211	3206-3690
Kumarswamy Fines 64% (-10mm)	f.o.t. Kumarsway mine basis	1400-1811	1531-1801	2687-3093
+65% Fe (5/18)	Ex-mine Mayurbhanj (Odisha)	1200	1300	-
Fines -65% Fe	f.o.r. S J Harvi mines (Karnataka)	1400	1625	1625
Lumps -65% Fe	f.o.r. S J Harvi mines (Karnataka)	2500	1750	1750
Lumps +65% Fe	f.o.r. S J Harvi mines (Karnataka)	-	1645	1645
+65% Fe Lumps	Ex-mine Rungta (Jharkhand)	5416	3156	3156
62-65% Fe Lumps	Ex-mine Rungta (Jharkhand)	1966	2245	2245
-62% Fe Lumps	Ex-mine Rungta (Jharkhand)	1589	1589	NA
Barbil (Mine)				
+65% Fe CLO (10-30 mm)	Ex-mine Barbil OMC Ltd (Odisha)	2639-5471	2560-3200	2350
+62%Fe Lump (10-180 mm)	Ex-mine Barbil OMC Ltd (Odisha)	1052-1809	1052-1179	2217
+62% Fe CLO (10-40 mm)	Ex-mine Barbil OMC Ltd (Odisha)	1152-2819	1152-1812	2650-3926
+65% Fe Lump	Ex-mine Barbil OMC Ltd (Odisha)	2769	1300	2603
+63% Fe Lump	Ex-mine Barbil OMC Ltd (Odisha)	1809-2104	-	2217
Fines (60-58%Fe)	Ex-mine Barbil OMC Ltd (Odisha).	151-620	111-308	111-308
Fines (60-62%Fe)	Ex-mine Barbil OMC Ltd (Odisha)	410-1051	308-408	700-2252
Fines (62-64%Fe)	Ex-mine Barbil OMC Ltd (Odisha)	537-1457	555-651	1105
Gandhamardan (Mine)				
+65% Fe Lump (10-180 mm)	Ex-mine Gandhmardanl OMC Ltd (Odisha)	1739-3371	1347-1551	3000
+62% Fe CLO (10-40 mm)	Ex-mine Gandhmardanl OMC Ltd (Odisha)	1460-2521	1290-1701	2610-4335
+63% Fe Lump (10-180 mm)	Ex-mine Gandhmardanl OMC Ltd (Odisha)	1251-2400	1105-1251	2500
+66.5% Fe Lump	Ex-mine Gandhmardanl OMC Ltd (Odisha)	1739-3485	1347-1950	2890
+65% Fe,Sft.Lump	Ex-mine Gandhmardanl OMC Ltd (Odisha)	-	1950	2852-4155
+65% Fe CLO (5-18 mm)	Ex-mine Gandhmardanl OMC Ltd (Odisha)	2639-5415	2560-2931	2560-2931
+64% Fe CLO (5-18 mm)	Ex-mine Gandhmardanl OMC Ltd (Odisha)	2589-5019	2218-2757	2218-2757
+62% Fe CLO (10-30 mm)	Ex-mine Gandhmardanl OMC Ltd (Odisha)	1460-3111	1290-1460	2700-4335
Fines (60-62% Fe)	Ex-mine Gandhmardanl OMC Ltd (Odisha)	628-2131	508-1012	1852-3461
Fines (62-64% Fe)	Ex-mine Gandhmardanl OMC Ltd (Odisha)	607-1050	608-801	2105-3551
Koira (Mine)				
+62% Fe CLO	Ex-mine Koira OMC Ltd (Odisha)	1711-4561	1513-2658	3652-4801
+65% Fe Lump	Ex-mine Koira OMC Ltd (Odisha)	1639-3211	1347-1861	2803-4059
Fines (60-62% Fe)	Ex-mine Koira OMC Ltd (Odisha)	508-1299	306-751	1201-2365
Daitari (Mine)				
+62% Fe CLO	Ex-mine Daitari OMC Ltd (Odisha)	1709-3591	1510-2416	3330-4455
+62% Fe BGL	Ex-mine Daitari OMC Ltd (Odisha)	-	1800	3330-4355
Fines (60-62%/62-64% Fe)	Ex-mine Daitari OMC Ltd (Odisha)	808-3030	912-1450	2302-3515

(Contd.)

Tabel - 2 (Concld.)

Grade	Market	2008-09	2009-10	2010-11 (P)
Manganese Ore				
MnO_2	Ex-mine OMDC Ltd (Odisha)	25758	-	-
32-38 Mn	Ex-mine OMDC Ltd (Odisha)	11675	2025-5550	2025-5550
30% Mn	Ex-mine OMDC Ltd (Odisha)	-	1125-2475	1125-2475
MnO_2	Ex-mine Siljora-Kalimati (Odisha)	25214.49	17537.21	17537.21
+46% Mn	Ex-mine Siljora-Kalimati (Odisha)	22708.28	11212.75	11212.75
+35% Mn	Ex-mine Siljora-Kalimati (Odisha)	15458.72	6194.66	6194.66
+25% Mn	Ex-mine Siljora-Kalimati (Odisha)	12860.38	3577.92	3577.92
Up to 28% Mn	Ex-mine OMC Ltd (Odisha)	10001	10001	NA
28-30% Mn	Ex-mine OMC Ltd (Odisha)	11501	11501	NA
H.S.up to-30% Mn	Ex-mine OMC Ltd (Odisha)	8501	8501	NA
30-34% Mn	Ex-mine OMC Ltd (Odisha)	13751	2650-13751	2650-13751
35-37% Mn	Ex-mine OMC Ltd (Odisha)	16830	4680-16830	4680-16830
38-40% Mn	Ex-mine OMC Ltd (Odisha)	19300	5070-19300	5070-19300
40-42% Mn	Ex-mine OMC Ltd (Odisha)	20520	7380-20520	7380-20520
42-44% Mn	Ex-mine OMC Ltd (Odisha)	22410	7740-22410	7740-22410
46-48% Mn	Ex-mine OMC Ltd (Odisha)	25200	8460-25200	8460-25200
74-76% MnO_2	Ex-mine OMC Ltd (Odisha)	25200	15000-25200	15000-25200
78-80% MnO_2	Ex-mine OMC Ltd (Odisha)	25200	15800-25200	15800-25200
82-84% MnO_2	Ex-mine OMC Ltd (Odisha)	25200	25200	NA
26-35% Mn Fines	Ex-mine OMC Ltd (Odisha)	4011	4011	NA
30% Mn (Lump Dump)	Ex-mine Sukli (Madhya Pradesh)	-	4856	7265
30% Mn (Dump Small)	Ex-mine Sukli (Madhya Pradesh)	-	5462	6809
28% Mn (Fines)	Ex-mine Sukli (Madhya Pradesh)	-	-	6099
35-46% Mn	Ex-mine Tirodi (Madhya Pradesh)	14257	9030	14482
25-35% Mn	Ex-mine Tirodi (Madhya Pradesh)	8759	4634	6906
Below 25% Mn	Ex-mine Tirodi (Madhya Pradesh)	5975	3179	4664
Fines	Ex-mine Tirodi (Madhya Pradesh)	4134	2389	3647
46% and above	Ex-mine Ukwa (Madhya Pradesh)	21509.65	11748.23	16834.50
Above 35% and below 46% Mn	Ex-mine Ukwa (Madhya Pradesh)	15355.97	9968.05	12284.15
Above 25% and below 35% Mn	Ex-mine Ukwa (Madhya Pradesh)	5041	3224.01	4248.53
Below 25% Mn	Ex-mine Ukwa (Madhya Pradesh)	6710.82	3298.06	-
25% to below 35% Mn	Ex-mine Gumgaon (Maharashtra)	4304.44	4536	4536
35% to below 46% Mn	Ex-mine Gumgaon (Maharashtra)	1942	2185	2185
46% above Mn	Ex-mine Gumgaon (Maharashtra)	6732.90	9189	9189
1st Gr. Lumpy 47% Mn	Ex-mine Kandri (Maharashtra)	17367	11209	17910
2nd Gr.boulder 44% Mn	Ex-mine Kandri (Maharashtra)	14623	7736	NA
3rd Gr.Dump Lump				
38.5-39% Mn	Ex-mine Kandri (Maharashtra)	12257	5398	12640
LGHS 25-30.5% Mn	Ex-mine Kandri (Maharashtra)	8772	4512	6701
Fines 34% Mn	Ex-mine Kandri (Maharashtra)	3839	2111	3489
Tin Concentrates				
50-60% SnO_2	Ex-stock Dantewada (Chhattisgarh)	272-504	273-473	426-795
Tungsten Ore and Conc.	Average c.i.f. price, Indian ports	18500	17678	33333

Non-Metallic Minerals

In non-metallic minerals, an upward trend in the prices was reported in 2010-11 as compared to previous year mainly in case of: R.O.M. and Powder grades of **apatite** at ex-factory S.Kota (Andhra Pradesh), **phosphorite/rockphosphate** at RSMML Rajasthan except 31.5 % non-SSP and 30-31% P_2O_5 stone, **asbestos** ex-mine prices for almost all grades except AA Spl grade, ex-mine prices of **ball clay** in all grades except ex-mine price of Chandi (Rajasthan), **barytes** ex-mine price of all grades except White Buff grade ex-mine Relpatlia (Rajasthan), **calcite** Third grade f.o.r. Jhamarkotra (Rajasthan) and Calcite sub grade mineral ex-mine Sanchli (Rajasthan). **Chalk** ex-mine prices for various grades ex-mine Adityana & Porbandar, **diaspore** ex-mine prices except ex-mine Garhi I (Madhya Pradesh), **dolomite** ex-mine prices of Andhra Pradesh, Maharashtra and Rajasthan (those in Chhattisgarh remained unchanged and declined in respect of Odisha), **dunite** ex-mine price of Kenchapura (Karnataka) and reject dunite of Dalmia (Tamil Nadu), **fire clay** ex-mine prices have shown mixed trend, **fluorspar/fluorite** ex-mine price in all reported grades, **graphite** ex-mine prices for 60-65 % C (-200 Mesh), 60-65% C (-100 Mesh) and 65-70% C (- 20 + 50) graphite, **gypsum** ex- mine prices have increased for most of the reported grades, **kaolin** ex-mine prices for most of the grades, **kyanite** prices of grade III B Nawargaon (Maharashtra), 45$\pm$5% ex-mine Pavri (Maharashtra), and Jyoti Pahari (Jharkhand), **limestone** ex-mine prices except Mauthampathy (Tamil Nadu) **and cement grades of Gujarat, magnesite** ex-mine prices of raw magnesite rejects >10.0% SiO_2 Dalmita (Tamil Nadu), Chettichavdi, Sri Ponguru (Tamil Nadu), Allayanapura (Karnataka), Jhiroli and Dundu (Uttar Pradesh), **mica** mixed blocks prices Utukur (Andhra Pradesh), **ochre** ex-mine prices of Kalugotta (Andhra Pradesh) and Fangli (Gujarat), **pyrophyllite** ex-mine prices of Niwari (Madhya Pradesh), **Quartz** ex-mine prices of Jaruadih (Jharkhand), Chamundeswari (Andhra Pradesh), Chellala Chelimala (Andhra Pradesh), Gottimukhala (Andhra Pradesh), Dokelav (Gujarat), Kakana Bhashwada (Gujarat) Jamkanali (Jharkhand) and Asuna (Rajasthan), **quartzite** ex-mine Mirzapur (Bihar), ex-mine Karnataka and Rajasthan, **selenite** ex-mine price of Thob and Lunkaransar, **silica sand** prices in Uppalpadu (Andhra Pradesh), Jitendra (Uttar Pradesh) and Nimbehra (Rajasthan), **sillimanite** Chilly grade I and Chilly grade II and unsorted chilly and 50+/-5 %Al_2O_3 grades, **talc/soapstone/steatite** ex-mine price of insecticide grade II, grade III and other than insecticide grade for Golchha (Rajasthan), and **vermiculite** prices of Sevathur (Tamil Nadu) and S. Kota (Andhra Pradesh)

The prices of other minerals grades remained unchanged (or did not respond to querries or were on lower side during 2010-11 as compared to previous year (Table-3).

1.2 Foreign Markets

The mineral prices in the foreign markets exhibited variation in 2010-11 as compared to previous year. However, increasing prices were observed mainly in case of calcined alumina delivered UK, 98.5 to 99.5% Al_2O_3 and alumina c.i.f. Europe, **barytes** delivered Aberdeen of drilling grade of ground, OCMA bulk and c.i.f. gulf coast of Indian, Chinese and Moroccan. All **bauxite** refractory grades Shanxi, f.o.b Xingang prices increased. Only of Wyoming API grade bagged ex-works USA **bentonite** price increased. **Chromite** refractory and chemical grades,wet bulk 46% Cr_2O_3, f.o.b.Transval, chemical grade 46 %Cr_2O_3, wet bulk f.o.b. South Africa and friable lumpy 40% Cr_2O_3, metallurgical grade f.o.b. South African Northwest increased. All reported grades of **diatomite** and **fluorite** prices reported in 2010-11 increased. Prices of crystalline large and medium flake of **graphite** for all reported grades.

Prices of all reported grades of **kyanite** and prices of **magnesite** except Greek raw increased. Prices of **perlite** all reported grades and prices of **wollastonite** acicular, minus 200 mesh, ex-works US and acicular, minus 325 mesh, ex-works, US increased.

The prices of minerals/grades other than above remained unchanged or on lower side in 2010-11 as compared to previous year (Table - 4).

.

Table – 3: Prices of Non-metallic Minerals, 2008-09 to 2010-11 (Domestic Markets)

(In ₹ per tonne)

Grade	Market	2008-09	2009-10	2010-11 (P)
Apatite & Phosphorite				
Apatite				
r.o.m.	Ex-factory S.Kota (Andhra Pradesh)	2500	2600	2800
powder	Ex-factory S.Kota (Andhra Pradesh)	3100	3300	3500
below 20% P_2O_5	Ex-mine Andhra Phophate	2209	2373	2373
below 20% P_2O_5	Ex-Beldih (West Bengal)	1753	1753	1753
Phosphorite/Rock phosphate				
18-20% P_2O_5	Ex-mineWBMDT (West Bengal)	1850	2000	2000
Above 25%-30% P_2O_5	Ex-Mine Hirapur (Madhya Pradesh)	953	931	931
Up to 20% P_2O_5	Ex-Mine Hirapur (Madhya Pradesh)	345	350	350
Above 20%-25% P_2O_5	Ex-Mine Jhabua (Madhya Pradesh)	-	620	620
18-20% P_2O_5	Ex-Mine Jhabua (Madhya Pradesh)	363-481	481-551	551-637
Above 25%-30% P_2O_5	Ex-Mine Guwali Kelkua (Madhya Pradesh)	1087	1087	NA
Above 20%-25% P_2O_5	Ex-mine Guwali Kelkua (Madhya Pradesh)	620	620	NA
Up to 20% P_2O_5	Ex-mineGuwali Kelkua (Madhya Pradesh)	481	486	486
Above 30% P_2O_5	Ex-mine Jhamarkotra (Rajasthan)	3900	4656	4888
Up to 20% P_2O_5	Ex-mine Jhamarkotra (Rajasthan)	211	228	239
A Gr. +29% P_2O_5	Ex-Mine Sagar (Madhya Pradesh)	790-1152	1152-1304	1304-1741
B Gr. +25-27% P_2O_5	Ex-Mine Sagar (Madhya Pradesh)	470-685	685-775	775-1035
Low Gr. 18-20% P_2O_5 r.o.m	Ex-Mine Sagar (Madhya Pradesh)	270-410	350-410	350-522
34% P_2O_5 DAP	Ex-Mine RSMML (Rajasthan)	4005-8005	7255-8005	7255
31.5% P_2O_5 SSP	Ex-Mine RSMML (Rajasthan)	2921-4321	4321-4753	4753-4828
31.54% P_2O_5 benificiated	Ex-Mine RSMML (Rajasthan)	3264-4664	4664-5130	5130-5205
31.5% P_2O_5 non SSP	Ex-Mine RSMML (Rajasthan)	3074-4474	4474-4921	4753-4828
30-31% P_2O_5 stone	Ex-Mine RSMML (Rajasthan)	3047-4447	4447-4892	4892-4967
18-20% P_2O_5 Rajphos	Ex-Mine RSMML (Rajasthan)	1205-1550	1550-1628	1628
32.5% P_2O_5 DAP	Ex-Mine RSMML (Rajasthan)	-	6600	6600-6675
Asbestos				
Open grade	f.o.r. Pulivendla (Andhra Pradesh)	75000	75000	130000
AAA	f.o.r. Pulivendla (Andhra Pradesh)	70000	75000	-
A Spl	f.o.r. Pulivendla (Andhra Pradesh)	130000	-	145000
C1B	f.o.r. Pulivendla (Andhra Pradesh)	41000	41000	49000
C1B SPL	f.o.r. Pulivendla (Andhra Pradesh)	42000	51000	NA
D3	f.o.r. Pulivendla (Andhra Pradesh)	30000	30000	-
D4	f.o.r. Pulivendla (Andhra Pradesh)	25000	28000	28000
AK4	f.o.r. Pulivendla (Andhra Pradesh)	35000	-	-
Superlong	f.o.r. Pulivendla (Andhra Pradesh)	120000	130000	155000
C	f.o.r. Pulivendla (Andhra Pradesh)	-	-	45000
AA	f.o.r. Pulivendla (Andhra Pradesh)	60000	80000	80000
AK-3	Ex-mineSri Saibaba (Andhra Pradesh)	30000-38000	-	37000
AAA-Grade	Ex-mineSri Saibaba (Andhra Pradesh)	45000	70000	-
AAA-Spl	Ex-mine Sri Saibaba (Andhra Pradesh)	70000-80000	80000	-
AA-Spl	Ex-mine Sri Saibaba (Andhra Pradesh)	57000-80000	87000-90000	63000-87000
Open Grade	Ex-mine Sri Saibaba (Andhra Pradesh)	-	-	180000
AA Grade	Ex-mine Sri Saibaba (Andhra Pradesh)	-	95000	-
Ball Clay				
Sp. grade	Ex-mine Dwaraka Turamala (Andhra Pradesh)	1200-1600	1200-1600	NA
Select grade	Ex-mine Dwaraka Turamala (Andhra Pradesh)	600	600	NA
Grade I	Ex-mine Dwaraka Turamala (Andhra Pradesh)	160	152	152
Grade II	Ex-mine Dwaraka Turamala (Andhra Pradesh)	42	42	NA
Double dressed	Ex-mine Srikolayatji (Rajasthan)	2000	2000	NA
1st grade	Ex-mine Srikolayatji (Rajasthan)	1200	1200	NA
ROM grade	Ex-mine Srikolayatji (Rajasthan)	800	800	NA
C & D grade	Ex-mine Srikolayatji (Rajasthan)	300	300	NA
Double dressed	Ex-mine Mudh (Rajasthan)	2300	2400	2600
1st grade	Ex-mine mudh (Rajasthan)	1900	1900	2000

(Contd.)

Table - 3 (Contd.)

Grade	Market	2008-09	2009-10	2010-11 (P)
C & D grade	Ex-mine Mudh (Rajasthan)	300	300	400
Super grade	Ex-mine Bikaner (Rajasthan)	550	560	775
Grade A	Ex-mine Bikaner (Rajasthan)	290	300	625
Grade C	Ex-mine Bikaner (Rajasthan)	90	95	95
Grade A	Ex-mine Bikaner (Rajasthan)	350	400	475
Grade B	Ex-mine Bikaner (Rajasthan)	210	250	325
Grade C	Ex-mine Bikaner (Rajasthan)	85	95	100
Ball clay	Ex-mine Neyveli (Tamil Nadu)	150	150	NA
Grade A	Ex-mine Bikaner (Rajasthan)	272	275	275
Grade B	Ex-mine Bikaner (Rajasthan)	192	195	195
Grade C	Ex-mine Bikaner (Rajasthan)	83	85	85
	Ex-mine Sri satya Sai (Andhra Pradesh)	160	200	303
	Ex-mine Tirumala Venkateswara (Andhra Pradesh)	152	152	172
	Ex-mine Gowtami (Andhra Pradesh)	85	140	140
	Ex-mine Charanka (Gujrat)	100	105	110
	Ex-mine Gagodar (Gujrat)	105	110	110
	Ex-mine Indo ka Bala (Rajasthan)	348	190	216
	Ex-mine Chandi (Rajasthan)	229	252	245
	Ex-mine Indo ka Bala (Rajasthan)	166	170	170
	Ex-mine Neyveli (Tamil Nadu)	226	224	224
Barytes				
A Grade	Ex-mine Mangampet (Andhra Pradesh)	1944	2042	2145
B Grade	Ex-mine Mangampet (Andhra Pradesh)	1490	1565	1644
Ist Grade (White)	Ex-mine Udaipur (Rajasthan)	460	452	500
IInd Grade (Buff)	Ex-mine Udaipur (Rajasthan)	360	368	376
White buff	Ex-mine Mahalakshmi (Andhra Pradesh)	210	210	NA
Off colour	Ex-mine Kumla (Himanchal Pradesh)	1500	1500	NA
White buff	Ex-mine Relpatlia (Rajasthan)	388	411	399
	Ex-mine Viswabharathi (Andhra Pradesh)	210	210	300
Calcite				
Calcite r.o.m.	Ex-mine Rabachh (Rajasthan)	300	300	300
Calcite r.o.m.	Ex-mine Belka Pahar (Rajasthan)	425	425	425
Third Grade	f.o.r Jhamarkotra (Rajasthan)	300	300	340
Calcite sub grade mineral Grade II	Ex-mine Sanchli (Rajasthan)	275	300	340
Chalk				
Grade - A	Ex-mine Adityana (Gujarat)	560	630	650
Grade - B	Ex-mine Adityana (Gujarat)	430	520	540
Grade - A	Ex-mine Adityana (Gujarat)	560	630	640
Grade - B	Ex-mine Adityana (Gujarat)	430	520	545
Grade - B	Ex-mine Adityana (Gujarat)	352	388	391
Chalk lumps	Ex-mine Porbandar (Gujarat	400	450	450
Chalk crude	Ex-mine Porbandar (Gujarat)	110	115	115
Chalk lumps loose	Ex-mine Porbandar (Gujarat)	825	825	NA
Raw crude	Ex-mine Porbandar (Gujarat)	210	230	330
Lumps	Ex-mine Porbandar (Gujarat)	410	450	550
Clay				
White shale	Ex-mine Dhone (Andhra Pradesh)	85	85	NA
White clay crude	Ex-mine Bennavolu (Andhra Pradesh)	50	50	NA
Raw clay	Ex-mine MML (Karnataka)	360	360	NA
Aluminous clay	Ex-mine MML (Karnataka)	180-270	180-270	NA
White clay A Grade	Ex-mine Chandi (Rajasthan)	472	564	564
White clay B Grade	Ex-mine Chandi (Rajasthan)	247	246	246
White clay C Grade	Ex-mine Chandi (Rajasthan)	120	125	125
Corundum				
Corundum, +70% Al_2O_3	Ex-mine Pohara (Maharashtra)	4650-4975	4975	4975-5075
Corundum reject	Ex-mine Pohara (Maharashtra)	1055	1130	1130

(Contd.)

Table - 3 (Contd.)

Grade	Market	2008-09	2009-10	2010-11 (P)
Diaspore				
Mesh (120) Powder D-I	Ex-mine Niwari (Madhya Pradesh)	3450-3800	3800-3900	4500
Mesh (120) Powder D-4	Ex-mine Niwari (Madhya Pradesh)	1650-1800	1800-2050	2500
Diaspore	Ex-mine Tikamgarh (Madhya Pradesh)	3500	3500-4500	4500
Lumps	Ex-mine Chhatarpur (Madhya Pradesh)	1485.71	1804.36	1804.36
	Ex-mine Garhi-1 (Madhya Pradesh)	800	970	534
	Ex-mine Garhi-1 Malhera (Madhya Pradesh)	875	875	1893
	Ex-mine Khurai (Madhya Pradesh)	1200	1500	2000
	Ex-mine Garhari, (Uttar Pradesh)	800	699	NA
	Ex-mine Mailar Shivpura (Uttar Pradesh)	782	912	NA
	Ex-mine Gourhari (Uttar Pradesh)	1150	1150	1000
	Ex-mine Puradhan Kaun (Uttar Pradesh)	1200	1500	1800
Dolomite				
SMS Grade Lumps (25-50)	f.o.r. Baradwar (Chhattisgarh)	467.36	467.36	NA
SMS Grade Lumps (40-70)	f.o.r. Baradwar (Chhattisgarh)	456.3	NA	626.3
SMS Grade Lumps (40-70)	f.o.r. Baradwar (Chhattisgarh)	650	675	675
White Dolomite Lumps	Ex-mine Patgowari (Maharastra)	300	320-338	338-345
Off-white/Grayish dolomite Lumps	Ex-mine Patgowari (Maharastra)	250	281-299	299-300
Dolomite chips	Ex-mine Patgowari (Maharastra)	175	195	195
Dolomite reject	Ex-mine Patgowari (Maharastra)	150	209-227	250
Mineralised waste	Ex-mine Patgowari (Maharastra)	85	85-90	95-120
r.o.m. (Grey, white, pink & black)	Ex-mine Nathdwara (Rajasthan)	125	125	150
r.o.m. (Grey, white, pink & black)	f.o.r. Kanjika Guda (Rajasthan)	190	-	215
r.o.m. (Grey, white, pink & black)	f.o.r. Udaipur (Rajasthan)	330	383	405
Dolomite	f.o.r. Nallamekalapalle (Andhra Pradesh)	143	143	161
Dolo Lumps	Ex-mine Banki (Odisha)	362.54-400	400-404	400-404
Dolo-chips	Ex-mine Banki (Odisha)	850	868-1000	850-925
Dolo boulder	Ex-mine Banki (Odisha)	-	-	300
BF Lumps	Ex-mine Sundargarh (Odisha)	310-535	300-460	520-838
BF Dolo chips	Ex-mine Sundargarh (Odisha)	650-905	685-840	630-863
BF Dolo boulder	Ex-mine Sundargarh (Odisha)	300-340	320-365	365
Dunite	Ex-mine Karya (Karnataka)	238	245	245
	Ex-mine Kenchapura (Karnataka)	85	85	133
	Ex-mine Arasu (Tamil Nadu)	916	291	291
	Ex-mine Chettichavadi (Tamil Nadu)	325	325	NA
5 mm to 6 mm	Ex-mine MML (Karnataka)	375	375	NA
40mm-150mm	Ex-mine Salem (Tamil Nadu)	825-775	825-775	NA
MgO-28-30%, SiO_2-35-40%	Ex-mine Bhadravati (Karnataka)	202	202	NA
Reject dunite	Ex -mine Dalmia (Tamil Nadu)	200	273	321
Felspar	Ex-mine Thimmajipally (Andhra Pradesh)	155	170	130
	Ex-mine Venkaata (Andhra Pradesh)	155	170	200
	Ex-mine Chamundeswari (Andhra Pradesh)	250	250	300
	Ex-mine Jamkanali (Jharkhand)	140	125	125
	Ex-mine Jaruadih (Jharkhand)	141	140	150
	Ex-mine Arudi (Karnataka)	210	210	276
	Ex-mine Narendra Loharwada (Rajasthan)	318	318	361
	Ex-mine Tiloli (Rajasthan)	194	194	262
	Ex-mine Asuna (Rajasthan)	160	160	225
	Ex-mine Kanyakheda (Rajasthan)	252	252	220
	Ex-mine Gulgaon (Rajasthan)	250	250	NA
	Ex-mine Pitha ka Khera (Rajasthan)	130	130	NA
	Ex-mine Mahavir (Rajasthan)	150	150	NA
	Ex-mine Bhunas (Rajasthan)	300	300	NA
Grade I	Ex-mine Bhilwara (Rajasthan)	300	500	500
Grade II	Ex-mine Bhilwara (Rajasthan	-	325	400
Grade III	Ex-mine Bhilwara (Rajasthan	-	250	250
Sorted I	Ex-mine Beawar (Rajasthan)	700	700	NA
Unsorted I	Ex-mine Beawar (Rajasthan)	200-250	200-250	200-250

(Contd.)

Table - 3 (Contd.)

Grade	Market	2008-09	2009-10	2010-11 (P)
Fireclay				
Plastic lumps loose	Ex-mine Bikaner (Rajasthan)	625	625	625
	Ex-mine Chirkunda, Dhanbad, Ramgarh	125	160	205
	Ex-mine Punyakshetram (Andhra Pradesh)	203	198	198
	Ex-mine Jayasree Mines & Minerals (Andhra Pradesh)	150	175	175
	Ex-mine V.R.&V.R Minerals (Andhra Pradesh)	297	298	298
	Ex-mine Sri Venkateswara (Andhra Pradesh)	281	339	344
	Ex-mine Bajarang (Gujarat)	79	127	95
	Ex-mine Seregara (Jharkhand)	180	190	200
	Ex-mine Nandihalli (Karnataka)	534	534	534
	Ex-min Talbasta (Odisha)	387	265	265
	Ex-mine Sunakhani (Odisha)	312	250	250
	Ex-mine Bholamal (Odisha)	245	398	398
	Ex-mine Marudhara (Rajasthan)	230	180	180
	Ex-mine Therani (Tamil Nadu)	270	219	349
	Ex-mine Chandidaspur (West Bengal)	177	162	162
	Ex-mine Padma (Andhra Pradesh)	180	200	200
	Ex-mine Fategadh (Gujarat)	100	115	110
	Ex-mine Thangadh (Gujarat)	92	108	128
	Ex-mine Bhadra (Madhya Pradesh)	51	53	115
	Ex-mine Kheirmar (Madhya Pradesh)	121	150	120
	Ex-mine Guda (Rajasthan)	63	116	92
	Ex-mine Golri (Rajasthan)	125	135	125
	Ex-mine Bhatina (West Bengal)	85	80	120
Fluorspar/Fluorite (Graded)				
Lumps + 85% CaF_2	Ex-mine Dongargaon (Maharashtra)	10524	10600	12190
Lumps + 80% to 85% CaF_2	Ex-mine Dongargaon (Maharashtra)	10000	10050	11560
Lumps + 70% to 75% CaF_2	Ex-mine Dongargaon (Maharashtra)	6325	6350	7305
Lumps + 65% to 70% CaF_2	Ex-mine Dongargaon (Maharashtra)	5950	6000	6900
Lumps + 75% to 80% CaF_2	Ex-mine Dongargaon (Maharashtra)	7240	7350	8455
Lumps + 60% to 65% CaF_2	Ex-mine Dongargaon (Maharashtra)	5600	5650	6500
Lumps + 55% to 60% CaF_2	Ex-mine Dongargaon (Maharashtra)	4400	4425	5090
Lumps + 40% to 45% CaF_2	Ex-mine Dongargaon (Maharashtra)	3200	3250	3740
Lumps + 50% to 55% CaF_2	Ex-mine Dongargaon (Maharashtra)	4000	4060	4670
Lumps + 45% to 50% CaF_2	Ex-mine Dongargaon (Maharashtra)	3800	3840	4420
Lumps + 35% to 40% CaF_2	Ex-mine Dongargaon (Maharashtra)	2200	2220	2555
Lumps + 30% to 35% CaF_2	Ex-mine Dongargaon (Maharashtra)	900	1025	1180
Lumps + 25% to 30% CaF_2	Ex-mine Dongargaon (Maharashtra)	-	900	1035
Dust fines + 65% to 70% CaF_2	Ex-mine Dongargaon (Maharashtra)	4600	4600	5290
Dust fines + 50% to 55% CaF_2	Ex-mine Dongargaon (Maharashtra)	2000	2000	2300
Dust fines + 40% to 45% CaF_2	Ex-mine Dongargaon (Maharashtra)	1225	1225	1410
Dust fines + 60% to 65% CaF_2	Ex-mine Dongargaon (Maharashtra)	3400	3400	3910
Dust fines + 45% to 50% CaF_2	Ex-mine Dongargaon (Maharashtra)	1525	1525	1755
Dust fines + 55% to 60% CaF_2	Ex-mine Dongargaon (Maharashtra)	2200	2200	2530
Waste dump (PMT)	Ex-mine Dongargaon (Maharashtra)	950	1301	1510
Waste lumps	Ex-mine Dongargaon (Maharashtra)	450-550	450-625	520-720
+ 95.5% CaF_2	Ex-mine GMDC (Gujarat)	15400-17300	15400-17000	15400-17000
+ 92.5% to 95.5% CaF_2	Ex-mine GMDC (Gujarat)	13720-16000	13720-16000	NA
+ 90% to 92.5% CaF_2	Ex-mine GMDC (Gujarat)	13440-15100	13440-15100	NA
Starch Briquettes 79% CaF_2 min	Ex-mine GMDC (Gujarat)	16520-18500	16520-18500	NA
Garnet				
Common grade	Ex-factory Kuttam (Tamil Nadu)	690-720	690-720	NA
OR Grade (Naked at works)	Ex-works Chatrapur (Odisha)	2150-2900	2900-3500	2900-3500
MK Grade Normal (bagged)	Ex- works Manavalakurichi (Tamil Nadu)	2825-3975	4000-5400	4000-5400
MK Grade Normal (Naked at works)	Ex- works Manavalakurichi (Tamil Nadu)	2500-3650	3750-4000	3750-4000
MK Grade Fine (bagged)	Ex- works Manavalakurichi (Tamil Nadu)	2475-3225	2475-3225	NA
MK Grade Fine (Naked at works)	Ex- works Manavalakurichi (Tamil Nadu)	2150-2900	2150-2900	NA
Graphite				
60-65% C (-200 mesh)	Ex-factory Patrapati (Odisha)	14500	18500	26000
60-65% C (-100 mesh)	Ex-factory Patrapati (Odisha)	13500	17500	25000
60-65% C (-150 mesh)	Ex-factory Patrapati (Odisha)	-	12500	-

(Contd.)

Table - 3 (Contd.)

Grade	Market	2008-09	2009-10	2010-11 (P)
60-65% C (-20+50)	Ex-factory Patrapati (Odisha)	-	-	39000
65-70% C (-20+50)	Ex-factory Patrapati (Odisha)	-	35000	42000
80-85% C (-20+50)	Ex-factory Patrapati (Odisha)	39000	-	-
80-85% C (-50+80)	Ex-factory Patrapati (Odisha)	23000	-	-
80-85% C (-80+120)	Ex-factory Patrapati (Odisha)	22000	24000	-
70-75% C (-80+120)	Ex-factory Patrapati (Odisha)	21000	23000	-
Below 10% F.C.	Ex-factory Ranchi (Jharkhand)	400	400-450	400-450
Graphite Flakes up to 84% FC	Ex mine Tamin (Tamil Nadu)	21580	26000	26000
Graphite Flakes up to 85-87% FC	Ex mine Tamin (Tamil Nadu)	22705	26603	26603
Graphite Flakes up to 88 -89 % FC	Ex mine Tamin (Tamil Nadu)	23452	20350	20350
Graphite Flakes up to 90% FC	Ex mine Tamin (Tamil Nadu)	24109	20560	20560
Graphite Flakes up to 91% FC	Ex mine Tamin (Tamil Nadu)	24271	20700	20700
Graphite Flakes up to 92% FC	Ex mine Tamin (Tamil Nadu)	24802	22322	22322
Graphite Flakes up to 93% FC	Ex mine Tamin (Tamil Nadu)	25801	22000	22000
Graphite Flakes up to 94% FC	Ex mine Tamin (Tamil Nadu)	27900	22365	22365
Graphite Flakes up to 95% FC	Ex mine Tamin (Tamil Nadu)	28300	23100	23100
Graphite Flakes up to 96% FC	Ex mine Tamin (Tamil Nadu)	32209	25000	25000
Graphite D.E. Fines up to 84% FC	Ex mine Tamin (Tamil Nadu)	18520	16800	16800
Graphite D.E. Fines up to 85-87% FC	Ex mine Tamin (Tamil Nadu)	19303	17325	17325
Graphite D.E. Fines up to 88-89% FC	Ex mine Tamin (Tamil Nadu)	19807	17850	17850
Graphite D.E. Fines up to 90-91% FC	Ex mine Tamin (Tamil Nadu)	21076	18900	18900
Graphite D.E. Fines up to 92-93% FC	Ex mine Tamin (Tamil Nadu)	22350	19950	19950
Graphite D.E. Fines up to 94% FC & above	Ex mine Tamin (Tamil Nadu)	24600	21020	21020
	Ex-mine Keeranur (Tamil Nadu)	308	308	435
	Ex-mine Sivaganga (Tamil Nadu)	314	500	500
	Ex-mine Rabda (Jharkhand)	400	423	423
	Ex-mine Gandabahali (Odisha)	400	375	375
Gypsum				
	Ex-mine Macherla (Andhra Pradesh)	1547.75	1582	1748.41
	Ex-mine Lifri (Gujarat)	100	124	175
	Ex-mine Ballar (Rajasthan)	227	300	300
	Ex-mine Siyar ka Kosita (Rajasthan)	234	270	270
	Ex-mine Sekhra (Rajasthan)	229	235	300
	Ex-mine Bajju (Rajasthan)	235	300	300
	Ex-mine Aladin ka Bera (Rajasthan)	224	300	300
	Ex-mine Kishanpura (Rajasthan)	235	300	300
r.o.m.	Ex-mine RSMML (Rajasthan)	272-300	300-452	452-480
r.o.m.	f.o.r. RSMML (Rajasthan)	646-760	760-915	903-915
Powder (loose)	Ex-mine RSMML (Rajasthan)	555-585	585-660	660-700
Powder (packed)	Ex-mine RSMML (Rajasthan)	755-785	785-860	860-900
Ilmenite				
Q grade (Naked at works)	Ex-mine Chavara (Kerala)	4175-4700	4175-4700	NA
Q grade (Bagged)	Ex-mine Chavara (Kerala)	4500-5025	4500-5100	NA
MK grade (Naked at works)	Ex-mine Manavalakurichi (Tamil Nadu)	3950-4450	3950-4450	NA
MK grade (Bagged)	Ex-mine Manavalakurichi (Tamil Nadu)	4275-4775	4275-4850	NA
OR grade (Naked at works)	Ex-mine Chatrapur (Odisha)	4625	5000	5000
Ilmenite standard grade	V.V. Mineral	2905	3009	3009
TiO_2 59.88%	Ex-works Chavara (Kerala)	3427	3427	NA
48-50% TiO_2	f.o.b. Tuticorin (Tamil Nadu)	3370	3370	NA
		US$75	US$75	NA
Above 51% TiO_2	f.o.b. Tuticorin (Tamil Nadu)	3800	3800	NA
		US$85	US$85	NA
Kaolin				
Crude rubber powder	Ex-mine Kolkata, Kanpur, Delhi	1090	1190	1280
Crude dry lumps loose	Ex-mine Kolkata, Kanpur,	450	500	550
Filler powder (ordinary)	Ex-mine Kolkata, Bihar	500	550	600
Super fine lumps(Bagged)	Ex-mine Kolkata, Faridabad	1230	1330	1430
Super white powder no.1(Bagged)	Ex-mine Kolkata, Kanpur, Delhi	2405	2505	2605
Super fine powder (Bagged)	Ex-mine Kolkata, Kanpur, Delhi	1850	1900	2000
Lilite first (packed) lump	Ex-mine Kannur (Kerala)	4300-5200	5200-5630	5630
Lilite first (packed) powder	Ex-mine Kannur (Kerala)	6200-7000	7000-7610	7610
Lilite first (dried loose) lump	Ex-mine Kannur (Kerala)	4000-4800	4800-5190	5190
Lilite first (wet loose) lump	Ex-mine Kannur (Kerala)	3900-4700	4700-5080	5080
Kerala spl. lump	Ex-mine Kannur (Kerala)	3700	3700-3980	3980

(Contd.)

Table - 3 (Contd.)

Grade	Market	2008-09	2009-10	2010-11 (P)
Kerala spl. powder	Ex-mine Kannur (Kerala)	4000	4000-4310	4310
Hindustan spl. lump	Ex-mine Kannur (Kerala)	3700-4500	4500-4860	4860
Hindustan spl. powder	Ex-mine Kannur (Kerala)	4000-5000	5000-5410	5410
Indian clay lump	Ex-mine Kannur (Kerala)	3300	3500-3760	3760
Indian clay powder	Ex-mine Kannur (Kerala)	3800	3800-4090	4090
China clay Grade I	Ex-mine Neemli (Rajasthan)	3900	4200	4200
China clay Grade II	Ex-mine Neemli (Rajasthan)	2500	3800	4000
China clay Grade A	Ex-mine Chilambil (Kerala)	290	250	300
China clay Grade B	Ex-mine Chilambil (Kerala)	180	175	250
Crude	Ex-mine Nadappa (Gujarat)	175	130	130
Crude	Ex-mine Melthonn (Kerala)	283	283	286
Crude	Ex-mine Paddhar (Gujarat)	200	180	180
Crude	Ex-mine Kharia (West Bengal)	415	415	415
Processed	Ex-mine Kharia (West Bengal)	1100	1100	1100
Crude	Ex-mine Kundra (Kerala)	135	150	150
Kyanite				
Raw kyanite, Grade II	Ex-mine Doranda (Jharkhand)	1257	1257	1369.83
Raw kyanite, Grade II	Ex-mine Baharagora (Jharkhand)	1100	1100	NA
kyanite, Grade II	Ex-mine Jyoti Pahari (J.S.M.D.C.)	1100	1100	1100
Special Grade	Ex-mine Nawargaon (Maharashtra)	2420	2420	2420
Grade I	Ex-mine Nawargaon (Maharashtra)	2090	2090	2090
Grade II A	Ex-mine Nawargaon (Maharashtra)	1430	1430	1430
Grade II B	Ex-mine Nawargaon (Maharashtra)	880	880	880
Grade III A	Ex-mine Nawargaon (Maharashtra)	880	880	880
Grade III B	Ex-mine Nawargaon (Maharashtra)	550	550	1200
Low grade	Ex-mine Nawargaon (Maharashtra)	440	440	440
Unsorted chilly (50-55% Al_2O_3)	Ex-mine Nawargaon (Maharashtra)	880	880	880
Unsorted chilly (45-50% Al_2O_3)	Ex-mine Nawargaon (Maharashtra)	550	550	550
50$\pm$5% Al_2O_3	Ex-mine Pavri (Maharashtra)	3750	3750	4600
45$\pm$5% Al_2O_3	Ex-mine Pavri (Maharashtra)	3450	3450	4000
	Ex-mine Jyoti Pahari (Jharkhand)	1219	1100	1186
	Ex-mine Pavri Jamddi (Maharashtra))	900	900	900
	Ex-mine Digori (Maharashtra)	813	NA	813
Laterite	Ex-mine Shoban babu (Andhra Pradesh)	118	118	NA
	Ex-mine Pashapur (Andhra Pradesh)	37	40	70
	Ex-mine Palkhada (Gujarat)	267	295	250
	Ex-mine Pakhar (Jharkhand)	154	150	150
	Ex-mine Golyali (Karnataka)	154	151	151
	Ex-mine Kaveri (Kerala)	188	188	320
	Ex-mine Kathara Kothar (Madhya Pradesh)	150	150	150
	Ex-mine Ghatania (Madhya Pradesh)	69	50	50
High Grade	Ex-mine Macherla (Andhra Pradesh)	960.12	-	1159.55
Low Grade	Ex-mine Macherla (Andhra Pradesh)	477.88	495	596.59
Limestone				
Cement grade	Ex-mine Amehta (Madhya Pradesh)	109	109	NA
	Ex-mine Nanwara (Madhya Pradesh)	158	91	91
	Ex-mine Mandadi (Andhra Pradesh)	315	310	323.29
	Ex-mine Jaggayyapeta (Andhra Pradesh)	407	483	621.63
	Ex-mine Dholipatti (Tamil Nadu)	317.64	263.67	266.38
	Ex-mine Modukkarai (Tamil Nadu)	166.94	159.41	168.53
	Ex-mine Mauthampathy (Tamil Nadu)	210.61	212.28	210.64
Cement grade	Ex-mine Periyanagalur (Tamil Nadu)	132	175.04	210.16
	Ex-mine Adityana (Gujarat)	125	163	136.82
	Ex-mine Sidhee (Gujarat)	109	122	122.76
	Ex-mine Solaj (Gujarat)	75	89	84.99
Cement grade	Ex-mine Kovaya (Gujarat)	91	125	125
Cement grade	Ex-mineNarmada (Gujarat)	95	127	127.30
	Ex-mineBadigund (Karnataka)	295	225	225
Cement Grade	Ex-mine Tirunelveli (Tamil Nadu)	180.21	180.21-208	208-228
Gr. I	Ex-mine Gaurala (Maharastra)	162-174	190	190-214
Gr. II	Ex-mine Gaurala (Maharastra)	130	130	130

(Contd.)

Table - 3 (Contd.)

Grade	Market	2008-09	2009-10	2010-11 (P)
Reject	Ex-mine Gaurala (Maharastra)	90	90	90
limestone	Ex-mine Macherla (Andhra Pradesh)	315.27	331	345.54
B.F Lumps	Ex-mine Sundargarh (Odisha)	326-456	365-460	445-578
limestone Gitti 30-80mm	Ex-mine Jaisalmer (Rajasthan)	348-364	364-383	383-414
limestone Gitti 10-35mm	Ex-mine Jaisalmer (Rajasthan)	166-174	174-183	183-198
Magnesite				
Raw magnesite +6% SiO_2	Ex-mine Talooru (Karnataka)	1350	1350-1450	1350-1450
Raw magnesite 3 - 3.99% SiO_2	Ex-mine Talooru (Karnataka)	2300	2300-2400	2300-2400
Raw magnesite MgO min 43%	f.o.r. Nainital (UPSIDC) (Uttarakhand)	1700	1954	1954
Less than 1.00% SiO_2	Ex-mine MML (Karnataka)	4430	4430	NA
Between 1.00% to 2.99% SiO_2	Ex-mine MML (Karnataka)	2790	2790	NA
Between 3.00% to 3.99% SiO_2	Ex-mine MML (Karnataka)	2400	2400	NA
Between 4.00% to 5.99% SiO_2	Ex-mine MML (Karnataka)	2280	2280	NA
Above 6%	Ex-mine MML (Karnataka)	1270	1270	NA
Less than 1% SiO_2	Ex-mine MML (Karnataka)	4880	4880	NA
raw magnesite Rejects > 10.0% SiO2	Ex-mine Dalmiya (Tamil Nadu)	1315	1418	1503
	Ex-mine Karya (Karnataka)	1805	2124	2128
	Ex-mine Allayanapura (Karnataka)	2695	2094	2435
	Ex-mine Arasu (Tamil Nadu)	1433	1432	1432
	Ex-mine Chettichavadi (Tamil Nadu)	1815	1560	2148
	Ex-mine Sri Ponguru (Tamil Nadu)	1463	1748	1839
	Ex-mine Jhiroli (Uttar Pradesh)	1296	1296	1346
	Ex-mine Dundu (Uttar Pradesh)	950	950	1018
Mica*				
Splittings	Average f.o.b./f.o.r. Price	30.65	30.05	18.24
Mica powder	Average f.o.b./f.o.r. Price	30.17	88.09	66.90
Micanite and all sort of builtup mica	Average f.o.b./f.o.r. Price	114.68	141.07	96.45
mixed blocks	Ex-mine Utukur (Andhra Pradesh)	38-90	35-40	39-90
Crude mica (split)	Ex-mine Mahanth (Andhra Pradesh)	20	20	20
Crude mica (split)	Ex-mine Bhunas (Rajasthan)	300	300	NA
Crude mica (spotted)	Ex-mine Nellor (Andhra Pradesh)	100	100	NA
Uncut chillas	Ex-mine Kalichedu (Andhra Pradesh)	30	30	30
Cut mica sported	Ex-mine Kalichedu (Andhra Pradesh)	100	100	100
5 down crude	Ex-mine Kalichedu (Andhra Pradesh)	13	13	13
4 up crude	Ex-mine Kalichedu (Andhra Pradesh)	90	90	90
Ochre				
	Ex-mine Kalugotla (Andhra Pradesh)	65	122	200
	Ex-mine Fangli (Gujarat)	100	100	110
	Ex-mine Jambunath (Karnataka)	145	150	150
	Ex-mine Tikar (Madhya Pradesh)	100	120	120
	Ex-mine Piparitola (Madhya Pradesh)	90	200	200
	Ex-mine Onkarpura (Rajasthan)	100	100	NA
	Ex-mine Iswal Sare (Rajasthan)	98	181	181
	Ex-mine Gagrol (Rajasthan)	53	50	50
Yellow ochre	Ex-mine Gandhigram (Madhya Pradesh)	200	200	200
Pyrophyllite				
Lumps II	Ex-mine Khera Majora (Maharashtra)	650	700	700
Grade I	Ex-mine Pohara (Maharashtra)	320	336	336
Mesh (300)Powder CG-1	Ex-mine Niwari (Madhaya Pradesh)	2100-2400	2500	3000
Mesh (300)Powder Super	Ex-mine Niwari (Madhaya Pradesh)	3000	3400	4300
Mesh (400)Powder Super	Ex-mine Niwari (Madhaya Pradesh)	3600	3900	4800
Mesh (240)Powder CG-2	Ex-mine Niwari (Madhaya Pradesh)	1800	1980	2350
Mesh (240)Powder CG-3	Ex-mine Niwari (Madhaya Pradesh)	-	1450	1600
Mesh (240)Powder CG-1	Ex-mine Niwari (Madhaya Pradesh)	-	2300	2800
Mesh (200)Powder CG-1	Ex-mine Niwari (Madhaya Pradesh)	-	2100	2600
Lumps Pesticide	Ex-mine Salaiya (Madhya Pradesh)	-	312	312
Lumps CG-1	Ex-mine Niwari (Madhya Pradesh)	1000	1350	1600
Lumps CG-2	Ex-mine Niwari (Madhya Pradesh)	625	700	1000
Lumps CG-3	Ex-mine Niwari (Madhya Pradesh)	300	450	700
Gitti (Mineral)	Ex- mine Chattarpur (Madhya Pradesh)	548.05	596.89	596.89
Lumps Gr III	Ex-mine Chattarpur (Madhya Pradesh)	374.76	650	650
Pyrophyillite Dust	Ex-mine Chattarpur (Madhya Pradesh)	-	340.52	340.52
Pyro Pesticide Gr. (C)	Ex-mine Chattarpur (Madhya Pradesh)	701.54	700	700

(Contd.)

Table - 3 (Contd.)

Grade	Market	2008-09	2009-10	2010-11 (P)
Lumps Gr. Handicraft	Ex-mine Chattarpur (Madhya Pradesh)	-	847.35	847.35
Pyro Lumps PQ Grade	Ex-mine Chattarpur (Madhya Pradesh)	-	274.26	274.26
Lumps Pesticide	Ex-mine Patan (Madhya Pradesh)	261.78	270	270
Lumps Refra. grade	Ex-mine Patan (Madhya Pradesh)	740.57	762	762
Lumps Grade II	Ex-mine Patan (Madhya Pradesh)	703.62	750	750
Quartz				
SiO_2 99%	Ex-mine WBMDT (West Bengal)	-	285	280
	Ex-mine Godhra (Gujarat	190	195	200
	Ex-mine B. Narasimhulu (Andhra Pradesh)	150	150	NA
	Ex-mine Sri Venkatesh (Andhra Pradesh)	500	200	200
	Ex-mine Sarita (Andhra Pradesh)	300	300	NA
	Ex-mine Sajivav (Gujarat)	140	140	135
	Ex-mine Karma (Jharkhand)	85	219	150
	Ex-mine Jaruadih (Jharkhand)	141	140	150
	Ex-mine Jamadih (Jharkhand)	253	345	345
	Ex-mine Wadad (Maharashtra)	250	230	230
	Ex-mine Devnara (Maharashtra)	200	200	180
	Ex-mine (Rajasthan)	150	150	NA
	Ex-mine Ghodas Rajasthan)	165	175	175
	Ex-mine Kaluthu (Tamil Nadu	491	NA	-
	Ex-mine Chamundeswari (Andhra Pradesh)	300	300	350
	Ex-mine Chellala Chelimala (Andhra Pradesh)	145	145	180
	Ex-mine Rajapur (Andhra Pradesh)	155	170	142
	Ex-mine Gottimukhala (Andhra Pradesh)	120	150	200
	Ex-mine Jukal (Andhra Pradesh)	120	150	200
	Ex-mine Dokelav (Gujarat)	137	140	145
	Ex-mine Kakana Bhashawada (Gujarat)	135	143	145
	Ex-mine Jamkanali (Jharkhand)	120	115	120
	Ex-mine Asuna (Rajasthan)	130	130	225
Quartzite				
96-98% (90mm)	Ex-mine Sai Krupa (Andhra Pradesh)	-	150	150
One Grade	Ex-mine Mayurbhanj (Odisha)	425	425	-
	Ex-mine Mirzapur (Bihar)	450	450	500
	Ex-mine Shitalpur (Bihar)	270	350	328
	Ex-mine Bihaobad (Chhattisgarh)	150	150	-
	Ex-mine Kedro (Jharkhand)	100	200	200
	Ex-mine Goravanakolla (Karnataka)	275	295	315
	Ex-mine Chhuinapalli (Odisha)	550	539	539
	Ex-mine Kolara (Rajasthan)	456	105	435
Rock Salt				
	Ex-mine Guma/Drang (Himachal Pradesh)	1805	2673	2476
Rutile				
Q/MK/OR Grade (Bagged)	Ex-works Chavara (Kerala/ Manavalakurichi (Tamil Nadu) Chatrapur (Odisha)	30000-37000	41000	41000
TiO_2 95% min, sand	V.V. Mineral	26613	34475	34475
TiO_2 94.85%	Ex-works Chavara (Kerala)	31007	31007	NA
Selenite				
Above 95% $CaSO_4$,$2H_2O$	Ex-pit Thob (Rajasthan)	850	850	1100
Above 95% $CaSO_4$,$2H_2O$	Ex-pit Lunkaransar (Rajasthan)	850	850	1043-1060
Silica sand				
	Ex-mine Uppalapadu (Andhra Pradesh)	92	159	190
	Ex-mine Southern Silica (Andhra Pradesh)	160	164	164
	Ex-mine Bhavani I (Gujarat)	70	70	70
	Ex-mine Bhavikodula (Karnataka)	140	140	NA
	Ex-mine Hejmady (Karnataka)	200	200	200
	Ex-mine Girota (Rajasthan)	275	199	199
	Ex-mine M.B.Silica (Maharashtra)	190	300	300
	Ex-mine Jitendra (Uttar Pradesh)	160	270	300
	Ex-mine Pratap Chithera (Uttar Pradesh)	207	280	280
Cement Grade	Ex-mine Nimbahera (Rajasthan)	53	53	60

(Contd.)

Table - 3 (Concld.)

Grade	Market	2008-09	2009-10	2010-11 (P)
Sillimanite				
'Q' Grade (bagged)	Ex-works Chavara (Kerala)	10000	10000	NA
OR Grade (Naked at works)	Ex-works Chatrapur (Odisha)	11000	11000	NA
Grade I (Lumps)	Ex-mine Pohra (Maharashtra)	3700-4300	4250-4300	4300
Grade II - A (Lumps)	Ex-mine Pohra (Maharashtra)	2250-3650	3650-3700	3700
Grade II - B (Lumps)	Ex-mine Pohra (Maharashtra)	1325-1420	1650	1650-1660
Grade III	Ex-mine Pohra (Maharashtra)	755-901	901-1800	1800-1805
Chilly Grade I	Ex-mine Pohra (Maharashtra)	2160-2465	2810	2810-2867
Chilly Grade II	Ex-mine Pohra (Maharashtra)	1050-1125	2250	2250-2295
Unsorted Chilly	Ex-mine Pohra (Maharashtra)	540	1270	1270-1285
Sillimanite Rejects	Ex-mine Girola/Sakra (Maharashtra)	1015-1085	1085	1085
Graded Lumps 53% Al_2O_3	Ex-mine Girola/Sakra (Maharashtra)	4750	4750	NA
Lumps, 50-53% Al_2O_3	Ex-mine Girola (Maharashtra)	1200	1200	NA
Lumps	Ex-mine Garhpendhari (Maharashtra)	640-761	761-770	770
50+/-5% Al_2O_3	Ex-mine Pavri (Maharashtra)	4000	4000	4600
Talc/Steatite/soapstone				
Bhaskar powder	f.o.r. Udaipur (Rajasthan)	1200	1200	-
Special Rajhans powder	f.o.r. Udaipur (Rajasthan)	1000	1000	-
Lumps 1st grade	Ex-mine Deopur/Punchpura (Rajasthan)	1600-2500	2100-2300	2100-2300
Lumps 2nd grade gitti	Ex-mine Deopur/Punchpura (Rajasthan)	800-1600	1750-2000	1750-2000
Lumps 2nd grade	Ex-mine Deopur/Punchpura (Rajasthan)	700-1050	1150-1500	1150-1500
Gitti 2nd grade	Ex-mine Deopur/Punchpura (Rajasthan)	525-700	500-1000	500-1000
Jurry/Ruffa	Ex-mine Deopur/Punchpura (Rajasthan)	125-450	130-400	130-400
Paper	Ex-mine semal (Rajasthan)	800	750	750
Paper	Ex-mine Chanawada (Rajasthan)	450	450	450
Insecticide	Ex-mine Chanawada (Rajasthan)	228	150	150
Insecticide	Ex-mine Murela (Rajasthan)	130	130	NA
Insecticide	Ex-mine Semal (Rajasthan)	250	115	115
High grade	Ex-Chirang (Odisha)	4467	4467	NA
Low grade	Ex-Chirang (Odisha)	2747	2747	NA
DDT	Ex-mine Kalyanpur (Rajasthan)	70	70	NA
Lower paper	Ex-mine Kalyanpur (Rajasthan)	120	120	NA
Paper	Ex-mine Kalyanpur (Rajasthan)	200	200	NA
Insecticide grade II	Ex-mine Golcha (Rajasthan)	450	450	550
Insecticide grade III	Ex-mine Golcha (Rajasthan)	-	550	650
Insecticide grade V	Ex-mine Golcha (Rajasthan)	700	700	700
Insecticide grade VI	Ex-mine Golcha (Rajasthan)	-	800	NA
Other than Insecticide Gr.	Ex-mine Golcha (Rajasthan)	-	850	850-950
Vermiculite				
	Ex-mine Andhra Phosphate (Andhra Pradesh)	1203	1270	1270
	Ex-mine Dugar I (Andhra Pradesh)	250	355	355
	Ex-mine Dugar II (Andhra Pradesh)	250	300	300
	Ex-mine Sevathur (Tamil Nadu)	2680	2221	2238
r.o.m.	Ex-factory S.Kota (Andhra Pradesh)	1800	1900	2100
Wollastonite				
r.o.m.	Ex-mine Belka Pahar (Rajasthan)	960.51	1040	1040
r.o.m.	Ex-mine Kheratarla (Rajasthan)	735.22	800	800
r.o.m. reject	Ex-mine Kheratarla (Rajasthan)	500.51	545	545
M-4 grade	Ex-mine Kheratarla (Rajasthan)	863.92	940	940
Zircon				
Q/MK (Bagged)	Ex-works Chavara (Kerala/ Manavalamurichi (Tamil Nadu)	34000-43000	44500-48000	44500-48000
OR (Bagged)	Ex-works Chatrapur (Odisha)	29000-40000	40000-45000	40000-45000
Premium grade sand ZrO_2+HfO_2 66% min	V.V.Mineral	30996	39546	39546
ZrO_2+HfO_2 64.81% min	Ex-works Chavara (Kerala)	39149	39149	NA

***Note:** Prices of ilmenite, rutile and zircon not received from Department of Atomic Energy. So data repeated.*
**Prices are in ₹ per kg.*

Table – 4: Prices of Minerals, 2008-09 to 2010-11 (Foreign Markets)

Grade	Market	Unit	Currency	2008-09	2009-10	2010-11 (P)
Alumina						
Alumina Calcined 98.5-99.5% Al_2O_3 bags included 20 ton lots	Delivered UK	tonne	£	850	550-650	600-700
Alumina Calcined, medium soda content 50 ton lots	c.i.f. main European port	tonne	£	850	700-800	700-800
Alumina fused white 25kg bags,	c.i.f. Europe		£	800-1000	1150-1200	1150-1280
Barytes						
Paint grades						
Micronised, off White, min. 99% < 20 microns	Delivered UK	tonne	£	140-150	195-220	195-220
Micronised, off White, min. 95% < 20 microns	Ex-works UK	Short ton	$	275-325	-	-
Drilling grade						
Ground, OCMA Bulk	Delivered Aberdeen	tonne	£	77-78	80-90	95-105
A.P.I. Lump						
Chinese	c.i.f. Gulf Coast	tonne	$	92-116	97-108	100-108
Indian	c.i.f. Gulf Coast	tonne	$	90-100	105-107	107-112
Moroccan chemical Grade	c.i.f. Gulf Coast	tonne	$	64-66	82-85	100-105
Chinese	c.i.f. Gulf Coast	tonne	$	120-140	92-114	138-145
Bauxite						
Refractory grade						
Round kiln 87/1.8/3.20+	Shanxi, f.o.b. Xingang	tonne	$	310-510	485-535	500-535
Round kiln 87/2.0/3.20	Shanxi, f.o.b. Xingang	tonne	$	500-520	500-535	510-535
Round kiln 86/2.0/3.15	Shanxi, f.o.b. Xingang	tonne	$	480-500	490-525	500-525
Round kiln 85/2.0/3.15	Shanxi, f.o.b. Xingang	tonne	$	470-490	400-420	405-425
Rotory kiln 87/1.8/3.20+	Shanxi, f.o.b. Xingang	tonne	$	510-530	470-535	495-535
Rotory kiln 87/1.8/3.20	Shanxi, f.o.b. Xingang	tonne	$	500-520	450-525	480-525
Rotory kiln 86/1.8/3.20	Shanxi, f.o.b. Xingang	tonne	$	490-510	480-500	480-500
Rotory kiln 85/1.8/3.15	Shanxi, f.o.b. Xingang	tonne	$	NA	400-420	405-425
Rotory kiln 86/1.8/3.15	Shanxi, f.o.b. Xingang	tonne	$	480-500	450-525	475-525
Round kiln 87/2.0/3.2	Guizhou f.o.b. Znanjiang/Fangcheng	tonne	$	400-430	450-525	470-525
Guana RASC Bauxite bulk	f.o.b. Liden	tonne	$	480-500	450-510	460-510
Abrasive grade						
Chinese	c.i.f. North Europe and USA	tonne	$	550-570	450-500	450-500
Chinese	f.o.b. China	tonne	$	470-490	320-350	320-350
Welding grade						
China	f.o.b. China	tonne	$	650-670	470-480	470-480
Guayna	f.o.b. Guayna	tonne	$	540-570	450-510	450-510
Bentonite						
Wyoming, rail hopper cars crude bulk, all grades	Ex-works USA	short ton	$	44-100	70-100	70-100
Wyoming foundry grade bagged	Ex-works USA	short ton	$	70-90	90-115	90-115
Wyoming API grade bagged	Ex-works USA	short ton	$	70-100	48-55	55-60
Cat litter grade 1.5mm bulk	f.o.b. Main European port	short ton	$	50-70	42-60	42-60
Chromite						
Refractory grade 46% Cr_2O_3 wet bulk	f.o.b. Transvaal	tonne	$	480-520	370-390	375-450
Chemical grade 46% Cr_2O_3 wet bulk	f.o.b. Transvaal	tonne	$	250-360	240-270	335-365
Foundry grade 46% Cr_2O_3 wet bulk	f.o.b. Transvaal	tonne	$	330-360	-	-
Refractory grade	f.o.b. Phillippines	tonne	$	125-140	-	-
Chemical grade 46% Cr_2O_3 wet bulk	f.o.b South Africa	tonne	$	250-360	240	335-365

(Contd.)

Table - 4 (Contd.)

Grade	Market	Unit	Currency	2008-09	2009-10	2010-11 (P)
Refractory grade 46% Cr_2O_3 wet bulk	f.o.b. South Africa	tonne	$	480-520	370-390	375-415
Foundry grade 46-47% Cr_2O_3 wet bulk	f.o.b. South Africa	tonne	$	330-360	NA	370-415
Foundry grade 45% Cr_2O_3 wet bulk	f.o.b. Transval	tonne	$	-	260-300	-
Metallurgical grade friable lumpy 40% Cr_2O_3	f.o.b.	tonne	$	130-150	115-190	185-250
Metallurgical grade 40-41% Cr_2O_3	Kazakh	tonne	$	350	220-250	-
Metallurgical grade 40-42% Cr_2O_3		tonne	$	350	240-260	-
Sand moulding grade 98% Cr_2O_3	del. U.K	tonne	£	400	360-380	360-380
Diatomite						
U.S. Calcined filter aids	Delivered UK	tonne	£	370-410	540-580	575-640
U.S. Flux Calcined filter aids	Delivered UK	tonne	£	380-420	540-750	580-825
Felspar						
Ceramic grade 170-200 mesh, bulk (Na)	Ex-works USA	short ton	$	60-75	70	-
Ceramic grade 200 mesh bulk (K)	Ex-works USA	short ton	$	125	-	-
30 mesh bulk (Na)	Ex-works USA	short ton	$	40-52	-	-
80 mesh bulk (K)	Ex-works USA	short ton	$	85-90	-	-
South African, bagged Ceramic grade	f.o.b. Durban	tonne	$	112-165	-	-
Micronised	f.o.b. Durban	tonne	$	205	-	-
Indian Ceramic grade (K), bulk	f.o.b. India	tonne	$	25-27	-	-
Powder grade 200 mesh	f.o.b. India	tonne	$	70	-	-
Turkish, Na felspar, Crude-10 mm bulk	f.o.b. Gulluk	tonne	$	NA	22-23	22-23
Turkish, Na felspar Glass Grade 500 Microns bagged	f.o.b. Gulluk	tonne	$	70	70	70
Fluorite (Fluorspar)						
Chinese, dry basis, acidspar	c.i.f. U.S. Gulf Port	tonne	$	530-550	350-380	440-460
South African acidspar filtercake	f.o.b. Durban	tonne	$	350-370	230-280	-
Mexican acidspar filtercake	f.o.b. Tampico	tonne	$	300-370	260-290	330-360
< 5 ppm acidspar filtercake	f.o.b. Tampico	tonne	$	400-420	-	-
South African dry basis	f.o.b. Durban	tonne	$	-	250-300	330-335
Garnet						
Idaho Almandine 8-250 mesh 20 s. ton lot, all uses	f.o.b. Mine	short ton	$	180-240	-	-
Graphite						
Crystalline large Flake, 94-97% C, +80 mesh	c.i.f. European Port	tonne	$	1000-1350	1250-1500	2000-2500
Crystalline medium Flake 94-97% C, +100-80 mesh	c.i.f. European Port	tonne	$	1200-1300	1100-1400	1800-2300
Crystalline fine 94-97% C, -100 mesh	c.i.f. European Port	tonne	$	1000-1050	700-1150	1750-2150
Crystalline large Flake, 90% C, +80 mesh	c.i.f. European Port	tonne	$	700-800	-	1100-1350
Crystalline medium flake, 90% C, +100-80 mesh	c.i.f. European Port	tonne	$	680-780	-	1050-1300
Crystalline fine 90% C, -100 mesh	c.i.f. European Port	tonne	$	550-650	550-700	1400-1800
Amorphous powder 80-85% C	Chinese del Europe	tonne	$	460	430	600-800

(Contd.)

Table - 4 (Contd.)

Grade	Market	Unit	Currency	2008-09	2009-10	2010-11 (P)
Kaolin						
Ceramic refined, bulk	Ex-works France	tonne	•	65-168	-	-
Ceramic refined, bulk	f.o.b. Rotterdam	tonne	£	60-100	-	-
Fillers bulk	Ex-Georgia Plant	short ton	$	80-100	-	-
Paper Coating grade	Ex-Georgia Plant	short ton	$	95-185	-	-
Calcined bulk grade	Ex-Georgia Plant	short ton	$	320-375	-	-
Sanitaryware grade, bagged	Ex-Georgia Plant	short ton	$	65-75	-	-
Tableware grade, bagged	Ex-Georgia Plant	short ton	$	125	-	-
No 1 paper coating grade	Ex-Georgia Plant	short ton	$	NA	146-185	150-195
No 2 paper coating grade	Ex-Georgia Plant	short ton	$	NA	95-147	100-155
Kyanite						
Kyanite 54 - 60% Al_2O_3 22 ton lots Calcined	Ex-works USA	tonne	$	-	351-414	373-439
Ex-works USA 54 - 60% Al_2O_3 raw kyanite	Ex-works USA	short ton	$	-	211-301	224-320
Magnesite						
European caustic calcined Industrial (natural)	c.i.f. main European Port	tonne	£	140-270	-	-
Agricultural	c.i.f. main European Port	tonne	•	205-215	205-215	220-330
Dead burned Chinese 97.5% MgO Lump	c.i.f. main European Port	tonn	•	490-520	440-470	530-560
Dead burned Chinese 94-95% MgO Lump	f.o.b.t. China	tonne	$	450-480	410-440	460-520
Dead burned Chinese 92% MgO Lump	f.o.b.t. China	tonne	$	435-450	380-410	430-470
Dead burned Chinese 90% MgO Lump	f.o.b.t. China	tonne	$	390-430	320-350	400-450
Calcined 90-92% MgO Lump	f.o.b.t. China	tonne	$	460	325-350	370-480
Fused Lump 96% Mgo	f.o.b.t. China	tonne	$	-	600-630	790-860
Fused Lump 97% Mgo	f.o.b.t. China	tonne	$	-	670-720	930-1050
Fused Lump 98% Mgo	f.o.b.t. China	tonne	$	-	800-850	1080-1210
Greek, raw (< 3.5% SiO_2)	f.o.b. East Mediterranean	tonne	•	65-75	66-75	65-75
Mica						
Dry ground	f.o.t. Plant. USA	tonne	$	300-400	300-400	300-400
Wet ground	f.o.t. Plant. USA	tonne	$	700-1300	700-1300	700-1300
Micronised	f.o.t. Plant. USA	tonne	$	700-1000	700-1000	700-1000
Flake	f.o.t. Plant. USA	tonne	$	350-500	350-500	350-500
Indian wet ground	c.i.f. Europe	tonne	$	600-900	600-900	600-900
Indian Micronised 325 mesh	c.i.f. Europe	tonne	$	300-545	-	-
Dry ground	f.o.b. India	tonne	$	200-430	-	-
Perlite						
Aggregate, Expanded	Ex-works UK	tonne	£	320-650	-	-
Filter-aids Expanded	Ex-works USA	tonne	$	210-410	-	-
Raw crushed	f.o.b. Turkey	tonne	$	70-80	90-95	95-100
Raw crushed big bags grade, bulk	f.o.b. Turkey	tonne	$	55-65	75-80	80-85
Coarse (filter aid)	f.o.b. East Mediterranean	tonne	•	50-55	60-65	65-70
Phosphate						
Moroccan 70 - 72% BPL	FAS Casablanca	tonne	$	100	-	-
Tunisia 65 - 68% BPL	FAS S. fax	tonne	$	100	-	-

(Contd.)

Table - 4 (Concld.)

Grade	Market	Unit	Currency	2008-09	2009-10	2010-11 (P)
Pyrophyllite						
Korean Clay filler 21-27% Al_2O_3	f.o.b. Nohwado port	tonne	$	110-150	-	-
Korean Fiber glass refractory 18-21% Al_2O_3	f.o.b. Nohwado port	tonne	$	166	-	-
Korean Ceramic, 15-19% Al_2O_3	f.o.b. Nohwado port	tonne	$	27-44	-	-
Australian Filler grade 300 mesh, milled	f.o.b. Sydney port	tonne	$	342	-	-
Salt						
Ground rock salt, 15-20 tonne lot average price)	Delivered UK	tonne	£	20-30	-	-
Australian solar salt, bulk	f.o.b.	tonne	$	22-38	50	50
Industrial solar salt,	Ex works China	tonne	$	22-38	27-29	27-29
Industrial Vaccum Salt	Ex works China	tonne	$	57	35-40	35-40
Silica sand						
Foundry sand dry bulk	Ex-works UK	tonne	£	15.5-16.5	-	-
Glass sand flint Container	Ex-works UK	tonne	£	15-17	14-26	20-26
Foundry sand dry bulk	Ex-works USA	tonne	$	14-40	-	-
Minus 20 micron FCL's bagged >92 Brightness	f.o.b. Durban	tonne	$	-	295	295
Steatite/soapstone						
Chinese normal 350 mesh	Ex-store UK	tonne	£	220-245	-	-
Norwegian ground	Ex-store UK	tonne	£	142-190	-	-
Norwegian micronised	Ex-works UK	tonne	£	220-294	-	-
Paint, 200 mesh	Ex-works USA	short ton	$	126	-	-
Paint, 400 mesh	Ex-works USA	short ton	$	210	-	-
Ceramic, 200 mesh	Ex-works USA	short ton	$	92	-	-
Ceramic, 325 mesh	Ex-works USA	short ton	$	115	-	-
Indian Paint 20-25 µ	f.o.b. India	tonne	$	185-195	-	-
Indian Plastic grade 20-10 µ	f.o.b. India	tonne	$	200-205	-	-
Cosmetic grade 200-230 mesh	f.o.b. India	tonne	$	190-195	-	-
Vermiculite						
South African bulk	f.o.b. Rotterdam	tonne	$	280-450	280-450	280-450
Raw bulk	Ex US Plant	short ton	$	170-250	-	-
Wollastonite						
Acicular, minus 200 mesh	Ex-works US	short ton	$	205	182	210-240
Acicular, minus 325 mesh	Ex-works US	short ton	$	264	191	220-250
Acicular, minus 400 mesh	Ex-works US	short ton	$	290	-	-
Chinese						
Acicular , minus 200 mesh	f.o.b.	tonne	$	80-100	80-90	80-90
Acicular, minus 325 mesh	f.o.b.	tonne	$	90-110	90-100	90-100

Source: *Industrial Minerals.*

2. METALS

2.1 Domestic Markets

In the Mumbai and Delhi domestic markets increasing trend was observed in 2010-11 in the prices of non-ferrous metals as compared to the previous year.The prices of aluminium of all varieties increased by 8% to 19%, brass of all varieties prices increased by 19% to 22%, copper of all varieties prices rose by 5% to 40 %, prices of gun metal increased by 18%, lead increased by 12% to 23%, nickel increased by 19% to 27%, silver prices in Mumbai and Delhi Markets increased by 47 % & 48% respectively, tin prices increased by 37% to 75% and zinc prices increased by 2% to 35%. Prices of Gold of all varieties increased by 22% each in Mumbai and Delhi markets (Table -5).

Various items of steel showed higher prices (except joists (150 x 75mm) at Gobindgarh and Mumbai Markets and CTD bars (local 8 mm) at Mumbai Market at slightly lower price) during 2010-11 in all the markets compared to the preceding year (Table - 6).

2.2 Foreign Markets

The Prices of metals in the foreign market have mostly increased.The prices of alluminium HG, antimony 99.65%, bismuth 99.99%, chromium (min 99%), copper grade A, germanium min 99.99%, gold (London), indium all grades, lead, magnesium min 99.8, mangnese min 99.7, mercury min 99.99, molybdenum, nickel, palladium min 99.9 %, platinum min 99.9%, selenium 99.5%, silver (London), tin HG and zinc SHG prices during the year 2011(in the month of March) were higher as compared to the previous year.

International prices of arsenic min 99%, all grades of cadmium (99.99% and 99.95%), cobalt 99.8%, rhodium min 99.9% and rhuthenium min 99.9% have decreased as compared to previous year (Table - 7).

Table – 5: Prices of Metals (Non-Ferrous), 2008-09 to 2010-11 (Domestic Markets)

(In ₹ per quintal)

Grade	Market	2008-09	2009-10	2010-11 (P)
Aluminium				
Utensil Scrap	Mumbai	7900	9481	10610
Sheet Scrap	Mumbai	7571	10969	12586
Wire Rod	Mumbai	8071	13319	14352
Ingot	Mumbai	8919	11643	13386
Wire Scrap	Mumbai	7610	11205	13214
Sheets (Scrap)	Delhi	7814	10962	12957
Utensil Scrap	Delhi	6181	10138	11948
Wire Scrap	Delhi	7524	11195	13276
Brass				
Honey	Mumbai	16624	25224	30138
Utensil Scrap	Mumbai	17876	25495	31043
Sheet Cutting	Mumbai	14610	26295	31895
Sheet Scrap	Delhi	18081	26295	31895
Copper				
Wire Scrap	Mumbai	21233	34067	35881
Utensil Scrap	Mumbai	21586	33043	42495
Wire Rod	Mumbai	20929	34086	47810

(Contd.)

Table - 5 (Concld.)

Grade	Market	2008-09	2009-10	2010-11 (P)
Copper				
Wire Bar	Mumbai	26033	38962	49686
Cathode	Mumbai	17224	35190	47500
Birch	Mumbai	NQ	NQ	NQ
Redberry	Mumbai	NQ	NQ	NQ
Wire Scrap	Delhi	20271	32643	41310
Wire Bar	Delhi	21119	38693	50452
Wire	Delhi	18195	30705	37762
Mixed Scrap	Delhi	23010	32886	41143
Gold*				
24 C	Mumbai	12885	15752	19229
Standard	Delhi	13004	15959	19527
Biscuits	Delhi	12996	15943	19493
Sovereign #	Delhi	10462	NA	19527
24 C	Chennai	12777	NA	19282
22 C	Chennai	12051	NA	NA
Gun Metal				
Gun Metal/Scrap	Delhi	20671	25936	30676
Lead				
Ingot	Mumbai	8795	10814	12114
Soft	Delhi	8433	10364	12795
Nickel				
Ingot	Mumbai	65257	106224	135190
Ingot	Delhi	77433	111862	133624
Silver**				
0.999 (Finesse)	Mumbai	21255	25299	37186
0.999 (Finesse)	Delhi	20933	25044	36886
Delivery	Delhi	20761	NA	NA
Raw	Delhi	20659	24712	36538
Ready	Chennai	21483	NA	37018
Tin				
Ingot	Mumbai	68714	91433	160333
Solder (40%)	Delhi	12124	19057	26124
Ingot	Delhi	70419	91619	159348
Zinc				
Ingot	Mumbai	8776	12848	13119
Ingot	Delhi	8290	12743	15414
Dross	Delhi	6824	9371	12657

** Prices in ₹ per 10 g*
*** Prices in ₹ per kg*
 # Price per piece
***Source:** Minerals and Metals Review.*

Table – 6: Prices of Steel, 2008-09 to 2010-11
(Domestic Markets)

(In ₹ per tonne)

Grade	Market	2008-09	2009-10	2010-11 (P)
CTD Bars (ISI, 8mm)	Delhi	38114	31600	32738
Joists (150 x 75 mm)	“	34986	29367	30312
Channels (75 x 40 mm)	“	35590	29437	30713
MS Squares (8mm)	“	37657	30796	31755
MS Angles (25 x 3mm)	“	36220	29965	31358
Melting Scrap	“	25875	19333	22704
Blooms (SAIL, 150 mm)	Mandi Gobindgarh	44329	40583	40860
Heavy Slab (BOKARO)	“	34850	26560	28971
Melting Scrap (rolling)	“	26631	20815	24355
MS Rounds (10 mm)	“	35631	28127	31196
CTD Bars (ISI 8 mm)	“	41581	34446	36827
MS Squares (8 mm)	“	34796	27742	30637
MS Angles (25 x 3 mm)	“	37113	30965	33758
Joists (150 x 75 mm)	“	34077	28473	27957
Induction ingots (round)	“	32227	25190	29588
Old Ship Breaking Scrap	“	30433	22962	26917
Joists (150 x 75 mm)	Mumbai	34618	28587	28173
MS Angles(40 x 6 mm)	“	35514	29046	30358
Induction ingots	“	29959	23244	26515
Melting Scrap	“	24584	18121	22371
CTD Bars (local 8 mm)	“	37551	30985	30735
MS Rounds (8 mm)	“	35657	28792	30075
CTD Bars (ISI, 8 mm)	Kolkata	32414	25727	26348
MS Squares (8 mm)	“	32892	25881	25922
MS Angles (25 x 3 mm)	“	31724	25227	30819
Channels (75 x 40 mm)	“	33196	26446	26935
Joists (150 x 75 mm)	“	31635	22606	23131
Induction Ingots	“	24259	18729	19689
Melting Scrap	“	19573	15204	18380
Arc Ingots	“	24460	19131	20057
Concast Billet Ingots	“	24737	19223	20647

Source: *Minerals & Metals Review.*

Table – 7: Prices of Metals, 2008-09 to 2010-11
(Foreign Markets)

Metal/Grade	Unit	Currency	2008-09	2009-10	2010-11 (P)
Aluminium HG@	tonne	$	2571.37	1667.55	2173
Antimony (min 99.65 %)	tonne	$	4200	6650	15000
Arsenic (min 99 %)	pound	$	0.88	0.88	0.65
Bismuth (min 99.99 %)	pound	$	9.00	8.8	10.5
Cadmium					
99.99%	pound	Cents	140	240	180
99.95%	pound	Cents	130	230	175
Chromium (min 99%)	tonne	$	8100	8350	13500
Cobalt					
99.8%	pound	$	16.00	21.5	20
99.3%	pound	$	-		
Copper Grade A@	tonne	$	6951.52	5163.59	7539.32
Germanium (min 99.99 %)	kg	$	750	650	950
Gold (London)	tr oz	$	935.80	1107.9	1439
Indium					
min 99.97%	kg	$	390	560	650
min 99.9%	kg	$	425	525	1050
Lead@	tonne	$	2084.76	1726.11	2147.56
Magnesium (min 99.8 %)	tonne	$	2700	2850	3200
Manganese (min 99.7%)	tonne	$	2350	2900	3550
Mercury (min 99.99%)	flask	$	700	650	1500
Molybdenum	pound	$	9.00	16.5	17.5
Nickel@	tonne	$	21027.22	14700.02	21809.29
Palladium (min 99.9%)	tr oz	$	220	447	766
Platinum (min 99.9%)	tr oz	$	1147	1580	1773
Rhodium (min 99.9%)	tr oz	$	1200	2575	2450
Ruthenium (min 99.9%)	tr oz	$	85	210	200
Selenium (min 99.5 %)	pound	$	21	38	75
Silver (London)	tr oz	$	13.58	16.98	37.87
Silicon					
(441 Grade)	tonne	$	2700	2650	-
(553 Grade)	tonne	$	-		
Tin HG@	tonne	$	18498.62	13592.94	20447.25
Titanium (12×120mm)	kg	$	-		
Tungsten	mtu	$	250	210	-
Zinc SHG@	tonne	$	1870.06	1658.88	2158.86

Prices at the end of March of the year stated except aluminium, copper, lead, nickel, tin and zinc.
@ Annual average LME settlement prices for the years 2008, 2009 and 2010, respectively.
***Source:** Minerals and Metals Review.*

Indian Minerals Yearbook 2011

(Part- I)

50th Edition

FOREIGN TRADE

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. +91712 - 2565471
PBX : +91712 - 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

10 Foreign Trade

EXPORTS

Ores & Minerals

During the year 2010-11, the value of exports (including re-exports) of ores and minerals at 165,080 crore accounted for 14.45% of the total value of all merchandise exported from India. The export value rose from ₹109,296 crore in 2008-09 to ₹ 127,831 crore in 2009-10 and further rose to ₹ 165,080 crore in 2010-11. The value of mineral exports showed an increase of 29.14% in 2010-11 as compared to that in the previous year.

Diamond (Total) continued to be the largest constituent item with a share of 71.43% in the total value of mineral exports in 2010-11. Next in order of share were iron ore with the contribution of 12.97%, followed by alumina 5.57%, granite 3.26% and zinc ores and concentrate 1.11%. The individual share of remaining minerals in the total value of exports of ores and minerals from India, during the year under review was less than 1%.

The value of exports showed a mixed trend for most of the minerals in 2010-11 as compared to that in the previous year. The exports of alumina during 2010-11 increased manifold as compared to previous year while that of silica sand, coke, lead ores & concentrate and zirconium ores & concentrate increased by more than four times, titanium ores & concentrate and natural gas by more than three times, while export value of zinc ores & concentrate and coal (excluding lignite) more than doubled. The exports of other minerals which have shown significant growth are sulphur (Excluding sublimed, precipited & colloidal) 94%, wollastonite 50%, sand (Excluding metal bearing) 41%, magnesite 40%, building and monumental stones 40%, diamond and mica 37% each, bentonite 34% and steatite and copper ores & concentrate 29% each. The minerals which have shown negative growth in value of exports during 2010-11 are chromite 64%, bauxite 58%, limestone 54%, sandstone 32%, manganese ore 28%, slate 27%, iron ore 25% and emerald (cut & uncut) 22%.

Ores and minerals were exported to 188 countries in 2010-11 as against 179 countries in 2009-10 (including country item “unspecified” in both the years). Ninety per cent of the total value of exports of ores and minerals was confined to only nine countries. Out of these, exports to four countries accounted for more than three-fourth of the total value of exports during the year. During the year under review, United Arab Emirates occupied the top position in 2010-11 and in terms of value accounted for 29.5% of the total mineral exports. Hong Kong was in the second place and contributed 20.6% followed by China 16.7%, USA 11.0%, Belgium 5.8%, Israel 2.7%, Bahrain 1.6%, Japan 1.3%, Iran 1.2%, Ukraine 1.2% and Thailand 1.1%. The individual share of remaining countries was less than one percent.

Countrywise analysis of mineral exports revealed that, exports of minerals has increased manifold to Ukraine, Bahrain, Iran, Egypt and Brazil. The increase in value of mineral exports was also significant for Turkey and United Arab Emirates 88% each, Nepal 69%, Bhutan 52%, South Africa 44%, Netherlands 41% and Republic of Korea 29% as compared to previous year. However, value of export of ores & minerals declined by 62% for Singapore, 36% for Bangladesh, 24% for Japan and 19% for Saudi Arabia as compared to that of previous year (Tables - 1 to 3).

Table – 1: Exports* of Ores and Minerals, 2008-09 to 2010-11

(Value in ₹ '000)

Mineral	Unit	2008-09		2009-10		2010-11(P)	
		Quantity	Value	Quantity	Value	Quantity	Value
All Minerals			**1092964455**		**1278311426**		**1650795724**
Abrasives (natural)	tonne	156998	1444288	184911	1406415	160351	1185689
Alabaster	tonne	5	33	-	-	74	329
Alumina (U)	tonne	968245	15823892	702657	9576723	5647794	92024661
Andalusite	tonne	++	2	-	-	40	96
Asbestos: Total	tonne	918	7545	559	1601	252	698
Asbestos (chrysotile)	tonne	107	897	63	805	43	97
Asbestos (others)	tonne	811	6648	496	796	209	601
Ballclay	tonne	23228	77787	32132	104567	19477	62920
Barytes	tonne	843789	2982457	999334	3349865	815788	2929545
Bauxite	tonne	1708349	3708188	475692	732096	119154	303921
Bentonite	tonne	566890	1414440	457079	1252043	628612	1672201
Borax: Total	tonne	1545	40414	1654	41690	1388	49512
Natural borate	tonne	902	9674	942	9342	581	6391
Sodium borate	tonne	464	21909	584	21039	545	19557
Other borates	tonne	179	8831	128	11309	262	23564
Building & monumental stones, NES	tonne	1291492	3783042	1053238	2955553	1217967	4125399
Calcite	tonne	1073	4217	674	3644	1212	5488
Chalk	tonne	1178	3623	1655	9527	689	2726
Chromite:Total	tonne	1899028	9736103	689081	8012506	172866	2860676
Chrome ore others	tonne	145516	1120480	150466	2082995	14285	243971
Chrome ore cons.	tonne	1549199	7787724	508831	5737336	102870	1760961
Chrome ore lumps	tonne	204313	827899	29784	192175	55711	855744
Clay (Others)	tonne	337244	392298	93381	273221	50121	199490
Coal (excl. Lignite)	000 t	1656	3484645	2471	5208101	4327	11516365
Lignite	000 t	11	186090	++	6397	++	9834
Coke	tonne	1345534	7295252	127251	2057266	650394	9912439
Coal gas	tonne	21000	465624	8621	412734	-	-
Cobalt (ores & concentrate)	tonne	522	125282	1	6	51	3733
Copper (ores & concentrate) (U)	tonne	26613	397134	40422	286841	8187	370999
Corundum (natural)	tonne	2312	9801	6807	34137	412	2527
Diamond: Total		**	722606545	**	859420958	**	1179119264
Diamond (mostly cut)	carat	57960232	720920219	66090838	851256380	78994450	1176426881
Diamond (industrial)	carat	2484310	1185472	770352	1058591	923182	191097
Diamond (powder)	'000 carat	8637	500854	16961	7105987	27362	2501286
Diatomite	tonne	725	4974	1146	11025	4558	40147
Dolomite	tonne	18892	48338	18707	46616	22871	62679
Earth clay	tonne	2170	13636	3305	18392	2521	13050
Emerald (uncut & cut): Total		**	4800533	**	4826365	**	3775168
Emerald (uncut)	tonne	2	39954	1	320832	4	52311
Emerald (cut)	'000 carat	6089	4760579	14213	4505533	17179	3722857
Felspar (natural)	tonne	337664	924103	315549	1074155	342280	1156358
Felspar (uncut & cut): Total		**	191202	**	50612	**	12842
Felspar (uncut)	tonne	++	3848	++	115	++	301
Felspar (cut)	'000 carat	1353	187354	358	50497	222	12541
Fireclay	tonne	5590	19655	9315	23727	8975	22758
Flint	tonne	1693	7102	940	2653	1688	6320
Fluorite/Fluorspar	tonne	203	1730	2024	18121	345	3389
Garnet (Abrasive)	tonne	252478	1939894	171420	1470702	209326	1571489
Garnet (cut & uncut): Total		**	76503	**	137014	**	18450
Garnet (uncut)	tonne	++	42	++	1026	1	1193
Garnet (cut)	'000 carat	101	76461	103	135988	260	17257
Granite: Total	tonne	3958853	48149007	3827668	49937324	4369384	53841248
Granite (crude or roughly trimmed)	tonne	2641496	16334115	2598235	16165697	2829329	16529603
Granite (cut blocks/slabs)	tonne	379326	1995799	295794	2341327	353597	2354229

(Contd.)

Table - 1 (Contd.) (Value in ₹ '000)

Mineral	Unit	2008-09 Quantity	2008-09 Value	2009-10 Quantity	2009-10 Value	2010-11(P) Quantity	2010-11(P) Value
Granite (polished blocks/tiles)	tonne	308493	9606869	207505	6719493	392244	10721576
Granite (others)	tonne	629538	20212224	726134	24710807	794214	24235840
Graphite (natural)	tonne	1909	91887	1048	81374	1070	69546
Gypsum & plaster	tonne	209157	157652	100520	114300	100470	134338
Iron ore: Total	000 t	68904	217253097	101531	283661742	46881	214159541
Iron ore: Non-agglomerated	000 t	1193	4396081	498	1276716	142	563698
Iron ore fines	000 t	58458	179843910	91045	255552349	43353	200653480
Iron ore lumps	000 t	8344	26009673	9701	26092192	3299	12366740
Iron ore pellets	000 t	909	7002286	287	739673	87	574835
Iron ore pyrites	000 t	++	1147	++	812	++	788
Kaolin	tonne	120418	477819	160935	490785	110117	408198
Kieselgurh	tonne	4	43	123	1017	79	935
Kyanite	tonne	219	1149	130	2315	28	381
Lead ores & concentrate	tonne	81095	5649354	36476	2434582	122200	10827976
Limestone	tonne	2122989	1255352	2405783	1537749	1040693	710924
Magnesite: Total	tonne	12284	136358	10595	141740	22763	198972
Magnesia (fused)	tonne	758	7820	6	23	67	1638
Magnesite (not calcined)	tonne	459	6301	625	8425	891	13442
Magnesite (calcined)	tonne	75	785	38	671	169	2730
Magnesia: Dead-burnt	tonne	25	490	76	1390	3	88
Magnesium oxide	tonne	7640	82556	6139	78132	4448	61311
Magnesite (others)	tonne	3327	38406	3711	53099	17185	119763
Manganese ore: Total	tonne	205424	1206074	289468	1167004	117963	836888
Manganese ore (46% or more Mn)	tonne	4212	104668	3371	59208	16147	286225
Manganese ore (35% or more but below 46% Mn)	tonne	1344	7631	-	-	2250	7552
Manganese ore (30% or more but below 35% Mn)	tonne	68122	506401	104737	402400	30858	147030
Manganese ore (Ferruginous, 10% or more)	tonne	-	-	19700	54727	-	-
Manganese ore (others)	tonne	131746	587374	161660	650669	68708	396081
Marble: Total	tonne	306545	3628602	275502	3045855	321293	3110107
Marble (dressed)	tonne	217874	2151093	211359	2003559	251567	2020044
Marble (others)	tonne	88671	1477509	64143	1042296	69726	1090063
Mica: Total	tonne	191037	1802852	94216	1620533	125357	2220119
Mica (unmanufactured): Total	tonne	190427	1361696	93341	1319956	124796	1870866
Mica (blocks)	tonne	3311	94977	1400	71381	3008	107538
Mica (splittings)	tonne	2952	72596	2704	74207	1999	61712
Mica (powder)	tonne	72106	710212	62073	778727	85560	1254584
Mica (condenser films)	tonne	9	2280	-	-	8	515
Mica (waste & scrap)	tonne	112049	481631	27164	395641	34221	446517
Mica (worked): Total	tonne	610	441156	875	300577	561	349253
Mica (cond. films, plates, cuts, NES)	tonne	1	1889	++	1307	4	2685
Mica (washers & discs)	tonne	29	20439	498	23229	55	60770
Mica (sheets & strips)	tonne	25	9263	8	4833	36	26602
Micanite & other built-up mica	tonne	12	7608	10	3894	13	4342
Mica (bricks)	tonne	++	265	1	1289	100	1568
Mica worked (others)	tonne	543	401692	358	266025	353	253286
Molybdenum ores & concentrate (U)	tonne	29784	162824	9056	33227	938	24570
Niobium or tantalum ores & concentrate	tonne	36	34325	10	13304	25	42652
Natural gas	tonne	38074	1518657	9293	379069	27244	1191530
Nickel ores & concentrate	tonne	-	-	20	45	-	-
Ochre:Total	tonne	12828	133324	8661	102014	9016	109290

(Contd.)

Table - 1 (Concld.)

(Value in ₹ '000)

Mineral	Unit	2008-09		2009-10		2010-11(P)	
		Quantity	Value	Quantity	Value	Quantity	Value
Ochre (earth colours)	tonne	12109	111212	7556	75808	7476	75020
Ochre (persian red)	tonne	54	7855	20	1295	29	1626
Ochre (red oxide)	tonne	657	13634	1081	24621	1288	28284
Ochre (yellow ochre)	tonne	8	623	4	290	223	4360
Petroleum (crude)	000 t	56	1397827	34	888968	1	548
Precious & semi-precious stones NES: Total		**	7791082	**	9658362	**	11074898
Precious & semi precious stones (uncut)	tonne	25917	327091	43397	488554	10876	1383533
Precious & semi precious stones (cut)	carat	19637	7463991	121801	9169808	206165	9691365
Precious metals ores/ concentrate: Total	kg	69617500	777291	146202	68351	76625	22702
Gold ores & concentrate	kg	20000	1021	7568	8121	2625	792
Silver ores/concentrate	kg	41500	19	-	-	-	-
Precious metals ores & conc. (others)	kg	69556000	776251	138634	60230	74000	21910
Quartz & quartzite (natural)	tonne	185306	859700	256421	1092657	203363	1208710
Quartz (natural)	tonne	148661	629584	202138	831203	165532	932931
Quartzite (natural)	tonne	36645	230116	54283	261454	37831	275779
Rock phosphate (Total)	tonne	5408	27205	924	10138	711	4487
Salts (Total)	tonne	1001498	1487346	1545022	1955033	1886641	1803375
Sand, excl. metal bearing	tonne	469008	339987	26932	88278	10305	124563
Sandstone	tonne	748753	4358769	632406	4387790	296796	3003688
Silica sand	tonne	17164	182087	7478	30073	12267	145497
Sillimanite	tonne	2013	11798	6708	21409	2325	26451
Slate: Total	tonne	154017	2072052	125463	1980721	113466	1455831
Slate (worked)	tonne	40067	800754	38114	890963	19685	421097
Slate (others)	tonne	113950	1271298	87349	1089758	93781	1034734
Steatite/talc/soapstone: Total	tonne	99520	650768	87870	618521	113411	800844
Steatite blocks	tonne	6418	38698	4602	24355	4122	24693
Steatite lumps	tonne	6930	32297	7915	44587	9674	43337
Steatite powder & others	tonne	86172	579773	75353	549579	99615	732814
Sulphur (excl. sublimed, precipitated & colloidal)	tonne	171160	3971228	124884	504615	167009	978329
Tin ores & conc.	tonne	2	21	7	371	-	-
Titanium ores & concentrates: Total	tonne	226306	1872050	464947	2526109	1893721	9678965
Titanium ores & concentrates: Ilmenite	tonne	224884	1841826	463625	2506478	1886469	9517746
Titanium ores & concentrates: Rutile	tonne	933	24100	382	14399	3688	132424
Titanium ores & concentrates (other)	tonne	489	6124	940	5232	3564	28795
Tripoli earth	tonne	25	391	-	-	-	-
Tungsten ores & concentrates	tonne	15915	56550	-	-	32	19244
Vanadium ores & concentrates	tonne	-	-	124	18554	++	1
Vermiculite	tonne	1118	7861	1015	6398	1449	10442
Witherite	tonne	155	1550	111	543	17	351
Wollastonite	tonne	21413	220102	12880	153755	20151	230659
Zinc ores & concentrates	tonne	88387	2389172	191960	6167984	439265	18270707
Zirconium ores & concentrates	tonne	25	692	8015	112724	31764	473254
Other minerals	tonne	752524	814178	372874	430820	702066	533801

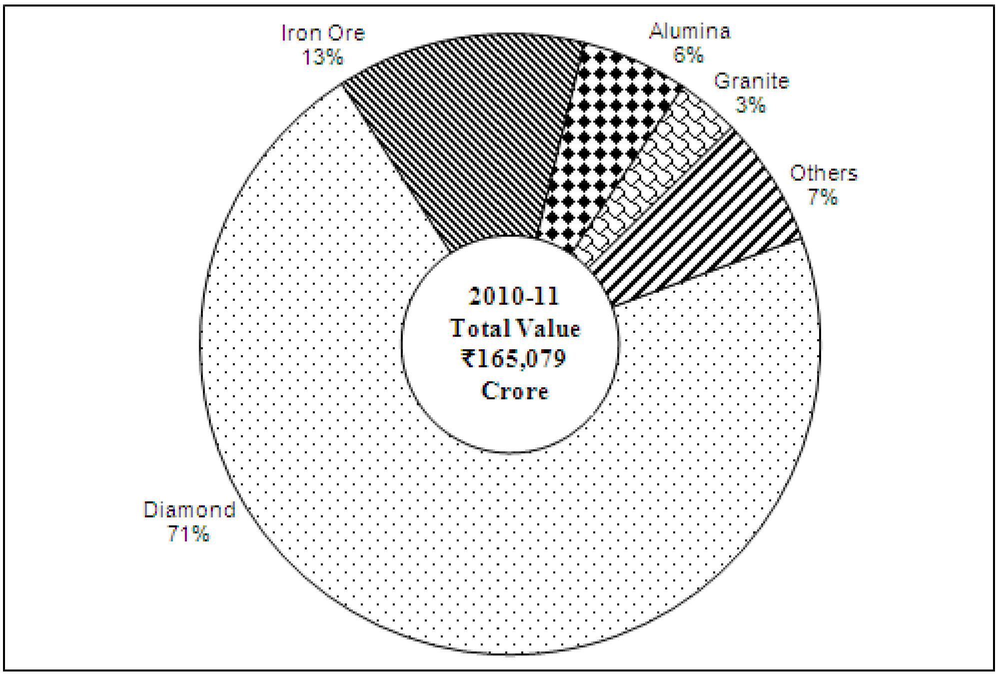
Source: *DGCI&S, Kolkata.*
** Including re-exports.*
*** Quantity not given due to partial coverage, value figures however have full coverage.*

Table – 2 : Value of Exports* of Ores & Minerals, 2008-09 to 2010-11
(By Principal Ores & Minerals)

Ores & Mineral	2008-09		2009-10		2010-11 (P)		% increase (+) or decrease (-) in 2010-11 over 2009-10
	Value in (₹ '000)	% share in total value	Value in (₹ '000)	% share in total value	Value in (₹ '000)	% share in total value	
All Minerals	**1092964455**	**100**	**1278311426**	**100**	**1650795724**	**100**	**29.14**
Diamond	722606545	66.11	859420958	67.23	1179119264	71.43	37.2
Iron ore	217253097	19.88	283661742	22.19	214159541	12.97	-24.5
Alumina	15823892	1.45	9576723	0.75	92024661	5.57	860.92
Granite	48149007	4.41	49937324	3.91	53841248	3.26	7.82
Zinc ores & conc.	2389172	0.22	6167984	0.48	18270707	1.11	196.22
Coal (excl. lignite)	3484645	0.32	5208101	0.41	11516365	0.70	121.12
Precious & semi-precious stones (cut & uncut): Total	7791082	0.71	9658362	0.76	11074898	0.67	14.67
Lead ores & conc.	5649354	0.52	2434582	0.19	10827976	0.66	344.76
Coke	7295252	0.67	2057266	0.16	9912439	0.60	381.83
Titanium ores & conc.	1872051	0.17	2526109	0.2	9678965	0.59	283.16
Building and monumental stones , NES	3783042	0.35	2955553	0.23	4125399	0.25	39.58
Emerald (cut & uncut)	4800533	0.44	4826365	0.38	3775168	0.23	-21.78
Marble	3628602	0.33	3045855	0.24	3110107	0.19	2.11
Sandstone	4358769	0.4	4387790	0.34	3003688	0.18	-31.54
Barytes	2982457	0.27	3349865	0.26	2929545	0.18	-12.55
Chromite	9736103	0.89	8012506	0.63	2860676	0.17	-64.3
Mica	1802852	0.16	1620533	0.13	2220119	0.13	37
Salt (Rock)	1487346	0.14	1955033	0.15	1803375	0.11	-7.76
Bentonite	1414440	0.13	1252043	0.1	1672201	0.10	33.56
Garnet (abrasive)	1939894	0.18	1470702	0.12	1571489	0.10	6.85
Slate	2072052	0.19	1980721	0.15	1455831	0.09	-26.5
Quartz and quartzite	859700	0.08	1092657	0.09	1208710	0.07	10.62
Natural gas	1518657	0.14	379069	0.03	1191530	0.07	214.33
Abrasive (natural)	1444288	0.13	1406415	0.11	1185689	0.07	-15.69
Felspar (natural)	924103	0.08	1074155	0.08	1156358	0.07	7.65
Sulphur (excl. sublimed, precipitated & colloidal)	3971228	0.36	504615	0.04	978329	0.06	93.88
Manganese ore	1206074	0.11	1167004	0.09	836888	0.05	-28.29
Steatite/talc/soapstone	650768	0.06	618521	0.05	800844	0.05	29.48
Limestone	1255352	0.11	1537749	0.12	710924	0.04	-53.77
Zirconium ores & conc.	692	0	112724	0.01	473254	0.03	319.83
Kaolin	477819	0.04	490785	0.04	408198	0.02	-16.83
Copper ores & conc.	397134	0.04	286841	0.02	370999	0.02	29.34
Bauxite	3708188	0.34	732096	0.06	303921	0.02	-58.49
Wollastonite	220102	0.02	153755	0.01	230659	0.01	50.02
Clay (others)	392298	0.04	273221	0.02	199490	0.01	-26.99
Magnesite	136358	0.01	141740	0.01	198972	0.01	40.38
Silica sand	182087	0.02	30073	0	145497	0.01	383.81
Gypsum	157652	0.01	114300	0.01	134338	0.01	17.53
Sand (excl. metal bearing)	339987	0.03	88278	0.01	124563	0.01	41.1
Other minerals	4801781	0.43	2601311	0.2	1182899	0.07	-54.53

***Source:** DGCI&S, Kolkata.*
** Including re-exports.*

Value of Mineral Exports, 2009-10 and 2010-11



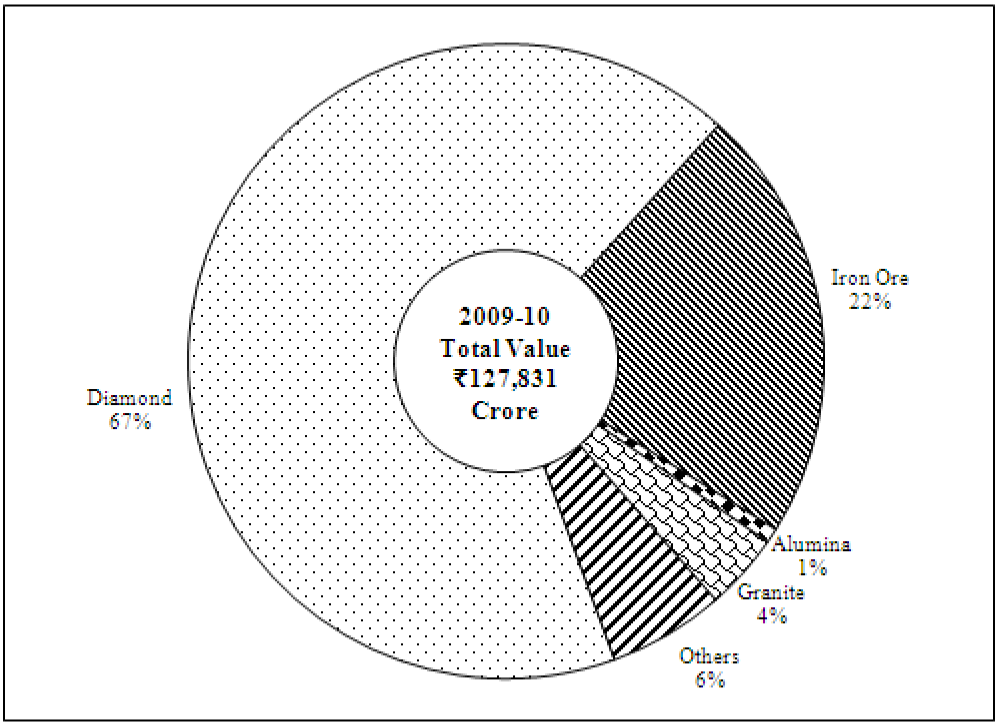


Table – 3 : Value of Exports* of Ores & Minerals, 2008-09 to 2010-11 (By Principal Countries)

Country	2008-09 Value in (₹'000)	2008-09 % share in total value	2009-10 Value in (₹ '000)	2009-10 % share in total value	2010-11 (P) Value in (₹ '000)	2010-11 (P) % share in total value	% increase (+) or decrease (-) in 2010-11 over 2009-10
All Countries	**1092964455**	**100**	**1278311426**	**100**	**1650795724**	**100**	**29.14**
UAE	169529381	15.51	258767480	20.24	487131757	29.51	88.25
Hong Kong	222913681	20.4	278749671	21.81	339525937	20.57	21.8
China	260987171	23.88	294681493	23.05	276390249	16.74	-6.21
USA	142792782	13.06	164467825	12.87	182293622	11.04	10.84
Belgium	85203087	7.8	79744197	6.24	96389982	5.84	20.87
Israel	37678420	3.45	35657865	2.79	44172247	2.68	23.88
Baharain	567544	0.05	871199	0.07	25565272	1.55	2834.49
Japan	27990994	2.56	29115537	2.28	22149332	1.34	-23.93
Iran	3177535	0.29	1869474	0.15	19868683	1.2	962.8
Ukraine	609476	0.06	158057	0.01	19665309	1.19	12341.91
Thailand	14596109	1.34	14858556	1.16	18126985	1.1	22
Egypt	1170810	0.11	1548984	0.12	14202479	0.86	816.89
UK	8784578	0.8	10734751	0.84	9322023	0.56	-13.16
Singapore	17856179	1.63	20107048	1.57	7624859	0.46	-62.08
Korea, Rep. of	4140991	0.38	5194371	0.41	6679705	0.4	28.6
Brazil	4464473	0.41	1129973	0.09	6567403	0.4	481.2
Switzerland	5636679	0.52	5287763	0.41	6416743	0.39	21.35
Australia	4631727	0.42	8215057	0.64	6121579	0.37	-25.48
Italy	6703890	0.61	6347180	0.5	5349461	0.32	-15.72
Germany	5964036	0.55	5816276	0.45	5056069	0.31	-13.07
Turkey	1642129	0.15	2242749	0.18	4223355	0.26	88.31
Malaysia	3732050	0.34	4105698	0.32	4125874	0.25	0.49
Bangladesh	5315996	0.49	6246446	0.49	4017063	0.24	-35.69
Netherlands	3649830	0.33	2644795	0.21	3730917	0.23	41.07
Nepal	2559935	0.23	1839175	0.14	3111001	0.19	69.15
Canada	3009515	0.28	2906536	0.23	2941557	0.18	1.2
South Africa	2529705	0.23	1796783	0.14	2585260	0.16	43.88
France	3279231	0.3	2006880	0.16	2202843	0.13	9.76
Chinese Taipei/Taiwan	2958985	0.27	1900381	0.15	2173804	0.13	14.39
Saudi Arabia	2356216	0.22	2446493	0.19	1982180	0.12	-18.98
Poland	1079195	0.1	1217006	0.1	1445332	0.09	18.76
Indonesia	861821	0.08	1071266	0.08	1185889	0.07	10.7
Spain	1499506	0.14	1278786	0.1	1133944	0.07	-11.33
Bhutan	865316	0.08	634532	0.05	963265	0.06	51.81
Kuwait	726036	0.07	1020796	0.08	841320	0.05	-17.58
Vietnam	596214	0.05	741488	0.06	762687	0.05	2.86
Lebanon	801464	0.07	885301	0.07	761901	0.05	-13.94
Russia	914266	0.08	572582	0.04	711849	0.04	24.32
Oman	544480	0.05	730748	0.06	707761	0.04	-3.15
Unspecified	8220000	0.75	4313794	0.34	1154017	0.07	-73.25
Other countries	20423022	1.87	14386434	1.13	11414209	0.69	-20.66

Source: *DGCI&S, Kolkata.*

***** *Including re-exports.*

The country-wise details relating to some of the commodities are not available from the source agency. The figures in respect of such commodities have been grouped under country item "unspecified".

Metals & Alloys

The value of exports of metals & alloys at ₹ 129,023 crore in 2010-11 more than doubled as compared to that of ₹ 57,975 crore in the previous year. The contribution of metals & alloys in the total value of India's exports was 11.29% during the year under review.

Iron & steel with a share of 46.4% continued to hold the top position in the total value of metals exported from India in 2010-11. Copper and alloys (including brass and bronze) came in second place and accounted for 28.5%. Ferro-alloys and aluminium & alloys including scrap occupied the third and fourth place, respectively, with a contribution of 10.4% and 5.5 %, respectively. The contribution of zinc & alloys including scrap was 3.0%, that of pig and cast iron (including spiegeleisen) was 2.5%, lead and alloys including scrap was 1.7% and precious metals/metal clad with precious metal was 1.3 per cent. The individual share of other remaining metals and alloys was less than one per cent.

As compared to the previous year, the value of exports for different important metals had shown a mixed trend in 2010-11 over previous year. The export value of antimony alloys and scrap has increased manifold and that of copper & alloys (including brass & bronze) to more than four times, lead and alloys including scrap and ferro-alloys to more than three times, pig & cast iron (including speigeleisen), while precious metals/metal clad with precious metal and zinc and alloys including scrap more than doubled.The export value of other metals & alloys that have shown significant growth are iron & steel 74.7%, manganese & alloys (including waste & scrap) 74.1%, tungsten and alloys including scrap 59.2%, selenium 54.5%, aluminium and alloys including scrap 44.2% and nickel and alloys including scrap 35.2%. The export value of metals & alloys that have recorded negative growth during 2010-11 as compared to previous year are silver 73.1%, platinium alloys & related metals 65.3%, titanium & alloys (including waste & scrap) 51.5%, gold (non-monetary & monetary) 45.9% and tin and alloys including scrap 37.2%.

India exported metals & alloys to 201 countries (including country item unspecified) in 2010-11 as against 204 countries in the preceding year. Bulk of the metals and alloys having share of more than 1% to total value were exported to 22 countries. These countries together accounted for 83% of the total value of exports during 2010-11. China with a share of 24.3% occupied the top position during 2010-11 followed by U S A 8.3%, United Arab Emirates 6.8%, Saudi Arabia 5.8 % , Belgium 5.5%, Republic of Korea 4.3%, Thailand 3%, Iran 2.9%, Malaysia 2.6%, Italy 2.4%, Kuwait 2.4% and Japan and Germany 2.0% each. The individual share of UK, Chinese Taipei/Taiwan, Singapore, Netherlands, Indonesia, Iraq, Sri Lanka, Nigeria and Kenya ranged between 1.7 to 1 per cent and less than one percent in respect of the remaining countries.

The value of exports of metals & alloys rose manifold for Belgium, Kuwait and China and that for Saudi Arabia,Thailand and Iraq to more than three times. The metal exports value for Japan, Netherlands, Turkey, Iran, Chinese Taipei/Taiwan, Rep. of Korea and USA more than doubled. The other countries that have recorded significant increase in value of exports of metals & alloys are UK 98.3%, Spain 87.5%, South Africa 80.7%, Italy 78.0%, Malaysia and Kenya 77.3% each, Ukraine 75.8%, Brazil 65.4%, Hong Kong 63.5%, Sri Lanka 61.8%, Nigeria 55.4%, Canada 53.8%, United Arab Emirates 52.9%,Germany 43.9%, Tanzania 43.9%, Ghana 35.7%, France 32.3% and Egypt 31.4%. The value of exports of metals & alloys, however, showed a decline for Algeria 63.4%, Vietnam 59.7%, Bangladesh 37.6% and Djibouti 25.9% during the year under review (Tables 4 to 6). Exports of selected mineral-based products during 2008-09 to 2010-11 are furnished in Table -7.

Table – 4 : Exports* of Metals and Alloys, 2008-09 to 2010-11

(Value in ₹ '000)

Metals/Alloys	Unit	2008-09		2009-10		2010-11(P)	
		Quantity	Value	Quantity	Value	Quantity	Value
All Metals and Alloys			**822391369**		**579753977**		**1290231272**
Aluminium alloys & scrap	tonne	429433	53404671	440762	49177673	553115	70907167
Antimony alloys & scrap	tonne	57	17537	32	13998	853	417247
Bismuth & scrap	tonne	10	9032	20	12650	++	312
Boron	tonne	383	44812	356	84795	29	6722
Cadmium including waste & scrap	tonne	++	2276	53	11864	14	13708
Cement copper (precipitated)	tonne	14	531	-	-	1	244
Chromium & alloys (scrap)	tonne	11	231901	7	4770	22	14454
Cobalt alloys & scrap: Total	tonne	274	704376	187	340757	264	422752
Cobalt & alloys	tonne	245	695140	168	338720	258	418944
Cobalt (scrap)	tonne	29	9236	19	2037	6	3808
Copper & alloys (incl. brass & bronze): Total (U)	tonne	278655	80988135	303749	85146161	973501	367165694
Copper and alloys	tonne	245683	72084889	274690	77997519	942931	357585954
Copper (scrap)	tonne	768	186253	2250	530500	3169	1153590
Copper alloys (scrap)	tonne	5	1013	19	2759	19	4971
Brass & bronze	tonne	31967	8639392	26565	6571018	27158	8387685
Brass & bronze (scrap)	tonne	232	76588	225	44365	224	33494
Ferro-alloys: Total	tonne	960100	68781535	862769	41394476	2240354	133915094
Ferro-boron	tonne	2	380	3	629	1	157
Ferro-chrome	tonne	491677	34188265	471953	21848549	1305855	81673185
Ferro-columbium	tonne	-	-	1	82	46	3276
Charge -chrome	tonne	1001	53644	++	3	6	1074
Ferro-manganese	tonne	121533	11214086	66521	3388350	120053	7282192
Ferro-molybdenum	tonne	888	53679	1766	237214	2719	685808
Ferro-nickel	tonne	8	3873	++	9	-	-
Ferro-niobium	tonne	192	41614	118	23717	1815	33681
Ferro-phosphorus	tonne	169	5637	11	740	233	6184
Ferro-selenium	tonne	++	19	-	-	-	-
Ferro-silicon	tonne	37170	2804810	20106	1156561	50011	3681465
Ferro-titanium	tonne	2	457	6	881	46	4926
Ferro-tungsten	tonne	3	128	1	232	15	1408
Ferro-vanadium	tonne	388	52353	29	6729	169	23247
Ferro-zirconium	tonne	24	2462	1	262	26	1684
Ferro- silico-chrome	tonne	26	2363	-	-	50476	878413
Ferro-silico-magnesium	tonne	3295	282169	3597	242902	3988	310083
Ferro- silico-manganese	tonne	300421	19983391	298301	14469837	699585	39222936
Ferro-alloys (others)	tonne	3301	92205	355	17779	5310	105375
Gold, non-monetary & monetary: Total (U)	kg	3680	1289329	22990	9827212	49537	5317442
Gold, monetary	kg	236	296055	1	105	-	-
Gold, non-monetary: Total	kg	3444	993274	22989	9827107	49537	5317442
Powder	kg	130	39	25	67	-	-
Other unwrought forms	kg	1900	927523	22667	9396337	49475	5249920
Other semi-manufactured form	kg	1414	65712	297	430703	62	67522
Gold-clad metals / base metals, NES	tonne	++	947	1	1473	1	927
Iron & Steel: Total	tonne	8381102	505364618	6115076	342946993	10169643	599195646
Iron & Steel(finished steel incl. C.R. sheets)	tonne	4187785	232711945	3143360	157564745	5075390	303282605
Iron & Steel (semi-finished steel incl. ingots)	tonne	2658246	130865923	1710812	69818464	3507643	145307883
Iron & Steel (steel wire)	tonne	83461	10567362	72363	7800739	98853	13282268

(Contd.)

Table - 4 (Concld.)

(Value in ₹ '000)

Metals/Alloysl	Unit	2008-09		2009-10		2010-11(P)	
		Quantity	Value	Quantity	Value	Quantity	Value
Iron & Steel (sponge iron)	tonne	29594	728806	52284	1191090	76657	1437007
Iron & Steel (scrap)	tonne	28548	1044012	23849	341729	7343	477649
Iron & Steel: alloy steel (granules))	tonne	361	13927	155	19314	729	103620
Iron & Steel: alloy steel (powder))	tonne	356	31493	571	26620	58	4685
Iron & Steel (other finished steel, NES)	tonne	1392751	129401150	1111682	106184292	1402970	135299929
Lead and alloys & scrap: Total	tonne	12566	1302253	53779	5469186	161430	21580636
Lead & alloys	tonne	12471	1296644	53658	5458634	161320	21571691
Lead (scrap)	tonne	95	5609	121	10552	110	8945
Magnesium & scrap	tonne	152	24255	25	9405	87	6587
Manganese & alloys (incl. waste & scrap)	tonne	267	72865	68	64327	120	111963
Manganese & alloys (Unwrought & Wrought)	tonne	27	21039	23	19109	52	57021
Manganese &alloys, NES	tonne	220	51133	44	45030	68	54942
Manganese waste & scrap	tonne	20	693	1	188	-	-
Mercury	tonne	99	55204	15	10817	53	63263
Molybdenum & scrap	tonne	17	56201	7	39440	15	48922
Nickel and alloys (incl. scrap): Total	tonne	1565	1104883	1524	1103460	1496	1491393
Nickel & alloys	tonne	1500	1074313	1375	1041448	1328	1415750
Nickel (scrap)	tonne	65	30570	149	62012	168	75643
Other rare metals, NES	tonne	7	16742	19	23233	13	3438
Pig & cast iron incl. spiegeleisen	tonne	541757	14671746	620990	10870770	1509984	31803705
Platinum, alloys and related metals: Total	kg	36491	67717779	10587	643700	3167	223645
Platinum (powder, unwrought & others)	kg	33046	67540466	10586	643678	205	174964
Other metals of platinum group	kg	3445	177313	1	22	2962	48681
Platinum-clad base /precious metals	kg	65	749	-	-	642	25368
Precious metals/metals clad with precious metals	tonne	329	5206994	388	7270953	739	16080083
Selenium	tonne	5594	290309	400	417874	182	645693
Silver	tonne	35	677720	62	4263083	55	1146411
Silver-clad base metals	kg	458	1193	26	34	422	2242
Silicon	tonne	289	26518	536	28455	165	23005
Tantalum & scrap: Total	tonne	49	45013	7	7009	4	14529
Tantalum alloys, unwrought	tonne	20	31944	++	2312	2	5201
Tantalum & scrap	tonne	29	13069	7	4697	2	9328
Tellurium	tonne	++	220	44	22834	58	13331
Tin and alloys (incl. scrap)	tonne	2243	1296515	2315	598850	1737	376268
Tin & alloys	tonne	1607	1216288	764	450443	253	196052
Tin & alloys: Worked	tonne	579	71190	1435	140417	1407	173951
Tin (scrap)	tonne	57	9037	116	7990	77	6265
Titanium & alloys (incl. waste & scrap)	tonne	60	236491	90	382639	216	185647
Tungsten alloys & scrap (U)	kg	166283	290497	79513	412084	432709	655916
Zinc and alloys (incl. scrap)	tonne	209434	18428890	175767	19140301	307288	38344923
Zinc & alloys	tonne	209374	18423436	175746	19134250	307283	38343746
Zinc (scrap)	tonne	60	5454	21	6051	5	1177

Source: *DGCI&S, Kolkata.*

***** *Including re-exports.*

Table – 5 : Value of Exports* of Metals & Alloys, 2008-09 to 2010-11 (By Principal Metals & Alloys)

Metal/Alloys	2008-09		2009-10		2010-11 (P)		% increase (+) or decrease (-) in 2010-11 over 2009-10
	Value in (₹ '000)	% share in total value	Value in (₹ '000)	% share in total value	Value in (₹ '000)	% share in total value	
All Metals & Alloys	**822391369**	**100**	**579753977**	**100**	**1290231272**	**100**	**122.55**
Iron & steel	505364618	61.45	342946993	59.15	599195646	46.44	74.72
Copper & alloys (incl. brass & bronze)	80988135	9.85	85146161	14.69	367165694	28.46	331.22
Ferro- alloys	68781535	8.36	41394476	7.14	133915094	10.38	223.51
Aluminium and alloys incl. scrap	53404671	6.49	49177673	8.48	70907167	5.5	44.19
Zinc and alloys incl. scrap	18428890	2.24	19140301	3.3	38344923	2.97	100.34
Pig & cost iron (incl. spiegeleisen)	14671746	1.78	10870770	1.88	31803705	2.46	192.56
Lead and alloys incl. scrap	1302253	0.16	5469186	0.94	21580636	1.67	294.59
Precious metals / metals clad with precious metals	5206994	0.63	7270953	1.25	16080083	1.25	121.16
Gold (non-monetary & monetary): Total	1289329	0.16	9827212	1.7	5317442	0.41	-45.89
Nickel and alloys incl. scrap	1104883	0.13	1103460	0.19	1491393	0.12	35.16
Silver	677720	0.08	4263083	0.74	1146411	0.09	-73.11
Tungsten and alloys incl. scrap	290497	0.04	412084	0.07	655916	0.05	59.17
Selenium	290309	0.04	417874	0.07	645693	0.05	54.52
Cobalt & alloys (incl. waste and scrap)	704376	0.09	340757	0.06	422752	0.03	24.06
Antimony alloys and scrap	17537	++	13998	++	417247	0.03	2880.55
Tin and alloys incl. scrap	1296515	0.16	598850	0.1	376268	0.03	-37.17
Platinium alloys & related metals	67717779	8.23	643700	0.11	223645	0.02	-65.26
Titanium & alloys (incl. waste & scrap)	236491	0.03	382639	0.07	185647	0.01	-51.48
Manganese & alloys (incl . waste & scrap)	72865	0.01	64327	0.01	111963	0.01	74.05
Other metals and alloys	544226	0.07	269480	0.05	243947	0.02	-9.48

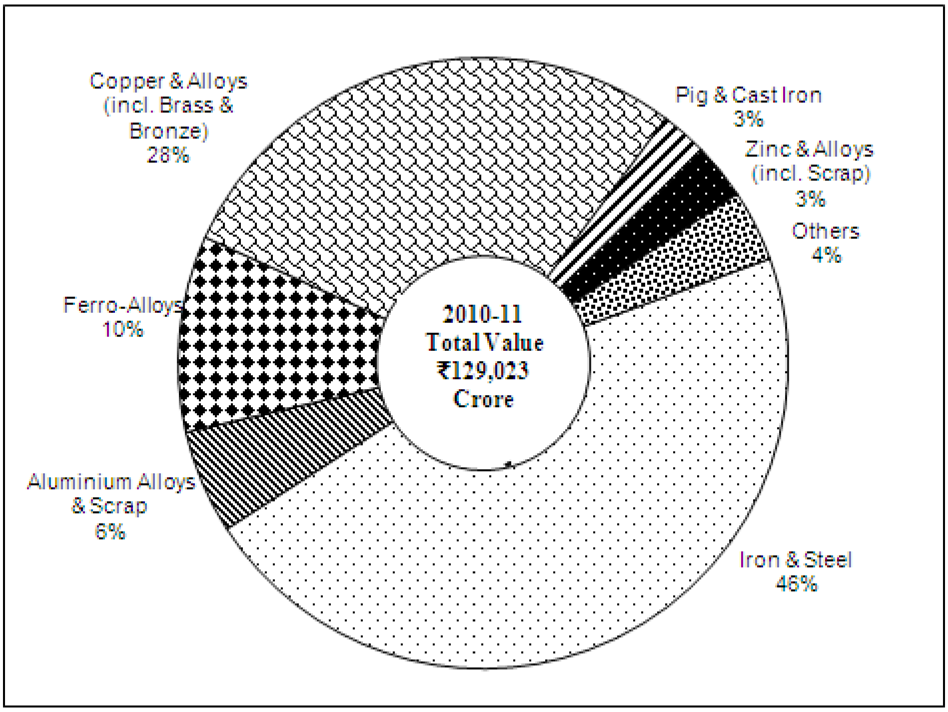
Source: *DGCI&S, Kolkata.*
*** Including re-exports.*

Table – 6 : Value of Exports* of Metals & Alloys, 2008-09 to 2010-11
(By Principal Countries)

Country	2008-09 Value in (₹ '000)	2008-09 % share in total value	2009-10 Value in (₹ '000)	2009-10 % share in total value	2010-11 (P) Value in (₹ '000)	2010-11 (P) % share in total value	% increase (+) or decrease (-) in 2010-11 over 2009-10
All Countries	**822391369**	**100.00**	**579753977**	**100.00**	**1290231272**	**100.00**	**122.55**
China	26089195	3.17	49172236	8.48	312816943	24.25	536.17
USA	111356027	13.54	51085293	8.81	106783532	8.28	109.03
UAE	108283030	13.17	57048667	9.84	87249041	6.76	52.94
Saudi Arabia	38340708	4.66	20117013	3.47	75306353	5.84	274.34
Belgium	34118542	4.15	8837423	1.52	70733081	5.48	700.38
Korea, Rep. of	23001935	2.80	26967586	4.65	55177706	4.28	104.61
Thailand	19615603	2.39	11690891	2.02	38542572	2.99	229.68
Iran	17610022	2.14	16244507	2.80	36791272	2.85	126.48
Malaysia	26744018	3.25	18800036	3.24	33328936	2.58	77.28
Italy	28712905	3.49	17517331	3.02	31183610	2.42	78.02
Kuwait	3500491	0.43	4102077	0.71	30266485	2.35	637.83
Japan	17844928	2.17	9901708	1.71	26014718	2.02	162.73
Germany	26186654	3.18	18073332	3.12	26011624	2.02	43.92
UK	26670572	3.24	10805220	1.86	21422301	1.66	98.26
Chinese Taipei/Taiwan	6566868	0.80	8800781	1.52	18874624	1.46	114.47
Singapore	25810688	3.14	14449256	2.49	18516013	1.44	28.15
Netherlands	19767350	2.40	6337702	1.09	15804173	1.22	149.37
Indonesia	9689514	1.18	13541940	2.34	14958177	1.16	10.46
Iraq	6106074	0.74	4823940	0.83	14625433	1.13	203.18
Sri Lanka	9623114	1.17	8292006	1.43	13412768	1.04	61.76
Nigeria	9685311	1.18	8575524	1.48	13323410	1.03	55.37
Kenya	7466150	0.91	7290600	1.26	12924599	1.00	77.28
Oman	7149942	0.87	9272876	1.60	11365827	0.88	22.57
Turkey	7922380	0.96	4846581	0.84	11183246	0.87	130.75
Nepal	8430570	1.03	11289538	1.95	10913668	0.85	-3.33
Spain	15061989	1.83	4709051	0.81	8830265	0.68	87.52
South Africa	6020174	0.73	4616831	0.80	8342348	0.65	80.69
Brazil	4476685	0.54	4995878	0.86	8261214	0.64	65.36
Canada	6748137	0.82	4121690	0.71	6339417	0.49	53.81
Bangladesh	6907412	0.84	10001401	1.73	6237967	0.48	-37.63
France	6680323	0.81	4466147	0.77	5906994	0.46	32.26
Egypt	3463872	0.42	3841942	0.66	5050000	0.39	31.44
Australia	5519148	0.67	4378081	0.76	4932678	0.38	12.67
Ghana	3453347	0.42	3516971	0.61	4770712	0.37	35.65
Hong Kong	4333635	0.53	2861049	0.49	4678790	0.36	63.53
Other countries	133434056	16.23	114360872	19.73	119350775	9.25	4.36

Source: *DGCI&S, Kolkata.*
** Including re-exports.*

Value of Exports of Metals & Alloys, 2009-10 and 2010-11



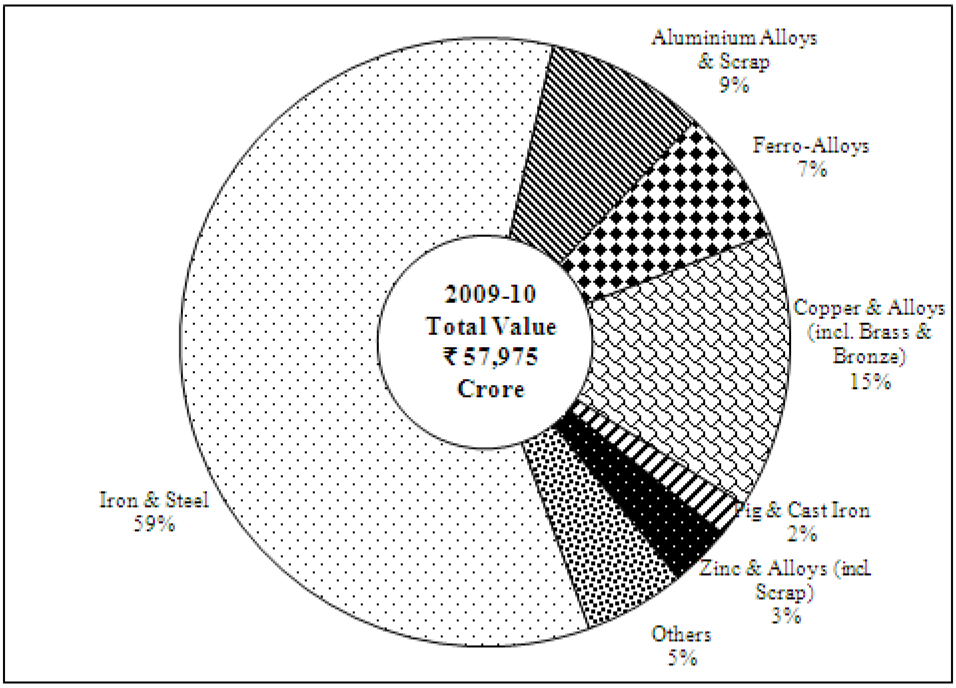


Table – 7 : Export of Selected Mineral Based Products, 2008-09 to 2010-11

(Value in ₹ '000)

Mineral-based-products	Unit	2008-09		2009-10		2010-11(P)	
		Quantity	Value	Quantity	Value	Quantity	Value
All Items			**1248053034**		**1468670418**		**1999533163**
Aluminium fluoride	tonne	8417	719245	8128	477074	6918	331850
Asbestos cement products	tonne	40659	484304	39389	547369	46882	606450
Bleaching powder	tonne	14939	638686	16506	736984	18258	764016
Boric acid	tonne	581	29567	804	18451	690	34660
Briquettes of coke, semi-coke of coal	tonne	10781	13695	28946	14282	79455	1114017
Calcium carbide	tonne	250	8728	971	34557	1135	44469
Caustic soda	tonne	56499	1435584	76995	1434172	234580	4233571
Cement: Total	tonne	3260261	8809436	2689485	6657266	3612062	9554773
Cement (portland grey)	tonne	2254216	6140203	1478108	3823614	2203854	6173343
Cement (portland white)	tonne	71370	334383	83241	398033	165559	711446
Cement (Clinkers)	tonne	817860	2007273	1012735	2051773	1137873	2321265
Cement (Others)	tonne	116815	327577	115401	383846	104776	348719
Cryolite (artificial)	tonne	653	31385	101	2597	24	454
Graphite (artificial)	tonne	15002	941332	7286	373050	9507	542331
Graphite bricks & shapes	tonne	216	5467	288	2470	190	4119
Graphite crucibles	tonne	681	21541	272	10831	569	37780
Hydrofluoric acid	tonne	714	51557	770	50306	1317	64447
Manganese oxide: Total	tonne	1191	48209	1313	31394	2169	69063
Manganese oxides (other than manganese dioxide)	tonne	989	41368	855	21181	1450	54063
Manganese dioxide	tonne	202	6841	458	10213	719	15000
Non-ferrous ash & residues	tonne	531784	1867251	313132	4473825	282071	403938
Petroleum Products: Total	000 t	38902	1220660000	50974	1440370000	59133	1961120000
Light distillates	000 t	13147	431010000	19804	615090000	24408	873560000
Naptha	000 t	7601	248490000	9911	298480000	10667	371840000
Other light distillates	000 t	5546	182520000	9893	316610000	13741	501720000
Middle distillates	000 t	18471	634230000	23094	644050000	24991	852670000
Heavy ends	000 t	7284	155420000	8076	181230000	9734	234890000
Other refractory manufactures	tonne	132201	1928913	115236	1348441	47449	1760391
Phosphoric acid	tonne	61193	2296686	143195	1767666	11798	464367
Phosphorus (elemental)	tonne	368	95366	407	80789	327	78316
Phosphatic fertilizers	tonne	15017	150527	1458	332253	478	5073
Potash fertilizer	tonne	41446	616524	29606	830878	29512	587651
Potassium nitrate	tonne	836	52168	2543	136932	1334	91950
Refractory bricks/Fire bricks	tonne	730254	2675674	358699	2783213	195762	6006862
Silicon carbide crucibles	tonne	5651	206577	6903	377106	8811	434517
Slag Dross	tonne	358104	1151991	669607	1752831	1021662	4368981
Soda ash	tonne	86203	1095634	257221	2093090	335838	3388972
Sodium nitrate	tonne	273	8060	175	4934	101	3094
Sodium nitrite	tonne	1322	50971	3267	105253	4567	130825
Sulphur (Sublimed, Precipitated & Colloidal): Total	tonne	5068	420343	5608	492006	21917	859708
Sulphur (colloidal)	tonne	53	990	35	806	13666	81803
Sulphur (Precipitated)	tonne	118	1513	67	965	46	631
Sulphur (Sublimed)	tonne	4897	417840	5506	490235	8205	777274
Titanium dioxide & oxide: Total	tonne	33643	1537613	28142	1330398	57999	2426518
Titanium dioxide	tonne	6833	616091	5941	579449	6868	809501
Titanium oxides (other than above)	tonne	26810	921522	22201	750949	51131	1617017

Source: *DGCI&S, Kolkata.*

IMPORTS

Ores and Minerals

The value of imports of ores & minerals in 2010-11 accounted for 39.74% of the total value of all merchandise imported into India. During 2010-11, the total value of imports of ores and minerals at ₹ 669010 crore registered a rise of 27% as compared to ₹524830 crore during 2009-10.

Petroleum (crude) continued to be the largest constituent item with a share of 63.0% in the total value of mineral imports in 2010-11. Next in order of importance was diamond (total) with a share of 22.8% followed by coal (excluding lignite) with the contribution of 6.2%, copper ores & concentrates 3.0% and natural gas 2.2%. The combined share of these five minerals was 97.2% in 2010-11 as against 97.1% in the previous year.

The value of imports for antimony ores & concentrate rose to more than 4 times during 2010-11 as compared to previous year and that of manganese ore, iron ore and diamond (total) more than doubled. The other minerals which registered increase in value of imports are molybdenum ores & concentrate 82%, zinc ores & concentrate 79%, zirconium ores & concentrate 76%, sulphur (excluding sublimed, precipitated & colloidal) 61%, lead ores & concentrate 53%, silica sand 44%, dolomite 41%, natural gas 32% and borax 30% . However, the value of imports declined by 23% for magnesite, 6% for coke and 4.5% for ball clay during 2010-11 over the previous year.

During 2010-11 minerals were imported from 75 countries (figure are inclusive of country item "unspecified"). Around 97% of the total value of imports of ores & minerals was confined to 30 countries. Out of these, 14 countries accounted for about 81% of the total value of minerals imported during the year under review. United Arab Emirates occupied the top position in 2010-11 and accounted for 15% of the total value of mineral imports. Next in order was Saudi Arabia 11%, Nigeria 7 %, Iran, Iraq and Kuwait 6% each, Hong Kong and Belgium 5% each, Australia, Qatar and Venezuela 4% each, Angola 3%, and Indonesia and Oman 2% each. The individual share of USA, Brazil, Algeria, Yemen Republic, South Africa and Malaysia varied between 1.5 to 1 per cent and that of remaining countries was less than one per cent.

Value of imports of ores & minerals from Norway increased manifold in 2010-11and that from Hong Kong and Gabon more than doubled. The other countries which recorded increase in value of imports of ore and minerals during the year are USA 92%, Columbia 91%, UAE 87%, Venezuela 78%, Algeria 70%, Israel 63%, Brazil 58%, Libya and Thailand 51% each, Belgium 48%, Nigeria 43%, Qatar 36%, UK 33% and Chile 32%. Imports value, however, showed a decline of 71% for Turkey, 48% for Brunei, 34% for Azerbaijan and 21% for Egypt.(Tables 8 to 10).

Table – 8 : Imports of Ores and Minerals, 2008-09 to 2010-11

(Value in ₹ ’000)

Mineral	Unit	2008-09		2009-10		2010-11(P)	
		Quantity	Value	Quantity	Value	Quantity	Value
All Minerals			**5145093369**		**5248299819**		**6690103838**
Abrasives (natural)	tonne	10007	106107	12058	154452	10082	139898
Alabaster	tonne	397	6822	413	7425	1237	19920
Alumina	tonne	212502	4392750	337072	6790221	281285	6924573
Andalusite	tonne	8267	165807	5930	127949	5515	104883
Antimony ores and conc.	tonne	476	53767	898	94154	2547	446982
Arsenic sulphide (natural)	tonne	75	2896	35	1306	57	2104
Asbestos: Total	tonne	346658	8744931	331415	9387999	365795	10025266
Asbestos (chrysotile)	tonne	346032	8697307	330106	9344369	353441	9939377
Asbestos (others)	tonne	626	47624	1309	43630	12354	85889
Ballclay	tonne	122026	755642	123073	667661	126695	637682
Barytes	tonne	1674	20681	3778	37295	2843	37498
Bauxite	tonne	45612	988232	54345	1141378	63584	1201033
Bentonite	tonne	4500	95996	2378	74132	2301	74759
Borax: Total	tonne	98533	1994633	78003	1873097	112225	2427019
Natural borate	tonne	44617	719253	30690	571010	48401	801445
Sodium borate	tonne	46214	1020727	42314	1070370	57107	1347556
Other borates	tonne	7702	254653	4999	231717	6717	278018
Building & monumental stones, NES	tonne	3067772	1362230	1874801	1466316	909936	1527459
Calcite	tonne	66205	188222	111887	368852	143164	430793
Chalk	tonne	128	2732	1659	11477	3185	17140
Chromite: Total	tonne	94416	1070152	95842	860966	86456	904750
Chrome ore others	tonne	41131	541786	6778	98446	5870	119661
Chrome ore conc.	tonne	1166	15358	14	2408	13	2866
Chrome ore lumps	tonne	52119	513008	89050	760112	80573	782223
Clay (others)	tonne	57061	392891	3200	59861	11610	103765
Coal (excluding Lignite)	000 t	59004	413413525	73257	391798228	68918	415494801
Lignite	000 t	++	1654	++	1053	++	310
Coke	tonne	1882191	46063197	2355535	33310985	1490210	31203551
Coal gas	tonne	-	-	-	-	-	-
Cobalt (ores & conc.)	tonne	7823	2353378	9590	1327248	5041	1515404
Copper ores & conc.	tonne	2264732	178221088	2187460	189675846	1902026	200234533
Corundum (natural)	tonne	++	54	-	-	-	-
Diamond: Total		**	748858813	**	744408663	**	1527908912
Diamond (industrial)	carat	24502	99064	2216	1031716	104159	845847
Diamond (mostly uncut)	carat	143464060	748417096	130101282	742991285	182227342	1526573162
Diamond (powder)	’000 carat	72333	342653	107077	385662	136271	489903
Diatomite	tonne	1817	48615	1584	46387	1510	47906
Dolomite	tonne	10119	111105	450979	991241	611833	1395183
Earth clay	tonne	138	8587	29	744	83	4275
Emerald (uncut & cut): Total		**	4253563	**	3905599	**	4957091
Emerald (uncut)	tonne	44	2137136	78	1562090	51	2394859
Emerald (cut)	’000 carat	4656	2116427	2946	2343509	3945	2562232
Felspar (natural)	tonne	290	3856	7281	32129	20409	64063
Felspar (uncut & cut): Total		**	4057	**	1560	**	6531
Felspar (uncut)	tonne	++	848	3	1272	1	2650
Felspar (cut)	’000 carat	5	3209	++	288	3	3881
Fireclay	tonne	121	4933	43	720	689	10920
Flint	tonne	1309	7522	862	5413	25	202
Fluorite/Fluorspar	tonne	153749	2558710	147138	1971459	161925	2333963

(Contd.)

Table - 8 (Contd.)

(Value in ₹ '000)

Mineral	Unit	2008-09		2009-10		2010-11(P)	
		Quantity	Value	Quantity	Value	Quantity	Value
Garnet (abrasive)	tonne	332	6483	20	42	357	7490
Garnet (cut & uncut) : Total		**	43092	**	23848	**	16114
Garnet (uncut)	tonne	++	3988	++	3783	3	10671
Garnet (cut)	'000 carat	242	39104	102	20065	21	5443
Granite (Total)	tonne	50786	996647	51214	1016841	55554	1163349
Granite (crude or roughly trimmed)	tonne	15771	350185	33072	618697	31300	578086
Granite (cut blocks/slabs)	tonne	21562	365965	3286	57671	2375	41510
Granite (polished blocks/tiles)	tonne	8306	136055	6267	159809	6207	157985
Granite (others)	tonne	5147	144442	8589	180664	15672	385768
Graphite (natural)	tonne	7309	247346	12780	395701	14348	460015
Gypsum & plaster	tonne	890912	1419361	1548701	2212673	1697746	2212981
Iron ore: Total	000 t	69	611112	897	4681128	1867	10284802
Iron ore conc.: Non-agglomerated	000 t	++	805	10	1601	5	79
Iron ore fines	000 t	-	-	152	779767	55	179933
Iron ore lumps	000 t	-	-	-	-	678	18869
Iron ore pellets	000 t	69	604776	721	3889791	1115	10070122
Iron ore pyrites	000 t	++	5531	14	9969	14	15799
Kaolin	tonne	62083	632016	46708	563887	52663	636698
Kieselgurh	tonne	176	9685	195	6337	156	5670
Kyanite	tonne	200	4457	292	8171	504	11318
Lead ores & conc.	tonne	5184	193822	6944	223284	9722	342050
Limestone	tonne	3603340	5607948	3899308	6191762	5035678	7043286
Magnesite: Total	tonne	51422	1427008	66118	2053876	54929	1590290
Magnesia (fused)	tonne	10854	332290	11846	327914	7869	244338
Magnesite (not calcined)	tonne	441	9389	412	17890	478	11829
Magnesite (calcined)	tonne	12992	381550	21758	752797	13239	415407
Magnesite: Dead-burnt magnesia	tonne	19669	431172	13950	267092	16579	320044
Magnesium oxide	tonne	4333	182792	4677	232483	6264	270221
Magnesite (others)	tonne	3133	89815	13475	455700	10500	328451
Manganese ore: Total	tonne	852198	19818562	797933	7470849	1299643	17813482
Manganese ore (46% or more Mn)	tonne	398033	11041290	283146	3227378	531465	8247614
Manganese ore (35% or more but below 46% Mn)	tonne	431162	8557785	512498	4212534	752600	9386983
Manganese ore (30% or more but below 35% Mn)	tonne	11062	115633	299	3126	3097	30401
Manganese ore (ferruginous 10% or more)	tonne	-	-	-	-	-	-
Manganese ore (others)	tonne	11941	103854	1990	27811	12481	148484
Marble: Total	tonne	313680	6533016	431022	8418728	512169	10320860
Marble (dressed)	tonne	217913	3621757	312665	5136712	427558	7273477
Marble (others)	tonne	95767	2911259	118357	3282016	84611	3047383
Mica: Total	tonne	2323	424930	1661	422697	1687	411461
Mica (unmanufactured)	tonne	552	14913	379	15874	409	13603
Mica (blocks)	tonne	59	4624	++	137	++	12
Mica (powder)	tonne	150	4526	72	6343	126	8429
Mica (splittings)	tonne	106	3249	191	5739	258	4707
Mica (waste & scrap)	tonne	237	2514	116	3655	25	455
Mica (worked)	tonne	1771	410017	1282	406823	1278	397858
Mica (condenser films, plates, cuts, NES)	tonne	144	27934	115	22377	92	48778

(Contd.)

Table - 8 (Concld.)

(Value in ₹ '000)

Mineral	Unit	2008-09		2009-10		2010-11(P)	
		Quantity	Value	Quantity	Value	Quantity	Value
Mica (washers & discs)	tonne	++	17	5	384	1	221
Mica (sheets & strips)	tonne	241	7509	136	10535	203	9356
Micanite & other built-up mica	tonne	41	4702	27	3809	22	2122
Mica (bricks)	tonne	-	-	-	-	4	1389
Mica worked (others)	tonne	1345	369855	999	369718	956	335992
Molybdenum ores & conc.	tonne	2559	4597646	3751	3336296	4382	6086645
Natural gas	tonne	8306769	128867509	9110571	110672243	9765763	146481792
Niobium/Tantalum ores & conc.	tonne	312	56528	5	18268	11	9227
Nickel ores & conc.	tonne	346	160035	91	80938	219	143868
Ochre Total:	tonne	1643	110488	2378	123482	1324	141001
Ochre (Earth colours)	tonne	202	1895	1155	6865	50	2404
Ochre (Persian red)	tonne	28	5268	++	179	135	15796
Ochre (Red oxide)	tonne	1355	94084	1145	111074	1086	116068
Ochre (Yellow ochre)	tonne	58	9241	78	5364	53	6733
Petroleum (crude)	000 t	130042	3468454807	153629	3659009475	153120	4216162484
Precious & semi-precious stones, NES: Total		**	4832841	**	5803493	**	7051601
Precious & semi precious stones (uncut)	tonne	773	3091723	455	4067067	72591	4706924
Precious & semi precious stones (cut)	000 carat	3395	1741118	3744	1736426	5756	2344677
Precious metal ores & conc.	kg	9606	2486	525	37392	167	298094
Quartz & quartzite (natural)	tonne	326	9794	823	11964	496	8699
Quartz (natural)	tonne	285	9100	486	7765	412	6189
Quartzite (natural)	tonne	41	694	337	4199	84	2510
Rock phosphate	tonne	5009662	48404898	5683654	32750208	5194203	32110281
Salts (other than common salt)	tonne	31948	69337	30838	67124	34148	82776
Sand (excluding metal bearing)	tonne	1041318	332095	493454	177268	22379	28609
Sandstone	tonne	52	398	21000	22343	-	-
Silica sand	tonne	10240	220828	15384	287033	93741	413702
Sillimanite	tonne	2745	36142	1148	12589	1363	15992
Slate	tonne	13	601	146	4663	89	3678
Steatite/talc/soapstone: Total	tonne	5218	91045	2605	52455	10087	130423
Steatite blocks	tonne	-	-	54	325	1	129
Steatite lumps	tonne	216	1345	180	876	6594	38009
Steatite powder & others	tonne	5002	89700	2371	51254	3492	92285
Sulphur (excluding sublimed, precipitated & colloidal)	tonne	1286429	29944603	1533628	6810816	1356774	10977136
Tin ores & conc.	tonne	979	464371	487	168047	195	86167
Titanium ores & conc.: Total	tonne	11071	283881	32104	747639	66759	861652
Titanium ores& conc.: Ilmenite	tonne	1492	6725	11137	68649	48747	287449
Titanium ores & conc.: Rutile	tonne	6592	210186	15239	527866	13390	432741
Titanium ores & conc. (other)	tonne	2987	66970	5728	151124	4622	141462
Tripoli earth	tonne	21	471	39	930	19	486
Tungsten ores & conc.	tonne	20	370	87	1538	27	890
Vanadium ores & conc.	tonne	39	22500	60	7762	4	1182
Vermiculite	tonne	305	13072	84	1906	312	7519
Witherite	tonne	150	2128	-	-	3	52
Wollastonite	tonne	223	4785	351	3889	2600	23913
Zinc ores & conc.	tonne	78201	2217983	59857	1911107	88171	3415929
Zirconium ores & conc.	tonne	30477	1268366	34724	1517772	54312	2665929
Other minerals	tonne	44994	390728	34178	369539	40359	367542

Source: *DGCI&S, Kolkata.*
******* *Quantity not given due to partial coverage; value figures, however, have full coverage.*

Table – 9 : Value of Imports of Ores & Minerals, 2008-09 to 2010-11 (By Principal Ores/Minerals)

Ore/Mineral	2008-09		2009-10		2010-11 (P)		% increase (+) or decrease (-) in 2010-11 over 2009-10
	Value in (₹ '000)	% share in total value	Value in (₹ '000)	% share in total value	Value in (₹ '000)	% share in total value	
All Minerals	**5145093369**	**100**	**5248299819**	**100**	**6690103838**	**100**	**27.47**
Petroleum (crude)	3468454807	67.41	3659009475	69.72	4216162484	63.02	15.23
Diamond	748858813	14.55	744408663	14.18	1527908912	22.84	105.25
Coal (excluding lignite)	413413525	8.04	391798228	7.47	415494801	6.21	6.05
Copper ores & conc.	178221088	3.46	189675846	3.61	200234533	2.99	5.57
Natural gas	128867509	2.5	110672243	2.11	146481792	2.19	32.36
Rock phosphate	48404898	0.94	32750208	0.62	32110281	0.48	-1.95
Coke	46063197	0.9	33310985	0.63	31203551	0.47	-6.33
Manganese ore	19818562	0.39	7470849	0.14	17813482	0.27	138.44
Sulphur (excluding sublimed, precipitated & colloidal)	29944603	0.58	6810816	0.13	10977136	0.16	61.17
Marble	6533016	0.13	8418728	0.16	10320860	0.15	22.59
Iron ore	611112	0.01	4681128	0.09	10284802	0.15	119.71
Asbestos	8744931	0.17	9387999	0.18	10025266	0.15	6.79
Precious & semi-precious stones (cut & uncut): Total	4832841	0.09	5803493	0.11	7051601	0.11	21.51
Limestone	5607948	0.11	6191762	0.12	7043286	0.11	13.75
Alumina	4392750	0.09	6790221	0.13	6924573	0.1	1.98
Molybdenum ores & conc.	4597646	0.09	3336296	0.06	6086645	0.09	82.44
Emerald (cut & uncut)	4253563	0.08	3905599	0.07	4957091	0.07	26.92
Zinc ores & conc.	2217983	0.04	1911107	0.04	3415929	0.05	78.74
Zirconium ores & conc.	1268366	0.02	1517772	0.03	2665929	0.04	75.65
Borax	1994633	0.04	1873097	0.04	2427019	0.04	29.57
Fluorite/fluorspar	2558710	0.05	1971459	0.04	2333963	0.03	18.39
Gypsum	1419361	0.03	2212673	0.04	2212981	0.03	0.01
Magnesite	1427008	0.03	2053876	0.04	1590290	0.02	-22.57
Building and monumental stones, NES	1362230	0.03	1466316	0.03	1527459	0.02	4.17
Cobolt ores & conc.	2353378	0.05	1327248	0.03	1515404	0.02	14.18
Dolomite	111105	0	991241	0.02	1395183	0.02	40.75
Bauxite	988232	0.02	1141378	0.02	1201033	0.02	5.23
Granite	996647	0.02	1016841	0.02	1163349	0.02	14.41
Chromite	1070152	0.02	860966	0.02	904750	0.01	5.09
Titanium ores & conc.	283881	0.01	747639	0.01	861652	0.01	15.25
Ball clay	755642	0.01	667661	0.01	637682	0.01	-4.49
Kaolin	632016	0.01	563887	0.01	636698	0.01	12.91
Graphite (natural)	247346	0	395701	0.01	460015	0.01	16.25
Antimony ores & conc.	53767	0	94154	0	446982	0.01	374.74
Calcite	188222	0	368852	0.01	430793	0.01	16.79
Silica sand	220828	0	287033	0.01	413702	0.01	44.13
Mica	424930	0.01	422697	0.01	411461	0.01	-2.66
Lead ores & conc.	193822	0	223284	0	342050	0.01	53.19
Other minerals	2704301	0.05	1762398	0.04	2028418	0.03	15.09

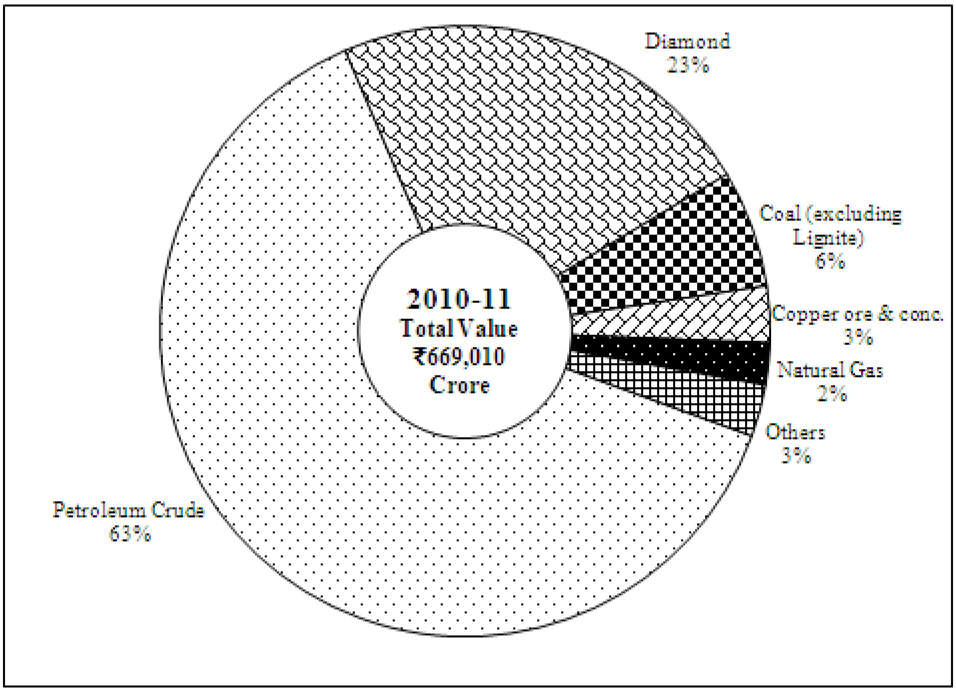
Source: *DGCI&S, Kolkata.*

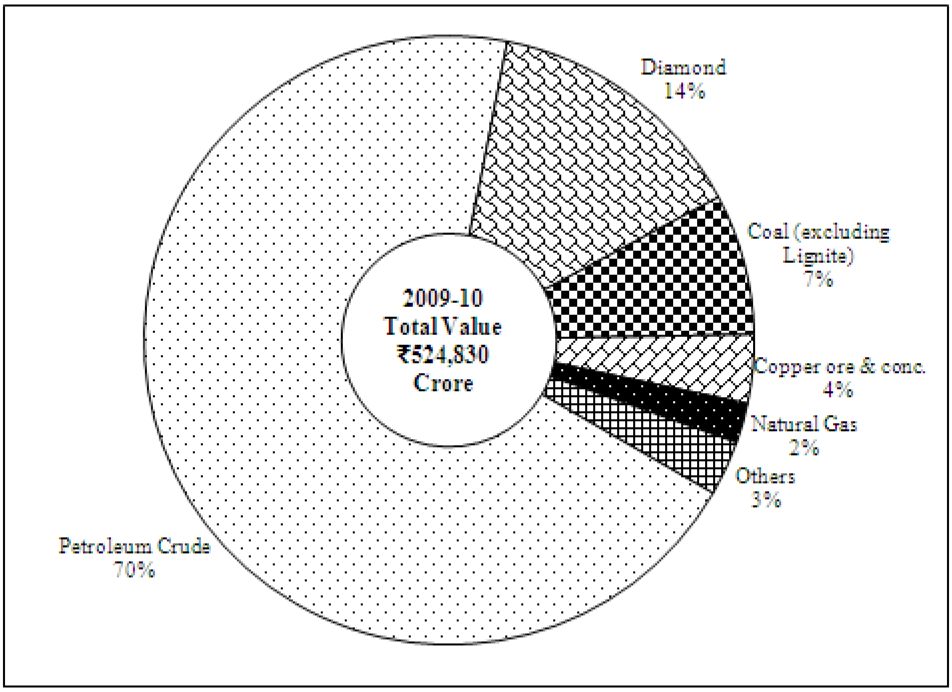
Table – 10 : Value of Imports of Ores & Minerals, 2008-09 to 2010-11 (By Principal Countries)

Country	2008-09		2009-10		2010-11 (P)		% increase (+) or decrease (-) in 2010-11 over 2009-10
	Value in (₹ '000)	% share in total value	Value in (₹ '000)	% share in total value	Value in (₹ '000)	% share in total value	
All Countries	**5145093369**	**100**	**5248299819**	**100**	**6690103838**	**100**	**27.47**
UAE	617182162	12	518931849	9.89	972371127	14.53	87.38
Saudi Arabia	719626057	13.99	665062569	12.67	745766548	11.15	12.13
Nigeria	396431103	7.71	339783934	6.47	484285160	7.24	42.53
Iran	513700248	9.98	497082588	9.47	439795940	6.57	-11.52
Iraq	341240038	6.63	330483468	6.3	407338682	6.09	23.26
Kuwait	361746406	7.03	346414651	6.6	400062416	5.98	15.49
Hong Kong	210815651	4.1	141141843	2.69	323172517	4.83	128.97
Belgium	191374897	3.72	215514515	4.11	319352737	4.77	48.18
Australia	253935006	4.94	258595361	4.93	289408116	4.33	11.92
Qatar	130302250	2.53	189851683	3.62	258017070	3.86	35.9
Venezuela	184472556	3.59	133174668	2.54	237198060	3.55	78.11
Angola	64988437	1.26	199896441	3.81	231709448	3.46	15.91
Indonesia	143168975	2.78	170950419	3.26	160263933	2.4	-6.25
Oman	19118608	0.37	134040820	2.55	144861436	2.17	8.07
USA	70529730	1.37	53435670	1.02	102349894	1.53	91.54
Brazil	19487028	0.38	63688128	1.21	100642737	1.5	58.02
Algeria	21340904	0.41	45725084	0.87	77877298	1.16	70.32
Yemen Republc	25728532	0.5	69240928	1.32	76541724	1.14	10.54
South Africa	63922846	1.24	74312607	1.42	75170301	1.12	1.15
Malaysia	125711237	2.44	66133025	1.26	67574947	1.01	2.18
Chile	61556764	1.2	45463698	0.87	59854933	0.89	31.65
Israel	28327050	0.55	34248915	0.65	55898933	0.84	63.21
UK	48295147	0.94	40462475	0.77	53613673	0.8	32.5
Egypt	58942313	1.15	67740267	1.29	53557835	0.8	-20.94
Libya	30700236	0.6	28951033	0.55	43751775	0.65	51.12
Russia	25883479	0.5	53412732	1.02	43638504	0.65	-18.3
Columbia	47777	0	19360837	0.37	36941918	0.55	90.81
China	75626113	1.47	23084600	0.44	28559732	0.43	23.72
Mexico	43781800	0.85	33373470	0.64	28456133	0.43	-14.73
Sudan	15937875	0.31	20648024	0.39	25754589	0.38	24.73
Congo, People's Rep. of	19287755	0.37	24570821	0.47	23318362	0.35	-5.1
Jordan	28205417	0.55	14718352	0.28	16010711	0.24	8.78
Turkey	40417399	0.79	54631792	1.04	16006367	0.24	-70.7
Gabon	4714721	0.09	5817270	0.11	12423312	0.19	113.56
Thailand	6813619	0.13	7879048	0.15	11901033	0.18	51.05
Brunei	18321268	0.36	20254829	0.39	10623176	0.16	-47.55
Norway	3102689	0.06	486614	0.01	9702431	0.15	1893.87
Azerbaijan	8486690	0.16	13252814	0.25	8754606	0.13	-33.94
New Zealand	8885078	0.17	10002992	0.19	8136697	0.12	-18.66
Unspecified	12888404	0.25	1737763	0.03	110734032	1.66	6272.22
Other countries	130049104	2.53	214741222	4.09	118704995	1.77	-44.72

Source: *DGCI&S, Kolkata.*
The country-wise details relating to some of the commodities are not available from the source agency. The figures in respect of such commodities have been grouped under country item "unspecified".

Value of Mineral Imports, 2009-10 and 2010-11





Metals & Alloys

The value of imports of metals & alloys at ₹ 286835 crores showed an increase of 33.8% in 2010-11 as compared to ₹ 214425 crore in the previous year. The contribution of metals & alloys in the total value of all merchandise imported in to India was about 17% in 2010-11.

Gold, non-monetary & monetary (total) with a share of 64.4% continued to occupy the top position in the total value of metals & alloys in 2010-11. Iron & steel came in second place and accounted for a share of 21.5%. Aluminium alloys & scrap occupied the third place with a share of 3.5%. Next in order were silver 3.1%, copper & alloys (including brass & bronze) 3.0% and nickel and alloys including scrap 1.1%. The individual share of remaining metals was less than one per cent of the total value of imports of metals & alloys.

The value of import that showed increase in 2010-11 as compared to that in the previous year among metals & alloys are silver 96.2%, nickel and alloys including scrap 65%, silicon 61.2%, selenium 61%, chromium & alloys 56.2%, copper & alloys (including brass & bronze) 54.8%, manganese & alloys (including waste & scrap) 50.1%, other rare metals (NES) 42.9%, tin and alloys including scrap 41%, aluminium and alloys including scrap 40.3%, molybdenum & scrap 40.3%, pig & cast iron (including speigeliesen) 36.2%, gold (non-monetary & monetary) 36%, cobalt & alloys(including waste and scrap) 35.9% and ferro alloys 35.4%. On the other hand, during 2010-11, the value of imports of metals and alloys that have declined as compared to the previous year are titanium & alloys (including waste & scrap) 63.0%, precious metal/metals clad with preciuos metals 60.9% and zinc & alloys including scrap 16.1%.

India imported metals & alloys from 181 countries in 2010-11 as against 182 countries in 2009-10 (both figures include “unspecified” country item). Bulk of the metals & alloys was imported from 30 countries (including “unspecified” country item) which accounted for 96.9 % of the total value of metal imports in 2010-11. Switzerland occupied the top position with a contribution of 36.1% of the total value of metal imports in 2010-11 followed by UAE in second place with a share of 13.7 percent. The countries next in the order were South Africa 7.6%, China 6.8%, Australia 5.6%, USA 3.3%, Rep. of Korea 3.1% and UK & Japan 2.4% each. The individual share of Germany, Russia, Chinese Taipei/ Taiwan, Hong Kong and Malaysia was between 1.9% and 1.1% and that of remaining countries was less than one per cent.

During 2010-11, value of imports from Indonesia, Malaysia and Chinese Taipei/Taiwan increased by more than doubled. The other countries which have recorded positive growth in imports are China 97.7%, Austria 93.6%, Saudi Arabia 72.8%, Switzerland 69.6%, Singapore 64.4%, Netherlands 57.7%, Thailand 57.0%, Finland 52.4%, Japan 39.1%, Bhutan 38.4%, Hong Kong 30.5%, and Russia 30.1%. Decline in the value of import of metals & alloys was however observed in 2010-11 in case of Australia by 45%, France by 32.2%, Turkey by 30.5% and Canada by 21.6% as compared to previous year (Tables - 11 to 13). Imports of selected mineral-based products in 2008-09 to 2010-11 are furnished in Table -14.

Table – 11: Imports of Metals and Alloys, 2008-09 to 2010-11

(Value in ₹ '000)

Metal/Alloy	Unit	2008-09		2009-10		2010-11(P)	
		Quantity	Value	Quantity	Value	Quantity	Value
All Metals and Alloys			**1994888257**		**2144246493**		**2868348244**
Aluminium alloys & scrap	tonne	564928	68722275	726656	72160299	881144	101220027
Antimony alloys & scrap	tonne	967	245595	927	231371	543	256726
Bismuth & scrap	tonne	99	94608	106	80768	112	107370
Boron	tonne	++	3517	1	2252	++	1027
Cadmium & scrap	tonne	526	113505	968	160628	655	122567
Chromium alloys & scrap	tonne	600	280271	640	258723	706	404055
Cobalt alloys & scrap: Total	tonne	804	1766544	597	1158986	726	1574437
Cobalt & alloys	tonne	804	1766544	597	1158986	726	1573775
Cobalt (scrap)	tonne	-	-	-	-	++	662
Copper (cement copper precipitated)	tonne	321	59757	2177	212716	147	21437
Copper & alloys (incl. brass & bronze)	tonne	220300	55434757	205591	55366184	260108	85717042
Copper and alloys	tonne	106417	32683321	110169	34138378	140163	51176534
Copper (scrap)	tonne	23245	6855978	24214	6407313	39651	14423261
Copper alloys (scrap)	tonne	3	1740	27	3879	-	…
Brass & bronze	tonne	18200	5661285	14626	4570432	16714	6022873
Brass & bronze (scrap)	tonne	72435	10232433	56555	10246182	63580	14094374
Ferro-alloys: Total	tonne	140415	18147906	208973	18630802	225263	25230287
Ferro-boron	tonne	198	26167	263	35288	429	58265
Ferro-chrome	tonne	12377	2661484	17226	1827839	22412	3041559
Charge -chrome	tonne	-	-	500	16354	2503	125126
Ferro-manganese	tonne	22007	1765283	28604	1700420	38929	2140883
Ferro-molybdenum	tonne	840	1815864	1109	1320615	963	1443459
Ferro-nickel	tonne	7663	2848105	21019	3465442	6862	4892738
Ferro-niobium	tonne	1779	1958029	769	1171887	1432	2221360
Ferro-phosphorus	tonne	1336	37898	1138	25771	1749	38095
Ferro-silicon	tonne	82751	5434244	125138	7025516	135094	8660391
Ferro-titanium	tonne	559	163324	1843	227645	1658	397378
Ferro-tungsten	tonne	45	61073	20	24976	72	71671
Ferro-tantalum	tonne	-	-	-	-	1	2011
Ferro-vanadium	tonne	243	512008	881	948903	891	1005527
Ferro-silico-chrome	tonne	….	….	7	997	16	2156
Ferro-silico-magnesium	tonne	3834	316924	1523	109062	1597	139830
Ferro-silico-manganese	tonne	239	25652	1377	61995	1642	87831
Ferro-zirconium	tonne	125	14229	193	22849	238	36640
Ferro-alloys (others)	tonne	6419	507622	7363	645243	8775	865367
Gold, non-monetary & monetary: Total	kg	771045	953238640	851023	1358831868	969738	1847287525
Gold, non-monetary : Total	kg	771045	953238640	851023	1358831868	969738	1847287525
Gold, non-monetary : powder	kg	1	628	32	52810	2	99
Gold, non-monetary: other semi-manufactured forms	kg	139603	164426453	4760	7638289	51961	102954219
Gold, non-monetary, other unwrought forms	kg	631441	788811559	846231	1351140769	917775	1744333207
Gold-clad metals/base metals, NES.	tonne	2	7235	++	11849	++	522
Iron & steel: Total	tonne	11778361	603114119	14442652	511365616	14401512	616497590
Iron & steel (finished steel incl. C.R. sheets)	tonne	2230126	174889161	2986180	171605291	2981662	200100488
Iron & steel (semi-finished							

(Contd.)

Table - 11 (Concld.) (Value in ₹ '000)

Metal/Alloy	Unit	2008-09		2009-10		2010-11(P)	
		Quantity	Value	Quantity	Value	Quantity	Value
steel incl. ingots)	tonne	4467284	211817689	5529733	162605997	5853171	199872343
Iron & steel (steel wire)	tonne	108309	8187717	126531	7783851	163060	11174142
Iron & steel (sponge iron)	tonne	295	86008	125464	1798556	41982	729817
Iron & steel (scrap)	tonne	4443073	105265307	5286225	96084087	4557022	108688994
Iron & steel (alloy steel (granules)	tonne	11069	518159	12776	531453	13866	567809
Iron & steel (alloy steel (powder)	tonne	1247	265392	956	232944	2068	396792
Iron & steel (other finished steel, NES)	tonne	516958	102084686	374787	70723437	788681	94967205
Lead and alloys & scrap	tonne	209455	18878086	253275	21984498	285662	27568237
Lead & alloys	tonne	183610	16713024	212890	18788265	227387	22411491
Lead (scrap)	tonne	25845	2165062	40385	3196233	58275	5156746
Magnesium & scrap	tonne	7745	1640852	8644	1333187	11151	1566701
Manganese & alloys incl. waste & scrap: Total	tonne	7176	1191814	11214	1351356	13982	2028316
Manganese & alloys (unwrought & wrought)	tonne	6651	1086531	11149	1334081	13565	1953655
Manganese & alloys, NES	tonne	525	105283	65	17275	417	74661
Mercury	tonne	115	90531	313	196831	191	243129
Molybdenum & scrap	tonne	420	1284932	297	664803	412	932478
Nickel and alloys (incl. scrap)	tonne	20514	19453631	23909	19473718	33306	32130836
Nickel & alloys	tonne	20194	19362231	22922	19242826	32264	31797943
Nickel (scrap)	tonne	320	91400	987	230892	1042	332893
Other rare metals, NES	tonne	127	291561	60	115227	44	164666
Pig & cast iron incl. spiegeleisen	tonne	35484	1780758	39013	1700708	48291	2316267
Platinum, alloys and related metals: Total	kg	53967	136803700	6215	7893762	5072	8451719
Platinum (powder, unwrought & others)	kg	50835	135124436	4210	6938320	2275	5872712
Other metals of platinum group	kg	3132	1679264	2005	955442	2797	2579007
Platinum-clad base/ precious metals	kg	361	905	22	537	5	405
Precious metals/metals clad with precious metals	tonne	6	203108	1	317483	4	124220
Selenium	tonne	164	435275	190	434583	209	699503
Silicon	tonne	19998	2140234	24245	2186037	32055	3523172
Silver	tonne	5696	94684290	2075	45636507	2656	89531561
Silver-clad base metals	kg	94	518	31	223	5	148
Tantalum & scrap: Total	tonne	8	32440	7	29111	14	22580
Tantalum alloys unwrought	tonne	8	31760	7	28732	11	20361
Tantalum & scrap	tonne	++	680	++	379	3	2219
Tellurium	tonne	++	13133	9	55532	3	35182
Tin and alloys (incl. scrap)	tonne	7689	4686282	7672	5148447	7494	7258073
Tin & alloys	tonne	5665	4604114	7367	5082623	7104	7114189
Tin (scrap)	tonne	41	15418	13	193	43	994
Tin & alloys: worked	tonne	1983	66750	292	65631	347	142890
Titanium alloys & scrap	tonne	809	1323628	1745	3069414	822	1135500
Tungsten alloys & scrap	kg	303988	711863	356156	702068	404654	848380
Zinc and alloys (incl. scrap)	tonne	94694	7977278	153920	13463420	112228	11302210
Zinc & alloys	tonne	80129	7018812	126684	11698545	82411	8635693
Zinc (scrap)	tonne	14565	958466	27236	1764875	29817	2666517
Zirconium & scrap	tonne	12	34709	10	16979	12	24349

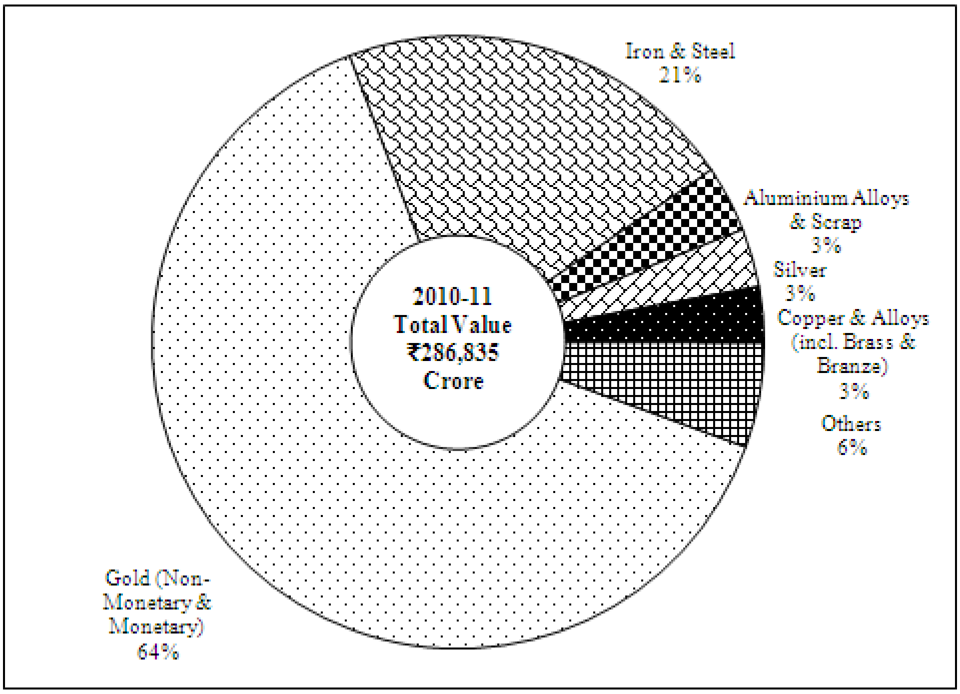
***Source**: DGCI&S, Kolkata.*

Table – 12 : Value of Imports of Metals & Alloys, 2008-09 to 2010-11 (By Principal Metals & Alloys)

Metal/Alloy	2008-09		2009-10		2010-11 (P)		% increase (+) or decrease (-) in 2010-11 over 2009-10
	Value in (₹ '000)	% share in total value	Value in (₹ '000)	% share in total value	Value in (₹ '000)	% share in total value	
All Metals & Alloys	**1994888257**	**100**	**2144246493**	**100**	**2868348244**	**100**	**33.77**
Gold (Non-monetary & monetary): Total	953238640	47.78	1358831868	63.37	1847287525	64.4	35.95
Iron & steel	603114119	30.23	511365616	23.85	616497590	21.49	20.56
Aluminium and alloys incl. scrap	68722275	3.44	72160299	3.37	101220027	3.53	40.27
Silver	94684290	4.75	45636507	2.13	89531561	3.12	96.18
Copper & alloys (incl. brass & bronze)	55434757	2.78	55366184	2.58	85717042	2.99	54.82
Nickel and alloys incl. scrap	19453631	0.98	19473718	0.91	32130836	1.12	65
Lead and alloys incl. scrap	18878086	0.95	21984498	1.03	27568237	0.96	25.4
Ferro-alloys	18147906	0.91	18630802	0.87	25230287	0.88	35.42
Zinc and alloys incl. scrap	7977278	0.4	13463420	0.63	11302210	0.39	-16.05
Platinum alloys & related metals	136803700	6.86	7893762	0.37	8451719	0.29	7.07
Tin and alloys incl. scrap	4686282	0.23	5148447	0.24	7258073	0.25	40.98
Silicon	2140234	0.11	2186037	0.1	3523172	0.12	61.17
Pig & cast iron (incl. speigeleisen)	1780758	0.09	1700708	0.08	2316267	0.08	36.19
Manganese & alloys (incl waste & scrap)	1191814	0.06	1351356	0.06	2028316	0.07	50.09
Cobalt & alloys (incl waste and scrap)	1766544	0.09	1158986	0.05	1574437	0.05	35.85
Magnesium & scrap	1640852	0.08	1333187	0.06	1566701	0.05	17.52
Titanium & alloys (incl. waste & scrap)	1323628	0.07	3069414	0.14	1135500	0.04	-63.01
Molybdenum & scrap	1284932	0.06	664803	0.03	932478	0.03	40.26
Tungsten and alloys incl. scrap	711863	0.04	702068	0.03	848380	0.03	20.84
Selenium	435275	0.02	434583	0.02	699503	0.02	60.96
Chromium & alloys	280271	0.01	258723	0.01	404055	0.01	56.17
Antimony alloys and scrap	245595	0.01	231371	0.01	256726	0.01	10.96
Mercury	90531	0	196831	0.01	243129	0.01	23.52
Other rare metals, NES	291561	0.01	115227	0.01	164666	0.01	42.91
Precious metals/ metals clad with precious metals	203108	0.01	317483	0.01	124220	0	-60.87
Other metals & alloys	360327	0.03	570595	0.03	335587	0.05	-41.19

Source: *DGCI&S, Kolkata.*

Value of Imports of Metals & Alloys, 2009-10 and 2010-11



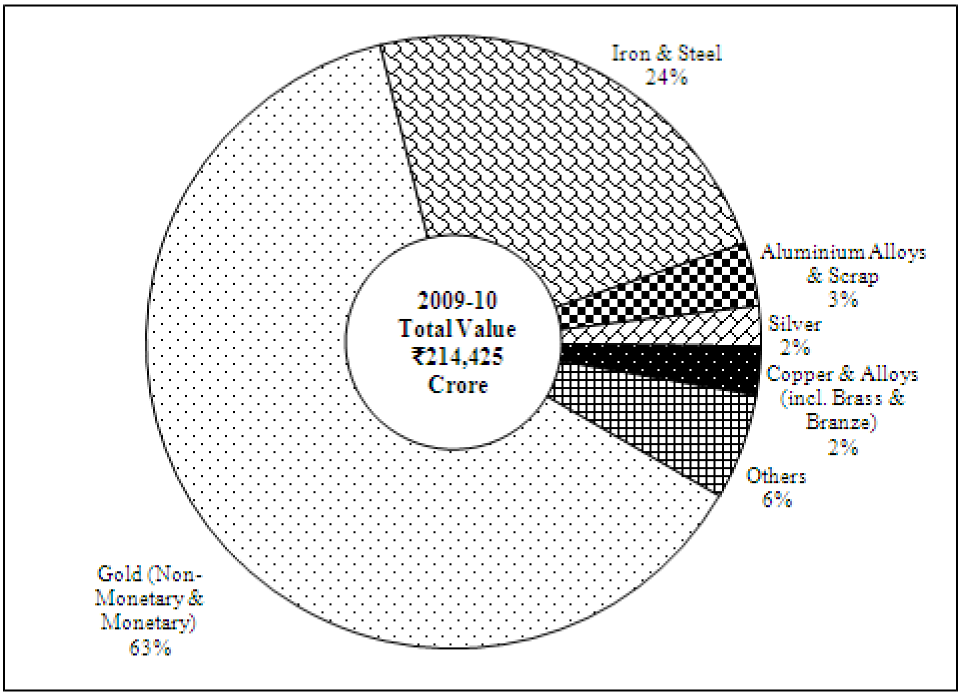


Table – 13 : Value of Imports of Metals & Alloys , 2008-09 to 2010-11 (By Principal Countries)

Country	2008-09 Value in (₹ '000)	2008-09 % share in total value	2009-10 Value in (₹ '000)	2009-10 % share in total value	2010-11 (P) Value in (₹ '000)	2010-11 (P) % share in total value	% increase (+) or decrease (-) in 2010-11 over 2009-10
All Countries	**1994888257**	**100**	**2144246493**	**100**	**2868348244**	**100**	**33.77**
Switzerland	443431635	22.23	610254224	28.46	1035064968	36.09	69.61
UAE	325947779	16.34	295988955	13.8	391933121	13.66	32.41
South Africa	139624483	7	171767648	8.01	218567066	7.62	27.25
China	160145756	8.03	98821827	4.61	195363686	6.81	97.69
Australia	206224142	10.34	291199793	13.58	160306464	5.59	-44.95
USA	69338965	3.48	75737309	3.53	95071736	3.31	25.53
Korea, Rep. of	81938036	4.11	71224250	3.32	87418595	3.05	22.74
UK	87690450	4.4	56543445	2.64	67807704	2.36	19.92
Japan	47177447	2.36	48426243	2.26	67358559	2.35	39.1
Germany	49482161	2.48	46575881	2.17	54193926	1.89	16.36
Russia	49343552	2.47	38079359	1.78	49545777	1.73	30.11
Chinese Taipei/Taiwan	9891213	0.5	15921157	0.74	33929487	1.18	113.11
Hong Kong	14286619	0.72	23185818	1.08	30256533	1.05	30.5
Malaysia	23786434	1.19	13432976	0.63	30017617	1.05	123.46
Ukraine	16653242	0.83	23898991	1.11	20270501	0.71	-15.18
Italy	20192116	1.01	23709154	1.11	19776884	0.69	-16.59
Netherlands	9568083	0.48	12009684	0.56	18942157	0.66	57.72
Thailand	19786486	0.99	11599216	0.54	18212751	0.63	57.02
Belgium	18666611	0.94	15559467	0.73	16742088	0.58	7.6
France	20097464	1.01	23094274	1.08	15659971	0.55	-32.19
Saudi Arabia	8541029	0.43	8533714	0.4	14744574	0.51	72.78
Singapore	11903043	0.6	8812849	0.41	14486974	0.51	64.38
Indonesia	4484167	0.22	5406217	0.25	14079354	0.49	160.43
Brazil	3532942	0.18	15321252	0.71	13193149	0.46	-13.89
Sweden	10625088	0.53	9805676	0.46	12090025	0.42	23.3
Spain	6365960	0.32	8287590	0.39	10545747	0.37	27.25
Finland	5090729	0.26	5521904	0.26	8413482	0.29	52.37
Canada	9207941	0.46	10160109	0.47	7965656	0.28	-21.6
Bhutan	4270065	0.21	5539292	0.26	7664693	0.27	38.37
Baharain	4288788	0.21	5998347	0.28	7330041	0.26	22.2
Austria	5465443	0.27	3339201	0.16	6462928	0.23	93.55
Turkey	8482112	0.43	9054560	0.42	6291147	0.22	-30.52
Nepal	6094757	0.31	5556392	0.26	6102666	0.21	9.83
Norway	3955699	0.2	4133451	0.19	5652390	0.2	36.75
Unspecified	4379673	0.22	4097572	0.19	17641066	0.62	330.52
Other Countries	84928147	4.26	67648696	3.15	89244761	3.11	31.92

Source: *DGCI&S, Kolkata*

The country-wise details of some of the commodities are not available from the source agency. The figures in respect of such commodities have been grouped under country item "unspecified".

Table – 14 : Import of Selected Mineral Based-Products 2008-09 to 2010-11

(Value in ₹ '000)

Mineral-based-product	Unit	2008-09		2009-10		2010-11(P)	
		Quantity	Value	Quantity	Value	Quantity	Value
All Items			**895052186**		**564593924**		**737970076**
Aluminium fluoride	tonne	23248	1424052	24140	1062421	13988	659655
Asbestos cement products	tonne	493	35651	2653	75254	5561	111165
Bleaching powder	tonne	-	-	42	1911	72	3156
Boric acid	tonne	10108	309126	7786	282304	9407	314416
Briquettes of coke, semi-coke of coal	tonne	42	1482	23	581	100	685
Calcium carbide	tonne	70861	2526028	51598	1665734	56479	1904603
Caustic soda	tonne	152446	2713648	311417	4376188	138480	2076410
Cement: Total	tonne	1025829	3451142	2111997	5683270	1095624	3526386
Cement (portland grey)	tonne	792429	2752299	726409	2222213	780180	2366507
Cement (portland white)	tonne	6860	38752	19371	77218	7910	50230
Cement (clinkers)	tonne	170602	323491	1257105	2799931	184033	420351
Cement (others)	tonne	55938	336600	109112	583908	123501	689298
Cryolite (artificial)	tonne	14331	326041	21330	336149	8176	146530
Fire bricks/Refractory bricks	tonne	778781	10309931	293578	8993946	366310	10726152
Graphite (artificial)	tonne	32281	2080876	13422	1324733	15903	1548569
Graphite bricks & shapes	tonne	594	20649	50	1509	215	12535
Graphite crucibles	tonne	6072	160680	3267	118418	5743	142945
Hydrofluoric acid	tonne	716	47260	2692	132679	1240	84867
Manganese oxide: Total	tonne	6449	499483	7154	637750	8963	623869
Manganese oxides (other than manganese dioxide)	tonne	1069	124001	1213	148747	1709	150331
Manganese dioxide.	tonne	5380	375482	5941	489003	7254	473538
Petroleum Products: Total	000 t	18524	608460000	14662	337540000	17364	558120000
Light distillates	000 t	8002	276240000	5194	151600000	8500	300650000
Naptha	000 t	5023	174100000	1734	49420000	2063	68530000
Other distillates	000 t	2979	102140000	3460	102180000	6437	232120000
Middle distillates	000 t	4201	162860000	3519	93260000	3364	118850000
Heavy ends	000 t	6321	169360000	5949	92680000	5500	138620000
Phosphoric acid	tonne	1643108	112249680	2692899	67332518	2008376	63786633
Phosphorus (elemental)	tonne	13842	4296459	15911	1987340	19949	2685267
Phosphatic fertilizers	tonne	165161	5735811	72805	1083798	82582	1553711
Potash fertilizer	tonne	5062896	131474703	5188833	120184457	4617512	77338258
Potassium nitrate	tonne	1476	78868	530	43787	466	22620
Silicon carbide crucibles	tonne	2607	180490	1150	48859	1262	45109
Soda ash	tonne	358555	4120215	555956	5628282	489955	4957343
Sodium nitrate	tonne	5832	119584	4060	90371	2483	52216
Sodium nitrite	tonne	10602	305715	14290	335598	12915	334565
Sulphur (sublimed, precipitated & colloidal): Total	tonne	1202	114502	2369	221905	5468	453101
Sulphur (colloidal)	tonne	7	971	17	386	32	2389
Sulphur (precipitated)	tonne	777	76999	1529	130614	4327	360751
Sulphur (sublimed)	tonne	418	36532	823	90905	1109	89961
Titanium oxide & dioxide: Total	tonne	15707	1469923	15453	1691888	18694	2148503
Titanium oxide	tonne	1617	90476	279	35580	399	54739
Titanium dioxide	tonne	14090	1379447	15174	1656308	18295	2093764
Other refractory manufactures	tonne	72574	1435321	37878	1310689	243722	1704100
Non-ferrous ash & residues	tonne	19354	1085031	59440	2372286	39937	2617672
Slag dros	tonne	327	19835	6497	29299	41040	269035

Source: *DGCI&S, Kolkata.*

Indian Minerals Yearbook 2011

(Part- I)

50th Edition

(ADVANCE RELEASE)

STATE REVIEWS
(Andhra Pradesh)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 001

PHONE/FAX NO. +91712 - 2565471
PBX : +91712 - 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

ANDHRA PRADESH

Mineral Resources

Andhra Pradesh is the sole holder of country's resources of shale & slate and is the leading producer of apatite, barytes, ball clay, dolomite, garnet, laterite, mica, limestone and vermiculite. The state is the sole producer of asbestos. The State accounts for 94% barytes, 78% kyanite, 70% corundum, 61% ball clay, 21% limestone, 41% mica and 33% garnet resources of the country. The State is endowed with the internationally known black, pink, blue and multicoloured varieties of granites. Krishna-Godavari basin areas of the State have emerged as new promising areas for hydrocarbons, especially natural gas.

Important minerals occurring in the State are **apatite** in Visakhapatnam district; **asbestos** in Cuddapah district; **ball clay** in West Godavari district; **barytes** in Anantapur, Cuddapah, Khammam, Krishna, Kurnool, Nellore and Prakasam districts; **calcite** in Anantapur, Cuddapah, Kurnool and Visakhapatnam districts; **china clay** in Adilabad, Anantapur, Chittoor, Cuddapah, East Godavari, West Godavari, Guntur, Kurnool, Mahbubnagar, Nalgonda, Nellore, Rangareddi, Visakhapatnam and Warangal districts; **coal** in Adilabad, East and West Godavari, Karimnagar, Khammam and Warangal districts; **corundum** in Anantapur and Khammam districts; **dolomite** in Anantapur, Khammam, Kurnool and Warangal districts; **felspar** in Anantapur, Cuddapah, West Godavari, Hyderabad, Khammam, Mahbubnagar, Medak, Nellore, Rangareddi and Vizianagaram districts; **fireclay** in Adilabad, Chittoor, Cuddapah, East Godavari, West Godavari, Kurnool, Nalgonda and Srikakulam districts; **garnet** in East Godavari, Khammam and Nellore districts; **granite** in Anantapur, Chittoor, Cuddapah, Guntur, Karimnagar, Khammam, Krishna, Mahbubnagar, Medak, Nalgonda, Nellore, Prakasam, Rangareddi; Srikakulam, Vizianagaram and Warangal districts; **iron ore (hematite)** in Anantapur, Cuddapah, Guntur, Khammam, Krishna, Kurnool and Nellore districts; **iron ore (magnetite)** in Adilabad, Prakasam and Warangal districts; **lead-zinc** in Cuddapah, Guntur and Prakasam districts; **limestone** in Adilabad, Anantapur, Cuddapah, East Godavari, West Godavari, Guntur, Hyderabad, Karimnagar, Krishna, Kurnool, Mahbubnagar, Nalgonda, Nellore, Rangareddi, Srikakulam, Visakhapatnam and Vizianagaram districts; **manganese ore** in Adilabad, Srikakulam and Vizianagaram districts; **mica** in Khammam and Nellore districts; **ochre** in Cuddapah, West Godavari, Guntur, Kurnool and Visakhapatnam districts; **pyrophyllite** in Anantapur district; **quartz/ silica sand** in Anantapur, Chittoor, Cuddapah, West Godavari, Guntur, Hyderabad, Khammam, Krishna, Kurnool, Mahbubnagar, Medak, Nalgonda, Nellore, Prakasam, Rangareddi, Srikakulam, Visakhapatnam, Vizianagaram and Warangal districts; **quartzite** in Kurnool, Srikakulam, Visakhapatnam and Vizianagaram districts; **talc/soapstone/steatite** in Anantapur, Chittoor, Cuddapah, Khammam and Kurnool districts and **vermiculite** in Nellore and Visakhapatnam districts. **Petroleum & natural gas** deposits of importance are located in the onshore and offshore areas of Krishna-Godavari basin of the State.

Other minerals that occur in the State are **bauxite** in East Godavari and Visakhapatnam districts; **chromite** in Khammam and Krishna districts; **copper** in Guntur, Khammam, Kurnool and Prakasam districts; **diamond** in Anantapur, Krishna and Kurnool districts; **fuller's earth** in Medak and Rangareddi districts; **gold** in Anantapur, Chittoor and Kurnool districts; **graphite** in East Godavari, West Godavari, Khammam, Srikakulam, Visakhapatnam and Vizianagaram districts; **gypsum** in Guntur, Nellore and Prakasam districts; **kyanite** in Khammam, Nellore and Prakasam districts; **magnesite** in Cuddapah district; **marble** in Khammam district; **pyrite** in Kurnool district; **sillimanite** in West Godavari district; **silver** in Guntur district; **titanium minerals** in East Godavari, Krishna, Nellore, Srikakulam and Visakhapatnam districts; and **tungsten** in East Godavari district (Tables - 1 and 2).

Exploration & Development

The details of exploration activities conducted by various agencies for coal and other minerals during 2010-11 are furnished in Table - 3.

ONGC continued its seismic survey and drilling for exploration of petroleum & natural gas in KG onland basin. In 2010-11, two new oil and three gas prospects were discovered in East Godavari, West Godavari & Krishna districts. Details of exploration activities are furnished in Table - 4.

Table –1: Reserves/Resources of Minerals as on 1.4.2010 : Andhra Pradesh

Mineral	Unit	Reserves				Remaining resources								Total resources (A+B)
		Proved STD 111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
			STD121	STD122			STD221	STD222						
Apatite	tonne	36019	-	1680	37699	-	-	-	-	-	200163	-	200163	237862
Asbestos	tonne	5754	-	9028	14782	856	3117	9191	-	1500	27085	-	41749	56531
Ball clay	tonne	6017412	-	1288720	7306132	1821233	2806267	9512513	-	2279330	27555824	-	43975167	51281299
Barytes	tonne	29396236	79736	1845270	31321242	173429	4252061	2500159	105872	387394	29632557	105721	37157193	68478435
Bauxite	'000 tonnes	-	-	-	-	-	-	-	188971	138120	288176	-	615267	615267
Calcite	tonne	3267	500	-	3767	-	-	104970	8562700	5200	122148	-	8795018	8798785
China clay	'000 tonnes	2524	339	2205	5068	683	1490	1147	126	691	61883	3088	69108	74176
Chromite	'000 tonnes	-	-	-	-	-	-	-	-	15	172	-	187	187
Copper														
Ore	'000 tonnes	-	-	-	-	686	666	105	-	5791	1000	-	8248	8248
Metal	'000 tonnes	-	-	-	-	6.88	9.12	1.05	-	97.45	8.32	-	122.82	122.82
Corundum	tonne	-	-	-	-	5824	7	9282	-	-	62008	-	77121	77121
Diamond	carat	-	-	-	-	-	-	-	200483	1524317	98155	-	1822955	1822955
Dolomite	'000 tonnes	55507	2082	10708	68296	50324	2851	29135	554	132589	896855	1848	1114156	1182452
Felspar	tonne	5469094	408487	2301765	8179346	2504362	274566	2181547	60776	5476671	2975298	145995	13619215	21798561
Fireclay	'000 tonnes	548	647	381	1576	50	735	1314	56	908	18444	132	21638	23214
Fuller's earth	tonne	-	-	-	-	-	-	-	-	-	25523983	-	25523983	25523983
Garnet	tonne	2911387	4500	710000	3625887	9051	42033	-	-	8800000	6587776	-	15438860	19064747
Gold														
Ore (primary)	tonne	-	-	-	-	655133	-	889515	8059000	55000	2616699	-	12275347	12275347
Metal(primary)	tonne	-	-	-	-	2.45	-	3.57	16.93	0.17	12.60	-	35.72	35.72
Granite														
(Dim. stone)	'000 cu m	-	-	-	-	-	-	-	-	-	2405890	-	2405890	2405890
Graphite	tonne	-	-	-	-	-	-	1135	-	124759	301306	-	427199	427199
Gypsum	'000 tonnes	-	-	-	-	-	-	-	-	-	404	-	404	404
Iron ore														
(hematite)	'000 tonnes	60038	58011	34167	152217	551	20988	32475	377	4624	169955	291	229261	381478
Iron ore														
(magnetite)	'000 tonnes	-	-	-	-	43034	-	-	13800	1266666	140027	14	1463541	1463541
Kyanite	tonne	-	-	-	-	-	-	399	-	-	80353829	-	80354228	80354228
Laterite	'000 tonnes	4349	2172	6942	13463	1830	60	2625	-	1107	6895	277	12794	26257
Lead-zinc														
Ore	'000 tonnes	-	-	-	-	-	-	-	1000	4159	17530	-	22689	22689
Lead metal	'000 tonnes	-	-	-	-	-	-	-	28.70	119.53	688.65	-	836,88	836.88
Zinc metal	'000 tonnes	-	-	-	-	-	-	-	12.40	43.57	7.19	-	63.16	63.16

(Contd.)

Table - 1 (concld.)

Mineral	Unit	Reserves: Proved STD 111	Reserves: Probable STD121	Reserves: Probable STD122	Reserves: Total (A)	Remaining resources: Feasibility STD211	Remaining resources: Pre-feasibility STD221	Remaining resources: Pre-feasibility STD222	Remaining resources: Measured STD331	Remaining resources: Indicated STD332	Remaining resources: Inferred STD333	Remaining resources: Reconnaissance STD334	Remaining resources: Total (B)	Total resources (A+B)
Limestone	'000 tonnes	2483095	581935	983048	4048078	311682	64645	460685	215847	1075504	28112011	3147926	33388299	37436377
Magnesite	'000 tonnes	-	-	-	-	-	-	-	-	-	80	-	80	80
Manganese ore	'000 tonnes	1719	596	1841	4155	412	130	251	188	4176	7877	410	13443	17598
Marble	'000 tonnes	-	-	-	-	-	-	-	-	-	3	-	3	3
Mica	tonnes	162325	15247	2790	180362	7794	5101	-	3750	5502	18277	-	40424	220786
Ochre	tonne	1692839	344121	631277	2668237	-	97810	1199762	347681	-	6569575	-	8214828	10883065
Pyrite	'000 tonnes	-	-	-	-	-	-	-	-	-	880	-	880	880
Pyrophyllite	tonne	245019	41841	171143	458003	121475	33360	-	-	75201	662193	-	892229	1350232
Quartz-silica sand	'000 tonnes	33590	3320	35772	72682	16664	6242	25109	5404	10965	65867	6099	136349	209031
Quartzite	'000 tonnes	2114	406	2131	4651	548	1009	7481	-	4390	5209	295	18931	23583
Sillimanite	tonne	518000	-	170000	688000	-	-	-	-	7430300	1526200	-	8956500	9644500
Shale	'000 tonnes	14992	76	263	15331	-	-	245	-	-	252	83	580	15911
Slate	'000 tonnes	-	-	-	-	-	113	1187	-	-	1069	-	2369	2369
Silver														
Ore	tonne	-	-	-	-	-	-	-	-	-	16950000	-	16950000	16950000
Metal	tonne	-	-	-	-	-	-	-	-	-	128.13	-	128.13	128.13
Talc/soapstone steatite	'000 tonnes	1031	1044	3060	5135	71	168	1187	-	369	3777	537	6109	11243
Titanium minerals	tonne	-	-	-	-	-	-	-	-	-	76702509	-	76702509	76702509
Tungsten														
Ore	tonne	-	-	-	-	-	-	-	3640000	4700800	5952500	509000	14802300	14802300
Contained WO_3	tonne	-	-	-	-	-	-	-	5096.00	6574.64	8273.65	318.28	20262.57	20262.57
Vermiculite	tonne	102058	24593	50939	177590	1912	3981	2750	35195	9878	119270	3600	176586	354176

Figures rounded off.
** Resources of ilmenite, rutile, leucoxene and zircon as per Department of Atomic Energy are provided in the respective Mineral Reviews.*

The proved and indicated balance recoverable reserves of crude oil and natural gas as on 1.4.2011 in the State are 5.23 million tonnes and 40.58 billion cu m, respectively.

Table – 2: Reserves/Resources of Coal as on 1.4.2011 : Andhra Pradesh

(In million tonnes)

Coalfield	Proved	Indicated	Inferred	Total
Total/Godavari Valley	9256.51	9730.37	3029.36	22016.24

Source: *Coal Directory of India, 2010-11.*

Table – 3: Details of Exploration Activities in Andhra Pradesh, 2010-11

Agency/ Mineral/ District	Location/ Area/ Block	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
GSI **Chromite** Krishna & Khammam	Kondapalli & Gangineni	-	-	-	-	24	Reconnaissance stage investigation (G-4) was taken up during FS 2010-12 in Eastern Ghat Supergroup ricts to assess the potential of the area for chromite mineralisation. The rock types encountered in and surrounding areas are pyroxene granulite and charnockite with enclaves of pyroxenite. The general trend of the foliation is NW-SE with moderate to steep southwesterly dip. In the area to the north of Village Koduru , a mappable pyroxinite body, which is about 28 m in length.and 17 m in width, is recorded that showed chromite mineralisation. The chromite mineralisation is confined to ultramafic rocks . In Kondapalli area the chromite occurred as lenses, bands, pockets and disseminations within steeply dipping and pitching lenticular bodies of pyroxenite. Insitu chromite mineralisation was recorded in all old chromite opencast quarries present in the area. The chromite ore is massive in character, black in color with sub metallic to metallic luster. It showed granular texture with high specific gravity. At places, stringers of chromite with 5 cm in length and 1cm in width are also observed within charnockite unit. The petrographic studies indicate that the chromite occurred in the form of disseminations in association with sulphides in pyroxenites. The analyses of rock samples collected from old workings, 30 m to 75 m length × 0.5 m to 2.5 m width in dimensions around Village Kondapalli, indicated Cr_2O_3 value ranging from 20.82% to 43.04%. The work is in progress.

(Contd.)

Table -3 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
GSI **Coal** **Godavari valley coal field** Khammam & West Godavari	Vutasamudram-Venkatapuram	-	-	02	-	-	Reconaissance stage (G-4) exploration was taken up during FS 2010-12 , to explore and evaluate coal potentiality of Barakar and Lower Kamthi Formations already established in northern adjoining Naraynapuram-Pattayagudem and Sitanagaram areas and to decipher the structural and stratigraphic set up of the area. The boreholes intersected Upper Kamthi Formation comprising of yellowish brown to grey colour, ferruginous, coarse grained to pebbly sandstone, friable, at places massive, feldspathic, micaceous cross-bedded, at places garnetiferous, with few lilac colour clay galls. The work is in progress.
- do - Khammam	Bugga-Khammamtogu	-	-	-	-	-	Prospecting stage (G-3) regional exploration was taken up during FS 2010-12 in in this area, Southern Part of main basin of Godavari Valley Coalfield to explore and evaluate coal resource potentiality of Barakar coal seams already established in the adjoining Manuguru Mining Block located to the northeast. The borehole drilled so far intersected lithounits belonging to Barakar Formation and Talchir Formation. Two regional interbanded coal-carbonaceous shale zones with cumulative thickness of 2.30 m and 7.31 m were recorded at very shallow depth between 23.40 m and 39.41 m. Three local seams of 0.70 m to 0.76 m thickness between 97.64 m and 103.00 m depths have been identified. The work is in progress.
Coal West Godavari and Khammam	Narayanapuram-Pattayyagudem	-	-	-	-	-	Spill over work of exploration for coal has been carried out **by** scout drilling in this area, southern sub basin of Godavari coal field to explore and evaluate the coal potentiality of Lower

(Contd.)

Table-3 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
West Godavari and Khammam (Contd.)	Narayanapuram-Pattayyagudem	-	-	02	-	-	Gondwana already established in adjoining Sattupalli and Siddavaram-Alipalli areas and to decipher the structural and stratigraphic set up of the area. During the period, drilling was continued in two boreholes, viz. (325.25 m to 620.50 m) and 313.75 m to 647.50 m). In borehole-7, only uppermost coal/carbonaceous shale zone, namely Czone of Lower member of Kamthi Formation was intersected at 557.55 m depth. The cumulative coal content is about 4.98 m in 10 splits (ranging from 0.30 m to 1.00 m). Borehole - 8 intersected Lower Kamthi Formation (Coal / carbonaceous shale zone- C of 40 m thick and zone-B 26.55 m thick) and Seam zone –A of Barakar Formation (72.60 m thick) having cumulative coal thickness of 25.50 m in 6 split sections between 414 m and 641.40 m depth. The investigation was completed .
GSI **Diamond** Mahaboobnagar, Nalgonda and Rangareddy	Amangal and Bhimanapali	1:50,000	550.0	-	-	112	Reconnaissance stage investigation (G-4) was taken up during FS 2010-12 in granite-greenstone terrain in this block to search for kimberlite rock, the host rock for diamond. The work was taken up through REC mapping sampling and laboratories studies. This area is a part of the Eastern Dharwar Craton known for emplacements of several kimberlite pipes and formed the catchment for the ancient alluvial diamond workings of the River Krishna and therefore is a suitable target area for indicator mineral surveys. Around 80-100 kg of stream sediment samples were collected from suitable trap sites from 4th and 5th order streams for regional, and for detailed sampling. . The samples were processed in a Garytz jig and the heavies were examined under stereomicroscope for kimberlite indicator minerals. Further work is in progress.

(Contd.)

Table -3 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks
		Scale	Area (sq km)	No. of boreholes	Meterage		Reserves/Resources estimated
GSI **Fullerene** Cuddapah	Cuddapah Basin	-	-	-	-	-	Reconnaissance stage (G-4) investigation was taken up during FS 2010-12 to search for possible occurrence of fullerene within carbonaceous tuff of Magampet barite prospects . Mapping and sampling of the carbonaceous tuff/ shale has been carried out and sent for chemical analysis. Analytical results so far received have not indicated any significant values for fullerene. The work is in progress.
Gold Mahaboobnagar and Kurnool	West of Remeta	1:12500	68.0	-	-	-	Reconnaissance stage (G-4) (G-4) was taken up during FS 2010-12 in Gadwal Schist Belt for gold and other associated elements in this area. Prominent quartz reef of 10 m to 40 m width extending for about 300 m trending along NW-SE direction without any sulfide mineralisation has been traced in the area east of Village Sanjivapuram within metabasalt. Pegmatite veins east and south of Sanjivapuram and Mittasomapuram areas have been mapped and bedrock samples have been collected and submitted to chemical division for REE analysis; the results are awaited. Bedrock and stream sediment samples have been collected mainly around Mittasomapuram, Peta, Sanjiva-puram areas. The analytical results, so far received, do not show any encouraging gold values. The work is in progress.
Cuddapah	Tellakonda	1:1200	13	-	-	-	Prospecting stage investigation (G-3) was taken up during FS 2010-12 within Veligallu Greenstone belt, for gold on the basis of encouraging results of earlier large scale mapping and geochemical studies. One major quartz reef is emplaced along the NE-SW trending shear zone. The quartz reef is

(Contd.)

Table - 3 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
Cuddapah (Contd.)	Tellakonda	1:1200	13	-	-	-	sheared and brecciated and contains sulphide mineralisation and this quartz reef extends farther southwards for 1km into Veligallu South Block. Five numbers of trenches have been made on the NE –SW trending quartz reef. Analytical results of the three trenches were received. Two samples of trench indicated 295 ppb and 45 ppb Au. One bedrock sample of the quartz reef near the canal indicated 65ppb Au. A few bedrock samples from ultramafic rock in Veligallu South Block indicated 205 ppm to 92 ppm Ni. Sulphide mineralisation is noticed in a metagabbro body of 60 m to 80 m wide having strike length of 100 m. EPMA studies of the samples indicated presence of Ag. The first borehole was drilled to intersect the mineralised zone exposed in trench TLT-2 at 60 m vertical depth where the samples have indicated gold value of 0.78 g/t x 5 m and 0.298g/t x 2 m. The borehole intersected mineralized zone having mainly pyrite, pyrhotite & arsenopyrite occurring in the form of veinlets & stringers within hornblende-biotite schist.
Limestone Kurnool	West of Nandikotkur	1:12,000	107.0	-	-	280	Reconnaissance stage investigation (G-4) initiated during 2009-10 was continued for limestone. 20 cu. m. of trenching, bed rock and trench samples have been collected. The analytical results of eleven samples of Narji limestone showed CaO content more than 43% which is ideal for cement industry. Two samples showed more than 50% of CaO which can be used in chemical industry. Two samples showed very less CaO% (Koilakuntla limestone). Detailed classification and resource evaluation of limestone will be carried out after the receipt of complete chemical analysis results. The work is in progress.

(Contd.)

Table - 3 (Concld.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks
		Scale	Area (sq km)	No. of boreholes	Meterage		Reserves/Resources estimated
MECL							
Coal							
Godavari Valley Coalfield	Tadikalaipudi	-	-	-	1264.10	-	Contractual drilling on behalf of NMDC was carried out.
-do-	Somavaram	-	-	-	6288.90	-	Contractual drilling on behalf of NMDC was carried out.
-do-	Dip side of Venkatapuram	-	-	-	4791.20	-	Contractual drilling on behalf of NMDC was carried out.
-do-	Jangareddygudam	-	-	-	2386.30	-	Contractual drilling on behalf of NMDC was carried out.

Table – 4: Exploration for Petroleum & Natural Gas in Andhra Pradesh during, 2010-11

Agency	Seismic Survey		Drilling			
			Exploratory		Development	
	2D(GLKM)	3D(SQKM)	Wells	Meterage	Wells	Meterage
ONGC	-	406	10	40260	13	23356
OIL	-	103	-	-	-	-

Production

The value of mineral production in Andhra Pradesh at ₹ 18,577 crore in 2010-11 was 3% higher as compared to that in the previous year. Almost all important minerals are produced in Andhra Pradesh. The principal minerals produced in the state were coal, iron ore, limestone, natural gas (utilised), petroleum (crude), barytes, manganese ore and dolomite which together accounted for 55% of total value of mineral production in the state during 2010-11. Coal alone contributed 44% and minor minerals accounted for about 45% of the total value of mineral production in the state.

Andhra Pradesh claims the third position among the states in the country with a contribution of 8% to the total value of the mineral production. It is the sole producer of asbestos in India and also contributes almost entire out put of barytes and mica (crude). In addition to this, it is also a leading producer of vermiculite, sand (others), apatite, laterite and quartz contributing 90%, 8 7%, 67%, 54% and 43% in the total production of respective minerals in the country. It is the second leading producer in the country and accounts for 43% for felspar , 37% each for silica sand and sillimanite and 27% for ball clay.

Among the important minerals produced in the state, the output of quartzite and sillimanite increased manifold and that of vermiculite by 98%, ball clay 27%, garnet (abrasive) 22% and silica sand 18%. However, a decline in production was observed in kaolin 89%, iron ore 77%, clay (others) 68%, apatite 33%, dolomite 32%, steatite 23% and lime kankar 21% as compared to the out put of previous year (Table - 5).

The value of minor mineral production was estimated at ₹ 8,287 crore for the year 2010-11.

The number of reporting mines in the state was 427 in 2010-11 as compared to 456 in the previous year.

The index of mineral production in Andhra Pradesh (base 1993-94=100) was 215.80 in 2010-11 as against 215.63 in the previous year.

Table – 5 : Mineral Production in Andhra Pradesh, 2008-09 to 2010-11 (Excluding Atomic Minerals)

(Value in ₹ '000)

Mineral	Unit	2008-09 No. of mines	2008-09 Quantity	2008-09 Value	2009-10 No. of mines	2009-10 Quantity	2009-10 Value	2010-11 (P) No. of mines	2010-11 (P) Quantity	2010-11 (P) Value
All Minerals		**469**		**164979718**	**456**		**179548979**	**427**		**185773828**
Coal	'000t	50	44546	55682500	49	50429	67373100	50	51333	81106100
Natural gas (utilised)	m c m	-	1524	5617792	-	1479	5535078	-	1384	5179545
Petroleum(crude)	'000t	-	289	4604365	-	304	5485306	-	305	5503350
Iron ore	'000t	31	10112	15211659	35	6246	8101303	29	1435	422293
Manganese ore	t	38	184552	307092	35	260628	332916	36	282876	471780
Apatite	t	1	3902	8620	1	3882	9212	1	2585	5493
Asbestos	t	3	315	14521	3	243	12268	3	258	12887
Ball Clay	t	15	262342	35221	12	202796	26700	12	256986	33740
Barytes	t	8	1679896	963372	9	2146460	2599224	5	2327700	2648968
Clay (others)	t	9	150265	10863	10	237220	26240	6	74843	7692
Dolomite	t	13	1254886	277705	15	1577072	317824	14	1072132	276549
Felspar	t	17	309352	61164	16	214406	51429	19	204518	51148
Fireclay	t	9	40615	8699	7	24540	5516	8	22166	4383
Garnet (abrasive)	t	2	74988	7981	3	124756	48255	2	152013	174906
Kaolin	t	10	47678	4730	10	108395	9937	8	11772	1629
Sillimanite	t				-	2025	12454	-	17848	137711
Laterite	t	6	528692	52571	7	596318	60449	8	630702	63144
Limestone	'000t	92	51818	6386659	84	49560	6419110	79	51750	6526323
Lime Kankar	t	2	1598	439	2	780	254	1	615	196
Limeshell	t	2	1355	437	-	-	-	-	-	-
Mica (crude)	t	31	1436	42468	29	1057	39817	28	1277	43586
Mica (waste & Scrap)*	t	-	4297	-	-	4394	-	-	4616	-
Ochre	t	4	25227	2741	3	34093	4690	3	35219	4839
Pyrophyllite	t	1	32	5	1	26	4	-	-	-
Quartz	t	27	139837	22138	26	182040	29642	31	197653	31873
Quartzite	t	2	595	89	2	122	18	4	7717	4309
Silica sand	t	43	1251780	61684	50	958934	64205	42	1132270	61541
Sand (others)	t	13	1338315	55406	10	1763495	75083	10	1673137	90600
Shale	t	3	195676	10062	3	130425	7092	2	111030	5659
Slate	t	1	11	22	-	-	-	-	-	-
Steatite	t	33	82439	23503	30	77064	24389	22	59336	20868
Vermiculite	t	3	10726	4275	4	10060	4095	4	19887	9347
Minor Minerals@		-	-	75500935	-	-	82873369	-	-	82873369

Note : *The number of mines excludes petroleum (crude), natural gas (utilised) and minor minerals.*
******* *Includes mine waste obtained while dressing of crude mica.*
@ *Figures for earlier years have been repeated as estimates, wherever necessary, because of non-receipt of data.*

Mineral-based Industry

The principal large and medium-scale mineral-based industries in the organised sector in the State are given in Table - 6.

Table – 6 : Principal Mineral-based Industries in Andhra Pradesh

Industry/plant	Capacity ('000 tpy)
Abrasives	
Grindwell Norton Ltd, Renigunta, Dist. Chittoor	5
Aluminium Foil	
Indal, Kollur	3
Asbestos Products	
Bhagyanagar Wood Plast Ltd, Nandikandi, Dist. Medak	60
Hyderabad Industries Ltd, Sanathnagar, Dist. Rangareddi	160
Hyderabad Industries Ltd, Thimmapur	230
Hyderabad Industries Ltd, Ibrahimpatnam, Dist. Krishna	45
J.J. Spun Pipe Industries, Arsapalli, Dist. Nizamabad	4.5
Ramco Industries, Jaggaiapet, Dist. Krishna	225
Visaka Industries Ltd, Medak	12.3
Bleaching Clay	
Ashapura Clay Tech. Ltd, Dharur, Dist. Rangareddi	20 (Fuller's earth granules) 15 (Bentonite granules)
Cement	
ACC Ltd, Mancherial, Dist. Adilabad	325
Andhra Cements Ltd, Gandhi Nagar, Vijayawada (G)	240
Andhra Cements Ltd (Visaka Cement Works), Durga Nagar, Dist. Visakhapatnam (G)	1120
Andhra Cements Ltd : Durga Cement Works, Dachepalli, Dist. Guntur	800
Anjani Portland Cements Ltd, Anjanipuram, Dist. Nalgonda	297
Bhagya Lakshmi Cement Ltd, Vajinapalli, Dist. Nalgonda	99
CCI Ltd, Adilabad, Dist. Adilabad	400
CCI Ltd, Tandur, Dist. Rangareddi	1000

(Contd.)

Table - 6 (Contd.)

Industry/plant	Capacity ('000 tpy)
Chanakya Cements Ltd, Wadapalli, Dist. Nalgonda	400
Dalmia Cement (Bharat) Ltd , Cuddapah	2660
Deccan Cements Ltd, Bhavanipuram, Dist. Nalgonda	797
Grey Gold Cements Ltd, Mattampally, Dist. Nalgonda	50
Hemadri Cements Ltd, Vedadri, Dist. Krishna	181
Kesoram Cement, Basantnagar, Dist. Karimnagar	1500
Koramandal Cements Ltd, Ramapuram, Dist. Nalgonda	66
Kakatiya Cement and Sugar Industries Ltd, Dondapadu, Dist. Nalgonda	302
Keerthi Industries Ltd, Mellacheruvu, Dist. Nalgonda	297
Lanco Industries Ltd, Chittoor	80
Madras Cements Ltd, Jayantipuram, Dist. Krishna	2800
Maata Cements Ltd, Dopperla, Dist. Visakhapatnam	99
Mancherial Cement Co. (P) Ltd, Mancherial, Dist. Adilabad	335
My Home Cement Industries Ltd, Mellacherur, Dist. Nalgonda	3200
Nagarjuna Construction Co. Ltd, Rachorla, Dist. Kurnool	198
Orient Cement, Devapur, Dist. Adilabad	2400
Panyam Cements & Mineral Industries Ltd, Cement Nagar, Dist. Kurnool	531
Penna Cement Industries Ltd, Talaricheruvu, Dist. Anantapur	1500
Penna Cement Industries Ltd, Boyareddy Palli, Dist. Anantapur	2000
Penna Cement Industries Ltd, Ganeshpahad, Dist. Nalgonda	1000
Rain Commodities Ltd (Priyadarshini Cements), Ramapuram, Dist. Nalgonda	1000
Sagar Cements Ltd, Mallapally, Dist. Nalgonda	198

(Contd.)

Table - 6 (Contd.)

Industry/plant	Capacity ('000 tpy)
Shri Chakra Cements Ltd, Guntur	698
Shez Cements Ltd, Chintalapalem, Dist. Nalgonda	200
The India Cements Ltd, Chilamkur, Dist. Cuddapah	1550
The India Cements Ltd, Malkapur, Dist. Rangareddi	2100
The India Cements Ltd, Yeraguntla 35002856 Raasi Cements), Wadapally, Dist. Nalgonda	520
The KCP Ltd., Macherla, Dist. Guntur	660
Toshali Cement Ltd, Visakhapatnam	132
Ultra-Tech Cements Ltd, Tadipatri, Dist. Anantapur	5600
Visaka Cement Industries Ltd, Malkapur, Dist. Rangareddi	1120
Zuari Cements Ltd (Sri Vishnu Cements Works), Dondapadu, Dist. Nalgonda	1679
Zuari Cement, Krishnanagar, Dist. Cuddapah	2079
Chemical	
A.P. Carbides Ltd, Kurnool	23 (calcium carbide)
Andhra Sugars Ltd, Saggonda, Dist. West Godavari	132 (caustic soda) 99 (H_2SO_4)
Shree Rayalseema Alkalies & Allied Chem. Ltd, Gondiparla, Dist. Kurnool	69.5 (caustic soda) 49.8 (Cl) 24.7 (HCl) 23.1 (KOH)
Shree Rayalseema High Strength Hypo Ltd, Gondiparla, Dist. Kurnool	9 (bleaching powder) 45 (H_2SO_4) 15 (Oleum)
Ceramic	
Hindustan Sanitaryware & Industries Ltd, Bibinagar, Dist. Nalgonda	18
Montana International Ltd, Faralwadi, Dist. Medak	3.6
RAK Ceramics India Pvt Ltd, Jaggammagaripeta, Dist. East Godavari	NA
Restile Ceramics Ltd, Mikapur	1.4 (mill. sq m)
Sentini Ceramics Pvt Ltd, Kanukollu, Dist. Krishna	75
Spartek Ceramics India Ltd, Narsingapuram, Dist. Chittoor	NA

(Contd.)

Table - 6 (Contd.)

Industry/plant	Capacity ('000 tpy)
Fertilizer	
Coramandal Fertilizer Ltd, Vizag	124.00 (N_2) 166.00 (P_2O_5)
Coromondal Fertilizers Ltd (Formerly Godavari Fertilizers & Chemicals Ltd), Kakinada, Dist. East Godavari	1000 (NPK)
Krishna Industrial Corpn. Ltd, Nidavolve, Dist. West Godavari	66.00 (SSP) 33.5 (H_2SO_4)
Nagarjuna Fertilizers & Chemicals Ltd, Kakinada, Dist. East Godavari	549.60 (N_2)
Subhodaya Chemicals, Govaripatnam, Dist. West Godavari	100 (SSP)
The Andhra Sugars Ltd, Kovvur, Dist. West Godavari	66 (SSP) 45 (H_2SO_4)
Pesticides	
Jayalakshmi Fertilizers, Tanuku, Dist. West Godavari	2.4
Glass	
Ceat Ltd, Thimmapur, Dist. Mahaboobnagar	10
Triveni Glass Ltd, Kondagudem, Dist. West Godavari	10 (mill. sq m)
Iron & Steel	
Visakhapatnam Steel Project, Visakhapatnam	5256 (sinter) 3400 (pig iron) 2656 (saleable steel) 3000 (crude/liquid steel) 42 (amm. sulphate)
Pig Iron	
Lanco Industries Ltd, Rachaguneri, Dist. Chittoor	165
Mid-west Iron & Steel Co Ltd, Dusi, Dist. Srikakulam	90
Sathavahana Ispat Ltd, Haresamudram, Dist. Anantapur	120
Pellets	
Essar Steel Ltd,Visakhapatnam	8000
Sponge Iron	
Ashirwad Steels & Ind. Ltd, Veliminedu, Dist. Nalgonda	60
Anand Metallics & Power Pvt. Ltd Kodi Cherla, Dist. Mahbubnagar	NA
Bright Star Iron & Steel Ltd,	NA

(Contd.)

Table - 6 (Contd.)

Industry/plant	Capacity ('000 tpy)
Mekaguda, Dist. Mahbubnagar	
Binjusaria Sponge & Power Pvt. Ltd, Farooq Nagar, Dist. Mahbubnagar	30
GSAL (India) Ltd, Sriramapuram, Dist. Vizianagaram	220
Kumar Metallurgical Corpn. Ltd, Nalgonda	60
Lakshmi Gayatri Iron & Steel, Kethepally Dist. Nalgonda	NA
Reactive Metals of India Ltd, Appajipally Dist. Mahbubnagar	100 (TPD)
Sunder Steels Ltd, S.D. Road, Secundarabad	24
Sponge Iron India Ltd, Paloncha, Dist. Khammam	60
Sree Rayalseema Green Steloy Ltd, Gooty, Dist. Anantapur	36
Sri Venkateshwara Sponge & Power Pvt Ltd, Merlapaka, Dist. Chittoor	90
Maa Mahamaya Industries Pvt Ltd, Relligaurammapeta, Dist. Vizianagaram	NA
Ferro-alloys	
Andhra Ferro Alloys Ltd, Kothavalasa, Dist. Vizianagaram	20
FACOR, Ltd, Shreeramnagar, Dist. Vizianagaram	72.5
GMR Technologies & Ind, Ltd, Ravivalasa, Dist. Srikakulam	25

(Contd.)

Table - 6 (Concld.)

Industry/plant	Capacity ('000 tpy)
Jindal Strips Ltd, Kothavalasa, Dist. Vizianagaram	40
Nav Bharat Ferro Alloys Ltd, Paloncha, Dist. Khammam	125
Shree Sarda Alloys Ltd, Ravivalasa	6
VBC Ferro Alloys Ltd, Rudraram, Dist. Medak	37
Refractory	
Carborandum Universal Ltd, Visakhapatnam	3.6
MPR Refractories Ltd, Medak	9.5
RHI Clasil Ltd, Venkatapuram, Visakhapatnam	50
Raasi Refractories, Narketapally, Dist. Nalgonda	35
Vesuvisindia Ltd, Visakhapatnam	24
Sea Water Magnesia	
Birla Periclase, Visakhapatnam	50
Indian Rayon & Industries Ltd, Visakhapatnam	NA
Lead-zinc	
HZL, Vizag Zinc Smelter, Visakhapatnam	56 (Zn)
Petroleum Refinery	
HPCL, Vizag	8300
ONGC, Tatipaka	70

Note: *As per All India Graphite Crucible Manufacturers Association, Rajahmundry, about 44 graphite crucible plants operate in the region in small and medium scale. However, information on installed capacity is not available.*

Indian Minerals Yearbook 2011

(Part- I)

50th Edition

(ADVANCE RELEASE)

STATE REVIEWS
(Arunachal Pradesh)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 001

PHONE/FAX NO. +91712 - 2565471
PBX : +91712 - 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

ARUNACHAL PRADESH

Mineral Resources

The important mineral resource of the State is **petroleum & natural gas** and its chief occurrence is reported in Ningru and Dam Duma areas. These hydrocarbon deposits are located in the Assam Arakan Fold Belt (AAFB) and Upper Assam basin in the State. The State also reports resources of **coal** in Namchick Namphuk Coalfields; **dolomite** in West Kameng district; **fuller's earth** in Tirap district; **graphite** in Lohit, Upper Siang and Upper Subansiri districts; **limestone** in Dibang Valley, Lohit, Upper Siang and Upper Subansiri districts and **quartzite** in West Kameng district (Tables - 1 and 2).

Table – 1 : Reserves/Resources of Minerals as on 1.4.2010 : Arunachal Pradesh

Mineral	Unit	Total Reserves (A)	Remaining resources				Total resources (A+B)
			Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
Dolomite	'000 tonnes	-	204	77633	-	77837	77837
Fuller's earth	tonne	-	10700	20000000	-	20010700	20010700
Graphite	tonne	-	-	-	72758257	72758257	72758257
Limestone	'000 tonnes	-	49220	433575	-	482795	482795
Quartzite	'000 tonnes	-	-	5270	-	5270	5270

Figures rounded off.
Resources of petroleum crude and natural gas in the State are included in Assam and are not available separately.

Table – 2 : Reserves/Resources of Coal as on 1.4.2011: Arunachal Pradesh

(In million tonnes)

Coalfield	Proved	Indicated	Inferred	Total
Total	**31.23**	**40.11**	**18.89**	**90.23**
Namchik	31.23	40.11	12.89	84.23
Miaobum	0.00	0.00	6.00	6.00

Source: *Coal Directory of India, 2010-11.*

Exploration & Development

Two wells with a metreage of 5,333 was drilled in the state by OIL. Particulars of exploration carried out by MECL in the State are furnished in Table - 3.

Table - 3: Details of Exploration Activities in Arunachal Pradesh, 2010-11

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks
		Scale	Area (sq km)	No. of boreholes	Metreage		Reserves/Resources estimated
MECL **Dolomite** West Kemang	West Kemang	1:5,000	1.0	04	266.50	147	Rupa dolomite is of BF/SMS grade belong to the Dublo-khomember of Rupa formations which showed variable strike & dip. Dolomite is grey, white & black in colour with quartzite intercalation. Strike length of the deposit is found to be 2 sq km. Borehole have intersected dolomite deposit at various vertical depth ranging from 79 m – 105 m. Available chemical analysis indicate MgO – 19.50% - 22.20%, CaO – 28.42 – 32.2% & SiO_2 – 0.36 – 6.64%.

Production

The value of mineral production in Arunachal Pradesh at ₹ 355 crore in 2010-11 decreased marginally by 1% as compared to the previous year. The value of the mineral production in the state during 2010-11 was pre-dominated by petroleum (crude) with a share of 59% followed by coal with 31% of the total value of the state (Table - 4).

The value of minor mineral production was estimated at ₹ 18 crore for the year 2010-11.

There was only 1 reporting mine of coal during the year.

The index of mineral production in Arunachal Pradesh (base 1993-94=100) was 236.54 in 2010-11 as against 267.13 in the previous year.

Table –4 : Mineral Production in Arunachal Pradesh, 2008-09 to 2010-11
(Excluding Atomic Minerals)

(Value in ₹ '000)

Mineral	Unit	2008-09			2009-10			2010-11 (P)		
		No. of mines	Quantity	Value	No. of mines	Quantity	Value	No. of mines	Quantity	Value
All Minerals		**1**		**2250056**	**1**		**3590280**	**1**		**3546293**
Coal	'000t	1	142	323800	1	251	894300	1	299	1106000
Natural Gas										
(utilised)	m c m	-	30	110586	-	40	149698	-	44	164668
Petroleum(crude)	'000t	-	102	1625070	-	131	2363734	-	116	2093077
Minor Minerals[@]		-	-	190600	-	-	182548	-	-	182548

Note : *The number of mines for petroleum (crude), natural gas (utilised) and minor minerals are not available.*
@ Figures for earlier years have been repeated as estimates because of non-receipt of data.

Indian Minerals Yearbook 2011

(Part- I)

50th Edition

(ADVANCE RELEASE)

STATE REVIEWS
(Assam)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 001

PHONE/FAX NO. +91712 - 2565471
PBX : +91712 - 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

ASSAM

Mineral Resources

Coal, petroleum & natural gas, limestone and minor minerals are the chief mineral resources of the State. **Coal** occurs in United Mikirs, North Cachar Hills, Sivasagar and Lakhimpur districts. Coal extracted from the State is friable and contains high sulphur. **Petroleum & natural gas** occurs in Digboi oilfields, Lakhimpur district and Moran and Rudrasagar oilfields in Sivasagar district located in Assam Arakan Fold Belt (AAFB), Upper Assam and Assam basins. **Limestone** occurs in Karbi Anglong, North Cachar Hills and Nagaon districts. Besides, **china clay** occurs in Karbi Anglong and Lakhimpur districts; **fireclay** in Dibrugarh, Karbi Anglong, North Cachar Hills and North Lakhimpur districts; **fuller's earth** in Nalbari district; **granite** in Goalpara, Kamrup and Karbi Anglong districts, **iron ore (hematite)** in Kokrajhar district; **iron ore (magnetite)** in Dhubri, Goalpara & Kokrajhar districts; **quartz/silica sand** in Nagaon district, and **sillimanite** in Karbi Anglong & Nagaon districts (Tables - 1 and 2).

Exploration & Development

GSI carried out exploration for coal in Sukchar-Singrimari block in Langrin coalfield (Table-3).

ONGC and OIL continued their seismic survey and drilling for exploration of petroleum & natural gas. A total of 41 wells with a metreage of 1,27,000 were drilled in the State by ONGC & a total of 31 wells with a meterage of 1,05,000 were also drilled by OIL.

Details of exploration activities conducted by OIL and ONGC for petroleum & natural gas during 2010-11 are furnished in Table - 4.

Significant discoveries of oil/gas struck by OIL in various districts of Assam during 2010-11 are given below.

The details of discovery of oil/gas made by OIL during 2010-11 in Assam are given below:

i) The well Jengoni-2, South of Makum North Hapjan area, Assam, encountered three gas bearing sands within Tipam formation and one oil bearing sand tested in Brail formation.

ii) The well Makum-33, Located in West Makum structure, encountered three possible hydrocarbons bearing sand within Brail, five hydrocarbon possible oil bearing sand within Lakadong Therria formation and one gas bearing sand tested in Langpar formation.

iii) The well Madhakali-1, lies on Madhakali structure. The well encountered one oil bearing sand, tested within Lakadong+Therria formation. The discovery of presence of commercial oil in this well has opened up a new area for exploration within Moran ML.

iv) The well Balimara-1, lies on Balimara structure, encountered four possible hydrocarbous bearing sand ranges within Kopili formation. The discovery of oil in this well has opened up new area for exploration within Dumduma ML.

v) The well Mahakali lies on Mahakali structure and is located about 2.5 km northwest of Kasomari-1 well. The well encountered a number of hydrocarbon (possibly oil) bearing sand ranges within Lakadong+ Therria formation. The discovery of oil in this well opened up new area of exploration within Hugrijan ML.

vi) The well NHK - 292, tested hydrocarbon within Girujan sand and produced gas. This discovery of gas by workover operation has opened up a new area for exploration within Hugrijan ML within Girujan reservior.

Production

The value of mineral production in 2010-11 in Assam at ₹ 9,971 crore decreased marginally as compared to that in the previous year. Assam claims eighth position which contributed 4% to the total value of mineral production in the country in 2010-11. petroleum (crude) was the principal mineral produced in the state, contributing 85% whereas the share of natural gas (utilized) was 10% and rest of the value of mineral production was accrued from coal, limestone & minor minerals in 2010-11.

Assam was the fourth largest producer of petroleum (crude) accounting for about 13% of the total production in the country. During 2010-11,the production of petroleum (crude) was almost at the same level as compared to previous year. It increased by more than 5 times for sulphur and decreased by 1% each for coal and natural gas (utilised) and 12% for limestone as compared to the production in previous year (Table - 5).

The value of minor mineral production was estimated at ₹ 37 crore for the year 2010-11.

The number of reporting mines in 2010-11 was 11 which was same as that in the previous year.

The index of mineral production in Assam (base 1993-94 =100) was 102.04 in 2010-11 as against 102.58 in the previous year.

Mineral-based Industry

The principal large and medium-scale mineral-based industries in the organised sector in the State are given in Table - 6.

Table - 1: Reserves/Resources of Minerals as on 1.4.2010 : Assam

Mineral	Unit	Reserves: Proved STD 111	Reserves: Probable STD121	Reserves: Probable STD122	Reserves: Total (A)	Remaining resources: Feasibility STD211	Remaining resources: Pre-feasibility STD221	Remaining resources: Pre-feasibility STD222	Remaining resources: Measured STD331	Remaining resources: Indicated STD332	Remaining resources: Inferred STD333	Remaining resources: Reconnaissance STD334	Remaining resources: Total (B)	Total resources (A+B)
China Clay	000 tonnes	-	-	-	-	-	131	-	392	-	3520	-	4043	4043
Fireclay	000 tonnes	-	-	-	-	-	-	-	-	-	3161	-	3161	3161
Fuller's earth	tonne	-	-	-	-	-	-	-	-	-	18860000	-	18860000	18860000
Granite (Dimen. stone)	000 cum	-	-	-	-	-	-	-	-	800	583150	-	583950	583950
Iron Ore (Hematite)	000 tonnes	-	-	-	-	-	-	-	-	8600	4000	-	12600	12600
Iron Ore (Magnetite)	000 tonnes	-	-	-	-	-	-	-	-	-	15380	-	15380	15380
Limestone	000 tonnes	183788	152562	-	336350	10902	9828	4257	154644	34200	897161	-	1110992	1447342
Quartz-silica sand	000 tonnes	-	-	-	-	-	-	-	-	-	1790	-	1790	1790
Sillimanite	tonne	-	-	-	-	-	-	-	-	850000	6700	3748000	4604700	4604700

Figures rounded off.

The proved and indicated balance recoverable reserves of crude oil and natural gas as on 1.4.2011 are 176.50 million tonnes and 127.93 billion cu m, respectively.

*The figures include those of Nagaland, Tripura and Arunachal Pradesh.**Figures rounded off.*

Table – 2: Reserves/Resources of Coal as on 1.4.2011 : Assam

(In million tonnes)

Coalfield	Proved	Indicated	Inferred	Total
Total	**464.78**	**45.51**	**3.02**	**513.31**
Singrimari	-	2.79	-	2.79
Makum	432.09	20.70	-	452.79
Dilli-Jeypore	32.00	22.02	-	54.02
Mikir Hills	0.69	-	3.02	3.71

Source: *Coal Directory of India, 2010-11.*

Table - 3 : Details of Exploration Activities in Assam, 2010-11

Agency/ Mineral/ District	Location/ Area/ Block	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of bore-holes	Meterage		
GSI **Coal** Langrin coal field Dhubri	Sukchar-Singrimari	-	1.15	-	-	-	Prospecting stage (G-3) regio exploration was taken up during 2010-12 in this block at the border Assam and Meghalaya to explore t behaviour and the northward extensi of the coal bands established during 1985-88 and to establish the c resource potentiality of the area.. T area formed a part of the Precambri Gneissic Complex comprising migmatities, biotite gneiss, gran gneiss, porphyritic granite and Tertia sedimentary rocks. Thinly laminat rocks belonging to the Talc Formation (greenish coloured sha siltstone, sandy clay, light green coloured sandstone) and Karharb Formation (coarse grained, gritty pebbly sandstone, medium to fi grained sandstone siltstone light grey black carbonaceous shale) occured Hallidayganj. These formations of t Gondwana Group overlie t Precambrian Gneissic Complex with unconformity. The work is in progres

Table – 4 : Exploration of Petroleum & Natural Gas in Assam during 2010-11

Agency	Seismic Survey		Drilling			
			Exploratory		Development	
	2D(GLKM)	3D(SQKM)	Wells	Meterage	Wells	Meterage
ONGC	-	162*	15*	52680*	26*	74031*
OIL	645**	370**	-	-	-	-

** Including Assam(Upper), Assam(Silcher) & Tripura.*
*** Including Arunachal Pradesh*

Table – 5 : Mineral Production in Assam, 2008-09 to 2010-11
(Excluding Atomic Minerals)

(Value in ₹ '000)

Mineral	Unit	2008-09			2009-10			2010-11 (P)		
		No. of mines	Quantity	Value	No. of mines	Quantity	Value	No. of mines	Quantity	Value
All Minerals		**12**		**87015349**	**11**		**100069898**	**11**		**99709241**
Coal	'000t	8	1009	2707900	7	1113	3965200	7	1101	4072600
Natural Gas (utilised)*	m c m	-	2573	9484631	-	2703	10115831	-	2682	10037240
Petroleum (crude)	'000t	-	4674	74466448	-	4740	85527470	-	4719	85148550
Limestone	'000t	4	365	85384	4	396	93537	4	349	82991
Sulphur[#]	t	-	566	-	-	665	-	-	3328	-
Minor Minerals[@]		-	-	270986	-	-	367860	-	-	367860

Note : The number of mines excludes petroleum (crude), natural gas (utilised) and minor minerals.
** Includes production of natural gas (utilised) for non-captive use in public sector in Arunachal Pradesh.*
 # Recovered as by-product from oil refinery.
@ Figures for earlier years have been repeated as estimates because of non-receipt of data.

Table – 6 : Principal Mineral-based Industries in Assam

Industry/plant	Capacity ('000 tpy)
Asbestos Products	
Assam Roofing Ltd, Bonda, Dist. Kamrup	58.4
Cement	
Barak Valley Cements Ltd, Badarpurghat, Dist. Karimganj	460 (TPD)
CCI Ltd, Bokajan, Dist. Karbi Anglong	198
Poneharatna Cement Pvt Ltd, Borera Titatabor, Dist. Jorhat	81
Mahashakti Cement, Bymihat, Dist. Kamrup	66
R. J. Cement Industries, Jabrakowa, Dist. Nagaon	60
River Valley Cement Corpn., Laxmi Nagar, Dist. Kamrup	54
Sri Balaji Cement Pvt Ltd, Charingiagaon, Dist. Jorhat	30

(Contd.)

Table – 6 (Concld.)

Industry/plant	Capacity ('000 tpy)
RCL Cement Pvt Ltd, Umrangshu	NA
Ceramic	
Rum Rum Tiles	NA
Rongtheang, Diphu, Dist. Karbi Anglong	NA
Fertilizer	
Assam State Fertilizer & Chemicals Ltd, Chandrapur, Dist. Kamrup	33.00 (SSP) 16.50 (H_2SO_4)
Brahmaputra Valley Fertilizers Corpn. Ltd, Namrup, Dist. Dibrugarh	510 (Urea)
Iron & Steel	
Shri Ganapati Ispat Pvt Ltd, Tinsukia	NA
Petroleum Refinery	
BRPL, Bongaigaon	2350
Indian Oil Corporation, Moonmati, Guwahati	1000
Indian Oil Corporation, Digboi	650
NRL, Numaligarh, Golaghat	3000

Indian Minerals Yearbook 2011

(Part- I)

50th Edition

(ADVANCE RELEASE)

STATE REVIEWS
(Bihar)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 001

PHONE/FAX NO. +91712 - 2565471
PBX : +91712 - 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

BIHAR

Mineral Resources

Bihar is the pricipal holder of country's pyrite resources and possesses 95% of resources. The important mineral occurrences in Bihar are **limestone** in Kaimur (Bhabhua), Monghyr and Rohtas districts; **mica** in Nawada district; **quartz/silica sand** in Bhagalpur, Jamui, Monghyr and Nalanda districts; **quartzite** in Lakhisarai, Monghyr and Nalanda districts; **talc/soapstone/steatite** in Monghyr district. Besides, occurrences of **bauxite** in Monghyr and Rohtas districts; **china clay** in Bhagalpur and Monghyr districts; **felspar** in Gaya, Jamui and Monghyr districts; **fireclay** in Bhagalpur and Purnea districts; **gold** in Jamui district; **granite** in Bhagalpur, Gaya, Jahanabad and Jamui districts; **iron ore (hematite)** in Bhagalpur district; **iron ore (magnetite)** in Gaya and Jamui districts; **lead-zinc** in Banka and Rohtas districts and **pyrites** in Rohtas district are reported (Tables - 1 and 2).

Exploration & Development

GSI carried out exploration for gold and silver near Monghyr-Rajgir, district Nalanda. Details of exploration activities conducted by GSI during 2010-11 are furnished in Table-3.

In 2010-11, ONGC conducted geo-physical survey under which an expanse of 357 (2D-GLKMK) was covered.

Production

The value of mineral production in Bihar at ₹ 291 crore in 2010-11 increased by about 3% over the previous year. Minor minerals pre-dominate the value of mineral production contributing 90% of the total value of mineral production in the state followed by limestone with 9% and a nominal contribution by quartzite and steatite. With an increase of 12% in output, the state contributed 54% of the total production of quartzite. An increase of 54% was also reportedin limestone as compared to that of the previous year. The production of 8,353 tonnes of sulphur was reported from the state (Table - 4).

The value of minor mineral production was estimated at ₹ 261 crore for the year 2010-11.

The number of reporting mines in Bihar in 2010-11 was 9 as against 6 in the previous year.

The index of mineral production in Bihar (base 1993-94=100) was 163.73 in 2010-11 as against 107.45 in the previous year.

Table – 2 : Reserves/Resources of Coal as on 1.4.2011 : Bihar

(In million tonnes)

Coalfield	Proved	Indicated	Inferred	Total
Total/Rajmahal	-	-	160.0	160.0

Source: *Coal Directory of India, 2010-11*

Table – 1: Reserves/Resources of Minerals* as on 1.4.2010 : Bihar

Mineral	Unit	Reserves: Proved STD111	Reserves: Probable STD121	Reserves: Probable STD122	Reserves: Total (A)	Remaining resources: Feasibility STD211	Remaining resources: Pre-feasibility STD221	Remaining resources: Pre-feasibility STD222	Remaining resources: Measured STD331	Remaining resources: Indicated STD332	Remaining resources: Inferred STD333	Remaining resources: Reconnaissance STD334	Remaining resources: Total (B)	Total resources (A+B)
Bauxite	000 tonnes	-	-	-	-	-	-	-	-	-	4114	-	4114	4114
China clay	000 tonnes	-	-	-	-	-	-	-	104	39	1296	-	1438	1438
Felspar	tonne	-	-	35147	35147	-	-	-	-	4195	4871499	-	4875694	4910841
Fireclay	000 tonnes	-	-	-	-	-	-	-	-	-	44	-	44	44
Gold					-									
Ore (primary)	tonne	-	-	-	-	-	-	-	-	-	128884860	94000000	222884860	222884860
Metal (primary)	tonne	-	-	-	-	-	-	-	-	-	21.6	16	37.6	37.6
Granite (Dimen. stone)	000 cu m	-	-	-	-	-	-	-	-	179000	698612	-	877612	877612
Iron ore (Hematite)	000 tonnes	-	-	-	-	-	-	-	-	-	55	-	55	55
Iron ore (Magnetite)	000 tonnes	-	-	-	-	-	-	-	-	-	2659	-	2659	2659
Lead-zinc					-								-	-
Ore	000 tonnes	-	-	-	-	-	-	-	-	435	11000	-	11435	11435
Lead metal	000 tonnes	-	-	-	-	-	-	-	-	-	24	-	24	24
Zinc metal	000 tonnes	-	-	-	-	-	-	-	-	14.75	24	-	38.75	38.75
Limestone	000 tonnes	7822	-	795	8617	-	6123	6689	86379	38210	709522	-	846923	855540
Mica	kg	-	-	74233	74233	-	-	-	-	-	12992434	7700	13000134	13074367
Pyrite	000 tonnes	-	-	-	-	13462	-	9680	-	51419	1500000	-	1574561	1574561
Quartzite	000 tonnes	-	32	-	32	146	461	20054	5287	22822	227531	-	276302	276334
Quartz-silica sand	000 tonnes	-	-	2121	2121	-	-	-	-	-	24652	-	24652	26773
Talc-steatite-soapstone	000 tonnes	-	-	149	149	-	-	-	-	-	3	-	3	152

Figures rounded off.
** Resources of zircon as per Department of Atomic Energy are provided in the respective Review.*

Table – 3 : Details of Exploration Activities in Bihar, 2010-11

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks
		Scale	Area (sq km)	No. of boreholes	Meterage		Reserves/Resources estimated
GSI **Gold** Gaya and Nalanda	Bathani	-	-	-	-	-	Reconnaissance stage investigation (G-4) was taken up during FS 2010-12 in Munger-Rajgir Group of rocks to assess the gold mineralization associated with Bathani volcano sedimentary sequence and Munger – Rajgir metasediments. The mapped area comprises of phyllitic tuff, BIF, brecciated BIF which suffered deformation resulting in fault gauge and slickenside. Phyllite –quartzite association is dominant in Rajgir metasediments. An old working has been noticed at the contact of BIF and phyllitic tuff to the NE of Majhauli village. Presence of yellow weathered ochre is noticed near Majhauli. Extensive carbonatisation of host rock at places has been noticed. Manganese stains and presence of botroidal psilomelane within quartzite along with perfectly developed hexagonal quartz crystals were noticed to the south of Village Saren . The work is in progress.
- do - Jamui	Gosari-Ghutwe block	-	-	-	-	-	Prospecting stage investigation (G-3) was taken up during FS 2010-12 in Sukhnar basin in Gosari-Ghutwe block of Sono area to assess the gold potentiality. The borehole GOS-1 has intersected schistose amphibolite between 2. m and 20.75 m depth and is underlained by mica gneiss upto 30.29 m depth. Samplings have been completed. The trench situated east of borehole no.-1 is located in soil covered area. It has exposed a few lenses of ferruginous quartzite having specks of sulphide minerals, especially arsenopyrite, within schistose amphibolites. The work is in progress.

Table –4 : Mineral Production in Bihar, 2008-09 to 2010-11
(Excluding Atomic Minerals)

(Value in ₹ '000)

Mineral	Unit	2008-09			2009-10			2010-11 (P)		
		No. of mines	Quantity	Value	No. of mines	Quantity	Value	No. of mines	Quantity	Value
All Minerals		**5**		**1343423**	**6**		**2838436**	**9**		**2912029**
Limestone	'000t	2	533	156594	2	567	203330	5	873	277837
Mica (waste & scrap)	t	-	-	-	-	-	-	-	-	-
Pyrites	t	-	-	-	-	-	-	-	-	-
Quartzite	t	2	33760	13027	3	56394	20855	3	63350	19785
Steatite	t	1	1410	179	1	2235	380	1	2948	536
Sulphur	t	-	10186	-	-	8681	-	-	8353	-
Minor Minerals@		-	-	1173623	-	-	2613871	-	-	2613871

Note: *The number of mines excludes minor minerals.*
@ *Figures for earlier years have been repeated as estimates, wherever necessary, because of non-receipt of data.*

Mineral-based Industry

The existing large and medium-scale mineral-based industries in the organised sector in the State with their total installed capacities are given in Table - 5.

Table – 5 : Principal Mineral-based
Industries in Bihar

Industry/plant	Capacity ('000 tpy)
Cement	
Kalyanpur Cements Ltd, Banjari, Dist. Rohtas	1000
Nirman Cement Ltd, Behtta, Dist. Patna	66
Rohtas Industries Ltd, Dalmianagar, Dist. Rohtas	45
Fertilizer	
Harabhara Fertilizer, Dhanukagra	9.8 (NPK)
Foundry	
Bharat Vagon & Eng. Co. Ltd, Mujaffarpur	NA
Petroleum Refinery	
Indian Oil Corporation, Barauni	6000

Indian Minerals Yearbook 2011

(Part- I)

50th Edition

(ADVANCE RELEASE)

STATE REVIEWS
(Chhattisgarh)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 001

PHONE/FAX NO. +91712 - 2565471
PBX : +91712 - 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

CHHATTISGARH

Mineral Resources

Chhattisgarh is the sole producer of tin concentrates and is one of the leading producers of coal, dolomite, bauxite and iron ore. The State accounts for about 36% tin ore, 18% iron ore (hematite), 17% coal and 11% dolomite and resources of the country. Important mineral occurrences of the State are **bauxite** in Bastar, Bilaspur, Dantewada, Jashpur, Kanker, Kawardha (Kabirdham), Korba, Raigarh & Sarguja districts; **china clay** in Durg & Rajnandgaon districts; **coal** in Koria, Korba, Raigarh & Sarguja districts; **dolomite** in Bastar, Bilaspur, Durg, Janjgir-Champa, Raigarh & Raipur districts; and **iron ore (hematite)** in Bastar district, Bailadila deposit in Dantewada district, Chhote Dongar deposit in Kanker district, Rowghat, Chargaon, Metabodeli & Hahaladdi deposits in Rajnandgaon district, Boria Tibbu deposits in Dalli-Rajhara area, Durg district. Bailadila-Rowghat hill ranges in the State are considered to be one of the biggest iron ore fields in India. **Limestone** occurs in Bastar, Bilaspur, Durg, Janjgir-Champa, Kawardha (Kabirdham), Raigarh, Raipur & Rajnandgaon districts; **quartzite** in Durg, Raipur, Rajnandgaon & Raigarh districts; and **talc/soapstone/steatite** in Durg & Kanker districts.

Other minerals found in the State are **corundum** in Dantewada district; **diamond** and other gemstones in Raipur, Mahasamund and Dhamtari districts; **fire clay** in Bilaspur, Raigarh and Rajnandgaon districts; **fluorite** in Rajnandgaon district; **garnet** & **marble** in Bastar district; **emerald** and **gold** in Raipur district; **granite** in Bastar, Kanker & Raipur districts; **quartz/silica sand** in Durg, Jashpur, Raigarh, Raipur & Rajnandgaon districts; and **tin** in Bastar & Dantewada districts (Table - 1). The reserves of coal are given in (Table - 2).

Exploration & Development

The details of exploration activities conducted by various agencies during 2010-11 are furnished in Table - 3.

Table – 2 : Reserves/Resources of Coal as on 1.4.2011 : Chhattisgarh

(In million tonnes)

Coalfield	Proved	Indicated	Inferred	Total
Total	**12878.99**	**32390.38**	**4010.88**	**49280.25**
Sohagpur	94.30	10.08	-	104.38
Sonhat	199.49	2463.86	1.89	2665.24
Jhilimili	228.20	38.90	-	267.10
Chirimiri	320.33	10.83	31.00	362.16
Bisrampur	849.15	765.55	-	1614.70
Bisrampur (East)	-	164.82	-	164.82
Lakhanpur	455.88	3.35	-	453.23
Panchbahini	-	11.00	-	11.00
Hasdeo-Arand	1369.84	3425.01	384.50	5179.35
Sendurgarh	152.89	126.32	-	279.21
Korba	4980.58	5936.50	838.58	11755.66
Mand-Raigarh	4177.90	17041.44	2552.72	23772.06
Tatapani-Ramkola	50.43	2392.72	202.19	2645.34

Source: *Coal Directory of India, 2010-11.*

Table – 1 : Reserves/Resources of Minerals as on 1.4.2010 : Chhattisgarh

Mineral	Unit	Reserves				Remaining resources								Total resources (A+B)
		Proved STD 111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
			STD121	STD122			STD221	STD222						
Bauxite	'000 tonnes	21246	48435	4818	74499	3992	4069	875	33764	11792	23241	18747	96480	170979
China Clay	'000 tonnes	834	-	344	1178	480	765	1076	-	-	11512	-	13832	15009
Corundum	tonne	-	310	288	597	-	-	-	-	-	288	-	288	885
Diamond	carat	-	-	-	-	-	-	-	-	-	1304000	-	1304000	1304000
Dolomite	'000 tonnes	41628	12984	6225	60836	19289	50384	24355	150795	24837	514235	1950	785846	846682
Fireclay	'000 tonnes	-	23	12	35	-	27	-	7180	3400	10336	-	20943	20978
Fluorite	tonne	-	-	-	-	65889	153132	9288	185485	5573	126088	-	545455	545455
Garnet	tonne	-	-	-	-	-	-	-	-	-	28800	-	28800	28800
Gold														
Ore (primary)	tonne	-	-	-	-	-	-	-	-	600000	4241033	-	4841033	4841033
Metal (primary)	tonne	-	-	-	-	-	-	-	-	1.8	3.71	-	5.51	5.51
Granite (Dim. stone)	'000 cu m	-	-	-	-	-	-	-	-	-	50057	-	50057	50057
Iron ore (Hematite)	'000 tonnes	636460	-	263650	900110	114382	5080	15610	107625	527563	872739	748715	2391714	3291824
Limestone	'000 tonnes	856930	10962	30004	897896	46468	742220	80465	1331984	480812	5379600	-	8061550	8959446
Marble	'000 tonnes	-	-	-	-	-	-	-	-	-	83000	-	83000	83000
Quartz-silica sand	'000 tonnes	141	-	46	187	385	-	620	56	-	191	7672	8924	9111
Quartzite	'000 tonnes	1404	-	1267	2672	3086	3926	2195	-	-	14706	-	23913	26584
Talc/soapstone steatite	'000 tonnes	22	-	8	30	-	-	-	-	70	8	-	78	108
Tin														
Ore	tonne	4404	1015	1713	7131	-	1690	-	168622	559914	29063345	-	29793572	29800703
Metal	tonne	925.75	189.76	16.92	1132.43	-	152.11	-	894.91	209.43	13097.75	-	14354.20	15486.63

Figures rounded off.

Table – 3: Details of Exploration Activities in Chhattisgarh, 2010-11

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks
		Scale	Area (sq km)	No. of boreholes	Metreage		Reserves/Resources estimated
GSI Coal (Mahanadi valley coal fields) Raigarh	Nawagaon	-	-	-	-	-	Regional exploration under G-2 stage initiated during FS 2009-10 was continued in this block, Mand – Raigarh Coalfield to establish the developmental pattern and continuity of the regional Barakar coal seams, and to assess coal resources potentiality as well as to carry out appraisal of CBM content. Ten regional Barakar coal seam / zones (Seam I to X, in ascending order) have been intersected between the depths of 45.37 m and 457.18 m. The important seams are Seam – I, IV, VI, VII and VIII with cumulative thickness of coal ranging from less than a meter to 10.46 m. Seam IV is the thickest seam and was intersected between the depths of 24.43 m and 425.04 m. Cumulative coal thickness of Seam I and IV varied from 2.35 m to 10.46 m. The work is in progress.
-do-	Teram	-	-	-	-	-	Regional exploration under G-2 stage was taken up during FS 2010-12 in this block Mand – Raigarh coalfield to establish the developmental pattern and continuity of the regional Barakar coal seams intersected in explored adjacent Kurumkela Blocks in the north-central part of Mand – Raigarh Coalfield and to evaluate additional coal resource in the area. In borehole-2 formational contact between Barren Measures and Barakar Formation was intersected at 162.22 m depth. In Barakar Formation, ten regional coal seams (Seam III to XII in ascending order) with cumulative thickness between 0.50 to 13.74 m intersected between the depths of 202.88 and 477.50 m. The thickest seam is highly banded in nature and its cumulative thickness ranges from 11.90 m to 13.74 m. The work is in progress.

(Contd.)

Table - 3 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks
		Scale	Area (sq km)	No. of boreholes	Metreage		Reserves/Resources estimated
GSI **Coal** Surguja	Korja	-	-	-	-	-	Regional exploration under G-2 stage was taken up during FS 2010-12 in this Hasdo - Arand Coalfield to establish the developmental pattern and continuity of the regional Barakar coal seams established in previously explored Pendrakhi Block in the west, to assess coal resource potentiality of the area as well as to generate CBM baseline data. The formational contact between Barakar and Talchir Formations is recorded at the depth of 365.60m in borehole – 1. Four regional Barakar coal seams / zones (Seam III to VI in ascending order) have been intersected between depths of 97.10 m and 188.65 m within Barakar Formation. Coal Seam /Zone IV and V are considered to be significant because of their cumulative coal thickness which ranges from 6.20 m to 7.75 m. Seams/Zones IV and V are represented by Composite Section with coal split varying in thickness from 0.30 m to 4.10 m. Four local coal seams (Seam L1 to Seam L4 in ascending order) have been recorded between depths of 258.95 m and 341.85 m within Lower Member of Barakar Formation. Thickness of individual split section varies from 0.15 m to 4.10 m. The work is in progress.

(Contd.)

Table - 3 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks
		Scale	Area (sq km)	No. of boreholes	Metreage		Reserves/Resources estimated
GSI							
Coal (Son valley coal fields) Surguja	Reonti (West)	-	-	-	-	-	Regional exploration for coal (G-2) was carried out in this block Tatapani – Ramkola coalfield to establish the continuity of Barakar coal seams beneath the younger Raniganj and Barren Measures Formations along with deciphering subsurface structural disposition as well as to appraise its resource potentiality. Subsurface data revealed the presence of Raniganj, Barren Measures and Barakar Formations. Six regional (I to VI in ascending order) and few local coal seams of Barakar Formation ranging in thickness from less than a metre to 29.78 m have been recorded between depths of 491.77 m and 841.20 m. Seams I to V are important for their thickness and regional persistency. The seam nos. IV and V are represented by four to five split sections with the cumulative thickness being 29.78 m and 12.22 m respectively. The work is in progress Reconnaissance stage investigation (G-4) was taken up during FS 2010-12 in Raigarh- Bilaspur Belt to locate kimberlite clan rocks in the granitic basement along the high permeable zone characterized by mafic dykes. Psamopelitic units comprising sandstone and shale are exposed in Dullapur area along nala section of Agar River. A suspected kimberlitic/ lamproitic rock is reported from parts of T.S.No. 64F/11, Bilaspur district. The rock is dominated by altered olivine, mica and opaques. The top soil below the bouldery rock outcrop has pink, purple and orange red garnets (pyrope), spinels and ilmenites. Further work is in progress for confirmation. Work is in progress for confirmation. Ground checks for interpreted PGRS map was carried out in the area.

(Contd.)

Table - 3 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks
		Scale	Area (sq km)	No. of boreholes	Metreage		Reserves/Resources estimated
GSI							
Diamond Bilaspur	Raigarh- Bilaspur Belt	-	-	-	-	-	A number of mafic dykes were observed along E-W, NW-SE and NE-SW directions. Around Patpara and Anwarpani area, boulder beds are overlain by sandstone and shale. Boulders of basic rock lying over the Gondwana rocks and along the nala sections were recorded. At Patpara, kimberlitic/lamproites boulders indicate that these may presumably be related to Deccan Trap occurring in the north. Few grains of garnet, spinel and ilmenite were selected for SEM-EDX / EPMA studies. The work is in progress
-do -	Agasmai & Bargarh	-	-	-	-	-	Regional ground evaluation of aero-geophysical anomalies (G-4) initiated during FS 2009-10 was continued to delineate KCR bodies and other types of Mineralisation. A number of small faults offsetting the Kansapather sandstone were observed near Agasmai and Bargarh village. A fault scarp with slickensides in Lohardih sandstone towards NW of Barra village was observed. In suitable trap sites of nalas/ streams, flowing along the fault zone/ cutting across the contact of the basement and Gondwana / Chhattisgarh Super-group of rocks, stream sediment samples were collected. Carbonaceous shale was observed along the Kataranganala. Open cast and underground coal mines of SECL are present near Chhal. A total of 33 grains of ilmenite and garnet grains have been separated from stream sediment samples and were sent for confirmation by SEM-EDX. The work is in progress

(Contd.)

Table - 3 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Metreage		
SAIL Iron ore (Hematite) Durg	Mahamaya	1:2,000	1522.67 (ha)	-	-	-	About 3.27 million tonnes iron ore resources wee estimated. The iron ore deposit is associated with banded ferruginous formation of Iron ore series of Dharwarian system. The total strike length of the deposit was found 2500 m & strike direction is N-S. Average depth of the ore body is 37 m dip varied from 50° – 80°.
-do-	Jharandalli	1:2,000	201.45 (ha)	-	-	-	The iron ore deposit is associated with banded feruginous formation of Iron ore series of Dharwarian system. The total strike length is 2060 m & average depth of the deposit 32.53 m (2.14 m – 64.0 m). As on 1.4.2011 the total iron ore resources were estimated at 5.69 million tones. (Fe – 61.94%, SiO_2 – 5.12%, Al_2O_3 – 2.08% & P – 0.086%).
-do-	Dalli Rajhara	1:2,000	220.42 (ha)	-	-	-	The iron ore deposits are associated with the BIF (Banded Iron Formations). The general rock type occurred in the area are BHQ, Shale, Laterite & Iron ore. Average width of the ore body is 200 m & average thickness of balance ore body is 40m. About 33.91 million tonnes of iron ore were estimated of grade Fe – 65.37%, SiO_2 – 3.45% & Al_2O_3 – 1.53%.
-do-	Dalli (Mech Mine)	1:2,000	333.50 (ha)	-	-	-	The iron ore bearing formation belongs to meta-sedimentary sequence of Dharwarian system of Archaeozoic age. Average width of the ore body was found to about 253 m & average thickness of balance ore body is 20.08 m. The general rock type occurred in the area are BhQ, Shale, Laterites & Hematite. About 24.5 million tonnes iron ore resources wee estimated of grade Fe – 63.07%, SiO_2 – 5.3% & Al_2O_3 – 2.54%.

(Contd.)

Table - 3 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Metreage		
Iron ore (Hematite) Durg	Dalli (Manual)	1:2,000	100.00 (ha)	-	-	-	The iron ore bearing formation belongs to meta-sedimentary sequence of Dharwarian system of Archaeozoic age. The deposit has a strike length of 1530 m. the ore body long with its surrounding rocks dipped towards north at 40o – 60o. Widespread laterisation has been noticed in the area. The iron ore bearing rocks of this deposit occurred along southern fringe of Chhattisgarh quadrangle. The ore body occurred as cap over the country rock of the ferruginous shale & BHQ continued at the depth for considerable thickness. About 1.30 million tonnes iron ore resources were estimated with grade Fe-61.25%, SiO_2 – 5.80% and Al_2O_3 – 2.32%.
DGM Buxite Kabirdham	Darai	1:50,000 1:4,000	514.0 2.16	93	873.10	1013	Bauxite occurred as weathered product of Deccan trap basalt, as an irregular & discontinuous lenses and pockets. Bauxite is generally pisolitic, brown, hard & compact. Thickness of bauxite was found to be up to 2 m. About 0.46 million tonnes bauxite resoures were estimated so far, out of which about 0.24 million tones wee estimated during the year.
-do- Surguja	Sarbhanja	1:50,000 1:4,000	0.30 36.0	32	390.65	100	Basaltic lava flows of Deccan trap were capped by thick lateritic profile with sporadic bauxite pockets of different dimensions. Pisolitic as well as massive bauxite was found which is dirty white, grey, light pink to pinkish brown. Thickness of bauxite was found to be upto 2 m. A total of 3 million tonnes bauxite were estimated out of which 1 million tones of metal grade bauxite has been estimated during the year.
-do-	Dandkeshra	1:50,000 1:4,000	150.0 2.0	83	848.0	592	Bauxite in this area was associated with laterite which found over Deccan trap basalt. Bauxite deposit occurred as pockets & irregular lenses of 100-200 m in length and upto 3.6 m. in thickness. About 3 million tones of bauxite mineral were estimated.

(Contd.)

Table - 3 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Metreage		
Coal Korba	Saila Pali	1:50,000 1:4,000	250.0 2.0	83	848.0	592	Coal seams of the area occurred in Barakar formation of Gondwana Super group. Coal also occurred as cyclic succession of coal, shaly coal, carb shale, grey shale & sandstone. Altogether 14 coal seams were encountered. Resources were not estimated during the year.
Raigarh	Dhaurabhata	1:50,000	50.0	06	1535.25	-	Coal seams occurred with Barakar formation as cyclic succession of shale, carb shale, shaly coal, coal & sandstone. 15 coal horizons have been intersected in this area. During the year about 29 million tonnes of C to G grade coal resources were estimated.
Limestone Raipur	Deogaon-Kurra	1:50,000 1:4,000	415.0 2.68	-	866.50	968	Main litho units are shale, limestone & laterite. Limestone is mostly horizontally bedded, trending E-SW. Depth of the limestone was confined upto 33 m. Limestone of this area is grey to pink, hard, compact, massive and stromatolitic. About 80 million tones limestone resources were estimated so far out of which, 50 million tonnes of cement (blendable)/ beneficiable) grade limestone resources were estimated during the year.
Bastar	-	-	-	-	-	-	Limestone of the area belongs to Jagadalpur & Kanker formation of Indravati Group. Limestone occurred as small mounds & is horizontally bedded with local warping. Outcrops of limestone were found in an area of 0.90 x 0.30 km with a thickness upto 10 m. Deposits of high grade limestone were demarcated around Villages Chitapur and Devrapal. So far, 13 million tonnes of cement grade limestone resources were estimated, out of which about 6.70 million tonnes of cement grade limestone resources were estimated during the year.
Granite	Murvend-Guruvandi	1:50,000	290.0	-	-	10	Area is mostly covered with Dongargarh granite with numerous acid & basic intrusive. Granite block (dolerite) has been marked as hillocks with dimesnsion of 500 m x 150 m. Thickness was found to be around 10 m. These rock are suitable for cutting/polishing purpose. About 75,000 m^3 granite block (dolerite) resources were estimated.

(Contd.)

Table - 3 (Concld.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Metreage		
Iron ore Kanker	Raoghat	1:50,000	514.0	-	-	54	Outcrops of BHQ & BHQ were spread over an area of 2 km x 0.2 km with thickness of 5 m. So far 41.17 million tonnes of iron ore resources were estimated, out of which 11 million tonnes of iron ore resources were estimated during the year.

Production

The value of mineral production in Chhattisgarh at ₹ 14,771 crore in 2010-11, increased significantly by about 47% as compared to that in the previous year. The state is ranked fifth in the country and accounted for 6% of the total value of mineral production. The important minerals produced in the state in 2010-11 were coal, bauxite, iron ore, tin (conc.), dolomite, limestone which together accounted for about 98% of the entire value of mineral production in the state.

Chhattisgarh was the sole producer of tin concentrate. The State is leading producer of coal accounting for 21% and dolomite 27% in the total production ofthe country of respective minerals. It also contributed 17% to the national out-put of bauxite 14% to iron ore and 8% to limestone during 2010-11. During the current year, no production of quartzite and steatite was reported from the state while all other minerals produced in the state reported higher production as compared to previous year (Table - 4).

The value of minor mineral production was estimated at ₹ 280 crore for the year 2010-11.

The number of reporting mines in Chhattisgarh was 153 in 2010-11 as against 152 in the previous year.

The index of mineral production in Chhattisgarh (base 1993-94=100) was 264.37 in 2010-11 as against 250.70 in the previous year.

Table – 4 : Mineral Production in Chhattisgarh, 2008-10 to 2010-11
(Excluding Atomic Minerals)

(Value in ₹ '000)

Mineral	Unit	2008-09			2009-10			2010-11 (P)		
		No. of mines	Quantity	Value	No. of mines	Quantity	Value	No. of mines	Quantity	Value
All Minerals		**162**		**132698116**	**152**		**100529786**	**153**		**147711732**
Coal	'000t	61	101922	67873600	60	109953	50308300	62	113824	58256200
Bauxite	t	14	1674427	557371	15	1687069	607911	13	2109945	765262
Iron ore	'000t	12	29997	59064269	10	26211	44227248	10	29146	82675755
Tin conc.	kg	5	59778	21267	5	59016	22895	6	61355	27100
Clay (others)	t	1	400	100	-	-	-	-	-	-
Dolomite	t	23	1317858	361156	24	1286514	335580	23	1387985	301339
Kaolin	t	-	-	-	-	-	-	-	-	-
Limestone	'000t	43	15789	2208173	33	15160	2231873	38	19096	2890099
Quartz	t	1	1846	258	1	384	54	1	655	92
Quartzite	t	1	50	8	1	50	8	-	-	-
Steatite	t	1	476	48	3	128	32	-	-	-
Minor Minerals@		-	-	2611866	-	-	2795885	-	-	2795885

Note : *The number of mines excludes minor minerals.*
@ Figures for earlier years have been repeated as estimates, wherever necessary, because of non-receipt of data.

Mineral-based Industry

The important large & medium-scale mineral-based industries in the organised sector in the State are furnished in Table - 5.

Table – 5 : Principal Mineral-based Industries in Chhattisgarh

Industry/plant	Capacity ('000 tpy)
Aluminium	
Bharat Aluminium Co. Ltd, Korba	200 (Alumina) 350 (Aluminium)
Cement	
ACC Ltd., Jamul, Dist. Durg	1580
Ambuja Cements Ltd, Rawan, Dist. Raipur	1146
CCI Ltd, Akaltara, Dist. Janjgir-Champa	400
CCI Ltd, Mandhar, Dist. Raipur	380
Century Cement, Baikunth, Dist. Raipur	2100
Grasim Cement, Rawan, Dist. Raipur	2500
Lafarge India Pvt. Ltd, Arasmeta, Dist. Janjgir-Champa	2240
Lafarge India Pvt. Ltd, Sonadih, Dist. Raipur	400
Ultra Tech Cement Ltd, Hirmi, Dist. Raipur	2750
Fertilizer	
BEC Fertilizers, Sirgitti, Dist. Bilaspur	66 (SSP)
Dharamsi Morarji Chemical Co. Ltd, Kumhari, Dist. Durg	183 (SSP & H_2SO_4)
Jairam Phosphate Ltd, Farahad, Dist. Rajnandgaon	66 (SSP) 49.5 (H_2SO_4)
Iron & Steel	
Bhilai Steel Plant, Bhilai	6334 (Sinters) 4700 (Pig iron) 3153 (Saleable steel) 3925(crude/liquid steel) 30 (Refractory bricks) 45 (H_2SO_4) 53.2 (Amm. sulphate)
Jindal Steel & Power Ltd, Raigarh	1600 (Hot metal) 1370 (Sponge iron) 36 (Ferro chrome) 3000(Crude/liquid steel)
Jayaswal NECO Industries Ltd, Siltara, Dist. Raipur	750 (Pig iron) 400 (Sponge iron) 800 (Sinter) 400 (Steel)
Sarda Energy & Minerals Ltd,	360 (Sponge iron)

(Contd.)

Table - 5 (Contd.)

Industry/plant	Capacity ('000 tpy)
(formerly Raipur Alloys & Steel Ltd)	240 (Finished steel)
Siltara, Dist. Raipur	60 MVA (Ferro Alloys)
Shri Bajrang Power & Ispat Ltd, Urla,	210(Sponge iron)
Dist. Raipur	130 (Steel)
Sponge Iron	
A.P.I. Ispat & Power Tech. Pvt. Ltd, Siltara Billets, Raipur	105
Alliance Integrated Metallics Ltd, Bemta, Dist. Raipur	500
Anjani Steel Ltd, Ujalpur, Dist. Raigarh	36
Arti Sponge & Power Ltd, Siltara, Dist. Raipur	45
Ambika Ispat (I) Pvt Ltd, Tarainal, Dist. Raigarh	30
Baldev Alloys Pvt. Ltd, Siltara, Raipur	30
Bhagavati Power & Steel Pvt Ltd, Siltara, Dist. Raipur	60
B.S. Sponge Pvt Ltd, Taraimal, Raigarh	30
Devi Iron & Power Pvt Ltd, Tandira, Dist. Raipur	30
Drolia Electro Steel Pvt Ltd, Siltara, Raipur	66
Euro Pratik Ispat Pvt Ltd, Charoda, Dist. Raipur	30
Gravity Treksim Pvt Ltd, Siltara, Dist. Raipur	30
Godavari Ispat & Power Ltd, Siltara, Dist. Raipur	495
Gopal Sponge & Power Pvt Ltd, Siltara, Dist. Raipur	30
Gitanjali Ispat & Power Pvt Ltd, Sirgititi, Dist. Bilaspur	30
GR Sponge & Power Ltd, Siltara, Dist. Raipur	37
Hare Krishna Sponge Pvt Ltd, Siltara, Dist. Raipur	30
HEG Ltd, Borai, Dist. Durg	120 (Sponge iron) 100 (Bxillets)
Hi-Tech Power & Steel Ltd, Parsada, Dist. Raipur	30
Ind Synergy Ltd, Kotmar, Dist. Raigarh	300
Indian Ispat & Power, Siltara, Dist. Raipur	30
Kalindi Ispat Pvt. Ltd, Belpan, Dist. Bilaspur	60
Khetan Sponge & Infrastructure Pvt. Ltd, Sarora, Dist. Raipur	30

(Contd.)

Table - 5 (Contd.)

Industry/plant	Capacity ('000 tpy)
Maa Kali Alloys (Ind.) Pvt Ltd, Pali, Dist. Raigarh	30
Mangal Sponge & Steel Pvt Ltd, Bilha, Bilaspur	30
Mangala Ispat Pvt Ltd, Natvarpur, Dist. Raigarh	30
Millennium High-Tech Industries Ltd, Parsada, Dist. Raipur	30
MSP Steel & Power Ltd, Raigarh	90
Monnet Ispat Ltd, Hasaud, Raipur	1000
NR Sponge Pvt. Ltd., Raipur	60
Nalwa Sponge Iron Ltd,Taraimal, Raigarh	198
Nakoda Ispat Ltd, Siltara, Raipur	66
Navdurga Fuse Pvt Ltd, Raigarh	60
Nova Iron & Steel Ltd, Dagori, Bilaspur	150
Nutan Ispat & Power Ltd, Jaroda, Raipur	30
PD Industries Pvt Ltd, Siltara, Raipur	30
Prakash Industries Ltd, Hathenewra, Janjgir-Champa.	450
Shree Radhe Industries Ltd, Silpahari, Bilaspur	60
Raigarh Ispat & Power Ltd, Delari, Dist. Raigarh	30
Rameswaram Steel & Power Ltd, Gharghoda, Dist. Raigarh	30
Salasar Sponge & Power Pvt Ltd, Gerwani, Dist. Raigarh	30
Sree Nakoda Ispat Ltd, Siltara, Dist. Raipur	66
Topworth Steel Pvt Ltd, Rosmada, Dist. Durg	60
Shakambri Steel & Power Pvt Ltd, Raigarh	30
Shakun Sponge Iron Pvt Ltd, Shirgitti, Dist. Bilaspur	30
Shivalaya Ispat & Power Pvt Ltd, Guma, Dist. Raipur	30
Sidhi Vinayak Sponge Iron Pvt Ltd, Raigarh	30

(Contd.)

Table - 5(Concld.)

Industry/plant	Capacity ('000 tpy)
S.K. Sarawagi & Co. Pvt Ltd, Siltara, Dist. Raipur	60
SKS Ispat & Power Ltd, Siltara, Dist. Raipur	270
Shivshakti Steel Pvt. Ltd, Chakradharpur, Dist. Raigarh	30
Shri Sita Ispat & Power Pvt. Ltd, Borjhara, Dist. Raipur	30
Shree Shyam Sponge & Power Ltd, Bachera, Dist. Raipur	30
Singhal Enterprises Pvt Ltd, Taraimal, Dist Raigarh	194
Sunil Sponge Pvt Ltd, Siltara, Dist. Raipur	30
Trimula Sponge Iron Pvt Ltd, Siltara, Raipur	30
Vandana Global Ltd, Siltara, Dist.Raipur	210
Vasvani Industries Ltd, Siltara, Dist. Raipur	30
Vidhyan Minerals India Pvt. Ltd, Bilaspur	30
Ferro Alloys	
Alok Ferro Alloys Ltd, Urla, Raipur	11
Chhattisgarh Electricity Co. Ltd, Siltara Dist. Raipur	36
Deepak Ferro Alloys Ltd, Urla, Dist. Raipur	5
Indsil Energy & Electro Chemical Ltd, Urla, Dist. Raipur	24
Hira Power & Steel Ltd., Urla, Dist. Raipur (Formerly Jain Carbides & Chemicals Ltd)	17
Monnet Ispat Ltd, Hasaud, Raipur	80
Nav-chrome Ltd, Urla, Dist. Raipur	50
Standard Chrome Ltd, Barmuda, Dist. Raigarh	15
Tirumala Balaji Alloys Pvt Ltd, Raigarh	21
Refractory	
Bharat Refractory Ltd, Bhilai, Dist. Durg (Bhilai Refractory Plant)	60
Vishva Vishal Engineering Ltd, Bhilai, Dist. Durg	8.2
Silicon Carbide Crucible	
M.P. Carbon (Pvt) Ltd, Raipur	NA

Indian Minerals Yearbook 2011

(Part- I)

50th Edition

(ADVANCE RELEASE)

STATE REVIEWS
(Delhi)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 001

PHONE/FAX NO. +91712 - 2565471
PBX : +91712 - 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

DELHI

Mineral Resources

Kaolin deposits are found in an area west of Qutub Minar at Mehrauli, Masoodpur, Kusumpur and Mahipalpur. In addition, occurrences of **fireclay** and silica material known as Badarpur **sand/quartzite** have also been reported from Delhi (Table - 1).

Mineral-based Industry

The important large and medium-scale mineral-based industries in the organised sector in Delhi with their total installed capacities are given in Table - 2.

Table – 1 : Reserves/Resources of Minerals as on 1.4.2010 : Delhi

Mineral	Unit	Reserves			Remaining resources				
		Proved STD111	Probable STD122	Total (A)	Measured STD331	Indicated STD332	Inferred STD333	Total (B)	Total resources (A+B)
China clay	'000 tonnes	-	-	-	857	630	3802	5289	5289
Fireclay	'000 tonnes	-	-	-	6	13	45	64	64

Figures rounded off.

Table – 2 : Mineral-based Industries in Delhi

Industry	No. of units	Total installed capacity (tpy)
Abrasive	1	120
Alum	1	35,500
Activated earth	1	3,600
Bleaching powder	1	10,000
Caustic soda	1	15,080
Asbestos products	1	25,000
Cement (grinding)	1	500,000
Ceramic & stoneware pipes	2	18,500
Refractory	2	39,000

Indian Minerals Yearbook 2011

(Part- I)

50th Edition

(ADVANCE RELEASE)

STATE REVIEWS
(Goa)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 001

PHONE/FAX NO. +91712 - 2565471
PBX : +91712 - 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

GOA

Mineral Resources

Goa is well-known for its iron and manganese ores. Bauxite and laterite are the other minerals produced in the State. Iron and manganese ore belts extend from south-east to north-west of the State. Manganese ores are associated with iron ores and occur as pockets of various sizes in the form of concretionary pebbles in shales. Important **iron ore** and **manganese ore** deposits are located at Bicholim, Sanguem and Satari talukas. **Bauxite** occurs in the North and South Goa districts; **kaolin** reportedly occurs in South Goa district while **quartz/silica sand** deposits occur in both North and South Goa districts (Table - 1).

Exploration & Development

Details of exploration activities conducted by M/s V. M. Salgaocar & Bro. Pvt. Ltd and M/s Chowgule and Co. Pvt Ltd during 2010-11 are furnished in Table - 2.

Production

The value of mineral production in Goa at ₹ 7,720 crore in 2010-11 increased by 31% as compared to the previous year. Almost 96% value of mineral production in Goa was contributed by iron ore. A nominal production of bauxite and manganese ore was also reported from the state in 2010-11.

During the year under review, production of bauxite increased by more than three times and that for iron ore and manganese ore, it decreased by 4% and 23% respectively as compared to the previous year (Table - 3).

The value of minor mineral production was estimated at ₹ 310 crore for the year 2010-11.

There were 75 reporting mines in both the years.

The index of mineral production in Goa (base 1993-94=100) was 257.56 in 2010-11 as against 267.33 in the previous year.

Table – 3 : Mineral Production in Goa, 2008-09 to 2010-11
(Excluding Atomic Minerals)

(Value in ₹ '000)

Mineral	Unit	2008-09			2009-10			2010-11 (P)		
		No. of mines	Quantity	Value	No. of mines	Quantity	Value	No. of mines	Quantity	Value
All Minerals		**77**		**51566051**	**75**		**58954591**	**75**		**77202351**
Bauxite	t	2	463150	34736	1	31050	3105	1	100900	10090
Iron ore	'000t	73	31195	48609019	71	38136	55846319	70	36723	74085391
Manganese ore	t	2	1170	2776	3	770	1047	4	590	2750
Minor Minerals@		-	-	2919520	-	-	3104120	-	-	3104120

Note : *The number of mines excludes minor minerals.*
@ Figures for earlier years have been repeated as estimates, wherever necessary, because of non-receipt of data.

Table – 1 : Reserves/Resources of Minerals as on 1.4.2010 : Goa

Mineral	Unit	Reserves				Remaining resources								Total resources (A+B)
		Proved STD 111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
			STD121	STD122			STD221	STD222						
Bauxite	'000 tonnes	15169	-	1207	16376	14941	1097	10121	6820	-	8646	-	41625	58001
China clay	'000 tonnes	-	-	-	-	-	-	16	-	-	-	-	16	16
Iron ore (hematite)	'000 tonnes	367378	44907	57559	469844	88723	63145	117393	7539	10050	141984	28493	457328	927172
Iron ore (magnetite)	'000 tonnes	12489	3186	-	15675	26211	1094	30400	-	-	147296	1997	206998	222673
Manganese ore	'000 tonnes	420	32	222	674	156	1674	3814	48	261	6968	-	12922	13596
Quartz-silica sand	'000 tonnes	-	-	-	-	-	20	1736	-	-	18248	-	20004	20004

Figures rounded off.

Table – 2: Details of Exploration Activities in Chhattisgarh, 2010-11

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks
		Scale	Area (sq km)	No. of boreholes	Metreage		Reserves/Resources estimated
Iron ore North Goa	Sirigao	-	-	-	-	-	General strike is N60° W/ S60° E dipping due NE at 35°-45° and due SW at 65°-85° considered as North Westerly plunging overturned anticline.
-do-	Pale	-	-	09	341.9	209	General strike of the ore body is found to be N30° W/ S30° E dipping due NE at 40°-45° and due SW at 30°-35°. Considered as double anticline separated by a minor syncline, with SE plunge. The iron ore resources were estimated at 0.40 million tonnes.
-do-	Onda	-	-	04	152.6	64	General strike of the ore body is found to be N 25° - 30° W/ S25°-30° E, extending over a strike length of 650 m. Ore body dipped on either side at moderate angles and is folded. The iron ore resources were estimated at 0.10 million tonnes.
Iron ore North Goa	Vaguriem	-	-	-	-	-	General strike of the ore body is found to be N35°W/S35°E. Asymmetrical anticline with south-western limb steeply dipping & NW limb dipping gently. Deposit was extended over a strike length of 1200 m.
-do-	Gavanem	-	-	-	-	-	General strike of the ore body is found to be NW/SE. Ore body occurred in the form of lenses & pockets extending over a strike length of 1100 m.
South Goa	Costi	-	-	-	-	-	General strike of the deposit is found to be N10°-20°W/S10°-20°E dipped medium to steep anticline & synelines with plunges on either directions resulting in cross folds.
South Goa	Tudou	-	-	-	-	-	General strike of the deposit is found to be N 50o – 60°W to S 50° – 60°E extending over a strike length of 1400 m. Ore body dipped on either sides at moderate angles and is folded.

(Contd.)

Table - 2 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks
		Scale	Area (sq km)	No. of boreholes	Metreage		Reserves/Resources estimated
Iron ore							
North Goa	Velguem/Surla	-	-	12	852.0	-	The entire area was covered with thick cap of laterite. Lower portion of the slope wee covered with clay and formed from weathering of phyllite & laterite. In general strike of the ore deposit is N 30°W S30°E and generally dips in North-Easterly direction. Amount of dip varied from 20° – 70°. At few places opposite dips are also seen indicating the cross folds as antiforms & synforms. This deposit extends over a strike length of 2.8 kms and spread over 4 contiguous mining leases. Iron ore resources were estimated at 11.62 million tonnes out of which 9.42 million tonnes were placed under category and 2.20 million tonnes were placed under category.
-do- South Goa	Sigao Iron ore mine	-	-	27	1672.00	-	The ore body is associated with manganiferrous & phyllitic clays on the hanging wall side and friable ferruginous siliceous formation/ siliceous manganeferrous clay on the footwall side. The general strike of the ore body is N 85°W – S 85°E dipped 25° – 60° northerly. Thickness of the ore body varied from 10 m – 15 m. The ore body consists of medium to hard lumpy ore nearer to the surface and becomes friable and powdery ore at depth. In general the ore body consists of fines with intercalations of hard ore. Mineralogically, the ore body consists mainly of hematite, martite, goethite & limonite. Chemically the ore varied from 58% Fe. In the case of earthy hematite to +62% Fe in the cse of hematite – martite-specularite combinations. The siliceous ore varied from +40 – 55% Fe. A total of 7.50 million tonnes iron ore resources were estimated. Out of which 1 million tones of +55%Fe grades & 6.49 million tones of +45-55% Fe.

(Contd.)

Table - 2 (Concld.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks
		Scale	Area (sq km)	No. of boreholes	Metreage		Reserves/Resources estimated
Iron ore							
South & North Goa	Sancordem-Malpona	-	-	-	-	-	The ore body is associated with phyllitic & limonitic clays with occasional bands of manganiferrous clays & friable ferruginous quartzites on the hanging wall side. Friable silica & siliceous mangniferous clays form the footwall. The strike of the ore body was found NW-SE. A total of 10.37 million tonnes iron ore resources were estimated out of which 8.81 million tones resources were placed under '111' category & 1.60 million tonnes under 121 & 122 category.

Mineral-based Industry

The important large and medium-scale mineral-based industries in the organised sector in the State are given in Table - 3.

Table – 3 : Principal Mineral-based Industries in Goa

Industry/plant	Capacity ('000 tpy)
Fertilizer	
Zuari Industires Ltd, Zuarinagar, Dist. South Goa	399.30 (Urea) 330 (NPK) 330 (DAP)
Pellets	
Mandovi Pellets Ltd, Mandovi	1800
Chowgule & Co. Ltd	550
Pig Iron	
Sesa Goa Ltd, Bicholim	180
Sponge Iron	
Ambey Metallic Ltd, Pissurlem, Sattari	36
Goa Sponge & Power Ltd, Santora	100
Shraddha Ispat Pvt. Ltd, Santora	60
Ferro Alloys	
Karthik Alloys Ltd, Cuncalim	4

Indian Minerals Yearbook 2011

(Part- I)

50th Edition

(ADVANCE RELEASE)

STATE REVIEWS
(Gujarat)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 001

PHONE/FAX NO. +91712 - 2565471
PBX : +91712 - 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

GUJARAT

Mineral Resources

Gujarat is the sole producer of agate, chalk, perlite and is the principal producer of fluorite (conc.), kaoline, silica sand, lignite, laterite, petroleum & natural gas and marl in the country. The State is the sole holder of the country's perlite resources and is said to possess 66% fluorite, 28% diatomite, 24% bentonite, 18% granite and 12% wollastonite.

The important mineral occurrences in the State are: **agate** found in Deccan Trap flows in Bharuch district; **bauxite** in Amreli, Bhavnagar, Jamnagar, Junagadh, Kheda, Kachchh, Porbandar, Sabarkantha and Valsad districts; **ball clay** in Banaskantha, Bharuch, Kachchh and Patan districts; **bentonite** in Amreli, Bhavnagar, Jamnagar, Kachchh and Sabarkantha districts; **china clay** in Amreli, Banaskantha, Bhavnagar, Jamnagar, Junagadh, Kachchh, Mahesana and Sabarkantha districts; **chalk** in Porbandar district; **diatomite** in Bhavnagar district; **dolomite** in Bhavnagar and Vadodara districts; **fireclay** in Bharuch, Kachchh, Mehsana, Rajkot, Sabarkantha, Surat and Surendranagar districts; **fluorite** in Vadodara and Bharuch districts; **fuller's earth** in Bhavnagar and Kachchh districts; **gypsum** in Bhavnagar, Jamnagar, Junagadh, Kachchh and Surendranagar districts; **lignite** in Bharuch, Bhavnagar, Kachchh and Surat districts; **limestone** in Amreli, Banaskantha, Bharuch, Bhavnagar, Jamnagar, Junagadh, Kheda, Kachchh, Panchmahals, Porbandar, Rajkot, Sabarkantha, Surat, Vadodara and Valsad districts; **ochre** in Banaskantha, Bhavnagar and Kachchh districts; **perlite** in Rajkot district; **petroleum and natural gas** in oil fields of Ankaleshwar, Kalol, Navgam, Balol and Cambay in Cambay onshore and offshore basins; **quartz/silica sand** in Bharuch, Bhavnagar, Dahod, Kheda, Kachchh, Panchmahals, Rajkot, Sabarkantha, Surat, Surendranagar, Vadodara and Valsad districts; and **talc/soapstone/steatite** in Sabarkantha district.

Other minerals that occur in the State are **apatite** and **rock phosphate** in Panchmahals district; **calcite** in Amreli and Bharuch districts; **copper ore** in Banaskantha district; **granite** in Banaskantha, Mahesana and Sabarkantha districts; **graphite** in Panchamahals district; **lead-zinc** and **marble** in Banaskantha and Vadodara districts; **manganese ore** in Panchamahals and Vadodara districts; **vermiculite** in Vadodara district; and **wollastonite** in Banaskantha district (Table - 1). The lignite resources are located in Bharuch, Bhavnagar, Kachchh and Surat districts (Table - 2).

Exploration & Development

The details of exploration activities conducted by various agencies for the exploration of lignite and other minerals during 2010-11are furnished in (Table - 3).

In 2010-11, ONGC discovered two new oil prospects, namely, Karnnagar-1 in karnnagar structure in Ahmedabad district and Limbodra East-1 in Limbodra East-1 structure of Gandhinagar district.. Four oil & gas prospects, namely Vemardi-1 in Vemardi-1 structure in Vadodara district, Vadatal-1 in Vadatal structure in Kheda district, Vadatal-3 in Vadatal structure in Kheda district and Matar-12 in Matar structure in Bharuch district, one gas prospects in Virgovindpura-3 in Vigovindpura structure in Ahmedabad district. Details of exploration activities conducted by ONGC during 2010-11 are furnished in Table - 4.

Table –2 : Reserves/Resources of Lignite as on 1.4.2011 : Gujarat

(In million tonnes)

District	Proved	Indicated	Inferred	Total
Total	**1243.65**	**318.70**	**1159.70**	**2722.05**
Bharuch	724.76	118.59	491.23	1334.58
Bhavnagar	-	-	299.17	299.17
Kachchh	300.61	91.40	33.09	425.10
Surat	218.28	108.71	336.21	663.20

Source: *Coal Directory of India, 2010-11.*

Table – 1 : Reserves/Resources of Minerals as on 1.4.2010 : Gujarat

Mineral	Unit	Reserves: Proved STD 111	Reserves: Probable STD121	Reserves: Probable STD122	Reserves: Total (A)	Remaining resources: Feasibility STD211	Remaining resources: Pre-feasibility STD221	Remaining resources: Pre-feasibility STD222	Remaining resources: Measured STD331	Remaining resources: Indicated STD332	Remaining resources: Inferred STD333	Remaining resources: Reconnaissance STD334	Remaining resources: Total (B)	Total resources (A+B)
Apatite	tonne	-	-	-	-	-	-	-	-	-	-	351000	351000	351000
Ball clay	tonne	-	-	-	-	-	-	-	249810	-	49670	-	299480	299480
Bauxite	'000 tonnes	98794	4560	10407	113761	3359	20295	2586	26593	22107	48019	-	122959	236720
Bentonite	tonne	-	-	12460170	12460170	-	-	-	2163813	1904	119553173	-	121718890	134179060
Calcite	tonne	-	-	-	-	-	-	-	-	-	12380	-	12380	12380
Chalk	'000 tonnes	3266	537	528	4332	184	5	127	-	-	269	-	585	4917
China clay	'000 tonnes	34290	240	6232	40763	4654	856	24135	-	878	40904	-	71425	112188
Copper														
Ore	'000 tonnes	-	4955	845	5800	-	-	-	129	-	7131	-	7260	13060
Metal	'000 tonnes	-	80.75	13.78	94.53	-	-	-	0.69	-	113.38	-	114.07	208.60
Diatomite	'000 tonnes	-	-	-	-	-	-	-	-	-	811	-	811	811
Dolomite	'000 tonnes	20130	1962	9803	31895	9556	26745	77285	20263	63780	295948	-	493578	525473
Fireclay	'000 tonnes	276	29	132	437	1175	635	923	638	962	53526	-	57859	58295
Fluorite	tonne	4280000	-	-	4280000	-	-	-	-	5723360	2001920	-	7725280	12005280
Granite														
(Dim. stone)	'000 cu m	-	-	-	-	-	-	-	-	-	8501947	-	8501947	8501947
Graphite	tonne	-	-	-	-	-	-	-	-	2520805	835000	-	3355805	3355805
Gypsum	'000 tonnes	9	5	24	37	-	-	-	-	-	15138	-	15138	15175
Laterite	'000 tonnes	9406	-	164	9570	-	-	-	-	-	-	-	-	9570
Lead-zinc														
Ore	'000 tonnes	-	4955	845	5800	-	-	-	129	-	200	-	329	6129
Lead metal	'000 tonnes	-	104.37	17.81	122.18	-	-	-	3.90	-	-	-	3.90	126.08
Zinc metal	'000 tonnes	-	224.04	39.37	263.41	-	-	-	1.10	-	-	-	1.10	264.51
Lead & zinc metal	'000 tonnes	-	-	-	-	-	-	-	-	-	0.90	-	0.90	0.90
Limestone	'000 tonnes	542498	72263	195715	810475	60640	88866	159549	18728	858265	18014634	-	19200681	20011157
Manganese ore	'000 tonnes	-	-	-	-	-	-	-	-	-	2954	-	2954	2954
Marble	'000 tonnes	-	-	-	-	-	26571	45000	-	17129	34871	-	123571	123571
Marl	tonne	33236150	4650000	2090000	139976150	11704870	-	-	-	-	-	-	11704870	151681020
Ochre	tonne	12243	32699	65047	109989	-	-	26520	6971	6210	2906608	-	2946309	3056298
Perlite	'000 tonnes	140	-	288	428	-	683	307	-	-	-	988	1978	2406
Quartz-silica sand	'000 tonnes	16042	684	19256	35982	17133	5110	11774	2144	2999	25629	-	64789	100771
Phosphorite/Rock phosphate	tonne	-	-	-	-	-	-	-	-	-	314820	-	314820	314820
Talc/soapstone/steatite	'000 tonnes	-	-	6	6	-	20	8	-	-	4	-	31	37
Vermiculite	tonne	-	-	-	-	-	-	-	-	-	1960	-	1960	1960
Wollastonite	tonne	-	-	-	-	-	-	-	-	-	1990000	-	1990000	1990000

Figures rounded off.
The proved and indicated balance recoverable reserves of crude oil and natural gas as on 1.4.2011 in the State are 134.42 million tonnes and 78.97 billion cu m, respectively.

Table – 3 : Details of Exploration Activities in Gujarat, 2010-11

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Metreage		
GSI **Bauxite** Kachchh	Ukheda, Daban, Wamoti & Naniand Khanpur	-	-	-	-	-	Reconnaissance stage investigation (G-4) was carried out during FS 2010-12 to search for titaniferous bauxite in order to appraise potential for high titanium bauxite occurrences and to study its mineralogy in the area . The area is characterized by presence of laterite and basaltic flows of Deccan trap. Bauxite occurred as a tabular body and in the form of pockets within thick laterite capping. Both massive and pisolitic varieties of bauxite are recorded in the area. The thickness of the massive bauxite is about 2.10 m whereas that of the pisolitic bauxite is about 3.00 m, as measured in trench section. The visual estimate of bauxite samples indicated that the alumina percentage may range between 20% to 30%. . The work is in progress.
GMDC **Bauxite** Katchchh	Balachod mine	-	-	25	275.0	17	Resources of bauxite were estimated at 1.89 million tonnes.
-do-	Dabanmine	-	-	63	724.0	43	Resources of bauxite were estimated at 1.04 million tonnes.
-do-	Guniasarmine	-	-	39	562.0	61	Resources of bauxite were estimated at 0.94 million tonnes.
-do-	Nandra-Naredi mine	-	-	15	173.0	06	Resources of bauxite were estimated at 0.32 million tonnes.
-do-	Naredi – 2 mine	-	-	22	226.0	08	Resources of bauxite were estimated at 0.67 million tonnes
-do-	Ratadiya mine	-	-	83	1522.0	66	Resources of bauxite were estimated at 3.04 million tonnes.
-do-	Roha-Kotada	-	-	82	1351.0	128	Resources of bauxite were estimated at 2.96 million tonnes.
-do-	Wandh mine	-	-	19	223.0	16	Resources of bauxite were estimated at 0.07 million tonnes. The deposit is pocket in nature where thickness is 1.00-2.50 m. 'Z' shaped exposures were lying NE-SW. Deposit mostly occurred in openground. Sometimes laterite has been encountered as overburden.

(Contd.)

Table-3 (Concld.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated.
		Scale	Area (sq km)	No. of bore-holes	Metreage drilled		
Bauxite Jamnagar	Mevasa bauxite mine	-	-	42	1100.00	52	Bauxite resources were estimated at 1.90 lakh tonnes.
Manganese ore Panchmahals	N/V Shivrajpur	1:1,000	424.20 (Hect)	10	1200.0	-	Manganese deposit occurred as lenticular in metamorphic rocks in association with phyllites, quartzites, cherts.
Lignite Kachchh	N/V Panandhro	1:50,000	-	-	-	-	The geological data has been interpreted to suggest an elliptical basin with a width of 3000 m at the southern side & 600 m at the northern side. The strata including the lignite seam has been seen to dip towards the centre of basin. The basin appeared to be a syncline with its axis in the south-west to NNE direction. The laki series of middle Eocene age contains formations like shale, clay, lignite & gypsum. The maximum thickness of aki series in this area is about 20 m clay & lignite. Laki series rocks are underlained by the Nummulitic limestones & are exposed in north eastern part of the basin. Resources were not estimated.
Limestone Kachchh	Panandhro	1:50,000	-	-	-	-	Around 41 million tonnes resources of limestone were estimated. The rocks of Laki series underlain by nummulitic limestones were exposed in the North-Eastern part of the basin. Chemical analysis showed that the limestone consisted CaO - 45.62%, MgO - 0.16% Al_2O_3 - 100% $MgCO_3$ - 0.35%, $CaCO_3$ - 81.48% and LOI - 39.50%.

Table – 4 : Exploration for Petroleum & Natural Gas in Gujarat during 2010-11

Agency	Seismic Survey		Drilling			
			Exploratory		Development	
	2D(GLKM)	3D(SQKM)	Wells	Meterage	Wells	Meterage
ONGC	431	523	42	74000	173	295958

Production

The value of mineral production in Gujarat in 2010-11 at ₹ 13,940 crore was 3% higher as compared to the previous year. The state is ranked sixth in the country and accounted for 6 % of the total value of mineral production in India during the year. Gujarat was the sole producer of agate, chalk and fluorite (conc.); leading producer of marl (86%), kaolin (49%) and silica sand (39%); second largest producer in lignite (35%), clay (others) (31%), laterite(20%), petroleum (crude) (16%) in the country. The production of ochre has increased by more than four times and that of manganese ore by more than three times and for silica sand by more than double as compared to the previous year.

The other minerals which have reported significant increase in production are sulphur (86%), agate (73%), laterite (27%) and lignite (24%). The minerals reporting fall in production during 2010-11 were dolomite (76%), bauxite (66%), fireclay (64%), quartz (57%), clay (others) (56%), fluorite (conc.) (50%) and ball clay (36%) (Table - 5).

The value of minor mineral production was estimated at ₹ 726 crore for the year 2010-11.

The number of reporting mines in the state was 412 in 2010-11 as compared to 446 in the previous year.

The index of mineral production in Gujarat (base 1993-94=100) was 111.35 in 2010-11 as against 112.78 in the previous year.

Table – 5 : Mineral Production in Gujarat, 2008-09 to 2010-11
(Excluding Atomic Minerals)

(Value in ₹ '000)

Mineral	Unit	2008-09			2009-10			2010-11 (P)		
		No. of mines	Quantity	Value	No. of mines	Quantity	Value	No. of mines	Quantity	Value
All Minerals		**440**		**124342958**	**446**		**135267795**	**412**		**139399161**
Lignite	'000t	7	10114	8926300	7	10526	7013700	7	13064	13480300
Natural gas (utilised)	m c m	-	2605	9602590	-	2444	9146538	-	2263	8469155
Petroleum(crude)	'000t	-	5946	94732029	-	5960	107540869	-	5905	106548462
Bauxite	t	101	3514016	897680	109	2687306	667424	98	913421	293540
Manganese ore	t	1	-	-	1	55090	27270	1	173383	86041
Agate	t	-	-	-	1	11	6	1	19	10
Ball clay	t	2	11539	579	2	31053	1477	1	20024	1082
Chalk	t	131	203085	77251	128	185218	71087	128	174914	65220
Clay (others)	t	4	369232	11000	3	420598	7040	2	185388	3490
Dolomite	t	15	169447	22962	15	346234	50554	12	84477	10094
Fireclay	t	9	27275	1975	9	92868	9829	5	33110	2326
Fluorite (conc.)	t	1	6814	88715	1	8786	98855	1	4394	66412
Gypsum	t	4	218	22	4	112	15	2	61	12
Kaolin	t	27	968928	201117	28	1306539	207944	20	1228759	221385
Laterite	t	2	259767	21104	2	184840	8343	2	234547	7284
Limestone	'000t	113	21952	2274585	112	23322	2864989	109	22152	2594745
Marl	t	-	4008452	188259	-	4284658	245373	-	3748504	206929
Ochre	t	1	280	28	2	649	65	1	2715	289
Perlite	t	-	-	-	-	-	-	-	-	-
Quartz	t	7	77400	8031	7	85343	8764	5	36837	4782
Silica sand	t	14	368720	32025	14	465530	40569	16	1210046	80626
Talc/steatite/soapstone	t	1	122	18	1	2660	396	1	2316	289
Sulphur*	t	-	13293	-	-	12045	-	-	22436	-
Minor Minerals@		-	-	**7256688**	-	-	**7256688**	-	-	**7256688**

Note : *The number of mines excludes petroleum (utilised), natural gas and minor minerals.*
******* *Recovered as by-product from oil refineries.*
@ *Figures for earlier years have been repeated as estimates, wherever necessary, because of non-receipt of data.*

Mineral-based Industry

The important large and medium-scale mineral-based industries in organised sector in the State are given in Table - 6.

Table – 6 : Principal Mineral-based Industries in Gujarat

Industry/plant	Capacity ('000 tpy)
Abrasives	
Carborandum Universal Ltd, Okha, Dist. Jamnagar	NA
Carborandum Universal Ltd, Bhatia, Dist. Jamnagar	NA
Flexo-Plast Abrasives, Ahmedabad	NA
Emery (I) Pvt Ltd, Badeshwar, Dist. Jamnagar	7
Aluminium	
Vedanta Aluminium Ltd, Jhagadia, Dist. Bharuch	250
Asbestos Products	
Gujarat Composite Ltd, Digvijaynagar, Dist. Jamnagar	98
Ramco Industries Ltd, Singura, Dist. Kachchh	72
Sanghi Industries Ltd, Sanghipuram, Dist. Kachchh	36
U.P. Asbestos Ltd, Valsad	36
Cement	
Ambuja Cements Ltd, Ambuja Nagar, Dist. Junagadh	4500
Grasim Industries Ltd, Sikka, Dist. Jamnagar	1075
Gujarat Sidhee Cements, Sidheegram, Dist. Junagadh	1200
HMP Cements Ltd, Porbandar, Dist. Junagadh	198
Sanghi Industries Ltd, Sanghipuram, Dist. Kachchh	2600
Shree Digvijay Cement Co. Ltd, Digvijaygram, Dist. Jamnagar	1075
Saurashtra Cements Ltd, Ranavav, Dist. Junagadh	1164
Tata Chemicals Ltd, Mithapur, Dist. Jamnagar	440
Ultra Tech Cement Co. Ltd, Pipavav, Dist. Amreli	5300
Ultra Tech Cement Ltd (Narmada Cement), Jafrabad, Dist. Amreli	400

(Contd.)

Table - 6 (Contd.)

Industry/plant	Capacity ('000 tpy)
Sunata Ceramics Pvt Ltd, Sabarkantha	21.6
Suncity Ceramics, Morbi, Rajkot	12
VAN Ceramics Ltd, Dalpur, Dist. Sabarkantha	35.3
Varmora Granito Pvt Ltd, Duva, Rajkot	24.8
Vrundavan Ceramics Ltd, Dhuva, Dist. Rajkot	71.3
Chemical	
Baroda Rayon Corpn. Ltd, Surat	26 (yarn) 21.8 (H_2SO_4) 2.2 (sodium sulphate)
Century Chemicals, Nava Nanga, Dist. Jamnagar	108 (refined salt)
Gujarat Alkalies & Chemicals Ltd, Baroda	14.9 (caustic soda)
Gujarat Alkalies & Chemicals Ltd, Dahej, Dist. Bharuch	242.6 (caustic Soda) 151.4 (Cl) 26.7 (phosphoric acid)
Indian Rayon Industries Ltd, Veraval, Dist. Junagadh	16 (yarn) 35.7 (H_2SO_4) 10 (carbon disulphide) 9.3 (sodium sulphate) 91.3 (caustic soda)
Navin Fluorine Industries Ltd, Surat	22(HF)
Saurashtra Chemicals Ltd, Porbandar, Dist. Porbandar	365 (soda ash) 20.4 (caustic soda) 26.4 (refined bicarbonate)
Shree Sulphurics Pvt. Ltd, Ankleshwar, Dist. Bharuch	58 (H_2SO_4) 12 (chloro-sulphuric acid)
Tata Chemicals Ltd, Mithapur, Dist. Jamnagar	875(soda ash)
Copper	
Hindalco Industries Ltd, Birla Copper, Dahej, Dist. Bharuch	500 (copper cathode) 1670 (H_2SO_4) 400 (DAP) 15 tonnes (Au) 150 tonnes (Ag)
Jhagadia Copper Ltd, Jhagadia, Dist. Bharuch	50 (electrolytic copper) 20 (copper anodes)
Fertilizer	
GSFC-Vadodara	367 (urea)

(Contd.)

Table - 6 (Contd.)

Industry/plant	Capacity ('000 tpy)
	108 (DAP) 196 (AS)
GSFC-Sikka, Jamnagar	177.10 (N_2) 452.70 (P_2O_5)
GNVFC Ltd, Bharuch	594 (urea) 142.5 (CAN) 142.5 (ANP)
HIL-Dahej, Dist. Bharuch	72.00 (N_2) 184.0 (P_2O_5)
IFFCO Ltd, Kandla, Dist. Kachchh	1215 (NPK) 1200 (DAP)
IFFCO Ltd, Kalol, Dist. Gandhinagar	544.5 (urea)
KRIBHCO Ltd, Hazira, Dist. Surat	1729.2 (urea)
Foundry	
Steelcast Ltd, Ruvapuri Road, Bhavnagar	NA
Iron &Steel	
Essar Steel Ltd, Hazira, Dist. Surat	5100 (HBI) 1000 (hot metal) 4600 (HRC) 1400 (CRC)
Ferro Alloys	
Baroda Ferro Alloys Ltd, Panchmahals	3.5
Essel Mining & Industries Ltd, Vapi, Dist. Valsad	2.1
Electro Ferro Alloys Ltd, Ahmedabad	0.3
Sponge Iron	
Electrotherm India Pvt Ltd, Samakhalli, Dist. Kachchh	75
Gallant Metal Ltd, Samakhialli, Dist. Kachchh	170
Global Hi-Tech Industries Ltd, Bhuj, Dist. Kachchh	105
Glass	
Alembic Glass Industries Ltd, Baroda	35.0
Bhagwati Glass Containers Ltd, Kalol	8.7
Bharat Glass Tube Ltd, Bharuch	7.2
Gobind Glass & Industries Ltd, Kadi	NA
Gopal Glass Works Ltd, Budasan, Dist. Mahesana	40.6
Gujarat Borosil Ltd, Govali, Dist. Bharuch	62.5
Gujarat Glass, Division of Nicholas Piramal, Mangrol	80.3

(Contd.)

Table - 6 (Concld.)

Industry/plant	Capacity ('000 tpy)
Gujarat Glass, Division of Nicholas Piramal, Jambusar	84
Gujarat Glass, Division of Nicholas Piramal, Kosamba	12.8
Haldyn Glass (Gujarat) Ltd, Padra, Vadodara	43
Prestige Glass Industries Pvt Ltd, Vagra	11.5
Petroleum Refinery	
IOCL, Koyali	13700
RPL, Jamnagar	33000
RPL (SEZ), Jamnagar	27000
Essar Oil Ltd, Vadinar	10500
Refractory	
Shri Natraj Ceramics & Chemical Industries Ltd, Khambhaliya, Dist. Jamnagar	28
Meenal Ceramics Pvt. Ltd, Chattral, Dist. Kalol	12
VRW Industries Ltd, Ahmedabad	24
Calcined Bauxite	
Bombay Minerals Ltd, Jamkhambhaliya	96
Saurashtra Calcine Bauxite & Allied Industries Ltd, Bhatia	39
Birla VXL Ltd, Porbandar	36
Shri Natraj Ceramics & Chemical Industries Ltd, Khambhaliya	24
Graphite Crucible	
Diamond Crucible Co. Pvt, Mahesana	NA
S.D. Industries, Ahmedabad	NA
Ahmedabad Carbon Products, Ahmedabad	NA
Silicon Carbide Cruicibles	
Vesuvius India Ltd, Mahesana	1

Indian Minerals Yearbook 2011

(Part- I)

50th Edition

(ADVANCE RELEASE)

STATE REVIEWS
(Haryana)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 001

PHONE/FAX NO. +91712 - 2565471
PBX : +91712 - 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

HARYANA

Mineral Resources

The state is the pricipal holder of country's resources of tin (64%), quartz-silica sand (52%) and quartzite (49%). The principal minerals occurring in Haryana are **china clay** in Faridabad, Gurgaon and Rewari districts; **limestone** in Ambala, Bhiwani, Mahendragarh and Panchkula districts; **quartz/silica sand** in Bhiwani, Faridabad, Gurgaon and Mahendragarh districts; **quartzite** in Faridabad and Gurgaon districts; **slate** in Mahendragarh and Gurgaon districts. Other minerals, such as, **barytes, calcite, felspar** and **marble** occur in Mahendragarh district; **copper** in Bhiwani and Mahendragarh districts; **dolomite** in Ambala and Mahendragarh districts; **granite** in Bhiwani district; **tin** and **tungsten** mineralisations in Tosham area of Bhiwani district have also been reported (Table - 1).

Exploration and Development

Details of exploration conducted by GSI during 2010-11 are furnished in Table - 2.

Production

During 2010-11, the value of mineral production in Haryana at ₹ 149 crore was at the same level as that of the previous year. The only mineral item reporting production in the state was sulphur which was 7% lower (Table - 3).

The value of minor mineral production was estimated at ₹ 149 crore for the year 2010-11.

There were no reporting mine during 2009-10 and 2010-10.

The index of mineral production in Haryana (base 1993-94=100) was 416.65 in 2010-11 as against 446.10 in the previous year.

Table – 3 : Mineral Production in Haryana, 2008-09 to 2010-11
(Excluding Atomic Minerals)

(Value in ₹ '000)

Mineral	Unit	2008-09			2009-10			2010-11 (P)		
		No. of mines	Qty	Value	No. of mines	Qty	Value	No. of mines	Qty	Value
All Minerals		-		**1487198**	-		**1487198**	-		**1487198**
Sulphur*	t	-	130155	-	-	146278	-	-	136622	-
Minor Minerals@		-	-	1487198	-	-	1487198	-	-	1487198

Note: *The number of mines excludes minor minerals.*
***** *Recovered as by-product from fertilizer plant.*
@ *Figures for earlier years have been repeated as estimates because of non-receipt of data.*

Table –1: Reserves/Resources of Minerals as on 1.4.2010 : Haryana

Mineral	Unit	Reserves				Remaining resources							Total resources
		Proved STD 111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Total (B)	(A+B)
			STD121	STD122			STD221	STD222					
Barytes	tonne	-	-	-	-	-	-	-	-	-	440	440	440
Calcite	tonne	-	-	-	-	166900	-	183900	-	-	-	350800	350800
China clay	'000 tonnes	-	-	-	-	2367	789	3377	13	34	5485	12065	12065
Copper													
Ore	'000 tonnes	-	-	-	-	-	2230	-	-	-	30678	32908	32908
Metal	'000 tonnes	-	-	-	-	-	11.82	-	-	-	101.8	113.62	113.62
Dolomite	'000 tonnes	-	-	-	-	5371	5149	3722	-	-	15247	29489	29489
Felspar	tonne	-	-	-	-	-	-	-	-	-	72164	72164	72164
Granite (Dim. stone)	'000 cu m	-	-	-	-	-	-	-	-	-	34000	34000	34000
Limestone	'000 tonnes	-	-	-	-	1425	15507	3382	-	2200	52163	74677	74677
Marble	'000 tonnes	-	-	-	-	-	1234	1602	-	-	19492	22328	22328
Quartz-silica sand	'000 tonnes	-	46	8317	8363	35553	252759	182478	27837	39767	1264473	1802868	1811231
Quartzite	'000 tonnes	-	-	-	-	15702	89742	112365	86951	85333	231887	621980	621980
Tin													
Ore	tonne	-	-	-	-	22580000	-	31330000	-	-	-	53910000	53910000
Metal	tonne	-	-	-	-	32187.80	-	54032.80	-	-	-	86220.60	86220.60
Tungsten													
Ore	tonne	-	-	-	-	2230000	-	-	-	-	-	2230000	2230000
Contained WO_3	tonne	-	-	-	-	3568	-	-	-	-	-	3568	3568

Figures rounded off.

Table – 2 : Details of Exploration Activities in Haryana, 2010-11

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Metreage		
GSI **Base metal** Mahendragarh	Parts of west of Bakrija	-	-	-	-	34	Prospecting stage investigation (G-3) was taken up during FS 2010-12 in North Delhi Fold Belt in the unexplored part of this area with an emphasis on demarcation of the host rock for copper mineralisation to assess the potential of copper mineralisation in the aforesaid area. Detailed geological mapping has been carried out in and around Village Bakrija. The area is mostly soil covered with few scanty outcrops. The lithounits exposed are amphibole marble occasionally inter-banded with calcareous quartz -biotite -schist which trends in NW-SE direction. The first Borehole was closed at 203.15m depth. Analytical results of 34 core samples of BH-1 from the calc quartz biotite schist and amphibole marble did not indicate any significant values of copper. The work is in progress
Gypsum Hissar and Bhiwani	Western part of Haryana	-	-	-	-	17	Reconnaissance stage investigation (G-4) was taken up during FS 2010-12 to assess the potential of gypsum in inter-dunal areas covered by alluvial/aeolian sediments. The area exhibits mild undulating topography with dense aeolian land forms viz. sand dunes, sand sheets and inter-dune depressions with reported gypsum occurrences. Alluvial sediments are exposed in the northern part of the area. Three new gypsum occurrences have been noticed at Chhapar Jogiyan, Garanpura Naya and Balaharan Ki Dhani. Three samples have been collected from a quarry west of Village Saharwa for TL/OSL dating from sandy horizons below and above the gypsum bands to ascertain the age of gypsum formation. Assay results indicated 67%-85% $CaSO_4$ content in eight samples and 41%-58% $CaSO_4$ in five and 25%-34% in four samples. The work is in progress.

Contd.

Table - 2 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks
		Scale	Area (sq km)	No. of boreholes	Metreage		Reserves/Resources estimated
DMG							
Gypsum							
Bhiwani/Hisar	Garanpur Kalan Dariyapur,	-	-	-	-	16	Gypsum occur as pocket deposits in agricultural land having variable Garanpur thickness. A total of 0.36 million tonnes gypsum resources was estimated, out of which 0.32 million tonnes each near Village Saharwa and 0.02 million tonnes near Village Dariyapur and Garanpur Kalan were identified.

Mineral-based Industry

The important large and medium-scale mineral-based industries in the organised sector in the State are given in Table - 4.

Table – 4 : Principal Mineral-based Industries in Haryana

Industry/plant	Capacity ('000 tpy)
Abrasives	
Indian Abrasives, Faridabad	0.6
Asbestos Products	
Hyderabad Industries Ltd, Ballabgarh	91.7
Cement	
CCI Ltd, Charkhi Dadri, Dist. Bhiwani	174
Ceramic	
Hindustan Sanitaryware & Industries Ltd, Bahadurgarh	NA
SPL Ltd, Bahadurgarh	35000 (sq m per day)
Somany Ceramics Ltd, Kassur, Dist. Jhajhar	10.4 (Mill sq m)

(Contd.)

Table – 4 (Concld.)

Industry/plant	Capacity ('000 tpy)
Chemical	
Oriental Carbon & Chemcials Ltd, Dharuhera, Dist. Rewari	55 (H_2SO_4) 5 (sulphur)
Fertilizer	
NFL-Gohana Road, Panipat	511.5 (urea) 8.70 (S)
Iron & Steel	
Jindal Stainless Ltd, Hissar	800 (stainless steel)
Ferro-alloys	
Haryana Ferro Alloys Ltd	2.5
Glass	
Haryana Sheet Glass Ltd., Sevli, Dist. Sonipat	89.5
Hindustan National Glass & Industries Ltd, Ballabgarh	690 TPD
Petroleum Refinery	
IOCL, Panipat	15000
Refractory	
Bhaskar Refractories & SW Pipes (P) Ltd, Amar Nagar	12
Husakha Industries, Faridabad	2.5
Hyderabad Industries Ltd., Dharuhera	3.5

Indian Minerals Yearbook 2011

(Part- I)

50th Edition

(ADVANCE RELEASE)

STATE REVIEWS
(Himachal Pradesh)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 001

PHONE/FAX NO. +91712 - 2565471
PBX : +91712 - 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

HIMACHAL PRADESH

Mineral Resources

The State is the sole holder of country's rock salt resources. Barytes, limestone, salt (rock) and shale are the important minerals produced in the State. **Barytes** occurs in Sirmaur district; **limestone** in Bilaspur, Chamba, Kangra, Kullu, Mandi, Shimla, Sirmaur and Solan districts; and **rock salt** in Mandi district. Other minerals that occur in the State are **antimony** in Lahaul and Spiti districts; **gypsum** in Chamba, Sirmaur and Solan districts; **magnesite** in Chamba district; **pyrite** in Shimla district; and **quartz, quartzite** and **silica sand** in Una district (Table - 1).

Exploration & Development

ONGC continued its seismic survey and drilling for exploration of petroleum & natural gas. and meterage of 4050 were drilled during 2010-11. Details of exploration activites conducted by various agencies for base metals and limestone during 2010-11 are furnished in Table - 2.

Production

The value of mineral production in Himachal Pradesh during 2010-11 at ₹ 150 crore increased by 31% as compared to that of the previous year.

Himachal Pradesh was the sole producer of salt (rock) in the country and its production decreased by 35% in 2010-11 as against the previous year. It is also the leading producer of shale accounting for 48% of the total production in the country. Limestone is the principal mineral produced in the state and accounted for 78% in the total value of mineral production in 2010-11. The production of shale and limestone in the current year increased by 56% and 36% respectively and that of salt (rock) decreased by 35% as against the previous year (Table - 3).

The value of minor mineral production was estimated at ₹ 29 crore for the year 2010-11.

The number of reporting mines in the state in 2010-11 was 24 as against 26 in the previous year.

The index of mineral production in Himachal Pradesh (base 1993-94=100) was 655.31 in 2010-11 as against 481.12 in the previous year.

Table – 2 : Details of Exploration Activities in Himachal Pradesh, 2010-11

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks
		Scale	Area (sq km)	No. of boreholes	Meterage		Reserves/Resources estimated
GSI **Glass sand** Shimla and Kullu	Village Sunda & Darshai	-	-	-	-	-	Reconnaissance stage investigation (G-4) was continued during FS 2010-12 in Rampur Group of rocks to search for quartzite and to assess its suitability for the glass industry and for other industrial purposes. Occurrences of pillow structure have been recorded in Banjar metavo-lcanics near Village Darshai . Large outcrops of white, grey and lavender quartzite belonging to Manikaran Formation of Rampur Group is exposed in the aforesaid area in northwest to the Satluj valley in Shimla & Kinnaur districts in the southeast. During the investigation, six blocks of white quartzite with average SiO_2 >96% have been delineated. White quartzite near Village Sunda have a strike length of more than 1 km with width varied from 50 m to 250 m. Quartzite near Village Darshai is white coloured, fine grained having a dimension of about 400 m length and width of around 200 m. The work is in progress
Department of Industries **Limestone**							
Mandi	Karla	-	-	02	113	-	Resources yet to be estimated.
Shimla	Vill: Gumma-	-	-	02	368	-	Resources yet to be estimated.

Table– 1: Reserves/Resources of Minerals as on 1-04-2010 : Himachal Pradesh

Mineral	Unit	Reserves: Proved STD 111	Reserves: Probable STD121	Reserves: Probable STD122	Reserves: Total (A)	Remaining resources: Feasibility STD211	Remaining resources: Pre-feasibility STD221	Remaining resources: Pre-feasibility STD222	Remaining resources: Measured STD331	Remaining resources: Indicated STD332	Remaining resources: Inferred STD333	Remaining resources: Reconnaissance STD334	Remaining resources: Total (B)	Total resources (A+B)
Antimony														
Ore	tonne	-	-	-	-	-	-	-	-	-	10588	-	10588	10588
Metal	tonne	-	-	-	-	-	-	-	-	-	174	-	174	174
Barytes	tonne	27288	-	12645	39933	-	12846	-	48904	12370	3000	-	77120	117053
Gypsum	000 tonnes	-	-	-	-	-	-	1365	-	-	3081	-	4446	4446
Limestone	000 tonnes	541555	226170	209638	977363	48410	44097	21220	1525202	1891	2830449	433	4471702	5449064
Magnesite	000 tonnes	-	-	-	-	-	-	-	-	-	298	-	298	298
Pyrite	000 tonnes	-	-	-	-	-	-	-	-	-	2560	-	2560	2560
Quartzite	000 tonnes	25	-	16	41	16	-	-	-	-	-	-	16	57
Quartz-silica sand	000 tonnes	1	-	7	8	99	-	-	-	-	2928	-	3027	3035
Rocksalt	000 tonnes	10036	-	5990	16026	-	-	-	-	-	-	-	-	16026

Figures rounded off

Table – 3 : Mineral Production in Himachal Pradesh, 2008-09 to 2010-11 (Excluding Atomic Minerals)

(Value in ₹ '000)

Mineral	Unit	2008-09			2009-10			2010-11 (P)		
		No. of mines	Quantity	Value	No. of mines	Quantity	Value	No. of mines	Quantity	Value
All Minerals		**26**		**1036722**	**26**		**1142505**	**24**		**1499659**
Barytes	t	1	582	873	1	107	161	-	-	-
Limestone	'000t	24	8158	773324	24	8411	824371	23	11467	1171695
Salt (rock)	t	1	2011	3630	1	1836	4908	1	1200	3380
Shale	t	-	674840	7573	-	924714	24700	-	1441517	36219
Minor Minerals@		-	-	251322	-	-	288365	-	-	288365

Note: *The number of mines excludes minor minerals.*
@ Figures for earlier years have been repeated as estimates, wherever necessary, because of non-receipt of data.

Mineral-based Industry

The principal large and medium-scale mineral-based industries in the organised sector in the State are given in Table - 4.

Table – 4 : Principal Mineral-based Industries in Himachal Pradesh

Industry/plant	Capacity ('000 tpy)
Cement	
ACC Ltd, Gagal, Dist. Bilaspur	4355
CCI Ltd, Rajban, Dist. Sirmaur	198
Grasim Industries, Sundernagar, Dist. Mandi	2000
Gujarat Ambuja, Darlaghat, Dist. Solan	1600
J. P. Industries Ltd,	
Bagga, Dist. Solan	2000
Baroh Sindh, Dist. Chamba	2000
India Cement, Gumma, Dist. Shimla	2000

Contd.

Table – 4 (Concld.)

Industry/plant	Capacity ('000 tpy)
Lafarge India, Alsindi, Dist. Mandi	2000
Chemical	
Bhagwati Chemical Industries, Paonta Sahib, Dist. Sirmour	8.7 (Hydrate lime)
Doon Shivalik Mineral Industries, Bhagani, Paonta Sahib, Dist. Sirmour	5.5 (Hydrate lime)
Hind Chemical Industries, Badripur Paonta Sahib, Dist. Sirmour	13.2 (Hydrate lime)
Lime Chemicals Ltd, Paonta Sahib, Dist. Sirmour	35 ($CaCO_3$)
M.I. Industries, Paonta Sahib, Dist. Sirmour	15 (Hydrate lime)
Superior Carbonate & Chemicals Ltd, Satiwala, Paonta Sahib, Dist. Sirmour	5 ($CaCO_3$)
Vashisht Chemical Pvt Ltd, Kala Amb, Paonta Sahib, Dist. Sirmour	6.3 ($CaCO_3$)

Indian Minerals Yearbook 2011

(Part- I)

50th Edition

(ADVANCE RELEASE)

STATE REVIEWS

(Jammu & Kashmir)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 001

PHONE/FAX NO. +91712 - 2565471
PBX : +91712 - 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

JAMMU & KASHMIR

Mineral Resources

Jammu & Kashmir is the sole holder of country's borax and sapphire resources and possesses 36% graphite, 21% marble and 14% of gypsum. Coal, gypsum and limestone are the important minerals produced in the State. **Coal** occurs in Poonch, Rajouri and Udhampur districts; **gypsum** in Baramulla and Doda districts; **limestone** in Anantnag, Baramulla, Kathua, Leh, Poonch, Pulwama, Rajauri, Srinagar and Udhampur districts; and **magnesite** in Leh and Udhampur districts.

Other minerals that occur in the State are **bauxite, ball clay** and **china clay** in Udhampur district; **bentonite** in Jammu district; **borax** and **sulphur** in Leh district; **diaspore** in Rajouri and Udhampur districts; **graphite** in Baramulla district; **lignite** and **marble** in Kupwara district; **quartz** and **silica sand** in Anantnag, Doda and Udhampur districts; **quartzite** in Anantnag district; and **sapphire** in Doda district (Tables - 1 and 2).

Exploration & Development

The details of exploration carried out by GSI in the state are furnished in Table - 3.

Production

The value of mineral production in Jammu & Kashmir at ₹ 71 crore during 2010-11 decreased by about 4% as compared to previous year. The minerals produced in the state were coal, limestone and gypsum. The production of coal and gypsum increased by 4% and 14% respectively while it decreased by 45% for limestone in the current year as compared to previous year (Table - 4).

The value of minor mineral production was estimated at ₹ 65 crore for the year 2010-11.

There were 10 reporting mines in 2010-11 as against 11 in the previous year.

The index of mineral production in Jammu & Kashmir (base 1993-94=100) was 139.89 in 2010-11 as against 175.21 in the previous year.

Table – 2 : Reserves/Resources of Lignite as on 1.4.2011 : Jammu & Kashmir

(In million tonnes)

District	Proved	Indicated	Inferred	Total
Total	-	**20.25**	**7.30**	**27.55**
Kupwara	-	20.25	7.30	27.55

Source: *Coal Directory of India, 2010-11.*

Mineral-based Industry

Jammu & Kashmir Cements Ltd, a State Government undertaking, operates a cement plant of 1.98 lakh tpy capacity at Khrew in Pulwama district. The company also owns a tiny cement plant of 20,000 tpy capacity located at Wuyan in Srinagar district, besides, two other tiny cement plants that have a total capacity of 39,000 tpy. The State also has a unit in Kathua district of 1,800 tpy capacity that manufactures ceramic and refractory products. A 3,000-tpy capacity calcium carbide plant is situated at Pulwama district. A calcined bauxite plant capable of producing 7,500 tpy is in operation in Jammu.

Table – 1 : Reserves/Resources of Minerals as on 1.4.2010 : Jammu & Kashmir

Mineral	Unit	Reserves				Remaining resources								Total resources (A+B)
		Proved STD 111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
			STD121	STD122			STD221	STD222						
Bauxite	'000 tonnes	-	-	-	-	-	-	-	1323	182	520	-	2025	2025
Bentonite	tonne	-	-	-	-	-	-	-	-	-	147400	-	147400	147400
Borax	tonne	-	-	-	-	-	-	-	-	-	-	74204	74204	74204
China clay	'000 tonnes	-	-	-	-	-	-	-	-	-	28122	-	28122	28122
Diaspore	tonne	-	-	-	-	-	-	-	-	566	711	-	1277	1277
Graphite	tonne	-	-	-	-	-	-	-	-	-	1059520	61681035	62740555	62740555
Gypsum	'000 tonnes	1664	153	442	2259	4784	9785	6570	7680	-	146694	-	175513	177772
Limestone	'000 tonnes	257480	5525	54100	317106	42116	21686	165199	43621	-	1001420	203	1274246	1591352
Magnesite	'000 tonnes	2610	740	-	3350	600	100	-	-	-	150	45	895	4245
Marble	'000 tonnes	-	-	-	-	-	-	-	-	-	404703	-	404703	404703
Quartz-silica sand	'000 tonnes	-	-	-	-	-	-	-	-	-	3110	-	3110	3110
Quartzite	'000 tonnes	1500	58	-	1558	-	-	-	-	-	-	-	-	1558
Sapphire	kg	-	-	-	-	-	-	-	-	-	450	-	450	450
Sulphur (native)	'000 tonnes	-	-	-	-	-	-	-	-	-	210	-	210	210

Figures rounded off.

Table – 3 : Details of Exploration Activities in Jammu & Kashmir, 2010-11

Agency/ Mineral/ District	Location/ Area/ Block	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of bore-holes	Metre-age		
GSI **Base metals** Reasi	Bakkal-Serasandhu-Khairikot	-	-	-	-	-	Reconnaissance stage investigation (G-4) was continued in this area to reassess the potentiality of Pb-Zn mineralisation and other associated metals. The area exposes lithounits belonging to Sirban Group (Proterozoic age) which is classified into two distinct formations viz. Trikuta Formation and Khairikot Formation having unconformable contact. The contact is marked by chert breccia. Surface indications of sulphide Mineralisation are seen in the form of gossans, slag pieces, ferruginisation, limonitisation, malachite staining in quartzite and presence of old workings. Presence of old workings and slag pieces near Village Sersandhu indicated ancient mining activity in the area. Galena in association with chalcopyrite and pyrite occurred in the form of disseminations, sporadic veins, stringers and fracture filling which are hosted in chert breccia and cherty dolomite mostly near the contact of Trikuta Formation and Khairikot Formation. The work is in progress.

Table – 4: Mineral Production in Jammu & Kashmir, 2008-09 to 2010-11 (Excluding Atomic Minerals)

(Value in ₹ '000)

Mineral	Unit	2008-09			2009-10			2010-11 (P)		
		No. of mines	Quantity	Value	No. of mines	Quantity	Value	No. of mines	Quantity	Value
All Minerals		**11**		**541984**	**11**		**737537**	**10**		**709979**
Coal	'000t	7	11	57800	7	23	18600	7	24	22400
Gypsum	t	1	4505	1352	2	33197	9959	2	37957	11387
Limestone	'000t	3	165	23727	2	278	59777	1	154	26991
Minor Minerals@		-	-	459105	-	-	649201	-	-	649201

Note: *The number of mines excludes minor minerals.*

@ Figures for earlier years have been repeated as estimates, wherever necessary, because of non-receipt of data.

Indian Minerals Yearbook 2011

(Part- I)

50th Edition

(ADVANCE RELEASE)

STATE REVIEWS
(Jharkhand)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 001

PHONE/FAX NO. +91712 - 2565471
PBX : +91712 - 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

JHARKHAND

Mineral Resources

Jharkhand is one of the leading mineral producing States. It is one of the leading producers of coal, kyanite, gold, silver, bauxite and felspar. Uranium ore is mined and processed by Uranium Corporation of India Ltd (UCIL) for use as fuel in the country's nuclear power reactors through four underground mines, one opencast mine, two processing plants and a by-product recovery plant, all in East Singhbhum district of the State. Jharkhand accounts for about 36% rock phosphate, 28% coal, 26% iron ore (hematite), 30% apatite, 22% andalusite, 18% copper ore and 5% silver ore resources of the country.

Important minerals that occur in the State are **bauxite** in Dumka, Gumla, Latehar, Lohardaga and Palamau districts; **china clay** in Dumka, Hazaribagh, Lohardaga, East & West Singhbhum, Sahebganj and Ranchi districts; **coal** in Bokaro, Deoghar, Dhanbad, Giridih, Godda, Hazaribagh, Palamau, Pakur and Ranchi districts; **copper** in Hazaribagh and East Singhbhum districts; **dolomite** in Garhwa and Palamau districts; **felspar** in Deoghar, Dhanbad, Dumka, Giridih, Hazaribagh, Jamtara, Koderma, Latehar, Palamau and Ranchi districts; **fireclay** in Dhanbad, Dumka, Giridih, Godda, Hazaribagh, Latehar, Palamau, Ranchi and West Singhbhum districts; **gold** in East Singhbhum district; **graphite** in Palamau district; **iron ore** (hematite) in West Singhbhum district; **iron ore** (magnetite) in Gumla, Hazaribagh, Latehar, Palamau and East Singhbhum districts; **kyanite** in Saraikala-Kharsawan and West Singhbhum districts; **limestone** in Bokaro, Dhanbad, Garhwa, Giridih, Hazaribagh, Palamau, Ranchi, East & West Singhbhum districts; **manganese ore** in East & West Singhbhum districts; **mica** in Giridih and Koderma districts; **ochre** in West Singhbhum district; **dunite/pyroxenite** in East Singhbhum district; **quartz/silica sand** in Deoghar, Dhanbad, Dumka, Giridih, Godda, Hazaribagh, Jamtara, Koderma, Latehar, Palamau, Ranchi, Sahebganj, Saraikala-Kharsawan and West Singhbhum districts; and **quartzite** in East & West Singhbhum districts.

Other minerals that occur in the State are **andalusite** and **rock phosphate** in Palamau district; **apatite, chromite, cobalt, nickel, gold** and **silver** in East Singhbhum district; **asbestos** in East & West Singhbhum districts; **barytes** in Palamau and East Singhbhum districts; **bentonite** in Pakur and Sahebganj districts; **garnet** in Hazaribagh district; **granite** in Deogarh, Dhanbad, Dumka, Giridih, Godda, Gumla, Hazaribagh, Koderma, Lohardaga, Palamau, Ranchi and East Singhbhum districts; **sillimanite** in Hazaribagh district; **talc/steatite/ soapstone** in Giridih, Kodarma, Palamau, East & West Singhbhum districts; **titanium minerals** in Ranchi and East Singhbhum districts; and **vermiculite** in Giridih and Hazaribagh districts (Table - 1). The reserve/resources of coal and the various coalfields located in Jharkhand are given in Table - 2.

Table – 1 : Reserves/Resources of Minerals as on 1.4.2010 : Jharkhand

Mineral	Unit	Reserves				Remaining resources								Total resources (A+B)
		Proved STD 111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
			STD121	STD122			STD221	STD222						
Andalusite	'000 tonnes	-	-	-	-	-	-	-	-	-	4000	-	4000	4000
Apatite	tonne	-	-	-	-	-	-	-	2110000	1620000	3540000	-	7270000	7270000
Asbestos	tonne	-	-	-	-	-	3871	18309	2885	5769	124059	-	154893	154893
Barytes	tonne	-	-	-	-	-	-	-	-	-	35900	-	35900	35900
Bauxite	'000 tonnes	16023	7290	12863	31657	5135	11341	5531	15760	17397	54447	536	110148	146323
Bentonite	tonne	-	-	609406	609406	-	3067	-	-	-	367527	-	370594	980000
China clay	'000 tonnes	8554	324	8731	17610	209	2031	1565	1936	148753	149957	18019	181081	
Chromite	'000 tonnes	-	-	-	-	-	-	-	15	98	623	-	736	736
Cobalt	million tonnes	-	-	-	-	-	-	-	-	2	-	7	9	9
Copper														
Ore	'000 tonnes	16540	49127	21151	86818	11720	17990	-	74857	64488	32252	-	201307	288126
Metal	'000 tonnes	163.03	448.83	196.91	808.78	202.76	194.30	-	869.43	606.35	412.65	-	2285.49	3094.27
Dolomite	'000 tonnes	22700	-	-	22700	-	350	-	-	54	18330	-	18734	41434
Dunite	'000 tonnes	373	-	570	943	130	-	140	607	780	6121	8637	16415	17358
Felspar	tonne	5675	-	274971	280646	-	40766	279433	32510	120388	881045	-	1354142	1634788
Fireclay	'000 tonnes	828	-	775	1602	12	479	125	-	249	64151	-	65017	66619
Garnet	tonne	-	58	234	292	-	-	88303	-	-	21768	-	110071	110071
Gold														
Ore (primary)	tonne	38059	-	-	38059	-	-	-	-	5164277	2949012	-	8113289	8151348
Metal (primary)	tonne	0.13	-	-	0.13	-	-	-	-	3.73	8.87	-	12.60	12.73
Granite														
(Dim. stone)	'000 cu m	-	-	-	-	-	-	-	-	651300	8197110	26930	8875340	8875340
Graphite	tonne	382036	72670	645823	1100529	47073	236783	1666551	2750	1855192	6798641	24350	11810340	12910869
Iron ore														
(hematite)	'000 tonnes	1840594	391052	72496	2304142	89372	14339	113334	45282	199455	594716	1000000	2292478	4596620
Iron ore (magnetite)	'000 tonnes	-	361	551	912	-	5	11	411	3948	2472	32	6879	10269
Kyanite	tonne	267222	524485	402325	1194032	-	-	-	-	1754900	3048500	-	4803400	5708533
Limestone	'000 tonnes	244259	4105	54713	203077	894	1630	2772	1956	9460	382745	1503	400961	745779

(Contd.)

Table - 1 (Concld.)

Mineral	Unit	Reserves: Proved STD 111	Reserves: Probable STD121	Reserves: Probable STD122	Reserves: Total (A)	Remaining resources: Feasibility STD211	Remaining resources: Pre-feasibility STD221	Remaining resources: Pre-feasibility STD222	Remaining resources: Measured STD331	Remaining resources: Indicated STD332	Remaining resources: Inferred STD333	Remaining resources: Reconnaissance STD334	Remaining resources: Total (B)	Total resources (A+B)
Manganese ore	'000 tonnes	1250	620	1586	3456	396	211	3053	-	-	6594	-	10254	13709
Mica	kg	-	-	-	-	-	-	-	-	-	1494430	170700	1665130	1665130
Nickel ore	million tonnes	-	-	-	-	-	-	-	-	2	7	-	9	9
Ochre	tonne	63695	-	4361	68056	-	-	-	-	-	-	-	147039	215095
Phosphorite/ Rock phosphate	tonne	858	-	328	1185	-	-	-	-	-	107370000	-	107370000	107370000
Quartz-silica sand.	'000 tonnes	563	40	8671	9238	2	989	3299	518	758	135745	6	140352	154766
Quartzite	'000 tonnes	1079	-	174	1253	-	-	-	197	275	38934	-	39405	40230
Sillimanite	tonne	-	-	-	-	-	-	-	-	-	83000	-	83000	83000
Silver														
Ore	tonne	-	-	-	-	-	-	-	-	-	23840000	-	23840000	23840000
Metal	tonne	-	-	-	-	-	-	-	-	-	5.22	-	5.22	5.22
Talc-steatite-soapstone	'000 tonnes	-	-	-	31	1	-	73	2	4	250	-	311	342
Titanium minerals	tonne	-	-	-	-	-	-	-	-	3630000	-	-	3630000	3630000
Vermiculite	tonne	-	-	-	-	-	-	-	-	-	30048	-	30048	30048

Figures rounded off.

** Resources of ilmenite, rutile, leucoxene and zircon, as per Department of Atomic Energy, are provided in the respective Mineral Reviews.*

Table – 2 : Reserves/Resources of Coal as on 1.4.2011 : Jharkhand

(In million tonnes)

Coalfield	Proved	Indicated	Inferred	Total
Total	**39633.05**	**30992.38**	**6338.26**	**76963.69**
Raniganj	1538.19	466.56	31.55	2036.30
Jharia	15077.57	4352.49	-	19430.06
East Bokaro	3351.87	3929.57	863.32	8144.76
West Bokaro	3629.03	1349.04	34.42	5012.49
Ramgarh	446.27	545.15	58.05	1049.47
North Karanpura	9499.42	5708.86	1864.96	17073.24
South Karanpura	2748.09	2048.56	1508.88	6276.87
Aurangabad	213.88	2279.82	503.41	2997.11
Hutar	190.79	26.55	32.48	249.82
Daltongunj	83.86	60.10	-	143.96
Deogarh	326.24	73.60	-	399.84
Rajmahal	2655.52	11751.26	1715.28	16122.06

Source: *Coal Directory of India, 2010-11.*

Exploration & Development

The details of exploration activities conducted by various agencies during 2010-11 are furnished in Table - 3.

Production

The value of mineral production in Jharkhand during 2010-11 at ₹ 20,444 crore increased by about 33% over the previous year. Claiming the second position in the country the state accounted for about 9% of total value of mineral production during 2010-11. Coal, the principal mineral produced in the state contributed 91% of the total value of mineral production in the state followed by iron ore 8%. The other principal minerals produced in the state were bauxite, copper ore and conc., dolomite, kyanite, graphite (r.o.m.), quartz and quartzite. Jharkhand was the leading producer of kyanite; second largest producer of coal, graphite(r.o.m), pyroxenite and quartzite. Among the important minerals, production of quartzite increased by more than double and that of graphite (r.o.m.) by 67%, fireclay 47%, felspar 45% and pyroxenite 11%. However, during 2010-11 the output of manganese ore declined by 86%, laterite 76%, kyanite 20% and kaolin by 14% as compared with the previous year. In the current year no production of pyrophyllite was reported from the state.

The value of minor mineral production was estimated at ₹ 40 crore for the year 2010-11. The number of reporting mines in Jharkhand during 2010-11 was 291 as against 299 in the previous year.

The index of mineral production in Jharkhand (Base1993-94=100) was 147.76 in 2010-11 as compared to 143.82 in the previous year (Table - 4).

Table – 3 : Details of Exploration Activities in Jharkhand, 2010-11

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks
		Scale	Area (sq km)	No. of boreholes	Metreage		Reserves/Resources estimated
GSI							
Gold							
Ranchi	Sindauri-Ghanshyampur	-	-	-	-	-	Prospecting stage investigation (G-3) was taken up during FS 2010-12 in Dalma volcanics and Singhbhum metasedimentary domain to assess the gold potentiality in this area. The domain consists of a volcano-sedimentary sequence comprising of quartz-chlorite-sericite schist, quatrzite and phyllite in which foliation varies from ENE-WSW with steep dip on either side along with laterites The associated sheared smoky/grey quartz vein is abundant but found to be unmineralised but the thin white coarse grained quartz vein which is limonitic in nature are gold bearing. Wall rock alterations in the form of chloritisation, carbonatization silicification, epidiotisation, etc. are noticed. The geochemical samples (BRS) indicated gold values ranging from 50 ppb to 1.5 ppm. In the borehole, sulphide mineralisation is massive to disseminated, with network of quartz stringers, veinlets and veins forming stockworks. Sulphide minerals are arsenopyrite, pyrite, chalcopyrite, pyrrhotite. The work is in progress.
Saraikela-Kharswan	Rudia Largadih Balidih	-	-	-	-	-	Prospecting stage investigation (G-3) was taken up during FS 2010-12 in North Singhbhum Mobile Belt to assess the gold potentiality. The area represents Proterozoic Dalma Volcanic Belt, which is flanked by the metasedimentaries of the Singhbhum Group. The Rudia Block comprises lithopackages of carbonaceous phyllite, acid volcanics, siliceous tuff, mafic (metabasalt)/ ultramafic (pyroxenite), breciated quartzite belonging to the Upper Dalma Formation (Dalma volcanics) and the metasedimentaries of the Chandil Formation.

(Contd.)

Table - 3 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks
		Scale	Area (sq km)	No. of boreholes	Metreage		Reserves/Resources estimated
GSI							
Gold Saraikela-Kharswan	Rudia Largadih Balidih	-	-	-	-	-	The lithounits are intensely sheared and is manifested by silicification, brecciation, ferrugination and is traversed by quartz veins/reefs. Sulfides occur in the form of stringers and disseminations in brecciated Ferruginous Quartzite and the associated volcanogenic siliceous tuffs. The sulphides comprise pyrite, pyrrhotite, arsenopyrite, shalerite and chalcopyrite with the first two constituting 70% of the total sulphides. Occasional visible gold specks are associated with sulphides. The work is in progress
West Singhbhum	Tilaitanr-Sobhapur	-	-	-	-	-	Prospecting stage investigation (G-3) was continued in Archaean greenstone belt to assess the gold, nickel and chromium potentiality in the area. . The lithounits belong to Gourumahisani – Badampahar greenstone belt of Archaean age. The northern part of the mapped area is along the contact with Chaibasa Formation while southern contact is in juxtaposition with Singhbhum Granite. The rock types exposed in the area include interbanded sequence of phyllite, tuffaceous phyllite, banded iron formation and chlorite schist which are occasionally sheared. The phyllitic unit is occasionally profusely intruded by thin veinlets of quartz. The trend of the lithopackage is ENE-WSW with dips towards north. The sulphide mineralisation is present in the form of pyrite and chalcopyrite within the quartz veins and veinlets which intrudes the phyllitic unit along foliation. The work is in progress.

(Contd.)

Table - 3 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks
		Scale	Area (sq km)	No. of boreholes	Metreage		Reserves/Resources estimated
GSI **REE** Ranchi	Kotam Kutru	-	-	-	-	-	Reconnaissance stage investigation (G- 4) has been taken up during FS 2010-12 in Chhotanagpur Gneissic Complex around this area to assess rare metal and REE potentials. The investigation was taken up based on the higher content of Cs, Li and Rb in trench and BRS samples from pegmatite bodies during earlier surveys. The area formed a part of the Chhotanagpur gneissic terrain. The dominant litho units consist of metamorphic assemblages with metasedimentary enclaves. The gneisses and granitoids are intersected by metabasic intrusive along with quartz and pegmatite veins.The ENE-WSW trending North Purulia Shear Zone (NPSZ), which cuts across the area, is the potential domain for REE mineralisation. The Kotam - Kutru Block is mostly soil covered. Sampling has been carried out in pegmatite bodies and sent for chemical analysis. The work is under progress.
SAIL **Iron ore** **(Hematite)** Singhbhum (W)	Kiriburu	1:2,000	2760.00	14	1017.00	-	The rock exposed in this region consists of a series of Precambrian Formations of iron ore. Geological structure of the are consists of inter layer of shales & BHQ/BHJ and irregularly overlying shales float ore & laterite sediments of recent formation. Strike extension of the deposit was found about 2000 m & depth – 138 m. about 24.62 million tones with an average grade of 62.70% Fe were estimated.
-do- Singhbhum (W)	Meghatatuburu	-	-	-	-	750	Deposit belonged to Precambrian formation structurally the deposit is controlled by folded, fault & joint. Continuity of the ore types are not homogeneous, rather occurred in patches. As on 1.4.2011 total iron ore resources were estimated at 51.42 million tonnes.

(Contd.)

Table - 3 (Concld.)

Agency/ Mineral/ District	Location	Mapping: Scale	Mapping: Area (sq km)	Drilling: No. of boreholes	Drilling: Metreage	Sampling	Remarks Reserves/Resources estimated
DMG **Coal** Latehar	Jalta-Parsahi	1:4,000	-	08	2248.50	367	The area represents western part of Auranga Coalfield belt. Coal seams were not exposed on the surface.
-do- Ramgarh	Burhakhap	1:4,000	-	06	1270.50	278	Area is a part of lower Gondwana formation, Barakar sandstone, shale, shaly coal, coal, carbonaceous shales were found in the area. Extension depth & grade yet to be established. Resources were not estimated.
Iron ore Singhbhum (N)	Silpunji - Kantoria, Noamundi	1:12,500	58.0	-	-	70	Occurrences of discontinuous lentoid residual deposits of iron ore were noticed in this area. The iron ore particularly in this area occurred within lateritic pockets developed over BHJ, small iron ore bodies were also noticed in the form of capping which are mostly confined to shale formation. At some places iron ore is being mined from BHJ. Resources of iron ore were not estimated.
Limestone Ramgarh	Ladi-Chikore	1:50,000 1:4,000	7.5 0.56	01	29.31	32	The area represented by proterozoic limestone, which is crystalline in nature, limestone is interstrafied with phyllite. About 1.03 million tonnes resources of limestone were estimated.

Table – 4 : Mineral Production in Jharkhand, 2008-09 to 2010-11 (Excluding Atomic Minerals)

(Value in ₹ '000)

Mineral	Unit	2008-09			2009-10			2010-11 (P)		
		No. of mines	Quantity	Value	No. of mines	Quantity	Value	No. of mines	Quantity	Value
All Minerals		**300**		**108106071**	**299**		**154258203**	**291**		**204440493**
Coal	'000t	173	96272	96741700	174	105917	140529500	174	108949	185716200
Petroleum (crude)	'000t	-	-	-	-	-	-	-	-	-
Bauxite	t	34	1585356	552684	35	1670577	673016	36	1827805	619458
Copper ore	t	-	328168	-	-	387843	-	-	396841	-
Copper conc.	t	1	11415	338694	1	13080	402092	1	12904	428308

(Contd.)

Table –4 : (Concld.)

(Value in ₹ '000)

Mineral	Unit	2008-09			2009-10			2010-11 (P)		
		No. of mines	Quantity	Value	No. of mines	Quantity	Value	No. of mines	Quantity	Value
Gold ore	t	-	4307	-	-	5066	-	-	4035	-
Gold	kg	1	18	21883	1	14	21251	1	14	27946
Iron ore	'000t	21	21329	9246556	19	22547	11242048	20	23174	16393379
Manganese ore	t	2	16044	14025	3	39875	41472	2	5759	25463
Dolomite	t	1	301341	271207	1	422019	379817	1	429866	386879
Felspar	t	3	10815	1864	3	10778	1904	3	15607	2288
Fireclay	t	6	12711	1652	6	16145	1912	6	23772	2910
Graphite (r.o.m.)	t	9	14405	5267	9	26714	9518	8	44536	15030
Kaolin	t	13	168922	92050	13	106828	102218	8	92029	90212
Kyanite	t	1	3615	4407	1	4420	4862	1	3547	4156
Laterite	t	-	4869	752	-	5084	667	-	1220	183
Limestone	'000t	20	1943	351690	18	1924	384303	15	1737	271079
Ochre	t	-	-	-	-	-	-	1	1200	205
Pyrophyllite	t	1	4629	2315	1	1007	614	-	-	-
Pyroxenite	t	4	50875	13297	3	49638	13176	3	54987	13798
Quartz	t	8	39434	5607	9	68331	13420	9	72413	7034
Quartzite	t	1	2014	201	1	10737	2147	1	24658	5242
Silica sand	t	1	120170	38772	1	91597	32818	1	85236	29275
Minor Minerals@		-	-	401448	-	-	401448	-	-	401448

Note: *The number of mines excludes minor minerals.*
@ Figures for earlier years have been repeated as estimates because of non-receipt of data.

Mineral-based Industry

The principal large and medium-scale mineral-based industries in the organised sector in the State are given in Table - 5.

Table – 5 : Principal Mineral-based Industries in Jharkhand

Industry/plant	Capacity ('000 tpy)
Alumina	
Hindalco Industries Ltd, Muri	450
Asbestos Products	
Hyderabad Industries Ltd, Jasidih, Dist. Deogarh	60
Cement	
ACC Ltd, Chaibasa, Dist. Singhbhum	870
ACC Ltd, Sindri, Dist. Dhanbad	600
Lafarge, Jojobera, Dist. Singhbhum	3000
Lemos Cement, Khalari, Dist. Ranchi	109
Sri Durga Cement Ltd, Hosla, Dist. Ramgarh	33
Sone Valley, Japla	254
Ceramic	
Bihar Industrial Corp. Ltd, Madhupur, Dist. Deoghar	0.48
Maithan Ceramics Pvt. Ltd, Dhanbad	NA
Chemicals	
Bihar Caustic & Chemicals Ltd, Garhwa Road, Dist. Palamau	92.75 (caustic soda lye)
Copper Smelter	
HCL, ICC, Ghatsila, Dist. Singhbhum (East)	18.5 (copper cathode) 84 (fabricated wire bar) 54(H_2SO_4) 390 t ($NiSO_4$) 480 kg ($CuSO_4$) 14.6 kg (selenium) 9868 kg (Ag) 698 kg (Au)
Foundry	
Hindustan Malleables & Forgings Ltd, Jalan Nagar, Dhanbad	NA
Iron & Steel	
Bokaro Steel Plant, Bokaro	6200 (sinter) 4585 (pig iron) 3780 (saleable steel) 4360(Crude/liquid steel) 35.5 (H_2SO_4)

(Contd.)

Table - 5 (Concld.)

Industry/plant	Capacity ('000 tpy)
Tata Steel Ltd, Jamshedpur	27.2 (ammonium sulphate) 2500 (pellets) 4808 (saleable steel) 6800 (Crude/liquid steel)
Sinters & Pellets	
Tata Steel Ltd, Noamundi	800
Pig Iron	
Usha Martin Industries, Jamshedpur	110
Sponge Iron	
Bihar Sponge Iron Ltd, Chandil, Dist. Saraikela-Kharsawan	186
Jai Durga Iron Pvt. Ltd, Jhumari Tellaiya, Dist. Koderma	36
Zoom Vallabh Steels Ltd, Dugdha, Dist. Saraikala-Kharswan	120
Ferro Alloys	
Anjani Ferro Alloys Ltd, Mihijam	NA
Gautam Ferro Alloys Ltd	5.5
Tin Plates	
The Tin Plate Co. of India Ltd, Jamshedpur	379 (electrolytic tin plate)
Glass	
IAG Co. Ltd, Bhandainagar	66.8
Refractory	
Allied Refractories (P) Ltd, Amaghata	7.2
Bharat Refractories Ltd, Marar, Dist. Hazaribagh (Ranchi Road Refractories Ltd.)	7.2
Bharat Refractories Ltd, Marar, Dist. Hazaribagh (IFICO Refractories Ltd)	42
Bharat Refractories Ltd, Bhandaridah, (Bhandaridah Refractory Plant) Dist. Bokaro	26
Jharia Firebricks Pottery Works (P) Ltd, Dhansar, Dist. Dhanbad	20
Mineral & Chemical Products, Kendposi, Dist. West Singhbhum	1.5 (calcined china clay)
Raj Refractory (P) Ltd, Hardag, Dist. Ranchi	6

Indian Minerals Yearbook 2011

(Part- I)

50th Edition

(ADVANCE RELEASE)

STATE REVIEWS
(Karnataka)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 001

PHONE/FAX NO. +91712 - 2565471
PBX : +91712 - 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

KARNATAKA

Mineral Resources

Karnataka has the distinction of being the principal gold producing State in the country. The State is the sole producer of felsite and leading producer of iron ore, chromite and dunite. Karnataka hosts the country's 78% vanadium ore, 73% iron ore (magnetite), 42% tungsten ore, 37% asbestos, 28% limestone, 22% gold, 20% granite, 17% dunite, and 14% corundum resources.

The important mineral-occurrence found in the State are **bauxite** in Belgaum, Chickmagalur, Uttara & Dakshina Kannada and Udupi districts; **china clay** in Bengaluru, Belgaum, Bellary, Bidar, Chickmagalur, Dharwad, Gadag, Hassan, Haveri, Kolar, Uttara & Dakshina Kannada, Shimoga and Tumkur districts; **chromite** in Chickmagalur, Hassan and Mysore districts; **dolomite** in Bagalkot, Belgaum, Bijapur, Chitradurga, Mysore, Uttara Kannada and Tumkur districts; **dunite/ pyroxenite** in Chickmagalur, Hassan and Mysore districts; **felspar** in Bengaluru, Belgaum, Chitradurga and Hassan districts; **fireclay** in Bengaluru, Chitradurga, Dharwad, Hassan, Kolar, Shimoga and Tumkur districts; **gold** in Chitradurga, Dharwad, Gadag, Gulbarga, Hassan, Haveri, Kolar, Raichur and Tumkur districts; **iron ore (hematite)** in Bagalkot, Bellary, Bijapur, Chickmagalur, Chitradurga, Dharwad, Gadag, Uttara Kannada, Shimoga and Tumkur districts; **iron ore (magnetite)** in Chickmagalur, Hassan, Uttara & Dakshina Kannada and Shimoga districts; **kyanite** in Chickmagalur, Chitradurga, Coorg, Mandya, Mysore, Shimoga and Dakshina Kannada districts; **limestone** in Bagalkot, Belgaum, Bellary, Bijapur, Chickmagalur, Chitradurga, Davangere, Gadag, Gulbarga, Hassan, Mysore, Uttara & Dakshina Kannada, Shimoga, Tumkur and Udupi districts; **magnesite** in Coorg, Mandya and Mysore districts; **manganese ore** in Belgaum, Bellary, Chickmagalur, Chitradurga, Davangere, Uttara Kannada, Shimoga and Tumkur districts; **ochre** in Bellary and Bidar districts; **quartz/silica sand** in Bagalkot, Bengaluru, Belgaum, Bellary, Chickmagalur, Chitradurga, Davangere, Dharwad, Gadag, Gulbarga, Hassan, Haveri, Kolar, Koppal, Mandya, Mysore, Uttara & Dakshina Kannada, Raichur, Shimoga, Tumkur and Udupi districts; **Quartzite** in Belgaum district; and **talc/steatite/soapstone** in Bellary, Chickmagalur, Chitradurga, Hassan, Mandya, Mysore, Raichur and Tumkur districts.

Other minerals that occur in the State are **asbestos** in Chickmagalur, Hassan, Mandya, Mysore and Shimoga districts; **barytes** and **pyrite** in Chitradurga district; **calcite** in Belgaum, Bijapur and Mysore districts; **copper** in Chickmagalur, Chitradurga, Gulbarga, Hassan, Uttara Kannada, Raichur and Shimoga districts; **corundum** in Bengaluru, Bellary, Chitradurga, Coorg, Hassan, Mandya, Mysore and Tumkur districts; **fuller's earth** in Belgaum and Gulbarga districts; **granite** in Bagalkot, Bengaluru, Bellary, Bijapur, Chamrajanagar, Chickmagalur, Chitradurga, Coorg, Dharwar, Gadag, Gulbarga, Hassan, Kolar, Koppal, Mandya, Mysore, Uttara & Dakshina Kannada, Raichur, Tumkur and Udupi districts; **graphite** in Kolar and Mysore districts; **gypsum** in Gulbarga district; **molybdenum** in Kolar and Raichur districts; **nickel** in Uttara Kannada district; **sillimanite** in Hassan, Mysore and Dakshina Kannada districts; **silver** in Chitradurga and Raichur districts; **titanium minerals** in Hassan, Uttara Kannada and Shimoga districts; **tungsten** in Gadag, Kolar and Raichur districts; **vanadium** in Hassan, Uttara Kannada and Shimoga districts; and **vermiculite** in Hassan, Mandya and Mysore districts (Table - 1).

Exploration & Development

The details of exploration activities conducted by various agencies during 2010-11 are furnished in Table - 2.

Table – 1 : Reserves/Resources of Minerals as on 1.4.2005 : Karnataka

Mineral	Unit	Reserves: Proved STD 111	Reserves: Probable STD121	Reserves: Probable STD122	Reserves: Total (A)	Remaining resources: Feasibility STD211	Remaining resources: Pre-feasibility STD221	Remaining resources: Pre-feasibility STD222	Remaining resources: Measured STD331	Remaining resources: Indicated STD332	Remaining resources: Inferred STD333	Remaining resources: Reconnaissance STD334	Remaining resources: Total (B)	Total resources (A+B)
Asbestos	tonne	-	-	-	-	-	-	-	-	2441037	5841420	-	8282457	8282457
Barytes	tonne	-	-	-	-	-	-	-	-	-	15175	-	15175	15175
Bauxite	000 tonnes	5399	542	-	5941	1735	394	10	-	2220	45405	-	49764	55705
Calcite	tonne	-	-	-	-	-	-	64	-	14400	51865	-	66329	66329
China clay	000 tonnes	943	835	280	2058	819	738	3390	220360	443	24685	6030	256466	258524
Chromite	000 tonnes	333	395	17	745	250	218	96	-	20	303	-	887	1632
Copper														
Ore	000 tonnes	836	1301	373	2510	-	-	2008	1750	6833	20434	-	31025	33535
Metal	000 tonnes	8.78	17.56	4.31	30.65	-	-	11.24	22.00	65.77	99.61	-	198.62	229.27
Corundum	tonne	-	-	-	-	-	756	105885	13	38	14169	526000	646860	646860
Dolomite	000 tonnes	86077	31399	10889	128365	18585	7826	15391	8519	17578	465852	-	533751	662116
Dunite	000 tonnes	3718	-	223	3940	-	-	-	23909	-	4149	-	28058	31998
Felspar	tonne	119525	69575	107055	296155	-	-	-	25000	135133	177300	3900	341333	637488
Fireclay	000 tonnes	95	324	85	503	792	595	6871	-	226	5250	-	13734	14238
Fuller's earth	tonne	-	-	58200	58200	-	-	-	-	551640	1471276	-	2022916	2081116
Gold														
Ore (primary)	tonne	16007614	7215335	863529	24086478	1168000	790000	215132	24979968	8204595	12003638	37355000	84716333	108802811
Metal (primary)	tonne	70.89	31.77	7.75	110.41	3.09	2.49	0.78	120.7	28.67	27.2	43.66	226.59	337.00
Granite (Dim. stone)	000 cu m	26363	19389	21836	67588	-	-	-	238	1231625	8012784	25659	9270306	9337894
Graphite	tonne	727	20820	1312	22859	7500	18750	-	-	18200	-	-	44450	67309
Gypsum	000 tonnes	-	-	-	-	-	-	-	-	-	3784	-	3784	3784
Iron ore (Hematite)	000 tonnes	602685	95458	178723	876866	73194	171202	59231	245454	42843	501669	188218	1281811	2158678

(Contd.)

Table-1 (Contd.)

Mineral	Unit	Reserves				Remaining resources								Total resources (A+B)
		Proved STD 111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
			STD121	STD122			STD221	STD222						
Iron ore														
(Magnetite)	000 tonnes	-	-	-	-	120022	-	18375	1498957	479372	5345018	340000	7801744	7801744
Kyanite	tonne	-	-	-	-	309525	21600	18843	386247	1610502	10688721	-s	13035438	13035438
Limestone	000 tonnes	538927	486300	72518	1097745	171995	394671	453541	1573788	13919929	34579866	8240	51102029	52199775
Magnesite	000 tonnes	332	202	163	697	18	-	499	88	10	2734	-	3349	4046
Manganese ore	000 tonnes	11455	1827	2821	16103	6056	3730	7523	2227	7385	52893	270	80085	96188
Molybdenum														
Ore	tonne	-	-	-	-	-	-	-	-	-	1320900	-	1320900	1320900
Contained														
MoS_2	tonne	-	-	-	-	-	-	-	-	-	1719	-	1719	1719
Nickel ore	Million tonnes	-	-	-	-	-	-	-	-	-	0.23	-	0.23	0.23
Ochre	tonnes	-	-	-	-	-	-	1766367	-	-	-	20000	1786367	1786367
Platinum group														
of metals	tonne	-	-	-	-	-	-	-	-	-	-	1.50	1.50	1.50
Pyrites	000 tonnes	-	-	-	-	-	-	-	-	-	3000	-	3000	3000
Quartzite	000 tonnes	390	-	1011	1401	-	-	190	-	-	-	1730	1920	3321
Quartz-														
silica sand	000 tonnes	8677	3809	2375	14861	12402	4970	8276	205	100	49508	525	75987	90848
Sillimanite	tonne	-	-	-	-	-	-	-	-	-	982725	-	982725	982725
Silver														
Ore	tonne	8681065	-	-	8681065	-	-	69462	-	-	314150	-	383612	9064677
Metal	tonne	2.67	-	-	2.67	-	-	0.48	-	-	2.92	-	3.40	6.07
Talc-steatite-														
soapstone	000 tonnes	35	-	182	217	49	124	217	11	208	1242	-	1851	2068

(Contd.)

Table-1 (Concld.)

Mineral	Unit	Reserves: Proved STD 111	Reserves: Probable STD121	Reserves: Probable STD122	Reserves: Total (A)	Remaining resources: Feasibility STD211	Remaining resources: Pre-feasibility STD221	Remaining resources: Pre-feasibility STD222	Remaining resources: Measured STD331	Remaining resources: Indicated STD332	Remaining resources: Inferred STD333	Remaining resources: Reconnaissance STD334	Remaining resources: Total (B)	Total resources (A+B)
Titanium minerals*	tonne	-	-	-	-	-	-	-	-	-	13862094	-	13862094	13862094
Tungsten														
Ore	tonne	-	-	-	-	-	-	-	15361152	11805499	172921	9338246	36677818	36677818
Contained WO_3	tonne	-	-	-	-	-	-	-	2915	1775	142	1403	6235	6235
Vanadium														
Ore	tonne	-	-	-	-	-	500000	4000000	-	-	14884430	-	19384430	19384430
Metal	tonne	-	-	-	-	-	700	5600	-	-	43197.55	-	49497.55	49497.55
Vermiculite	tonne	-	-	-	-	-	69050	64500	-	1562	66658	-	201770	201770

Figures rounded off

* *Resources as per Department of Atomic Energy areprovidedinthe respective Mineral Reviews.*

Table – 2 : Details of Exploration Activities in Karnataka, 2010-11

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks
		Scale	Area (sq km)	No. of boreholes	Metreage		Reserves/Resources estimated
GSI **Diamond** Raichur	Parts of Raichur	-	-	-	-	-	Reconnaissance stage investigation (G-4) was been taken up during FS 2010-12 in Dharwar craton to locate kimberlites in the area based on the previous finds of kimberlites (Raichur Kimberlite Field). The area is well traversed by a network of several dykes mostly trending E-W, NW-SE. Emphasis was also given to identify the surface indication of possible ultramafic bodies/ kimberlite from calcrete and tonal variations in the soil. Stream sediment samples was collected from the best possible trap sites near natural obstacles. Two suspected Cr-diopside grains were recovered from one stream sediment sample. The anomaly zones from the Aero-magnetic data obtained from RSAS are under investigation. The work is in progress
Kolar	Bangalore-Penukonda	-	-	-	-	-	Regional ground Evaluation of Aero Magnetic and AeroRadiometric data in this block was carried out during FS 2010-12 to search for kimberlite bodies, gold and any other mineralisation. Geological traverses using scintillometer were taken in anomalous zones. North of Masalahalli in a leocogranite quarry within a pegmatite intrusion, a high radiometric value of >1mR/hr compared to 0.2 m R/hr bgc was observed. west of kachanayakkanahalli, a pegmatite vein within ganite gneiss yielded high radiometric value of 1 mR/hrs. West of Chellammakotikonda, pegmatite vein with grey granite yielded high radiometric value of 1 mR/hr. Suspected uranite/thorianite crystals were found within the pegmatite body. The work is in progress

(Contd.)

Table - 2 (Contd.)

Agency/ Mineral/ District	Location		Mapping Scale	Area (sq km)	Drilling No. of boreholes	Metreage	Sampling	Remarks Reserves/Resources estimated
GSI **Gold** Tumkur	Ajjanahalli Block-D and Block-E	1:12,500 1:1,000	9.0 0.5	06	-	407 103		Prospecting stage investigation (G-3 and G-4 Stage) in Chitradurga Schist Belt for Gold , was taken up in this sector which constitutes several gold prospects including the present Block-D, where earlier investigation identified mineralisation in BIF and adjacent country rocks. Drilling has been taken up to study the subsurface nature, behaviour, depth persistence and gold content of the auriferous Banded Iron Formation (BIF) bands. In Block –D. all the boreholes have intersected the targeted mineralised zones at anticipated depths. The gold assay value of ADG-5 (Zone-V is 0.58 g/t / 2.00 m); for ADG-6, the average assay values are 1.16 g/t / 1.5 m (Zone-IV) and 1.17 g/t / 1.00 m (Zone-V) respectively. The maximum value recorded in Zone-VI is 0.45 g/t over a width of 0.50 m. In ADG-7 (Zone-IV) the average assay value is 0.87g/t over width of 1.5 m (the maximum value recorded is 1.19g/t/0.50 m) and part of analytical result received for ADG-8 (Zone –VIII) is 0.30g/t Au x 1.00 m. The electrical resistivity and magnetic susceptibility have demarcated the shear zones, which are significant locales of gold mineralisation. The study of anomalies of various geophysical parameters confirms 5 mineralized zone. The mineralized zones well collaborates with the drill core logging and geophysical logging. An area in and around Dasudi,. Karebalanahatti and Marenadupalya in Block-E. Four parallel to sub parallel potential auriferous BIF bands have been delineated. Bedrock samples have been collected from all the four BIF bands.

(Contd.)

Table - 2 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Metreage		
GSI **Gold** Tumkur (Contd.)	Ajjanahalli Block-D and Block-E	1:12,500 1:1,000	9.0 0.5	06	-	407 103	In Block-E, six BIF bands we delineated. The BIF is sheared, wi quartz carbonate veins/veinlets, high limonitised, having oxidized sulphid often noticed in the form of vugs ar cavities. There are sheared quar veins, of which some are boudinage a cumulative strike length of 4900 has been established. A total of 180 c m of trenching has been carried out c Band-I, IV, V and VI to access t width, strike continuity and go potentiality of BIF bands. The work in progress.
- do -	Adivala-Obalapura & Mavinamadu	-	78.0	-	-	254	Reconnaissance stage investigatio (G-4) was taken up during FS 2010-1 in Chitradurga Schist belt, to assess t auriferous nature and locales possible gold mineralisation in t eastern shear of the Chitradurga Sch Belt. A total of six BIF bands we delineated during LSM. These ban are mineralized and strike in NE-SW NW-SE with steep dips towards ea The width of the band varies from 2 to 6 m Surface manifestation mineralisation is noticed noticed in t form of alteration, silicificatio shearing, limonitisation, sulphi dissemination, carbonitisation ar leaching within BIF and carbonat metabasalt. Fine disseminations pyrite, arsenopyrite, chalcopyrite ar pyrrhotite have been noticed within t lithounits. . Auriferous zones have be identified in the westernmost ar central BIF bands. The work is progress.

(Contd.)

Table - 2 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks
		Scale	Area (sq km)	No. of boreholes	Metreage		Reserves/Resources estimated
GSI							
Gold Tumkur	Bhairapura and Hosahalli					06	Reconnaissance stage investigation (G-4) for gold mineralisation in Shimoga Schist Belt has been initiated during FS 2010-12. This is one of the important schist belt in Western Dharwar Craton and. The most important prospects in the southern part of the schist belt having gold potentiality are Jalagaragundi, Siddarahalli, Honnahatti and Singanamane area. Auriferous zone has been identified at the contact of granite gneiss and metabasalt in the central portion of Kenchapura hill which is located 1.5 km north of Village Kenchapura. Trench samples analyzed gold values upto 11.26 ppm. A total of 6 samples have analysed gold values ranging from 0.86 ppm to 2.19 ppm. Surface manifestations of auriferous sulphide mineralisation is noticed in the form silicification, limonitisation, sulphide dissemination, carbonitisation and leaching within quartz-chlorite schist and quartz carbonate rock associated with talc-chlorite schist. The work is in progress.
Hutti Gold Mines Co. Ltd							
Gold							
Raichur	Hutti	1:400	- (UG)	-	-	-	Out of the total 18.34 million tonnes of gold resources estimated, 9.18 million tonnes indicated 5.6894 g/t Au and 9.16 million tonnes contained Au @5.68 g/t.
-do-	Hira Buddini	-	-	-	-	2340	About 567.10 m of exploratory mining was carried out. About 0.75 million tonnes gold resources were estimated with presence of Au @ 3.26 g/t.
-do-	Uti	1:2,000	3.00	-	-	-	Around 294.60 m of exploratory mining was carried out. Out of 61.48 lakh tonnes resources estimated, indication of Au values in 0.11 lakh tonnes was @ 2.06 g/t); in 54.40 lakh tonnes it was @ 2.51 g/t); and in 6.97 lakh tonnes it was @2.06 g/t.

(Contd.)

Table - 2 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks
		Scale	Area (sq km)	No. of boreholes	Metreage		Reserves/Resources estimated
GSI **Ironore** Chitradurga	Kenkeri, Melanahalli, Guruvapura, Kempanahalli Dasudi, Kandikere	-	-	-	-	-	Reconnaissance stage investigation (G- 4) was initiated during FS 2010-12 s for preliminary assessment of the iron ore occurrences in parts of Chitradurga Schist Belt . Large scale mapping in Melanahalli and Guruvapura Blocks has brought out three bands of BIF. The analytical results of four samples collected from trench nos. T3/CSB and T5/CSB in Guruvapura Block analysed 33.23 to 34.01 wt% Fe. A higher value of 55.01 % Fe was obtained near a fold closure indicating a structural control for the ore concentration. Bed rock samples have given value range of 20.11 wt % to 46.91 wt % Fe. The investigation is in progress. In Devadaribetta Range (NMDC block), Bellary district, which was explored during FS 2005-08, a Reconnaissance resource (334) of 8.20 million tones of iron ore(Hematite) with 57.37 Fe has been estimated.
GSI **Limestone** Bagalkot	Jalikatti, Lokapur and adjoining areas	-	-	-	-	-	Reconnaissance (G-4) stage investigation has been taken up during FS 2010-12 as per request of DGM, Karnataka in Kaladgi basin around this areas (DMG blocks: A and B) of Bagalkot district to assess for SMS grade limestone for alkali content. Preliminary assessment indicates that the dark grey limestone belonging to Yendigere Formation tentatively conforms to the specifications of flux and SMS grade limestone. The work is under progress to categorize the limestone based on chemical analysis results. Evidences of stromatolites have been noted in Petlur limestone near Venkatapur, Nagnapur (Jalikatti) of Muddapur Fm. and Chitrabanukot dolomite (Varchagal) of Yargatti Formation.

(Contd.)

Table - 2 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Metreage		
DMG **Iron ore** Bagalkot	N/V Ameengarh	1:50,000	85.0	-	-	-	The area are comprises of peninsular gneissic complex (tonalite/migmatite) followed by metamorphic horizon of kaladgi group of rocks and younger intrusions such as dolerite & quartz veins with laterite capings. The banded iron formation is of BHQ and BMQs with occasional intermittent beds of BHJ. Fe ranges 42.05-58.75%. Resources were not estimated.
Limestone Gulbarga	Parts of Malkhed	-	-	05	588.0	-	Geologically the area was composed of horizontal beds with tight bedding planes of limestone. The limestone deposit is of protrozoic age and is of sedimentary origin. Limestones are generally massive, grey tolightr grey and pale blue in colour. Sample collection for chemical analysis were been carried out. CaO ranges from 29.40 – 44.20%.
Limestone/ Dolomite Tumkur	N/V Melanahalli	-	-	07	642.0	-	Principally area composed of Dharwar Group of metamorphosed schists with isolated batholiths of Archean complexes. The general strike trend is NNW-SSE with dips on either side at angles ranging from 50o to almost vertical. The lithological units are highly folded and disturbed. They are also intruded by basic dykes besides quarts and pegmatite veins emplacing the host rock.
Platinum Group of Elements Mandya	Around Karighatta	1:50,000	75.0	-	-	-	Geologically the area comprises of peninsular gneissic complex (tonalite/ migmatite) followed by mafics and ultramafic sequences are interbedded with quartz felspathic veins and felsites porphyries. Besides there are layered complex of ultra basic patches in the form of pori dotites and serpentinites along the contact zones. Resources were not estimated.
Hutti Gold Mine **Gold** Raichur	Vill: Hutti	1:400	2530 m -	-	7144.0	12035	The Hutti Lode gold deposit was located at the North-Eastern periphery of the Hutti Green Stone belt. Total

(Contd.)

Table - 2 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Metreage		
Hutti Gold Mine **Gold** Raichur (Contd.)	Vill: Hutti						nine well defined parallel to sub-parallel tabular auriferous quartz reefs were: i) Main reef ii) Prospect reef iii) Oakley's reef iv) Middle reef v) Zone-1 reef vi) Village reef vii) Strike reef viii) Foot wall strike reef ix) New East reefs occurred within the metavolcanics dominantly composed of massive fine, medium grained pillowed metabasalts and subordinate bonds of rhyodacitic composition which occur intermittently as concordant narrow bodies in the Hutti mine block. Out of this nine auriferous zones, the production has been reported only from six lodes viz; i) Oakley's ii) Zone iii) Middle iv) Village v) Strike and Foot wall strike reefs. The Hutti gold deposit has a definite stratigraphic, lithological and structural control. The wall rock alteration vein formations and primary gold-quarts sulphide mineralization occurred contemporaneously with first fold deformation; economic gold concentration in the form of 'Shoots' has been found with second phase of folding and associated metamorphism through the process of remobilization and redeposition of gold in the structurally favourable zone. Deposit was encountered over a strike length of about 2.80 kms. Total width of the mineralized ground covering the area from Main Reef to New East Reef has been noticed to about 1.0 km and average width of the individual lode zone was found to about 6.0 m. About 9.25 million tones @ 5.26 g/t resources were estimated.
Gold Raichur	Hira-Buddini	1:400	3.0	-	-	1164	This gold deposit was located in the eastern limb of Hutti cross fold & closed to Maski Schist belt. The mineralisation occurred along the scheared contact of acidic & basic volcanic rocks which is manifested by chloritised brecciated rocks with quartz carbonate veins, veinlets with sulphides. The trend of the mineralised

(Contd.)

Table - 2 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Metreage		
Gold Raichur (Contd.)	Hira-Buddini						zone is N 70° E dip 80° due north. Mineralised zone has indicated by the surface exploration over a strike length of about 600 m & was explored upto 150 m vertical depth. About 0.78 million tones resources were estimated at 3.99 g/t.
-do-	Uti gold mine	1:2,000	-	-	-	1435	Gold mineralization has been confined to fine to coarse grained amphibolite and meta acid volcanic rocks. Mineralisation of economic significance is only within coarse grained & fine grained amphibolite. The mineralized zone has been characterised by sulphidisation and biotisation. The general trend of the lode was found to be N 25oE with steep easterly dip. Lode No.4 was extensively explored over a strike length of about 700 m. Lode No.3 has about 300 m strike length. A total of 2.18 million tones resources of gold were estimated. I) South open pit : 0.31 million tones @ 2.50 g/t ii) Lode No.4 (UG) : 1.73 million tones @ 2.64 g/t iii) Lode No.3 (UG) : 0.14 million tones @ 2.91 g/t.
NMDC **Iron ore** Bellary	Donimalai	-	-	08	717.50	320	Donimalai Iron ore deposit is located in the Se portion of Sandur Schist Belt. The trend is NNW-SSE & dipping between 70o-80o ENE. Hematite is the main ore constituent whereas BHJ/ BHQ & S hale are the main waste constituents. Iron ore have been originated from BHJ by leaching of silica and enrichment of iron oxide by meteoric agencies. Resources yet to be estimated.
MML **Iron ore** Bellary	N/V Krishnagar (Thimmappanagudi mine)	-	-	37	2768	2585	The iron ore deposit occurred in the area in the form of reef with banded iron formation includes BHQ, BHJ and BHC. The other litho units occurred in the mine area are laterite, Metavolcanic/Shale. Ore body has been exposed over a strike length of 800 m. the dip varied between 65o to 70o towards north east. The ore body is

(Contd.)

Table - 2 (Concld.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Metreage		
MML **Iron ore** Bellary (Contd.)							banded and powdery in nature, reddish brown in colour band hard metallic luster. Quality of ore is good with the grade varies and ranging from 50%-60% Fe content. The area is structurally disturbed with folds and fault. A total of 17.1 million tones resources were estimated out of which 3.5 million tones are placed under 111 category, 9.5 million tones under 121 & 122 category and remaining 4.1 million tones resources are placed under 333 category.
-do-	Ubbalagundi	-	-	23	756	-	The iron ore formations observed is mostly of Hematite and confined to the Banded Hematite quartzite and phyllite e striking N15^{o}W to S15^{o}E and dipping westernly at an angle of 80o. The ore body formed lenticular masses and bands intercalated with the quartzite and schist after disposed along the same trend of these rocks. The ore observed in this area has been formed by a process of replacement and subsequent enrichment of clayee schist & phyllite associated closely with banded hematite quartzite. The width of the ore body in the main working varied from 25-30 m with a strike length of 1000 m and the same has been considered for reserves/resource estimation. The maximum width which was noticed at the northern side and the ore body thinning towards southern side. It was also noticed that flaky type of hematite are intercalated with BHQ on the top and western slope of the lease area has been observed as parallel bands. As the depth increases the ore became friable towards the valley side 65o-70o the ore become fines. Total million tones hematite resources were estimated out of which about million tones were placed under 111 category and million tonnes under 333 category.

Production

The value of mineral production in Karnataka at ₹ 7,508 crore in 2010-11 increased by about 24% as compared to the previous year. Iron ore, gold, limestone and manganese ore being the important minerals produced in the state together accounted for 92% of the total value of mineral production during the year. Karnataka was the sole producer of felsite and the leading producer of gold with a share of 99% ; second largest producer of limeshell (38%), iron ore (18%) and dunite (11%); third largest producer of shale (19%) and quartzite (9%) in the country.

Among the minerals, the production of fireclay increased by more than double and that of ochre by 60%,quartzite 51%, gold ore 41%, manganese ore 34% and chromite 31% during 2010-11, whereas the production of quartz decreased by 96%, dunite 95%, limeshell 71%, felspar 67%, silica sand 64%, kaolin 50%, bauxite 47%, shale 40% and laterite 36% as compared to the previous year (Table - 3).

The value of minor mineral production was estimated at ₹ 585 crore for the year 2010-11.

The number of reporting mines in Karnataka was 238 in 2010-11 as against 233 in the previous year.

The index of mineral production in Karnataka (Base1993-94=100) was 264.02 in 2010-11 as compared to 289.21 in the previous year.

Table – 3: Mineral Production in Karnataka, 2008-09 to 2010-11
(Excluding Atomic Minerals)

(Value in ₹ '000)

Mineral	UnitP	2008-09			2009-10			2010-11 (P)		
		No. of mines	Quantity	Value	No. of mines	Quantity	Value	No. of mines	Quantity	Value
All Minerals		**241**		**66958311**	**233**		**60707229**	**238**		**75082543**
Bauxite	t	2	127830	24418	2	123316	32748	2	65517	14162
Chromite	t	3	4115	36475	3	6483	30856	3	8491	36851
Gold ore	t	-	582908	-	-	512454	-	-	722985	-
Gold	kg	3	2420	3130737	3	2070	3404563	3	2225	4274150
Iron ore	'000t	91	46971	57305574	93	43163	48811665	94	37878	62114924
Manganese ore	t	17	332686	638173	19	301163	611165	20	404948	756354
Silver*	kg	-	229	5216	-	230	5770	-	206	7596
Dolomite	t	16	354015	52262	15	385041	55044	15	423490	65720
Dunite	t	1	32550	7486	1	37346	8830	1	1971	360
Felspar	t	1	573	120	1	3100	651	2	1024	383
Fireclay	t	1	7593	3555	-	5523	2949	2	12225	3797
Felsite	t	6	1238	1367	6	1337	1608	6	923	1463
Kaolin	t	3	6164	6110	3	19543	12015	3	9785	8347
Laterite	t	2	108628	36527	3	203378	69711	3	130300	17108
Limestone	'000t	55	15774	1482328	56	17959	1718707	63	18548	1865056
Limeshell	t	3	56422	30985	4	39880	25406	3	11375	6636
Magnesite	t	3	9591	14668	2	6437	13591	2	6974	14409
Ochre	t	-	777	113	-	4156	4862	-	6657	17742
Quartz	t	4	17500	1289	-	275	108	-	10	3
Quartzite	t	1	5500	1513	2	7437	2054	1	11200	2667
Silica sand	t	29	107266	12961	20	109468	15206	15	39272	4900
Shale	t	-	1152357	43820	-	936636	34304	-	559356	24499
Minor Minerals@		-	-	4122614	-	-	5845416	-	-	5845416

Note: *The number of mines excludes minor minerals.*
** Recovered at Raichur and Tumkur during refining of gold.*
@ Figures for earlier years have been repeated as estimates because of non-receipt of data.

Mineral-based Industry

The important large and medium-scale mineral-based industries in organised sector in the State are given in Table - 4.

Table – 4 : Principal Mineral-based Industries in Karnataka

Industry/plant	Capacity ('000 tpy)
Abrasives	
Grindwell Norton Ltd, Bengaluru	NA
Sri Sadguru Abrasives Pvt. Ltd, Mache, Dist. Belgaum	24 (t)
Alumina	
Hindalco Industries Ltd, Belgaum	350 (alumina) 138 (spl. alumina)
Asbestos Products	
Ramco Industries Ltd, Karur, Dharwad	NA
Southern Asbestos Ltd, Karur, Dist. Dharwad	NA
Cement	
ACC Ltd, Wadi, Dist. Gulbarga	5950
Bagalkot Cement Industries Ltd, Bagalkot	297
CCI Ltd, Kurkunta, Dist. Gulbarga	198
HMP Cements Ltd, Shahabad, Dist. Gulbarga	476
Kanoria Industries, Bagalkot	330
Heidenberg Cement India Ltd, (Formerly Mysore Cements Ltd) Ammasandra, Dist. Tumkur	570
Raj Shree Cement, Malkhed, Dist. Gulbarga	3242
Siddaganga Cement Pvt Ltd, Sadarahalli, Dist. Tumkur	9

(Contd.)

Table - 4 (Contd.)

Industry/plant	Capacity ('000 tpy)
Vasvadatta Cement, Sedam, Dist. Gulbarga	8565
Zawar Cement (P) Ltd, Shahabad, Dist. Gulbarga	495
Ceramic	
Ceramic Products Ltd, Khanapur, Dist. Belgaum	5
H&R Johnson (India) Ltd, Hubli	47.72
Murudeshwar Ceramics Ltd, Dharwad	115
The Mysore Spongware Pipes Potteries Ltd, Solandavanahalli, Dist. Bengaluru	6
Chemical	
Solaris Chem Tech Industries Ltd, Bhinga, Dist. Uttara Kannada	59.4 (caustic soda) 52.3 (Cl) 133.7 (HCl) 24.0 (H_3PO_4)
Fertilizer	
Mangalore Chemical & Fertilizers Ltd, Panambur, Dist. Dakshina Kannada	380 (urea) 260 (DAP)
Foundry	
ALSTOM Projects India Ltd, Shahabad, Dist. Gulbarga	NA
Glass	
United Glass Bottles Mfg. Co. Ltd, Avalahalli Bengaluru	NA
Iron & Steel	
JSW Steel Ltd, Vijayanagar, Dist. Bellary	4200 (pellets) 720 (pig iron) 2000 (steel) 6800(crude/liquid steel)
Visvesvaraya Iron & Steel Ltd, Bhadravati, Dist. Shimoga	205 (pig iron) 144 (saleable steel) 118(crude/liquid steel) 4.8 (refractory bricks)

(Contd.)

Table - 4 (Contd.)

Industry/plant	Capacity ('000 tpy)
Sunvik Steels Pvt. Ltd, Jodidevarahally, Dist. Tumkur	60 (sponge iron) 60 (TMT bar)
Pellets	
KIOCL, Mangalore	4000 (pellets) 6700 (conc.) 228 (pig iron)
Pig Iron	
Uni-Metal Ispat Ltd, Bellary	75
Kalyani Ferrous Ind. Ltd, Koppal	120
Kirloskar Ferrous Industries Ltd, Bevinahalli, Dist. Koppal	240
KIOCL Ltd, Mangalore	227
Sponge Iron	
Agrawal Sponge & Energy (P) Ltd, Kuduthini, Dist. Bellary	72
Balakundi Premium Steels Pvt. Ltd, Halakundi, Dist. Bellary	34
Bellary Ispat (P) Ltd, Halakundi Dist. Bellary	33
Bellary Steel & Alloys Ltd, Bellary	60
Benaka Sponge Iron Pvt. Ltd, Belagal, Dist. Bellary	60
Dhruvdesh Metasteel Pvt. Ltd, Hirebaganal, Dist. Koppal	60
Divya Jyoti Steel Ltd, Taranagar, Dist. Bellary	30
Embitee Iron & Steel Pvt. Ltd, Bellary	60
Gayatri Metals Pvt Ltd, Belagal, Dist. Bellary	30
Janki Corp. Ltd, Sidiginamola, Dist. Bellary	180
Haryana Steel and Power, Shanthigrama, Dist. Hassan	35

(Contd.)

Table - 4 (Concld.)

Industry/plant	Capacity ('000 tpy)
Hare Krishna Metallics Pvt Ltd, Hire Baganal, Dist. Koppal	75
Hospet Ispat Pvt. Ltd, Allanagar Bagnal Road, Dist. Koppal	60
Hothur Ispat Pvt. Ltd, Veniveerpur, Dist. Bellary	60
KMMI Steel Pvt. Ltd, Yerabanahally, Dist. Bellary	120
Mastek Steels Pvt. Ltd, Halakundi, Dist. Bellary	105
Noble Distillaries & Powers Ltd, Sirivar, Dist. Bellary	72
PGM Ferro Steel Pvt. Ltd, Hariganadani, Dist. Bellary	60
Popuri Steels Ltd, Halakundi, Dist. Bellary	30
Rayon Steel Pvt Ltd, Veniverapur, Dist. Bellary	60
Rengineni Steel Pvt. Ltd, Halakundi, Dist. Bellary	25
Shree Venkteshwara Sponge & Power Ltd, Halakundi, Dist. Bellary	30
Yashshvi Steel & Alloys Ltd, Halakundi, Dist. Bellary	30
Ferro Alloys	
Dandeli Steel & Ferro Alloys Ltd, Dandeli	6
Yashashvi Steels & Alloys Pvt Ltd, Nalakundi, Dist. Bellary	30
S.R. Chemicals & Ferro Alloys Ltd, Honaga, Dist. Belgaum	0.3
Thermit Alloys Pvt. Ltd, Shimoga	1.2
Petroleum Refinery	
MRPL, Mangalore	11820

Indian Minerals Yearbook 2011

(Part- I)

50th Edition

(ADVANCE RELEASE)

STATE REVIEWS
(Kerala)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 001

PHONE/FAX NO. +91712 - 2565471
PBX : +91712 - 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

KERALA

Mineral Resources

Kerala is well-known for its deposits of excellent quality china clay and beach sands containing valuable minerals like ilmenite, rutile, sillimanite, zircon, garnet, leucoxene and monazite. The State is the principal producer of kaolin, limeshell and sillimanite. The State also accounts for 88% zircon, 33% titanium minerals and 25% china clay, 13% kyanite and 11% sillimanite of the country's resources. Important mineral occurrences in the State are **bauxite** in Kannur, Kasaragod, Kollam & Thiruvananthapuram districts; **china clay** in Alappuzha, Ernakulam, Kannur, Kasaragod, Kollam, Kottayam, Palakkad, Thiruvananthapuram & Thrissur districts; **limestone** in Alappuzha, Ernakulam, Kannur, Kollam, Kottayam, Kozhikode, Malappuram, Palakkad & Thrissur districts; **quartz/silica sand** in Alappuzha, Kasaragod, Thiruvananthapuram & Wayanad districts; **sillimanite** in Kollam and Thiruvananthapuram districts; and **titanium minerals** in Kasaragod, Kollam, Pathanamthitta & Thiruvananthapuram districts; and **zircon** in Kollam district.

Other minerals that occur in the State are **fire clay** in Alappuzha, Ernakulam, Kannur & Kollam districts; **garnet** in Kollam & Thiruvananthapuram districts; **gold** in Malappuram & Palakkad districts; **granite** in Palakkad and Thiruvananthapuram districts; **graphite** in Ernakulam, Idukki, Kollam, Kottayam & Thiruvananthapuram districts; **iron ore (magnetite)** in Kozhikode and Malappuram districts; **kyanite** in Kollam and Thiruvananthapuram districts; **lignite** in Alappuzha, Kollam and Kannur districts; **magnesite** in Palakkad district; and **steatite** in Kannur and Wayanad districts (Tables - 1 and 2).

Exploration & Development

GSI carried out exploration for PGE at Attapady Valley in Palakkad district in 2010-11. Details of exploration are furnished in Table-3.

Production

The value of mineral production in Kerala during 2010-11 at ₹ 1,206 crore decreased as compared to that in the previous year. The important minerals produced in the state during 2010-11 were kaolin, laterite, limestone, limeshell, silica sand and sillimanite which together accounted for 4% of the value of mineral production in the state (rest of the value is attributed to minor minerals). Kerala was the largest producer of limeshell ; second largest producer of kaolin; and third largest producer of sillimanite with a share of 62%, 27% and 17% to the total production of respective minerals in the country.

Among important minerals, production of laterite and sillimanite increased by 30% and 5% respectively whereas it decreased for silica sand by 58% and limeshell by 17% (Table - 4).

The value of minor minerals' production was estimated at ₹ 1159 crore for the year 2010-11.

The number of reporting mines in Kerala was 28 during 2010-11 as against 30 in the previous year.

The index of mineral production in Kerala (Base1993-94=100) was 370.98 in 2010-11 as compared to 385.01 in the previous year.

Table –1: Reserves/Resources of Minerals as on 1.4.2010 : Kerala

Mineral	Unit	Reserves: Proved STD 111	Reserves: Probable STD121	Reserves: Probable STD122	Total (A)	Remaining resources: Feasibility STD211	Remaining resources: Pre-feasibility STD221	Remaining resources: Pre-feasibility STD222	Remaining resources: Measured STD331	Remaining resources: Indicated STD332	Remaining resources: Inferred STD333	Remaining resources: Reconnaissance STD334	Remaining resources: Total (B)	Total resources (A+B)
Bauxite	000 tonnes	-	-	-	-	29	-	24	2037	9284	2722	-	14096	14096
China clay	000 tonnes	3352	792	-	4144	2447	463	2985	43930	20439	569226	20200	659690	663834
Fireclay	000 tonnes	-	-	-	-	-	-	-	8200	51	9929	-	18181	18181
Garnet	tonne	-	-	45797	45797	-	-	-	100874	-	52190	-	153064	198861
Gold					-									
Ore (Primary)	tonne	-	-	-	-	-	-	-	462280	96180	-	-	558460	558460
Metal (Primary)	tonne	-	-	-	-	-	-	-	0.17	0.03	-	-	0.20	0.20
Ore (Placer)	tonne	-	-	-	-	-	-	-	-	2552000	23569000	-	26121000	26121000
Metal (Placer)	tonne	-	-	-	-	-	-	-	-	2.29	3.57	-	5.86	5.86
Granite (Dimen. Stone)	000 cum	140	-	-	140	-	-	-	-	99	2570	-	2669	2808
Graphite	tonne	-	-	-	-	-	8300	17762	134900	1088550	335818	-	1585330	1585330
Iron Ore (Magnetite)	000 tonnes	-	-	-	-	-	-	-	-	59912	23523	-	83435	83435
Kyanite	tonne	-	-	-	-	-	-	-	192360	-	10000	-	202360	202360
Laterite	000 tonnes	180	-	1500	1680	-	-	-	-	-	-	16717	16717	18397
Limestone	000 tonnes	12959	-	-	12959	122659	77	1576	21161	2888	35228	-	183589	196548
Magnesite	000 tonnes	-	-	-	-	-	-	-	2	-	38	-	40	40
Quartz-silica sand	000 tonnes	-	38	-	38	404	1959	3354	14611	30241	77528	-	128096	128135
Sillimanite	tonne	698056	-	-	698056	317569	120000	-	2479816	165408	3369200	-	6451993	7150049
Talc-Steatite-Soapstone	000 tonnes	-	-	-	-	-	-	-	-	-	14390	-	14390	14390
Titanium Minerals*	tonne	13796194	-	-	13796194	5198882	-	-	-	22668876	87048716	-	114916474	128712668
Zircon	tonne	972624	-	-	972624	649938	-	-	81741	338525	716279	-	1786483	2759107

Figures rounded off

** Resources as per Department of Atomic Energy are provided in the respective Mineral Reviews.*

Table –2 : Reserves/Resources of Lignite as on 1.4.2011 : Kerala

(In million tonnes)

District	Proved	Indicated	Inferred	Total
Total	-	-	**9.65**	**9.65**
Kannur	-	-	9.65	9.65

Source: *Coal Directory of India, 2010-11.*

Table –3 : Details of Exploration Activities in Kerala, 2010-11

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Metreage		
GSI **PGE** Palakkad	Attapadi valley	1:12,500	115.0	-	-	-	Reconnaissance (G-4) stage investigation for PGE Minerali-sation in this area has been initiated during FS 2010-12. Sampling of mafic/ultramafic lithounits has been carried out for the analysis of PGE. Chromite bearing ultramafics have been also identified in Kalkandi and Narasimukku areas. Quartz rich auriferous lithounits containing a steel grey coloured metallic mineral have been noticed in Bhuthuvazhi, Attapadi valley, Palakkad and Maddalapara, Malappuram district. The XRD analysis has indicated the presence of graphite, stibnite, pyrite, arsenopyrite and sillimanite. On panning, these samples have yielded a few grains of gold. The work is in progress.
DMG **Bauxite & Cina clay** Kannur	Perinthatta	-	-	11	244.3	-	The average thickness of clay horizon encountered is 6 m.
China clay Kollam	Kannjiramkode	-	-	07	340.0	-	The average thickness of clay horizon was found to be 8 m with 4-4.5 m thick overburden. The clay encountered is white to pale red in colour. About 0.33 million tonnes tentative resources of china clay were estimated, over an area of 2.5 hect. The investigation is continued.
-do- Kannur	Pazhangadi	-	-	04	83.5	-	The average thickness of china clay horizon encountered is 2m. The clay is pale white in colour.

Table – 4 : Mineral Production in Kerala, 2008-09 to 2010-11 (Excluding Atomic Minerals)

(Value in ₹ '000)

Mineral	Unit	2008-09 No. of mines	2008-09 Quantity	2008-09 Value	2009-10 No. of mines	2009-10 Quantity	2009-10 Value	2010-11 (P) No. of mines	2010-11 (P) Quantity	2010-11 (P) Value
All Minerals		**32**		**9539218**	**30**		**12114392**	**28**		**12055832**
Kaolin	t	16	587222	258656	15	698915	214303	15	672438	182660
Sillimanite	t	1	10423	91504	1	7939	75460	1	8315	89989
Laterite	t	4	77327	21410	4	69171	15322	3	89665	28466
Limestone	'000t	1	535	165864	1	533	169645	1	529	128354
Limeshell	t	2	40079	41834	2	22335	25511	2	18468	21439
Silica Sand	t	8	46965	17112	7	33988	20220	6	14215	10993
Minor Minerals		-	-	8942838	-	-	11593931	-	-	11593931

Note : *The number of mines excludes minor minerals.*
@ Figures for earlier years have been repeated as estimates, wherever necessary, because of non-receipt of data.

Mineral-based Industry

The important large and medium-scale mineral-based industries in organised sector in the State are given in Table - 5.

Table – 5 : Principal Mineral-based Industries in Kerala

Industry/plant	Capacity ('000 tpy)
Abrasives	
Carborandum Universal Ltd, Ernakulam	NA
Carborandum Universal Ltd, Thrissur	NA
Carborandum Universal Ltd, Pathanamthitta	NA
Aluminium	
Hindalco Industries Ltd, Alwaye	10 (closed)
Asbestos Products	
Hyderabad Industries Ltd (formerly Malabar Building Products Ltd) Mulagunnathukavu, Dist. Thrissur	84
Cement	
Malabar Cements, Walayar, Dist. Palakkad	620
The Travancore Cements Ltd, Kottayam	81
Ceramic	
Kerala Ceramics Ltd, Kundara, Dist. Kollam	23
Tata Ceramics, Kozhikode	NA
Chemical	
Tecil chemicals and Hydro Power Ltd, Chingavanam, Dist. Kottayam	30 (calcium carbide) 2 (acetylene black) 7.5 (ferro silicon)

(Contd.)

Table - 5 (Concld.)

Industry/plant	Capacity ('000 tpy)
Synthetic Rutile	
CMRL, Ernakulam	45
KMML, Chavara	50
TiO_2 Pigment	
TTPL, Thiruvananthapuram	17.5
KMML, Chavara	40
Fertilizer	
FACT Ltd, Udyogmandal, Dist. Ernakulam	225 (AS) 148.5 (AP)
FACT Ltd, Ambalamedu, Dist. Ernakulam	485 (NP)
Ferro-alloys	
INDSIL Electrosmelts Ltd, Pallatheri, Dist. Palakkad	14
Shri Laxmi Electro Smelters Pvt. Ltd, Erumathala	NA
The Silcal Metallurgic Ltd, Wayalur	3.6
Foundry	
HMT Machine Tools Ltd, Bengaluru	NA
Glass	
Excel Glass Ltd, Pathirapally, Dist. Alleppey	72
Lead-Zinc	
BZL Zinc Smelter, Binanipuram	38 (Zn ingot) 80 (Cd ingot) 50 (H_2SO_4)
Petroleum Refinery	
KRL, Cochin	7500

Indian Minerals Yearbook 2011

(Part- I)

50th Edition

(ADVANCE RELEASE)

STATE REVIEWS
(Madhya Pradesh)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 001

PHONE/FAX NO. +91712 - 2565471
PBX : +91712 - 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

MADHYA PRADESH

Mineral Resources

Madhya Pradesh is the only diamond producing State in the country and is the leading producer of copper conc., pyrophyllite, manganese ore, diaspore and clay (others). The State hosts the country's 90% diamond, 63% diaspore, 61% laterite, 56% pyrophyllite, 41% molybdenum, 29% dolomite, 17% each of rock phosphate & fireclay resources.

Important mineral occurrences in the State are: **bauxite** in Balaghat, Guna, Jabalpur, Katni, Mandla, Rewa, Satna, Shahdol Shivpuri, Sidhi & Vidisa districts; **calcite** in Barwani, Jhabua, Khandwa & Khargone districts; **china clay** in Betul, Chhatarpur, Chhindwara, Gwalior, Hoshangabad, Jabalpur, Khargone, Narsinghpur, Raisen, Satna, Shahdol & Sidhi districts; **copper** in Balaghat, Betul & Jabalpur districts; **coal** in Betul, Shahdol & Sidhi districts; **diamond** in Panna district; **diaspore & pyrophyllite** in Chhatarpur, Shivpuri & Tikamgarh districts; **dolomite** in Balaghat, Chhindwara, Damoh, Dewas, Harda, Hoshangabad, Jabalpur, Jhabua, Katni, Mandla, Narsinghpur, Sagar and Seoni districts; **fireclay** in Betul, Chhindwara, Jabalpur, Katni, Narsinghpur, Panna, Sagar, Shahdol & Sidhi districts; **iron ore (hematite)** in Betul, Gwalior, Jabalpur & Katni districts; **limestone** in Balaghat, Chhindwara, Damoh, Dhar, Hoshangabad, Jabalpur, Jhabua, Khargone, Katni, Mandsaur, Morena, Narsinghpur, Neemach, Rewa, Sagar, Satna, Sehore, Shahdol & Sidhi districts; **manganese ore** in Balaghat and Jhabua districts; **ochre** in Dhar, Gwalior, Jabalpur, Katni, Mandla, Rewa, Satna, Shahdol & Umaria districts; **pyrophyllite** in Chhatarpur, Sagar, Shivpuri & Tikamgarh districts; **quartz/silica sand** in Balaghat, Dewas, Dhar, Jabalpur, Khandwa, Khargone, Morena, Rewa & Shahdol districts; **talc/steatite/soapstone** in Dhar, Jabalpur, Jhabua, Katni, Narsinghpur & Sagar districts; and **vermiculite** in Jhabua district.

Other minerals that occur in the State are: **barytes** in Dewas, Dhar, Shivpuri, Sidhi & Tikamgarh districts; **calcareous shales** (used in slate pencil) in Mandsaur district; **felspar** in Jabalpur & Shahdol districts; **fuller's earth** in Mandla district; **gold** in Jabalpur and Sidhi districts; **granite** in Betul, Chhatarpur, Chhindwara, Datia, Jhabua, Panna, Seoni & Shivpuri districts; **graphite** in Betul & Sidhi districts; **gypsum** in Shahdol district; **lead-zinc** in Betul district; **molybdenum** in Balaghat district; **potash** in Panna district; **quartzite** in Sehore district; **rock phosphate** in Chhatarpur, Jhabua & Sagar districts; and **sillimanite** in Sidhi district (Table - 1). The reserves/resources of coal along with various coalfields in Madhya Pradesh are given in Table - 2.

Exploration & Development

ONGC carried out its seismic survey and drilling for exploration of petroleum & natural gas. One exploratory well with metreage of 3,150 were drilled during 2010-11. The details of exploration activities conducted by various agencies for coal and other minerals during 2010-11 are furnished in Table - 3.

Table – 1: Reserves/Resources of Minerals* as on 1.4.2010 : Madhya Pradesh

Mineral	Unit	Reserves				Remaining resources								Total resources (A+B)
		Proved STD 111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
			STD121	STD122			STD221	STD222						
Barytes	tonne	-	-	-	-	-	18500	4472	-	35000	233940	-	291912	291912
Bauxite	000 tonnes	17144	1068	1590	19802	3151	11733	1199	6640	53715	50551	-	126989	146791
Calcite	tonne	-	-	-	-	215327	82577	194333	20250	180226	400791	97476	1190980	1190980
China clay	000 tonnes	-	-	-	-	942	-	61	-	415	11741	-	13160	13160
Copper														
Ore	000 tonnes	90909	71481	35929	198319	-	-	-	49650	33700	95519	-	178869	377188
Metal	000 tonnes	1218.18	957.84	467.08	2643.1	-	-	-	155.75	104.7	916.02	-	1176.47	3819.57
Diamond	carat	1045318	-	-	1045318	-	-	-	104118	-	27645359	-	27749477	28794795
Diaspore	tonne	719609	562818	174476	1456903	51764	386086	349488	248335	132794	1081412	46068	2295946	3752849
Dolomite	000 tonnes	26637	28553	27244	82434	17893	85680	67042	17250	291229	1601188	115087	2195369	2277803
Felspar	tonne	-	-	-	-	-	-	-	-	-	339851	-	339851	339851
Fireclay	000 tonnes	2167	2026	269	4462	829	3747	5690	1582	2823	101081	100	115852	120314
Fuller's earth	tonne	-	-	-	-	-	-	-	-	-	117200	-	117200	117200
Gold														
Ore (primary)	tonne	-	-	-	-	-	-	-	-	5841000	1947000	-	7788000	7788000
Metal (primary)	tonne	-	-	-	-	-	-	-	-	6.18	2.22	-	8.4	8.4
Granite (Dim. stone)	000 cu m	-	160	-	160	-	-	-	-	-	1885924	108000	1993924	1994084
Graphite	tonne	-	-	-	-	-	-	-	-	-	1006660	-	1006660	1006660
Gypsum	000 tonnes	-	-	-	-	-	-	-	-	-	69	-	69	69
Iron ore (Hematite)	000 tonnes	40534	7099	9181	56814	9978	587	10170	4710	4014	145162	10	174632	231446
Laterite	000 tonnes	-	-	-	-	-	-	-	-	-	158910	129778	288688	288688

(Contd.)

Table – 1 (Concld.)

Mineral	Unit	Reserves: Proved STD 111	Reserves: Probable STD121	Reserves: Probable STD122	Reserves: Total (A)	Remaining resources: Feasibility STD211	Remaining resources: Pre-feasibility STD221	Remaining resources: Pre-feasibility STD222	Remaining resources: Measured STD331	Remaining resources: Indicated STD332	Remaining resources: Inferred STD333	Remaining resources: Reconnaissance STD334	Remaining resources: Total (B)	Total resources (A+B)
Lead-zinc													-	-
Ore	000 tonnes	-	-	-	-	129	117	-	1510	4006	5930	3150	14841	14841
Lead metal	000 tonnes	-	-	-	-	-	-	-	26.12	5.13	5.04	-	36.29	36.29
Zinc metal	000 tonnes	-	-	-	-	5.2	4.71	-	114.76	41.93	186.02	101.12	453.74	453.74
Limestone	000 tonnes	460445	1166513	24865	1651823.09	287634	204089	88311	514783	560472	3971168	264247	5890703	7542526
Manganese ore	000 tonnes	30094	1944	2954	34992	7769	3934	1719	2179	943	4190	-	20733	55725
Molybdenum														
Ore	tonne	-	-	-	-	-	-	-	-	-	8000000	-	8000000	8000000
Contained														
MOS_2	tonne	-	-	-	-	-	-	-	-	-	5020	-	5020	5020
Ochre	tonne	486269	128178	41027	655474	253245	1549706	1094108	267721	2141616	3732142	749250	9787788	10443262
Potash	Million tonnes	-	-	-	-	-	-	-	-	1206	-	-	1206	1206
Pyrophyllite	tonne	6779943	5239637	2622217	14641797	585596	3451594	2062603	2407790	3753640	4418648	248405	16928276	31570073
Quartzite	000 tonnes	-	-	-	-	-	-	-	-	-	832	-	832	832
Quartz/														
silica sand	000 tonnes	144	11	14	169	51	-	86	47	316	2191	-	2692	2861
Phosphorite/Rock														
Phosphate	tonne	6589894	1763187	9787162	18140243	3131683	13700000	5990814	-	2730000	5725000	-	31277497	49417740
Sillimanite	tonne	-	-	-	-	-	-	-	-	-	-	101600	101600	101600
Silver														
Ore	tonne	-	-	-	-	-	-	-	-	2096000	1120000	-	3216000	3216000
Metal	tonne	-	-	-	-	-	-	-	-	150.61	9.25	-	159.86	159.86
Talc/steatite/														
soapstone	000 tonnes	-	-	-	-	4	375	954	-	1679	6107	-	9119	9119
Vermiculite	tonne	-	-	-	-	197	-	66	-	-	66	-	329	329

Figures rounded off.

Resources of coal bed methane (CBM) of Madhya Pradesh are included in the western offshore areas of India and are not available separately.

Table – 2 : Reserves/Resources of Coal as on 1.4.2011 : Madhya Pradesh

(In million tonnes)

Coalfield	Proved	Indicated	Inferred	Total
Total	**8871.31**	**12191.72**	**2062.70**	**23125.73**
Johilla	185.08	104.09	32.83	322.00
Umaria	177.70	3.59	-	181.29
Pench-Kanhan	1405.24	789.61	316.78	2511.63
Pathakhera	290.80	88.13	68.00	446.93
Gurgunda	-	47.39	-	47.39
Mohpani	7.83	-	-	7.83
Sohagpur	1643.20	4926.36	190.36	6842.82
Singrauli	5078.75	6232.36	1454.73	12765.84

Source: *Coal Directory of India, 2010-11.*

Table – 3 : Details of Exploration Activities in Madhya Pradesh, 2010 - 11

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks
		Scale	Area (sq km)	No. of boreholes	Metreage		Reserves/Resources estimated
GSI							
Coal							
(Pench valley coal fields) Chhindwara	Payalidhana	-	-	-	-	-	Prospecting stage (G-3) regional exploration was continued in this sector, to establish the strike continuity of Barakar coal seams below the Deccan Traps under favourable structural set up already recorded in Bagbardiya sector to the southwest and Dhankasa area in the southeast and to assess the coal resource potentiality of the area. The work led to the establishment of about 4 km strike extension of regional coal seams. Five regional Barakar coal seams with individual seam thickness ranging from 1.00 m to 3.05 m were intersected between 282.24 m and 319.44 m depth. Total cumulative coal thickness of coal is 13.79 m in PP-2. Coal petrographic study revealed gradual increase in rank character (VRo%) of the seams from 0.72% to 1.13% along depth suggesting normal coalification trend in this part of the basin. Coals can be categorized under 'High Volatile Bituminous B' to 'Medium Volatile Bituminous' rank. The work is in progress.

(Contd.)

Table - 3 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Metreage		
GSI							
Coal (Sohagpur Coalfield) Shahdol	Devanitola	1:10,000	2.0	04	1508.25	-	Regional exploration under G-2 stage was continued in Sohagpur Coalfield to establish develop-mental pattern of superior grade Barakar coal seams at shallow depth. Exploration in this block reveals occurrence of four regional & two local seams varying from 0.63 m to 7.25 m in the depth range from 101.90 m to 285.15 m. Cumulative thickness of the regional and local seams ranges from 11.90 m to 16.31 m. Out of these four seams, seam III is the thickest (maximum cumulative thickness 7.25 m) and composite in nature and characteristically showed two split sections. Seam III, being the most persistent, thickest and composite in nature, is very much significant. The work is in progress.
Coal (Sohagpur Coalfield) Shahdol	Pachri	-	-	-	-	-	Regional exploration under G-2 stage was continued in this block, Sohagpur Coalfield to establish developmental pattern of superior grade Barakar coal seams at shallow depth, to decipher major structural set-up of the area and to evaluate additional coal resources. Exploration in this block revealed occurrences of four regional Barakar coal seams at shallow depth (145 m - 170 m) under the cover of younger lithopack of Barren Measures. Coal seams (I to IV with few local seams) vary in thickness from 0.35 m to 3.30 m and occur between 138.60 m and 328.70 m. Seam III is the thickest with two split sections having a cumulative thickness ranging from 2.47 m to 3.30 m. Cumulative thickness of all the coal seams varied from 7.00 m to 8.50 m and coal resources estimated at 200 million tonnes from this block is prognosticated. Seam III being thickest and composite in nature, generally occured 80 m – 100 m below the contact between Barren Measures and Barakar Formation. The work is in progress

(Contd.)

Table - 3 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Metreage		
GSI							
Coal Singrauli	Sarai (East)	-	-	-	-	-	Reconnaissance stage (G-4) exploration by scout drilling was taken up during FS 2010-12 in this Coalfield to assess the coal development pattern and resource potentiality, establishing strati-graphic set up of the area and to generate CBM baseline data. Contact between Barren Measures and Barakar Formation has been intersected at 202.38 m depth in borehole -1. Seven regional coal seams of Barakar Formation ranging from 1.05 m to 3.35 m were intersected at relatively shallow depth (between 259.69 m and 493.13 m). Out of these, Seam VI and Seam VII are relatively thick (3.35 m and 2.15m respectively). The work is in progress.
Umaria	Amiliha						Regional exploration under G-2 stage initiated during FS 2009-10, was continued in this block in Sohagpur Coalfield to establish developmental pattern of superior grade Barakar coal seams at moderate depth, to evaluate additional coal resources and to assess CBM potentiality. The area of exploration is covered mostly by rocks of Raniganj Formation associated with frequent basic intrusives (dolerite) and partly by Barren Measures occurring in southern and western parts. Subsurface data reveals that the thickness of Raniganj Formation ranges between 36.75 m to 89.66 m and are underlain by Barren Measures having a maximum thickness of 117.88 m. Four regional Barakar coal seams ranging in thickness from 0.30 m to 3.75 m have been intersected between 178.45 m and 343.70 m depth. Coal seam III is the thickest (2.56 m to 3.75 m) and composite in nature and was intersected between 145.75 m and 343.70 m depth. Coal seam III is the thickest (2.56 m to 3.75 m) and composite in nature and was intersected between 145.75 m and 285.95 m depth. Seam III is used as a key horizon for correlation of coal seams. Cumulative thickness of the seams recorded in two boreholes varies from 4.52 m to 9.79 m and occurs between 178.45 m and 351.55 m depth.

(Contd.)

Table - 3(Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Metreage		
GSI							
Coal Umaria	Naurazabad (North) area	-	-	-	-	-	Reconnaissance stage (G-4) exploration, was continued during FS 2010-12 in this area (Johilla Coalfield) to delineate potential area of high rank superior grade coal, evaluation of additional coal resources, to decipher structural set up of the area and to assess CBM potentiality. The drilling indicated litho assemblages akin to Barren Measures . Based on the subsurface data obtained from boreholes -1 and 2, efforts are made to differentiate unclassified Supra Barakar into Barren Measures, Raniganj, Pali (Panchet) and Parsora Formations. Updating of geological map on 1: 50,000 scale revealed the occurrence of sub-horizontally disposed Parsora rocks, which abut against older Gondwana sequence occurring in the southern part along a fault trending roughly E-W. The work is in progress.
Diamond Chhattarpur, Sagar, Tikamgarh	Parts of Chhattarpur, Sagar, Tikamgarh (M.P)	-	-	-	-	-	Regional ground evaluation of Aero Geophysical anomalies (G-4) in this parts was continued to delineate priority block to locate possible KCR bodies and other type of mineralisation. No specific signature of interpreted lineaments and magnetic breaks have been found during ground evaluation. The stream sediment samples have been collected from down streams of the catchment area of all these magnetic breaks and lineaments. The area is mostly covered by cultivated land and bouldary out crops of Deccan Trap. Sulphide minerali-sation is noticed near the Village Nainaghir in dump material within the sandstone / shale. The intersection of magnetic breaks and lineaments are being checked for any mafic rocks and also for collection of stream sediment samples. The work is in progress.

(Contd.)

Table - 3 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Metreage		
GSI							
Manganese Jhabua	Parts of Meghnagar	-	-	-	-	-	Reconnaissance stage investigation (G-4) was taken up during FS 2010-12 to delineate the manganese ore bearing quartzite-phyllite sequence through LSM, pitting-trenching, Sampling, Geophysical Survey and scout drilling. The work is in progress
Phosphorite Jhabua	Piploda and Dhanpura-Khatamba	-	1.0	-	-	-	Reconnaissance stage investiga-tion (G-4) was taken up during FS 2010-12 for phosphorite in this area to locate and assess phosphorite bands associated with dolomitic limestone and chert sequence within Lunavada Group of rocks belonging to Aravalli Supergroup. A phosphorite bearing zone of about 300 m strike length with 8-10 m width has been delineated in Khatamba Block within the chert and cherty dolomite. The analysis indicated P_2O_5 content ranging from 1% to 12%. Representative samples covering 10 meters width has indicated P_2O_5 content varied from 10% to 17.44%. . A zone of 340 m length and 50 m width has been identified with P_2O_5 values ranging between 6% and > 20% as measured using Shapiro's kit. The actual dimensions of the significant zone will be calculated after receiving the chemical analytical data. A new phosphatic stromatolite bearing zone with strike length of about 1km and cummulative width of about 100 m has been located South West of Dhanpura-Katamba Block. This zone comprises of stromatolitc dolomite along with thinly laminated phosphatic material. Three grab samples indicated P_2O_5 content varying from 10% to 17%. The work is in progress.

(Contd.)

Table - 3 (Concld.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks
		Scale	Area (sq km)	No. of boreholes	Metreage		Reserves/Resources estimated
GSI							
Phosphorite Chhatarpur and Sagar	Lukri-Akrotha-Raipura-Surajpura	-	-	-	-	-	Reconnaissance stage investigation (G-4) has been taken up during FS 2010-12 in Bijawar basin to assess the extent and grade of phosphorite in Bijawar Group. In Akrotha – Raipura Block, phosphatic ferruginous chert breccia belonging to Hirapur Formation occurred as lensoidal body with more than 30 m strike length and width of 8 m to 10 m at about 1.5 km east of Akrotha. In the northern slope of the Jhalautar Pahar, brecciated phosphorite tested with shiprio solution yielded 25% P_2O_5. Another brecciated phosphorite body occurred an about 750 m sw of Rajghat, at the northern slope hill. It is 100 m in length with more than 5 m width. The P2O5 content varied from 20-25% (V.E.). In Lukri block a lensoidal body of ferruginous phosphatic chert breccia of nearly 200 m strike length and 20 m to 30 m width showing more than 20% P_2O_5. This phosphatic chert breccia is associated with ferruginous shale and ferruginous sandstone belonging to Gangau Formation of Bijawar Group. The work is in progress.
MOIL							
Manganese ore Balaghat	Tirodi	1:1,000	1.2	01	76.00	-	As on 1.4.2011, Manganese ore resources were estimated at 1.61 million tonnes.
-do-	Bharweli	-	-	02	1401.00	-	Ore zone is overlained by Sericite schist of Manser formation. The ore strike was found to be N 25^{o}E S25^{o}W & dip 25^o-85^o due west. The average thickness is about 10 m. Braunite is the principle mineral associated with secondary minerals of oxide & dioxide origin. The manganese ore is of 30-48% Mn. The strike length of the deposit was found to be about 2.8 km. about 24.58 million tonnes manganese ore resources were estimated.
Nagpur	Gumgaon	-	-	-	04	1001.90	As on 1.4.2011, Manganese ore resources were estimated at 4.34 million tonnes.

Production

The value of mineral production in Madhya Pradesh at ₹ 12,305 crore in 2010-11 increased by 9% as compared to the previous year. Madhya Pradesh contributed 5% in the total value of mineral production among states and claims seventh position in the country. The state was the sole producer of diamond. The state was the leading producer of pyrophyllite with a share of 88%, copper conc. 58% ,clay (others) 55% and manganese ore 25% in the national output of respective mineral. Madhya Pradesh was also the second leading producer of diaspore with a share of 45%, shale 20%, fireclay and phosphorite 6 % each to total out put of the respective minerals.

During 2010-11, the production of iron ore increased by 65% and that of clay(others) 37%, copper conc. 21%, manganese ore 19% and diamond 17%. However, decline in production was observed in kaolin 67%, laterite 46%, bauxite 45%, phosphorite 37% and ochre 25% as compared to the previous year (Table - 4).

The value of minor mineral production was estimated at ₹ 1,703 crore for the year 2010-11.

The number of reporting mines in Madhya Pradesh was 292 in 2010-11 as against 287 in the previous year.

The index of mineral production in Madhya Pradesh (base 1993-94=100) was 213.81 in 2010-11 as against 219.99 in the previous year.

Table – 4 : Mineral Production in Madhya Pradesh, 2008-09 to 2010-11 (Excluding Atomic Minerals)

(Value in ₹ '000)

Mineral	Unit	2008-09			2009-10			2010-11 (P)		
		No. of mines	Quantity	Value	No. of mines	Quantity	Value	No. of mines	Quantity	Value
All Minerals		**329**		**108500965**	**287**		**112878992**	**292**		**123050412**
Coal	'000t	75	71325	78404100	75	74074	84933100	71	71104	93673600
Petroleum (crude)	'000t	-	-	-	-	-	-	-	-	-
Bauxite	t	24	1037724	376581	17	1056847	365097	18	585791	122283
Copper ore	t	-	2073524	-	-	1975938	-	-	2246597	-
Copper conc.	t	1	57575	1802506	1	64913	1926362	1	78779	2499132
Iron ore	'000t	6	412	101332	5	1058	359750	6	1745	789840
Manganese ore	t	28	726114	6234950	25	607148	4094882	28	722109	4672602
Phosphorite	t	5	250556	157198	5	212168	122007	5	133358	72462
Clay (others)	t	-	556030	42586	-	235027	20453	-	322607	32186
Diamond	crt	2	536	4537	2	16891	116279	2	19774	152651
Diaspore*	t	-	10180	7410	-	11042	8540	-	11995	6970
Dolomite	t	42	199377	25986	42	277017	36190	43	243052	30079
Fireclay	t	11	48278	3911	8	34704	3193	11	36124	3719
Kaolin	t	2	8400	762	3	17350	1209	2	5806	460
Laterite	t	4	94779	6659	4	133080	7269	3	71758	4701
Limestone	'000t	96	30565	4249682	72	28967	3795849	72	30547	3909142
Ochre	t	8	17923	1741	7	39201	4990	8	29454	4228
Pyrophyllite	t	23	210622	44306	21	209127	53123	20	205633	45853
Quartz	t	-	-	-	-	-	-	2	1889	155
Silica sand	t	1	40	5	-	-	-	-	-	-
Shale	t	-	589620	5307	-	637088	5734	-	598220	5384
Slate	t	1	8920	5530	-	-	-	-	-	-
Minor Minerals@		-	-	17025876	-	-	17024965	-	-	17024965

Note : *The number of mines excludes minor minerals.*
***** *Associated with pyrophyllite.*
@ *Figures for earlier years have been repeated as estimates wherever necessary, because of non-receipt of data.*

Mineral-based Industry

The important large and medium-scale mineral-based industries in organised sector in the State are furnished in Table-5.

Table – 5 : Principal Mineral-based Industries in Madhya Pradesh

Industry/plant	Capacity ('000 tpy)
Asbestos Products	
Everest Building Products Ltd, Kymore	NA
Kalani Industries Pvt. Ltd, Pitampur, Dhar	NA
Ramco Industries Ltd, Maksi, Dist. Sajapur	66
Cement	
ACC Ltd, Kymore, Dist. Katni	2200
Birla Corpn. Ltd (Satna Cement Works), Satna	2200
CCI Ltd, Mayagaon, Dist. Neemuch	1400
Diamond Cement, Narsingarh, Dist. Damoh	1525
Jaypee Rewa Cement, Dist. Rewa	3500
Jaypee Cement, Bela	2200
Maihar Cement, Maihar, Dist. Satna	3800
Prism Cement Ltd, Satna	2510
Vikram Cement, Khor, Dist. Neemuch	4500

(Contd.)

Table-5 (Concld.)

Industry/plant	Capacity ('000 tpy)
Ceramic	
EID Parry India Ltd, Dewas	9
H&R Johnson India Ltd, Dewas	6.7
Govind Tiles Pvt Ltd, Garra, Dist. Balaghat	758 million nos.
Fertilizer	
Khaitan Chemical & Fertilizers Ltd, Nimrani, Dist. Khargone	400 (SSP) 115.5 (H_2SO_4)
NFL-Vijaipur, Dist. Guna	1452 (Urea)
Ferro-alloys	
Crescent Alloys Pvt. Ltd, Seoni	4.5
Jalan Ispat Castings Ltd, Meghnagar, Dist. Jhabua	12
MOIL Ferro Manganese Plant, Bharveli, Dist. Balaghat	10
Petroleum Refinery	
Bharat Oman Refineries Ltd, Bina, Dist. Sagar	6000
Refractory	
ACC Refractories, Katni	65
Premier Refractories of India Pvt. Ltd, Katni	12.9

Indian Minerals Yearbook 2011

(Part- I)

50th Edition

(ADVANCE RELEASE)

STATE REVIEWS
(Maharashtra)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 001

PHONE/FAX NO. +91712 - 2565471
PBX : +91712 - 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

MAHARASHTRA

Mineral Resources

Maharashtra is the second largest producer of kyanite and the third largest producer of manganese ore. The principal mineral-bearing belts in Maharashtra are Vidarbha area in the east and Konkan area in the west. Important mineral occurrences are **bauxite** in Kolhapur, Raigad, Ratnagiri, Satara, Sindhudurg & Thane districts; **china clay** in Amravati, Bhandara, Chandrapur, Nagpur, Sindhudurg & Thane districts; **chromite** in Bhandara, Chandrapur, Nagpur & Sindhudurg districts; **coal** in Nagpur, Chandrapur & Yavatmal districts; **dolomite** in Chandrapur, Nagpur & Yavatmal districts; **fireclay** in Amravati, Chandrapur, Nagpur & Ratnagiri districts; **fluorite** & **Shale** in Chandrapur district; **iron ore (hematite)** in Chandrapur, Gadchiroli and Sindhudurg districts; **iron ore (magnetite)** in Gondia district; **kyanite** in Bhandara & Nagpur districts; **laterite** in Kolhapur district; **limestone** in Ahmednagar, Chandrapur, Dhule, Gadchiroli, Nagpur, Nanded, Pune, Sangli & Yavatmal districts; **manganese ore** in Bhandara, Nagpur & Ratnagiri districts; **corundum & pyrophyllite** in Bhandara district; **quartz & silica sand** in Bhandara, Chandrapur, Gadchiroli, Gondia, Kolhapur, Nagpur, Ratnagiri & Sindhudurg districts and **quartzite** in Gondia & Nagpur districts; and **sillimanite** in Chandrapur district.

Other minerals that occur in the State are **barytes** in Chandrapur & Gadchiroli districts; **copper** in Bhandara, Chandrapur, Gadchiroli & Nagpur districts; **felspar** in Sindhudurg district; **gold** in Bhandara & Nagpur districts; **granite** in Bhandra, Chandrapur, Dhule, Gadchiroli, Nagpur, Nanded, Nasik, Sindhudurg & Thane districts; **graphite & mica** in Sindhudurg district; **lead-zinc & tungsten** in Nagpur district; **marble** in Bhandara & Nagpur districts; **ochre** in Chandrapur & Nagpur districts; **silver** & **vanadium** in Bhandara district; **steatite** in Bhandara, Ratnagiri & Sindhudurg districts; and **titanium minerals** in Gondia & Ratnagiri districts (Table - 1). The coal reserves and resources along with the various coalfields located in the State are given in Table - 2.

Exploration & Development

The details of exploration activities conducted by various agencies during 2010-11 are furnished in Table - 3.

Table – 2 : Reserves/Resources of Coal as on 1.4.2011 : Maharashtra

(In million tonnes)

Coalfield	Proved	Indicated	Inferred	Total
Total	**5489.61**	**3094.29**	**1949.51**	**10308.09**
Wardha Valley	3297.19	1307.98	1439.07	6044.24
Kamptee	1276.14	1191.83	505.44	2973.41
Umrer	308.41	-	-	308.41
Nand-Bander	468.08	483.95	-	952.03
Bokhara	10.00	-	20.00	30.00

Source: *Coal Directory of India, 2010-11* .

Table –1: Reserves/Resources of Minerals as on 1.4.2010 : Maharashtra

Mineral	Unit	Reserves				Remaining resources								Total resources (A+B)
		Proved STD 111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
			STD121	STD122			STD221	STD222						
Barytes	tonne	-	-	-	-	-	-	-	14800	89450	18610	-	122860	122860
Bauxite	'000 tonnes	14461	4473	7219	26153	16886	6704	12531	52191	10524	49896	-	148732	174885
China clay	'000 tonnes	-	-	-	-	418	256	856	11	184	5523	-	7248	7248
Chromite	'000 tonnes	53	23	-	76	5	-	-	43	67	441	-	556	632
Copper														
Ore	'000 tonnes	-	-	-	-	-	-	-	-	9399	3811	-	13210	13210
Metal	'000 tonnes	-	-	-	-	-	-	-	-	89.65	43.05	-	132.70	132.70
Dolomite	'000 tonnes	22741	11987	13325	48053	5612	1028	3569	7000	18050	337511	-	372771	420824
Felspar	tonne	228655	-	91462	320117	-	-	423180	-	-	485606	-	908786	1228903
Fireclay	'000 tonnes	244	-	388	632	-	-	-	-	-	6850	-	6850	7482
Fluorite	tonne	261843	-	104737	366580	-	-	-	-	-	52369	-	52369	418949
Gold														
Ore (primary)	tonne	-	-	-	-	-	-	-	-	-	1517000	-	1517000	1517000
Metal(primary)	tonne	-	-	-	-	-	-	-	-	-	3.55	-	3.55	3.55
Granite (Dim. stone)	'000 cu m	-	-	-	-	-	6300	-	486925	-	665622	-	1158847	1158847
Graphite	tonne	-	-	-	-	-	-	-	-	-	1160000	-	1160000	1160000
Iron ore (hematite)	'000 tonnes	6937	6460	17	13414	7544	6093	7659	79793	71806	64714	32185	269795	283209
Iron ore (magnetite)	'000 tonnes	559	-	315	875	211	-	60	-	-	215	-	486	1361
Kyanite	tonne	284307	-	96514	380821	-	4317	1167175	-	58500	1713600	-	2943592	3324413
Lead-zinc														
ore	'000 tonnes	-	-	-	-	-	-	-	1967	6305	1000	-	9272	9272
Zinc metal	'000 tonnes	-	-	-	-	-	-	-	133.56	428.11	28.00	-	589.67	589.67
Laterite	'000 tonnes	-	-	-	-	-	-	-	-	-	4000	-	4000	4000
Limestone	'000 tonnes	589789	176015	60794	826598	464232	176987	52152	28470	159309	1114112	-	1995262	2821860
Manganese ore	'000 tonnes	10000	2210	108	12318	497	3010	12001	-	1589	4655	84	21835	34153
Marble	'000 tonnes	-	324	-	324	-	-	81	-	-	57642	-	57723	58047
Mica	kg	-	-	-	-	-	-	65916000	-	-	15120000	-	81036000	81036000
Ochre	tonne	22260	-	16000	38260	17680	38080	100980	6010	6010	286000	-	454760	493020

(Contd.)

Table - 1(Concld.)

Mineral	Unit	Reserves: Proved STD 111	Reserves: Probable STD121	Reserves: Probable STD122	Reserves: Total (A)	Remaining resources: Feasibility STD211	Remaining resources: Pre-feasibility STD221	Remaining resources: Pre-feasibility STD222	Remaining resources: Measured STD331	Remaining resources: Indicated STD332	Remaining resources: Inferred STD333	Remaining resources: Reconnaissance STD334	Remaining resources: Total (B)	Total resources (A+B)
Pyrophyllite	tonne	702680	-	281072	983752	-	-	-	958000	-	2185696	-	3143696	4127448
Quartz-silica sand	'000 tonnes	12356	2085	10884	25326	29372	15172	48391	-	355	58374	-	151663	176989
Quartzite	'000 tonnes	48700	-	19480	68180	9516	28	1639	-	-	11353	-	22536	90716
Sillimanite	tonne	145144	-	58058	203202	-	-	-	-	64	2664	-	2728	205930
Silver														
Ore	tonne	-	-	-	-	-	-	-	-	-	235000	-	235000	235000
Metal	tonne	-	-	-	-	-	-	-	-	-	0.23	-	0.23	0.23
Talc/steatite/ soapstone	'000 tonnes	-	-	-	-	-	-	-	-	2565	14262	-	16827	16827
Titanium minerals	tonne	293539	-	117416	410955	-	151888	-	1020326	846000	1997108	-	4015322	4426277
Tungsten														
Ore	tonne	-	-	-	-	-	-	-	610000	5637250	1830000	-	8077250	8077250
Contained WO_3	tonne	-	-	-	-	-	-	-	1903	10304	3828	-	16035	16035
Vanadium														
Ore	tonne	293539	-	117416	410955	-	-	-	-	-	58708	-	58708	469663
Metal	tonne	1144.80	-	457.92	1602.72	-	-	-	-	-	228.96	-	228.96	1831.68

Figures rounded off.
** Resources of ilemenite and zircon as per Department of Atomic Energy are provided in the respective Mineral Reviews.*

Table – 3: Details of Exploration Activities in Maharashtra, 2009-10

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
GSI **Base metals** Chandrapur	Area between Nai Dilli- Dighori and Lal Heti Dugula	-	-	-	-	-	Reconnaissance stage investigation (G-4) wastaken up during FS 2010-12 in this block (Archaean Gneissic terrain) to establish northern strike continuity of Thanewasana copper and associated base metal mineralisation. The investigation was carried by way of geochemical sampling on grid pattern (100x 50m) followed by detailed geophysical and geological mapping & soil sampling from Dugula area were analyzed by cold extraction techniques which indicated presence of sulphide mineralisation. Hydrothermal breccias and quartzchloritic vein with boxwork development is recorded in this area. Surface indication in the form of suphide disseminations in pyroxenite was recorded in Nai Dilli area. Presence of barite is noted in Phutana area. The work is under progress.
- do - Gadchiroli	Ghanpur- Mudohli	-	-	-	-	-	Prospecting stage investigation (G-3) in West Bastar Craton for copper and associated mineralisation was continued as spill over item in F.S 2010-12 to establish potential zones of copper mineralisation. The target of spill over drilling has been achieved. Chemical analysis results are awaited
Bauxite Ratnagiri and Sindhudurg	Sides of VoghotanRiver	-	-	-	-	59	Reconnaissance stage investigation (G-4) was taken up during FS 2010-12 in Sindhudurg belt in the lateritic terrain to search for bauxite potential. The area comprises laterite on the surface, and the Upper Cretaceous to lower Eocene Deccan basalts occurred along the deep nala beds and in low lying areas. The saprolite often retains the relict structures of basalt. The Deccan basalt flows overlie the Proterozoic sandstones belonging to Kaladgi Supergroup. The laterite exhibits

(Contd.)

Table - 3 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
GSI **Bauxite** Ratnagiri and Sindhudurg (Contd.)	Sides of Voghotan River	-	-	-	-	59	altered vermicular features with iron oxide rich rims and clay rich central portions. The 8m vertical section of the Nanarwadi laterite quarry exposes 1m to 1.5 m thick hard and compact limonitised laterite in the top followed by 4cm to 5cm thick reddish soil with rare lenses and pockets of white aluminous laterite. In the bottom zone, 1-2m thick lateritic bauxite/bauxite lenses occurred. Samples were collected from the bottom sidewall portions of trenches excavated (dimension nearly 1 m x 1.5 m x several km) for laying out telephone cables in the study area all along the main track of the plateau. The analytical results of the samples are awaited. The work is in progress
Maharahstra (Wardha valley coal field) Yavatmal	Dewala-Mangali	-	-	-	-	02	Prospecting stage (G-3) regional exploration was continued during FS 2010-12 in this block to establish the strike continuity of Barakar coal seams already recorded in Asthona- Kothurla - Mangli area in the NW below the Deccan Traps and to assess the coal resource potentiality of the area. Boreholes were drilled, but due to drilling problems the borehole could not reach the Barakar Formation which is coal bearing. The work is in progress
Manganese Nagpur	Parseoni	-	-	-	-	-	Prospecting stage investigation (G-3) initiated during FS 2009-10 was continued in Sausar fold belt to establish manganese ore horizons west of Parseoni mines. The area is covered by highly folded and faulted manganese bearing sediments associated with the Tirodi Gneiss of Archaean age. During FS 2010-12, detailed mapping was carried out over an area of 0.6 sq km around Savali old working and Mohgaon area along with pitting, trenching and geophysical magnetic and gravity surveys. The Savali old working has a length of 54 m; width varied from 1 m to 7.5 m and depth of 5 m. Manganese ore body in the old working occurs within the marbles as irregular bands and lenses varying in thickness from 0.5 m to 1m and plunges 350 towards northwest. The Mn ore is braunite with subordinate

(Contd.)

Table - 3 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
GSI **Manganese** Nagpur (Contd.)	Parseoni	-	-	-	-	-	psilomelane / pyrolusite. Manganese band of 160 m length and width varying from 1 m to 1.5 m is delineated by digging pits in soil covered Savali Block. In trench No. T2/S alternate, fresh and weathered ore body is exposed for a width of 8 m. Chemical analysis of pit samples so far received indicated low Phosphorous manganese ore ranging from 0.02% to 0.37% Mn. Out of 21 pits samples analysed for Mn, values in 5 samples range from 20.83% to 41.44% and the remaining samples yielded <3.39% Mn. Out of 46 bed rock samples analysed for Manganese, values in 4 samples ranged from 18.79% to 42.23% and the remaining samples contain <5.40% Mn. In Mohgaon area, 10 manganese bands varried in length from 30 m to 75 m and width of 0.5 m to 2.5 m were delineated within pinkand white marbles. Drilling will be taken up after the interpretation of geological and geophysical work, the latter are in progress. The work is continuing.
PGE Chandrapur	Heti	-	-	-	-	-	Prospecting stage investigation (G-3) was taken up during FS 2010-12 in Western Bastar craton in the maficultramafics of Heti area to assess the economic potentiality of the earlier delineated PGE and Ni zones within gabbro-noritepyroxenite bodies. Surface occurrences of pyrite, pyrrhotite, pentlandite and chalcopyrite dissemination have been recorded at the contact of gabbro and pyroxenite near Ganeshpipri. Two parallel mineralized gabbro-noritepyroxenite bodies with anomalous PGE values have been mapped intermittently for a stretch of 600 m in Heti Block. upBH-2 intersected disseminated sulphide zones at various depth within gabbroic unit. The work is in progress.

(Contd.)

Table - 3 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
DGM							
Bauxite Ratnagiri	Guhaghar	-	-	-	-	-	The area wholly composed of basalt which is overlained by laterite above 80-100 m contour level covered about 80% of the area which showed existence of low grade bauxite.
Coal Chandrapur	Panwadala	-	-	-	-	242.10	Based on the exploration work carried out so far, thickness of top coal seam ranges from 12.16 – 3.70 m and middle coal seam ranges from 6.25 m – 13.50 m at a depth of 172.65 m to 365.50 m.
-do-	Nandori	-	-	-	2179.50	-	So far, workable coal seam ranges in thickness from 7.25 m - 18.60 m up to a depth of 378.15 m. A total of 180 million tonnes resources were estimated out of which 170.95 million tonnes were placed under proved category so far.
-do-	Chalbaradi	-	-	-	-	343.00	Based on the borehole data the thickness of the top coal seam encountered is 355.05 m, 1.28 million tonnes resources were estimated.
-do-	Wislon	-	-	-	-	1102.50	In this block top coal seam thickness varied from 341.70 - 344.70 m and middle coal seam varied from 427.20 - 445.20 m. A total of 21.30 million tonnes resources were estimated out of which 9.49 million tonnes resources were estimated under proved coal.
-do- Nagpur	Makardhokda Block-V Dawa-Phukeshwar	1:25,000 1:5,000	10.0 2.0	-	900.70	-	The exploration work indicated six coal seams ranging in thickness from1.10 m – 6.65 m. the depth of coal seam ranges from 30 m – 420 m. 1.23 million tones resources were estimated.
-do-	Nand-Panjrepar	1:25,000 1:5,000	4.0 2..40	-	3261.41	-	Exploration work carried out established six coal seams whose thickness varied from o.30 m – 5.82 m. The depth range was observed from 50.25 m -435.60 m. 5.10 million tonnes resources were estimated. A total 24.98 million tonnes resources estimated under proved category so far.
-do- Wardha	Shekapur	-	-	-	738.0	-	Based on exploration work carried out so far two composite coal seams were established which ranges from 71 m – 195.80 m. thickness of workable coal seam varied from 1.01 in its 2.5 m. 8.16 million tones resources were proved so far.

(Contd.)

Table - 3 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
Yavatmal	Dara-Parsoda	1:25,000	11.0	-	1310.80	-	Two workable coal seams were established. The depth range in respect of top coal seam varied from 18.30 m – 139.08 m & that of middle coal seam from 27.56 m – 56.43 m. Thickness of workable coal seam varied from 1 m – 1.64 m. 0.50 million tones resources were estimated 24.98 million tones resources were proved so far.
-do-	Ashtona-Kothurma	1:25,000 1:5,000	22.0 1.0	-	677.35	-	Based on regional boreholes data taken so far one workable coal seam has been intersected within a depth range from 139.69 m – 237.00 m. the effective workable thickness of coal seam ranged from 1-8 m. 0.99 million tones resources were estimated.
Construction Minerals Aurangabad	Around Gangapur	-	-	-	-	-	The area is covered by Deccan trap. The suitable areas for construction minerals were located around the villages Gurudhanora Dhamori & Mangrul-Nangi-Khurd.
Manganese Nagpur	Parseoni	1:25,000	37 sq km	-	-	-	Manganese exposures were noticed near villages Savali & Mohgaon. Overall trend of manganese deposit was found East-West dipping 55o due south.
Pyrophyllite/ Sillimanite Chandrapur	Walni-Khatgaon	-	-	-	538.95	-	As a result of work carried out quartz-quartzite, pyrophyllite-sillimanite rock were noticed in the area. About 1.29 million tones resources were estimated in the area. Presence of Almandine garnet crystals were also noticed in quartz-mica-schist.

(Contd.)

Table - 3 (Concld.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
MOIL **Manganese** Nagpur	Beldongri	-	-	-	-	-	As on 1.4.2011, Manganese ore resources were estimated at 0.40 million tonnes.
-do-	Chikla Extn.	-	-	-	-	380.0	As on 1.4.2011, Manganese ore resources were estimated at 4.22 million tonnes.
-do-	Dongri-Buzurg	-	-	-	-	1095.0	As on 1.4.2011, Manganese ore resources were estimated at 11.22 million tonnes.
-do-	Kandri	-	-	-	-	779.0	As on 1.4.2011, Manganese ore resources were estimated at 3.50 million tonnes.
-do-	Mansar	-	-	-	-	187.0	As on 1.4.2011, Manganese ore resources were estimated at 4.66 million tonnes.

Production

The value of mineral production in Maharashtra during 2010-11 at ₹ 6183 crore increased by 5% as compared to that in the previous year. Maharashtra accounted for about 3% of the total value of mineral production in the country during the year under review. It was the largest producer of fluorite (graded) in 2010-11 in the country. It is the second largest producer of kyanite (36%) and third largest producer of manganese ore with 22% share in the national output of the mineral. Coal contributed 87% and manganese ore 7% of the total value of mineral production in the state during the year under review.

Among the important minerals, the production of iron ore increased by more than five times and that for kyanite 88% and bauxite 8%. whereas fall in production was reported in sillimanite 62% , fireclay 55%, fluorite (graded) 48%, sand (others) 41%, shale24% and quartz 20%. No production for corumdum, laterite and chromite was reported in the current year.

The value of minor mineral production was estimated at ₹ 102 crore for the year 2010-11.

The number of reporting mines was 157 in 2010-11 as against 158 in the previous year (Table - 4).

The index of mineral production in Maharashtra (base 1993-94 = 100) in 2010-11 was 193.31 as against 200.09 in the previous year.

Mineral-based Industry

The important large and medium-scale mineral-based industries in the organised sector in the State are given in Table-5.

Table – 4 : Mineral Production in Maharashtra, 2008-09 to 2010-11 (Excluding Atomic Minerals)

(Value in ₹ '000)

Mineral	Unit	2008-09 No. of mines	2008-09 Quantity	2008-09 Value	2009-10 No. of mines	2009-10 Quantity	2009-10 Value	2010-11 (P) No. of mines	2010-11 (P) Quantity	2010-11 (P) Value
All Minerals		**158**		**61726081**	**158**		**58641888**	**157**		**61831773**
Coal	'000t	55	38705	47850300	55	41005	50887500	55	39336	53628800
Bauxite	t	14	2053512	625275	13	1985006	628556	15	2135235	550780
Chromite	t	-	-	-	1	66	489	-	-	-
Iron ore	'000t	11	294	236085	12	283	221777	15	1520	1231774
Manganese ore	t	17	680629	7364783	15	613520	4618651	19	623078	4224429
Corundum	kg	-	21000	63	-	6600	20	-	-	-
Dolomite	t	5	94896	16849	5	76625	15566	5	76907	12655
Felspar	t	1	587	103						
Fireclay	t	2	6786	509	2	6744	641	2	3064	346
Fluorite (graded)	t	1	3176	15626	1	4931	20473	1	2552	13082
Kyanite	t	4	1005	777	3	1075	950	2	2022	1760
Sillimanite	t	2	9130	7628	2	9539	7093	2	3618	3419
Laterite	t	2	163331	23419	2	108901	15615	-	-	-
Limestone	'000t	21	10484	1202790	26	9433	1069248	21	8919	1053748
Pyrophyllite	t	-	2127	625	-	1446	461	-	1299	394
Quartz	t	4	15989	3619	4	12650	2761	4	10144	2252
Quartzite	t	-	1054	264	-	2481	620	-	2455	614
Silica sand	t	16	341866	92503	15	271517	90831	13	264191	69427
Sand (others)	t	2	469870	51565	2	395910	26316	3	233009	11734
Shale	t	1	434570	23498	-	405085	17458	-	308417	9697
Minor Minerals@		-	-	4209800	-	-	1016862	-	-	1016862

Note : *The number of mines excludes minor minerals.*

@ Figures for earlier years have been repeated as estimates wherever necessary, because of non-receipt of data.

Table – 5 : Principal Mineral-based Industries in Maharashtra

Industry/plant	Capacity ('000 tpy)
Abrasives	
Associated Abrasives Ltd, Nasik	NA
Flexoplast Abrasives (I) Ltd, Chikalthana Dist. Aurangabad	500000 (sq m)
Grindwell Norton Ltd, Mora, Uraon, Raigad	NA
Aluminium products	
Hindalco, Recycling plant, Taloja	50
Hindalco, Mouda, dist. Nagpur	30 (rolling mill) 14 (conductor rod)
Asbestos Products	
Everest Building Products Ltd, Mulund	NA
Hyderabad Industries Ltd, Musarane	60.0
Newkem Products Corp, Mumbai	9.9
Swastik Roofing Ltd, Chinchwad	NA
Cement	
ACC Ltd., Chanda, Dist. Chandrapur	1000
Ambuja Cement Ltd, (Maratha Cement Works), Upparwahi, Chandrapur	2850
Indo Rama Cement Ltd. Khar Kavari, Dist. Raigad (G)	1000
Manikgarh Cement, Gadchandur, Dist. Chandrapur	1900
Orient Cement, Jalgaon (G)	800
Rajashree Cement, Hotgi (G)	1400
Ultra Tech Cement Ltd, Awarpur, Dist. Chandrapur	3600
Ultra Tech Cement Ltd, (Narmada Cement), Ratnagiri Works (G), Dist. Ratnagiri	400
Ceramics	
Four Field, Pimpri, Dist. Pune	1.2
H&R Johnson (India) Ltd, Pen	154.8
Joglekar Refractory & Ceramics Pvt Ltd, Robale, Dist. Thane	364.8
NITCO Tiles Ltd, Alibag	64.8
NECO Ceramics, Nagpur	8.1

(Contd.)

Table - 5 (Contd.)

Industry/plant	Capacity ('000 tpy)
Chemicals	
Borax Morarji Ltd, Ambarnath	17 (borax) 6 (boric acid)
Century Rayon, Shahad, Dist. Thane	25 (rayon yarn) 20 (caustic soda)
Foseco India Ltd, Sanswadi	15 (foundry chemicals)
Gopalchand Rasayan, Tarapur, Dist. Thane	41.3 (H_2SO_4)
MTZ Industries Ltd, Patalganga	1.2 (sulphur)
National Peroxide Ltd, Kalyan, Dist. Thane	1.4 (sodium per borate)
Sudarshan Chemical Ind. Ltd, Roha, Dist. Raigad	5.2 (pigments)
Tecil Chemical & Hydro Power Ltd, Mumbai	30 (calcium carbide)
Zirconium Chemicals Pvt. Ltd, Taloja, Dist. Raigad	0.3 (zirconium salt)
Copper Wire Rods	
HCL, Taloja	60
Electrode	
GEE Ltd., Thane	4.02 (Mill. m)
Electrolytic Manganese Dioxide	
MOIL, Dist. Bhandara	1
Fertilizers	
BEC Fertilizer, Gunjakheda, Wardha	66 (SSP) 33 (SAP) 45 (GSSP)
Dharamsi Morarji Chemicals Co. Ltd, Ambarnath	300 (SSP) 220 (H_2SO_4) 46.20 (Al_2SO_4)
DFPCL-Taloja	52.90 (N_2) 52.90 (P_2O_5)
MAIDCL, Nanded	45 (NPK)
MAIDCL, Rasayani, Dist. Raigad	45 (SSP)
MAIDCL, Pachora, Dist. Jalgaon	50 (NPK)
MAIDCL, Wardha	45 (NPK)

(Contd.)

Table - 5 (Contd.)

Industry/plant	Capacity ('000 tpy)
RCF-Trombay	300 (NPK) 361 (ANP)
RCF-Thal, Alibag, Dist. Raigad	1707 (urea)
VCMSL, Butibori, Dist. Nagpur	42 (NPK)
VCMSL, Badnera Road, Dist. Amravati	30 (NPK)
Pesticides	
Hindustan Insecticides Ltd, Rasaini, Dist. Raigad	13.2
Pentacem, Kendgaon, Dist. Ahmednagar	1.7
Maharashtra Insecticides Ltd, Akola	NA
Glass	
Ace Glass Containers Ltd, Pimpri, Dist. Nasik	NA
Apte Flasks & refills Pvt. Ltd, Raigaon	1500
Astral Glass Pvt. Ltd, Igatpuri	16.4
Empire Industries Ltd, (Vitrum Glass) Vikroli, Mumbai	37.5
Hindustan National Glass & Industries Ltd, Nasik	320 TPD
Paisa Fund Glass Works, Talegaon Dabhade	0.06
The Mahalaxmi Glass Works Pvt. Ltd, Mumbai	48.0
Foundry	
CP Foundry Works, Nagpur	NA
Aditya Foundry Pvt Ltd, Nasik	NA
S.M. Iron Works, Sinnar, Nasik	NA
Iron & Steel	
JSW Ispat Steel Ltd, Dolvi, Raigad	2240 (sinter) 1600 (DRI) 3000 (HRC) 3000 (CRC) 2000 (pig iron)
Lloyds Steel Ltd, Wardha	600 (HRC) 350 (CRC) 250 (GPC)

(Contd.)

Table - 5 (Concld.)

Industry/plant	Capacity ('000 tpy)
Indian Seamless Steel & Alloys Ltd, Jejuri, Dist. Pune	450 (seamless tubes) 350 (alloy & carbon steel)
Sunflag Iron & Steel Co. Ltd, Bhandara	150 (sponge iron) 200 (alloy steel)
Usha Ispat Ltd, Satara, Sawantwadi	300
Pig Iron	
Ispat Metallics India Ltd, Dolvi, Raigad	2000
Tata Metalics Ltd (Usha Ispat Ltd, Redi), Dist. Sindhudurg	300
Sponge Iron	
Ambey Iron Pvt. Ltd, Chincholi, Solapur	45
Dhanalakshmi Sponge Iron, Daregaon, Dist. Jalana	60
Lloyds Metals & Engineers, Ghugus, Chandrapur	270
Vikram Ispat, Salav, Dist. Raigad	900
Welspum Max Steel Ltd, Salav, Dist. Raigad	900
Ferro-alloys	
Bharat Pulverising Mills Ltd, Mumbai	0.2
Chandrapur Alloys Ltd, Chandrapur (formerly, Maharashtra Electrosmelt Ltd)	100
Nagpur Power & Industries Ltd, Nagpur	NA
Natural Sugar & Allied Industries Ltd, Sai Nagar, Ranjani, Dist. Osmanabad	11 MVA
Sunbel Alloys Co. Ltd, Thane-Belapur	0.3
Welspun Maxsteel Ltd, Salav, Raigad	90
Refractory	
ACE Refractories, Nagpur	60
Petroleum Refinery	
BPCL, Mumbai	12000
HPCL, Mumbai	6500

(G) : *Grinding units.*

Indian Minerals Yearbook 2011

(Part- I)

50th Edition

(ADVANCE RELEASE)

STATE REVIEWS
(Manipur)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 001

PHONE/FAX NO. +91712 - 2565471
PBX : +91712 - 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

MANIPUR

Mineral Resources

Occurrences of **chromite, china clay** and **limestone** are reported in Chandel, Churehandapur and Ukhrul districts (Table - 1).

Exploration &Development

Details of exloration activities conductred by GSI during 2010-11 is furnished in Table-2.

Production

No mineral production (except minor minerals) was reported from Manipur in 2010-11. The value of minor minerals production was estimated at ₹ 29 lakh for the year 2010-11.

Mineral-based Industry

A cement plant set up by Manipur Cements Ltd. (a State Govt. undertaking) at Hundung in Ukhrul district is in operation since 1989. The plant has a capacity of 15,000 tpy.

Table – 2 : Details of Exploration Activities in Manipur, 2010-11

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
GSI **PGE** Ukhrul	Siruhi, Gamnom and Pushing	1:50,000	100.0	-	-	-	Reconnaissance stage investigation (G-4) was continued during FS 2010-12 for Platinum Group of elements in ophiolite belt to assess the potential of PGE Mineralisation in the favourable host rocks in ultramafic suite comprising chromiferous dunite, peridotite and pyroxenite**.** Reconnoitory geological traverse have been carried out in the ophiolite belt of Manipur and an area of 100 sq. km was mapped in parts of aforesaid area. Ultramafic clan of rocks with chromitite layers were identified. The ultramafic suites were emplaced into the pelagic-sediments of Tertiary age. A total of eighteen chromite bands / lenses containing massive chromite with maximum dimension of 20 m x 2 m have been delineated within the serpentinised peridotite which are parallel to the regional trend. Chromite is medium to coarse grained, subhedral to euhedral and dark grey in colour and shows metallic lustre. The chromite samples analysed Cr_20_3 content varied from 44% to 59% and is akin to the Alpine Type Podiform Chromite. The work is in progress

Table –1: Reserves/Resources of Minerals as on 1.4.2010 : Manipur

Mineral	Unit	Reserves				Remaining resources					Total resources
		Proved STD111	Probable STD121	Probable STD122	Total (A)	Pre-feasibility STD222	Measured STD331	Indicated STD332	Inferred STD333	Total (B)	(A+B)
China clay	'000 tonnes	-	-	-	-	-	2520	-	-	2520	2520
Chromite	'000 tonnes	3	21	52	76	-	-	529	6052	6581	6657
Limestone	'000 tonnes	-	-	-	-	-	19953	2138	23962	46053	46053

Fe*igures rounded off.*

Indian Minerals Yearbook 2011

(Part- I)

50th Edition

(ADVANCE RELEASE)

STATE REVIEWS
(Meghalaya)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 001

PHONE/FAX NO. +91712 - 2565471
PBX : +91712 - 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

MEGHALAYA

Mineral Resources

Coal and limestone are the only major minerals mined in the State. **Coal** occurs in Mikir Hills, Khasi Hills, Jaintia Hills and Garo Hills districts. The production of upgraded coal was reported by private non-captive mines in the unorganised sector located in these areas except Mikir Hills district. The mines are operated mostly by the local tribals in their private lands. Resources of **limestone** occur in West Garo Hills, East Khasi Hills, West Khasi Hills and Jaintia Hills districts. Other mineral occurrences are **apatite** in Jaintia Hills district; **china clay** in East Garo Hills & West Garo Hills, Jaintia Hills & East Khasi Hills districts; **copper, lead-zinc, silver** and **titanium minerals** in East Khasi Hills district; **felspar** and **rock phosphate** in East Garo Hills & Jaintia Hills districts; **fireclay** in East Khasi Hills & West Garo Hills districts; **granite** in West Khasi Hills district; **iron ore (magnetite)** in East Garo Hills district; **quartz** and **silica sand** in East Garo Hills, West Garo Hills & East Khasi Hills districts; and **sillimanite** in West Khasi Hills district (Table -1). The various coalfields and their reserves/resources in the State are given in Table-2.

Exploration & Development

Details of exploration activities conducted by various agencies during 2010-11 are furnished in Table - 3.

Production

The value of mineral production in Meghalaya was at ₹ 2,616 crore in 2010-11 was 22 higher as compared to ₹ 2,138 crore in the previous year. About 99% of the value of mineral production was accrued from coal during the year under review whereas the remaining was contributed by limestone and minor minerals .

Meghalaya has emerged as an important coal producer of the country. The production of coal is spread over in Jantia hills, Garo Hills, East khasi hills and West khasi hills areas. The entire production is of ungraded coal mined from the large number of small scale mines operated mostly by the local tribal in unorganised private sector. Hence number of coal mines is not available for the state (Table - 4).

The value of minor minerals production was estimated at ₹ 721 lakh for the year 2010-11.

There were 9 reporting mines in 2009-10 and 2010-11.

The index of mineral production in Meghalaya (base 1993-94=100) was 281.10 in 2010-11 as against 249.30 in the previous year.

Table – 2 : Reserves/Resources of Coal as on 1.4.2011 : Meghalaya

(In million tonnes)

Coalfield	Proved	Indicated	Inferred	Total
Total	**89.04**	**16.51**	**470.93**	**576.48**
West Darangiri	65.40	-	59.60	125.00
East Darangiri	-	-	34.19	34.19
Balphakram-Pendenguru	-	-	107.03	107.03
Siju	-	-	125.00	125.00
Langrin	10.46	16.51	106.19	133.16
Mawtong Shelia	2.17	-	3.83	6.00
Khasi Hills	-	-	10.10	10.10
Bapung	11.01	-	22.65	33.66
Jaintia Hills	-	-	2.34	2.34

Source*: Coal Directory of India, 2010-11*

Table – 1 : Reserves/Resources of Minerals as on 01-04-2010 : Meghalaya

Mineral	Unit	Reserves: Proved STD 111	Reserves: Probable STD121	Reserves: Probable STD122	Reserves: Total (A)	Remaining resources: Feasibility STD211	Remaining resources: Pre-feasibility STD221	Remaining resources: Pre-feasibility STD222	Remaining resources: Measured STD331	Remaining resources: Indicated STD332	Remaining resources: Inferred STD333	Remaining resources: Reconnaissance STD334	Remaining resources: Total (B)	Total resources (A+B)
Apatite	tonne	-	-	-	-	-	-	-	-	-	1300000	-	1300000	1300000
China clay	000 tonnes	-	-	-	-	-	-	-	1410	6266	76032	5167	88875	88875
Copper														
Ore	000 tonnes	-	-	-	-	-	-	-	-	880	-	-	880	880
Metal	000 tonnes	-	-	-	-	-	-	-	-	9	-	-	9	9
Felspar	tonne	-	-	-	-	-	-	-	-	-	37449	-	37449	37449
Fireclay	000 tonnes	-	-	-	-	-	-	-	-	-	10999	-	10999	10999
Granite														
(Dimen. stone)	000 cu m	-	-	-	-	-	-	-	-	-	286467		286467	286467
Iron ore														
(Hematite)	000 tonnes	-	-	-	-	-	-	-	-	-	225	-	225	225
Iron ore														
(Magnetite)	000 tonnes	-	-	-	-	-	-	-	-	-	3380	-	3380	3380
Lead-Zinc														
Ore	000 tonnes	-	-	-	-	-	-	-	-	880	-	-	880	880
Lead metal	000 tonnes	-	-	-	-	-	-	-	-	16.5	-	-	16.5	16.5
Zinc metal	000 tonnes	-	-	-	-	-	-	-	-	14	-	-	14	14
Limestone	000 tonnes	138207	94459	-	232666	36898	23400	-	460107	2811179	13941438	-	17273022	17505688
Quartz-														
Silica sand	000 tonnes	-	-	-	-	-	-	-	-	177	6906	-	7083	7083
Phosphorite/Rock														
Phosphate	tonne	-	-	-	-	-	-	-	-	-	1311035	-	1311035	1311035
Sillimanite	tonne	-	-	-	-	-	-	-	-	-	55807	-	55807	55807
Silver														
Ore	tonne	-	-	-	-	-	-	-	-	880000	-	-	880000	880000
Metal	tonne	-	-	-	-	-	-	-	-	19.8	-	-	19.8	19.8
Titanium														
minerals	tonne	-	-	-	-	-	-	-	-	3345000	-	-	3345000	3345000

Figures rounded off

Table – 3 : Details of Exploration Activities in Meghalaya, 2010-11

Agency/ Mineral/ District	Location/ Area/ Block	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of bore-holes	Metreage		
GSI **Base metal** East Garo Hills	N/V Simsang Diwa	-	-	-	-	-	Reconnaissance stage investigation (G- 4) was taken up during FS 2010-12 in this area (Archaean Gneissic Complex) to assess base metal potential of the area. During mapping different varieties of granites viz porphyritic granites and homophanous granites were delineated. The granite contains various proportions of biotite and feldspar and is intrusive into the banded gneiss. Lamprophyre dykes are exposed near Simsang Diwa. Three major dioritic intrusions are recorded in the area between Simsang Diwa and Gambil. No significant sulphide mineralised zone could be delineated in the area so far.
Limestone Jaintia Hills	Umphyrluh Block	-	-	-	-	-	Prospecting stage investigation (G-3) was taken up during FS 2010-12 in this area to explore limestone resources in the peripheral area of the Litang valley limestone deposit. The limestone is bedded type striking NNE-SSW with horizontal to sub-horizontal dip of about 3° to 5° towards ESE. The work is in progress
REE East Khasi Hills	Part of Sung ultramafic-alkalinecarbonatite complex	-	-	-	-	-	Reconnaissance stage investigation (G-4) was taken up during FS 2010-12 in the peripheral of this area to evaluate REE potential. The Sung Valley intrusive is an oval-shaped body covering about 30 sq. km. area within Precambrian Shillong Group. The body is strongly discordant to the envelope rocks and its walls appear to dip steeply inwards The major rock types are serpentinite, pyroxenite, uncompahrite, ijolite, syenite, carbonaite and apatite-magnetite rock. The inferred contact between quartzite and pyroxenite has been delineated for two kilometers north and northwest of

(Contd.)

Table - 3 : (Concld.)

Agency/ State/ District	Location/ Area/ Block	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of bore-holes	Metreage		
GSI **REE** East Khasi Hills	Part of Sung ultramafic-alkaline carbonatite complex	-	-	-	-	-	Village Tryshong. The quartz contains plenty of magnetite near t northern most part of investigati area. It is presumed that during t emplacement of Sung Ultramafic ir the quartzite of the Shillong Group, t magnetite is localized into the quartz as influx. The work is in progress.
Dte. of Mineral Resources **Limestone** Jaintia Hills	Jaintia Hills	1:50,000	0.50	08	1148.50	488	Occurrence of high grade limestone has been noticed in this block. Limestone is bedded in nature & strike is found to be NNE-SSW with low dip of2-5o due ESE. The limestone deposit spread over a strike length of 1 sq km with thickness 30-160 n. Limestone is also fossiliferrous in nature. As per available analytical data the grade of the limestone is Cao-51.26%, Mgo – 1.82%, SiO2 – 1.96%.

Table - 4 : Mineral Production in Meghalaya, 2008-09 to 2010-11
(Excluding Atomic Minerals)

(Value in ₹ '000)

Mineral	Unit	2008-09			2009-10			2010-11 (P)		
		No. of mines	Qty	Value	No. of mines	Qty	Value	No. of mines	Qty	Value
All Minerals		**8**		**13184867**	**9**		**21374850**	**9**		**26159622**
Coal	'000t	-	5489	12514900	1	5767	20545600	1	6974	25796800
Limestone	'000t	8	2929	597892	8	3249	757175	8	1460	289112
Sand (others)	t							-	10220	1635
Minor Minerals@		-	-	72075	-	-	72075	-	-	72075

Note: *The number of mines excludes minor minerals.*
@ Figures for earlier years have been repeated as estimates because of non-receipt of data.

Mineral-based Industry

The important large and medium-scale mineral-based industries in the organised sector in the State are given in Table - 5.

Table – 5 : Principal Mineral-based Industries in Meghalaya

Industry/plant	Capacity ('000 tpy)
Cement	
Mawmluh Cherra Cements Ltd, Cherapunji, Dist. East Khasi Hills	210
Meghalaya Cements Ltd, Thangshai, Dist. Jaintia Hills	495
Cement Manufacture Co. Ltd, Lumshnong Khleehriat	590 tpd
CMJ Cement, East Garo Hills	1000 tpd
Megha Technical & Engineering (P) Lumshnong, Dist. Jaintia Hills	462
Ferro-alloys	
Jaintia Ferro Alloys Pvt. Ltd, Byrnihat	6.0
Iron & Steel	
Jai Kamakhya Alloy	815 tpd

Indian Minerals Yearbook 2011

(Part- I)

50th Edition

(ADVANCE RELEASE)

STATE REVIEWS
(Mizoram & Nagaland)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 001

PHONE/FAX NO. +91712 - 2565471
PBX : +91712 - 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

MIZORAM

Mineral Resources

Occurrences of lignite, sandstone and pyrites are reported from the State. Major deposits of economic importance have not been reported so far in the State.

Exploration & Development

OIL conducted geo-physical survey for petroleum & natural gas and data for 346.55 (2D-GLKM) was acquired in 2010-11.

Production

No mineral production (except minor minerals) was reported from Mizoram during 2010-11. The value of minor mineral production was estimated at ₹ 63 lakh for the year 2010-11.

NAGALAND

Mineral Resources

Important mineral occurrences in the State are **coal** in Borjan, Jhanzi-Disai, Tiesang and Tiru Valley Coalfields; **iron ore (magnetite), cobalt** and **nickeliferous chromite** in Tuensang district; and **limestone** in Phek and Tuensang districts (Table-1). The various coalfields and their reserves/resources are given in Table - 2.

Production

No mineral production (except minor minerals) was reported from Nagaland during 2010-11. The value of minor minerals production was estimated at ₹ 18 lakh for the year 2010-11.

Mineral-based Industry

A mini-cement plant with a 600 tpy capacity was being set up at Waziho in Tuensang district. Another mini-cement plant was in operation in Phek district.

Table – 1 : Reserves/Resources of Minerals as on 1.4.2010 : Nagaland

Mineral	Unit	Reserves		Remaining resources				Total resources
		Proved STD111	Total (A)	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	(A+B)
Cobalt ore	million tonnes	-	-	-	-	5	5	5
Chromite	'000 tonnes	-	-	-	3200	-	3200	3200
Copper								
Ore	000 tonnes	-	-	-	2000	-	2000	2000
Metal	'000 tonnes	-	-	-	15	-	15	15
Iron ore (magnetite)	'000 tonnes	-	-	5280	-	-	5280	5280
Dunite	'000 tonnes	-	-	-	4800	-	4800	4800
Limestone	'000 tonnes	825	825	1010000	27000	-	1037000	1037825
Nickel ore	million tonnes	-	-	-	5	-	5	5

Figures rounded off.
Resources of Petroleum crude and Natural gas in the State are included in Assam and are not available separately.

Table – 2 : Reserves/Resources of Coal as on 1.4.2011 : Nagaland

(In million tonnes)

Coalfield	Proved	Indicated	Inferred	Total
Total	**8.76**	**-**	**306.65**	**315.41**
Borjan	5.50	-	4.50	10.00
Jhanzi-Disai	2.00	-	0.08	2.08
Tiensang	1.26	-	2.00	3.26
Tiru Valley	-	-	6.60	6.60
DGM	-	-	293.47	293.47

Source: *Coal Directory of India, 2010-11.*

Indian Minerals Yearbook 2011

(Part- I)

50th Edition

(ADVANCE RELEASE)

STATE REVIEWS
(Odisha)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 001

PHONE/FAX NO. +91712 - 2565471
PBX : +91712 - 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

ODISHA

Mineral Resources

Odisha is the leading producer of chromite, graphite, bauxite, manganese ore, iron ore, sillimanite, quartzite, pyroxenite and dolomite. The State hosts the country's sole resources of ruby and platinum group of metals. It accounts for the country's 95% chromite, 92% nickel ore, 69% cobalt ore, 55% bauxite, 51% titaniferous magnetite, 40% limestone, 36% pyrophyllite, 33% iron ore (hematite), 26% sillimanite, 25% each fireclay & garnet, 24% each coal & zircon and 20% vanadium ore resources.

Important minerals that occur in the State are : **bauxite** in Balangir, Kalahandi, Kandhamal, Keonjhar, Koraput, Malkangiri, Rayagada & Sundergarh districts; **china clay** in Bargarh, Boudh, Balangir, Keonjhar, Koraput, Mayurbhanj, Sambalpur & Sundergarh districts; and **chromite** in Balasore, Cuttack, Dhenkanal, Jajpur & Keonjhar districts. Chromite deposits of Sukinda and Nuasahi ultramafic belt constitute 95% of the country's chromite resources. Besides, **coal** occurs in Ib river valley coalfield, Sambalpur district & Talcher coalfield, Dhenkanal district; **dolomite** in Bargarh, Keonjhar, Koraput, Sambalpur & Sundergarh districts; **dunite/pyroxenite** in Keonjhar and Sundergarh districts; **fireclay** in Angul, Cuttack, Dhenkanal, Jharsuguda, Khurda, Puri, Sambalpur & Sundergarh districts; **garnet** in Ganjam, Kalahandi & Sambalpur districts; **graphite** in Bargarh, Boudh, Balangir, Kalahandi, Koraput, Nuapada & Rayagada districts; **iron ore (hematite)** in Dhenkanal, Jajpur, Keonjhar, Koraput, Mayurbhanj, Sambalpur & Sundergarh districts; **iron ore (magnetite)** in Mayurbhanj district; **limestone** in Bargarh, Koraput, Malkangiri, Nuapada, Sambalpur & Sundergarh districts; **manganese ore** in Balangir, Keonjhar, Koraput, Rayagada, Sambalpur & Sundergarh districts; **Pyrophyllite** in Keonjhar district; **quartz/silica sand** in Boudh, Balangir, Kalahandi, Sambalpur & Sundergarh districts; **quartzite** in Balangir, Dhenkanal, Jajpur, Jharsugada, Keonjhar, Mayurbhanj, Sambalpur & Sundergarh districts; **sillimanite** in Ganjam & Sambalpur districts; **talc/steatite/soapstone** in Mayurbhanj, Sundergarh & Sambalpur districts; **titanium minerals** in Dhenkanal, Ganjam, Jajpur & Mayurbhanj districts; and **zircon** in Ganjam district.

Other minerals that occur in the State are **asbestos** in Keonjhar district; **cobalt** in Cuttack & Jajpur districts; **copper** in Mayurbhanj and Sambalpur districts; **granite** in Angul, Boudh, Balangir, Cuttack, Deogarh, Dhenkanal, Ganjam, Keonjhar, Khurda, Koraput, Mayurbhanj, Nuapada, Rayagada & Sambalpur districts; **lead** in Sargipalli area, Sundergarh district; and **nickel** in Cuttack, Keonjhar & Mayurbhanj districts. Occurrences of **ruby** and **emerald** are reported from Balangir and Kalahandi districts, respectively. **Platinum Group of Metals** occur in Keonjhar district; **silver** in Sundergarh district; **tin** in Koraput and Malkangiri districts; and **vanadiferous magnetite** occurs in Balasore and Mayurbhanj districts (Table - 1). The various coalfields along with their reserves/resources are given in Table - 2.

Exploration & Development

The details of exploration activities conducted by various agencies during 2010-11 are furnished in Table - 3.

Table – 2 : Reserves/Resources of Coal as on 1.4.2011 : Odisha

(In million tonnes)

Coalfield	Proved	Indicated	Inferred	Total
Total	**24491.71**	**33986.96**	**10680.21**	**69158.88**
Ib-River	8057.54	8611.31	5847.64	22516.49
Talcher	16434.17	25375.65	4832.57	46642.39

Source: *Coal Directory of India, 2010-11.*

Table – 1 : Reserves/Resources of Minerals as on 1.4.2010 : Odisha

Mineral	Unit	Reserves				Remaining resources								Total resources (A+B)
		Proved STD 111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
			STD121	STD122			STD221	STD222						
Asbestos	tonne	-	-	-	-	-	-	-	10000	37200	9500	-	56700	56700
Bauxite	000 tonnes	132314	22855	144354	299523	56667	188316	237723	310224	155081	562924	-	1510934	1810457
China clay	000 tonnes	2376	715	811	3901	-	1252	2476	223	35393	236421	1259	277025	280926
Chromite	000 tonnes	31263	6725	15085	53073	1116	1189	4335	31722	35796	41431	21359	136948	190021
Cobalt	Million tonnes	-	-	-	-	-	-	-	31	-	-	-	31	31
Copper														
Ore	000 tonnes	-	-	-	-	-	-	-	1420	2536	2095	-	6051	6051
Metal	000 tonnes	-	-	-	-	-	-	-	21.69	21.06	20.69	-	63.44	63.44
Dolomite	000 tonnes	119853	44549	2710	167112	19558	27887	76634	40387	39474	268930	33063	505933	673045
Dunite	000 tonnes	3337	-	-	3337	-	4717	5267	-	384	627	-	10995	14333
Fireclay	000 tonnes	581	278	52	911	2135	11280	3774	26185	42747	83045	-	169166	170076
Garnet	tonne	-	3185605	-	3185605	5	-	-	-	-	348000	-	348005	3533610
Granite														
(Dimen. stone)	000 cum	-	80000	-	80000	-	-	-	330328	-	1432492	240	1763060	1843060
Graphite	tonne	495296	2172684	622933	3290913	-	1106192	1224811	11179	98665	2923002	19890	5383739	8674652
Iron ore														
(Hematite)	000 tonnes	2422247	569186	321568	3313000	12844-	471517	138365	49408	317074	1404450	107978	2617232	5930232
Iron ore														
(Magnetite)	000 tonnes	-	-	54	54	-	102	-	-	-	43	-	145	199
Lead-Zinc					-									
Ore	000 tonnes	-	-	-	-	-	961	119	-	-	670	-	1750	1750
Lead metal	000 tonnes	-	-	-	-	-	34.32	4.25	-	-	38.39	-	76.96	76.96
Limestone	000 tonnes	280588	466627	126717	873932	3225	49045	241871	133600	44562	386952	49800	909055	1782987
Manganese														
ore	000 tonnes	41354	4361	22784	68499	8244	14906	22714	1090	9371	61343	3880	121548	190047

(Contd.)

Table - 1 (Concld.)

Mineral	Unit	Reserves: Proved STD 111	Reserves: Probable STD121	Reserves: Probable STD122	Reserves: Total (A)	Remaining resources: Feasibility STD211	Remaining resources: Pre-feasibility STD221	Remaining resources: Pre-feasibility STD222	Remaining resources: Measured STD331	Remaining resources: Indicated STD332	Remaining resources: Inferred STD333	Remaining resources: Reconnaissance STD334	Remaining resources: Total (B)	Total resources (A+B)
Mica		-	-	-	-	-	6216000	52024000	-	20328000	26712000	-	105280000	105280000
Nickel ore	Million tonnes	-	-	-	-	-	21	21	31	51	51	-	174	174
Pt. Group of metals	tonne	-	-	-	-	-	-	7.7	-	-	6.5	-	14.2	14.2
Pyrophyllite	tonne	3329278	1001802	525100	4856180	1973032	194121	3920129	80	40	1331393	17161	7435955	12292135
Quartzite	000 tonnes	3629	1151	1783	6563	4204	9834	3744	681	-	34851	523	53837	60400
Quartz-silica sand	000 tonnes	438	69	860	1367	1161	1503	2599	90	63385	3836	-	72573	73940
Ruby		143	-	93	236	-	-	3165	286	38	1623	-	5113	5349
Sillimanite	tonne	-	1602228	-	1602228	-	-	6557013	-	-	4943600	-	11500613	13102841
Silver														
Ore	tonne	-	-	-	-	-	960500	119000	-	-	670000	-	1749500	1749500
Metal	tonne	-	-	-	-	-	27.34	3.4	-	-	34.17	-	64.91	64.91
Talc-steatite-soapstone	000 tonnes	123	178	112	414	31	1	109	-	-	265	-	406	820
Tin														
Ore	tonne	-	-	-	-	12692	636	-	-	1166	1000	-	15494	15494
Metal	tonne	-	-	-	-	34.63	500.78	-	-	22.2	10	-	567.61	567.61
Titanium minerals*	tonne	-	4274178	-	4274178	-	-	-	950000	-	38280000	-	39230000	43504178
Vanadium														
Ore	tonne	-	-	-	-	-	1220000	-	-	232000	3412795	-	4864795	4864795
Metal	tonne	-	-	-	-	-	2135	-	-	487.2	10935.74	-	13557.94	13557.94
Zircon*	tonne	-	146085	-	146085	-	-	-	-	-	-	-	-	146085

Figures rounded off

** Resources of Ilmenite, rutile and zircon as per Department of Atomic Energy are provided in the respective Mineral Reviews.*

Table – 3 : Details of Exploration Activities in Odisha, 2010-11

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
GSI							
Coal							
Ib-River Coalfield, Jharsuguda	Khariaparha	-	-	02	-	-	Regional Exploration under G-2 stage for coal in this block, was continued during FS.2010-12 with objective: (a) to explore the possible continuity of the regional coal seam zones of Raniganj and Barakar Formations of already explored Kuraloi (A) North Block, (b) to establish structural set up and stratigraphy of the area, (c) to assess the coal resource potentiality of the area and (d) to have a preliminary appraisal of CBM potentiality. In the first two boreholes-1 & 2 four regional Barakar coal seam zones namely Belpahar , Parkhani, Lajkura and Rampur seam zones were intersected from 12.10 m to 488.76 m depth. Lajkura seam zone is the thickest having cumulative coal thickness of 55.40 m intersected at roof depth of 305.66 m. Belpahar, Parkhani and Rampur seam zones are 12.51 m, 21.16 m and 13.05 m thick respectively with multiple split sections. The work is in progress.
-do-							
Talcher Coal field Angul	Simlisahi-Kunjabiharipur	-	-	-	-	-	Regional exploration under G-2 was continued during FS 2010-12 in this block to explore the westward continuation of regional coal seams of Barakar Formation already intersected in the adjacent Jalatap block and to appraise the coal resource potentiality of the area. Thick coal seams have been intersected at shallow to moderate depths. In the boreholes -7, 8 and 9, ten regional Barakar coal seams (II to XI) in the ascending order were intersected within depth range from 278.70 m to 638.78 m. Cumulative thickness of the individual coal seams varied from 2.65 m to 56.09 m. The work is in progress.

(Contd.)

Table - 3 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
GSI							
Coal							
Talcher coal field Angul	Nuagaon North	-	-	-	-	-	Reconnaissance stage (G-4) regional exploration by scout drilling was taken up during FS 2010-12 in this area to explore the downdip continuation of regional coal seams of Barakar and Karharbari Formations already explored in Nuagaon-Telisahi block and Kudanali NE blocks and to assess the resource potentiality of the area. Continuation of the regional coal seams has been established in Nuagaon North Block. In borehole -1, seam zones of II, III and VI-VIII belonging to Barakar Formation and Seam Zone-I of Karharbari Formation have been intersected between depth range of 161.49 m and 363.60 m. The Seam-III is the thickest having cumulative coal thickness of 19.94 m. Cumulative coal thickness of Seam –II is 15.78 m and Seam-I (Karharbari) is of 3.21 m respectively. The work is in progress
- do -	Korara-Danara	-	-	-	-	-	Prospecting stage (G-3) regional exploration was taken up during FS.2010-12 in this sector, to establish the updip continuity of Karharbari coal seam at shallow to quarriable depth and to assess the coal potentiality of the area. The first borehole-1 drilled a depth of 313.50 m intersected the basal Barakar conglomerate zone. The Karharbari coal seam (seam-1) has not been intersected within upper Karharbari Formation. The work is in progress
- do -	Harichandra-pur	-	-	-	-	-	Regional exploration under G-2 work has been carried out in this block to establish the northward continuity of regional coal zones of Barakar and Karharbari Formations already intersected in the adjacent Tribira block and to assess coal resources of the area. In boreholes -

(Contd.)

Table - 3 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
GSI							
Coal							
Talcher Coalfield Angul (Contd.)	Harichandrapur	-	-	-	-	-	3 and 4, all the ten regional Barakar coal seams (II to IX in ascending order) were intersected within the depth range from 13.95 m to 386.89 m with cumulative thickness of individual seams varying from 0.92 m to 56.19 m. Seam-II is the thickest having cumulative coal thickness ranging from 26.52 m to 56.19 m. The work is in progress.
Ib-River coalfield	Piplimal Khairkuni	-	-	-	-	-	Spill over work has been carried out in this block to explore the possible continuity of the regional Barakar coal seam zones towards south east of already explored Kuraloi (B) and Kuraloi (A) North Blocks and to establish structural set up and stratigraphy of the area and to assess the coal resource potentiality of the area. In the last borehole -11, two regional Barakar coal seam zones, namely Rampur and Ib seam zones with cumulative coal thickness of 35.40 m and 4.47 m have been intersected at 410.54 m and 472.00 m roof depths respectively. Investigation was completed.
-do-	Grindola	-	-	-	-	-	Regional exploration for coal inthis block, Ib-River Coalfield, (FS 2010-12) is scheduled to be taken up from October, 2011. Objective of the work is (a) to explore the possible continuity of the regional coal seam zones of Raniganj and Barakar Formations of already explored Kuraloi (A) North block, (b) to establish structural set up and stratigraphy of the area and (c) to assess the coal resource potentiality of the area.

(Contd.)

Table - 3 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
GSI							
Chromite Dhenkanal	South of Raibola-Kanheipal	-	-	-	-	-	Reconnaissance stage investigation (G-4) was taken up with scout drilling to search for chromite bodies in the transition zones of Eastern Ghat Mobile Belt (EGMB) and Iron Ore Supergroup (IOSG) of rocks south of Sukinda ultramafic complex. The ultramafics are mainly exposed in the old mining pits. However, a few small patches of intensely silicified serpentinite are exposed in western part of the mapped area. The old mining pits are scattered within a strike length of 1.5 km and width of 100 m in NW-SE direction. Chromite is present in weathered and silicified serpentinite as discrete grains, laminae and bands up to 70 cm width. The work is in progress.
Iron Ore							
Sundergarh	Sagasahi East	-	-	-	-	-	Prospecting stage (G-3) investigation in Bonai-Kendujhar belt was taken up during FS 2010-12 to assess iron ore potential in the northern contiguous area of Ghoraburhani block. The iron ore bodies contained hematite and occurred as bands, lenses and pockets with varying dimensions and are covered by laterite. The strike length of iron ore bands is 600 m with width of about 200 m. All the boreholes intersected iron ore and the thickness varied from 11.00 m to a maximum of 80 m. In course of drilling, the continuity of iron ore bodies below lateritic cover has been established and the thickness of ore zone is as good as Ghoraburhani-Sagasahi Block explored earlier. Analytical results of core samples are awaited. The work is in progress.

(Contd.)

Table - 74 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
GSI							
Iron Ore							
Keonjhar	Damurda Champu-asahi	-	-	-	-	-	Prospecting stage investigation(G-3) in Bonai- Kendujhar belt was taken up during FS 2010-12 to assess the potential of low grade iron ore associated with BHJ and ferruginous laterites in the area. The iron ore is haematite and occured as lenses and as narrow bands within ferruginous shale and BHJ. It is mainly powdery, soft and hard laminated type. The trend of ore bodies in Damurda-Lasarda ridge is NE-SW and extends over a strike length of 2.5 km with surface width varying from 50 m to 300 m The iron content ranges from 35 to 65%. Two boreholes CBH-1 and 2 were drilled at a strike interval of 200 m. The first borehole CBH- 1, planned to intersect the ore body at 50 m depth, intersected the BHJ between 41.55 m and 67.55 m with occasional shale parting and iron ore bands. The iron ore band (hematite) was intersected from 51.50 m to 53.60 m depth. The work is in progress.
Manganese							
Keonjhar	Damurda South, Bolani South, and Bolani NE Continuous	-	-	07	-	-	Prospecting stage investigation (G-3) was continued for resource assessment of manganese. The manganese ore in the area occurred with duricrusted laterite near to the surface, with brecciated chert and with the ferruginous shale, saprolitic clay and shale. The nature of the ore is lumpy, friable and powdery. Mineralisation is controlled by lithology and structure and is commonly seen along fractures, joints and fissile planes in shale and brecciated chert. Two boreholes are in progress. All the seven boreholes drilled intersected mineralised zones. The subsurface exploration so far carried out has identified mineralised zones over a strike length of 300 m. Individual thickness of ore zones varies from 0.20 m to as thick as 12 m with

(Contd.)

Table - 3 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
Manganese Keonjhar (Contd.)	Damurda						Mn>10% (V.E.). Analytical data of the samples received so far show Mn content varying from 10.44% to 42.16% and Fe from 11.17% to 22.61%. The phosphorous content varied from 0.12% to 0.18%. The inferred ore resource estimated from boreholes drilled during the FS 2009-10 at 20% Mn cut off is about 0.152 million tonnes (333) with an average grade of 18.98% Mn (Resource figure with 30 m strike length). The work is in progress.
GSI **Manganese** Keonjhar	Balagorha-Champuasahi	-	-	-	-	-	Reconnaissance stage investi-gation (G-4) was continued in this area belonging to Bonai-Kendujhar Belt to search for potential manganese ore bodies. Manganese ore body occurred as lenses and pockets within the manganiferrous laterite on the dip slope of the hills. The manganese ore is both hard and soft in nature. Mineralisation is also recorded along the fracture planes of brecciated chert as cavity fillings and within the porous and cavemous laterite. On the basis of surface indications a potential Mn mineralised zone over 300 m strike length and 30-40 m width has been delineated.
PGE Keonjhar	Bangur and Banaipank	-	-	-	-	-	Prospecting stage investigation (G-3) was taken during 2010 to delineate PGE bearing horizons in the Bangur chromite mining areas and to search for possible extension of potential ultramafic units in the Baniapank area. The mapping in the area indicated that the ultramafic brecciated zone is the host rock for PGE. Petrological samples were collected and studied to characterise different lithotypes exposed in area which belongs to Baula-Nuasahi ultramafics complex. Petro mineragraphic and SEM-EDX study of breccia zone indicated the presence of PGE minerals associated with basemetal sulphides and ferritchromite. Chemical analytical results are awaited.

(Contd.)

Table - 3 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
Dte. of Geology Base metal (copper) Mayurbhanj	North of Kesharpur	1:25,000 1:2,000	115.0 1.0	-	-	53	The area comprises of Iron ore group of rocks, which are represented by hornblende-chlorite schist, hornblende-schist and quartzite which are also intruded by granite/granite-gneiss, dolerite dykes and quartz vein. Copper mineralization was hosted by the sheared hornblende-schist at the contact with granite & gneiss. The general trend of foliation of hornblende-chlorite schist is N 35^o W dipping 50^o NW and that of granite gneiss is N 30^o W – S 30^o E with 40^o dip NE. Result of chemical & geochemical analysis awaited.
Bauxite Bhawanipatna	Around Kaniguma	1:50,000 1:2000	60.0 1.4	-	-	377	Seven bauxite plateaus have been identified i) East & South east of village Kaniguma ii) NW of Dhuligurha iii) E & S of Odiguma iv) West of Matrugurha v) East of Thuamul vi) South of Madrigurha and vii) South of Sundijobe. Average strike length varies from 0.5 – 2.0 km & width varies from 200 – 500 m. thickness of bauxite deposit in the scrap section varies from 3-9 m. The general trend of foliation also varies from N10oW – S10^{o}E to N35^{o}W – S 35^o E dipping 70^o – 85^o north-easternly. The litho units also showed three sets of joints. One occurrence of ruby has been noticed also at 500 m NW of village Teshalmul. Estimation of resource & grade is under progress.
-do- Bhawanipatna & Kalahandi	Around Cingapadar	1:50,000 1:25,000	101 1.5	-	-	-	Three bauxite bearing plateau were delineated. i) 1.5 km north of Lingapadar ii) 1.7 km east of Lingapadar iii) 1.0 km north of Simelgurha village. The length of the plateau to north of Lingapadar is 1.5 km along strike direction i.e N 45^{o}W – S 45^{o}E with average width 0.75 km. Scarp thickness around the periphery of the plateau also varies from 5-8.60 m. General trend of foliation of litho units were also varies from N 25^{o}E – S 25^{o}W to N 45^{o}W – S 45^{o}E with 70^o – 80O dip towards north-east. Estimation of resources & grade is under progress.

(Contd.)

Table - 3 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
Chromite Jajpur	South of Mahagiri Hill	1:2,000	1.12	-	-	482	This exploration block is a part of Sukinda Ultramafic complex lying to the south-western foot hill of Mahagiri range. It is a flat terrain occupied by soil and laterite. The result of trace element study of soil samples (under progress) may reveal the presence of chromiferous zone, if any.
-do-	-do-	-	1.25	-	-	-	The area forms a part of the iron ore super group. The major litho units were exposed in this area are quartzites, granite, laterite and soil. Mahagiri hill range which is the northern boundary of the working area is folded on an ENE-WSW direction plunging WSW. The strike of quartzites of this hill runs in an ENE-WSW direction and does not showed any swerving towards north.
Coal Angul	A.B block of Talchir coalfield	-	-	13	2077.70	-	-
-do-	North of Arakh pal & Shirampur coal blocks of Talchir	-	-	02	372.30	-	-
Jharsuguda	Vill- Kudopalli	-	-	03	279.60	-	-
-do-	Madhupur block 16 Valley coalfield	-	-	11	2103.80	-	-
Sundergarh	Manoharpur block – lb river coalfield	-	-	06	1205.00	-	-

(Contd.)

Table - 3 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
Diamond Nuapada	Supuli valley	-	-	-	-	29.5 tonnes (bulk samples	The area under investigation form a part of Bastar Cratonic Complex which consists of grey gneiss/ granodiorite, gneiss intruded by gabbro, dolerite, porphyritic granite, medium grained pink granite, pegmatite and quartz vein, olivine lamproite indifferent phases. Scanning for any Diamond Indicator Mineral within suspected ultrabasic rock is in progress.
-do-	Village- Darrimunda	1:25,000 1:2,000	10.0 0.15	-	-	27	Archaean basement rocks like granite gneissis intruded by newer granite, basic & ultrabasic rocks and overlained in patches by metasediments. Cratonic basement rocks are also intruded by acid, basic and ultrabasic rocks.
Heavy Mineral (Ilmenite, rutile, garnet, sillimanite, zircon, monazite, etc.) Jagasingnhpur	Balikuda block	-	-	-	1229	659	The area was occupied by alluvium and sand in the form of beach, berm & dunes in coastal zone of Quarternary Era. It was observed that the beach zone consists of fine to medium grained sand. In beach ridges (dunes) the upper part of sand is mixed with silt upto a depth of 1 m at some places. Heavy mineral have been distributed throughout the area in varying proportion.
-do- Puri	Village – Hunda in Krushnaparasad block	1:2,000	1.04	-	2060	2060	The beach placer deposit comprises of fine to coarse sand belonging to Quarternary Era. The sand deposit runs continuously parallel to coast in form of front-rear-intermediate dunes & continued beyond 10 m depth. Estimation of resources and grade will be made only after receipt of detailed analysis data.

(Contd.)

Table - 3 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks
		Scale	Area (sq km)	No. of boreholes	Meterage		Reserves/Resources estimated
Iron ore & Manganese ore Keonjhar	Around Harmutu, Gamli, Rugtudihi, Panduliposi	1:25,000	50.0	-	-	67	The area forms a part of Western limb of Bonei-Keonmjhar Horse-Shoe shaped synclinorium. The lithounits which encountered in this area are BHQ/BHJ, shale, quartzite, basalt, dolerite and laterite. The strike of the bedding varies from N-S to N 30^{o} E – S 30^{o}W dipping 30^{o}-80^{o} north-westerly. Hematitic iron ore has been encountered around Harmuta, Panduliposi & Bichiyaburu hill. i) Harmutu presence of hard laminated ore & hard massive ore have been noticed in the area 115 km ESE of Harmutu having dimension of 100 m x 500 m x 5 m. ii) Hard laminated ore has been also encountered to the east & south-east of village Panduliposi having dimension of 500 m x 100 m x 10 m & 300 m x 25 m x iii) Hematitic are associated with BHJ has also been traced with dimension of 1.4 km x 800 m.
Limestone Nabarangpur	Around Mokia & Jamuguda of Papadahandi block	1:25,000	110.0	-	-	72	The area under investigation forms a part of north-eastern boundry of the Indravati basin. It exposes basement granie of Archaean age overlained by Indravati Group of rocks of proterozoic age represented by quartzite, shale, laterite with intrusion of vein quartz, gabbro and dolerite. Intromatolitic limestone deposit occurred as sub-horizontally bedded underlained & overlained by purple shale near Village Burubhusi. The strike of the bed is N 40^{o}E – S40^{o}W, dipping 25^{o} south easterly. The dimension of the deposit was found to be 400 m x 50 m. A small occurrences of secondary grade (9 Nos.), ore floats zone (250 m x 50 m) have been noticed to the length of 2km east of Kohiagura.

(Contd.)

Table - 3 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
Limestone/ Dolomite Bargarh	Around Jharabandh in the western part of Nuapada-putka belt.	1:50,000	125.0	-	-	20	The area forms a part of the Chhattisgarh Group of rocks represented by quartzite, shale, limestone & dolomite intruded by granite & basic dykes. The limestone and dolomite horizon associated/ interbedded with shale are exposed on the eastern bank of Ong river to NE of Saraumsili. The bedding in shale varied from N 25° – 35° E to S 25° – 35oW dipping 20° – 30° SE. The trend of foliation in quartzite is N 40° E –S 40° W dipping 50° – 70° SE.
Sundergarh	Around Mundagaon, Jarangloi & Lahandabad	1:50,000	122.0	-	-	25	The area represents a part of Gangpur Group of rocks comprising conglomerate quartzite, carbonaceous phyllite/shale, limestone/ dolomite, staurolite and garnet-schist. Discontinuous dolomite occurrences reported earlier was traced upto a strike length of 4 km from Tumelbad to Tilaimalti and a width of 300 m was proved by pitting. The rocks are highly folded. Besides, surfacial crenulations & warping has also been noticed. One manganese occurrence & two quartz veins were also encountered.
-do-	Around Orangtoli, Udarama, Kultra & Kumarmunda block	1:50,000	112.0	-	-	61	The area forms a part of the northern limb of Gangpur Group of rocks comprising conglomerate, quartzite, carbonaceous phyllite, limestone/ dolomite, quartz schist and quartz-mica-schist. Discontinuous dolomite bodies were exposed to the NW of Udarama over a length of 2.5 km. Exposures to the South of Oranagtoli and north-west of Udarama area were aligned in ENE – WSE direction with 40° – 65° dip due SE. The strike varied from N 60° E – S60° W to N75°E – S 75°W with dip 40°-65°SE.
SAIL **Iron ore (Hematite)** Keonjhar	Bolani iron ore mine	1:2,000	1321.45 (ha)	-	-	-	Friable, banded & massive type iron ore has been noticed. Strike was found NNE-SSW. Resources were not estimated.

(Contd.)

Table - 74 (Concld.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
MECL							
Ultramic Rock (Dunite/ Pyroxenite) sundergarh	Rajabasa block	1:5,000	0.20	05	441.50	84	Ultramaphic rock comprises of dunite, hartzburgite, therzolige which occurred as enclave within Bonai granite. Strike length of the deposit was found to be 2200 m & depth 60 m from surface. Ultrmaphic rocks are fairly homophonous with little variation within bodies. Boreholes have been intersected ultramafic bodies like dunite, hartzburite & pyroxenite having thickness ranging from 7-16 m.

Production

The value of mineral production in Odisha at ₹ 24,259 crore in 2010-11 increased by 41% as compared to the previous year. The state contributed about 10% of the total value of mineral production and claims by first position among the states in the country during the year under review. The important minerals produced in Odisha were coal, bauxite, chromite, iron ore, manganese ore, dolomite, limestone and graphite which together accounted for about 99% of the total value of mineral production in 2010-11.

Odisha was the leading producer of chromite with a share 99.8%, pyroxenite 77%, sillimanite and bauxite 38% each and iron ore 37% in the total production of the respective minerals in the country during the year 2010-11. The state was also the second largest producer of manganese ore and dolomite with share of 23% and 22%, respectively.

Of the important minerals, production of garnet (abrasive) increased by 67%, limestone and sillimanite by 27% each, chromite by 24% and manganese ore by 8% as compared to that in the previous year whereas production of quartzite decreased by 85%, graphite (r.o.m.) by 56%, kaolin by 38% and pyroxenite by 19% during the year 2010-11. No production of silica sand, quartz, pyrophyllite and fireclay was reported from the state in the current year (Table - 4).

The value of minor mineral production was estimated at ₹ 86 crore for the year 2010-11.

The number of reporting mines in 2010-11 was 175 as against 220 in the previous year.

The index of mineral production in Odisha (base 1993-94 = 100) was 445.39 in 2010-11 as against 438.27 in the previous year.

Table -4 : Mineral Production in Odisha, 2008-09 to 2010-11 (Excluding Atomic Minerals)

(Value in ₹ '000)

Mineral	Unit	2008-09			2009-10			2010-11 (P)		
		No. of mines	Qty	Value	No. of mines	Qty	Value	No. of mines	Qty	Value
All Minerals		**239**		**177278940**	**220**		**171636707**	**175**		**242593085**
Coal	'000t	25	98402	51725700	26	106409	58751300	28	102565	73545300
Bauxite	t	4	4734421	1591786	4	4879580	1909188	3	4856275	2353153
Chromite	t	21	4069364	22597152	18	3419031	10422275	18	4253716	22918824
Iron ore	'000t	82	72627	95665250	74	80896	95807348	7176350		137623681
Manganese ore	t	43	839930	3163383	40	605313	2165165	30	651699	3431440
Dolomite	t	5	1616347	502265	4	1316371	450677	2	1137103	388671
Fireclay	t	4	71865	18518	4	51312	16015	-	-	-
Garnet (abrasive)	t	-	11455	22360	-	11080	36209	-	18473	65689
Graphite (r.o.m.)	t	24	42925	21828	21	46192	18636	10	20201	8456
Iolite	kg	-	-	-	1	758	40862	-	-	-
Kaolin	t	3	3453	1771	3	4558	2165	1	2809	2261
Sillimanite	t	1	13878	136879	1	14117	163009	1	17890	193845
Limestone	'000t	16	2978	831117	16	2937	843098	9	3736	1094803
Pyrophyllite	t	2	15655	2949	2	11926	2748	-	-	-
Pyroxenite*	t	-	230910	125846	-	229694	139195	-	185425	107841
Quartz	t	-	1500	375	1	1570	257	-	-	-
Quartzite	t	7	47451	13149	4	29886	11093	2	4608	2354
Silica sand	t	1	7381	1845	1	2800	700	-	-	-
Talc/steatite/soapstone	t	1	4	-	-	-	-	-	-	-
Minor Minerals@		-	-	856767	-	-	856767	-	-	856767

Note: *The number of mines excludes minor minerals.*

***** *Associated with chromite.*

@ *Figures for earlier years have been repeated as estimates because of non-receipt of data.*

Mineral-based Industry

The important large and medium mineral-based industries in organised sector in the State are given in Table - 5.

Table – 5 : Principal Mineral-based Industries in Odisha

Industry/plant	Capacity ('000 tpy)
Aluminium/Alumina	
Hindalco Industries Ltd, Hirakud	161.4 (aluminium)
NALCO, Damanjodi	2100 (alumina)
NALCO, Angul	460 (aluminium)
Vedanta Aluminium Ltd, Lanjigarh, Dist. Kalahandi	1000 (alumina)
Vedanta Aluminium Ltd, Jharsuguda, Dist. Sambalpur	500 (aluminium)
Asbestos Products	
UAL Industries Ltd, Korian, Dist. Dhenkanal	30
Cement	
Bargarh Cement Ltd, Bargarh	960
Ultra-Tech Cement Ltd., Jharsuguda (G)	800
OCL India Ltd., Rajgangpur, Dist. Sundergarh	2000
Toshali Cements Pvt Ltd, Ampavalli, Dist. Koraput	180
Fertilizer	
OCF-Paradeep	325.20 (N_2) 802.8 (P_2O_5)
Paradeep Phosphates Ltd, Paradeep	129.6 (N_2) 331.2 (P_2O_5)
SAIL Fertilizer Plant, Rourkela, Dist. Sundargarh	360 (CAN)
Iron & Steel	
Rourkela Steel Plant, Rourkela, Dist. Sundergarh	3070 (sinter) 2000 (pig iron) 1671 (saleable steel) 1900(crude/liquid steel)

(Contd.)

Table - 5 (Contd.)

Industry/plant	Capacity ('000 tpy)
	85 (tin plates)
Visa Steel Ltd, Kalinganagar, Dist. Jajpur	225 (pig iron) 300 (sponge iron) 50 (charge-chrome)
OCL India Ltd, Lamloi, Dist. Sundargarh	120 (sponge iron) 85 (billets)
Orissa Sponge Iron Ltd, Palaspanga, Dist. Keonjhar	250 (sponge iron) 100 (steel ingot)
Neelachal Ispat Nigam Ltd, Dubri, Dist. Jajpur	1711 (sinter) 1110 (pig iron) 1100(crude/liquid steel) 13 (fertilizer)
Pig Iron	
IDCOL Kalinga Iron Works Ltd, Barbil, Dist. Keonjhar	170
Sponge Iron	
Action Ispat & Power (P) Ltd, Pandripather, Dist. Jharsuguda	250
Adhunik Metaliks Ltd, Chandrihariharpur, Dist. Sundergarh	180
Beekay Steel & Power Ltd, Uliburu, Dist. Barbil	105
Bhusan Steels & Strips Ltd, Meramandali, Dist. Angul and Dhenkanal	300
Crackers India (Pvt) Ltd, Bobardhanpur, Dist. Keonjhar	60
Deepak Steel & Power Ltd, Topadihi, Dist. Keonjhar	144
Dinabandhu Steel & Power Ltd, Kalinganagar, Dist. Jajpur	60
Jay Iron & Steel Lltd, Balanda, Rourkela, Dist. Sundergarh	60
MGM Steel Ltd, Nimidha, Dist. Dhenkanal	100
Ganesh Sponge Pvt Ltd, Krushnachandrapur, Dist. Angul	30

(Contd.)

Table - 5 (Contd.)

Industry/plant	Capacity ('000 tpy)
Kusum Powermet Pvt. Ltd, Kutugaon, Dist. Keonjhar	100
Mayur Electro Ceramics Pvt. Ltd, Pratapgarh, Dist. Mayurbhanj	15
Neepaz Metaliks Pvt Ltd, Sundergarh	60
Rexon Strips Ltd, Kumakela, Dist. Sundergarh	60
Rungta Mines Ltd,	
Unit-I, Karakola, Barbil, Dist. Keonjhar	330
Unit-II, Kamando, Dist. Sundergarh	
Scan Sponge Iron Ltd, Rambahal, Dist. Sundergarh	60
Scaw Industries Pvt. Ltd, Gundichapada, Dist. Dhenkanal	100
Sponge sales (India) Pvt Ltd, Kutugaon, Dist. Keonjhar	60
Sree Metallic Ltd, Loidapada, Dist. Keonjhar	174
Suraj Products Ltd, Barpalli, Dist. Sundergarh	45
Surya Sponge Iron Ltd, Budhakendua, Dist. Jajpur	84
Tata Sponge Iron Ltd, Joda, Dist. Keonjhar	390
Vikram Pvt Ltd, Tumkela, Dist. Sundergarh	60
Ferro Alloys	
Balasore Alloys Ltd, Balgopalpur, Dist. Balasore	100
FACOR, Charge Chrome Plant, Randia, Dist. Bhadrak	65

(Contd.)

Table - 5(Concld.)

Industry/plant	Capacity ('000 tpy)
IDCOL Ferro Chrome & Alloys Ltd., Dist. Jajpur	18
Indian Charge Chrome Ltd., Choudwar, Dist. Cuttack	62.5
Indian Metals & Ferro Alloys Ltd, Therubali, Dist. Cuttack	190
Nav Bharat Ferro Alloys Ltd, Khargprasad, Dist. Dhenkanal	75
Rohit Ferro-Tech Ltd, Kalinganagar, Dist. Jajpur	110
Jaypore Sugar Co. Ltd, Rayagada	22.5
Superb Metals Alloys Pvt. Ltd, Rairangpur	0.3
Tata Steel Ltd, Ferro-Manganese Plant, Joda, Dist. Keonjhar	30.5
Tata Steel Ltd, Charge Chrome Plant, Bamnipal, Dist. Keonjhar	55.2
Refractory	
IFGL Refractory Ltd, Kalunga, Dist. Sundergarh	0.3
Orissa Industries Ltd, Lakhikata, Dist. Sundergarh	125
Orissa Industries Ltd, Barang, Dist. Cuttack	19
Tata Refractories Ltd, Belpahar, Dist. Jharsuguda	172
Silicon Carbide	
Indian Metals & Carbide Ltd, Therbali	NA
Synthetic Rutile	
IRE, Orissa Sands Complex, Ganjam (Presently non-operational)	100

(G) : *Grinding units.*

Indian Minerals Yearbook 2011

(Part- I)

50th Edition

(ADVANCE RELEASE)

STATE REVIEWS
(Punjab)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 001

PHONE/FAX NO. +91712 - 2565471
PBX : +91712 - 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

PUNJAB

Mineral Resources

Minerals reported to occur in the State are **quartz** and **silica sand** in Hoshiarpur district; and **quartzite** in Hoshiarpur and Ropar (Rupnagar) districts (Table - 1).

Production

Production of sulphur and minor minerals were only reported in the state. Sulphur is recovered as by-product from fertilizer plants. During 2010-11, its output stood at 2,111 tonnes decreasing 14% as compared to that in the previous year.

The value of minor mineral production was estimated at ₹ 39 crore for the year 2010-11 (Table -2).

The index of mineral production in Punjab (base 1993-94=100) was 27.59 in 2010-11 as against 32.26 in the previous year.

Table – 1: Reserves/resources of Minerals as on 1.4.2010 : Punjab

Mineral	Unit	Reserves	Remaining resources			Total resources (A+B)
		Total (A)	Indicated STD 332	Inferred STD 333	Total (B)	
Quartz/silica sand	'000 tonnes	-	-	3927	3927	3927
Quartzite	'000 tonnes	-	116	81796	81912	81912

Figures rounded off.

Table –2: Mineral Production in Punjab, 2008-09 to 2010-11
(Excluding Atomic Minerals)

(Value in ₹ '000)

Mineral	Unit	2008-09			2009-10			2010-11 (P)		
		No. of mines	Qty	Value	No. of mines	Qty	Value	No. of mines	Qty	Value
All Minerals		-		**607612**	-		**392267**	-		**392267**
Sulphur	t	-	3894	-	-	2468	-	-	2111	-
Minor Minerals		-	-	607612	-	-	392267	-	-	392267

***Note** : The number of mines for minor minerals are not available.*
 # Recovered as by-product from fertilizer plant.
@ Figures for earlier years have been repeated as estimates, wherever necessary, because of non-receipt of data.

Mineral-based Industry

The important mineral-based industries with their total installed capacities in the organised sector in the State are given in Table - 3.

Table – 3: Principal Mineral-based Industries in Punjab

Industry/plant	Capacity ('000 tpy)
Alloy Steel	
Antarctic Industries Ltd, Ludhiana	16
Cement	
Gujarat Ambuja Cement, Ropar (Rupnagar) (G)	2500
Gujarat Ambuja Cement, Bathinda (G)	500
Grasim Industries, Bathinda (G)	1200

(Contd.)

Table - 3 (Concld.)

Industry/plant	Capacity ('000 tpy)
Chemical	
Siel Chemical Complex, Charatrampur	74.3 (NaOH) 65.8 (Cl) 18 (bleaching powder) 66.0 (HCl)
Fertilizer	
NFL, Naya Nangal, Dist. Ropar (Rupnagar)	478.5 (urea) 22 (methanol)
NFL Sibian Road, Dist. Bathinda	511.5 (urea) 8.7 (S)
PNF-Nangal	16.00 (N_2)
Ferro Alloys	
Mehra Ferro Alloys Ltd, Verka	0.3
Sponge Iron	
Vallabh Steels Ltd, Sahnewal, Ludhiana	120

(G): *Grinding units.*

Indian Minerals Yearbook 2011

(Part- I)

50th Edition

(ADVANCE RELEASE)

STATE REVIEWS

(Rajasthan)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 001

PHONE/FAX NO. +91712 - 2565471
PBX : +91712 - 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

RAJASTHAN

Mineral Resources

Rajasthan is the richest state in terms of availability and variety of minerals in the country and produces about 30 different minerals. Rajasthan is the sole producer of lead & zinc ores and conc., calcite, selenite and wollastonite. Rajasthan was the sole producer of garnet (gem) till 2004-05. Almost entire production of calcite and natural gypsum in the country comes from Rajasthan. The State is a major producer of asbestos, copper conc., ochre, phosphorite/rock phosphate, silver, steatite, ball clay, fluorite and felspar. The State is also an important producer of marble of various shades. Makrana area is world famous centre for marble mining.

More than 85% of the country's potash, wollastonite, lead & zinc and silver resources are located in Rajasthan. The State is said to possess substantial share of the total resources of potash (94%), lead & zinc ore (89%), wollastonite (88%), silver (81%), gypsum (82%), fuller's earth (74%), diatomite (72%), marble (64%), asbestos (62%), copper ore (50%) and rock phosphate (30%).

Important minerals that are found to occur in the State are: **asbestos (amphibole)** in Ajmer, Bhilwara, Dungarpur, Pali, Rajsamand & Udaipur districts; **ball clay** in Bikaner, Nagaur & Pali districts; **barytes** in Alwar, Bharatpur, Bhilwara, Bundi, Chittorgarh, Jalore, Pali, Rajsamand, Sikar & Udaipur districts; **calcite** in Ajmer, Alwar, Bhilwara, Jaipur, Jhunjhunu, Pali, Sikar, Sirohi & Udaipur districts; **china clay** in Ajmer, Barmer, Bharatpur, Bhilwara, Bikaner, Bundi, Chittorgarh, Dausa, Jaipur, Jaisalmer, Jhunjhunu, Kota, Nagaur, Pali, Sawai Madhopur & Udaipur districts; and **copper** in Khetri belt in Jhunjhunu district & Dariba in Alwar district. Deposits of copper are also reported at Ajmer, Bharatpur, Bhilwara, Bundi, Chittorgarh, Dausa, Dungarpur, Jaipur, Jhunjhunu, Pali, Rajsamand, Sikar, Sirohi and Udaipur districts. Occurrence of other minerals, namely, **Dolomite** in Ajmer, Alwar, Bhilwara, Chittorgarh, Dausa, Jaipur, Jaisalmer, Jhunjhunu, Jodhpur, Sikar & Udaipur districts; **felspar** in Ajmer, Alwar, Bhilwara, Jaipur, Pali, Rajsamand, Sikar, Tonk & Udaipur districts; **fireclay** in Alwar, Barmer, Bharatpur, Bhilwara, Bikaner, Dausa, Jaisalmer, Jhunjhunu & Sawai Madhopur districts; **fluorspar** in Ajmer, Dungarpur, Jalore, Jhunjhunu, Sikar, Sirohi & Udaipur districts; **garnet** in Ajmer, Bhilwara, Jhunjhunu, Sikar & Tonk districts; **gypsum** in Barmer, Bikaner, Churu, Sri Ganganagar, Hanumangarh, Jaisalmer, Jalore, Nagaur & Pali districts; **iron ore (hematite)** in Alwar, Dausa, Jaipur, Jhunjhunu, Sikar & Udaipur districts; **iron ore (magnetite)** in Bhilwara, Jhunjhunu & Sikar districts; **lead-zinc** in Zawar in Udaipur district, Bamnia Kalan, Rajpura-Dariba in Rajsamand & Rampura/Agucha in Bhilwara district have also been reported. Lead-zinc occurrences have also been reported from Ajmer, Chittorgarh, Pali and Sirohi districts. **Lignite** deposits are found to occur in Barmer, Bikaner, Jaisalmer and Nagaur districts. Flux grade **limestone** occurs in Jodhpur and Nagaur districts and chemical grade limestone in Jodhpur, Nagaur and Alwar districts. Cement grade deposits of limestone are widespread in Ajmer, Alwar, Banswara, Bhilwara, Bikaner, Bundi, Chittorgarh, Churu, Dungarpur, Jaipur, Jaisalmer, Jodhpur, Jhunjhunu, Kota, Nagaur, Pali, Sawai Madhopur, Sikar, Sirohi and Udaipur districts. **Magnesite** in Ajmer, Dungarpur, Pali & Udaipur districts; **marble** in Ajmer, Alwar, Banswara, Bhilwara, Bundi, Chittorgarh, Dungarpur, Jaipur, Nagaur, Sikar, Sirohi & Udaipur districts; **mica** in Ajmer & Bhilwara districts; **ochre** in Baran, Bharatpur, Bhilwara, Bikaner, Chittorgarh, Jaipur, Sawai Madhopur & Udaipur districts; **pyrite** in Sikar district; **pyrophyllite** in Alwar, Bhilwara, Jhunjhunu, Rajsamand & Udaipur districts; **quartz/silica sand** in Ajmer, Alwar, Bharatpur, Bhilwara, Bikaner, Bundi, Chittorgarh, Dausa, Jaipur, Jaisalmer, Jhunjhunu, Jodhpur, Kota, Pali, Rajsamand, Sawai Madhopur, Sikar, Sirohi, Tonk & Udaipur districts; **quartzite** in Ajmer, Alwar, Jhunjhunu & Sawai Madhopur districts; **rock phosphate** in Alwar, Banswara, Jaipur, Jaisalmer & Udaipur districts; **talc/steatite/soapstone** in Ajmer, Alwar, Banswara, Bharatpur, Bhilwara, Chittorgarh, Dausa, Dungarpur, Jaipur, Jhunjhunu, Karauli, Pali, Rajsamand, Sawai Madhopur, Sirohi, Tonk & Udaipur districts; **vermiculite** in Ajmer & Barmer districts; and **wollastonite** in Ajmer, Dungarpur, Pali, Sirohi & Udaipur districts are other mineral occurrences of the State.

Other important minerals that occur in the State are: **apatite** in Udaipur & Sikar districts; **bauxite** in Kota district; **bentonite** in Barmer, Jaisalmer & Jhalawar districts; **corundum** in Tonk district; **diatomite** in Barmer & Jaisalmer districts; **emerald** in Ajmer & Rajsamand districts; **fuller's earth** in Barmer, Bikaner & Jodhpur districts; **gold** in Banswara, Bhilwara, Dausa, Sirohi and Udaipur districts; **granite** in Ajmer, Alwar, Banswara, Barmer, Bhilwara, Chittorgarh, Jaipur, Jaisalmer, Jalore, Jhunjhunu, Jodhpur, Pali, Rajsamand, Sawai Madhopur, Sikar, Sirohi, Tonk & Udaipur districts; **graphite** in Ajmer, Alwar & Banswara districts; **kyanite** and **sillimanite** in Udaipur district; **manganese ore** in Banswara, Jaipur, & Pali districts; **potash** in Jaisalmer & Nagaur districts; **silver** in Ajmer, Bhilwara, Jhunjhunu, Rajsamand, Sikar & Udaipur districts; and **tungsten** in Nagaur & Sirohi districts (Table - 1). Districtwise reserves/resources of lignite in the State are provided in Table-2.

Table – 1 : Reserves/Resources of Minerals as on 1.4.2010 : Rajasthan

Mineral	Unit	Reserves				Remaining resources								Total resources (A+B)
		Proved STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
			STD121	STD122			STD221	STD222						
Apatite	tonne	-	-	-	-	-	-	-	51521	1016000	-	-	1067521	1067521
Asbestos	tonne	1694398	4588	797073	2496059	108785	3065861	3230441	87802	42101	4526861	57800	11119651	13615710
Ballclay	tonne	6275408	350832	2845470	9471710	4301217	1100691	2875062	18676	-	14045369	-	22341015	31812725
Barytes	tonne	134448	11108	77397	222953	6018	4782	103931	37808	311500	2304688	-	2768727	2991680
Bauxite	000 tonnes	-	-	-	-	-	-	-	-	-	528	-	528	528
Bentonite	tonne	-	11415982	574950	11990932	-	-	-	24356005	222017000	139423096	25730000	411526101	423517033
Calcite	tonne	1261868	38025	1360678	2660571	283227	144688	2642951	539285	1037038	3090782	-	7737971	10398542
China clay	000 tonnes	70012	7603	22497	100113	11524	14008	29483	1260	4067	271314	749	332405	432517
Copper														
Ore	000 tonnes	25103	228	75585	100916	3375	-	10253	16513	100256	545858	-	676255	777171
Metal	000 tonnes	214.73	3.29	973.16	1191.18	3.37	-	10.25	320.48	686.6	2179.09	-	3199.79	4390.97
Corundum	tonne	-	-	-	-	-	-	-	-	-	11925	-	11925	11925
Diatomite	000 tonnes	-	-	-	-	634	-	-	-	-	1440	-	2074	2074
Dolomite	000 tonnes	34309	9601	20250	64160	3559	5598	19484	16502	25480	324604	784	396010	460170
Feldspar	tonne	18083327	7793709	8837983	34715019	9839519	4042309	9666832	3154174	668648	25859733	-	53231216	87946235
Fireclay	000 tonnes	8543	659	5000	14202	195	1071	583	2256	2580	45536	-	52221	66423
Fluorite	tonne	24391	-	41345	65736	608000	592258	520678	1528348	489488	1294529	145183	5178483	5244219
Fuller's Earth	tonne	-	-	-	-	-	-	-	-	350000	189709080	-	190059080	190059080
Garnet	tonne	6251	10700	9299	26250	214	39868	26687	2013	17694	85690	-	172167	198416
Gold														
Ore (primary)	tonne	-	-	-	-	-	-	-	4600000	50193000	59182720	-	113975720	113975720
Metal (primary)	tonne	-	-	-	-	-	-	-	6.67	103.34	107.47	-	217.48	217.48
Grannite (Dimen. Stone)	000 cu m	5581	100380	4500	110461	38462	-	-	-	-	9021742	20000	9080204	9190665
Graphite	tonne	-	-	-	-	47600	-	165920	-	250000	1450034	-	1913554	1913554
Gypsum	000 tonnes	20821	81	15834	36736	3405	63397	3105	750	710604	237550	-	1018810	1055546
Iron ore (Hematite)	000 tonnes	5169	1152	819	7139	3168	3239	500	-	11510	5004	-	23420	30560
Iron ore (Magnetite)	000 tonnes	2924	125	1191	4240	-	-	-	-	-	522590	-	522590	526831
Kyanite	tonne	-	-	-	-	13097	-	10606	-	-	-	-	23703	23703

(Contd.)

Table - 1 (Concld.)

Mineral	Unit	Reserves: Proved STD111	Probable STD121	Probable STD122	Total (A)	Remaining resources: Feasibility STD211	Pre-feasibility STD221	Pre-feasibility STD222	Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	Total resources (A+B)
Laterite	000 tonnes	-	-	-	-	-	-	-	-	-	60490	62860	123350	123350
Lead-zinc														
ore	000 tonnes	20215	82178	287	102680	-	-	3864	13157	200065	287576	190	504852	607532
Lead metal	000 tonnes	398.42	1706.62	9.21	2114.25	-	-	46.7	272.54	2604.74	5055.46	-	7979.44	10093.69
Zinc metal	000 tonnes	1938.37	10223.8	11.66	12173.83	-	-	86.91	741.17	8821.59	12950.2	0.53	22600.4	34774.23
Lead-zinc														
metal	000 tonnes	-	-	-	-	-	-	-	-	-	117.55	-	117.55	117.55
Limestone	000 tonnes	1740173	91434	428111	2259717	141539	1607076	4438479	467462	720874	11110360	914330	19400121	21659838
Magnesite	000 tonnes	1024	57	2045	3126	-	1420	76	-	149	49033	-	50678	53804
Manganese														
ore	000 tonnes	1134	-	647	1780	-	-	-	-	-	4030	-	4030	5810
Marble	000 tonnes	103736	172337	98	276171	-	2037	25606	-	90000	837615	-	955258	1231429
Mica	kg.	7515531	21957	2767649	10305137	13633000	310	927638	48973690	16673890	19831574	50015	100090117	110395254
Ochre	tonne	37586097	178095	13637968	51402160	15626752	11546886	16820861	1824210	896371	19196918	-	65911998	117314158
Potash	Million tonnes	-	-	-	-	-	-	-	-	16936	3462	22	20419	20419
Pyrite	000 tonnes	-	-	-	-	13667	-	22917	9590	26310	18392	-	90876	90876
Pyrophyllite	tonne	139650	-	187041	326691	54308	38989	110709	232212	68587	277249	-	782054	1108745
Quartzite	000 tonnes	163	-	86	249	-	18	18	-	-	706	-	742	991
Quartz-														
silica sand	000 tonnes	132135	10472	27757	170364	40583	13344	23433	3202	7658	73883	-	162104	332468
Rock														
phosphate	tonne	14107400	1589807	941200	16638407	20631561	7140437	13382355	152633	79750	29893783	-	71280519	87918926
Sillimanite	tonne	-	-	-	-	300	-	519	-	-	-	-	819	819
Silver														
Ore	tonne	37428349	17220000	123729631	178377980	3375000	88200	5216400	9240000	81580000	128042579	-	227542179	405920159
Metal	tonne	1589.18	1934.4	4498.03	8021.61	270	0.26	50.42	883.8	6022.18	11757.93	-	18984.59	27006.2
Talc-steatite-														
soapstone	000 tonnes	28719	2705	14770	46193	6155	7323	19196	1685	837	50768	5	85969	132162
Tungsten														
Ore	tonne	-	-	-	-	-	-	-	-	963666	17000628	5964000	23928294	23928294
Contained														
WO_3	tonne	-	-	-	-	-	-	-	1421.44	90171.5	2115	-	93707.94	93707.94
Vermiculite	tonne	-	-	-	-	20623	2759	4428	-	13000	2883	-	43693	43693
Wollastonite	tonne	2289869	-	197253	2487122	3750545	-	3724191	76088	3325042	1213352	-	12089218	14576340

Figures rounded off

** Resources of crude oil and natural gas in Rajasthan are included in the Western Offshore areas of India and are not available separately.*

Table – 2 : Reserves/resources of Lignite as on 1.4.2011 : Rajasthan

(In million tonnes)

District	Proved	Indicated	Inferred	Total
Total	**1166.56**	**2148.72**	**1519.61**	**4834.89**
Barmer	494.83	1861.56	1073.72	3430.11
Bikaner	558.73	226.59	295.66	1080.98
Jaisalmer & Barmer	-	-	13.80	13.80
Jalore	-	-	76.08	76.08
Nagaur	113.00	60.57	60.35	233.92

Source: *Coal Directory of India, 2010-11.*

Deposits of **petroleum** are located in the Bikaner-Nagaur basin and those of **natural gas** in Jodhpur and Jaisalmer basins in the State.

Exploration & Development

ONGC and OIL continued their seismic survey and drilling for exploration of petroleum and natural gas. Two wells with a meterage of 3,331 were drilled in the State by Oil India Ltd. Details of exploration activities conducted by ONGC and OIL for petroleum and natural gas are furnished in Table - 3.

The details of exploration activities conducted by various agencies for lignite and other minerals during 2010-11 are furnished in Table - 4.

Table – 3 : Exploration for Petroleum & Natural Gas in Rajasthan, during 2010-11

Agency	Seismic Survey		Drilling			
			Exploratory		Development	
	2D(GLKM)	3D(SQKM)	Wells	Meterage	Wells	Meterage
ONGC	508	43	1	3420	-	-

Table – 4 : Details of Exploration Activities in Rajasthan, 2010-11

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Metreage		
GSI							
Base Metals Alwar	Khera & Mundiyawas-Khera	-	-	-	-	-	Reconnaissance stage investigation (G-4) was taken up during FS 2010-12 in North Delhi Fold Belt in the aforesaid block to evaluate potential of copper and precious metal mineralisation. The area has been investigated by detailed mapping, pitting/trenching, scout drilling and sampling. The analytical results are awaited. The work is in progress.
Bhilwara	Kamalpura & Devpura	-	-	-	-	-	Reconnaissance stage investigation (G-4) was taken up during FS 2010-12 in Pur-Banera Belt for integrated reevaluation of multisensor aerogeophysical anomalies in this block, to identify target areas for base metal mineralisation. The work is in progress.
- do -	Karoi-Rajpura	-	-	-	-	-	Reconnaissance stage investigation (G-4) initiated in FS 2009-10, was continued (Pur-Banera belt) to assess the base metal potential of the area. The calc-biotite gneiss present in the mapped area is the dominant host rock for copper mineralisation. Evidences of mineralisation are manifested in calc-biotite gneiss in the form of malachite stains and as specks, pods, stringers and veins of chalcopyrite, bornite and covellite. The dominant copper sulphide minerals are chalcopyrite and bornite and oxide mineral is hematite. Based on available analytical data of bedrock and channel samples, a copper mineralised zone having a strike length of about 300 m and width range from 80 m to 130 m with an average grade of 0.34% copper was delineated. This zone warrants further probing by scout drilling. The work is in progress.

(Contd.)

Table - 4 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Metreage		
Base Metals							
Bhilwara	Rampuriya & Gadariyakhera	-	-	-	-	489	Reconnaissance stage investigation (G-4) was continued in Pur-Banera Belt between aforesaid village, to identify the target areas for base metals and gold mineralisation by ground evaluation of airborne geophysical anomalies through integrated geological and geochemical surveys. The area is mostly soil covered and minor outcrops of BIF bands are present. Out of 489 samples, results of 119 samples are received. Soil samples collected on 500 m x 100 m grid indicated Pb values ranging from >10 ppm to 460 ppm and Zn from 20 ppm to 1100 ppm. Statistical analysis of soil samples for Pb and Zn indicated that the background and threshold values of Pb are 17.9 ppm and 214 ppm respectively, while those of Zn are 80 ppm and 461 ppm respectively. The investigation work is in progress.
- do -	Northern part of the Salampura	-	-	-	-	-	Prospecting stage investigation (G-3) was taken up during FS 2010-12 in this area (Pur-Banera Belt) to assess the base metals potential between Pur-Dariba copper prospect and Gurla base metals prospect. The dominant rock unit is quartz-mica schist (± garnet) with bands of calc silicate. The boreholes drilled intersected eight mineralised zones having about 5% to 6% total sulphides (visual estimate). Zone II, IV, VI and VII are rich in sphalerite and galena with minor chalcopyrite. The other zones are rich in pyrite and pyrrhotite. The sulphides are seen along the foliation and fracture planes. Analytical results of the drill core samples are awaited. The work is in progress.

(Contd.)

Table - 4 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Metreage		
GSI							
Base Metals							
Jaipur	Dantali	-	-	-	-	-	Prospecting stage investigation (G-3) for base metals and associated gold in this was scheduled to be taken up during FS 2010-12 to evaluate the potential of base metals and gold mineralisation in North Delhi Fold Belt. As the area of investigation falls under Jamawa-Ramgarh Wild Life Sanctuary, the work has been temporarily suspended.
- do -	Dholpura	-	-	-	-	-	Reconnaissance stage investigation (G-4) initiated was continued in this area (North Delhi Fold Belt) to assess the extent and potential of base metals and associated gold mineralisation in the Raialo Group of rocks. The work involved mainly large- scale geological mapping with photo geological interpretation and geochemical evaluation. The litho units exposed in the area belong to the Railo Group and Rajgarh Group of Delhi Supergroup. The Raialo rocks are mainly represented by dolomite, banded hematite quartzite/ brecciated quartzite and quartz mica schist. Photogeological studies define three sets of lineaments, resulting in dome and basin structure. Ground evaluation of the lineaments has not indicated any significant association with base metals mineralisation. . The rocks in the area exhibit evidences of three phases of deformation. Analytical results of the channel/bedrock samples collected during FS 2009-10 indicated Cu values ranging from < 5 ppm to maximum 686 ppm. Only three samples from the old workings with malachite stains have recorded 0.1% to 0.18% Cu. The Pb values range from < 25 ppm to maximum of 100 ppm and Ag values are <5 ppm. The area appears to be promising for iron ore mineralisation. The work is in progress.

(Contd.)

Table - 4 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Metreage		
Base Metal							
Pali	Trans-Aravalli	-	-	-	-	-	Reconnaissance stage investigation (G-4) was taken up during FS 2010-12 in this area to assess the polymetallic mineral potential of Dhani Granite Analytical results so far available yielded 35% Fe and >2% REE for Dhani granite. The unusual abundance of REE forms the basis for taking up the present investigation. The work is in progress.
-do- Sikar	Dariba North	-	-	-	-	-	Reconnaissance stage investigation (G-4) was taken up during FS 2010-12 in North Delhi Fold Belt in this block to delineate the zones of base metals mineralisation and associated precious metals in Dariba–Baleshwar area. Surface indications of sulphide mineralisation are manifested in the form of malachite stains and specks of unaltered sulphides in amphibole marble and dolomitic marble. The analytical results are awaited. The work is in progress.
-do –	Mahawa	-	-	-	-	-	Prospecting stage investigation (G-3) was taken up during FS 2010-12 in North Delhi Fold Belt to assess the depth continuity of base metals mineralisation within the Kushalgarh Formation on the western flank of the Kundla ki Dhani-Baniwala ki Dhani- Dokan Copper Belt. The borehole intersected sulphide mineralisation. in the form of disseminations, streaks, stringers, veins and fracture fillings. Sulphides are pyrite, chalcopyrite, with minor bornite and is associated with specularite. Dusty chalcopyrite was also noticed. The work is in progress.
- do -	Nanagwas	-	-	-	-	-	Reconnaissance stage investigation (G-4) was taken up during FS 2010-12 in North Delhi Fold Belt in the west of this area, to delineate the zones

(Contd.)

Table - 4 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Metreage		
Base Metals							
Sikar (Contd.)	Nanagwas	-	-	-	-	-	metal mineralisation and associated precious metals. Surface indications of mineralisation are manifested in the form of malachite stains and specks of unaltered sulphides of pyrite, bornite in amphibole marble and in thin quartz veins within amphibole marble. The analytical results are awaited. The work is in progress.
Tonk	Janula-Danota	-	-	-	-	-	Reconnaissance stage investigation (G-4) was taken up during FS 2010-12 in Mangalwar Supergroup between Janula-Danota in Agucha-Malpura-Chaksu flown belt for ground evaluation of airborne geophysical anomalies by detailed geological mapping and systematic geochemical sampling to identify target areas for base metal mineralisation. The work is in progress.
Gold							
Banswara	Gundelapara NW Block	-	-	-	-	-	Prospecting stage Investigation (G-3) was taken up during FS 2010- 12 based on favourable geological setup, structure, surface manifestations and encouraging analytical results from previous work in Bhukia Gold Belt for gold and copper mineralisation in this block. The investigation helped in delineation of two subparallel surface mineralised zones in impure marble and keratophyre. The maximum dimensions of mineralised zones are 600 m x 50-100 m and 450 m x 40-60 m respectively. The surface evidences of mineralisation are in the form of gossans, malachite stains, sulphide disseminations and presence of ore grinding implements and slag heap in and nearby areas. In borehole -1 three mineralised zones were intersected from 24.0 m to 48.0 m (24.0 m x 5-10% sulphides in visual estimates); 50.75 m to 54.90 m (4.15 m x 4-5% sulphides in visual estimates)

(Contd.)

Table - 4 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Metreage		
Gold							
Banswara (Contd.)	Gundelapara NW Block	-	-	-	-	-	and from 68.10 m to 106.0 m (37.90 m X 5-10% sulphides in visual estimates). Within third mineralised zone, a 10.20 m zone of massive to semi-massive (> 60 to 30%) sulphide zone was intersected from 85.70 m to 95.90 m depths. The work is in progress
- do -	Jagpura	-	-	-	-	-	Prospecting stage investigation (G-3) was taken up during FS 2010-12 in (Bhukia gold belt) this block to delineate the potential zones for gold and associated base metals mineralisation. Favourable geological setup, old working structure, surface manifestations and the encouraging analytical results of earlier work formed the basis for taking up this investigation. The gold analysis of the samples from 2 channels indicated average gold values of 1.72 ppm x 16 m and 5 ppm x 5m respectively. The work is in progress.
Iron Ore	Aravalli Fold Belt	-	-	-	-	-	Reconnaissance stage investigation (G-4) for ferrous and associated metallic minerals was initiated during FS 2010-12 to evaluate and delineate the iron ore occurrences in parts of south Rajasthan. Two moderately dipping BIF bands trending NE-SW have been delineated within Banded Gneissic complex. The BGC comprises granite gneiss, leucogranite and migmatite. The eastern BIF band is prominent with strike length of about 4.5 km and width varying from 200 m to 500 m. The western BIF band occurring in northwestern part is about 1.5 km in length and 25 m to 150 m in width. The BIF is reddish brown in colour and showed well-developed compositional banding. The BIF bands in association with banded amphibolite are also reported from west of Ghatol in south Rajasthan. The BIF bands have been sampled and submitted for chemical analysis. The results are awaited. The work is in progress.

(Contd.)

Table - 4 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Metreage		
Limestone							
Jaisalmer	Jiraj ka Toba-AsuTar	-	-	-	-	02	Prospecting stage of investigation (G-3) was taken up in Tertiary limestone belt, **to** locate low silica SMS (LD-grade) limestone in view of increasing demand by steel plants. The borehole-2 has intersected hard and massive fossiliferous/limestone, moderately hard limestone, gritty limestone and fragmentary ironstone in the ascending order. The hard and massive limestone is similar to the Khuiala limestone intersected in the Minyun ki Dhani. The work is in progress.
Phosphorite							
Banswara	Kalinjara, East of Sallupat	-	-	-	-	-	Reconnaissance stage investigation (G-4) has been carried out during FS 2010-12 in Aravalli Fold Belt for low- grade phosphorite occurrences to delineate and locate new areas of phosphorite bearing dolomite/limestone lenses within Kalinjara (Maton) Formation belonging to Aravalli Supergroup. One persistent band of dolomite with 5 km strike length and width varying from 20 m to 500 m has been delineated in the area between Pargisath to Mahuri. The dolomite band contained chert lenses of varied length from 5 m to 30 m and width from 10 cm to about 3 m. Discontinuous thin bands/lenses of brecciated stromatolite are confined to grey dolomite band with thickness variying from 2 cm to 10 cm. The phosphate concentration is confined to this brecciated unit (15 to 20% V.E.). Two intertrappean horizons (10 m – 15 m thick) having significant phosphate concentration (5% – 10% V.E.) has been traced for 3 km. However, chemical result of seven samples of this unit indicated P_2O_5 ranging from 0.43%-0.72%. The work is in progress.
DMG							
Lignite Bikaner	N/V Surpura, Mahiyon- ki-Dhani	-	-	01	24.0	02	Geologically the area consists of Tertiary formation. Lignite belongs to Palana formation. It is horizontally bedded at the depth of 60 m – 100 m. Lignite was not encountered in (SBH–6) borehole.

(Contd.)

Table - 4 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Metreage		
DMG							
Lignite Bikaner	N/V Kenya-ki-basti	1:50,000	250.0	01	162.0	60	Geologically the area is a part of Tertiary basin, consisting of formation as clay, bajri, friable sandstone and carbonaceous zones as grey-black-clay, lignite shale & lignite. The formations in horizontally bedded form, varied in thickness. During survey new occurrences of lignite were noticed N/V Lohiya, Khetolai & Mokha where carbonaceous zones were reported at the depth range of 150 m – 170 m. Carbonaceous zones were intersected in the borehole such as (i) Grey black clay – 132 – 144 m (12 m); ii) Lignite shale – 144 m – 160 m (16 m); Lignite – 160 m – 161.50 (1.50 m). About 0.60 million tonnes resources were estimated based on visual estimation of core.
Sikar	Mahawa Block	-	-	-	-	-	Prospecting (G-3) stage investigation for base metal in this area was taken up during the year 2009- 10 to assess the mineralised zones delineated in Kushalgarh Formation of Ajabgarh Group in North Delhi Fold Belt on the western flank of the Kundla ki Dhani - Baniwala ki Dhani – Dokan copper Belt. The analytical results of surface channel samples indicated Cu values ranging from 10 ppm to 6400 ppm. So far a strike length of 470 m mineralised zone has been explored by drilling by putting 3 boreholes (MBH- 1, MBH-2 & MBH-3). The first borehole intersected one 3.40 m (along borehole) mineralised zone, the second borehole intersected three mineralised zones of 12.40 m, 18.60 m and 4.00 m and the third borehole intersected four mineralised zones of 8.30 m, 5.00 m, 1.70 m and 4.50 m so far and is under progress. Analytical results are awaited.

(Contd.)

Table - 4 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Metreage		
DMG							
Gypsum Bikaner & Sri Ganganagar	N/V Khajuwala Kundal	1:50,000 1:10,000 1:2,000	325.0 11.0 2.0	-	-	20	Gypsum deposits are quarternary evaporate or palaya. The general thickness of gypsum varied from 1-2 m below sand overburden of 0.80 m – 1 m. Gypsum beds are generally in horizontally bedded form, massive in nature and dull white in colour. New gypsum occurrences of 200 m – 500 m horizontal extension and thickness 1 m – 2 m were located & mapped N/V Nandgarh, Rojri, Rawla, Faridsar and Phulewala. About 1 million tonnes resources of gypsum were estimated.
Clay Bikaner	N/V Nokhra, Udat & Tonkla	1:50,000 1:10,000 1:2,000	250.0 10.0 2.0	-	-	02	Geologically the area consists of Tertiary formation. Clay belongs to Marh formation. The general thickness of clay varied from 1 m – 18 m. Generally exposed below overburden of 4 m – 31 m. New clay occurrences of horizontal extension were noticed below overburden at Kalamagra having thickness between 1 m & 18 m respectively. Resources were not estimated.
Granite Jodhpur	N/V Gangani, Sevki kalan & Khurd, Ummed, Khangta	1:50,000 1:10,000	150.0 10.0	-	-	27	Occurrences of subsurface granite were inferred on the basis of wells & pits. This rock is off white-brown in colour, mostly of weathered nature. Occurrence of quartz-felspar has also been noted in the form of pegmatite bodies near Olvi, Binawas in 150 x 50 m area. Greenish grey volcanic ash beds suitable for making roads meta was located N/V Kaparda in 200 x 1000 m area. Occurrences of grayish granite were mapped at six places of the following dimensions (i) 165 m x 169 m (ii) 75 m x 75 m (ii) 20 m x 15 m. (iv) 30 m x 15 m (v) 80 m x 80 m (vi) 550 m x 3000 m extent. Resources were not estimated.

(Contd.)

Table - 4 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Metreage		
Limestone Nagaur	N/V Madpura	1:10,000 1:2,000	20.0 1.50	13	351.0	174	The area under investigation comprises of carbonate lithofacies of Bilara Group and Siliciclastic lithofacies of Jodhpur group, both belonging to Marwar Supergroup of Cambrian Age. The main rock types of the investigated area are limestone (Chemical grade) and dolomitic limestone. The limestone showed horizontal dips. High-grade limestone bands N/V Shivpura (Madpura) were located in 8.96 sq km area besides high-grade limestone were also located in 2.0 sq km area. Limestone resources were estimated at 26 million tonnes.
-do-	N/V Harima & Pitasar	1:10,000 1:2,000	25.0 2.50	38	1193.0	796	The area mainly comprises lithofacies of Gotan formation of Bilara Group of Marwar Supergroup of Cambrian Age. The main rock types of the investigated area are dolomitic limestone and high- grade limestone. These limestone deposits are bedded in nature & showed horizontal disposition. The potential area which contained cement grade chemical grade limestone were also found N/V Harima & Pitasar. About 129.60 million tonnes limestone resources were estimated.
-do- Jaipur	N/V Ajirpura Pitasar	1:10,000 1:2,000	15.0 1.50	-	-	-	Geologically the area comprises of Quartzite, Calc-silicate, Limestone etc. Granite, Pegmatite & Vein quartz belonging to the Delhi Super Group. The general strike of limestone was found. N 55°E – S 55°W with sub vertical dip. On the basis of tube well cuttings the limestone has been found spread over the villages Yadvon-ki-dhani (800 m x 350 m), Sanwalon-ki-dhani (600 m x 400 m) & Gujron-ki-dhani (350 m x 150 m). Resources were not estimated.
Granite Jaisalmer	N/V Rampura	1:50,000 1:10,000 1:2,000	50.0 15.0 1.0	-	-	10	The light reddish coloured medium grained granite outcrops/ boulders have been observed N/V Rampura. The size of granite boulders varied in dimension from 1m x 1m x 0.50 to 2m x 1.5 m x 1m.

(Contd.)

Table - 4 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Metreage		
Sandstone Jodhpur	N/V Halodi (Nerva), Panchla & Janiyon-ki-Dhani, etc.	1:50,000 1:10,000 1:2,000	150.0 10.0 2.0	-	-	-	The area is occupied by the litho units of Marwar Supergroup comprising ferruginous gritty sandstone, thin beds of massive sandstone, shale & lime kankar occurring at the top. A massive sandstone having 1.5 m – 4 m thickness was noticed N/V Mandiyai, Halodi, Janiyon-ki-dhani, Gudiala-Suveri. Outcrops 0.45 sq km, 0.75 sq km & 1.5 sq km were noticed in the area. About 10-15 cm thick jasper veins were also located N/V Ujaliya and Mandiyai. Resources were not estimated.
Sandstone Dhaulpur	N/V Badaria, Vijaipura	1:10,000 1:4,000	20.0 3.0	-	-	24	The buff red, spotted red, light grey and offwhite coloured spittable sandstone has been exposed in this area. It is fine-grained, equigranular & well-bedded in nature. The offwhite, buff red (at places spotted) blockable sandstone was also exposed in the area. It is medium to coarse-grained and massive in nature. The sandstone have following dimensions: i) N/V Badaria – offwhite, buff red blockable sandstone marked in 600 x 300 m. ii) N/V Badaria – Buff red spotted coloured splittable sandstone marked in 1000 x 800 m. iii) N/V Vijaipura – Buff red, spotted red coloured splittable sandstone marked in 500 x 200 m. About 2.59 million tonnes resources of sandstone (blockable) were estimated near Village Badaria. Sandstone (splittable) resources were estimated at 11.52 million tonnes, 1.44 million tonnes N/V Badia & N/V Vijaipura respectively.

(Contd.)

Table - 4 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Metreage		
DMG							
Rock Phosphate Udaipur	N/V Kaya, Dakan Kotra, Dhol-ki-Pati, etc.	1:10,000	20.0	-	-	36	Geologically the rock type of the area belongs to Udaipur Group of Aravalli Supergroup & it is represented by flysch like sediments with minor intercalatory chemo biogenic rock. The main rock types found are dolomite, but at places dolomite with phosphatic stromatolite phyllite, metagrawacke, mica schist, quartzite carbon phyllite, chert etc. were also found. Resources were not calculated as the complete chemical analysis results are awaited.
Dolomite Udaipur	Iswal, Piprach, Jhalon-ka-guda	1:10,000 1:2,000	-	-	-	60	Geologically the area belongs to Haldhighati formation of Nathdwara group of Aravalli Supergroup. The rock types found are generally dolomite, phyllite, ferruginous cherty breccia, quartzite and yellowish/reddish colour ochers. Resources were not calculated as the complete chemical analysis results are awaited.
Limestone Jaipur	Bithloda, Mandha, Karoi, etc.	1:10,000 1:2,000	15.0 1.0	-	-	06	Geologically the area comprises quartzite, calc-silicate, limestone etc. The general strike of the limestone is N 55°E – S 55°W with sub-vertical dip. On the basis of tube well cuttings the limestone has been found to spread over/around the villages Yadvon-ki-dhani (800 m x 350 m), Sanwalon-ki-dhani (600 m x 400 m) & Gujron-ki-dhani (350 m x 150 m). Resources were not estimated.
-do- Jhalawar	N/V Dungarpur, Salora Khurd & Bariya	1:50,000 1:10,000 1:2,000	55.0 11.0 1.0	-	-	16	Geologically the area comprises shale & limestone. Limestone of marginal cement grade was noticed in 2250 m x 500 – 1300 m x 1-2 m near Village Dungarpur and in 1750 m x 200 m – 500 m x 1-2 m near Village Sarola Khurd & Bariya. A total of 9.88 million tonnes of resources of marginal cement grade limestone were estimated, out of which about 7.39 million tonnes were estimated N/V Dungarpur & 2.29 million tonnes N/V Sarola & Khurd & Bariya.

(Contd.)

Table - 80(B) (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Metreage		
DMG							
Clay Karauli	N/V Khaoda & Gajjupura	1:50,000 1:10,000 1:2,000	55.0 11.0 1.0	-	-	16	Geologically the area comprises rock belonging to Vindhyan supergroup. Clay potential area was observed at two places, N/V Khaoda (100 m x 30 m x 3 m & 200 m x 30 x 3 m) and N/V Gajjupura (400 m x 30 m x 3 m). About 1.01 million tonnes resources of clay were estimated out of which 0.07 million tonnes were located N/V Khaoa & 0.94 million tonnes N/V Gajupura.
Limestone & Sandstone Baran	N/V Ladwara-Raipura Baldara	1:50,000 1:10,000 1:2,000	115 12.5 1.35	-	-	16	Geologically the area comprises rock formation of Bhander group of Vindhyan Supergroup. The limestone of marginal cement grade was observed along Kali Sindh river in 2200 m x 100 m x 5-8 m N/V Ladwara – Raipura, 100 m x 100 m x 5-8 m N/V Baldara & 500 m x 200 m x 4 m, 200 m x 100 m x 1.5 m area N/V Nagda.
Sandstone Kota	N/V Khan-ki-Jhonpariya	1:50,000 1:10,000 1:2,000	115.0 12.5 1.35	-	-	02	Limestone resources about 3.43 million tonnes N/V Dungarpur, 2.29 million tonnes N/V Rajpura-Ladwara, 1.56 million tones N/V Baldara & 1.12 million tones N/V Nagda were estimated. About 37.5 million tones resources of sandstone (masonary stone) also were estimated N/V Nagda.
Limestone (dolomitic) Ajmer	Dhanar, Kabra, Rajpura, etc.	1:50,000 1:10,000 1:2,000	100.0 10.0 1.00	-	-	13	Rock types exposed in this area are quartzite, mica, schist, dolomitic limestone & pegmatite. General trend of the rock formation is NE-SW. Four intermittently exposed bands of dolomitic limestone trending NE-SW were mapped in Dhanar in north to Raipur in south in about 3000 m strike length. Width of the deposit varied from 20-60 m.
Base Metals Ajmer	N/V Kirap, Ratangarh, Rajpura, etc.	1:50,000 1:10,000 1:2,000	100.0 10.0 1.00	-	-	29	Rock types exposed in the area are biotite schist, garnetiferous schist, calc-gneiss, calc-schist with limestone, quartzite, granite gneiss, amphibilite, pegmatite etc. General trend of rock formation is NE-SW. Intermittently exposed gossan zone was located at the contact of impure limestone & quartzite in about 80 m x 1-3 m near Village Bhairukhjda. It is reddish brown to cherry red in colour and highly ferruginous. Analysis results of the samples are still awaited.

(Contd.)

Table - 4 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Metreage		
DMG							
Garnet, Quartz, Felspar, Beryl, etc. Tonk	N/V Tordi, Mandolai, etc.	1:50,000 1:10,000 1:2,000	115.0 11.50 1.15	-	-	16	Garnetiferous mica schist of light grey to brownish grey coloured, highly foliated, comprising quartz, biotite, muscovite, garnet etc. were located due south of Village Tordi. Garnet crystals of size up to 2-3 cm weres also noticed.
Base Metals Udaipur	Kun, Punj-ki-bhagal	-	-	01	90.00	47	The rock types exposed in this area were mainly granite gneiss, amphibole gneiss at places intruded by acid and basic intrusives. Old working were noticed near Village Kodarwalia, Lasadia along the granite and amphibole gneiss. It showed plenty of malachite encrustation and staining. In the borehole stringers and specks of pyrite and chalcopyrite were observed.
Granite/ masonary stone Sikar & Jhunjhunic	Nand, Rijani, Maragsar, Rsora, Nand-ka-Bas, etc.	1:50,000 1:10,000 1:2,000	165.0 20.0 1.00	-	-	04	In Nand, Rajani block granite is grayish, white grayish in colour, medium to coarse-grained and occurrs as boulders. Granite has been exposed over an area of 400 x 100 x 200 m N/V Nand, 350 x 100 x 20 m N/V Rajani. There is possibility of extracting small sized blocks from the granite of this area. Granite from Maragsar, Rasora block is grayish in colour with black chunks, medium-grained and occurres as boulders. Granites of 600 x 100 – 300 m and 350 x 100 – 150 m were exposed in the areas near Village Margasar and Rasora respectively.In Makhar-Keharpura block, granite is reddish pink in colour with black chunks, medium-grained was found to occur as boulders in the form of hillock-granite exposed in an area of 350 x 50 – 120 m & 500 x 100 – 300 m located north and north east of Village Makhar.Granite rocks mostly fractured one exposed over areas of 1200 x 250 m, 1400 x 200 m N/V Jaitpura, Neem-ka-Thana and 120 x 200 m, 700 x 200 m area N/V Hukampura, Bamlawasar. The possibility of exploitation of this granite as large size blocks is rare.

(Contd.)

Table - 4 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Metreage		
Lignite Barmer	Bandra	1:2,000	5.50	-	-	-	Carbonaceous material was intersected at 78-92 m, 97-104 m, 122 – 135 m, 141 – 147 m & 159 – 72 m. The tube well data revealed that kankar bed was intersected from 9 – 25 m (6 m) and sticky clay from 31-72 m (41 m). After depth of 172 m sandstone continued up to 337 m which was interbedded by variegated clay.
Bentonite Barmer	N/V Pusad	1:50,000 1:10,000 1:2,000	210.0 16.0 2.00	-	-	-	Occurrences of bentonite mineral have been noted in nalla N/V Pusad. spread over a length about 30 m, width 20 m and thickness exposed to about 1.5 m, It is grey to off white in colour. Besides this, some ferruginous sandstone patches were seen to occur as overlain that marked the horizon of bentonite mineral. The bentonite, grey in colour, soft in nature, found in lumps, fine-grained in texture, belongs to Alkli formation and show almost horizontal deposition. The bentonite appear to be of foundry grade.
Gypsum Barmer	N/V Purwa, Daboi & Piprali	1:50,000 1:10,000 1:2,000	-	-	-	-	Gypsum mineral 0.3 – 1.5 m and of grade more than 75% was found to occur N/V Daboi. Gypsum is observed at ground level from 0.2 – 0.7 m. The gypsum bed is mostly seen in khatedari land.
Limestone Sikar	N/V Kairpura, Kotari, Luharwas, etc.	1:10,000 1:2,000	20.0 1.0	-	-	-	Occurrences of quartzite, limestone, calc-silicate, mica schist, amphibole gneisses, phyllite etc. intruded by albetite, pegmatite, quartz etc were noted in the area. The area was also found covered by several bands of impure limestone. Extension of these bands varied from 150-160 m in length and 15-60 m in width.

(Contd.)

Table - 80 (B) (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
Masonry stone Alwar	N/V Guwalda	1:50,000 1:10,000 1:4,000	180.0 10.0 0.50	-	-	18	In this area quartzite was found as the dominating rock unit. It is light grey, brown in colour. In general it is hard & massive but at places it is found as weathered on the surface. This rock is fine to medium-grained and has uneven joints & fractures. The hardness and compactness of the rock makes it useful as masonry stone. This stone area was located in 450 x 100 m N/V Guwalda. About 3.87 million tonnes resources were estimated.
Bajri Dausa	N/V Arnia, Pichupura, Shalawas Kala & Barial etc.	1:10,000 1:4,000	20.0 2.0	-	-	18	The bajri of coarse-grained deposit found in the river channel is generally covered by top soil and alluvium. Along the width of the channel the deposit of bajri is from 80 – 150 m and at meanders it increases up to 200 m. Study of existing pits showed that below 1-3 m of soil cover there is good coarse-grained bajri. It is brown or earthy coloured and the admixture contains soil, kanker and clay. The thickness of bajri is varied from 1-6 m at places. Below this clayey material, light brown & yellow coloured depositswas found. Coarse-grained brown coloured bajri marked in 2000 x 80-100 m area N/V Pamari, Shalawas Khurd & Khera etc. and 500 x 80-100 m N/V Barial Kala in Sanwan river were identified . About 3 million tonnes resources were estimated N/V Pamaro and Bhandera.
Base Metal Bhilwara	N/V Thadia	1:2,000	0.50	-	-	13	A ferruginous brecciated gossan zone is located north-east of Village Thadia, extending over a strike length 1150 m with width 30-40 m which is indication of base metal occurrence in the area.
Quartz & Felspar Rajsamand	N/V Tikkhi	1:10,000	20.0	-	-	17	The area is occupied by biotite-schist, granite gneisses, migmatites intruded by pegmatites and ultrabasic rocks. Pegmatite bands were observed in the area. In general, strike length varied from 50-200 m and width 2-50 m. Pegmatite bands which have the potential for mineral quartz, feldspar & mica were identified.

(Contd.)

Table - 4 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Metreage		
Gypsum Jalore	Parts of Sanchore Tehsil.	1:50,000 1:10,000 1:2,000	100.0 10.0 1.0	-	-	20	Gypsum, gypsite & clay kankar of recent to sub-recent were indications seen at places. The occurrences of 0.3 – 0.7 m gypsum/gypsite were seen N/V Hemaguda (500 x 200 m^2), Sangarva (500 x 300 m^2), Laljiki Dungri (1 x 0.5 km^2), Kalgi Ki Beri (200 x 100 m) and Sutharon Ki Dhani (400 x 300 m^2) under 0-2 m soil over-burden. The gypsum of the areas is white to yellowish white in colour & gypsitic in nature. About 0.83 million tonnes resources of gypsum were estimated.
Granite (Blockable) Jalore	Around of Bhinmal & Raniwara Tehsil	1:10,000 1:4,000	10 01				The area suitable for blockable granite was seen near Borta, Tavab, Nasoli Kot Kasta (TI275 &477). The granite N/V Gaseri, Bhadarda Rhyolito and N/V Chatwara, Lakhawas, Tavidar, Silasan, Rampura, Sai Ke Beri, Chara, Chirpatia & Raniwara Khurd cable used as masonry stone.
MECL **Copper** Chittorgarh	Wari block	1:1,000	1.50	23	3994.00	1121	Based on the sub-surface data, major rock types found are garnetiferous mica schist with intercalation of thin amphibolites, calc-silicate, quartzite, etc. Strike formation is N-S E-W with sub-vertical westerly dip. Host rock for mineralisation is garnetiferous mica schist with thin amphibolites intercalations with strike extension up to 1300 m depth. Rock type for about 175 m was seen subjected to three phases of folding and exhibited synclinal structure with axis of fold plunging west. Nine mineralised zones have been delineated in the blocks. A total of 2.56 million tonnes copper resources were estimated with 1.09% Cu, besides the ore also contained Ni-168 ppm & Co-161 ppm.

(Contd.)

Table - 4 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Metreage		
MECL **Phosphorite/ Rock phosphate** Udaipur	Dhol-ki-Pati	1:1,000	1.00	19	1784.00	700	Rock types exposed are dolomite with phyllitic intercalation, capped by quartzite (silicrete) phosphorite occurred as lenses & pockees in dolomite. It is bluish grey in colour brecciated & fragmented. Six phosphorite bands have been deliniated. Strike length was 800 m & depth 100 m from the surface. Two phosphorite zones have been intersected in boreholes thickness ranged from 2-11 m with grade varied from P_2O_5 – 4.18% - 11.15%.
Lead-Zinc Ajmer	Block is 105 km away fromAjmer	1:1,000	0.20	08	1826.0	100	Lead-zinc mineralization is confined to lower marble of Sowar Group. General strike of the formation is NE-SW with moderate to steep dip due east. The strike extension of the deposit was found to be 700 m & depth 250 m. Three lodes have been intersected in boreholes. Thickness varied from 2-4 m with grades 3-4% TMC. Few individual samples have been analysed which showed lead ranging from 15-30%. Work is in progress.
HZL **Lead & Zinc** Rajsamand	Rajpur Dariba mine	1:200	1551.1	15	798.00	391	22.34 million tonnes resources were estimated.
Udaipur	Baroi	1:200	-	-	-	2745	12.23 million tonnes Lead & Zinc resources were estimated.
-do-	Balaria	1:200	1157.7	41 14	1728.80 11778.1	1889	23.23 million tonnes Lead & Zinc resources were estimated.
-do-	Mochia	1:200	-	-	-	1753	24.32 million tonnes Lead & Zinc resources were estimated.

(Contd.)

Table - 4 (Concld.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Metreage		
Lead-Zinc Udaipur	Zawarmala	1:200	-	-	-	526	6.08 million tonnes lead & zinc resources were estimated.
RSMML Rock Phosphate Udaipur	SE of Udaipur	-	-	-	-	-	The deposit was found extending over a strike length of 2 km with dip varying from sub-vertical to about 30%. Structurally folded and undulating ore bed dipping towards the centre of Jhamarkotra basin was seen. A total of 1,23,432 tonnes resources was estimated.

Production

The value of mineral production in Rajasthan during 2010-11 at ₹ 18,478 crore increased by more than double as compared to the previous year. Its share to the total value of mineral production in the country in 2010-11 was about 8% and is ranked fourth position among the states in the country during the year under review. It is the richest state in terms of variety of minerals available and produces about 30 types of minerals. The state has reported manifold increase in the production of petroleum (crude) during the year. Rajasthan was the sole producer of lead and zinc ores as well as concentrate, calcite, selenite and wollastonite. Almost entire production of silver and gypsum during 2010-11 in the country was reported from the State.

Rajasthan was the leading producer of ochre and phosphorite accounting for 94% each, steatite 74%, ball clay 69%, fire clay 67% and felspar 51% of the total production in the country. Besides, it was the second leading producer of copper conc. sharing 33%, quartz 25% and fluorite (graded) 19% of the nation's output for the year 2010-11. During the year under review there was manifold increase in the production of petroleum (crude) and fluorite (graded). Among the important minerals, increase in production was reported in manganese ore 97%, natural gas (utilised) 81%, fireclay 54%, phosphorite 45%, wollastonite 38%, gypsum 29%, lignite 26% as compared to that in the previous year. Whereas the production of clay (others) decreased by 95%, selenite and silica sand by 54% each, quartz 26%, quartzite 24% and calcite 20% over the previous year (Table - 5).

The value of minor mineral production was estimated at ₹ 4,751 crore for the year 2010-11**.**

The number of reporting mines in Rajasthan was 270 in the year 2010-11 as against 289 in the previous year.

The index of mineral production in Rajasthan (base 1993 - 94 = 100) was 272.01 in 2010-11 as against 246.33 in the previous year.

Table – 4 : Mineral Production in Rajasthan, 2008-09 to 2010-11 (Excluding Atomic Minerals)

(Value in ₹ '000)

Mineral	Unit	2008-09 No. of mines	2008-09 Qty	2008-09 Value	2009-10 No. of mines	2009-10 Qty	2009-10 Value	2010-11 (P) No. of mines	2010-11 (P) Qty	2010-11 (P) Value
All Minerals		**291**		**69094220**	**289**		**89019420**	**270**		**184783528**
Lignite	'000t	3	999	1160000	3	1207	479400	4	1525	1071600
Natural Gas (utilised)	m c m	-	216	796222	-	239	894445	-	432	1616737
Petroleum (crude)	'000t	-	-	-	-	447	8065565	-	5149	92907372
Copper ore	t	-	1050714	-	-	907388	-	-	971600	-
Copper conc.	t	2	68524	1949913	2	46584	1481008	2	45173	2541831
Iron ore	'000t	1	23	4276	1	13	2594	1	27	6392
Lead & zinc ore	t	-	6680698	-	-	7101872	-	-	7489693	-
Lead conc.	t	7	133768	1362744	7	133921	1765874	6	145043	1961805
Zinc conc.*	t	*	1224077	9466647	*	1279880	13058419	*	1420105	17633867
Manganese ore	t	1	7900	11850	1	8443	12665	1	16638	24957
Silver**	kg	-	105055	2142362	-	138550	3382924	-	148082	5430068
Phosphorite/ Rock phosphate	t	2	1553398	2930419	2	1393321	2981088	2	2018857	5441287
Asbestos	t	1	-	-	2	-	-	2	-	-
Ball clay	t	28	698795	159328	24	676559	184938	22	665925	164318
Barytes	t	1	5670	2200	1	5985	2457	1	6105	2392
Calcite	t	2	67284	22729	2	49309	16980	3	39370	13048
Clay (others)	t	5	144669	15931	5	163428	17561	3	7864	1140
Dolomite	t	-	147123	19807	2	224803	30966	1	206287	31826
Felspar	t	44	208131	32497	52	265212	43083	45	239924	41477
Fireclay	t	8	191054	30920	7	247473	40580	10	381059	75587
Fluorite (graded)	t	-	-	-	1	64	141	1	598	1903
Gypsum	t	22	3871948	992091	21	3337013	994657	25	4308682	1292605
Jasper	t	1	99	51	-	-	-	-	-	-
Kaolin	t	16	202189	36027	14	436773	83958	14	408940	81177
Laterite	t	-	-	-	1	-	-	1	-	-
Limestone	'000t	23	38918	5513166	23	47180	6971469	23	43505	6163400
Mica (crude)	t	4	26	260	3	4	123	3	16	377
Mica (waste & scrap)#	t	-	1388	-	-	3704	-	-	1204	-
Ochre	t	10	722175	66071	9	1180108	212274	11	1094598	122370
Quartz	t	27	120512	23769	33	154698	29471	22	114703	22857
Quartzite	t	1	7034	3208	1	5545	582	1	4191	451
Silica sand	t	9	398540	82051	9	418311	103878	7	194073	57274
Talc/steatite/soapstone	t	68	653258	459348	58	647691	529722	54	665001	411338
Selenite	t	3	15224	12940	3	14598	12408	3	6728	5719
Wollastonite	t	2	111581	125957	2	132385	111930	2	182600	150093
Minor Minerals@		-	-	41671436	-	-	47508260	-	-	47508260

Note : *The number of mines excludes natural gas (utilised) and minor minerals.*
** Number of mines covered under lead concentrates.*
*** Recovered at Chanderiya Lead-Zinc Smelter of HZL from lead concentrates produced in Rajasthan.*
 # Includes mine waste and that obtained while dressing of crude mica.
@ Figures for earlier years have been repeated as estimates,wherever necessary, because of non-receipt of data.

Mineral-based Industry

The important large and medium-scale mineral-based industries in the organised sector in the State are given in Table - 5.

Table – 5 : Principal Mineral-based Industries in Rajasthan

Industry/plant	Capacity ('000 tpy)
Cement	
ACC Ltd, Lakheri, Dist. Bundi	480
Aditya Cement, Shambhupura	1750
Gujarat Ambuja Cements Ltd, Rabriyawas Dist. Pali	3600
Binani Cement, Binanipuram, Dist. Sirohi	4850
Birla Corporation Ltd, Chittorgarh	
Birla Cement Works,	720
Chanderia Cement Works	1280
Grasim Industries Ltd (White Cement Division) Kharia Khangar, Dist. Jodhpur	560 (white cement) 200 (wall putty)
J.K.Udaipur Udyog Ltd, Udaipur	900
J.K.Cement, Nimbahera, Dist. Chittorgarh	3300
J.K.Cement, Mangrol	750
J.K. White Cement Works, Gotan, Dist. Nagaur	300
J.K.Laxmi Cement, Banas, Dist. Sirohi	5000
Manglam Cement, Morak, Dist. Kota	2000
Neer Shree Cement, Morak, Dist. Kota	600
Shree Cement Ltd,	
Andheri, Deori, Dist. Ajmer	4200
Beawar, Dist. Ajmer	2600
Rasi, Dist. Pali	3000
Kushkhera, Dist. Alwar (G)	1200
Shriram Cement Works, Kota	400
Chemical	
DCM Shriram Industries Ltd, Kota	9 (rayon/yarn) 7.7 (sodium sulphate)
Modi Alkalies & Chemicals Ltd, Alwar	84.2 (caustic soda) 50.3 (Cl) 39.6 (HCl)
Ceramics	
Bikaner Ceramics Pvt. Ltd, Bikaner	2.2
Kajaria Ceramics Ltd, Bhiwadi	16.7 (million sq m)
Fertilizer	
Chambal Fertilizer & Chemical Ltd, Gadepan, Dist. Kota	1729.2 (urea)
Khaitan Chemical & Fertilizers Ltd, Dhinwa, Dist. Chittorgarh	200 (SSP)
Shriram Fertilizers & Chemicals Ltd, Shriramnagar, Dist. Kota	330 (urea) 113.8 (caustic soda) 13.2 (bleaching powder) 61.2 (HCl) 61.2 (Cl)

(Contd.)

Table - 5 (Contd.)

Industry/plant	Capacity ('000 tpy)
Plaster of Paris	
Abhishek Plaster Industries, Baramsar, Dist. Hanumangarh	6.1
Agrawal Industries, Nohar, Dist. Hanumangarh	6.3
Balaji Plaster Industries, Taranagar, Dist. Churu	6
Balaji Industries, Taranagar, Dist. Churu	6.5
Ganesh Plaster Industries, Taranagar, Dist. Churu	6
Gil Brothers, Taranagar, Dist. Churu	7.1
Hind Plaster Industries, Taranagar, Dist. Churu	6
Jaishri Plaster Industries, Taranagar, Dist. Churu	6.3
Jagdamba Plaster Industries, Rawatsav, Dist. Hanumangarh	7
Jai Bhavani Plaster Industries, Baramsar, Dist. Hanumangarh	6
Jai Sriram Plaster Industries, Taranagar, Dist. Churu	7.1
M.G. Plaster Pvt Ltd, Taranagar, Dist. Churu	6.2
Mahabir Plaster Industries, Taranagar, Dist. Churu	6
Multani Industries, Nohar, Dist. Hanumangarh	8.4
R.D. Plaster Industries, Nohar, Dist. Hanumangarh	8.4
R.N.Industries, Bikaner, Dist. Bikaner	18
Shalimar Plaster & Chemical Industries, Sardarshahar, Dist. Churu	14
Shri Lakshmi Gypsum, Chak, Dist. Hanumangarh	6
Shriram Plaster, Taranagar, Dist. Churu	6.3
SS Plaster Industries, Taranagar, Dist. Churu	6
Shiv Bhakti Industries, Nohar, Dist. Hanumangarh	8.4
Tiger Plaster, Sardarshahar, Dist. Churu	11
The Sardarshahar Plaster & Minerals, Sardarshahar, Dist. Churu	19.4
Updesh Industries Ltd, Chak, Dist. Hanumangarh	9
Copper Smelters	
HCL, KCC, Jhunjhunu	31(Cu cathode) 182 (H_2SO_4)
Lead & Zinc Smelters	
HZL Zinc Smelter, Debari	88 (Zn)
HZL Lead-zinc Smelter, Chanderiya	185 (Pb) 525 (Zn) 0.74 (Cd)* 168 tonnes (Ag)* 2.1 (Cu cathode) 704 (H_2SO_4)*

** Total for all smelters of HZL*

Indian Minerals Yearbook 2011

(Part- I)

50th Edition

(ADVANCE RELEASE)

STATE REVIEWS
(Sikkim)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 001

PHONE/FAX NO. +91712 - 2565471
PBX : +91712 - 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

SIKKIM

Mineral Resources

The important mineral resources of the State are **copper-lead-zinc** and **silver** reported in Bhotang, Rangpo and Dikchu in East Sikkim district. Occurrences of other minerals reported in the State include **dolomite, quartzite** and **talc/ steatite/soapstone** in West Sikkim district; **limestone** in North Sikkim district and **marble** in East Sikkim and North Sikkim districts (Table -1).

Production

No mineral production (except minor minerals) was reported in 2010-11. The value of minor mineral production was estimated at ₹ 188 lakh for the year 2010-11.

Mineral-based Industry

SMC, a joint venture of Government of Sikkim and Government of India, was established for the purpose of development of Bhotang polymetal ore deposit at Rangpo. The copper, lead and zinc concentrates produced after treatment of ores at its beneficiation plant at Rangpo are sold to HCL, Ghatsila and HZL, Visakhapatnam for processing. The trials carried out by HZL for the utilisation of SMC's lead concentrates have not been successful. The lead concentrates remained unsold due to high bismuth content and presence of other impurities. A talc/silica powder unit is reported to be working in East Sikkim district. The Sikkim Mining Corp. is also reportedly involved in exploitation of lower Pacheykhani Copper deposit to supplement production of concentrates in its Bhotang mine. Sikkim's Mines & Geology Department has set up a pilot dimension rock cutting unit and pilot lime making unit to ascertain the feasibility of setting up of commercial lime plant and dimension rock cutting plant in the State. A ferro alloys plant, namely, Akshay Ispat & Ferro Alloys Ltd with an installed capacity of 6,000 tpy is located at Mamring, South Sikkim district.

Table - 1: Reserves/Resources of Minerals as on 1-04-2010 : Sikkim

Mineral	Unit	Reserves				Remaining resources								Total resources
		Proved	Probable		Total	Feasibility	Pre-feasibility		Measured	Indicated	Inferred	Reconnaissance	Total	
		STD 111	STD121	STD122	(A)	STD211	STD221	STD222	STD331	STD332	STD333	STD334	(B)	(A+B)
Copper														
Ore	000 tonnes	-	8	-	8	-	437	63	300	-	150	-	950	958
Metal	000 tonnes	-	0.09	-	0.09	-	7.77	0.91	8.47	-	4.23	-	21.38	21.47
Dolomite	000 tonnes	-	-	-	-	-	-	-	-	-	2756	-	2756	2756
Lead-Zinc					-								-	-
Ore	000 tonnes	-	436	64	500	-	-	-	300	-	150	-	450	950
Lead metal	000 tonnes	-	6.9	1.68	8.58	-	-	-	-	-	-	-	-	8.58
Zinc metal	000 tonnes	-	12.88	3.14	16.02	-	-	-	3	-	1.05	-	4.05	20.07
Limestone	000 tonnes	-	-	-	-	-	-	-	-	-	2380	-	2380	2380
Marble	000 tonnes	-	-	-	-	-	-	-	-	-	2382	-	2382	2382
Quartzite	000 tonnes	-	-	-	-	-	-	-	-	675	16444	-	17119	17119
Silver														
Ore	tonne	-	435843	63780	499623	-	-	-	300000	-	150000	-	450000	949623
Metal	tonne	-	15.25	0.04	15.29	-	-	-	27.6	-	13.8	-	41.4	56.69
Talc-steatite-soapstone	000 tonnes	-	-	-	-	-	-	60	-	-	-	-	60	60

Figures rounded off

Indian Minerals Yearbook 2011

(Part- I)

50th Edition

(ADVANCE RELEASE)

STATE REVIEWS
(Tamil Nadu)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 001

PHONE/FAX NO. +91712 - 2565471
PBX : +91712 - 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

TAMIL NADU

Mineral Resources

Tamil Nadu is the leading holder of country's resources of vermiculite, magnetite, dunite, rutile, garnet, molybdenum and ilmenite. The State accounts for the country's 81% lignite,75% vermiculite, 69% dunite, 59% garnet, 52% molybdenum and 30% titanium minerals resources.

Important minerals that are found to occur in the State are **bauxite** in Dindigul, Namakkal, Nilgiris & Salem districts; **dunite/pyroxenite** in Salem district; **felspar** in Coimbatore, Dindigul, Erode, Kanchipuram, Karur, Namakkal, Salem & Tiruchirapalli districts; **fireclay** in Cuddalore, Kanchipuram, Perambalur, Pudukottai, Sivaganga, Thiruvallur, Tiruchirapalli, Vellore & Villupuram districts; **garnet** in Ramanathapuram, Tiruchirapalli, Tiruvarur, Kanyakumari, Thanjavur & Tirunelveli districts; **granite** in Dharmapuri, Erode, Kanchipuram, Madurai, Salem, Thiruvannamalai, Tiruchirapalli, Tirunelveli, Vellore & Villupuram districts; **graphite** in Madurai, Ramnathapuram, Shivganga & Vellore districts; and **gypsum** in Coimbatore, Perambalur, Ramnathapuram, Tiruchirapalli, Tirunelveli, Thoothukudi & Virudhunagar districts. Similarly, occurrences of minerals, such as, **lignite** deposits are located in Cuddalore Ariyalur, Thanjavur, Thiruvarur, Nagapattinam & Ramanathapuram districts; **limestone** in Coimbatore, Cuddalore, Dindigul, Kanchipuram, Karur, Madurai, Nagapattinam, Namakkal, Perambalur, Ramnathapuram, Salem, Thiruvallur, Tiruchirapalli, Tirunelveli, Vellore, Villupuram & Virudhunagar districts; **magnesite** in Coimbatore, Dharmapuri, Karur, Namakkal, Nilgiri, Salem, Tiruchirapalli, Tirunelveli & Vellore districts; **quartz/silica sand** in Chennai, Coimbatore, Cuddalore, Dharmapuri, Dindigul, Erode, Kanchipuram, Karur, Madurai, Namakkal, Periyar, Perambalur, Salem, Thiruvallur, Thiruvarur, Nagapattinam, Tiruchirapalli, Villupuram, Virudhunagar & Vellore districts; **talc/ steatite/soapstone** in Coimbatore, Salem, Tiruchirapalli & Vellore districts; **titanium minerals** in Kanyakumari, Nagapattinam, Ramanathapuram, Thiruvallur, Tirunelveli & Thoothukudi districts; **vermiculite** in Dharmapuri, Tiruchirapalli & Vellore districts; and **zircon** in Kanyakumari district have been established.

Other minerals that occur in the State are **apatite** in Dharmapuri & Vellore districts; **barytes** in Erode, Madurai, Perambalur, Tirunelveli & Vellore districts; **bentonite** in Chengai-Anna district; **calcite** in Salem district; **china clay** in Cuddalore, Dharampuri, Kanchipuram, Nilgiris, Sivaganga, Thiruvallur, Tiruvannamalai, Tiruchirapalli & Villupuram districts; **chromite** in Coimbatore & Salem districts; **copper, lead-zinc** and **silver** in Villupuram district; **corundum** and **gold** in Dharmapuri district; **dolomite** in Salem & Tirunelveli districts; **emerald** in Coimbatore district; **iron ore (magnetite)** in Dharmapuri, Erode, Nilgiris, Salem, Thiruvannamalai, Tiruchirapalli & Villupuram districts; **kyanite** in Kanyakumari & Tirunelveli districts; **molybdenum** in Dharmapuri, Dindigul & Vellore districts; **pyrite** in Vellore district; **sillimanite** in Kanyakumari, Karur & Tirunelveli districts; **tungsten** in Madurai & Dindigul districts; and **wollastonite** in Dharmapuri & Tirunelveli districts (Table -1). Districtwise reserves/resources of lignite are provided in Table-2.

Petroleum and natural gas deposits are located in Cauvery basin area.

Table –1: Reserves/Resources of Minerals as on 1.4.2010 : Tamil Nadu

Mineral	Unit	Reserves				Remaining resources								Total resources (A+B)
		Proved STD 111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
			STD121	STD122			STD221	STD222						
Apatite	tonne	-	-	-	-	-	-	-	-	-	240000	-	240000	240000
Barytes	tonne	-	-	-	-	-	-	-	-	500	221919	-	222419	222419
Bauxite	'000 tonnes	708	-	-	708	-	1141	3564	960	10084	8363	-	24112	24820
Bentonite	tonne	-	-	-	-	-	-	-	-	3725333	5818519	-	9543852	9543852
Calcite	tonne	-	-	-	-	-	-	-	-	-	116632	-	116632	116632
China clay	'000 tonnes	-	-	-	-	-	-	-	-	327	56570	-	56897	56897
Chromite	'000 tonnes	-	-	-	-	-	-	-	7	-	276	-	282	282
Copper														
Ore	'000 tonnes	-	-	-	-	-	-	-	200	590	-	-	790	790
Metal	'000 tonnes	-	-	-	-	-	-	-	1.08	2.73	-	-	3.81	3.81
Corundum	tonne	-	-	-	-	-	-	-	-	-	4000	-	4000	4000
Dolomite	'000 tonnes	-	-	-	-	-	-	-	2010	135	-	-	2145	2145
Dunite	'000 tonnes	7466	-	1450	8916	-	-	102190	-	-	5773	-	107963	116879
Felspar	tonne	613184	6450	31302	650936	2328227	70156	416162	18870	69822	5447875	-	8351111	9002047
Fireclay	'000 tonnes	322	3269	423	4014	4833	171	1611	1561	-	102069	-	110244	114258
Garnet	tonne	334469	1511397	10595388	12441254	-	-	92051	15000	1408995	19871019	-	21387065	33828319
Gold														
Ore (primary)	tonne	-	-	-	-	-	-	-	-	-	67000	-	67000	67000
Metal(primary)	tonne	-	-	-	-	-	-	-	-	-	1.00	-	1.00	1.00
Granite (Dim. stone)	'000 cu m	-	1448	238	1686	-	45690	8234	7	-	503818	-	557749	559435
Graphite	tonne	2807113	-	810450	3617563	-	39486	2486	65330	647500	3866390	-	4621193	8238756
Gypsum	'000 tonnes	-	-	64	64	313	469	6584	25	249	19540	10	27191	27255
Iron ore (Magnetite)	'000 tonnes	-	-	-	-	-	-	-	-	169388	110728	226921	507037	507037
Kyanite	tonne	-	-	-	-	-	-	-	-	167000	81359	-	248359	248359

(Contd.)

Table -1(Concld.)

Mineral	Unit	Reserves				Remaining resources								Total resources (A+B)
		Proved STD 111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
			STD121	STD122			STD221	STD222						
Lead-zinc														
Ore	'000 tonnes	-	-	-	-	-	-	-	200	590	-	-	790	790
Lead metal	'000 tonnes	-	-	-	-	-	-	-	2.26	5.48	-	-	7.74	7.74
Zinc metal	'000 tonnes	-	-	-	-	-	-	-	11.76	24.76	-	-	36.52	36.52
Limestone	'000 tonnes	199243	115705	55165	370112	19229	55984	42014	69951	32169	460412	-	679759	1049871
Magnesite	'000 tonnes	12462	5968	7474	25904	997	27	474	17	737	12355	-	14608	40511
Molybdenum														
Ore	tonne	-	-	-	-	-	1500000	-	36000	569304	7692728	167800	9965832	9965832
Contained MoS_2	tonne	-	-	-	-	-	1050	-	83.00	287.00	4430.53	50.34	5900.87	5900.87
Pyrite	'000 tonnes	-	-	-	-	-	-	-	-	-	24	-	24	24
Quartz-silica sand	'000 Tonnes	60063	9	93	60166	29644	4892	7523	3387	95837	27150	-	168432	228598
Sillimanite	tonne	331800	-	561766	893566	-	4000	13525323	-	-	3529577	-	17058900	17952466
Silver														
Ore	tonne	-	-	-	-	-	-	-	-	330000	460000	-	790000	790000
Metal	tonne	-	-	-	-	-	-	-	-	15.87	26.68	-	42.55	42.55
Talc-steatite/ soapstone	'000 tonnes	-	-	333	333	194	210	1400	-	-	524	-	2328	2661
Titanium minerals*	tonne	1181486	-	2367410	3548896	-	-	-	76454	19687147	93466694	-	113230295	116779191
Tungsten														
Ore	tonne	-	-	-	-	-	-	-	-	-	-	250000	250000	250000
Contained WO_3	tonne	-	-	-	-	-	-	-	-	-	-	50	50	50
Vermiculite	tonne	1526417	-	-	1526417	-	-	-	-	-	343051	-	343051	1869468
Wollastonite	tonne	-	-	-	-	-	-	-	-	-	3533	-	3533	3533
Zircon*	tonne	53318	-	175443	228761	-	-	-	-	-	-	-	-	228761

Figures rounded off.
The proved and indicated balance recoverable reserves of crude oil and natural gas in the State as on 1.4.2011 are 8.49 million tonnes and 36.88 billion cu m, respectively.
** Resources as per Department of Atomic Energy are provided in the respective Mineral Reviews.*

Table –2: Reserves/Resources of Lignite as on 1.4.2011 : Tamil Nadu

(In million tonnes)

District	Proved	Indicated	Inferred	Total
Total	**3735.23**	**22900.05**	**6257.64**	**32892.92**
Cuddalore (Incl. parts of Puducherry)	2831.00	2530.74	1199.78	6561.52
Ariyalur	904.23	302.50	481.07	1687.80
Thanjavur	-	2290.71	72.66	2363.37
Thanjavur & Thiruvarur	-	17248.06	3123.46	20371.52
Thanjavur & Nagapattinam	-	359.21	1108.24	1467.45
Ramanathapuram	-	168.23	272.43	441.26

Source: *Coal Directory of India, 2010-11.*

Exploration & Development

The details of exploration activities conducted by various agencies for lignite and other minerals during 2010-11 are furnished in Tables - 86(A).

In 2010-11, ONGC conducted geo-physical survey and drilling for exploration of petroleum & natural gas and discovered new three prospects for oil, namely, Pundi-2 in Thanjavur district, North Kovilkailappal-1 in and Kuthanallur in Tiruvarur district. Details of geo-physical survey and drilling are furnished in Table -3.

Production

The value of mineral production in Tamil Nadu at ₹ 4,325 crore in 2010-11 decreased by 4% as compared to that in the previous year. The state contributed about 2% to the total value of mineral production in the country. The principal minerals produced in the state were lignite, petroleum (crude), natural gas (utilised), garnet (abrasive), graphite (r.o.m.), limestone, magnesite, marl and lime kankar which together accounted for about 97% of the total value of the minerals produced in the state in 2010-11. The state was the leading producer of lime kankar (almost entire output), garnet (abrasive) (92%), dunite (89%), magnesite (72%), lignite (61%) and graphite (r.o.m.) (44%). It was also the second largest producer of marl (associate mineral with limestone) (14%) and vermiculite (10%) in country.

During the year under review, there was manifold increase in the production of felspar and bauxite as compared to previous year. Other minerals which have registered increase in production are vermiculite 34%, garnet (abrasive) 31%, steatite 30% and silica sand 20%. A sharp decline in production of marl by 61%, dunite 52%, ball clay 31% and magnesite 30%, was also observed in the state during the year 2010-11 (Table -4).

The value of minor mineral production was estimated at ₹ 117 crore for the year 2010-11.

The number of reporting mines was 179 in 2010-11 as against 175 in the previous year.

The index of mineral production in Tamil Nadu (base 1993 - 94 = 100) was 202.15 in 2010-11 as against 204.20 in the previous year.

Table –3: Details of Exploration Activities in Tamil Nadu, 2010-11

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Metreage		
GSI **Molybdenum** Dharmapuri	Vellakkal Central	-	-	3	-	170	Prospecting stage (G-3) investigation was taken up during FS 2010-12 for molybdenum in Harur-Uttangarai molybdenum belt. The maiden borehole -1 intersected the shear zone between 80.70 m and 108.50 m depths.Visible molybdenite mineralisation was rarely noticed in the shear zone. Samples collected from this borehole have analysed Mo values up to 220 ppm. Borehole-2 intersected sheared quartz-feldspathic gneiss, sheared epidote-hornblende gneiss and quartz vein. The shear zone is characterised by sericitisation in quartz-feldspathic portions and chloritisation in mafic rich portions of the country rock. Samples collected from this borehole have analysed Mo values up to 200 ppm. In borehole - 3 molybdenite specks with galena and pyrite are noticed . Random samples from borehole cores analysed for rhenium during the earlier phase of investigation indicated average Re value of 6 ppm for 16 samples.
PGE							
	Solavanur, Karappadi and Mallanaya-kanpalayam	-	-	06 03	-	42	Reconnaissance (G-4) stage investigation for PGE is being continued during FS 2010-12. Scout drilling and detailed mapping along with pitting and trenching were carried out. One borehole has been drilled in Solavanur block up to a depth of 87.95 m. Two boreholes have been drilled in Karappadi block; one up to a depth of 91.25 m and the other borehole was drilled to a depth of 75.10 m. Seven meta-pyroxenite bands with a cumulative thickness of 18.5 m have been delineated.

(Contd.)

Table - 3 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Metreage		
GSI PGE	Solavanur, Karappadi & Mallanaya-kanpalayam (Contd.)						Three boreholes have been drilled in Mallanayakanpalaiyam block to intersect the meta-pyroxenite±chromitite band. The first borehole 1 was drilled to intersect the main chromitiferous metapyroxenite / meta pyroxenite band. Band–I metapyroxenite ± chromitite contains 238 ppb of Pt and 451 ppb of Pd over a width of 2.9 m. Samples from Band–II meta-pyroxenite have yielded 373 ppb of Pt and 380 ppb of Pd over a width of 0.75 m. Band – III meta-pyroxenite showed an average grade of 388 ppb of Pt and 683 ppb of Pd over a width of 2 m at 30 m vertical depth (R.L. 228.89 m). The second borehole was drilled to intersect the main meta-pyroxenite band. The borehole has intersected mainly incipiently gneissic anorthositic gabbro/ gabbroic anorthosite with ± garnet along with 12 meta-pyroxenite bands with a cumulative width of about 14.57 m. The third borehole was also drilled to intersect the main meta-pyroxenite band. The borehole has intersected mainly anorthositic gabbro / gabbroic anorthosite with ± garnet along with 6 meta-pyroxenite bands with a cumulative width of about 18.35 m along the borehole. The work is in progress.
- do -	Mettuppa-laiyam	1:12,500	163.0		-	117	A reconnaissance **(**G-4**)** stage investigation for PGE in Mettupalaiyam Ultramafic belt was taken up during FS 2010-12. Meta-pyroxenite bands have been demarcated. About 64 samples for petrography and 53 samples for petrochemical studies have been collected. IN all 18 samples each for SEM-EDX, EPMA and ore microscopic studies have also been collected. Work is in progress.

(Contd.)

Table - 3 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Metreage		
GSI **PGE**	Tasamp-alaiyam	-	-	-	-	117	Reconnaissance stage (G-4) investigation was continued in 2010-12 in this block in Sittampundi layered mafic-ultramafic complex. Close spaced trench work covering 340 cu.m was carried out to trace the strike continuity as well as to assess the grade of PGE mineralised chromitite/ chromiferous meta-pyroxenite bands. Based on the close spaced trenching work, the T3 sector extending for about 2 km in WNW-ESE direction was divided into six segments viz., Segments A to F. Two zones of chromitite/ chromiferous meta-pyroxenite were delineated viz., the Northern and Southern Zones. The Northern Zone is traceable in all the six segments whereas the Southern Zone is traceable only in segment "B" and segment "E". The Northern zone, delineated disconti-nuously for a strike length of 700 m, has recorded PGE values ranging from 0.95 ppm to 3.68 ppm of Pt+Pd. The Southern Zone prominently exposed in segment "E" analysed 22.89 ppm of Pt+Pd. Trench work has been carried out in T4 sector of Tasampalaiyam Block lying in the western part of Sittampundi Complex to trace the strike continuity as well as the grade of PGE mineralised chromitite/ chromiferous metapyroxenite bands. This sector covering 1.5 km strike length has been divided into five segments viz, A, B, C, D and E from east to west for the correlation of mineralised bands. An anomalous segment "C" covering 230 m delineated west of "B" segment exposes five to

(Contd.)

Table - 3 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Metreage		
GSI PGE	Tasampalaiyam (Cont.)						Seven bands of chromitite/ chromiferous meta-pyroxenite with width of the individual bands varies from 0.25 m to 1.00 m and the PGE values ranging from 161 ppb to 495 ppb of Pt and 142 ppb to 1294 ppb of Pd.Scout drilling has been carried out in Karungalpatti Block lying in the eastern part of Sittampundi Complex which exposes eight to ten bands of chromitite/ chromiferous meta-pyroxenite .

Table – 4: Mineral Production in Tamil Nadu, 2008-09 to 2010-11 (Excluding Atomic Minerals)

(Value in Rs. '000)

Mineral	Unit	2008-09			2009-10			2010-11 (P)		
		No. of mines	Qty	Value	No. of mines	Qty	Value	No. of mines	Qty	Value
All Minerals		**178**		**40700821**	**175**		**45157727**	**179**		**43248291**
Lignite	'000t	3	21308	26791600	3	22338	30262900	3	23144	28755300
Natural gas (utilised)	m c m	-	1242	4578279	-	1178	4408601	-	1119	4187797
Petroleum (crude)	'000t	-	265	4221996	-	239	4312461	-	234	4222242
Bauxite	t	3	269766	42690	1	3342	852	3	45896	8752
Ball clay	t	1	25000	5650	1	22585	5059	1	15519	3476
Dunite	t	-	18385	15996	-	34296	10451	-	16620	4836
Felspar	t	-	3078	1065	-	451	117	1	7980	2357
Fireclay	t	6	35920	7956	3	23260	4431	4	26960	3802
Garnet (abrasive)	t	61	1064798	535596	63	1444781	678913	60	1887780	959551
Graphite (r.o.m.)	t	2	60437	19523	2	51719	25676	2	50099	23612
Sillimanite	t	-	271	860	-	67	763	-	-	-
Limestone	'000t	79	18190	2866664	83	20619	3717570	81	20087	3530359
Lime kankar	t	1	432734	75728	1	334287	58500	1	383201	50928
Magnesite	t	5	188564	281693	4	235446	349195	5	164756	257984
Marl	t	-	159000	5660	-	1623568	136226	-	626027	49189
Quartz	t	12	10589	9324	8	6952	7898	10	7542	9898
Silica sand	t	4	12009	3396	4	10476	5688	6	12526	5211
Talc/steatite/soapstone	t	-	-	-	1	1000	200	1	1295	259
Sulphur*	t	-	48453	-	-	41346	-	-	-	-
Vermiculite	t	1	1921	5148	1	1602	3558	1	2151	4070
Minor Minerals@		-	-	1231997	-	-	1168668	-	-	1168668

Note: *The number of mines excludes petroleum (utilised), natural gas and minor minerals.*

** Recovered as by-product from oil refinery.*

@ Figures for earlier years have been repeated as estimates because of non-receipt of data.

Mineral-based Industry

The important large and medium-scale mineral-based industries in organised sector in the State are given in Table -5.

Table – 5 : Principal Mineral-based Industries in Tamil Nadu

Industry/plant	Capacity ('000 tpy)
Abrasives	
Carborandum Universal Ltd, Chennai	NA
Cutfast Abrasives Tools Pvt. Ltd, Chennai	NA
Aluminium	
MALCO, Mettur Dam (Non-operational)	85 (alumina) 40 (aluminium)
Asbestos Products	
Hyderabad Industries Ltd, Kannigaiper	100.0
Ramco Industries Ltd, Arakkonam, Dist. Kancheepuram	NA
Tamil Nadu Asbestos, Alangulam, Dist. Virudhunagar	28.5
Cement	
ACC Ltd., Madukkarai, Dist. Coimbatore	960
Chettinad Cement Corpn. Ltd, Karur, Dist. Dindigul	600
Chettinad Cement Corpn. Ltd, Karikalli Dist. Tiruchirapalli	1200
Dalmia Cements, Dalmiapuram, Dist. Trichirapalli	4000
Grasim South, Reddipalayam	1030
The India Cements Ltd, Sankarnagar, Dist. Tirunelveli	2050
The India Cements Ltd, Sankari, Dist. Salem (G)	700
The India Cements Ltd, Dalavoi, Ariyalur	2160
Ultra-Tech Cement Ltd Reddipalayam, Dist. Ariyalur	1400
Ultra-Tech Cement Works, ARCW, Arakkonam (G)	1200
Madras Cements, R.S. Raja Nagar, Dist. Virudhunagar	750

(Contd.)

Table - 5 (Contd.)

Industry/plant	Capacity ('000 tpy)
Madras Cements, Alathiyur	3120
Tamil Nadu Cements, Alangulam, Dist. Virudhunagar	400
Tamil Nadu Cements, Ariyalur, Dist. Ariyalur	500
Ceramics	
Carborandum Universal Ltd, Hosur	NA
Parryware Glamourooms Pvt. Ltd, Ranipet Dist. Vellore	15
Murugappa Morgan Thermal Ceramics Ltd., Ranipet, Dist. Vellore	5.44
Neycer India Ltd, Vadalur, Dist. Cuddalore	9.0
Spartek Ltd, Chennai	NA
Copper Smelter	
Sterlite Industries (I) Ltd, Thoothukudi	300 (Cu anode) 205(Cu cathode) 90 (wire rods) 1050 (H_2SO_4)
Fertilizer	
CPFL, Muthugoundanpadur Dist. Coimbatore	60 (SSP) 30 (H_2SO_4) 3 (oleum)
Coramandal Fertilizer Ltd, Ranipet Dist. Vellore	132 (SP) 33 (H_2SO_4)
Coramandal Fertilizer Ltd, Ennore, Dist. Thiruvallur	330 (NPK) 492 (phospho-gypsum)
EID-Parry (I) Ltd, Ranipet Dist. Vellore	132.00 (super) 33.00 (H_2SO_4)
KICL, Ennore	82.00 (SSP) 41.00 (SAP)
Madras Fertilizer Ltd, Manali, Dist. Thiruvallur	486.7 (urea) 840 (NPK)
Southern Petrochemical Industries Corpn. Ltd, Thoothukudi	512 (urea) 606 (DAP) 2.56 (AlF_3)
Chemicals	
Tanfac Industries Ltd, Cuddalore	17 (HF) 17 (AlF_3)
Tuticorin Alkali Chemicals & Fertilizers Ltd, Thoottukudi	115 (soda ash) 115 (NH_4Cl)

(Contd.)

Table -5 (Contd.)

Industry/plant	Capacity ('000 tpy)
Synthetic Rutile	
DCW Ltd., Sahupuram, Dist. Thoothukudi	48
TiO_2 Pigment	
VVTi Pigments (P) Ltd, (formerly, Kilburn Chemicals) Dist. Thoothukudi	13
Foundry	
Raja Foundry, Singanallur, Dist. Coimbatore	NA
CPC Premier (P) Ltd, Coimbatore	NA
Hinduja Foundries Ltd, Ennore	NA
Krishna Engineering Co. Pvt Ltd, Tiruchirapalli	NA
The KCP Ltd, Thiruvottiyur, Chennai	NA
Iron & Steel	
Salem Steel Plant (SAIL), Salem	320 (saleable steel)
Southern Iron & Steel Co. Ltd, Salem	180 (pig iron) 300 (saleable steel)
Sponge Iron	
Adhunik Metalics Ltd, Eguvarpalayam, Dist. Thiruvallur	60
Arshara Industries Ltd, Equvarpalayam, Dist. Thiruvallur	60
Kaushik Steel Industries Ltd, Pappen Kuppam Dist. Thiruvallur	60
Agni Steels Pvt Ltd, Olappalayam Road, Ingur, Dist. Erode	30
Refractory	
ABREF Pvt. Ltd, Gummudipoondi, Dist. Thiruvallur	1.3
Sharda Ceramics Pvt. Ltd, Ambattur, Chennai	9.9
Shri Natraj Ceramic & Chemical Industries Ltd, Dalmiapuram, Dist. Tiruchirapalli	42

(Contd.)

Table - 5 (Concld.)

Industry/plant	Capacity ('000 tpy)
VRW Refractories, Vanagaram	21.6
DBM & Calcined Magnesite	
Badrinath Refractories, Salem	0.9 (DBM) 2 (calcined)
Burn Standard Co. Ltd, Salem	18 (calcined magnesite) 54 (DBM) 48 (refractory)
Carborandum Universal Ltd, Ranipet, Dist. Vellore	NA
Carborandum Universal Ltd, Pallikkaranai	NA
Dalmia Magnesite Corpn., Chettichavadi Dist. Salem	125 (DBM)
Khaitan Hostambe Spinels, Salem	30 (DBM) 10 (Mg-Cr clinker)
Ramkrishna Magnesite Mines, Salem	3 (calcined)
Salem Refractories, Salem	18 (DBM)
Tamil Nadu Magnesite Ltd, Kurumbapatty, Dist. Salem	19.5(calcined magnesite) 30(DBM)
Tata Refractories Ltd, Salem	25 (DBM) 2 (Calcined)
Tamil Nadu Products, Salem	3 (Calcined)
Pon Kumar Magnesite Ltd, Salem	26.5 (DBM)
Khetan Hostambe Spinels Ltd, Salem	30 (DBM) 10 (Cr magnesite)
Silicon Carbide	
Carborandum Universal Ltd, Tiruvottiyur	NA
Petroleum Refinery	
CPCL, Manali, Dist. Thiruvallur	10500
CPCL, Narimanam	1000

(G) : Grinding unit.

Indian Minerals Yearbook 2011

(Part- I)

50th Edition

(ADVANCE RELEASE)

STATE REVIEWS
(Tripura)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 001

PHONE/FAX NO. +91712 - 2565471
PBX : +91712 - 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

TRIPURA

Mineral Resources

Natural gas is the most important mineral resource in Tripura located in the Assam Arakan Fold Belt (AAFB) basin. Other minerals of significance found to occur in the State are glass sands, limestone, fireclay, plastic clay, shale and sand used particularly for building/construction purposes (Table-1).

Exploration and Development

ONGC continued geo-physical survey and drilling to explore petroleum and natural gas in the State. In 2010-11, new gas findings were reported from namely, Sundulbari structure in West Tripura district. Details of exploration activities conducted by ONGC during 2010-11 are furnished in Table-2.

Production

The value of mineral production in 2010-11 at ₹ 230 crore increased 8% as compared to the previous year. Natural gas (utilised) produced in the state, accounted almost entire value of mineral production with 8% increase in output (Table -3).

The value of minor mineral production was estimated at ₹ 149 lakh for the year 2010-11.

The index of mineral production in Tripura (base 1993-94 =100) was 598.04 during 2010-11 as against 552.94 in the previous year.

Mineral-based Industry

A 3,000 tpy lime-pozzolana mixture factory has been in operation at Kumarghat in North Tripura district. A 150 tpy glazed pottery unit of Tripura Khadi and Village Industrial Board is also in operation at Anandnagar in Tripura (West) district. The State Government is actively wooing private sector investment for establishment of gas-based industries. Besides, Private Sector's involvement in setting up of Ceramic tiles units and other mineral-based industries are also being actively pursued. Private participation in setting up plastic clay and glass sand industries too, is under consideration by the State Government.

Table – 1: Reserves/Resources of Minerals as on 1.4.2010 : Tripura

Mineral	Unit	Total reserves (A)	Remaining resources			Total resources (A+B)
			Measured STD331	Inferred STD333	Total (B)	
Fireclay	'000 tonnes	-	1	369	370	370
Quartz-silica sand	'000 tonnes	-	225	264	490	490

Figures rounded off.
Resources of Petroleum crude and Natural gas in the State are included in Assam and are not available separately.

Table – 2: Exploration for Petroleum & Natural Gas in Tripura during 2010-11

Agency	Seismic Survey		Drilling			
			Exploratory		Development	
	2D(GLKM)	3D(SQKM)	Wells	Meterage	Wells	Meterage
ONGC	43	50	6	25050	1	1930

Table –3: Mineral Production in Tripura, 2008-09 to 2010-11
(Excluding Atomic Minerals)

(Value in ₹ '000)

		2008-09			2009-10			2010-11 (P)		
Mineral	Unit	No. of mines	Qty	Value	No. of mines	Qty	Value	No. of mines	Qty	Value
All Minerals		**-**		**2049111**	**-**		**2125606**	**-**		**2297759**
Natural gas (utilised)	m c m	-	553	2038477	-	564	2110739	-	610	2282892
Minor Minerals@		-	-	10634	-	-	14867	-	-	14867

Note : *The number of mines for natural gas (utilised) and minor minerals is not available.*
@ Figures for earlier years have been repeated as estimates, wherever necessary, because of non-receipt of data.

Indian Minerals Yearbook 2011

(Part- I)

50th Edition

(ADVANCE RELEASE)

STATE REVIEWS
(Uttarakhand)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 001

PHONE/FAX NO. +91712 - 2565471
PBX : +91712 - 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

UTTARAKHAND

Mineral Resources

Important minerals that are found to occur in the State are high-grade **limestone** in Almora, Bageshwar, Dehradun, Nainital, Pauri-Garhwal, Pithoragarh & Tehri-Garhwal districts; **magnesite** and **steatite** in Almora, Bageshwar, Chamoli & Pithoragarh districts; and **tungsten** in Almora district.

Other minerals that occur in the State are **asbestos** in Chamoli district; **barytes** and **marble** in Dehradun district; **copper** in Almora, Dehradun & Pithoragarh districts; **dolomite** in Dehradun, Nainital and Tehri-Garhwal districts; **graphite** in Almora district; **gypsum** in Dehradun, Pauri-Garhwal & Tehri-Garhwal districts; **lead-zinc** and **silver** in Dehradun & Pithoragarh districts; and **rock phosphate** in Dehradun & Tehri-Garhwal districts (Table - 1).

Exploration and Development

GSI carried out exploration for gold around Villages Lameri-Ratura in Rudraprayag district during 2010-11. Details of exploration are furnished in Table-2.

Production

The value of mineral production in Uttarakhand at ₹ 6,387 crore in 2010-11 was almost at the same level as compared to the value of previous year. Uttarakhand was the second leading producer of magnesite and steatite contributing 25% and 18% to the total output of the respective minerals in country. During the year under review, production of magnesite decreased by 2% while steatite increased by 13% from that of the previous year (Table -3).

The value of minor mineral production was estimated at ₹ 6,364 crore for the year 2010-11**.**

The number of reporting mines in Uttarakhand in 2009-10 and 2010-11 was 34 and 36 respectively.

The index of mineral production in Uttarakhand (base 1993-94=100) was 26.55 in 2010-11 as against 24.92 in the previous year.

Mineral-based Industry

The important medium and large-scale mineral-based industries in the organised sector in the State are given in Table - 4.

Table – 2: Details of Exploration Activities in Uttarakhand, 2010-11

Agency/ Mineral/ District	Location		Mapping		Drilling		Remarks
			Scale	Area (sq km)	No. of boreholes	Metreage	Reserves/Resources estimated
GSI **Gold** Rudra-prayag	Lameri-Ratura	-	-	-	-	-	Reconnaissance stage investigation (G-4) was taken up during FS 2010-12 in Garwal Group based on the encouraging results of previous work in this area to delineate and assess the auriferous mineralized zones in the area. The mapping revealed presence of dolomite, limestone with carbonaceous slate, quartzite, phyllite, volcano-sedimentary sequence of Pithoragarh Formation and quartzite, quartz-mica schist, dolomite lenses and metavolcanics with basic intrusive of Berinag Formation. The general strike of the bedding is NW-SE with moderate dips. Three sulphide mineralized zones have been delineated. In Lameri area, zone having old workings and sulphide disseminations extends for 150 m X 300 m. In Tilni area, carbonaceous slate having pyrite specks forms a rich zone of 9 m. In Tilni–Koteshwar area the sulphide mineralised zone extends up to 1.2 km discontinuously over an average width of 8 m. The control of mineralisation is litho-structural. Gold flakes up to 1mm size have been recorded from stream sediment samples. Bedrock and stream sediment samples indicated gold values up to 475 ppb and 200 ppb respectively. The work is in progress.

Table –1: Reserves/Resources of Minerals as on 1.4.2010 : Uttarakhand

Mineral	Unit	Reserves				Remaining resources								Total resources (A+B)
		Proved STD 111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
			STD121	STD122			STD221	STD222						
Asbestos	tonne	-	-	-	-	-	-	-	-	311	-	-	311	311
Barytes	tonne	-	-	-	-	-	-	-	-	-	25000	-	25000	25000
Copper					-									
Ore	'000 tonnes	-	-	-	-	-	-	-	3170	390	660	-	4220	4220
Metal	'000 tonnes	-	-	-	-	-	-	-	53.45	1.44	5.15	-	60.04	60.04
Dolomite	'000 tonnes	1985	1798	22	3805	224	1052	349	1946	981	199592	-	204144	207950
Graphite	tonne	-	-	-	-	-	-	-	10700	-	-	-	10700	10700
Gypsum	'000 tonnes	-	-	-	-	-	-	35	-	-	2012	-	2047	2047
Lead-zinc														
Ore	'000 tonnes	-	-	-	-	-	-	-	3170	1790	660	-	5620	5620
Lead metal	'000 tonnes	-	-	-	-	-	-	-	138.85	34.25	9.50	-	182.60	182.60
Zinc metal	'000 tonnes	-	-	-	-	-	-	-	151.21	87.99	27.63	-	266.83	266.83
Limestone	'000 tonnes	-	-	1051	1051	5035	91872	59378	29486	164879	1191059	-	1541709	1542760
Magnesite	'000 tonnes	4424	818	3632	8874	162	697	31277	58902	58756	73481	-	223274	232148
Marble	'000 tonnes	-	-	-	-	-	-	-	-	-	6000	-	6000	6000
Phosphorite/Rock phosphate	tonne	-	-	-	-	3063503	-	1734370	2760000	-	16620513	-	24178386	24178386
Silver														
Ore	tonne	-	-	-	-	-	-	-	1600000	1400000	390000	-	3390000	3390000
Metal	tonne	-	-	-	-	-	-	-	134.00	4.20	0.39	-	138.59	138.59
Talc-steatite-soapstone	'000 tonnes	24684	4845	8021	37550	3228	4551	3876	4705	1524	23604	-	41487	79037
Tungsten														
Ore	tonne	-	-	-	-	-	-	-	-	138000	-	520000	658000	658000
Contained WO_3	tonne	-	-	-	-	-	-	-	-	25	-	680	705	705

Figures rounded off.

Table –3: Mineral Production in Uttarakhand, 2008-09 to 2010-11 (Excluding Atomic Minerals)

(Value in ₹ '000)

Mineral	Unit	2008-09			2009-10			2010-11 (P)		
		No. of mines	Qty	Value	No. of mines	Qty	Value	No. of mines	Qty	Value
All Minerals		**32**		**50147511**	**34**		**63867627**	**36**		**63865854**
Dolomite	t	-	53947	4532	-	63	6	-	3576	340
Magnesite	t	2	54725	67153	2	59187	72332	2	58004	69127
Talc/steatite/soapstone	t	30	151286	115426	32	145770	158589	34	164921	159687
Minor Minerals@		-	-	49960400	-	-	63636700	-	-	63636700

Note: *The number of mines excludes minor minerals.*
@ Figures for earlier years have been repeated as estimates, because of non-receipt of data.

Table – 4: Principal Mineral-based Industries in Uttarakhand

Industry/plant	Capacity ('000 tpy)
DBM	
Almora Magnesite Ltd., Matela, Dist. Bageshwar	24
Himalayan Hostambe, Pithoragarh	20 (DBM) 3 (Calcined magnesite)
Magnesite & Minerals Ltd, Pithoragarh	45
Orissa Industries Ltd., Chandak, Pithoragarh	45
Glass	
Hindustan National Glass & Industries Ltd, Rishikesh	340 TPD

Indian Minerals Yearbook 2011

(Part- I)

50th Edition

(ADVANCE RELEASE)

STATE REVIEWS
(Uttar Pradesh)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 001

PHONE/FAX NO. +91712 - 2565471
PBX : +91712 - 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

UTTAR PRADESH

Mineral Resources

The State is the principal holder of country's andalusite & diaspore resources and is said to possess 78% andalusite, 37% diaspore and 10% pyrophyllite. Important minerals occurring in the Stateare **coal** in Singrauli coalfields, Sonbhadra district; and **diaspore & pyrophyllite** in Hamirpur, Jhansi, Lalitpur and Mahoba districts. Naini area of Allahabad district contains high quality **silica sand**, an important source of glass sand, containing 98% SiO_2 and a very low Fe_2O_3. It is found in Shankargarh, Lohargarh in Allahabad district and also Bargarh in Banda district. It is also found in Aligarh and Chitrakoot districts.

Other minerals that occur in the State are **andalusite** and **calcite** in Mirzapur district; **bauxite** in Banda, Varanasi & Lalitpur districts; **china clay & dolomite** in Banda and Sonbhadra districts; **felspar** in Jhansi district; **fireclay, limestone, potash & sillimanite** in Sonbhadra district; **ochre** in Banda district; **granite** in Banda, Hamirpur, Lalitpur & Mahoba districts; **iron ore (hematite)** and **rock phosphate** in Lalitpur district (Table -1). The reserves/resources of coal along with detail of coalfield are provided in Table-2.

Exploration & Development

GSI carried out exploration for gold tungsten in Chacoria Cha area, district Sonbhadra. On the basis of fluorescence studies three mineralised zones have been identified which reportedly contained two minerals of tungsten i.e. powellite and scheelite. Analytical results are awaited. ONGC pursued their seismic survey and drilling for exploration for petroleum & natural gas. In 2010-11, ONGC covered 168 sq km area for 3D geophysical data. Details of exploration for gold and other minerals are furnished in Table-3.

Production

The value of mineral production in Uttar Pradesh at ₹ 4304 crore in 2010-11 was almost at the same level of the previous year. Coal alone accounted for 35% of the total value of mineral production in the state. Uttar Pradesh was the leading producer of diaspore with a share of 55% and second leading producer of pyrophyllite with 12% contribution to the total production of the respective mineral in the country. Among the important minerals, production of pyrophyllite, limestone and coal increased by 60%, 17% and 11% respectively whereas it decreased by 29% for silica sand during the year under review (Table - 4).

The value of minor mineral production was estimated at ₹ 2750 crore for the year 2010-11**.**

The number of reporting mines in Uttar Pradesh was 23 as against 25 in the previous year.

The index of mineral production in Uttar Pradesh for 2010-11(base 1993-94 = 100) was 141.45 as against 126.95 in the previous year.

Table –2 : Reserves/Resources of Coal as on 1.4.2011 : Uttar Pradesh

(In million tonnes)

Coalfield	Proved	Indicated	Inferred	Total
Total/Singrauli	**866.05**	**195.75**	-	**1061.80**

Source: *Coal Directory of India, 2010-11.*

Table –1: Reserves/Resources of Minerals as on 1.4.2010 : Uttar Pradesh

Mineral	Unit	Reserves				Remaining resources								Total resources (A+B)
		Proved STD 111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
			STD121	STD122			STD221	STD222						
Andalusite	'000 tonnes	-	-	-	-	-	-	-	-	-	14450	-	14450	14450
Bauxite	'000 tonnes	-	-	-	-	-	-	-	10390	500	8018	-	18908	18908
Calcite	tonne	-	-	-	-	-	-	-	-	-	11000	-	11000	11000
China clay	'000 tonnes	-	-	-	-	-	-	-	11600	3447	10018	-	25065	25065
Diaspore	tonne	750078	543478	109215	1402771	136057	328230	138907	545	-	224183	-	827921	2230692
Dolomite	'000 tonnes	-	-	-	-	-	12622	-	3500	-	66230	-	82352	82352
Felspar	tonne	-	-	-	-	-	-	-	-	-	200000	-	200000	200000
Fireclay	'000 tonnes	-	-	-	-	-	-	-	-	-	3221	-	3221	3221
Granite (Dim. stone)	'000 cu m	-	-	-	-	-	-	-	-	-	494819	-	494819	494819
Iron ore (Hematite)	'000 tonnes	-	-	-	-	-	-	-	-	-	38000	-	38000	38000
Limestone	'000 tonnes	-	-	-	-	45130	135590	21050	142763	40000	31200	-	415733	415733
Ochre	tonne	-	-	-	-	-	-	-	25000	35000	10000	-	70000	70000
Potash	million tonnes	-	-	-	-	-	-	-	-	-	190	-	190	190
Pyrophyllite	tonne	948617	605071	454154	2007842	522104	1201221	502246	378450	66512	911508	43200	3625241	5633083
Quartz-silica sand	'000 tonnes	8042	14530	3977	26549	1946	15482	3071	957	6290	51590	-	79337	105886
Phosphorite/Rock phosphate	tonne	-	-	-	-	-	432898	3118586	-	740000	21481960	-	25773444	25773444
Sillimanite	tonne	-	-	-	-	-	-	-	2100000	9350000	-	-	11450000	11450000

Figures rounded off.

Table –3: Details of Exploration Activities in Uttar Pradesh, 2010-11

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Metreage		
GSI							
Gold Sonbharda	Chakoriya - -Charka	-	-	-	-		Reconnaissance stage investigation (G-4 stage) was taken up during FS 2010-12 in Mahakoshal Group for search of gold and associated mineralisation . The earlier studies in the area established auriferous nature of quartz veins intruding the metasediments of Mahakoshal Group. The large-scale mapping reveals that the area mapped around Chakoriya-Charka comprises phyllite, chlorite phyllite with impersistent bands of chert and basic rocks of Agori Formation of Mahakoshal Group and are intruded by quartz/ quartz-carbonate veins having sulphide disseminations. The general strike of the rocks varied from N60°W to N75°W with vertical to steep dips towards south. Field evidences reveal that mineralisation is associated with sheared quartz vein. The sulphides occurred as fracture filling in quartz vein which are parallel to the regional trend of phyllite. In the Chakoriya area, 17 old workings spread over a strike length of 700 m with width of 2-3 m were noticed. In the Amriniyan area, brown, green, orange oxidation along with arsenopyrite are seen in sheared quartz vein over a strike length of >1km with width varying from 2 to 7 m. Further, galena-rich zone as detached bodies having width varying from 2 m to 5 m has been identified along >1km strike length in the Machohi area. An auriferous mineralised zone has been located about 500 m south of Village Parsoi . The mineralised zone, trending N70°-80°E - S70°-80°W to E-W, has been traced over a strike length of about 1km with width varying between 1.5 m and 4.0 m. The surface manifestations are marked by brown,

(Contd.)

Table – 3 (Concld.)

Agency/ Mineral/ District	Location	Mapping Scale	Mapping Area (sq km)	Drilling No. of boreholes	Drilling Metreage	Sampling	Remarks Reserves/Resources estimated
Gold							
Sonbhadra (Contd.)	Chakoriya-Charka	-	-	-	-	-	black, orange green and turquoise green oxidation material. The green to turquoise green coloured scorodite ($FeAsO_4.2H_2O$) and orange coloured mansfieldite ($FeAlAsO_4.2H_2O$) are formed due to oxidation of arsenopyrite. Scorodite occurred as lumps (10 to 70 cm) within phyllite as well as in the quartz veins as fracture filling, They also contain unoxidised sulphides, viz. arsenopyrite and pyrite. Sericite, chlorite and apatite occurred as other hydrothermal alteration minerals. At places, the mineralised zone is intruded by quartz-sulphide veins. The mineralisation appeared to be shear controlled.Four grab samples from the mineralised zone have indicated gold values ranging between 2.65 ppm and 5.48 ppm and arsenic between 29.9% and 33.5%. The work is in progress.

Table –4: Mineral Production in Uttar Pradesh, 2008-09 to 2010-11 (Excluding Atomic Minerals)

(Value in ₹ '000)

Mineral	Unit	2008-09 No. of mines	2008-09 Qty	2008-09 Value	2009-10 No. of mines	2009-10 Qty	2009-10 Value	2010-11 (P) No. of mines	2010-11 (P) Qty	2010-11 (P) Value
All Minerals		**26**		**36337639**	**25**		**42973146**	**23**		**43043967**
Coal	'000t	5	12029	8747200	5	13968	15067800	5	15526	15122300
Diaspore*	t	-	14462	15974	-	14527	18882	-	14910	18498
Limestone	'000t	1	477	50105	1	2455	353545	1	2865	379183
Pyrophyllite	t	8	22634	5631	8	17215	3475	9	27555	5882
Silica sand	t	12	182067	23729	11	183367	34444	8	129639	23104
Sulphur#	t	-	42915	-	-	36130	-	-	38856	-
Minor Minerals@		-	-	27495000	-	-	27495000	-	-	27495000

Note: *The number of mines excludes minor minerals..*

***** *Associated with pyrophyllite.*

 # Recovered as by-product from oil refinery.

@ *Figures for earlier years have been repeated as estimates, wherever necessary, because of non-receipt of data.*

Mineral-based Industry

The important large and medium-scale mineral-based industries in the organised sector in the State are given in Table - 5.

Table –5 : Principal Mineral-based Industries in Uttar Pradesh

Industry/plant	Capacity ('000 tpy)
Abrasives	
John Oakey and Mohan Ltd, Gaziabad	NA
Aluminium	
Hindalco Industries Ltd, Renukoot	700 (alumina) 345 (aluminium)
Cement	
ACC Ltd., Tikaria, Dist.Sultanpur (G)	2000
Ambuja Cement, Dadri, Gautam Budh Nagar	1500
Birla Cement, Raibareli (G)	630
Diamond Cement, Jhansi (G)	500
Jaypee Cement, Sadvakhurd (G)	600
Jaypee Cement, Churk, Dist. Sonbhadra	475
Jaypee Cement, Dalla, Dist. Sonbhadra	432
Jaypee Cement, Chunar, Dist. Sonbhadra (G)	1680
Jaypee Cement, Ayodhya, Dist. Faizabad (G)	1000
Ceramics	
BHEL, Porcelain Insulator Division, Sultanpur	NA
Kajaria Ceramics Ltd, Sikandrabad, Dist. Bulandsahar	9.7 (million sq m)
Orients Ceramics & Industry Ltd, Sikandrabad	95
UP Ceramics & Potteries Ltd, Gaziabad	4.8

(Contd.)

Table - 5 (Concld..)

Industry/plant	Capacity ('000 tpy)
Chemical	
Kanoriya Chemicals Ltd, Renukoot	48 (caustic soda)
Fertilizer	
Duncan Industries Ltd, Kanpur	722 (urea)
IFFCO-Phulpur, Dist. Allahabad	1687.90 (urea)
IFFCO, Aonla	795.40 (N_2)
IGCL-Jagdishpur	397.70 (N_2)
Khaitan Chemical & Fertilizers Ltd, Gora Machia, Dist. Jhansi	132 (SSP) 52.8 (H_2SO_4)
Malwan, Dist. Fatehpur	113.5 (SSP) 52.8 (H_2SO_4)
Mahadeo Fertilizers Ltd, Fatehpur	113.5 (SSP) 52.8 (H_2SO_4)
OCF-Shahajahapur	397.70 (N_2)
Tata Fertilizer Works, Babrala, Dist. Badaun	864.6 (urea)
Ferro Alloys	
Hindustan Ferro Alloys, Hamirpur	3.2
The India Thermit Corpn. Ltd, Kanpur	0.3
Iron & Steel	
Malvika Steel Ltd, Jagdishpur	511 (pig iron) 600 (saleable steel)
Glass	
Hind Lamps Ltd, Shikohabad	NA
Mohan Crystal Glass Works, Mohan Nagar Dist. Gaziabad	40.9
Universal Glass Co., Gaziabad	60
Petroleum Refinery	
IOCL, Mathura	8000

Indian Minerals Yearbook 2011

(Part- I)

50th Edition

(ADVANCE RELEASE)

STATE REVIEWS
(West Bengal)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 001

PHONE/FAX NO. +91712 - 2565471
PBX : +91712 - 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

WEST BENGAL

Mineral Resources

West Bengal is the principal holder of country's apetite resources and is said to possess 16% china clay resources. Important minerals that occur in the State are **apatite** in Purulia district; **coal** in Bardhaman, Bankura, Birbhum, Darjeeling, Jalpaiguri and Purulia districts; **china clay** in 24-Parganas, Bankura, Birbhum, Bardhaman, Hoogly, Midnapur and Purulia districts; and **fireclay** in Bankura, Birbhum, Bardhaman and Purulia districts.

Other minerals that occur in the State are **barytes, copper, gold, kyanite, pyrite** and **titanium minerals** in Purulia district; **dolomite** in Jalpaiguri district; **felspar** in Bankura and Purulia districts; **granite** in Bankura, Birbhum and Purulia districts; **lead-zinc** in Darjeeling district; **limestone** in Bankura and Purulia districts; **manganese ore** and **sillimanite** in Midnapur district; **quartz/silica sand** in Bankura, Hoogly and Purulia districts; and **tungsten** & **vermiculite** in Bankura district (Table - 1). Reserves/ resources of coal along with details of coalfields are provided in Table-2.

Exploration & Development

ONGC carried out seismic survey and drilling for exploration of petroleum & natural gas and data for 2562 (2D-GLKM) & 1948 (3D- sq km) was rcquired in 2010-11.The details of exploration activities conducted by various agencies for coal and other minerals during 2010-11 are furnished in Table - 3.

Table – 2 : Reserves/Resources of Coal as on 1.4.2011 : West Bengal

(In million tonnes)

Coalfield	Proved	Indicated	Inferred	Total
Total	**11752.54**	**13131.69**	**5070.70**	**29954.92**
Raniganj	11638.27	7750.71	4443.91	23832.89
Barjora	114.27	-	-	114.27
Birbhum	-	5380.98	611.79	5992.76
Darjeeling	-	-	15.00	15.00

Source: *Coal Directory of India, 2010-11*

Table – 1 : Reserves/Resources of Minerals as on 1.4.2010 : West Bengal

Mineral	Unit	Reserves				Remaining resources							Total resources (A+B)
		Proved STD111	Probable		Total (A)	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
			STD121	STD122		STD221	STD222						
Apatite	tonne	2052517	-	-	2052517	-	1225345	120000	8845250	852605	666646	11709846	13762363
Barytes	tonne	-	-	-	-	-	-	-	433000	-	-	433000	433000
China clay	'000 tonnes	1232	185	906	2323	202	703	38	332236	80335	5826	419340	421663
Copper													
Ore	'000 tonnes	-	-	-	-	-	-	-	113	-	-	113	113
Metal	'000 tonnes	-	-	-	-	-	-	-	2.09	-	-	2.09	2.09
Dolomite	'000 tonnes	-	12528	48000	60528	-	-	-	73226	104275	-	177501	238029
Felspar	tonne	25874	-	-	25874	-	-	900000	3400000	201250	-	4501250	4527124
Fireclay	'000 tonnes	771	104	854	1729	476	883	-	419	11115	958	13852	15581
Gold													
Ore (primary)	tonne	-	-	-	-	-	-	-	-	-	12833333	12833333	12833333
Metal (primary)	tonne	-	-	-	-	-	-	-	-	-	0.65	0.65	0.65
Granite (Dim. stone)	'000 cu m	3658	-	-	3658	-	-	19827	1140	8802	-	29768	33426
Kyanite	tonne	-	-	-	-	-	-	-	-	26520	-	26520	26520
Lead-zinc													
Ore	'000 tonnes	-	-	-	-	-	-	-	3371	335	-	3706	3706
Lead metal	'000 tonnes	-	-	-	-	-	-	-	130.07	10	-	140.07	140.07
Zinc metal	'000 tonnes	-	-	-	-	-	-	-	130.42	13	-	143.42	143.42
Limestone	'000 tonnes	-	-	-	-	-	-	7104	15482	22120	-	44706	44706
Manganese ore	'000 tonnes	-	-	-	-	-	-	-	-	200	-	200	200
Pyrite	'000 tonnes	-	-	-	-	-	-	-	-	2500	-	2500	2500
Quartz-silica sand	'000 tonnes	779	-	1022	1801	11	11	-	-	4607	-	4629	6430
Sillimanite	tonne	-	-	-	-	-	-	-	-	1653000	-	1653000	1653000
Titanium minerals*	tonne	-	-	-	-	-	-	-	-	2279000	-	2279000	2279000
Tungsten Ore	tonne	-	-	-	-	-	173063	-	190739	400000	-	763802	763802
Contained WO_3	tonne	-	-	-	-	-	450	-	80.84	1000	-	1530.84	1530.84
Vermiculite	tonne	-	-	-	-	-	-	-	490	5076	-	5566	5566

Figures rounded off.

** Resources of ilmenite, rutile and zircon as per Department of Atomic Energy for the minerals are provided in the respective Mineral Reviews.*

Table – 3 : Details of Exploration Activities in West Bengal, 2010-11

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks
		Scale	Area (sq km)	No. of boreholes	Metreage		Reserves/Resources estimated
GSI							
Apatite Purulia	Panrkidih	-	-	-	-	-	Prospecting stage investigation (G-3) was taken up during FS 2010-12 in this area to assess the potentiality and resource evaluation of apatite and associated minerals. The area exposes biotite gneiss ± garnet, garnetiferous sillimanite gneiss, porphyroclastic granite gneiss (PCG), apatite -magnetite bearing rock and late intrusive pegmatite and quartz vein. Apatite-magnetite bearing cherty rock having 1m average surface width and approximately 600 m strike length has been established , by detailed mapping. The Apatite-Magnetite bearing rocks occurred as small continuous lensoidal bodies near Village Panrkidih arranged in a curvilinear fashion following the main regional structural trend i.e. E-W to NE-SW. The second borehole intersect the apatite magnetite body in the central part of the mineralised zone at 30 m vertical depth intersected weathered pegmatite up to 8 m depth.
Coal (Damodar valley coal field) Birbhum	East of Bhabaniganj						Reconnaissance stage (G-4) regional exploration by scout drilling in this area, (Ranianj Coalfield,) was continued to examine the continuity of Barakar coal seams to the east of Nabasan and Binodpur-Bhabaniganj Blocks and to appraise the development pattern and regional persistence of the coal seams in the Barakar Formation. The area lies in the eastern adjacent part of Binodpur-Bhabaiganj Block and south of Kasta area in the Trans-Ajay part of Raniganj Coalfield. Borehole -2 progressed from 328.50 m to 497.20 m and intersected the Barren Measure/ Barakar and Barakar/basement contacts at 402.30 m and 486.90 m depths respectively .In this borehole, one coal seam of 5.60 m thickness has been intersected at464.30 m depth. The coal seam belongs to Salanpur-A Group of seams. Borehole -3 progressed up to 341.70 m and intersected the Raniganj Formation/Barren Measure contact at 83.55 m depth. The work is in progress.

(Contd.)

Table - 3 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Metreage		
Birbhum coal field Birbhum	Dhobbanpur	-	02	-	-	-	Prospecting stage (G-3) regional exploration for Gondwana coal under the cover of Tertiary sedimentaries in this sector, Birbhum Coalfield was continued in FS.2010-12 with an objective (a) to establish continuity of coal bearing Barakar Formation below the cover of Tertiary sediments to the south and east of Makhdumnagar and south of allotted CBM block (BB-CBM-2005/III of DGH), Birbhum Coalfield (b) to examine the development pattern of coal seams.. The first borehole located in the central part of the sector intersected five Barakar coal seams (0.70 m to 4.70 m thick) with a cumulative thickness of 11.65 m at depths ranging from 440.75 m to 512.45 m. The second borehole located in the southwestern part on the northern bank of Dwarka River intersected Tertiary claystone and fine grained sandstone followed downwards by Rajmahal and Barakar Formations. CBM desorption study of core samples collected from the coal seams has indicated a mere presence of desorbed gas (0.12 cc/gm). The investigation is under progress.
Birbhum	Gazipur	-	-	02	737.70	-	Reconnaissance stage (G-4) regional exploration by scout drilling was con tinued during FS 2010-12 in and around this area to the south of Mahalla, Rajmahal Master Basin to examine the extent of coal bearing Barakar and other Gondwana formations below the cover of Tertiary sedimentaries around Gazipur, south of Mahalla, to appraise the coal development, if any, and for gener ating CBM baseline data. The second borehole located in the southwestern corner of the area has intersected ten Barakar coal seams ranging in

(Contd.)

Table - 3 Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Metreage		
GSI **Coal** Birbhum (Contd.)	Gazipur						thickness from 0.50 m to 2.50 m (cumulative thickness 10.30 m) in the depth range from 479.95 m to 615.65 m. CBM study is under progress. The third borehole-3 located in the central part has recorded 235.15 m of Tertiaries and 180.70 m of Rajmahal Trap so far. A Tertiary lignite seam of 0.50 m thickness has been intersected of 0.50 m thickness has been intersected at 226.30 m depth in this borehole. The investigation is under progress.
Raniganj Coalfield Birbhum	South of Hingla river						Reconnaissance stage (G-4) regional exploration by scout drilling was initiated during FS 2010-12 in this area in Raniganj Coalfield, to establish the development pattern and structural disposition of Barakar coal seams at depth under the cover of Barren Measures along with appraisal of the coal resource potentiality and to establish strike-wise continuity of the regional Barakar coal seams already established in Nabasan and Binodpur-Bhabaniganj Blocks located towards west in order to generate CBM baseline data. The investigation in this area covering 20 sq km was taken up for two years and commenced on 10.11.2010. The first borehole-1 intersected the Barren Measure/ Barakar and Barakar basement contacts at 202.60 m and 266.05 m depth respectively. One coal seam of 1.86 m thickness was intersected at 254.95 m depth. The second borehole -2 progressed upto 363.65m depth and intersected Barren Measure/Barakar contact at 323.95 m depth. The work is in progress.

(Contd.)

Table - 3 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Metreage		
Talc/Steatite/ Soapstone Darjeeling	Lapcha, Basti and Singla	-	-	-	-	-	Reconnaissance stage investigation (G-4) was taken up during FS 2010-12 in Darjeeling Himalayan belt to search for talc/steatite/soapstone occurrences and their relationship with associated rocks, and to assess the economic potentiality of talc-steatite rocks. The lithologies exposed are the Precambrian metasedi-mentaries belonging to Gorubathan Formation, Daling Group and the Darjeeling Gneiss. The low-grade metamorphic rocks of Daling Group are represented by well bedded quartzites, phyllites and the quartz-chlorite-mica schist and covers about 75 % of the exposure. Talc deposit has been located in the northeastern part of the area at Darjeeling Gorkha Hill Council Forest beside Village Singla on a hill slope. The talc is impure on the surface with thick ferruginous stains and the impurity decreases with depth. It is platy, friable, white colored and sandwiched between an overlying Daling quartzite and Daling phyllite. Its approximate width is about 100 cm. Grab sample so far analyzed yielded MgO: 34.56%, SiO_2: 54.03%, Al_2O_3: 3.34% and Fe_2O_3: 1.41%**.** Though the grade appears to be very good, the exact dimension of the deposit will be ascertained after the trenching. The work is in progress.

(Contd.)

Table - 3 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Metreage		
DMM **China clay** Bankura	Village-Siarbada	-	1.5	-	-	-	The clay deposit was found associated with the Archeans. The area was covered with gravels/alluvial/lateritic soil which acts as a capping of the underlying clay beds. The overburden have encountered with variable thickness of about 1.5 m – 2.4 m and the thickness of clay beds ranges from1.2 m to 1.3 m, upto a maximum depth of about 5.7 m from the surface. Resources were not estimated.
Magnetite Bankura	N/V Pathardihi	-	7	-	-	-	The magnetite bearing zone at the south of Pathardih was encountered which was striking E-W. The zones were occurred at the boundry of anorthositic rock & granite gneiss. The total length of the magnetite bearing zone were consisting of several discontinuous bands which was 650 m (approx.) with an overall cumulative width of parallelly detached bands varying from 20-60 m (approx.) on outcrop surface and also found to be enclosed within metabasic rock which lies within anorthositic rock. Resources were not estimated.
Quartz Bankura	N/V Kenduadihi	1:4545	4 0.5	-	-	8	The area under investigation was mainly contains laterite & lateritic soil with pegmatitic veins. Inclusion of minor quartz veins was also noticed. Resources were not estimated.
Talc/Steatite/ Soapstone Darjeeling	Gok-karmi area	1:25,000	10	-	-	51	In this area, the talc/ steatite/soapstone were encountered on hill slopes mainly on two blocks between the hills namely near Tiruk khola & Ramsukkhola. Occurrences were confined withinthe overlying quartzite & underlying carbonaceous phyllite. Lensoid deposits have also been detected. The general strike varies from WNM-ESE with moderate to high dip (30^o-70^o) towards SSW and WNW. About 60,000tonnes resources of talc/steatite/ soapstone were estimated.

(Contd.)

Table - 3 (Contd.)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Metreage		
Talc/Steatite/ Soapstone Darjeeling	Lepcha Basti & Singla area	1:25,000	30	-	-	31	The area under investigation quartzite and phyllite are the prominent rock types. Quartzites are fine to medium grined, highly ferruginous and sheared at places. Phyllites are crenulated, puckered and thinly laminated with multiple quartz veins at places. Carbonaceous phyllites were also observed which were grey to dark grey in colour. Talc appears to be a lensoid body with thickening & thinning behavior. Strike extension of the body was found app. 150 m & thickness app. 3 m which may vary at places. Resources will be estimated after receipt of chemical analysis report.
Apatite/ Magnetite Purulia	N/V Chirugora	1:500	10,720	-	-	43	Quartz-Apatite-Magnetite bearing rock was present within phyllitic country. At places ore body was found highly weathered. Strike of the ore body was found roughly WNW-ESE dipping 40^o-65^o towards south. Rocks were mainly massive and at some places schistosity & compositional layering were also noticed. Quartz-apatite-magnetite rocks were also jointed. Strike extension of the deposit was about 200 m. Resource was estimated after completion of drilling.
WBMDTCL **Coal** Bardhaman	Ichhapur Coal Block	1:2,000	2.0	29	25141.90	450	Rocks of Tertiary, Panchet Raniganj were present in this block

(Contd.)

(Table - 3 : Concld)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Metreage		
WBMDTCL **Coal** Bardhaman (Contd.)	Ichhapur Coal Block						in the ascending order. The strike of the strata is almost E to W. The dip of the beds varied from 4º - 6º towards south. The coal seam in this block has been referred as Seam-I. The depth range of the coal seam varied from 725 m – 1200 m.
-do-	Sitarampur Coal Block	1:2,000	2.0	14	8249.45	210	Rocks of Tertiary, Raniganj, Barren Measure, Barakars, Talchir & Archaeans were present in this block in the ascending order. The strike of the strata is almost NE-SW. The dip of the beds varied from 5º – 10º towards southeast. Occurrences of Laikdih seam were observed in the block & depth range varied from 320 m – 920 m. Occurrences of Begunia & Ramnagar seam were also noticed.
-do-	Kulti Coal block	1:2,000	8.75	12	14253.40	220	Rocks of Tertiary, Raniganj, Barren Measure, Barakars, Talchir & Archaeans were present in this block in the ascending order. In major part of the block the strike of the data is almost NE – SW. The dip of the beds varied from 5º – 10º towards southeast. Based on borehole data, all together four faults have been interpreted, all of which are more or less oblique faults. The throw of the faults varied from 40º – 90º.

Production

The value of mineral production in West Bengal at ₹ 2,982 crore increased by 38% in 2010-11 as compared to the previous year. The state accounted for 1% of the value of mineral production in India. West Bengal is the only other producer of apatite and accounted for 33% of the total production in the country. Coal alone accounted for 94% of the value of mineral production in the state during the year under review. The production of sulphur and natural gas (ut) increased by 63% and 8% respectively whereas production of apatite, fireclay and kaolin decreased by 40%, 29% and 10% respectively as compared to that of the previous year (Table - 4) .

The value of minor mineral production was estimated at ₹ 146 crore for the year 2010-11**.**

The number of reporting mines in West Bengal in 2010-11 was 108 as against 112 in the previous year.

The index of mineral production in West Bengal for 2010-11(base 1993-94 =100) was 129.60 as against 138.46 in the previous year.

Table – 4 : Mineral Production in West Bengal, 2008-09 to 2010-11
(Excluding Atomic Minerals)

(Value in ₹ '000)

Mineral	Unit	2008-09			2009-10			2010-11 (P)		
		No. of mines	Qty	Value	No. of mines	Qty	Value	No. of mines	Qty	Value
All Minerals		**113**		**34322198**	**112**		**21561666**	**108**		**29822774**
Coal	'000t	101	22905	32740700	100	23133	19908200	98	21659	28164100
Natural gas (utilised)	m c m	-	20	73724	-	38	142213	-	41	153440
Petroleum (crude)	'000t	-	-	-	-	-	-	-	-	-
Apatite	t	1	2513	4405	1	2110	3699	1	1260	2209
Clay (others)	t	1	187	19	-	-	-	-	-	-
Felspar	t	-	1496	838	-	3050	1464	-	2988	1724
Fireclay	t	5	53684	5721	5	46179	4614	3	32941	3375
Kaolin	t	3	90775	40524	3	99439	42979	3	89843	39428
Quartz	t	2	6127	1154	3	15823	3384	3	14983	3385
Sulphur#	t	-	20110	-	-	15511	-	-	25292	-
Minor Minerals@		-	-	1455113	-	-	1455113	-	-	1455113

Note : *The number of mines excludes minor minerals.*

 # Recovered as by-product from oil refinery.

@ Figures for earlier years have been repeated as estimates, because of non-receipt of data.

Mineral-based Industry

Important large and medium-scale mineral-based industries located in the State with their total installed capacities are given in Table - 5.

Table – 5 : Principal Mineral-based Industries in West Bengal

Industry/plant	Capacity ('000 tpy)
Asbestos Products	
Everest Building Products Ltd, Kolkata	NA
Ramco Industries Ltd, Haratara, Dist. Paschim Midnapur	NA
UAL Industries Ltd, Tungadhowa, Dist. Paschim Midnapur	150
Abrasives	
Carborandum Universal Ltd, Gopalpur	NA
K.L.Thirani & Co. Ltd, Kolkata	NA
Cement	
Ambuja Eastern, Sankrail (G)	1000
Birla Corporation Ltd, Durgapur (G)	600
Damodar Cement, Purulia (G)	525
Ultra-Tech Cement Works, Durgapur (G)	1000
Durga Hitech Cement (G)	1000
Ceramics	
Jayshree Insulators, Rishra	NA
WBCDC Ltd, Kolkata	0.18
Chemical	
Hindustan Heavy Chemicals Ltd, Khardah, Dist. 24-Parganas	14.8 (caustic soda) 6 (Cl) 9.8 (HCl) 4.5 (ferric alum) 18.7 (H_2SO_4)
Electrodes	
Graphite India Ltd, Kolkata	NA
Fertilizer	
Jay Shree Chemicals & Fertilizers Ltd, Khardah, Dist. 24-Parganas	159.72 (SSP) 62.70 (H_2SO_4)
TCL-Haldia	121.5 (N_2) 310.5 (P_2O_5)
Glass	
Hindustan National Glass & Industries Ltd, Rishra	680 TPD
Iron & Steel	
Durgapur Steel Plant, SAIL, Durgapur	3070 (sinter) 2000 (pig iron) 1586 (saleable steel) 1800 (crude/liquid steel)
IISCO Steel Plant, SAIL, Burnpur, Dist. Bardhaman	254 (pig iron) 500 (steel ingot) 9.5 (Ammonium sulphate)
Alloy Steel Plant, SAIL, Durgapur	178 (Saleable Steel) 264 (crude/liquid steel)

(Contd.)

Table - 5 (Concld.)

Industry/plant	Capacity ('000 tpy)
Pig Iron	
Electrosteel Castings Ltd, Khardah	110
Kajaria Iron Castings Ltd, Durgapur	110
Tata Metaliks Ltd, Kharagpur	90
Sponge Iron	
Adhunik Corporation Ltd, Durgapur	60
Aryavrata Trading Pvt. Ltd, Lohamelya Dist. Paschim Midnapur	36
Howrah Gasses Ltd, Raniganj, Dist. Bardhaman	60
Jai Balaji Sponge Ltd, Raniganj, Dist. Bardhaman	105
Rashmi Cement Ltd, Paschim Midnapur	60
Rashmi Ispat (Pvt) Ltd, Raghunathpur, Dist. Paschim Midnapur	60
Shyam Sel Ltd, Dewabdighi, Bardhaman	100
Sunil Sponge Iron Ltd, Kolkata	115
Ferro-alloys	
Kartik Alloys Ltd, Durgapur	10.7
Maithan Alloys Ltd, Bardhaman	12.5
Modern India Con-Cast Ltd, Bishnupur Dist. Bankura	22
Rohit Ferro-Tech Ltd, Bishnupur, Dist. Bankura	55
Corporate Ispat Alloys Ltd, Durgapur	40
Modern India Cone Cost Ltd, Bishnupur Dist. Bankura	75
Shyam Ferro Alloys Ltd, Bardhaman	100
Shri Vasavi Industries Ltd, Bishnupur Dist. Bankura	45
Srinivasa Ferro Alloys Ltd, Durgapur, Dist. Bardhaman	84.2
Shri Goyatri Minerals Pvt. Ltd, Bishnupur, Dist. Bankura	24
Refractory	
Alcoa-ACC Industrial Chemicals Ltd, Kalatalahat	10
Barazkar Refractories (P) Ltd, Barakar, Dist. Bardhaman	3.6
Kero Rajendra Monolithics Ltd, Banjora	NA
Saswat International Ltd, Kulti, Dist. Bardhaman	NA
Vesuvius India Ltd, Kolkata	96.5
Coke Oven Batteries	
IISCO Burnpur Works, Burnpur, Dist. Bardhaman	1084
Petroleum Refinery	
IOCL, Haldia	7500
TiO_2 Pigment	
Kolmak Chemicals Ltd, Kalyani, dist. Nadia	4.8

(G) : Grinding units.

Indian Minerals Yearbook 2011

(Part- I)

50th Edition

(ADVANCE RELEASE)

STATE REVIEWS
(Union Territories)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 001

PHONE/FAX NO. +91712 - 2565471
PBX : +91712 - 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

UNION TERRITORIES

ANDAMAN & NICOBAR ISLANDS

Occurrences of chromite, diatomaceous earth, gold, limestone, nickel, selenite and sulphur are reported in the Territory.

No mineral production (except minor minerals) was reported from Andaman & Nicobar Islands during 2010-11. The value of minor mineral production was estimated at ₹ 17 crore for the year 2010-11.

CHANDIGARH

No mineral production (except minor minerals) was reported from Chandigarh in 2010-11. The value of minor mineral production was estimated at ₹ 17 lakh for the year 2010-11.

DADRA & NAGAR HAVELI

Production of minerals was not reported during the year. Principal large & medium-scale mineral-based industries located in Dadra & Nagar Haveli are furnished in Table - 1.

Table – 1 : Principal Mineral-based Industries in Dadra & Nagar Haveli

Industry/plant	Capacity ('000 tpy)
Aluminium	
Hindalco Industries Ltd, Silvasa	30 (Al foil)
Asbestos Products	
Ramco Industries Ltd, Golanda, Silvasa	NA
Copper	
Sterlite Industries (India) Ltd,	195 (copper cathode)
Chinchpada, Silvasa	150 (CC copper rod)
Alloy	
Hindustan Alloys Mfg. Co Ltd,	3 (tin ingot)
(HAMCO), Silvasa	38 (Al alloy ingot)
	2.8 (Sn-Pb solder wire)

DAMAN & DIU

Occurrence of limestone have been reported in Diu Island. Limestone mining, however, is carried out only as a minor mineral. In Daman, basalt is quarried for building and other purposes (Table - 2).

No mineral production (except minor minerals) was reported from Daman & Diu during 2010-11.

The value of minor minerals production was estimated at ₹ 6 lakh for the year 2010-11.

Rohit Pulp and Paper Mills Ltd set up a secondary lead and lead alloys plant at Daman, having a licensed capacity of 6,000 tpy and secondary tin plant with 1,000 tpy capacity.

LAKSHADWEEP

Occurrences of limestone/limeshell have been reported in the Union Territory but mineral production is not reported.

PUDUCHERRY

Occurrences of **limestone** along the borders of Kancheepuram district of Tamil Nadu have been reported. Other mineral occurrences in the Union Territory are **kaolin** in Karaikal and Puducherry areas; and **lignite** in Bahur area. Lignite reserves in Bahur and west of Bahur area of Puducherry as on 1.1.2006 are estimated at 416.61 million tonnes (Table - 3).

No mineral production (except minor minerals) was reported during the year 2010-11 from Puducherry.

There is a 6,000 tpy capacity ordinary portland cement producing plant belonging to Polson Ltd in the Territory. Four calcium carbide producing units exist with a total capacity of 6,250 tpy. There are also a caustic soda and hydrochloric acid plant having 14,380 tpy and 14,290 tpy capacity, respectively and three small-scale units producing ferro-silicon with a total capacity of 8,000 tpy. There is a unit manufacturing special porcelain, refractories and insulators. Three units are engaged in chalk manufacture using gypsum and one insecticide unit using soapstone. There are a number of granite cutting and polishing units. A couple of units are also reportedly coming up in the Territory that would manufacture glazed and unglazed tiles and steel ingots. Three EAF units (mini steel plants) with a total installed capacity of 1,97,000 tpy belonging to East Coast Steel Ltd., Sumangala Steel (P) Ltd and The Indian Steel Rolling Mills Ltd are in existence (Table - 4).

Table – 2 : Reserves/Resources of Minerals as on 1.4.2010 : Daman & Diu

Mineral	Unit	Total reserves (A)	Remaining resources				Total resources (A+B)
			Measured STD331	Indicated STD332	Inferred STD333	Total (B)	
Limestone	'000 tonnes	-	-	-	128670	128670	128670

Figures rounded off.

Table – 3 : Reserves/Resources of Minerals as on 1.4.2010 : Puducherry

Mineral	Unit	Total reserves (A)	Remaining resources				Total resources (A+B)
			Measured STD331	Indicated STD332	Inferred STD333	Total (B)	
China clay	'000 tonnes	-	-	-	2940	2940	2940
Limestone	'000 tonnes	-	4433	4433	6966	15732	15732

Figures rounded off.

Table – 4 : Principal Mineral-based Industries in Puducherry

Industry/plant	Capacity ('000 tpy)
Ceramics	
Regency Ceramics Ltd, Yanam	150
H&R Johnson (India) Ltd, Karaikal	24.2
Ferro Alloys	
The Silcal Metallurgic Ltd	12.4
VSK Ferro Alloys Ltd, Tuthipet	3
Snam Alloys Pvt. Ltd, Kariamanikam	12
Glass	
Hindustan National Glass & Industries Ltd, Puducherry	350 TPD

Indian Minerals Yearbook 2011
(Part- I)

50th Edition

(ADVANCE RELEASE)

STATE REVIEWS
(Offshore Regions)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 001

PHONE/FAX NO. +91712 - 2565471
PBX : +91712 - 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

OFFSHORE REGIONS

The Government of India notified the Offshore Areas Minerals (Development & Regulation) Act, 2002 (OAMDR Act), No. 17 of 2003 in the Gazette of India, Extraordinary, Part-II, Section-1, No. 17, dated 31.1.2003. The purpose of the Act is to provide for development and regulation of mineral resources in the territorial waters, continental shelf, exclusive economic zone and other maritime zones of India and to provide for matters connected therewith or incidental thereto. The Act is applicable to all minerals in offshore areas including minerals prescribed under Atomic Energy Act, 1962, but excludes oils and related hydrocarbons as there is separate legislation for them in force. The Act came into effect from 15.1.2010 vide S.O.338(E), dated 11.2.2010 notified by the Central Government.

The Act makes it mandatory to undertake reconnaissance, exploration or production operation in the offshore areas in accordance with the prescribed terms and conditions for reconnaissance permit (RP), exploration licence (EL) or production lease (PL) granted under the Act and the rules made thereunder. The availability of the areas for grant of RP, EL or PL shall be notified within six months from the commencement of the Act, and subsequently at such times as considered necessary. The Act empowers the Central Government to make rules for the purpose of the Act including terms and conditions under the RP, EL, PL, etc. The Rules, namely, the Offshore Areas Mineral Concession Rules, 2006 have been framed and notified on 3.11.2006 by G.S.R.691(E) published in the Gazette of India, Extraordinary, Part II, Section 3(i), No. 539, dated 4.11.2006. The Rules have come into effect on the date on which the Offshore Areas Mineral (Development and Regulation) Act, 2002 came into force, i.e, 15.1.2010.

As a sequel, the Controller General, Indian Bureau of Mines has been notified as the "administering authority" and "authorised officer" under Section 4 and Clause (i) of Section 22 of the Act vide S.O.339(E) and 340(E) dated 11.2.2010. The Secretary, Ministry of Mines has been notified as "authorised officer" to hear and decide cases relating to Clauses (a) and (b) of Section 28(1) vide S.O.341(E) dated 11.2.2010.

As per S.O.134(E) dated 7.6.2010, The Controller General, Indian Bureau of Mines has notified the mineral bearing offshore blocks available for grant of Exploration Liicence. As per the attached Schedule to the said Notification, there are 26 offshore areas available in offshore waters of Bay of Bengal and 36 offshore areas in the offshore waters of Arabian Sea for grant of Exploration Licence. The Geological Survey of India and National Institute of Oceanography (NIO) have carried out exploration in these areas. Out of the 377 applications received, 16 applicants were granted 62 mineral blocks on 5.4.2011 on the recommendation of the Screening Committee.

The Government of India had announced the New Exploration Licensing Policy (NELP) in 2000 under which blocks for exploration of oil and gas were on offer for bidding. The NELP provides an international class fiscal and contract framework for exploration and production of hydrocarbons. A total of 235 blocks have been signed for contract in eight rounds of NELP during the period, spanning 2000-2010. Under NELP-IX, the Government invited bids for 34 areas out of which bids for 33 areas were received. Bids of 7 deep water blocks and 3 shallow water blocks were rejected.

Resources

Deposits of hydrocarbon are located in the offshore areas in the Mumbai offshore and Cambay basin on the west coast and Cauvery and Krishna-Godavari basins on the east coast. The resources of hydrocarbon in offshore areas are furnished in Table-1. The reserves of crude oil and natural gas in offshore areas accounted for 58% and 77% of total reserves, respectively, in India. As on 1.4.2011, proved and indicated reserves of crude oil and natural gas in offshore areas have been updated to 429.8 million tonnes and 956.6 billion cu m, respectively.

ONGC

ONGC continued its operations for exploration of oil and gas in offshore areas of the country in Cambay Basin, Gujarat; Krishna-Godavari (Andhra Pradesh); Cauvery (Tamil Nadu); West Bengal and in East Coast and West Coast offshore areas.

Table – 1 : Reserves of Crude Oil & Natural Gas in Indian Offshore Areas (As on 1.4.2011)

(Crude oil in million tonnes)
(Natural Gas in billion cu m)

Area	Crude oil	Natural gas
Offshore : Total	**429.79**	**956.57**
Western Offshore@	403.60	420.91
Eastern offshore	26.19	535.66

Source: *Indian Petroleum & Natural Gas Statistics 2010-11, Ministry of Petroleum & Natural Gas.*

@ *Includes Bombay High Off-shore, Rajasthan and J & C. also includes Madhya Pradesh (Coal Bed Methane) in case of natural gas.*

During 2010-11, ONGC acquired a total of 13,116 GLK/LK of 2D seismic data which included 8,615 LK offshore data. During the same period, 19,355 sq km of 3D seismic data was also acquired which included 16,024 sq km offshore areas. ONGC's 125 exploratory wells included 41 wells to a total depth of 1,44,170 m in off-shore areas (Table-2).

During 2010-11, ONGC reported new offshore hydrocarbons discoveries, namely, C-23-9, C-1-6, GK-28-2 and GK-28-3 in Western Offshore basin; GS-KV-1,GS-21-3 and GS-29-6 in KG Offshore basin and MDW-10 in MBA basin.

OIL

Offshore exploration/development operation were not reported by OIL during 2010-11.

Reliance Industries Ltd. (RIL)

RIL made a gas discovery in the exploration block KG-DWN-2003/1 (KG-V-D3) of NELP-V, which is a deepwater block located in the Krishna basin, about 45 km off the coast in the Bay of Bengal. The block covers an area of 3,288 sq km.

Drilling of six wells in Panna-L is expected to commence soon and oil production is expected in the later part of financial year 2012. Its reserves are estimated at 7.0 MMBL. The estimated production from all six wells is approximately 3,000 BOPD.

Table – 2 : Exploration for Petroleum & Natural Gas By ONGC during 2010-11

Area	Seismic Survey		Drilling			
			Exploratory		Development	
	2D(GLKM)	3D(SQKM)	Wells	Meterage	Wells	Meterage
Western Offshore	-	6778	22	69230	33	80090
Eastern Offshore	8615	9246	19	74940	-	-

Marine Survey

GSI's Marine Wing continued its offshore geoscientific studies both in Exclusive Economic Zone (EEZ) and Territorial Waters (TW) along the East and West Coasts of India. Surveys in the near-shore zones (0 m - 10 m isobaths) were carried out using hired small mechanical boats.

During 2010-11, a total of twenty cruises were undertaken using three vessels.

The following marine geoscientific surveys were carried out during 2010-11 (October, 2010 to April, 2011) Field Season :

1. Six cruises aboard R.V. Samudra Manthan within EEZ conducted the following:

a) Search for possible occurrence of phosphatic sediments in the outer shelf and upper continental margin off Kollam, Kerala (SM-213).

b) Multibeam bathymetric survey to the east of Nicobar Islands between West Andaman Fault and Sewell Rise (SM-214).

c) Study of the sea bed morphology and magnetic anomaly pattern across the arc-trench gap off Great Nicobar Island (SM-215).

d) Studies on geomorphological configuration of Barren Island along with acquaintance of Multibeam echosounder (SM-215A).

e) Systematic magnetic survey in Bay of Bengal over 85^{o}E Ridge and Multibeam bathymetric survey of the three submarine valleys off Puducherry (SM-216).

f) Search for possible occurrence of phosphatic sediments off Ratnagiri, Maharashtra (SM-217).

2. Eight cruises aboard R.V.Samudra Kaustubh within the TW off the east coast conducted:

a) Parametric Survey within TW off Porto Novo and south of Karaikal, Tamil Nadu (ST-207).

b) Mapping of seabed within TW off Nagapattinum,Tamil Nadu (ST-208).

c) Placer mineral resource evaluation in the TW off north of Bhimunipatnam, Andhra Pradesh (ST-209).

d) Placer mineral resource evaluation in the TW off Palur-Malud, Odisha (ST-210).

e) Geotechnical surveys off Harichandi-Puri , Odisha (ST-211).

f) Parametric surveys between Gopalpur and Dhamara areas off Odisha coast (ST-212).

g) Parametric survey within TW off Porto Novo and North of Puducherry (ST-213).

h) Mapping of seabed within TW north-east of Point Calimere, Tamil Nadu (ST-214).

3. Six cruises aboard R.V. Samudra Shaudhikama within the TW off the West Coast conducted:

a) Placer mineral resource evaluation in the TW off Paravur, Kollam district, Kerala (SD-225).

b) Mapping of the seabed off Okha, Gujarat (SD-230).

c) Swath bathymetric survey of part of Gulf of Cambay, off Valsad, Gujarat (SD-231).

d) Parametric (seismic and magnetic) survey in the shelf area off Vizhinjam-Kanyakumari, Kerala & Tamil Nadu Coast (SD-232).

e) Evaluation of relict sand body off Shertallai, Kerala . (SD-233).

f) Geotechnical appraisal off Kulai, Karnataka, (SD-234).

Production

Petroleum (crude) and natural gas (utilised) are the mineral items produced from offshore regions. The value of production of these two items in 2010-11 at ₹ 54,739 crore increased by 1% in the region as compared to that of the previous year. Offshore regions accounted for 24% of total value of mineral production in India.

Offshore accounted for 56% production of petroleum (crude) and 84% of natural gas (utilised) in the country during 2010-11. The production of natural gas (utilised) increased 12% over previous year while a decline of about 3% was indicated in case of petroleum (crude).

The index of mineral production of Offshore regions (base 1993-94=100) in 2010-11 was 205.78 as against 196.03 in the previous year (Table-3).

Table –3 : Mineral Production in Offshore Region, 2008-09 to 2010-11

(Excluding Atomic Minerals)

(Value in ₹ '000)

Mineral	Unit	2008-09		2009-10		2010-11 (P)	
		Quantity	Value	Quantity	Value	Quantity	Value
All Minerals			**442972988**		**539847278**		**547390142**
Natural gas (utilised)	m c m	24082	88771430	38811	145248072	43647	163346541
Petroleum (crude)	'000t	22232	354201558	21869	394599206	21284	384043601

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

ANTIMONY

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

13 Antimony

Antimony is a strategic metal. Stibnite, composed of antimony trisulphide, Sb_2S_3, (Sb 71.4%) is the predominant ore of antimony. Antimony in its elemental form is a silvery white, brittle, fusible, crystalline solid that exhibits poor electrical and heat conductivity properties and vaporises at low temperatures. Antimony and some of its alloys are unusual in nature that they expand on cooling. Commercial forms of antimony are generally traded in the form of ingots, broken pieces, granules or cast cake. Other forms are powder, shots, and single crystals. The occurrence of antimony in the earth crust ranges from 0.2 to 0.5 parts per million. Antimony is geochemically categorised as a chalcophile, occurring with sulphur and associated with heavy metals, lead, copper and silver. The metal is obtained commonly as a by-product in lead-zinc-silver smelting. During 2010-11, HZL conducted various R&D activities. One of the studies was related to recovery of antimony-rich residue from antimony dross of Pyro-smelter of the company.

Presently, there is no production of antimony in India. The entire requirement of antimony in the country is met through imports of its ore and concentrates.

RESOURCES

As per the UNFC system, as on 1.4.2010, total resources are estimated at 10,588 tonnes ore with metal content of 174 tonnes , all in inferred category in Lahaul & Spiti district, Himachal Pradesh (Table-1).

The stibnite and its decomposition products, cervantite and kermesite occur as veins, stringers and specks. Occurrences of antimony ores are also reported from the states of Andhra Pradesh, Bihar, Jammu and Kashmir, Karnataka and Uttar Pradesh.

USES

Antimony and its alloys find numerous applications in a wide range of high technology industries like electronic, space and defence, photographic materials, electroplating, besides cosmetic, paint, plastics and textile industries. Traditionally, it is used in type metal and other alloys. It is now used extensively worldwide to harden and increase the mechanical strength of lead, particularly in battery industry. Antimony trioxide is the most important of the antimony compounds and is primarily used in flame-retardant applications, including such markets, as children's clothing, toys, aircraft and automobile seat covers. Antimony sulphide is one of the ingredients of safety matches. It is also used as a decolourising and refining agent in glass industry. Antimony compounds may be used in pharmaceuticals. It is also used in semi-conductors for making infrared detectors, diodes and acoustic devices.

SUBSTITUTES

Combination of tin, calcium, copper, selenium, cadmium, strontium and sulphur are among the substitutes used as hardeners for lead used in batteries. Low maintenance batteries have shifted to use of calcium as additive to substitute for antimony. Antimony can be replaced by organic compounds or hydrated aluminium oxide in flame-retardants and by tellurium and selenium in rubber manufacturing. Compounds of titanium, zinc, chromium, tin and zirconium may be substituted for antimony chemicals in paints, pigments and enamels.

Table – 1 : Reserves/Resources of Antimony as on 1.4.2010 (By States)

(In tonnes)

India/State		Reserves Total (A)	Remaining resources Inferred (STD 333)	Total (B)	Total resources (A+B)
India					
	Ore	–	**10588**	**10588**	**10588**
	Metal	–	**174**	**174**	**174**
Himachal Pradesh					
	Ore	–	10588	10588	10588
	Metal	–	174	174	174

TECHNICAL POSSIBILITIES

Antimony products can be used as stabilizers in specialised plastics. Development of electric vehicles could lead to the use of high antimony batteries because of their deep cycling characteristics. Antimony semiconductors have possible use in aircraft night vision systems and in space-based astronomy. The antimonial lead scrap extracted from the spent lead acid storage batteries is recycled largely from and for storage battery industry. Antimony has found a new use in the manufacture of DVDs.

WORLD REVIEW

The world reserves of antimony are 1.8 million tonnes in terms of metal content. Antimony reserves are located mainly in China, which contributes about 53% to the total reserves followed by Russia (19%), Bolivia (17%), Tajikistan (3%) and South Africa (1%) (Table-2).

The world production of antimony metal increased to 147,000 tonnes in 2010 as against 127,000 tonnes in the previous year. China was the main producer of antimony accounting for about 88% of world production. Bolivia, Russia, South Africa, Kyrgyzstan and Mexico were the other important producers (Table-3).

Table – 2 : World Reserves of Antimony (By Principal Countries)

(In tonnes of metal content)

Country	Reserves
World : Total (rounded)	**1,800,000**
Bolivia	310000
China	950000
Russia (Recoverable)	350000
South Africa	21000
Tajikistan	50000
Other countries	150000

Source: *Mineral Commodity Summaries, 2012.*

Chile

Mandalay Resources Corporation commenced drilling at the Yasna vein at its Cerro Bayo mine in Patagonia. Another vein (Delia NW) was scheduled for initial development in mid-2011. Mandalay plans to produce 1,500 tpy of antimony from the mine,besides gold.The project was slated to restart with a ramped up design and production rate of 700 tpy by end of 2011 while concentrator was to commence operations by early 2011.

Table – 3 : World Production of Antimony (By Principal Countries)

(In tonnes of metal content)

Country	2008	2009	2010
World : Total	**119000**	**127000**	**147000**
Bolivia	3905	2990	4980
China	100230	112000	129831
Kyrgyzstan	250	918	900
Mexico	380	74	71
Peru	531	145	-
Russia[e]	3000	3000	3000
South Africa	3674	2090	2250
Other countries	7030	5783	5698

Source: *World Mineral Production, 2006-2010.*

China

China dominates the world antimony production.The governement set the 2010 antimony production quota at 100,000 tonnes,including 62,520 tonnes for primary production and 30,480 tonnes for recycling. Chinese authorities were concerned that too much antimony was leaving the country in the form of refined metal rather than being processed. Hence the restrictions on metal exports. Hsikwangshen Twinkling Star Co. Ltd is China's largest antimony metal and trioxide producer. The company has two smelters, both with a capacity of 1,000 tonnes per month.

FOREIGN TRADE

Exports

Exports of antimony alloys and scrap was 853 tonnes in 2010-11 against 32 tonnes in the previous year. Exports were mainly to Thailand (34%) , USA (19%) and Belgium (18%) (Table - 4)

Imports

Imports of antimony ores and concentrates increased considerably to 2,547 tonnes in 2010-11 from 898 tonnes in the previous year. Imports were mainly from South Africa (67%), Russia (8%) and Italy (7%).

Import of antimony alloys and scrap decreased in 2010-11 from 927 tonnes in the previous year to 543 tonnes in the current year. Import of alloys and scrap was mainly from China (90%) (Tables - 5 and 6).

Table – 4 : Exports of Antimony Alloys and Scrap (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**32**	**13998**	**853**	**417247**
Thailand	-	-	287	155008
USA	8	2531	160	84548
Belgium	-	-	153	52179
Pakistan	-	-	89	47735
Netherlands	-	-	84	40698
Russia	-	-	60	24894
Japan	-	-	10	5077
Nigeria	17	7251	4	2803
Egypt	-	-	5	2783
UAE	-	-	1	767
Other countries	7	4216	++	755

Table – 5 : Imports of Antimony Ores & Conc. (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**898**	**94154**	**2547**	**446982**
South Africa	834	83143	1707	288584
Russia	-	-	193	35972
Italy	18	3681	184	33842
Singapore	-	-	131	29137
France	23	1569	118	19108
USA	-	-	104	17919
China	-	-	82	14236
Hong Kong	-	-	24	6080
Austria	9	2915	4	2104
Other countries	14	2846	-	-

Table – 6 : Imports of Antimony Alloys & Scrap (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹'000)
All Countries	**927**	**231371**	**543**	**256726**
China	655	169527	490	234233
Kyrghyzstan/Kighzia	-	-	23	10976
Chinese Taipei/Taiwan	-	-	20	5967
Vietnam	115	23219	6	3268
USA	++	3	2	1516
Germany	4	907	2	490
Austria	-	-	++	213
UK	-	-	++	62
Other countries	153	37715	++	1

FUTURE OUTLOOK

Continued mining restrictions in China may result in higher market prices of antimony. The future growth in demand for antimony will be much dependent on the level of requirement from the flame-retardant sector which accounts for 55% primary antimony consumption worldwide and for about 90% global antimony trioxide consumption. In the flame-retardant sector, antimony trioxide is used as a synergist normally with bromine and chlorine. Currently, antimony-based catalysts account for around 90% usage worldwide in polyethylene terephthalate (PET) production.

A new chip based on germanium-antimony-telluride was developed abroad for 'Phase-change' Random Access Memory chips (PRAMS) which can process data faster than flash memory chips and, unlike silicon, are non-flammable. The chips are commercialised and expected to find applications in mobile telephones and digital cameras. In contrast, little or no growth is anticipated for antimony metal in metallurgical and battery markets.

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

APATITE AND ROCK PHOSPHATE

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

14 Apatite and Rock Phosphate

Apatite is the most abundant crystalline phosphate mineral found as an accessory mineral in practically all kinds of igneous rocks. Sometimes, it is concentrated in pegmatites, metallic veins and magmatic deposits. It also occurs in metamorphic rocks and as a secondary mineral in phosphatic rocks of sedimentary origin. Fluor-apatite $Ca_5(PO_4)_3F$ is the most common variety of apatite and also a secondary source of fluorine. Collophane is apparently a cryptocrystalline or amorphous calcium phosphate complex. Rock phosphates or phosphorites are sedimentary phosphatic deposits comprising fine-grained mixture of various calcium phosphates, most important being hydroxyl-apatite, carbonate-apatite, fluor-apatite and their solid solutions. About 80% phosphate production in the world is derived from phosphate rocks (phosphorite) containing one or more phosphatic minerals, usually calcium phosphate of sufficient purity and quantity to permit its use directly or after concentration in manufacturing commercial products.

Phosphate rock is also the source of by-product fluorine. Apatite & rock phosphate containing 3 to 4% CaF_2 are useful for recovery of fluorite. It is recovered as by-product Hydrofluoro-silicic acid obtained from phosphoric acid plants during processing of rock phosphate. Phosphate rocks also contain uranium which are considered as significant and secondary resource of uranium.

RESOURCES

Apatite

The total resources of apatite as per UNFC system as on 1.4.2010 are placed at 24.23 million tonnes. Out of these resources, the reserves are only 2.09 million tonnes and 22.14 million tonnes are remaining resources. Of the total resources, the bulk (57%) are located in West Bengal followed by Jharkhand (30%) and Meghalaya (5%). The remaining 8% resources are available in Rajasthan, Andhra Pradesh, Gujarat and Tamil Nadu. Gradewise, soil reclamation grade accounts for 45% followed by beneficiable grade (31%), low and non-beneficiable grade (18%) and blendable, others and not-known grades (6%). The resources of chemical fertilizer grade are over one percent (Table-1).

Rock Phosphate

The total resources of rock phosphate as per UNFC system as on 1.4.2010 are placed at 296.3 million tonnes. Out of these, the reserves constitute only 34.8 million tonnes. There are 261.5 million tonnes remaining resources. Of the total resources, 36% are in Jharkhand, 30% in Rajasthan, 17% in Madhya Pradesh, 9% in Uttar Pradesh and 8% in Uttarakhand. Meagre resources are located in Gujarat and Meghalaya. Gradewise, low grade account for 39%, followed by beneficiable (29%), soil reclamation (12%), blendable (9%), chemical fertilizer (6%) and unclassified and not-known grades (about 5%) (Table-2).

EXPLORATION & DEVELOPMENT

Exploration activities for apatite and rock phosphate carried out by the Geological Survey of India; DMG, Rajasthan, DMM, West Bengal and RSMML, Rajasthan during 2010-11 are furnished in Table - 3.

PRODUCTION, STOCKS & PRICES

Apatite

The production of apatite at 3,845 tonnes during 2010-11 decreased by 36% as compared to that in the previous year due to less demand.

There were two reporting mines of apatite in both the years. The share of public sector to the total output of apatite was about 33% in 2010-11. The entire production of apatite was of grade 15-20% P_2O_5 (Tables - 4 to 6).

Andhra Pradesh continued its leading position in the production of apatite contributing

Table – 1 : Reserves/Resources of Apatite as on 1.4.2010
(By Grades/States)

(In tonnes)

State/Grade	Reserves			Remaining resources						Total Resources
	Proved STD111	Probable STD122	Total (A)	Pre-feasibility STD222	Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	(A+B)
All India : Total	**2088536**	**1680**	**2090216**	**1225345**	**2281521**	**11481250**	**6132768**	**1017646**	**22138530**	**24228746**
By Grades										
Chemical Fertilizer	36019	1680	37699	–	30000	–	200163	–	230163	267862
Soil reclamation	1560699	–	1560699	–	2233500	6243000	800000	–	9276500	10837199
Low/Non-beneficiable	–	–	–	–	3360	2363000	1350000	666646	4383006	4383006
Beneficiable	491818	–	491818	1225345	12477	1875250	3592605	351000	7056677	7548495
Blendable	–	–	–	–	2184	–	–	–	2184	2184
Unclassified	–	–	–	–	–	1000000	–	–	1000000	1000000
Non-known	–	–	–	–	–	–	190000	–	190000	190000
By States										
Andhra Pradesh	36019	1680	37699	–	–	–	200163	–	200163	237862
Gujarat	–	–	–	–	–	–	–	351000	351000	351000
Jharkhand	–	–	–	–	2110000	1620000	3540000	–	7270000	7270000
Meghalaya	–	–	–	–	–	–	1300000	–	1300000	1300000
Rajasthan	–	–	–	–	51521	1016000	–	–	1067521	1067521
Tamil Nadu	–	–	–	–	–	–	240000	–	240000	240000
West Bengal	2052517	–	2052517	1225345	120000	8845250	852605	666646	11709846	13762363

Figures rounded off.

Table – 2 : Reserves/Resources of Rock Phosphateas on 1.4.2010
(By Grades/States)

(In tonnes)

Grade/State	Reserves				Remaining resources							Total resources (A+B)
	Proved STD111	Probable		Total (A)	Feasibilty STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Total (B)	
		STD121	STD122			STD221	STD222					
All India : Total	**20697294**	**3352994**	**10728362**	**34778650**	**26826747**	**21273335**	**24226125**	**2912633**	**3549750**	**182717111**	**261505701**	**296284351**
By Grades												
Chemical fertilizer	8140800	-	1399542	9540342	-	6889000	-	-	-	1081200	7970200	17510542
Blendable	3361723	1589807	4643763	9595293	3063503	-	1734370	13333	-	13942513	18753719	28349012
Soil reclamation	3382381	1763187	3715763	8861331	622561	251437	7406169	732800	10000	16887166	25910133	34771464
Beneficiable	5812390	-	969294	6781684	23140683	14132898	15085586	2166500	2799750	21863615	79189032	85970716
Low grade	-	-	-	-	-	-	-	-	-	115271844	115271844	115271844
Unclassified	-	-	-	-	-	-	-	-	740000	10095773	10835773	10835773
Not-known	-	-	-	-	-	-	-	-	-	3575000	3575000	3575000
By States												
Gujarat	-	-	-	-	-	-	-	-	-	314820	314820	314820
Jharkhand	-	-	-	-	-	-	-	-	-	107370000	107370000	107370000
Madhya Pradesh	6589894	1763187	9787162	18140243	3131683	13700000	5990814	-	2730000	5725000	31277497	49417740
Meghalaya	-	-	-	-	-	-	-	-	-	1311035	1311035	1311035
Rajasthan	14107400	1589807	941200	16638407	20631561	7140437	13382355	152633	79750	29893783	71280519	87918926
Uttar Pradesh	-	-	-	-	-	432898	3118586	-	740000	21481960	25773444	25773444
Uttarakhand	-	-	-	-	3063503	-	1734340	2760000	-	16620513	24178386	24178386

Figures rounded off.

Table – 3 : Details of Exploration Activities for Apatite & Rock Phosphate during 2010-11

Agency/ State/District	Location	Mapping		Drilling		Sampling	Remarks
		Scale	Area (sq km)	No. of boreholes	Meterage	No	Reserves/Resources estimated
Apatite							
GSI							
West Bengal Purulia	Panrkidih area	-	-	-	-	-	Apatite-magnetite bearing cherty rock having 1 m average surface width & approx. 600 m strike length has been established. In this area the apatite-magnetite bearing rocks occur as small discontinuous lensoidal bodies,& follow the main regional structural trend i.e., E-W to NE-SW. The drilling was in progress.
DMM, West Bengal Purulia	Chirugora village PS Boro	1:500	1072 sq m.	-	-	43	Pitting has been carried out, Resources will be estimated after completion of drilling.
Rock Phoshate							
GSI							
Madhya Pradesh Jhabua	Piploda & Dhanpura-Khatamba Block	-	-	-	-	-	In Piploda Block, a zone of 340 m length & 50 m width with P_2O_5 values between 6% and more than 20% has been identified. A new phosphatic stromatolite bearing zone with strike length of about 1 km & width of 100 m is located SW of Dhanpura-Katamba Block. Three grab samples indicated 10% to 17% of P_2O_5 content. A phosphorite zone of about 300 m length with 8-10 m width has been delineated in Khatamba Block. P_2O_5 content varies from 1% to 12%. The representative samples covering 10 m width indicated P_2O_5 content varying from 10% to 17.44%.
Chhatarpur & Sagar	Lukri-Akrotha-Raipura-Surajpura area						In Akrotha-Raipura Block, a lensoidal body with more than 30 m strike length and 8 to 10 m width occurs at about 1.5 km from Akrotha. Another phosphorite body occurs in the area 750 m SW of Rajghat which is 100 m in length with more than 5 m width showing 20% -25% P_2O_5 content.

(Contd.)

Table 3 (Contd.)

Agency/ State/District	Location	Mapping Scale	Mapping Area (sq km)	Drilling No. of boreholes	Drilling Meterage	Sampling No	Remarks Reserves/Resources estimated
Rajasthan Banswara	Kalinjara, East of Sallupat	-	-	-	-	-	One persistent band of dolomite with 5 km strike length and 20 to 500 m width has been delineated between Pargisath to Mahuri. Phosphate concentration (15 to 20% V.E.) is confined to discontinuous thin bands/ lenses of brecciated stromatolites occuring in dolomite band. The work was in progress.
DMG							
Rajasthan Banswara	NV/Kaya, Dhol ki Pati	1:50,000	150.0	–	–	–	Resources will be estimated after receipt of complete chemical analysis results.
	Jhar, Khuntana	1:10,000	1.5	–	–	–	
	Ram ka Munna, etc.	1:2,000	1.5	–	–	–	
RSMML							
Rajasthan Udaipur	A Extn. & G - Block Jhamarkotra mine (25 km SE from Udaipur)	–	–	–	–	–	Exploratory mining has been carried out in this block. Strike length is 2.0 km. Folded & undulating ore beds dip sub-vertical to 30^{o} towards centre of Jhamarkotra basin.Total resources of 123,432 tonnes were estimated during the year. Ongoing exploratory mining was expected to continue till Dec. 2011.

about 67% output and the remaining 33% was reported from West Bengal.

The mine-head stock at the beginning of 2010-11 was 9,379 tonnes as against 8,067 tonnes at the end of the year (Table - 7).

The average daily labour employed in apatite mines during 2010-11 was 151 as against 271 in the previous year.

Phosphorite/Rock Phosphate

The total production of phosphorite/rock phosphate at 2,152 thousand tonnes in 2010-11 increased by about 34% as compared to that in the previous year due to more lifting of ore at crushing plant of Jhamarkotra mine of RSMML, Rajasthan.

There were 7 reporting mines in both the years. Rajasthan continued to be the principal producing state, contributing 94% of the total production followed by Madhya Pradesh with 6%.

About 49% of the total production of phosphorite/rock phosphate was of 30-35% P_2O_5 grade, 6% of 25-30% P_2O_5 grade, 1% of 20-25% P_2O_5 grade and 44% of 15-20% P_2O_5 grade (Tables - 8 to 10).

The mine-head stocks at the end of the year 2010-11 was 537 thousand tonnes as compared to 449 thousand tonnes at the beginning of the year (Table-11).

The average daily labour employed in phosphorite mines in 2010-11 was 1,523 as against 1,236 in the previous year.

The domestic prices of apatite and phosphorite/rock phosphate are furnished in the General Review on 'Prices'.

Table – 4 : Producers of Apatite, 2010-11

Name and address of producer	Location of mine	
	State	District
Andhra Phosphate (Pvt.) Ltd, D.No.45-58-17/15, Narasimha Nagar, Visakhapatnam-530 024, Andhra Pradesh.	Andhra Pradesh	Visakhapatnam
West Bengal Mineral Development & Trading Corp. Ltd, II-Floor, 13, Nellie Sengupta Sarani, Lindsay Street, Kolkata-700 087, West Bengal.	West Bengal	Purulia

Table – 5 : Production of Apatite, 2008-09 to 2010-11
(By States)

(Quantity in tonnes; value in ₹ '000)

State	2008-09		2009-10		2010-11 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**6415**	**13025**	**5992**	**12911**	**3845**	**7702**
Andhra Pradesh	3902	8620	3882	9212	2585	5493
West Bengal	2513	4405	2110	3699	1260	2209

Table – 6 : Production of Apatite, 2009-10 and 2010-11
(By Sectors/States/Districts/Grade)

(Quantity in tonnes; value in ₹ '000)

State/District	2009-10			2010-11 (P)		
	No. of mines	Quantity 15-20% P_2O_5	Value	No. of mines	Quantity 15-20% P_2O_5	Value
India	**2**	**5992**	**12911**	**2**	**3845**	**7702**
Public sector	1	2110	3699	1	1260	2209
Private sector	1	3882	9212	1	2585	5493
Andhra Pradesh	**1**	**3882**	**9212**	**1**	**2585**	**5493**
Visakhapatnam	1	3882	9212	1	2585	5493
West Bengal	**1**	**2110**	**3699**	**1**	**1260**	**2209**
Purulia	1	2110	3699	1	1260	2209

Table – 7 : Mine-head Stocks of Apatite, 20010-11 (P) (By States/Grades)

(In tonnes)

State	At the beginning of the year 15-20% P_2O_5	At the end of the year 15-20% P_2O_5
India	**9379**	**8067**
Andhra Pradesh	117	74
West Bengal	9262	7993

Table – 8 : Producers of Phosphorite/Rock Phosphate, 2010-11

Name and address of producer	Location of mine	
	State	District
Rajasthan State Mines & Minerals Ltd, C-89/90, Janapath, Lal Kothi Scheme, Jaipur-302 004, Rajasthan.	Rajasthan	Udaipur
Madhya Pradesh State Mining Corp. Ltd, E-5/14, Arera Colony, Bhopal-462 016, Madhya Pradesh.	Madhya Pradesh	Sagar
Hindustan Zinc Ltd., Yashad Bhavan, Udaipur-313 004, Rajasthan	Rajasthan	Udaipur

Table – 9 : Production of Phosphorite/Rock Phosphate, 2008-09 to 2010-11 (By States)

(Quantity in tonnes; value in ₹'000)

State	2008-09		2009-10		2010-11(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**1803954**	**3087617**	**1605489**	**3103095**	**2152215**	**5513749**
Madhya Pradesh	250556	157198	212168	122007	133358	72462
Rajasthan	1553398	2930419	1393321	2981088	2018857	5441287

Table – 10 : Production of Phosphorite, 2009-10 and 2010-11 (P)
(By Sectors/States/Districts/Grades)

(Quantity in tonnes; value in ₹'000)

State/ district	2009-10 No.of mines	Grade : P_2O_5 content 30 35%	25-30%	20-25%	15-20%	Total Qty	Value	2010-11(P) No. of mines	Grade : P_2O_5 content 30-35%	25-30%	20-25%	15-20%	Total Qty	Value
India	**7**	**597586**	**36574**	**83613**	**887716**	**1605489**	**3103095**	**7**	**1056590**	**135814**	**22497**	**937314**	**2152215**	**5513749**
Public Sector	7	597586	36574	83613	887716	1605489	3103095	7	1056590	135814	22497	937314	2152215	5513749
Madhya Pradesh	**5**	**160**	**36574**	**68948**	**106486**	**212168**	**122007**	**5**	**-**	**13475**	**22497**	**97386**	**133358**	**72462**
Chhatarpur	1	160	9952	1403	8158	19673	13164	1	-	5146	-	17674	22820	12134
Jhabua	3	–	7996	61869	57222	127087	74861	3	-	-	20806	39309	60115	36280
Sagar	1	–	18626	5676	41106	65408	33982	1	-	8329	1691	40403	50423	24048
Rajasthan	**2**	**597426**	**–**	**14665**	**781230**	**1393321**	**2981088**	**2**	**1056590**	**122339**	**-**	**839928**	**2018857**	**5441287**
Udaipur	2	597426	–	14665	781230	1393321	2981088	2	1056590	122339	-	839928	2018857	5441287

Table – 11 : Mine-head Stocks of Phosphorite/Rock Phosphate, 2010-11 (P)
(By States/Grades)

(In tonnes)

State	At the beginning of the year: Grade : P_2O_5 content 30-35%	25-30%	20-25%	15-20%	Total	At the end of the year: Grade : P_2O_5 content 30-35%	25-30%	20-25%	15-20%	Total
India	**68777**	**63932**	**70857**	**244960**	**448526**	**66791**	**124966**	**21665**	**323525**	**536947**
Madhya Pradesh	–	63932	56192	14112	134236	–	554	21665	19132	41351
Rajasthan	68777	–	14665	230848	314290	66791	124412	–	304393	495596

MINING AND MARKETING

Apatite mining is confined to Visakhapatanam district, Andhra Pradesh and in Purulia district, West Bengal. In apatite mine of Andhra Phosphate (Pvt.) Ltd, manual mining was carried out by putting inclined shafts, following the dip of ore body, and by lateral developments of levels along the strike. A mineral treatment plant at Srungavarapukota, about 20 km from the apatite mine consists of two disintegration units of 15 hp and 50 hp located in two separate sheds. Apatite after disintegration is screened to 40 mesh, 60 mesh and 100 mesh. The screened material of right size is packed for sale in polythene-lined gunny bags weighing 50kg each and despatched to buyers through Srungavarapukota railway station.

In Beldih semi-mechanised mine of West Bengal Mineral Development & Trading Corporation (WBMDTC), apatite is mined by opencast method. WBMDTC has adopted semi-mechanised opencast mining method with the deployment of machines/ equipment/vehicles like JCB excavator, jackhammer drills, air compressor, tippers, etc. on single shift basis to develop the mine with a targetted production of about 15,000 tonnes of in situ ore per annum. Half of the low grade ore (10-12% P_2O_5) is blended with available high grade ore (>22%, P_2O_5) manually to produce additional quantity of saleable ore (18-20% P_2O_5). The desired grade (18-20% P_2O_5) of apatite ore is ground to 100 mesh and sold as direct application phosphatic fertilizer in the brand name of "PURULIA PHOS".

The production of phosphorite/rock phosphate was reported from seven mines in public sector. Of these, two were in Madhya Pradesh at Hirapur in Chhattarpur and Sagar districts and three in Jhabua district and two in Rajasthan in Udaipur district.

The Khatamba mine in Jhabua district and Hirapur mine in Chhattarpur and Sagar districts of Madhya Pradesh are opencast, and are operated manually by Madhya Pradesh State Mining Corporation. Compressed-air jackhammers are deployed for drilling. The present run-of-mine capacity of Jhabua mine is 90,000 tonnes. The lumpy ore is crushed by mechanised crushers. Four jaw crushers (30 hp, 40 hp and two 20 hp each) and a grinding unit (50 hp) have been set up at Meghnagar railway siding, about 22km from the mine. Despatches are made to manufacturers of phosphatic fertilizers and chemicals.

The run-of-mine ore from Hirapur mine after hand sorting and dressing is transported to the crushing plant, situated at a distance of 6 km on Hirapur-Damoh road. There are two jaw crushers, each having 4 to 8 tonnes per hour capacity. A small pulveriser with 3 to 4 tonnes per hour capacity had also been installed to meet the special demand of material of 30 to 100 mesh. The crushed material is despatched by trucks.

Jhamarkotra area extends over a length of 16 km, has an average width of phosphate bed of about 15 m and an average inclination of about 55^0 from the vertical. The height of the bench is maintained up to 10 m. Shovels (6.1 cu m) and dumpers (85 tonnes) are used for removing ore and overburden. Jhamarkotra is probably the largest opencast mine in India outside the iron ore, bauxite, copper and coal sector. The mine has an annual rock handling capacity of about 20 million tonnes. The thin and sharply dipping ore body results in long and narrow pits with great depth extension, involves very high stripping ratio (i.e., 1:10) with high lead and lift for waste and mineral. In Jhamarkotra, the problem of groundwater had affected the mining operations. Therefore, an effective dewatering scheme was implemented. The working levels are kept dry. The pumping of groundwater is continued through tube wells constructed on periphery of the pit limit. The beneficiation plant of RSMML at Jhamarkotra has 9 lakh tpy capacity to treat run-of-mine low grade ore, analysing 16% P_2O_5. Production from Jhamarkotra mine is despatched to many phosphatic fertilizer and chemical manufacturers from Udaipur and Umra railway stations which are located 18 and 25 km, respectively, away from the mine.

RSMML produces the following products:

(1) **+31.5% P_2O_5 crushed -1/2" size high-grade rock phosphate** (for SSP manufacturing units).

(2) **31.5% P_2O_5 high grade rock phosphate Chips** (for di-ammonium phosphate (DAP) manufacturing units, etc.

(3) **30% P_2O_5 + 1/2" size high grade rock phosphate (Gitti)** (for elemental phosphorus manufacturing units).

(4) **32.5% P_2O_5 high grade rock phosphate Chips** (for di-ammonium phosphate (DAP) manufacturing units, etc.

(5) **19% P_2O_5 ground low-grade beneficiated rock phosphate (RAJPHOS)** (as fertilizer for direct application to acidic soils).

(6) **31.54% P_2O_5 - BRP Grade**

RSMML could not market its low grade rock phosphate (trade name-Rajphos) till 2005-06 because of its high R_2O_3 content which could neither be blended nor beneficiated. However, during recent years, this grade of rock phosphate was sold to DAP manufacturers.

INDUSTRY

At present, there are 56 large fertilizer units, manufacturing a wide range of nitrogenous, phosphatic and complex fertilizers. Of these, 21 large-size fertilizer units produce DAP and complex fertilizers. Besides, there are 72 small-scale and medium-scale units which produce single superphosphate (SSP). The total installed capacity of phosphatic nutrient as on 31.1.2010 was 56.59 lakh tonnes. The production of phosphate fertilizer in 2010-11 was estimated at 45.32 lakh tonnes compared to 43.21 lakh tonnes in 2009-10. The share of public and cooperative sector during 2010-11 was 15.28 lakh tonnes while that of private sector was 30.04 lakh tonnes.

The major phosphatic fertilizer plants in public sector are Fertilizers and Chemicals (Travancore) Ltd (FACT) at Udyogmandal, and Kochi (Kerala); Rashtriya Chemicals and Fertilizer Ltd (RCF) at Trombay, Mumbai (Maharashtra);

Madras Fertlizer Limited at Chennai (Tamil Nadu); HCL at Khetri (Rajasthan); and Paradeep Phosphates Ltd (PPL) at Paradeep (Odisha). The plants in private sector are Gujarat State Fertilizer Company Ltd (GSFC) at Vadodara and Sikka (Gujarat); Coromandal Fertilizer Ltd at Visakhapatnam (Andhra Pradesh) and Ennore (Tamil Nadu); Zuari Agro Chemicals Ltd in Goa; Southern Petro Chemicals Industries Corporation Ltd (SPIC) at thoothukudi (Tamil Nadu); Mangalore Chemicals and Fertilizer Ltd at Mangalore (Karnataka); Gujarat Narmada Fertilizer Corporation (GNFC) at Bharuch (Gujarat); TCL at Haldia (West Bengal), Deepak Fertilizers & Petrochemicals Corp. Ltd (DFPCL) at Taloja (Maharashtra); EID-Parry at Ennore (Tamil Nadu); Hindustan Industries Ltd at Dahej (Gujarat); Oswal Chemicals & Fertilizers Ltd (OCF) at Paradeep (Odisha); and Godawari Fertilizers & Chemicals Ltd (GFCL) at Kakinada (Andhra Pradesh). The only plant in the co-operative sector to manufacture phosphatic fertilizer is of Indian Farmers Fertilizer Co-operative Ltd (IFFCO) at Kandla (Gujarat).

M/s RSMML already has a beneficiation plant in Jhamarkotra in Rajasthan. M/s Krishna Phoschem Ltd has also set up a 600 tpd rock phosphate beneficiation plant at Meghnagar in Jhabua district of Madhya Pradesh.

Only about 35-40% requirement of raw material for phosphate fertilizer production is met through indigenous sources. The remaining requirement is met through import in the form of rock phosphate, phosphoric acid and direct fertilizers.

In India, most of the existing phosphatic fertilizer and phosphoric acid plants have been designed for high grade imported rock phosphate, mainly from Morocco and Jordon. The Indian deposits are relatively of low grade. Therefore, the fertilizer and phosphoric acid plants that may be set up as replacement to the existing plants will have to be designed to accept indigenous ores as a feed.

Coimbatore Pioneer Fertilizer Ltd and Rashtriya Chemicals & Fertilizers Ltd, Mumbai were the domestic plants which recover by-product fluorine from rock phosphate in the form of hydrofluorosilicic acid, sodium silico-fluoride, and aluminium fluoride. Department of Atomic Energy has issued sanctions for establishment of 2 units for recovery of uranium from rock phosphatic sources, these are: Rashtriya Chemicals & Fertilizers, Mumbai in association with Heavy Water Board (HWB); and SPIC, Thoothukudi in association with IREL.

RCF is also setting up a rapidwall plant for manufacture of unique building material using phospho-gypsum as a raw material which is the by-product of phosphoric acid plant. The project is estimated to cost Rs. 75 crore.

Red phosphorus is manufactured mainly by Star Chemicals (Bombay) Pvt Ltd and United Phophorus Ltd. Red phosphorus is consumed in matches industry. It also has applications as fumigant in agriculture industry and as flame retardant.

Joint Ventures Abroad

Due to total dependence on imported raw materials for production of phosphatic fertilizers, the Government has been encouraging Indian Companies to establish joint ventures in other countries which have rich reserves of natural gas and rock phosphate. Important joint ventures abroad by Indian Companies for phosphatic fertilizers are as follows:

(1) The Government of India (GoI), Indian Farmers Fertilizers Cooperative Ltd (IFFCO) and Southern Petrochemicals Industries Corporation Ltd (SPIC) had earlier set up a joint venture company named, Industries Chimiques du Senegal (ICS) in Senegal. However, SPIC withdrew from the project later on. The company has a capacity to produce 6.6 lakh tpy phosphoric acid and finished phosphate fertilizers in its Senegalese plants. A major portion of phosphoric acid to the tune of 5.5 lakh tonnes against an installed capacity of 6.6 lakh tpy is being utilised by IFFCO through long-term buy back arrangement. The company had suffered financial losses and with the active support of Government of India was restructured to improve its performance. The restructuring plan was approved by the Regional High Court of Dakar (Senegal) and the company is in operation.

Overseas Joint Ventures

(1) Gujarat State Fertilizers & Chemicals Ltd (GSFC) and Coromandel Fertilizers Ltd (CFL) along with 'Groupe Chimique Tunisien' (GCT) and 'Compagnie Des Phosphates De Gafsa' (CPG) are setting up a joint venture project in Tunisia for production of 3.6 lakh tpy phosphoric acid. The entire production of phosphoric acid is for off-take by GSFC and CIL.

(2) IFFCO and Jordan Phosphate Mining Company (JPMC) have agreed to set up a phosphoric acid plant in Jordan with installed capacity of 0.5 million tpy of P_2O_5 (1,500 tonnes per day of phosphoric acid) under a joint venture company, Jordan India Fertilizer Company (JIFCO). The equity holdings in the project is 52 : 48 between IFFCO and JPMC, respectively.

(3) IMACID, joint venture between Office Cherifien Des Phosphates (OCP), Morocco and Chambal Fertilizers & Chemicals Ltd (CFCL) to produce 3.60 lakh tonnes phosphoric acid per annum was commissioned in October 1999. After subsequent joining of Tata Chemicals Ltd (TCL), capacity of the plant has been increased to 4.30 lakh tonnes per annum.

(4) SPIC, Jordan Phosphate Mines Company Ltd. (JPMC) and Arab Investment Company (AIC) set up a joint venture project, Indo-Jordan Chemicals Ltd. (IJC) in Jordan in May 1997 with a capacity of 2.24 lakh tonnes of phosphoric acid production per annum. Phosphoric acid produced by IJC is off-taken by SPIC and other fertilizer units in India.

ENVIRONMENTAL CONCERNS

Phospho-gypsum, is formed as a by-product during manufacturing of phosphoric acid. It contains about 1% P_2O_5, 1% F and 10-30 times more radon, none of which is desirable. Environment Protection Agency (EPA) of USA stipulated in 1989 that phospho-gypsum is unsuitable for sale as common gypsum. Production of each tonne of P_2O_5 yields about five tonnes phospho-gypsum. EPA has prescribed stringent measures for storage, transport and disposal of phospho-gypsum. In India, however, by-product phospho-gypsum is used widely in cement manufacture.

The use of phosphate also falls under scrutiny. Much attention has been paid to its role in stimulating the growth of algae and other organisms in surface water, the process known as eutrophication. This process is deleterious because it causes blooms of algae which consume dissolved oxygen in lakes and even observed in shallow, isolated arms of the ocean. Phosphate fertilizers are probably not the only cause of phosphate-induced eutrophication. Fertilizer phosphate does not leach readily from soil. One of the best ways to remove this phosphate is through the addition of lime which causes precipitation of apatite. However, this procedure, being relatively costly, has not been applied widely. Instead, the use of phosphate in detergents has been discouraged.

USES

Phosphate rock is used primarily as a plant nutrient, either by direct application to the soil as a powdered product or in the manufacture of superphosphate, triple superphosphate, or diammonium phosphate (DAP) fertilizers. Elemental phosphorus and phosphoric chemicals derived from phosphate rock are also used in detergents, insecticides, matches, fireworks, military smoke screens, incendiary bombs, and many other products.

SPECIFICATIONS

Elemental Phosphorus and Phosphoric acid

BIS (IS:11224-1985, reaffirmed 2010) has prescribed the following specifications of rock phosphate required for the manufacture of elemental phosphorus (Type-I) and phosphoric acid (Type-II).

Sl. No.	Characteristics	Requirement	
		Type I	Type II
1.	Total Phosphate (as P_2O_5) by mass (min)	30.0	32.0
2.	Silica (as SiO_2) % by mass (min)	10.0	5.0

Table (Concld.)

Sl. No.	Characteristics	Requirement Type I	Type II
3.	CO_2 % by mass (max)	2.0	3.0
4.	Fluoride (F) % by mass (max)	2.0	4.0
5.	Mixed Aluminium and iron oxide (Al_2O_3 and Fe_2O_3) % by mass (max)	3.0	3.5
6.	Moisture % by mass (max)	1.5	1.5
7.	Magnesium oxide (MgO) % by mass (max)	0.5	0.5
8.	Chloride (Cl) % by mass (max)	0.015	0.05
9.	Organic Matter and combined water % by mass (max)	2.0	1.5

Single Superphosphate

The P_2O_5 content in rock phosphate for manufacturing single superphosphate should be minimum 31%. Silica up to 8% can be tolerated. Iron and alumina; i.e., R_2O_3 should not be more than 3.5%. Higher R_2O_3 may tend reversion of available P_2O_5 (water soluble P_2O_5). Carbonate up to 5% will improve the reactivity of rock phosphate by increasing the reaction temperature and making the mass porous.

Direct Application of Rock Phosphate as Fertilizer

In India, the finely-ground rock phosphate containing 16% P_2O_5 is used directly on the soil for soil amendment and is suited most for pastures and forage crops and for acidic soils. The following specifications are considered for utilising any rock phosphate as phosphatic fertilizer for direct application in acidic soils

1.	Absolute citrate solubility index	7% max
2.	Apatite to carbonate ratio CO_2% : P_2O_5%	0.035
3.	Origin of rock phosphate	Sedimentary
4.	Mesh size	100
5.	Hydroxyl ion in crystal lattice is higher indicating substitution of OH for PO_4:H_2O	2
6.	Grade of rock phosphate powder citrate soluble fraction	16% P_2O_5
7.	Iron as Fe_2O_3	5%
8.	CaO to P_2O_5 ratio	1.8

The use of rock phosphate for direct application as fertilizer depends on its level of solubility in acidic soil.

CONSUMPTION

The consumption of apatite and rock phosphate in 2010-11 was about 3.68 million tonnes against 3.15 million tonnes in 2009-10, increasing about 17%. Fertilizer industry alone accounted for about 77% consumption followed by chemical (23%). The consumption in glass, sugar and iron & steel industry was meagre (Table - 13).

Table – 13 : Reported Consumption@ of Apatite and Rock Phosphate, 2008-09 to 2010-11 (By Industries)

(In tonnes)

Industry	2008-09	2009-10 (R)	2010-11 (P)
All Industries	**3351500**	**3145600**	**3675800**
Chemical	847900(10)	818100(7)	830100(7)
Fertilizer	2503200(23)	2327100(24)	2845300(24)
Others (glass, sugar, iron & steel)	400(4)	400(4)	400(4)

Figures rounded off. Data collected on non-statutory basis. Figures in parentheses denote the number of units in organised sector reporting consumption.*

*(*Includes actual reported consumption and/or estimates made wherever required).*

@ Consumption for organised sector, excluding small scale units. Besides rock phosphate, imported phosphoric acid is also consumed for manufacturing phosphatic fertilizers. Apatite and rock phosphate in ground form are also used directly in acidic soil. Data relates only to those units who have actually responded to the questionnaire sent by IBM.

POLICY

Imports of natural calcium phosphates (including apatite), natural aluminium-calcium phosphates and phosphatic chalk are allowed freely under heading no. 2510 as per the Foreign Trade Policy 2009-2014. All chemical fertilizers except urea continue to be decontrolled. The Government of India has been implementing a scheme of concession fixing indicative maximum retail price (MRP) for enabling sales of decontrolled phosphatic and potassic fertilizers at reasonable prices.

In case of phosphate fertilizer industry, the paucity of domestic raw material constrains the attainment of self-sufficiency in the country. Indigenous rock phosphate supplies meet only 5-10% requirement of P_2O_5. A policy has, therefore, been adopted which involves following three options:

i) domestic production based on indigenous imported rock phosphate and imported sulphur.

ii) domestic production based on imported intermediates; viz, phosphoric acid.

iii) imports of finished fertilizers.

WORLD REVIEW

The world reserves of phosphate rock are about 71 billion tonnes, located mainly in Morocco & Western Sahara (70%), Iraq (8%), China (5%), Algeria (3%) and South Africa, Jordan, United States of America and Russia (2% each). Large deposits have also been identified on the continental shelves and on seamounts in the Atlantic Ocean and Pacific Ocean. World resources of phosphate rock are more than 300 billion tonnes (Table - 14).

The world production of phosphate rock increased to 182 million tonnes in 2010 from 159 million tonnes in 2009. China (37%), Morocco (15%), USA (14%), Russia (6%) and Tunisia (4%) were the major producers. Almost 90% of the rock phosphate production was consumed for the chemical fertilizer products (Table - 15).

Australia

Four major phosphate projects were under development in Australia in 2010. The largest of the four being the Wonarah Rock Phosphate Project located near Tennant Creek, Northern Territory. The company completed a feasibility study for a direct-shipping ore operation, which was likely to start by late 2011. The next stages would involve construction of a beneficiation plant and a rail spur to the main railway to the Port of Darwin.

Legend International Holdings, Inc. completed feasibility study by Wengfu Group Ltd of China for the Paradise Phosphate Project in Queensland. The project included the Paradise North and Paradise South Mines and a processing facility at Mt. Isa. Legend planned to start mining at Paradise North in 2013 at a rate of 1.25 million tpy of marketable rock, with an average grade of 29.5% P_2O_5. The company planned to start mining at Paradise South in 2017 at a rate of 2.5 million tpy.

Korab Resources Ltd was developing a phoshate rock deposit near Rum Jungle in the Northern Territory. The production is planned to start in 2011 at a rate of 15,000 tpy, increasing to 30,000 tpy in 2013.

In the other project in the Northern Territory, phosphate rock would be recovered as a byproduct of rare earth processing. The Arafura Resources Ltd.'s, Nolans Bore Project, located 135 km NW of Alice Springs, had resources of 3.9 million tonnes of phosphate rock, with an average grade of 12.9% P_2O_5, in addition to 848,000 tonnes of rare earth oxides, and 6,000 tonnes of uranium. The company planned to start production in 2013.

Morocco

OCP Group, the Moroccan phosphate rock producer, announced plans to expand its phosphate rock and fertilizer production capacity incrementally during a 7-year period beginning in 2011. The company among others plans to increase annual phosphate rock mine production capacity from 30 million tpy to 50 million tpy and beneficiation capacity from 9 million tpy to 38 million tpy. OCP expected to start building a 44 million tpy slurry pipeline to transport ore from the mines to the new and existing phosphate plant at Jorf Lasfar. Upon completion of all projects, Morocco will be the world's leading supplier of phosphate rock, phosphoric acid, DAP and MAP.

Namibia

Marine Phosphate (Pty.) Ltd. (a joint venture between Minemakers, Tungeni Africa Investments cc. and Union Resources Ltd.) completed a scoping study of Sandpiper/Meob offshore phosphate joint-venture project about 60 km offshore of Namibia at a depth of 225m. Initial indicated reserves are 73.9 million tonnes, with an average grade of 20.57% P_2O_5 and inferred reserves are 1,500 million tonnes with an average grade of 18.7% P_2O_5. The project was planned to start production in late-2013.

Peru

Vale of Brazil began production at its Miski Mayo Mine Phosphate Rock mine in the Sechura desert in the Piura region of northwestern Peru. Production

Table – 14 : World Reserves of Phosphate Rock (By Principal Countries)

(In '000 tonnes)

Country	Reserves
World: Total (rounded)	**71000000**
Algeria	2200000
Australia	250000
Brazil	310000
Canada	2000
China	3700000
Egypt	100000
India	6100
Iraq	5800000
Israel	180000
Jordan	1500000
Mexico	3000
Morocco and Western Sahara	50000000
Peru	240000
Russia	1300000
Senegal	180000
South Africa	1500000
Syria	100000
Togo	60000
Tunisia	100000
USA	1400000
Other countries	500000

Source: *Mineral Commodity Summaries, 2012.*

was expected to increase gradually from 1 million tpy to full capacity of 3.9 million tpy within several years.

Stonegate Agricom Ltd of Canada was developing the Mantaro Phosphate property located near Huancayo 250 km from Lima Feasibility study was planned in 2011 and start of production in 2013.

FOREIGN TRADE

Exports

In 2010-11, exports of rock phosphate were 711 tonnes compared to 924 tonnes in the previous year. Similarly, exports of phosphatic fertilizers were 478 tonnes in 2010-11compared to 1,458 tonnes in the preceding year. The export of phosphoric acid decreased drastically to 11,798 tonnes from 143,195 tonnes and that of elemental phosphorus to 327 tonnes from 407 tonnes in the previous year. Rock phosphate was exported mainly to Nepal (71%), Nigeria (18%) and South Africa (9%). Elemental phosphorus was mainly exported to USA (45%), Iran (9%) and South Africa (8%). In 2010-11, exports of phosphatic fertilizers were mainly to UAE (63%), Nepal (24%) and Oman (8%) while those of phosphoric acid were to Indonesia (46%), Bangladesh (44%), and Saudi Arabia (8%) (Tables - 16 to 19).

Table – 15 : World Production of Phosphate Rock (By Principal Countries)

(In '000 tonnes)

Country	2008	2009	2010
World: Total	**165000**	**159000**	**182000**
Australia	2157	1963	2136
Brazil	6730	6100	6300
China	50741	60209	68070
Egypt	3179	3708	3435
Israel	3088	2697	2777
Jordan	6266	5281	6589
Morocco	24861	18307	26603
Russia	9810	9538	10834
South Africa	2287	2237	2494
Syria	3221	2466	3765
Tunisia	7692	7409	8149
USA	30200	26400	26100[e]
Other countries	14768	12685	14748

Source: World Mineral Production, 2006-2010.

Imports

Imports of rock phosphate decreased marginally to 5.19 million tonnes in 2010-11 from 5.68 million tonnes in the previous year. Imports were mainly from Jordan (46%), Egypt (17%) and Morocco (12%). Imports of elemental phosphorus increased to 19,949 tonnes from 15,911 tonnes in the previous year. The imports of elemental phosphorus were mainy from Vietnam (60%) and China (40%) . In 2010-11, 82,582 tonnes of phosphatic fertilizers was imported mainly from China (96%) and UAE (2%). Imports of phosphoric acid decreased to 2 million tonnes in 2010-11 from 2.69 million tonnes in the previous year. Imports were mainly from Morocco (43%), South Africa (18%) and USA (12%) (Tables - 20 to 23).

Table – 16 : Exports of Rock Phosphate (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**924**	**10138**	**711**	**4487**
Nigeria	30	893	131	1768
Nepal	192	1188	503	1555
USA	50	716	5	642
South Africa	-	-	67	332
Congo, P. Rep.	21	116	3	99
Togo	-	-	1	68
New Zealand	-	-	1	10
Ethiopia	20	247	++	5
Guinea Bissau	-	-	++	3
Mali	-	-	++	2
Other countries	611	6978	++	3

Table – 17 : Exports of Phosphorus (Elemental) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**407**	**80789**	**327**	**78316**
USA	255	25201	146	28789
Iran	15	11208	31	11645
South Africa	11	4141	27	9639
Indonesia	13	2958	23	5636
Philippines	11	3381	16	4288
Korea, Rep. of	-	-	10	3907
UAE	7	4128	7	3282
Egypt	33	8553	14	3198
UK	-	-	10	2858
Peru	14	4523	15	2727
Other countries	48	16697	28	2348

Table – 18 : Exports of Phosphatic Fertilizers (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**1458**	**332253**	**478**	**5073**
UAE	469	3066	303	2575
Nepal	313	1931	113	1421
Bahrain	-	-	3	309
Oman	100	1581	40	293
Malaysia	27	639	2	191
Ecuador	1	177	2	143
Thailand	-	-	12	64
Tanzania	-	-	++	47
Mozambique	28	442	3	24
USA	-	-	++	6
Other countries	520	324417	-	-

Table – 19 : Exports of Phosphoric Acid (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**143195**	**1767666**	**11798**	**464367**
Bangladesh	46675	457951	5229	182586
Indonesia	56221	677047	5405	139327
Saudi Arabia	8392	241126	1001	130374
UAE	23	3635	24	4512
Mozambique	18	1678	36	3201
Sri Lanka	3	541	19	1450
Chinese Taipei/ Taiwan	21815	263308	9	860
Oman	-	-	12	744
Kenya	-	-	52	675
Nepal	4	145	4	240
Other countries	10044	122235	7	398

Table – 20 : Imports of Rock Phosphate (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**5683654**	**32750208**	**5194203**	**32110281**
Jordan	2472464	14712711	2401648	15992302
Egypt	827514	4403793	872185	4075579
Morocco	863517	5368501	622658	4024469
Togo	406629	2533771	437906	3202460
Israel	393485	2315659	303448	2011248
Vietnam	292403	1074043	310183	1309815
Syria	33032	179423	90016	479391
Japan	61600	365051	62200	403710
Algeria	121533	603615	35364	202404
Nauru	120917	741964	24750	183312
Other countries	90560	451477	33845	225591

Table – 22 : Imports of Phosphoric Acid (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**2692899**	**67332518**	**2008376**	**63786633**
Morocco	1273174	28276474	860313	24855382
South Africa	332770	8109751	353897	10527759
USA	222308	6130394	235231	8335642
Tunisia	298101	8221610	227292	7966524
Senegal	332198	10108641	212676	7778297
Saudi Arabia	5620	141274	30381	1133912
Israel	142757	3897909	31322	1108442
UAE	-	-	13892	486791
China	3998	174236	9173	404022
Lebanon	-	-	7682	276003
Other countries	81973	2272229	26517	913859

Table – 21 : Imports of Phosphorus(Elemental) (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**15911**	**1987340**	**19949**	**2685267**
Vietnam	6922	847970	11967	1559588
China	8949	1132942	7932	1117177
Turkey	-	-	50	8482
UK	1	117	++	16
Unspecified	38	5882	++	4
Other countries	1	429	-	-

Table – 23 : Imports of Phosphatic Fertilizers (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**72805**	**1083798**	**82582**	**1553711**
China	72358	1055926	79654	1454832
UAE	400	20873	1977	81410
Netherlands	1	21	880	10850
Italy	46	6901	46	6300
Pakistan	-	-	24	292
Australia	-	-	1	27
Other countries	++	76	-	-

FUTURE OUTLOOK

There is no substitute for phosphorus in agriculture. The country is deficient in all fertilizer minerals hence, concentrated effort should be made by making consortium of public private companies to acquire assets abroad specifically in countries like Uzbekistan, Jordan, etc. Strenghthering ties with mineral rich countries and provinces with functional and specific MoUs and utilisation of IMG mechanism to align domestic stakeholders with MoUs is required. Only about 21% requirement of raw material for phosphate fertilizer production is met through indigenous sources. The remaining requirement is met through import in the form of rock phosphate, phosphoric acid and direct fertilizers. The reserves of chemical and fertilizer grades apatite and rock phosphate in India are very limited. Therefore, detailed exploration is necessary for conversion of remaining resources into reserves. Secondly, the search for apatite and rock posphate may have to be itensified in Andhra Pradesh, Rajasthan, Madhya Pradesh, Jharkhand, Tamil Nadu, Meghalaya, Gujarat, Uttar Pradesh, Uttarakhand, West Bengal, etc. Till the domestic resources of these two minerals are improved, the country has no alternative but to depend on their imports. Private sector participation in rock phosphate mining needs to be promoted in order to make available the above two minerals to reduce import dependence for promotion of fertilizers for agricultural sector.

As per the Report of the Working Group for 12th Plan period (2012-17), the apparent demand of apatite and rock phosphate was 7.23 million tonnes in 2009-10. The apparent consumption of apatite and rock phosphate is estimated at 8.59 million tonnes by 2011-12 and at 13.22 million tonnes by 2016-17 at 9% growth rate. Demand of phosphatic fetilizer will continue to rise due to growth in population and corresponding increase in food requirements.

In India, most of the existing phosphatic fertilizer and phosphoric acid plants have been designed for high grade imported rock phosphate, mainly from Morocco and Jordan. The Indian deposits are of low grade. Therefore, the fertilizer and phosphoric acid plants that may be set up as replacement of the existing plants will have to be designed to accept indigenous ores as a feed. Beneficiation of domestic low grade ores would be a step in the right direction and should be promoted indigeneously.

The Working Group for has recommended that: (i) Mining of rock phosphate may be opened for private sector, (ii) Cluster mining may be resorted to reduce the mining loss and degradation of environment to the extent possible, (iii) Environmental issues may be sought amicably to start mining operations in Aravali areas, (iv) Technology for extraction of low grade ores may be adopted and (v) Further exploration is needed in various parts of the country.

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

ASBESTOS

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

15 Asbestos

Asbestos is a group of fibrous minerals. The physical properties, besides fibrous character, such as, fineness, flexibility, tensile strength & length of fibres, infusibility, low heat conductivity and high resistance to electricity & sound as also to corrosion by acids, make asbestos commercially important. Commercial asbestos is classified into two main mineralogical groups: serpentine asbestos or chrysotile asbestos and amphibole asbestos. The latter includes asbestos minerals, such as, tremolite, actinolite, anthophyllite, amosite and crocidolite. Commercially, chrysotile asbestos is far superior in physical properties and hence more valuable than amphibole asbestos.

India's asbestos requirement is mainly met through imports from Russia, Canada, Brazil and Kazakhstan .

RESOURCES

As per the UNFC system, the total resources of asbestos in the country as on 1.4.2010 are placed at 22.17 million tonnes (Table-1). Of these, 2.5 million tonnes are reserves and 19.6 million tonnes are remaining resources. Out of the total resources, Rajasthan accounts for 13.6 million tonnes (61%) and Karnataka 8.28 million tonnes (37%). The remaining two percent resources are estimated in Jharkhand, Andhra Pradesh, Odisha and Uttarakhand. Table-2 summarises the mineralogical varieties of asbestos occurring in various parts of the country.

PRODUCTION, STOCKS & PRICES

The production of asbestos at 258 tonnes in 2010-11 increased by about 6% as compared to that in the previous year. There were 5 reporting mines in both the years. However, production of asbestos was reported by three mines in Andhra Pradesh. Two asbestos mines in Rajasthan reported production of associated minerals only. In 2010-11, the entire production of 258 tonnes was of chrysotile variety of asbestos and was produced by three mines in Cuddapah district of Andhra Pradesh.

The entire production of asbestos was from private sector in both the years. Padma Minerals (P) Ltd contributed above 69% of the chrysotile variety. The remaining production was reported by Baba Minerals Corporation (Tables - 3 to 5).

The mine-head stocks of asbestos at the beginning of the year were 9 tonnes and remained unchanged at the end of the year (Table - 6).

The average daily employment of labour strength was 63 in 2010-11 as against 71 in the preceding year. Prices of asbestos are furnished in the General Review on 'Prices'.

Table – 2 : Occurrences of Asbestos in India

State	District	Mineralogical variety
Andhra Pradesh	Cuddapah	Chrysotile
Jharkhand	Singhbhum	Chrysotile, tremolite, chrysotile mixed with other minerals
Karnataka	Chickmagalur	Amosite
	Hassan	Anthophyllite
	Mandya	Mixed amphibole minerals
	Mysore	Chrysotile
	Shimoga	Amosite
Rajasthan	Ajmer	Mixed amphibole minerals
	Bhilwara	-do-
	Dungarpur	-do-
	Pali	Tremolite, chrysotile mixed with other amphibole minerals
	Rajsamand	Tremolite, actinolite and mixed amphibole minerals
	Udaipur	Chrysotile, tremolite and mixed amphibole minerals
Uttarakhand	Chamoli	Others

Table – 1 : Reserves/Resources of Asbestos as on 1.4.2010
(By Grades/States)

(In tonnes)

Grade/State	Reserves				Remaining resources								Total resources (A+B)
	Proved STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
		STD121	STD122			STD221	STD222						
All India : Total	**1700152**	**4588**	**806101**	**2510841**	**109641**	**3072849**	**3257941**	**100687**	**2527918**	**10528926**	**57800**	**19655762**	**22166603**
By Grades													
Chrysotile	5754	-	9028	14782	856	3117	9191	2885	17619	41992	-	75660	90442
Amosite	-	-	-	-	-	-	-	-	3987	4459680	-	4463667	4463667
Tremolite	-	-	-	-	-	94768	116516	-	2426700	1562125	-	4200109	4200109
Chrysotile mixed with others	-	-	-	-	-	3871	18309	-	-	336	-	22516	22516
Mixed Amphibole	1634775	4588	770739	2410102	108785	2638007	2975117	87802	42101	4121718	-	9973530	12383632
Actinolite	-	-	-	-	-	-	-	-	311	34000	-	34311	34311
Anthophyllite	-	-	-	-	-	-	-	-	-	20000	-	20000	20000
Others	-	-	-	-	-	332459	99675	-	-	-	-	432134	432134
Not-known	59623	-	26334	85957	-	627	39133	-	-	279574	57800	377134	463091
Unclassified	-	-	-	-	-	-	-	10000	37200	9500	-	56700	56700
By States													
Andhra Pradesh	5754	-	9028	14782	856	3117	9191	-	1500	27085	-	41749	56531
Jharkhand	-	-	-	-	-	3871	18309	2885	5769	124059	-	154893	154893
Karnataka	-	-	-	-	-	-	-	-	2441037	5841420	-	8282457	8282457
Odisha	-	-	-	-	-	-	-	10000	37200	9500	-	56700	56700
Rajasthan	1694398	4588	797073	2496059	108785	3065861	3230441	87802	42101	4526861	57800	11119651	13615710
Uttarakhand	-	-	-	-	-	-	-	-	311	-	-	311	311

Figures rounded off.

Table – 3 : Principal Producers of Asbestos, 2010-11

Name & address of producer	Location of mine	
	State	District
Padma Minerals (P) Ltd, 1/5A, Ambikapalli Road, Pulivendla, Dist. Cuddapah – 516 390 Andhra Pradesh.	Andhra Pradesh	Cuddapah
Baba Minerals Corporation, 1/25 Krishnappa Nagar, Near Rly. Station, Cuddapah Dist. Cuddapah Andhra Pradesh.	Andhra Pradesh	Cuddapah

Table – 4 : Production of Asbestos, 2008-09 to 2010-11 (By States)

(Qty in tonnes; value in ₹'000)

State	2008-09		2009-10		2010-11(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**315**	**14521**	**243**	**12268**	**258**	**12887**
Andhra Pradesh	315	14521	243	12268	258	12887
Rajasthan	-	-	-	-	-	-

Table – 5 : Production of Asbestos, 2009-10 and 2010-11 (By States/Districts/Grades)

(Qty in tonnes; value in ₹'000)

State/District	2009-10					2010-11(p)				
	No. of mines	Quantity			Value	No. of mines	Quantity			Value
		Chrysotile	Amphibole	Total			Chrysotile	Amphibole	Total	
India	**5**	**243**	**-**	**243**	**12268**	**5**	**258**	**-**	**258**	**12887**
Private sector	5	243	-	243	12268	5	258	-	258	12887
Andhra Pradesh	**3**	**243**	**-**	**243**	**12268**	**3**	**258**	**-**	**258**	**12887**
Cuddapah	3	243	-	243	12268	3	258	-	258	12887
Rajasthan*	**2**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**
Ajmer	2	-	-	-	-	2	-	-	-	-

**Production of felspar and quartz reported as associated minerals.*

Table – 6 : Mine-head Stocks of Asbestos, 2010-11 (P) (By State/Grades)

(In tonnes)

State	At the beginning of the year			At the end of the year		
	Chrysotile	Amphibole	Total	Chrysotile	Amphibole	Total
India	**9**	**–**	**9**	**9**	**-**	**9**
Andhra Pradesh	9	–	9	9	-	9

MINING & MILLING

The mines in Rajasthan, producing amphibole variety of asbestos were small opencast workings and were operated manually.

The usual method of mining chrysotile in Pulivendla tehsil, Cuddapah district, Andhra Pradesh, is by opening an incline along the dip varying from 20^0 to 25^0, keeping the trap as floor and limestone as roof. Two or three such inclines are converted into a regular underground mine by developing levels and winzes connecting them and adopting board-and-pillar system of development. In almost all the mines, operations like blasthole drilling, hoisting, pumping and ventilation are mechanised.

The run-of-mine is subjected to manual sorting of asbestos-bearing rock (ABR). ABR is then hand-combed for chipping off the asbestos-bearing portion in small pieces of about 2.5 cm for producing asbestos concentrates. From ABR, the serpentine is removed as a waste. The asbestos concentrate is fed manually into hopper of a hammer mill. In hammer mill, asbestos and other minerals are separated and then fed to double-deck screen having 10 to 40 mesh sieves. The screening gives three fractions: (a) oversize, (b) middling, and (c) tailing.

Tailing is taken as a waste which generally does not contain appreciable quantity of asbestos. The oversize is recycled in the hammer mill, and the middling fibre is sucked up by a cyclone and collected. There are five processing or milling plants located in Pulivendla area, Andhra Pradesh.

GRADING & MARKETING

Small fibres recovered through milling process account for nearly a two-third production. The general grading system adopted is as follows:

Grade	Fibre Size	Method
Grade - As	45 mm and above	Hand-sorted
Grade - A	Between 25 and 45 mm	
Grade - B	Between 12 and 25 mm	
Grade - C	Above 16 mesh	Mill-processed
Grade - D3	24 mesh	
Grade - D4	40 mesh	
Grade - D6	60 mesh	

Producers of amphibole asbestos sell their output as crude or fluff and powder.

CLASSIFICATIONS

Various classifications of chrysotile asbestos followed in India are based, by and large, on fibre length:

(1) Grade As or A Special - 25.4 mm fibres or larger

- As_1 - 25.4 mm and larger fibres but brittle compared to As or A Special
- A - 19.05 to 25.4 mm fibres
- A_1 - 19.05 to 25.4 mm fibres but brittle compared to A
- A_2 - 19.05 to 25.4 mm fibres but brittle compared to A_1
- Grade B - 6.35 to 19.05 mm fibres
- B_1 - 6.35 to 19.05 mm fibres but brittle compared to B
- B_2 - 6.35 to 19.05 mm fibres but brittle compared to B_1
- C - Below 6.35 mm fibres

(2) Grade A Special - Above 31.5 mm

- A - Between 19 and 31.5 mm
- B - Between 6.3 and 19 mm
- C - Below 6.3 mm including powder
- D - Dust

(3) Quebec standard asbestos testing machine classification of chrysotile asbestos according to groups is given below:

Crude Asbestos

Group No. 1 Crude No. 1: Consists basically of crude, 3/4 inch and longer staple

Group No. 2 Crude No. 2: Consists basically of crude, 3/8 to 3/4 inch staple.

Milled Asbestos

Standard designation of grade	Guaranteed minimum spinning test
Group No. 3 (spinning fibres)	
3 D	10.5-3.9-1.3-0.3
3 Z	0-8-6-2
Group No. 4 (shingle fibres)	
4 D	0-7-6-3
4 Z	0-1.5-9.5-5

(Contd.)

(Concld.)

Standard designation of grade	Guaranteed minimum spinning test
Group No. 5 (paper fibres)	
5 D	0-0.5-10.5-5
5 R	0-0-10-6
Group No. 6 (waste)	
6 D	0-0-7-9
Group No. 7 (shorts or refuse)	
7 D	0-0-8-11
7W	0-0-0-16
Group No. 7 (floats)*	
7 RF	No test
7 TF	No test
Group No. 8 (sand & gravel)	
8 S	Less than 50 lb per cu ft loose measure
8 T	Less than 75 lb per cu ft loose measure.
Group No. 9 (gravel & stone)	
9 T	More than 75 lb cu ft loose measure

** The suffix 'F' designates 'floats' in the case of 7R and 7T grades.*

USES

Industrial use of asbestos is linked with the type of asbestos. Chrysotile asbestos, being more fibrous and possessing better tensile strength than amphibole variety, is used in the manufacture of asbestos fabrics, cement sheets, pipes and allied products. It is also used in brake linings, insulation and fireproof clothing. Short fibres are used with cement as binders for manufacturing asbestos-cement products. Amphibole asbestos generally finds use in heat insulation and treatment of acids. Anthophyllite and tremolite fibres, although of good length, are too weak and brittle to be spun. They are therefore used for boiler lagging, hard-setting magnesia composition and as a filler in asbestos paints and various asbestos-moulded articles.

CONSUMPTION

The reported consumption of asbestos in 2010-11 was about 103 thousand tonnes and was almost entirely utilised for manufacturing asbestos-cement and asbestos-based products. Minor quantity was utilised for insulation purpose in some industries. The available consumption data relate almost entirely to imported chrysotile asbestos. Reliable data on consumption of amphibole asbestos were not available as the consuming industries were mostly in small-scale sector, producing low-pressure asbestos-cement pipes used in construction industry (Table - 7).

Table – 7 : Reported Consumption of Asbestos 2008-09 to 2010-11 (By Industries)

(In tonnes)

Industry	2008-09	2009-10(R)	2010-11 (P)
All Industries	**103700**	**104000**	**103300**
Asbestos products	103600(22)	103900(22)	103200(22)
Refractory	100(4)	100(4)	100(4)
Others (foundry, paper paint)	++(5)	++(5)	++(5)

Figures rounded off. Data collected on non-statutory basis.
Figures in parentheses denote the number of units in organised sector reporting consumption.*
*(*Includes actual reported consumption and/or estimates made wherever required).*

INDUSTRY

The installed capacity of asbestos sheets in the organised sector was not available while that of asbestos-cement pressure pipes was 149,640 tpy. The production of asbestos cement sheets and accessories in 2009-10 was about 2.43 million tonnes and production of asbestos cement pressure pipes was 149.6 thousand tonnes according to Department of Industrial Policy & Promotion. Data for 2010-11 is not available. The asbestos-cement pressure building pipes and other asbestos-based products like brake linings, clutch facings, ferobestos sheets, textiles, mattresses, joining, limpet sheets, mill boards, moulded thermal insulation articles, asbestos yarn and hydraulic packings, asbestos plugs and fire-resistant cement were manufactured by a number of medium and small units. Presently, there are about 75 plants engaged in the production of asbestos products in the country and these are mainly located in Gujarat, Karnataka, Madhya Pradesh and Andhra Pradesh. Besides, about 114 asbestos cement sheet and pipe units are reported from Rajasthan.

SUBSTITUTION

Material substitued for asbestos include calcium silicate, carbon fibres, fibres of cellulose, ceramic, glass & steel, wollastonite and several organic fibres like aramid, polyethylene, polypropylene and polytetrafluoroethylene. Where reinforcement properties of fibres are not required, several non-fibrous minerals are also considered for possible substitution. However, no single substitution is found to be as versatile or as cost-effective as asbestos.

ENVIRONMENTAL ISSUES

There has been a concern about the role of asbestos causing lung diseases. Research towards this problem has been hampered by the long period between asbestos exposure and symptoms, known as a latency period, which can exceed 30 years. Further, difficulty was faced in diagnosing the diseases and due to fragmented medical records. Results obtained so far suggested that chrysotile, most widely used asbestos, was less dangerous than amphibole asbestos minerals. Asbestosis is a chronic affliction resulting from inhalation of asbestos fibres and is commonly seen in workers who have been associated with high levels of asbestos dust. It led to an increase in the amount of fibrous protein in the lung, which ultimately decreased its flexibility and oxygen-absorbing capacity, sometimes leading to death. The incidence of severe asbestosis has been declining for years and should continue to do so because of dust control in the work place.

Mesothelioma, which can be either benign or malignant, is a tumour in tissue that encases the lung. The asbestos problem is almost certainly the wider issue involving all fibrous materials, both natural and man-made. However, a decision to ban asbestos is not simple. Crocidolite and amosite appear to be strongly linked to disease, whereas chrysotile is not. Just as scientific community has begun to grasp the wide diversity of fibrous materials and their effects, the public has come to think of all fibrous materials as highly dangerous as asbestos. This has resulted in clamour for removing asbestos from buildings where it is found in insulation around pipes and in ceiling and floor tiles.

Minerals and chemicals containing 0.1% or more silica are considered as carcinogenic hazard. Therefore, unless processing can reduce the crystalline silica to less than 0.1%, asbestos will come under the regulation similar to US OSHA Hazard Communication Standards. France banned the production and import of asbestos-based products in 1997, followed by Belgium in 1998. During November 1999, UK prohibited the use, import and manufacture of chrysotile asbestos on the grounds of health risks. On 10 September 1998, the Rotterdam Convention on Prior Informed Consent (PIC) adopted procedure for certain Hazardous Chemicals and Pesticides in international trade by the United Nations and in 2002, a decision was made to initiate the addition of all forms of asbestos except chrysotile to the PIC procedure. Another attempt to bring chrysotile, the most common form of asbestos, under the Prior Informed Consent (PIC) list of the

Rotterdam Convention had failed. Parties to this international treaty governing trade in toxic substances met in Geneva in October 2006. But they could not agree on adding chrysotile to a list of 39 substances about which exporting countries must inform importers before shipping.

The convention is a multilateral agreement that tries to ensure that export of hazardous materials takes place with the knowledge of importing nations.

TRADE POLICY & LEGISLATION

No restrictions have been imposed on exports of asbestos in the amended Foreign Trade Policy, 2009-14. As per the prevailing Foreign Trade Policy, asbestos under heading 2524 can be imported freely with the exception of amosite which is restricted. However, the imports of crocidolite, actinolite, anthophyllite, amosite and tremolite are restricted in terms of Interim Prior Informed Consent (PIC) Procedure of Rotterdam Convention for Hazardous Chemicals and Pesticides.

Ministry of Environment and Forest, vide Notification dated 13.10.1998, under Sections 3 (1) and 6 (2) (d) of Environment (Protection) Act, 1986 and Rule 13 of Environment (Protection) Rules, 1986, has prohibited the imports of waste asbestos (dust and fibre), being a hazardous waste detrimental to human health and environment.

WORLD REVIEW

The world reserves of asbestos are believed to be quite large. Large reserves are located mainly in Canada, China, Kazakhstan and Russia.The world production of asbestos was around 2 million tonnes in 2010. Russia was the leading producer and accounted for 49% production, followed by China (20%), Brazil (15%), Kazakhstan (11%) and Canada (5%) (Tables - 8 and 9).

In Canada, an International Consortium is in the process of purchasing the Mine Jeffrey Inc. The purchase would enable the company to complete the underground portion of its mine and increase the production from 15,000 tpy to 250,000 tpy eventually.

Table – 8 : World Reserves of Asbestos (By Principal Countries)

Country	Reserves
World: Total	**Large**
Brazil	Moderate
Canada	Large
China	Large
Kazakhstan	Large
Russia	Large
USA	Small
Other countries	Moderate

Source: *Mineral Commodity Summaries, 2012.*

Table – 9 : World Production of Asbestos (By Principal Countries)

(In '000 tonnes)

Country	2008	2009	2010
World: Total	**2107**	**2114**	**2029**
Brazil	305	288	312
Canada (chrysotile)^e	160	150	100
China^e	380	440	400
Kazakhstan	230	230	214
Russia	1020	1000	1000
Zimbabwe (chrysotile)	11	5	2
Other countries	01	01	01

Source: *World Mineral Production, 2006-2010.*

FOREIGN TRADE

Exports

Exports of asbestos were 252 tonnes in 2010-11 as compared to 559 tonnes in the previous year. Out of the total exports in 2010-11, exports of chrysotile asbestos were 43 tonnes while those of other asbestos varieties were 209 tonnes.

Exports were mainly to Nepal. Exports of asbestos-cement products were 46,882 tonnes in 2010-11 as compared to 39,389 tonnes in the preceding year. Exports of asbestos cement products were mainly to UAE (66%), Saudi Arabia (7%), Nepal (6%),and South Africa (3%) (Tables-10 to 13).

Imports

Imports of asbestos were 365,795 tonnes in 2010-11 against 331,415 tonnes in the previous year. The imports comprised chrysotile asbestos 353,441 tonnes and asbestos (others) 12,354 tonnes. Imports of asbestos were mainly from Russia (49%), Canada (16%), Brazil (15%) and Kazakhstan (14%). A total of 5,561 tonnes asbestos-cement products were also imported in 2010-11 as against 2,653 tonnes in the previous year. Imports were mainly from Thailand (93%) (Tables-14 to 17).

Table – 10 : Exports of Asbestos : Total (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**559**	**1601**	**252**	**698**
Nepal	533	1209	209	390
Sri Lanka	-	-	36	241
Uganda	-	-	4	50
Libya	-	-	3	10
China	-	-	++	7
Other countries	26	392	-	-

Table – 11 : Exports of Asbestos (Chrysotile) (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**63**	**805**	**43**	**97**
Iraq	9	24	-	-
Nepal	54	781	43	97

Table – 12 : Exports of Asbestos (Others) (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**496**	**796**	**209**	**601**
Nepal	479	427	166	292
Sri Lanka	-	-	36	241
Uganda	-	-	4	51
Libya	-	-	3	10
China	-	-	++	7
Other countries	17	369	-	-

Table – 13 : Exports of Asbestos Cement Products (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**39389**	**547369**	**46882**	**606450**
UAE	22692	278420	31071	361567
Nepal	5226	81780	2612	43353
Kuwait	286	3892	1316	38853
Saudi Arabia	3423	43343	3307	37313
South Africa	2225	31677	1617	21268
Bhutan	120	3681	185	15098
Qatar	1091	12937	1151	13052
Bahrain	167	2052	747	12515
Iran	119	4452	702	9003
Canada	1	11	707	8856
Other countries	4039	85124	3467	45572

Table – 14 : Imports of Asbestos : Total (By Countries)

Country	2009-10		201011	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**331415**	**9287999**	**365795**	**10025266**
Russia	152448	4241597	178479	4872619
Brazil	57427	1772798	55414	1722218
Canada	70934	2014889	58052	1629659
Kazakhstan	45224	1192113	51844	1428290
Ukraine	202	4808	4588	124824
China	377	8333	2204	59392
Egypt	-	-	10010	51818
USA	50	1072	928	25566
UAE	-	-	412	12402
Unspecified	327	8189	1553	37899
Other countries	4426	144200	2311	60579

Table – 15 : Imports of Asbestos (Chrysotile) (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**330106**	**9244369**	**353441**	**9939377**
Russia	152448	4241597	176782	4856407
Brazil	56507	1740785	55414	1722218
Canada	70598	2006277	57562	1616584
Kazakhstan	45224	1192113	51844	1428290
Ukraine	202	4808	4588	124824
China	374	8229	2141	56746
USA	50	1072	928	25566
UAE	-	-	392	11975
Thailand	-	-	337	7274
Unspecified	327	8189	1553	37899
Other countries	4376	141299	1900	51594

Table – 16 : Imports of Asbestos (Others) (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**1309**	**43630**	**12354**	**85889**
Egypt	-	-	10010	51818
Russia	-	-	1697	16212
Canada	336	8613	490	13075
China	3	104	63	2646
Korea, Rep. of	-	-	36	775
UK	20	576	20	554
UAE	-	-	20	428
Spain	-	-	18	381
Other countries	950	34337	-	-

Table – 17 : Imports of Asbestos Cement Products (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**2653**	**75254**	**5561**	**111165**
Thailand	2274	54280	5185	86457
China	293	12733	151	9033
USA	26	2613	45	4234
UK	1	100	8	3345
Philippines	++	20	102	1290
Indonesia	++	12	6	973
Netherlands	++	16	12	914
Malaysia	8	2934	20	857
Saudi Arabia	-	-	++	794
Germany	7	159	2	773
Other countries	44	2387	30	2495

FUTURE OUTLOOK

The resources of chrysotile variety of asbestos are very much limited in India. So, there is an urgent need to go for detailed exploration as the internal demand for asbestos in the country cannot be met from indigenous production. There is a need to look into the existing restrictions on the mining of chrysotile asbestos used as flux and in construction industries. Mining operations should therefore be undertaken with appropriate pracautions and by utilisation of improved methods so that no adverse impact is caused to the health of the workers. Necessary guidelines in this regard need to be framed. The apparent demand of asbestos is estimated to be 393 thousand tonnes by 2011-12 and 605 thousand tonnes by 2016-17 with 9% growth rate as per the Report of the Working Group for 12th Plan.

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

BARYTES

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

16 Barytes

Baryte or barite is the mineral form of barium sulphate. Approximately, 85% barytes produced worldwide is used for oil and gas drilling as weighting agent in drilling mud because of its unique physical and chemical properties and magnetic neutrality. It is also used as a feedstock for production of various barium compounds, and is also utilised as filler, extender and aggregate. Another application after its conversion to barium carbonate is in the manufacture of ceramic and glass. The Mangampet deposit in Cuddapah district of Andhra Pradesh is the single largest barytes deposit in the world. India is one of the leading producers and exporters of barytes in the world.

RESOURCES

The total resources of barytes in India as on 1.4.2010 as per UNFC system are placed at 73 million tonnes constituting 43% reserves and 57% remaining resources. By grades, 40% resources are of oil-well drilling grade followed by 6% of chemical grade 1% of paint grade and 33% constitute low grade. About 20% resources are of other, unclassified and not-known categories. Andhra Pradesh alone accounts for 94% of the country's baryte resources (Table - 1).

PRODUCTION, STOCKS AND PRICES

The production of barytes at 2,334 thousand tonnes in 2010-11 registered an increase of 8% as compared to that in the previous year. There were 6 reporting mines during the year under review as against 11 in the preceding year. Andhra Pradesh continued to be the premier state in barytes production and accounted for almost the entire production of barytes. Very nominal production was reported from Rajasthan.

The Andhra Pradesh Mineral Development Corporation (APMDC) Ltd, is the sole producer in public sector, which accounted for 98% of the total production during 2010-11. The remaining two percent output of barytes was contributed by 5 private sector mines. Among them contribution of two mines was only 68 tonnes. The rest was contributed by two mines with an annual production range of 5 thousand to 20 thousand tonnes each and one mine having annual production above 20 thousand tonnes.

Almost the entire production of barytes was of off-colour variety. Only nominal production was reported in snow white variety which was mainly from Udaipur district of Rajasthan (Tables - 2 to 5).

The mine-head stocks of barytes at the end of year 2010-11 were 5,236 thousand tonnes as against 4,007 thousand tonnes in the beginning of the year (Table-6).

The average daily employment of labour in 2010-11 was 516 as against 507 in the previous year. Domestic prices of barytes are furnished in the General Review on 'Prices'.

MINING, MARKETING AND TRANSPORT

Barytes mines in India are worked by opencast method, except one in Himachal Pradesh and two in Andhra Pradesh. Andhra Pradesh Mineral Development Corp. Ltd, (APMDC), the largest producer, obtains barytes from the mechanised opencast mine in Mangampet area in Cuddapah district, Andhra Pradesh. Drills, loaders, dozers and dumper trucks are used for removing overburden. Barytes is won from benches using jackhammers and then loaded mainly on to trucks. Barytes is milled in crushing/grinding plants before marketing. Barytes is exported from Chennai Port, 100 km away from the mine.

While marketing, barytes is graded into two varieties: off-colour and snow-white. The white and snow-white varieties are used generally as fillers in the manufacture of rubber goods and as an opacifying material in the manufacture of paints and paper. The off-colour barytes is used for manufacturing chemicals or as drilling muds. Both the well-known grades laid down by Oil Companies Material Association (OCMA) and American Petroleum Institute (API) were produced and marketed in the country. The country supplies drilling grade barytes to Middle East and South America.

Table –1 : Reserves/Resources of Barytes as on 1.4.2010
(By Grades/States)

(In tonnes)

Grade/State	Reserves				Remaining resources								Total resources (A+B)
	Proved STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
		STD121	STD122			STD221	STD222						
All India : Total	**29557972**	**90844**	**1935312**	**31584128**	**179447**	**4288189**	**2608562**	**207384**	**1269214**	**32491229**	**105721**	**41149746**	**72733874**
By Grades													
Chemical-A	91368	41970	133860	267198	1694	21665	20081	-	140553	546843	-	730836	998034
Chemical -B	1469453	17550	603280	2090283	28913	24860	111201	21717	493318	905933	12835	1598777	3689060
Oill- well Drilling	20843906	16722	882447	21743075	85522	169400	562294	48550	177407	6295057	-	7338230	29081305
Paint	87795	14602	119669	222066	-	28452	15606	48904	21608	147135	-	261705	483771
Low	5000	-	5285	10285	-	58068	333928	1210	361950	23040953	92886	23888995	23899280
Others	7032150	-	190771	7222921	28206	3985744	1535592	-	-	12599	-	5562141	12785062
Unclassified	28300	-	-	28300	35112	-	29440	83195	69878	1494283	-	1711908	1740208
Not-known	-	-	-	-	-	-	420	3808	4500	48426	-	57154	57154
By States													
Andhra Pradesh	29396236	79736	1845270	31321242	173429	4252061	2500159	105872	387394	29632557	105721	37157193	68478435
Haryana	-	-	-	-	-	-	-	-	-	440	-	440	440
Himachal Pradesh	27288	-	12645	39933	-	12846	-	48904	12370	3000	-	77120	117053
Jharkhand	-	-	-	-	-	-	-	-	-	35900	-	35900	35900
Karnataka	-	-	-	-	-	-	-	-	-	15175	-	15175	15175
Madhya Pradesh	-	-	-	-	-	18500	4472	-	35000	233940	-	291912	291912
Maharashtra	-	-	-	-	-	-	-	14800	89450	18610	-	122860	122860
Rajasthan	134448	11108	77397	222953	6018	4782	103931	37808	311500	2304688	-	2768727	2991680
Tamil Nadu	-	-	-	-	-	-	-	-	500	221919	-	222419	222419
Uttarakhand	-	-	-	-	-	-	-	-	-	25000	-	25000	25000
West Bengal	-	-	-	-	-	-	-	-	433000	-	-	433000	433000

Figures rounded off.

Table – 2 : Principal Producers of Barytes 2010-11

Name and address of producer	Location of mine	
	State	District
M/s. Andhra Pradesh Mineral Development Corpn. Ltd, HMWS SB, Rear Block, 3rd Floor, Khairatabad, Hyderabad - 500 004, Andhra Pradesh.	Andhra Pradesh	Cuddapah
Salaruddin Grey Barytes Sri G. Srmi Vasulu Laxmi Street Post-Kodour Rly Dist. Cuddapah, Andhra Pradesh.	Andhra Pradesh	Cuddapah

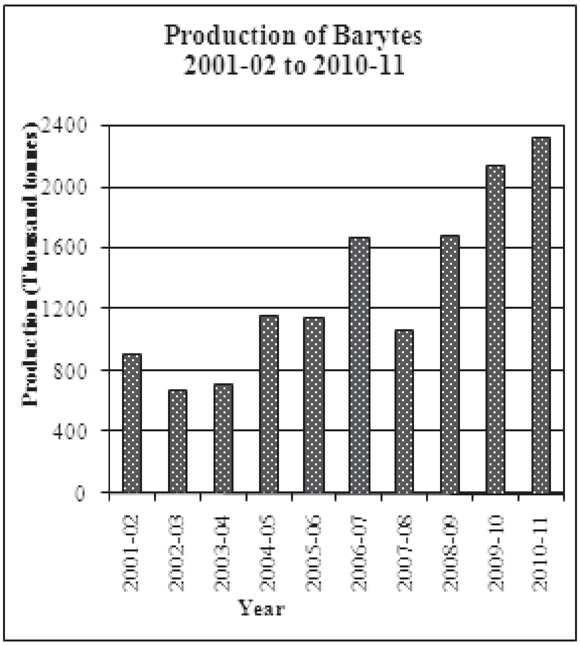


Table – 3 : Production of Barytes, 2008-09 to 2010-11 (By States)

(Qty in tonnes; value in ₹ '000)

State	2008-09		2009-10		2010-11(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**1686148**	**966445**	**2152552**	**2601842**	**2333805**	**2651360**
Andhra Pradesh	1679896	963372	2146460	2599224	2327700	2648986
Himachal Pradesh	582	873	107	161	-	-
Rajasthan	5670	2200	5985	2457	6105	2392

Table – 4 : Production of Barytes, 2009-10 and 2010-11 (By Sectors/States/Districts/Grades)

(Qty in tonnes; value in ₹'000)

State/District	2009-10					2010-11(P)				
	Grades			Total		Grades			Total	
	No. of mines	Snow-White	Off-colour	Quantity	Value	No of mines	Snow-White	Off-colour	Quantity	Value
India	**11**	**16950**	**2135602**	**2152552**	**2601842**	**6**	**1142**	**2332663**	**2333805**	**2651360**
Public sector	1	–	2111795	2111795	2591172	1	–	2289791	2289791	2638285
Private sector	10	16950	23807	40757	10670	5	1142	42872	44014	13075
Andhra Pradesh	**9**	**15753**	**2130707**	**2146460**	**2599224**	**5**	**31**	**2327669**	**2327700**	**2648968**
Cuddapah	7	15753	2122069	2137822	2597378	4	31	2317683	2317714	2646364
Khammam	2	–	8638	8638	1846	1	–	9986	9986	2604
Himachal Pradesh	**1**	–	**107**	**107**	**161**	**-**	–	**-**	**-**	**-**
Sirmour	1	–	107	107	161	-	–	-	-	-
Rajasthan	**1**	**1197**	**4788**	**5985**	**2457**	**1**	**1111**	**4994**	**6105**	**2392**
Udaipur	1	1197	4788	5985	2457	1	1111	4994	6105	2392

Table – 5 : Production of Barytes, 2009-10 and 2010-11(P)
(By Frequency Groups)

(Qty. in tonnes)

Production Group	No. of mines		Production for the group		Percentage in total production		Cumulative percentage	
	2009-10	2010-11	2009-10	2010-11	2009-10	2010-11	2009-10	2010-11
All Groups	**11**	**6**	**2152552**	**2333805**	**100.00**	**100.00**	**–**	**–**
Up to 500	2	2	227	68	0.01	0.01	0.01	0.01
501-2000	3	-	2421	-	0.11	0.00	0.12	0.01
2001-5000	1	-	2644	-	0.12	0.00	0.24	0.01
5001-20,000	4	2	35465	16091	1.65	0.69	1.89	0.70
Above 20,000	1	2	2111795	2317646	98.11	99.30	100.00	100.00

Table – 6 : Mine-head Stocks of Barytes, 2010-11(P)
(By States/Grades)

(In tonnes)

State	At the beginning of the year			At the end of the year		
	Grades		Total	Grades		Total
	Snow-white	Off-colour		Snow-white	Off-colour	
India	**33503**	**3973467**	**4006970**	**146180**	**5089331**	**5235511**
Andhra Pradesh	33211	3972908	4006119	146097	5088754	5234851
Himachal Pradesh	–	87	87	–	87	87
Rajasthan	292	472	764	83	490	573

CONSUMPTION

The reported consumption of barytes decreased to 192 thousand tonnes in 2010-11 from 200 thousand tonnes in 2009-10. The Oil-well drilling Industry, the main consumer of barytes, accounted for 78% consumption, which was followed by Chemical Industry with 18% consumption. Other barytes consuming industries like paint, asbestos products, glass, rubber, paper and cement accounted for the remaining 4% consumption (Table-7).

USES AND SPECIFICATIONS

Oil and Gas Drilling

The properties like insolubility in water, inertness and high specific gravity enable barytes application as a weighting agent in drilling operations to control pressure, prevent blow-out and at the same time to provide lubrication. Barytes powder containing minimum 90% barium sulphate with 4.15 specific gravity is recommended for drilling. For offshore drilling, the specific gravity should be 4.2. At least 97% ground barytes should pass through 75- micron IS sieve and 95% through 53- micron IS sieve.

Chemical

Major barium chemicals obtained from barytes are carbonate, chloride, oxide, hydroxide, nitrate, peroxide and sulphate. Barium carbonate is used in glass industry, electro-ceramics and for removing inconvenient impurities in phosphoric acid. Barium hydroxide is used in the preparation of barium salts of organic acids which are utilised as additives for lubricating oils and as stabilisers for PVC. Barium sulphate is used as pigment, extender and filler in rubber and paper industries.

Lithopone, a mixture of $BaSO_4$ and ZnS, is used in paint and lacquer industries as white pigment, extenders and fillers. Barium nitrate is used in green signal flares, tracer bullets, primers

Table - 7 : Reported Consumption of Barytes, 2008-09 to 2010-11 (By Industries)

(In tonnes)

Industry	2008-09	2009-10 (R)	2010-11(P)
All Industries	**141300**	**200500**	**191900**
Asbestos products	1000(1)	1000(1)	1000(1)
Chemical	34300(5)	34300(5)	34300(5)
Glass	600(7)	600(7)	600(7)
Oil-well drilling	99300(2)	143200(2)	149500(2)
Paint	6000(30)	6100(30)	6400(31)
Paper	++(1)	++(1)	++(1)
Rubber	100(2)	100(2)	100(2)
Cement	-	15200(1)	-(1)

Figures rounded off. Data collected on non-statutory basis.
Figures in parentheses denote the number of units in organised sector reporting consumption.*
*(*Includes actual reported consumption and/or estimates made wherever required).*

and detonators. Barium oxide is used in electric furnace. Barium titanate finds use in miniature electronic and communication equipment. Barytes is also used in explosive manufacture.

For chemical industry, purity is the prime criterion, with ferric oxide and strontium sulphate limited to a maximum 1% and fluorine to traces. The mesh size is also important in manufacturing chemicals. Barytes used in explosive manufacture may be bleached or unbleached. It should be in dry powder form free from extraneous matter.

Paint

Barytes is used as filler and extender in paint industry. White pigment is manufactured from barytes. Barytes should be free from mud, clay or siliceous minerals. Presence of iron oxide is undesirable. The material should be in the form of dry powder.

Glass

In glass manufacturing, barytes is added to the glass melt for making the glass more workable and enhancing its brilliance. Iron is the most undesirable impurity.

Rubber

Barytes is used as a filler and extender in rubber products. It is added to rubber compounds for reinforcement. Barytes containing minimum 99.5% $BaSO_4$ is usually preferred. Since such purity material is not found in nature, before use, barytes is normally bleached called 'blanc fixe'. The sieve residue through 75-micron and 150- micron sieve should be 4% and 0.01% max, respectively. BIS has prescribed IS:1683-1994 (Reaffirmed 2008) as specification of barytes for use in rubber industry.

Other Uses

Barytes is used in the manufacture of asbestos products required for autobrake lining and other frictional materials. It is used as a filler in paper industry. Finely ground barytes and clay are used as suspension in Barvois system of coal washing. Barytes is also used in concrete aggregate required for reactor shielding. In medicine it is used in radiodiagnosis to highlight the abnormalisation of internal body parts. Barytes also finds use in explosives and pyrotechnics composition for which BIS has laid down specifications vide IS 7588-1992 (Reaffirmed 2011).

The specifications of barytes for various industries are given in Table - 8.

SUBSTITUTES AND TECHNICAL POSSIBILITIES

Drilling mud substitutes include celestite, iron ore, synthetic hematite and ilmenite but the low cost and technical advantages of barytes deter substitution. Iron ore fines and ilmenite are substitutes used for deep drilling. Reclamation and recycling of drilling muds have been increasingly hampering the requirement for new supplies. Further new oil exploration techniques and drilling methods have reduced the need for new boreholes and wells, which have led to curtailment in the requirement for drilling muds. As a filler, barytes can be substituted by diatomite, felspar, kaolin, mica, talc and silica flour.

Table – 8 : Specifications of Barytes in Different Industries

Industry	IS Specifications/ Specifications of other organisation	Chemical constituent: $BaSO_4$	SiO_2	Ca & Mg as $CaCO_3$	$BaCO_3$	Aluminium as Al	Iron as Fe	Physical characteristic: Fineness	Relative density	Colour	Volatile matter	Residue on sieve	Oil absorption	pH	Remarks
1. Oil-well drilling	IS : 2881-1984, (Second Revision, Reaffirmed 2003) Grade-2	90% min	-	-	-	-	-	(a) Passing through 75-micron IS sieve : 97% min (b) Passing through 53 micron IS sieve : 95% min	4.15 at 27 °C	Off-colour	-	-	-	-	For offshore drilling, relative density shall be 4.20.
2. Chemical	IS : 2881-1984, (Second Revision, Reaffirmed 2003) Grade-1	Quality 'A' 97% min	2% max	0.1% max	-	0.1% max	0.1% max	-	-	-	-	-	-	-	-
		Quality 'B' 90% min	-	2% max	-	-	1.5% max	-	4.0 min	-	-	-	-	-	Silica and aluminium oxide together shall be 6% max.
3. Paint	IS : 64-1972, (First Revision, Reaffirmed 2004) Type - I (Natural barytes) Grade - I	95% min	-	-	2.24% max	-	-	-	4.45 at 25 °C	Snow-white to white.	0.5% max	0.25% on 40-micron IS sieve (400 mesh)	6 to 12	6 to 8	Matter soluble in water should not be more than 0.5%.
	Grade-II	95% min	-	-	2.24% max	-	-	-	4.45% at 25 °C	-do-	0.5% max.	0.25% on 63-micron IS-Sieve (240 mesh)	6 to 12	6 to 8	Matter soluble in water should not be more than 0.5%.
	Type-II (Precipitated barytes)	97% min	-	-	0.45% max	-	-	-	3.36 at 25 °C	A close match to that of approved sample	0.5% max	0.1% on 40-micron IS-sieve (400 mesh)	15 to 30	6 to 8	Matter soluble in water should not be more than 0.5%.
4. Glass	Based on user's demand	90 to 98% (preferably 96%)	1.5% max	-	-	0.15% max as Al_2O_3	0.3 to 0.5% max (preferably 0.1% Fe_2O_3)	30/80 mesh	-	-	-	-	-	-	Iron is the most undesirable impurity; white colour or light shades are preferred.

Note: BIS has prescribed IS: 1683-1994 for specifications of barytes used in rubber industry and IS:7588-1992 for that used in explosive industry.

TRADE POLICY

As per Foreign Trade Policy (FTP) 2009-14, in force, import and export of barytes (both lumps and powder) as also witherite (natural barium carbonate) are allowed without restrictions under heading No. 2511.

WORLD REVIEW

The world reserves of barytes are assessed at 240 million tonnes. China, India, USA, Algeria, Morocco, Mexico and Turkey accounted for 82% world reserve (Table-9).

The world production of barytes increased to 8.5 million tonnes in 2010 from 7.5 million tonnes in 2009. The leading producers were China (46%), India (24%), USA (8%) and Morocco (7%). The countrywise production of barytes is given in Table - 10.

Table – 9 : World Reserve of Barytes (By Principal Countries)

(In '000 tonnes)

Country	Reserves
World : Total (rounded)	**240000**
Algeria	29000
China	100000
Germany	1000
India	32000
Iran	NA
Kazakhstan	NA
Mexico	7000
Morocco	10000
Pakistan	1000
Russia	12000
Turkey	4000
UK	100
USA	15000
Other countries	24000

Source : *Mineral Commodity Summaries, 2012.*

Table – 10 : World Production of Barytes (By Principal Countries)

(In '000 tonnes)

Country	2008	2009	2010
World : Total	**9400**	**7500**	**8500**
Brazil	42	39	40[e]
Bulgaria	40	14	0.50
China	5000	2900	3900
Germany	79	46	56
India	1686	2138	2000[e]
Iran	226	361	200[e]
Kazakhstan	170	170	200
Mexico	140	153	143
Morocco	725	587	572
Russia[e]	64	64	64
Thailand	9	52	33
Turkey	150	213	225
U.K.	43	36	33
USA	648	383	670[e]
Vietnam	80	70	90
Other countries	298	274	274

Source : *World Mineral Production, 2006-2010.*

FOREIGN TRADE

Exports

Exports of barytes increased to 8.16 lakh tonnes in 2010-11 from 9.99 lakh tonnes in the previous year. Exports were mainly to Saudi Arabia (34%), Kuwait (12%), Oman and UAE (7% each), Mexico, Colombia, Venezuela and USA (6% each) (Tables - 11 and 12).

Table – 11 : Exports of Barytes (By Countries)

Country Name	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**999334**	**3349865**	**815788**	**2929545**
Saudi Arabia	463356	1422088	274015	893616
Kuwait	59184	195236	93934	310099
Venezuela	16499	69305	45596	241724
Oman	44636	155554	59857	203261
UAE	43891	143206	53401	170293
Mexico	98800	315136	46858	152202
Colombia	14135	46620	46670	149944
U S A	43084	130562	45500	143325
Sudan	24494	107149	23484	101231
Brazil	66812	253547	19124	81486
Other countries	124443	511462	107349	482364

Table – 12 : Exports of Witherite (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**111**	**543**	**17**	**351**
Saudi Arabia	–	–	16	271
Nepal	11	35	1	80
Other countries	100	508	–	–

Imports

In 2010-11, imports of barytes were at 2,843 tonnes as compared to 3,778 tonnes in the previous year. Imports were mainly from China and Thailand (Tables - 13 and 14).

FUTURE OUTLOOK

India ranks second in the production of barytes in the world after China and is one of the important exporters in the world market. The world wide demand for barytes would continue to grow till petroleum products are preferred as chief source of energy. In the domestic front, however, ore exploration is necessary to locate new deposits of barytes especially in Rajasthan, Himachal Pradesh, etc. The apparent domestic demand of barytes is estimated to be 1.36 million tonnes by 2011-12 and 2.09 million tonnes by 2016-17 and is expected to grow at 9% growth rate. About 85% of the world's barytes is used in the petroleum industry.

Table – 13 : Imports of Barytes (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**3778**	**37295**	**2843**	**37498**
China	2080	19436	1587	19000
U K	203	3617	374	6846
Thailand	1353	9773	631	5231
Germany	17	3644	22	4279
Yemen, Rep. of	-	-	200	1230
Italy	-	-	20	686
Korea, Rep. of	++	52	6	122
USA	++	16	3	93
Japan	-	-	++	8
UAE	-	-	++	3
Other countries	125	757	-	-

Table – 14 : Imports of Witherite (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**-**	**-**	**3**	**52**
UK	-	-	2	42
China	-	-	1	9
Other countries	-	-	++	1

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

BAUXITE

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

17 Bauxite

Bauxite is basically an aluminous rock containing hydrated aluminium oxide as the main constituent and iron oxide, silica and titania in varying proportions. Hydrated aluminium oxides present in the bauxite ore are diaspore and boehmite, $Al_2O_3.H_2O$ (Al_2O_3-85%; Al-45%); gibbsite or hydrargillite, $Al_2O_3.3H_2O$ (Al_2O_3- 65.4%; Al-34.6%), and bauxite (containing colloidal alumina hydrogel), $Al_2O_3.2H_2O$ (Al_2O_3-73.9%; Al-39.1%). The iron oxide in bauxite ore is present as hematite or goethite, silica asclay and free quartz, and titania as leucoxene or rutile. Bauxite is an essential ore of aluminium which is one of the most important non-ferrous metals used in the modern industry. It is also an essential ore for refractory and chemical industries. The country has abundant resources of bauxite which can meet both domestic and export demands.

RESOURCES

Resources of bauxite in the country as on 1.4.2010, as per UNFC system, are placed at 3,480 million tonnes. These resources include 593 million tonnes reserves and 2,887 million tonnes remaining resources. By grades, about 84% resources are of metallurgical grade. The resources of refractory and chemical grades are limited and together account for about 4%. By States, Odisha alone accounts for 52% of country's resources of bauxite followed by Andhra Pradesh (18%), Gujarat (7%), Chhattisgarh and Maharashtra (5% each) and Madhya Pradesh and Jharkhand (4% each). Major bauxite resources are concentrated in the East Coast bauxite deposits in Odisha and Andhra Pradesh (Table-1).

EXPLORATION & DEVELOPMENT

Details of exploration carried out for bauxite by GSI, State Directorates of Geology & Mining, Governments of Maharashtra and Odisha and GMDC during 2010-11 are given in Table - 2.

PRODUCTION, STOCKS & PRICES

The production of bauxite at 12.64 million tonnes in 2010-11 decreased by 11% as compared to previous year due to lack of demand, development work and temporary discontinuance of some mines. There were 189 reporting mines in 2010-11 as against 197 in the previous year. Besides, production of bauxite was reported as associate mineral by 3 mines during the year. In all, 72 producers reported production of bauxite in 2010-11. Ten principal producers having 45 mines contributed 87% of the total production. Thirty nine major mines, each producing more than 50 thousand tonnes per annum, together accounted for 90% of the total production.

The contribution of the Panchpatmali bauxite mine of NALCO was 38% of the total production. The share of 18 public sector mines was about 45% of the total production in 2010-11. The same mines had contributed 44% in the previous year.

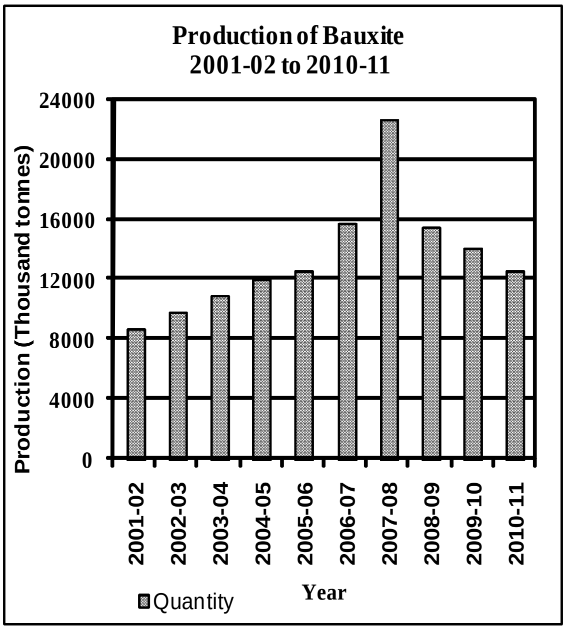


Table - 1 : Reserves/Resources of Bauxite as on 1.4.2010
(By Grades/States)

(In '000 tonnes)

Grade/State	Reserves				Remaining resources								Total resources (A+B)
	Proved STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
		STD121	STD122			STD221	STD222						
All India : Total	**321258**	**89223**	**182457**	**592938**	**105894**	**245091**	**274165**	**655673**	**431006**	**1155570**	**19283**	**2886682**	**3479620**
By Grades													
Chemical	2314	-	-	2314	-	3986	411	2493	182	4947	-	12019	14333
Refractory	26480	44837	951	72268	753	5590	402	5201	208	9326	-	21480	93748
Chemical/Refractory mixed with others	3416	-	39	3455	202	1924	344	1919	216	9038	-	13643	17098
Metallurgical-1	184786	38129	155095	378010	65568	187321	215300	446004	293097	630731	14843	1852864	2230874
Metallurgical-2	28669	961	12265	41895	13956	9938	29189	104223	67309	309123	4440	538178	580073
Metallurgical mixed	11435	338	5019	16792	3919	1135	2518	53898	-	28611	-	90081	106873
Low Grade	32145	4452	5133	41730	21054	6334	18614	22189	54837	108521	-	231549	273279
Mixed Grade excluding chemical/ refractory	21283	268	1312	22863	177	6960	6766	3800	4244	13373	-	35320	58183
Abrasive	113	20	40	173	-	634	123	92	56	961	-	1866	2039
Others	8640	103	2544	11287	92	-	472	2489	5136	9135	-	17324	28611
Unclassified	1088	115	59	1262	171	21257	26	13360	5720	11039	-	51573	52835
Not-known	889	-	-	889	-	12	-	5	-	20765	-	20782	21671
By States													
Andhra Pradesh	-	-	-	-	-	-	-	188971	138120	288176	-	615267	615267
Bihar	-	-	-	-	-	-	-	-	-	4114	-	4114	4114
Chhattisgarh	21246	48435	4818	74499	3992	4069	875	33764	11792	23241	18747	96480	170979
Goa	15169	-	1207	16376	14941	1097	10121	6820	-	8646	-	41625	58001
Gujarat	98794	4560	10407	113761	3359	20295	2586	26593	22107	48019	-	122959	236720
Jammu & Kashmir	-	-	-	-	-	-	-	1323	182	520	-	2025	2025
Jharkhand	16023	7290	12863	36176	5135	11341	5531	15760	17397	54447	536	110147	146323
Karnataka	5399	542	-	5941	1735	394	10	-	2220	45405	-	49764	55705
Kerala	-	-	-	-	29	-	24	2037	9284	2722	-	14096	14096
Madhya Pradesh	17144	1068	1590	19802	3151	11733	1199	6640	53715	50551	-	126989	146791
Maharashtra	14461	4473	7219	26153	16886	6704	12531	52191	10524	49896	-	148732	174885
Odisha	132314	22855	144354	299523	56667	188316	237723	310224	155081	562924	-	1510935	1810458
Rajasthan	-	-	-	-	-	-	-	-	-	528	-	528	528
Tamil Nadu	708	-	-	708	-	1141	3564	960	10084	8363	-	24112	24820
Uttar Pradesh	-	-	-	-	-	-	-	10390	500	8018	-	18908	18908

Figures rounded off.

Table -2: Detailsw of Exploration Activities for Bauxite, 2010-11

Agency/ State/ District	Location/ Area/ Block	Mapping		Drilling		Sampling	Remarks
		Scale	Area (sq km)	No. of boreholes	Meter-age drilled	(No.)	Reserves/Resources estimated
Geological Survey of India							
Gujarat Kachchh	Ukheda, Daban Wamoti Naniand Khanpur	-	-	-	-	-	Bauxite occurs as a tabular body and in the form of pockets within thick laterite capping. The thickness of massive bauxite is about 2.1 m and that of pisolitic bauxite is about 3.0 m with alumina content between 20% to 30%. .
Madhya Pradesh Dindori	Tantar & Tainchi Blocks	-	-	-	-	-	Area is characterised by laterite cappings and basaltic lava flows. Bauxite occurs as a tabular body within thick lateritic capping and also in the form of pockets. Massive bauxite is exposed near Bharra (Maharani) tantar toil area. Pisolitic bauxite exposed near Silpiri (Teklukheru) village is about 30-135 m wide. Alumina content ranges between 20% to 40% in bauxite by visual estimation. Thickness of massive bauxite is about 2.10 m and that of pisolitic bauxite is about 3 m as measured in trench section.
Directorate of Geology, Odisha							
Bhawanipatna & Kalahandi	Around Kaniguma Tq Thuamul - Rampur sub div	1:50,000 1:2000	60 1.4	-	-	418	Seven bauxite bearing plateaux were delineated.
	Around linga-padar Tq Thuamul- Rampur	1:50000 1:25000	101 1.5	-	-	377	Three bauxite bearing plateaux were delineated.
Directorate of Geology & Mining, Maharashtra							
Ratnagiri	Guhaghar Area	-	-	-	-	NA	Surface samples were collected. Laterite above 80-100 m covers about 80% area which shows existence of low grade bauxite.

Contd.

Table -2 (Concld)

Agency/ State/ District	Location/ Area/ Block	Mapping		Drilling		Sampling	Remarks
		Scale	Area (sq km)	No. of boreholes	Meter-age drilled	(No.)	Reserves/Resources estimated
GMDC, Gujarat							
Kachchh	(i) Dadan Mine	-	-	63	724	43	Estimated 1.04 million tonnes resources under indicated category.
	(ii) Roha-Kotda mine	-	-	82	1351	128	Estimated 2.96 million tonnes resources under indicated category.
	(iii) Balachod Mine	-	-	25	275	17	Estimated 1.89 million tonnes resources under indicated category.
	(iv)Nandra-Naredi mine	-	-	15	173	06	Estimated 0.32 million tonnes resources under indicated category.
	(v) Rataoliya Mine	-	-	83	1522	66	Estimated 3.04 million tonnes resources under indicated category.
	(vi) Naredi-II Mine	-	-	22	226	08	Estimated 0.67 million tonnes resources under indicated category.
	(vii) Wandh-I Mine	-	-	19	223	16	Estimated 0.07 million tonnes resources under indicated category.
	(viii) Goniasar Mine	-	-	39	562	61	Estimated 0.94 million tonnes resources under indicated category.
Jamnagar	Mevasa Mine	-	-	42	1100	52	Estimated 0.19 million tonnes resources under indicated category with avg. chemical analysis of Al_2O_3 40-53%, Fe_2O_3 20 - 33%, SiO_2 - 12%, TiO_2 0.5 - 3% & MgO 0.01 - 0.1%.

About 52% of the total production of bauxite was of grade 40-45% Al_2O_3 , 26% was of 45-50% Al_2O_3 grade, 10% was of below 40% Al_2O_3 grade, 4% was of cement grade, 3% was of 50-55% Al_2O_3 grade and one percent was of 55% to below 60% Al_2O_3 grade. Nominal production of less than one percent was reported in refractory, abrasive and chemical grades during 2010-11. Four percent production was reported in grades other than the mentioned ones.

Odisha continued to be the leading producing state accounting for about 38% production. Next in the order of production were Chhattisgarh and Maharahtra (17 % each), Jharkhand (14%), Gujarat (7%) and Madhya Pradesh 5%. The remaining two percent was produced by Goa, Karnataka and Tamil Nadu (Tables - 3 to 6).

Mine head stocks at the end of 2010-11 were 9,575 thousand tonnes as compared to 8,411 thousand tonnes at the beginning of the year. About 95% of total stock was held in Gujarat at the end of the year (Tables- 7).

Table-3: Principal Producers of Bauxite, 2010-11

Name & address of producer	Location of mine	
	State	District
National Aluminium Co. Ltd NALCO Bhawan,P/1, Nayapali Bhubaneshwar – 751 013 Odisha	Odisha	Koraput
Hindalco Industries Ltd Century Bhawan, Dr. Annie Besant Road, Worli Mumbai – 400 025 Maharashtra	Chhattisgarh Jharkhand Maharashtra	Surguja Gumla Lohardag Kolhapur
Bharat Aluminium Co. Ltd BALCO Nagar, Korba – 495 684 Chhattisgarh	Chhattisgarh	Kawardha
Ashapura Minechem Ltd Jeevan Udyog Building, 278, D.N.Road, Fort Mumbai – 400 001	Maharashtra	Ratnagiri
Gujarat Mineral Dev. Corp. Ltd Khanij Bhavan, 132 Ft, Ring Road Vastrapur, Ahmedabad	Gujarat	Jamnagar

Conte

Table-3 Contd.

Name & address of producer	Location of mine	
	State	District
M.P.State Mining Corporation Ltd Paryawas Bhawan, Block No 1(A), Second Floor, Jail Road, Arera Hill, Bhopal - 462 011 Madhya Pradesh	Madhya Pradesh	Rewa Satna
Chhattisgarh Mineral Dev. Corp. Ltd Sonakhan Bhawan II Floor, Ring Road No. 1 Raipur - 492 006, Chhattisgarh	Chhattisgarh	Surguja
Alatage Stone Crushing Ind. 34/35 Corporation Complex, Goaves Hind wadi Dist. Belgaum - 590 011, Karnataka	Maharashtra	Raigarh
Mahaveer Mineral, "Yashashvi" 66, Malviya Nagar Dist. Durg – 491 001, Chhattisgarh.	Chhattisgarh	Kawardha
Panditrao Mines & Minerals Pvt. Ltd At. Post- Minche Budruk Tah. Bhudargad Dist. Kolhapur - 416 223 Maharashtra.	Maharashtra	Kolhapur

Table – 4 : Production of Bauxite, 2008-09 to 2010-11
(By States)

(Quantity in tonnes; value in ₹'000)

States	2008-09		2009-10		2010-11(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**15460202**	**4703221**	**14124093**	**4887897**	**12640785**	**4737480**
Chhattisgarh	1674427	557371	1687069	607911	2109945	765262
Goa	463150	34736	31050	3105	100900	10090
Gujarat	3514016	897680	2687306	667424	913421	293540
Jharkhand	1585356	552684	1670577	673016	1827805	619458
Karnataka	127830	24418	123316	32748	65517	14162
Madhya Pradesh	1037724	376581	1056847	365097	585791	122283
Maharashtra	2053512	625275	1985006	628556	2135235	550780
Odisha	4734421	1591786	4879580	1909188	4856275	2353153
Tamil Nadu	269766	42690	3342	852	45896	8752

Table – 5 (A) : Grad wise Production of Bauxite, 2009-10
(By Sectors, States and Districts)

(Qty in tonnes; value in ₹'000)

State/District	No. of mines	Production by Grades : Al_2O_3 content — For use in Alumina & Aluminium extraction						For use other than Alumina & Aluminium extraction					Total	
		60% & above	55%-60%	50%-55%	45%-50%	40%-45%	Below 40%	Cement	Abrasive	Refractory	Chemical	Others	Quantity	Value
India	**197(5)**	**-**	**84207**	**401277**	**2095406**	**8458104**	**417306**	**769617**	**105310**	**203889**	**4200**	**1584777**	**14124093**	**4887897**
Public sector	18	-	48544	271707	116884	5727708	-	-	-	-	-	-	6164843	2373085
Private sector	179(5)	-	35663	129570	1978522	2730396	417306	769617	105310	203889	4200	1584777	7959250	2514812
Chhattisgarh	**15**	**-**	**-**	**-**	**1387530**	**298920**	**96**	**-**	**-**	**523**	**-**	**-**	**1687069**	**607911**
Kanker	3	-	-	-	-	120	96	-	-	523	-	-	739	240
Kawardha	2	-	-	-	300000	211326	-	-	-	-	-	-	511326	106377
Surguja	10	-	-	-	1087530	87474	-	-	-	-	-	-	1175004	501294
Goa	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**31050**	**-**	**-**	**-**	**-**	**31050**	**3105**
South Goa	1	-	-	-	-	-	-	31050	-	-	-	-	31050	3105
Gujarat	**109**	**-**	**84207**	**375577**	**50**	**13790**	**4250**	**508686**	**105310**	**200277**		**1395159**	**2687306**	**667425**
Amreli	1	-	-	-	-	-	-	45609	-	-	-	-	45609	11357
Jamnagar	91	-	200	-	50	13790	-	400251	103756	200277	-	1296211	2014535	479790
Junagarh	1	-	-	-	-	-	-	-	-	-	-	48700	48700	4870
Kachchh	9	-	84007	375577	-	-	-	-	1554	-	-	13546	474684	150427
Kheda	2	-	-	-	-	-	-	5300	-	-	-	15052	20352	4419
Porbandar	4	-	-	-	-	-	-	57526	-	-	-	21650	79176	16051
Sabarkantha	1	-	-	-	-	-	4250	-	-	-	-	-	4250	510
Jharkhand	**35**	**-**	**-**	**-**	**28966**	**1312179**	**329432**	**-**	**-**	**-**	**-**	**-**	**1670577**	**673016**
Gumla	21	-	-	-	24000	953186	-	-	-	-	-	-	977186	392396
Latehar	1	-	-	-	-	24048	-	-	-	-	-	-	24048	11254
Lohardaga	13	-	-	-	4966	334945	329432	-	-	-	-	-	669343	269366

Contd.

Table-5(A) (Concld.)

(Qty in tonnes; value in ₹'000)

State/District	No. of mines	Production by Grades : Al_2O_3 content — For use in Alumina & Aluminium extraction: 60% & above	55%-60%	50%-55%	45%-50%	40%-45%	Below 40%	For use other than Alumina & Aluminium extraction: Cement	Abrasive	Refractory	Chemical	Others	Total: Quantity	Value
Karnataka	**2**	**-**	**-**	**-**	**-**	**120016**	**3300**	**-**	**-**	**-**	**-**	**-**	**123316**	**32747**
Belgaum	1	-	-	-	-	-	3300	-	-	-	-	-	3300	343
South Kannad	1	-	-	-	-	120016	-	-	-	-	-	-	120016	32405
Madhya Pradesh	**17(4)**	**-**	**-**	**-**	**99675**	**858220**	**76417**	**15246**	**-**	**3089**	**4200**	**-**	**1056847**	**365097**
Katni	2(1)	-	-	-	98135	40295	45400	15246	-	-	-	-	199076	40634
Rewa	2	-	-	-	-	44825	431	-	-	-	-	-	45256	15498
Satna	10(3)	-	-	-	1540	40600	27228	-	-	3089	4200	-	76657	19017
Shahdol	2	-	-	-	-	732500	-	-	-	-	-	-	732500	289495
Sidhi	1	-	-	-	-	-	3358	-	-	-	-	-	3358	453
Maharashtra	**13**	**-**	**-**	**25700**	**579185**	**975868**	**-**	**214635**	**-**	**-**	**-**	**189618**	**1985006**	**628556**
Kolhapur	6	-	-	25700	488385	710753	-	214635	-	-	-	-	1439473	457484
Raigad	5	-	-	-	-	18500	-	-	-	-	-	189618	208118	40343
Ratnagiri	2	-	-	-	90800	246615	-	-	-	-	-	-	337415	130729
Odisha	**4(1)**	**-**	**-**	**-**	**-**	**4879111**	**469**	**-**	**-**	**-**	**-**	**-**	**4879580**	**1909188**
Koraput	2	-	-	-	-	4878888	-	-	-	-	-	-	4878888	1908963
Sundargarh	2(1)	-	-	-	-	223	469	-	-	-	-	-	692	225
Tamil Nadu	**1**	**-**	**-**	**-**	**-**	**-**	**3342**	**-**	**-**	**-**	**-**	**-**	**3342**	**852**
Salem	1	-	-	-	-	-	3342	-	-	-	-	-	3342	852

Figure in parentheses indicate number of associated mines with fireclay, kaolin, manganese ore and ochre.

Table – 5 (B) : Grad wise Production of Bauxite, 2010-11
(By Sectors, States and Districts)

(Qty in tonnes; value in ₹'000)

State/District	No. of mines	Production by Grades : Al_2O_3 content — For use in Alumina & Aluminium extraction: 60% & above	55%-60%	50%-55%	45%-50%	40%-45%	Below 40%	For use other than Alumina & Aluminium extraction: Cement	Abrasive	Refractory	Chemical	Others	Total: Quantity	Value
India	**189(3)**	-	**76018**	**421741**	**3255926**	**6534413**	**1255531**	**467492**	**56233**	**39446**	**9407**	**524578**	**12640785**	**4737480**
Public sector	18	-	52396	333898	1196355	3339564	765634	-	-	-	-	35816	5723663	1133189
Private sector	171(3)	-	23622	87843	2059571	3194849	489897	467492	56233	39446	9407	488762	6917122	3604291
Chhattisgarh	**13**	-	-	-	**1745786**	**363457**	-	-	**702**	-	-	-	**2109945**	**765262**
Kanker	1	-	-	-	-	-	-	-	-	-	-	-	*	*
Kawardha	2	-	-	-	509150	189500	-	-	702	-	-	-	699352	170881
Surguja	10	-	-	-	1236636	173957	-	-	-	-	-	-	1410593	594381
Goa	**1**	-	-	-	-	-	-	**100900**	-	-	-	-	**100900**	**10090**
South Goa	1	-	-	-	-	-	-	100900	-	-	-	-	100900	10090
Gujarat	**98**	-	**76018**	**421741**	**14817**	**10071**	**3715**	**94203**	**55381**	**39446**	**9407**	**188622**	**913421**	**293540**
Amreli	1	-	-	-	-	-	-	8380	-	-	-	-	8380	1508
Jamnagar	84	-	-	175	-	10071	120	68721	54096	39446	8954	138382	319965	100430
Kachchh	9	-	76018	421566	14817	-	3595	365	1285	-	453	50180	568279	189565
Porbandar	3	-	-	-	-	-	-	16737	-	-	-	60	16797	2037
Sabarkantha	1	-	-	-	-	-	-	-	-	-	-	-	*	*
Jharkhand	**36**	-	-	-	**15030**	**1400705**	**412070**	-	-	-	-	-	**1827805**	**619458**
Gumla	23	-	-	-	14825	1032057	-	-	-	-	-	-	1046882	373925
Latehar	1	-	-	-	-	19667	-	-	-	-	-	-	19667	9352
Lohardaga	12	-	-	-	205	348981	412070	-	-	-	-	-	761256	236181

Contd.

Table-5(B) (Concld.)

(Qty in tonnes; value in ₹'000)

State/District	No. of mines	Production by Grades : Al_2O_3 content For use in Alumina & Aluminium extraction						For use other than Alumina & Aluminium extraction					Total	
		60% & above	55%-60%	50%-55%	45%-50%	40%-45%	Below 40%	Cement	Abrasive	Refractory	Chemical	Others	Quantity	Value
Karnataka	**2**	-	-	-	-	**38300**	**27217**	-	-	-	-	-	**65517**	**14162**
Belgaum	1	-	-	-	-	-	27217	-	-	-	-	-	27217	3806
Dakshin Kannad	1	-	-	-	-	38300	-	-	-	-	-	-	38300	10356
Madhya Pradesh	**18(3)**	-	-	-	**246289**	**163646**	**172160**	**3696**	-	-	-	-	**585791**	**122283**
Jabalpur	1	-	-	-	-	-	-	-	-	-	-	-	*	*
Katni	2	-	-	-	137710	12143	38480	-	-	-	-	-	188333	36705
Rewa	1	-	-	-	75090	-	-	-	-	-	-	-	75090	23653
Satna	9(3)	- -	-	-	32925	19123	7356	3696	-	-	-	-	63100	11394
Shahdol	2		-	-	-	132380	124870	-	-	-	-	-	257250	50278
Sidhi	3	-	-	-	564	-	1454	-	-	-	-		2018	253
Maharashtra	**15**	-	-	-	**162130**	**1414202**	-	**222947**	-	-	-	**335956**	**2135235**	**550780**
Kolhapur	5	-	-	-	162130	791142	-	217947	-	-	-	-	1171219	325918
Raigarh	6	-	-	-	-	-	-	-	-	-	-	335956	335956	54458
Ratnagiri	4	-	-	-	-	623060	-	5000	-	-	-	-	628060	170404
Odisha	**3**	-	-	-	**1071874**	**3144032**	**640369**	-	-	-	-	-	**4856275**	**2353153**
Koraput	2	-	-	-	1071874	3144032	640369	-	-	-	-	-	4856275	2353153
Sundergarh	1	-	-	-	-	-	-	-	-	-	-	-	*	*
Tamil Nadu	**3**	-	-	-	-	-	-	**45746**	**150**	-	-	-	**45896**	**8752**
Namakkal	2	-	-	-	-	-	-	-	-	-	-	-	*	*
Salem	1		-	-	-	-	-	45746	150	-	-	-	45896	8752

Figure in parentheses indicate number of associated mines with laterite and ochre
**only labour reported*

Table – 6 : Production of Bauxite, 2009-10 and 2010-11 (P)
(By Frequency Groups)

(Quantity in tonnes)

Production Group	No. of Mines		Production		Percentage to total production		Cumulative Percentage	
	2009-10	2010-11	2009-10	2010-11	2009-10	2010-11	2009-10	2010-11
Total	**197(5)**	**189(3)**	**14124093**	**12640785**	**100.00**	**100.00**	**-**	**-**
Upto 1000	54(1)	69	10279	3378	0.07	0.03	0.07	0.03
1001 - 3000	12(1)	14(1)	23796	26778	0.17	0.21	0.24	0.24
3001 - 5000	14(1)	14(2)	60635	64853	0.43	0.51	0.67	0.75
5001 - 10000	16	12	120275	90890	0.85	0.72	1.52	1.47
10001 - 25000	34(2)	22	597448	326006	4.23	2.58	5.75	4.05
25001 - 50000	21	19	771016	698162	5.46	5.52	11.21	9.57
50001 and above	46	39	12540644	11430718	88.79	90.43	100.00	100.00

Figures in parenthesis indicate number of associated mines.

Table – 7 (A) : Mine-head Stocks of Bauxite at the beginning of the year, 2010-11
(By States & Grades)

(In tonnes)

State	Stocks by Grades : AL_2O_3 Content For use Alumina & Aluminium metal extraction						For use other than Alumina & Aluminium metal extraction					Total
	60% & above	55% - 60%	50% - 55%	45% - 50%	40% - 45%	Below 40%	Cement	Abrasive	Refra-ctory	Chemical	Others	
India	**-**	**57134**	**828738**	**64243**	**243552**	**111847**	**335120**	**9960**	**13653**	**3855**	**6742611**	**8410713**
Chhattisgarh	-	-	-	37339	1029	144	-	-	4274	-	-	42786
Goa	-	-	-	-	-	23528	500	-	-	-	-	24028
Gujarat	-	57134	826444	250	79840	11823	310171	9960	8589	-	6723081	8027292
Jharkhand	-	-	-	371	21414	28	-	-	-	-	-	21813
Karnataka	-	-	-	-	14246	6641	-	-	-	-	-	20887
Madhya Pradesh	-	-	1552	2545	7881	24185	2082	-	790	3855	-	42890
Maharashtra	-	-	742	20142	105887	-	22367	-	-	-	19530	168668
Odisha	-	-	-	3596	5470	24911	-	-	-	-	-	33977
Tamil Nadu	-	-	-	-	7785	20587	-	-	-	-	-	28372

Table – 7 (A) : Mine-head Stocks of Bauxite at the end of the year, 2010-11 (By States & Grades)

(In tonnes)

State	Stocks by Grades : AL_2O_3 Content For use Alumina & Aluminium metal extraction					For use other than Alumina & Aluminium metal extraction					Total
	55% - 60%	50% - 55%	45% - 50%	40% - 45%	Below 40%	Cement	Abrasive	Refra-ctory	Chemical	Others	
India	**1685**	**611153**	**200303**	**1084251**	**328008**	**5553642**	**3096**	**20508**	**353106**	**1419598**	**9575350**
Chhattisgarh	-	-	52878	4601	-	-	80	4275	-	-	61834
Goa	-	-	-	-	-	30928	-	-	-	-	30928
Gujarat	1685	611153	94533	867026	226281	5490004	3016	16233	349949	1400990	9060870
Jharkhand	-	-	585	22160	12201	-	-	-	-	-	34946
Karnataka	-	-	19296	-	4822	-	-	-	-	-	24118
Madhya Pradesh	-	-	9478	7842	53086	94	-	-	3157	-	73657
Maharashtra	-	-	21374	161649	-	19291	-	-	-	18608	220922
Odisha	-	-	2159	20973	15183	-	-	-	-	-	38315
Tamil Nadu	-	-	-	-	16435	13325	-	-	-	-	29760

MINING & TRANSPORT

The mining of bauxite is carried out by opencast method. The mines are classified in the following three categories depending upon the level of mechanisation.

(i) Manually-operated mines;

(ii) Semi-mechanised mines;

(iii) Mechanised mines.

Manually-operated Mines

Many bauxite mines are small, producing less than 25,000 tpy. The entire work of overburden removal, extraction of bauxite and loading of bauxite in trucks is carried out manually and the bauxite is transported to respective railway siding or plants by road.

Semi-mechanised Mines

In semi-mechanised mines, mining operations are carried out by Jack hammer drilling and normally ANFO mixture is used as an explosive for blasting in mineralised zone as well as in overburden, if required. Loading of mineral to trucks or dumpers is done by payloaders or manually. Since bauxite occurs as small lenses or pockets of boulders or as segregations in murrum and laterite, it is difficult to mechanise the mining operations.

Mechanised Mines

Mechanised mining operations are carried out in a few captive mines of the alumina/aluminium plants. In these mines, use of compressed-air drills for drilling blastholes is made. Sometimes, compressed-air jack hammer drills are also used for drilling blastholes for secondary blasting of boulders and also in toe drilling in irregular bauxite faces which result due to improper fragmentation of bauxite. The blasted overburden/ore materials are handled and transported separately by using shovels or excavators and trucks/dumpers. Separate benches are maintained for the overburden and ores. The height of benches in ore varies from 1.5 to 7.5 m. Hindalco has done away with drilling and blasting at its Durgmanwadi mines in Maharashtra by using state-of-the-art ripper dozer which is regarded as "Miner's Plough". A ripper dozer silently ploughs the mine surface to extract the mineral. It has totally eliminated the ground vibrations and air pollution normally caused by dust, gases and noise.

In Bagru Hill mines of Hindalco in Jharkhand, the blasted bauxite is transported with the help of dumpers to the crusher. The 4-inch crushed bauxite is then transported to Lohardaga railway station by a monocable aerial ropeway.

BALCO also has monocable ropeway for transporting bauxite from its captive mines to the alumina plant at Korba in Chhattisgarh.

Computerised mine planning, use of mobile crusher, simultaneous land reclamation, restricting operations to small portions of mining area at a time, etc. have greatly helped in conserving energy and faster land rehabilitation.

In Odisha, NALCO has adopted the mechanised 'Trench method' of opencast mining at Panchpatmali mine. In this method, a pilot trench is driven through the mid deposit and several other trenches are opened on both the sides in a staggered pattern exposing and creating more number of working fronts. The fertile top soil is preserved by dozing aside and hard laterite of 3 m thickness is drilled and blasted. The overburden is removed using higher capacity mobile equipment like dumpers and wheel loaders to expose the bauxite bed.

The top slice of bauxite having 8-10 m thickness is loosened by drilling and blasting and the bauxite of 3-4 m thickness at the bottom contact is removed selectively using backhoe shovels. The mine has achieved overall capacity of 4.8 million tonnes bauxite after expansion. Accordingly, higher capacity mobile equipment like dumpers, wheel loaders, ripper dozers and faster drills have been introduced. NALCO is planning to further increase bauxite mining capacity to 6.3 million tonnes under Second phase expansion.

CONSUMPTION

In 2010-11, reported consumption of bauxite was 11.77 million tonnes as compared to 12.23 million tonnes in the previous year. Alumina/aluminium industry was the principal consumer of bauxite, accounting for 91% consumption in 2010-11 followed by cement (7.5%) and refractory (1%) (Table-8).

Gujarat was the main supplier of abrasive and refractory grade bauxite. Alumina plants draw supplies mostly from their captive mines. Hindalco sources bauxite from other suppliers also (Table - 9).

USES & SPECIFICATIONS

Bauxite is primarily used to produce alumina through the Bayer process. Aluminium industry normally uses bauxite containing minimum 38% Al_2O_3. However, slightly inferior grades with a suitable blend are also used, depending upon other characteristics, such as solubility in caustic soda and absence of silica. The IS : 5953-1985 (Reaffirmed 2008) specifications for metallurgical grade bauxite are given in Table-10. Details of the 'Aluminium and Alumina' industries are provided in a seperate review.

Table - 8 : Reported Consumption of Bauxite* 2008-09 to 2010-11 (By Industries)

(In tonnes)

Industry	2008-09	2009-10(R)	2010-11(P)
All Industries	**12348600**	**12226200**	**11767700**
Abrasives	4200(5)	4200(5)	4200(5)
Alumina[1/]	10860800(4)	11026500(4)	10730800(4)
Cement	1144400(28)	1042800(27)	888000(27)
Ceramic	100(3)	100(3)	100(3)
Chemical	5900(3)	5900(3)	5900(3)
Ferro-alloys	8900(5)	12900(5)	10200(6)
Fertilizer	18200(2)	18200(2)	18200(2)
Iron & steel	1200(7)	1200(7)	1200(7)
Refractory[2/]	304900(62)	114400(53)	109100(53)

Figures rounded off. Data collected on non-statutory basis. Figures in parentheses denote the number of units in organised sector reporting consumption.*
*(*Includes actual reported consumption and/or estimates made wherever required).*
** Excludes industrial end-use consumption of laterite which was 3,011,900 tonnes, 3,614,500 tonnes and 3,240,400 tonnes during 2008-09, 2009-10 and 2010-11, respectively.*
1/ Includes about 8083 thousand tonnes, 9096 thousand tonnes and 9726 thousand tonnes bauxite equivalent of alumina estimated to have been consumed in the production of aluminium metal in 2008-09, 2009-10 and 2010-11, respectively.
2/ Includes consumption of calcined bauxite.

Table – 9 : Domestic Sources of Supplies of Bauxite to Alumina Plants

Producer	Plant	Source of supply
NALCO	Damanjodi, Koraput (Odisha)	Captive mines at Panchpatmali Hills, Koraput dist, Odisha.
BALCO	Korba (Chhattisgarh)	Captive mines in Surguja & Bodai-Daldali in Kawardha (Kabirdham) dist. Chhattisgarh.
Hindalco Industries	Renukoot (Uttar Pradesh)	Captive mines in Shahdol dist., Madhya Pradesh; Gumla and Lohardaga dist., Jharkhand and Surguja dist. in Chhattisgarh & other suppliers in Odisha, Madhya Pradesh and Jharkhand; Katni Bauxite Pvt. Ltd, Satna, Laxmidasji Ramji, Katni and Minerals & Minerals Corp., Gujarat.
	Belgaum (Karnataka) Muri, Ranchi (Jharkhand)	Captive mines in Chandgad and Durgmanwadi, Kolhapur dist, Maharashtra and Lohardaga dist., Jharkhand.
Vedanta Aluminium	Lanjigarh (Odisha)	GMDC, Gujarat, Ashapura Minechem, Maharashtra, BALCO Chhattisgarh.

Table – 10 : Specifications for Metallurgical Grade Bauxite (IS : 5953-1985; Reaffirmed 2008)

(In % by weight)

Constituent	Gr. I (essentially gibbsite or trihydrate)	Gr. II * (mixture of gibbsite, boehmite and diaspore or trihydrate & monohydrate)
Total Al_2O_3 min	40	47
Total available alumina, min	36	43
Total SiO_2, max	4	4
Module Al_2O_3/SiO_2, min	12	12
Fe_2O_3/TiO_2, max	30	30
P_2O_5, max	0.20	0.20
V_2O_5, max	0.20	0.20
Loss on ignition at 1100 °C	20	20

** Normally,1 to 20% diaspore and 5 to 7% boehmite.*

In steel industry, bauxite is used as a slag corrector in place of fluorite. Steel industry consumes bauxite, containing 45 to 54% Al_2O_3 and 5% SiO_2 (max). Size preference is 25 to 125 mm with a tolerance of 5% (max) for -25 mm and +100 mm fractions.

The BIS has prescribed the following specifications for bauxite in refractory industry (Table-11).

Table – 11 : IS Specifications of Bauxite for Refractory Industry (IS : 10817-1984: Reaffirmed 2008)

Constituent	Percent
Al_2O_3	58 min
Fe_2O_3	3 max
TiO_2	3 max
CaO	0.5 to 0.6
LOI	27 to 30

The refractory manufacturers use bauxite of the following specifications:

Specifications of Bauxite used by Refractory Industry

Constituent	Percent
Al_2O_3	55-60
Fe_2O_3	4-6
TiO_2	5-8
SiO_2	2
Others	25-40
PCE	33-36 (Ortan)

The IS specifications of bauxite for consumption in chemical and petroleum industries are given in Table-12.

Table – 12 : IS Specifications of Bauxite for Chemical and Petroleum Industries (IS : 3605-1984; Reaffirmed 2010)

Constituent	Requirement
Alumina (as Al_2O_3), % by mass, min	58.0
Silica (as SiO_2), % by mass, max	3.0
Iron oxide (as Fe_2O_3), % by mass, max	2.0
Titania (as TiO_2), % by mass, max	4.0
Phosphorus pentoxide (as P_2O_5), % by mass, max	0.3
Manganese dioxide (as MnO), % by mass, max	0.1
Calcium and magnesium (as CaO), % by mass, max	2.0
Loss on ignition, % by mass, max	32.0

Apart from the chemical specifications, the physical requirements are that the material passing through 90-micron IS sieve but retained on 212-micron IS sieve should be 90% max, that passing through 300-micron IS sieve shall be 1% by mass max and that passing through 212- micron IS sieve but retained on 300-micron IS sieve should be 10% maximum.

The other specifications laid down by BIS are IS:8228-1976 (Reaffirmed 2008) for bauxite sand and IS:8988-1978 (Reaffirmed 2008) for bauxite powder for foundry washes.

SUBSTITUTION

There is no substitute of bauxite for aluminium metal extraction on a large scale. However, calcined clay can be substituted for refractory bauxite but only with reduction in length of time and stock resistance. Sillimanite, alumina, silicon carbide, magnesite-chromite and carbon-magnesite refractories are the alternatives for high-alumina material but at higher cost. Silicon carbide and diamonds can substitute for fused aluminium oxide in abrasive use but again at higher cost. Synthetic mullite substitutes for bauxite-based refractories. Silicon carbide and alumina- zirconia are costlier substitutes for bauxite-based abrasives. The raw material like alunite, anorthosite, coal wastes and oil shales are other potential sources of alumina. The extraction would require new plants with different technology. These non-bauxitic materials could satisfy the demand for primary metal, refactories, aluminium chemicals and abrasives.

TRADE POLICY

As per the Foreign Trade Policy for 2009-2014 and policy on export and import, imports of aluminium ores and concentrates including natural bauxite, whether calcined or not, and others are permitted freely. There are no policy restrictions on the export of bauxite.

WORLD REVIEW

The bauxite reserves are estimated at 29 billion tonnes, located mainly in Guinea (26%), Australia (21%), Brazil (12%) and Vietnam and Jamaica (7% each). Countrywise reserves of bauxite are given in Table - 13.

The world production of bauxite was estimated at 219 million tonnes in 2010. Australia continued to be the major producer accounting for 31% share in total production, followed by Brazil (15%), China (14%), Guinea (8%)and India (6%) (Table -14).

Table – 13 : World Reserves of Bauxite (By Principal Countries)

(In '000 tonnes)

Country	Reserves
World : Total (rounded)	**29,000,000**
Australia	6,200,000
Brazil	3,600,000
China	830,000
Greece	600,000
Guinea	7,400,000
Guyana	850,000
India*	900,000
Jamaica	2,000,000
Kazakhstan	160,000
Russia	200,000
Suriname	580,000
USA	20,000
Venezuela	320,000
Vietnam	2,100,000
Other countries	3,300,000

Source: *Mineral Commodity Summaries, 2012.*
** India's total resources of bauxite as per UNFC system are placed at 3.48 billion tonnes as on 1.4.2010.*

China

Chinalco completed the construction of 1.7 million tpy bauxite mine adjacent to an 800,000 tpy alumina refinery at Zunji in Guizhon Province which was also completed. Galuminum Group Ltd was developing a Guangdong mine of 1.6 milion tpy capacity to supply bauxite to the nearby 800,000 tpy alumina refinery at Quingzhen in Guizhon Province. The refinery was slated for completion in 2011 while the mine would be completed in early 2012.

Indonesia

PT Aneka Tambang (Antam) was developing a bauxite deposit - besides continuing exploration in several other bauxite prospects in West Kalimantan for supplying bauxite to the nearby 300,000 tpy chemical grade alumina refinery at Tayan. The construction of the refinery was to start in 2011 with production expected from early 2014.

Saudi Arabia

Saudi Arabian Mining Co. and Alcoa began construction of a project comprising Raz as Zawr smelter (740,000 tpy) and a rolling mill (380,000 tpy) to be completed in 2013, in addition to a 4 million tpy bauxite mine at Al Baitha and a 1.8 million tpy alumina refinery to be completed in 2014.

Turkey

Demiroller Mining Co. was expanding the production of bauxite from 400,000 tpy to 750,000 tpy in 2011.

Vietnam

Vinacomin and Chinalco started construction of a 600,000 tpy alumina refinery and an adjacent bauxite mine in Lam Dong to be completed in 2012. They were also constructing a 650,000 tpy refinery along with a mine in Nhan Co, Dak Nong Province that was slated to be completed in 2013. Atlantic Ltd was studying the feasibility of developing the Bao Loc bauxite deposit. This would be followed by studies for a refinery and smelter subject to the feasibility of the mine.

FOREIGN TRADE

Exports

Exports of bauxite decreased substantially to 119 thousand tonnes in 2010-11 from 476 thousand tonnes in 2009-10. Exports were mainly to Kuwait (42%), Qatar (17%), Oman(14%) and Nepal (9%) (Tables - 15).

Imports

In 2010-11, imports of bauxite increased to 63,584 tonnes from 54,345 tonnes in the previous year. Imports were mostly from China (Table - 16).

Table – 14 : World Production of Bauxite, 2008 to 2010 (By Principal Countries)

(In '000 tonnes)

Country	2008	2009	2010
World: Total	**214000**	**197000**	**219000**
Australia	64038	66168	68535
Brazil	28098	26074	32028
China	25177	29213	30000[e]
Greece	2174	1935	1902
Guinea	17682	14774	16427
Guyana	2092	1485	1083
India*	15460	13952	12064[e]
Jamaica	14636	7818	8540
Kazakhstan	5160	5131	5310
Russia	5675	5300	5000
Suriname	5333	3388	3096
Venezuela	4192	3611	3126
Other countries	24283	19700	31889

Source: *World Mineral Production, 2006-2010.*
**India's production of bauxite during 2008-09, 2009-10 and 2010-11 was 15,460 thousand tonnes, 14,124 thousand tonnes and 12,641 thousand tonnes, respectively.*

Table – 16 : Imports of Bauxite (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**54345**	**1141378**	**63584**	**1201033**
China	53574	1109414	62735	1176872
Netherlands	162	6360	360	12981
USA	103	3608	222	5904
Germany	-	-	200	2009
Korea,Rep.of	-	-	7	1523
Austria	3	296	10	1437
Pakistan	-	-	50	306
Other countries	503	21700	-	1

Table – 15 : Exports of Bauxite (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All countries	**475692**	**732096**	**119154**	**303921**
Slovenia	4861	42858	7200	65825
Kuwait	182244	227560	49800	59077
Japan	2780	56210	3200	44803
Oman	-	++	16170	25974
Qatar	-	++	20000	21456
Saudi Arabia	2747	26472	2995	21071
France	40	978	480	11300
Italy	6386	14798	1127	10444
USA	1661	7799	1931	8492
Nepal	6371	4296	10723	7131
Other countries	268602	351125	5528	28348

FUTURE OUTLOOK

The country has large resources of bauxite, occupying the sixth place in the world total resources. The resources of metallurgical grade bauxite are quite adequate while those of the chemical and refractory grade bauxite are relatively limited considering the future requirements. As per the Report of the Working Group for 12th Five Year Plan, the abundance of bauxite resources in Eastern Ghat regions of Odisha and Andhra Pradesh are likely to be the hubs for bauxite mining activities in future. The Working Group has recommended that the large deposits of these areas can be reserved for the greenfield alumina refineries. Additional bauxite resources are required for the brownfield expansion of the existing alumina refineries.

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

BENTONITE

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

18 Bentonite

Bentonite is essentially highly plastic clay containing not less than 85% clay mineral, montmorillonite. Agreat commercial importance is attached with Bentonite which possess inherent bleaching properties like fuller's earth. Hence, it is known as bleaching clay. There are two types of bentonites; namely, swelling-type or sodium bentonite and non-swelling-type or calcium bentonite. Sodium bentonite is usually referred to as bentonite, whereas calcium bentonite is called Fuller's earth. The commercial importance of bentonite depends more on its physico-chemical properties rather than its chemical composition. Excellent plasticity and lubricity, high dry-bonding strength, high shear and compressive strength, low permeability and low compressibility make bentonite commercially viable. Bentonite is valued in foundry sand binding, drilling mud, iron ore pelletisation and as waterproofing and sealing agent in civil engineering works. Processing is a prerequisite for bentonite marketing. Bhavnagar and Kachchh districts of Gujarat and Barmer district of Rajasthan are the major producers of bentonite. The sodium bentontie mined in Rajasthan tends to be of lower quality and is used as foundry sand. Both activated and granular bentonite are produced in the country. Bentonite is exported in unprocessed (crude) and processed (including activated) forms as well.

RESOURCES

The total resources of bentonite in the country as per UNFC system as on 1.4.2010 are about 568 million tonnes out of which 25 million tonnes are categorised as reserves. Bulk of the resources i.e., 424 million tonnes (76%) are in Rajasthan, 134 million tonnes (24%) in Gujarat and the remaining in Tamil Nadu, Jharkhand and Jammu & Kashmir. About 9 million tonnes resources are placed under drilling fluid grade, 55 million tonnes under foundry grade and 19 million tonnes resources are placed under poor/blendable grades, respectively. Substantial quantity (485 million tonnes or 85%) of total resources is placed under 'unclassified' and 'not-known' categories. The reserves/resources of bentonite as per the UNFC system as on 1.4.2010 are furnished in Table - 1.

EXPLORATION & DEVELOPMENT

During 2010-11, Directorate of Mines & Geology, Rajasthan carried out exploration near village Pusad, Barmer district where occurrences have been noticed. It is grey to off white in colour. The deposit has a length of about 30 m, width 20 m and exposed thickness was found to be about 105 m, but bottom has not been exposed. Besides this, some ferruginous sandstone patches were also noticed to occur as overlain marker horizon of bentonite mineral. The bentonite appeared to be of foundry grade. Regional Mineral Survey over 210 sq km Regional Geological Mapping over 16 sq km and Detailed Geological Mapping over 2 sq km was carried out.

PRODUCTION

Bentonite is declared as a minor mineral under Mines & Minerals (Development & Regulation) Act, 1957.

The value of bentonite produced in India in 2009-10 at ₹ 40 crore increased by 172% as compared to the previous year. During 2009-10, Rajasthan alone accounted for 71% share and Gujarat for the remaining 29% in the total value of production of bentonite (Table - 2).

MINING & PROCESSING

Bentonite is exploited mainly from manual mines. The bentonite deposit is very close to the surface and mined to a depth of 25 metres. A few mine owners in Kachchh and Bhavnagar districts of Gujarat deploy shovels and dumpers for mining, haulage, etc. Working of bentonite often involves selective mining, blending and processing to achieve the required grade.

The processing involves drying, grinding, sizing and at times use of additive for cation exchange. The mined material is first graded and sun-dried before pulverisation. Bentonite is processed generally by simple milling techniques that involve removal of water and volatile matter like carbon dioxide, if present, and grinding it to the appropriate sizes. Small amounts of chemicals like soda ash are added sometimes before grinding to control the properties of bentonite. Raw bentonite when delivered to the processing plant contains 25 to 40% moisture. It is, therefore, dried in dryers and the dried clay is ground in roll and hammer mills or other pulverisers and screened. Most of the bentonite is ground to approximately 90% finer than 200 mesh. For insecticide purpose, bentonite is made in the form of granules. Ashapura Minchem Ltd is one of the major processors which processed about 159,789 tonnes of bentonite lumps and produced 50,993 tonnes of granules during 2010-11.

Table – 1 : Reserves/Resources of Bentonite as on 1.4.2010
(By Grades/States)

(In tonnes)

Grade/State	Reserves: Probable STD121	Reserves: Probable STD122	Reserves: Total (A)	Remaining resources: Pre-feasibility STD221	Remaining resources: Measured STD331	Remaining resources: Indicated STD332	Remaining resources: Inferred STD333	Remaining resources: Reconnaissance STD334	Remaining resources: Total (B)	Total resources (A+B)
All India : Total	**11415982**	**13644526**	**25060508**	**3067**	**26519818**	**225744237**	**265309715**	**25730000**	**543306838**	**568367346**
By Grades										
Drilling fluid	-	-	-	-	-	-	9303460	-	9303460	9303460
Foundry	592570	3565120	4157690	-	420000	-	50468524	-	50888524	55046214
Poor/blendable	-	-	-	-	-	-	18530969	-	18530969	18530969
Unclassified	2126060	609406	2735466	3067	13583818	5302333	52583197	-	71472415	74207881
Not-known	8697352	9470000	18167352	-	12516000	220441904	134423565	25730000	393111469	411278821
By States										
Gujarat	-	12460170	12460170	-	2163813	1904	119553173	-	121718890	134179060
Jammu & Kashmir	-	-	-	-	-	-	147400	-	147400	147400
Jharkhand	-	609406	609406	3067	-	-	367527	-	370594	980000
Rajasthan	11415982	574950	11990932	-	24356005	222017000	139423096	25730000	411526101	423517033
Tamil Nadu	-	-	-	-	-	3725333	5818519	-	9543852	9543852

Figures rounded off.

Table – 2 : Value of Production of Bentonite 2007-08 to 2009-10 (By States)

(In ₹'000)

State	2007-08	2008-09(P)	2009-10(P)
India	**128414**	**146768**	**400260**
Gujarat	115153	115153	115153
Rajasthan	13261	31615	285107

Source: *State Governments.*
Figures have been repeated where necessary due to non-availability of data.

In case local supply of bentonite is not available, synthetic bentonite can be prepared from fuller's earth; i.e., calcium bentonite, by treating it with anhydrous soda ash.

USES & SPECIFICATIONS

Bentonite has high swelling properties along with good viscosity and liquid limit. These properties are highly valued in most of the industrial applications. Sodium bentonite is well suited as a binder in the preparation of pellets and in foundry and as oilwell drilling mud. Bentonite also acts as a suspending agent in oil well drilling fluids. Bentonite exhibits good green strength along with high hot and dry strength which helps in preventing moulds from breaking or cracking during the pouring or cooling process in the foundry industry. Owing to high green strength resulting from its property to absorb and then release moisture, bentonite is used in iron ore pelletisation. Sodium-based bentonite of 75 micron size finds suitability in iron ore pelletisation for bonding by user industries. Bentonite clay is also used in pyrotechnics, to make end plugs and rocket engine nozzles.

Bentonite has remarkable colloidal and waterproofing properties. Bentonite gels are used as a carrier for a number of cosmetic preparations, toothpastes, creams, etc. Bentonite is also used in chemical, rubber, insecticide & pesticide industries and in civil construction works. Bentonite in the form of fine powder free from dirt and other foreign matter and of least swelling property is used in ceramic industry. Bentonite which is the active mineral in clays with medicinal properties is also prescribed as a bulk laxative and it is also used as a base for many dermatological formulations

The specifications of bentonite for chemical & rubber and oil-well drilling industries vide BIS Specification IS:6186-1986 (Second Revision Reaffirmed 2010) are given in Table-3. Specifications for ceramic industry vide IS:12621-1988 (Reaffirmed 2011) are given in Table-4. BIS has revised the specifications of bentonite for use in foundries; the new specifications are prescribed vide IS : 12446 - 2007 (first Revision, Reaffirmed 2012).

Table – 3 : BIS Specifications of Bentonite in Chemical, Rubber and Oil - Well Drilling Industries {IS:6186-1986 (Second Revision, Reaffirmed 2010)}

Sl. No.	Characteristic	Industry: Type 1 Chemical & Rubber	Type 2* Oil-well drilling: High grade	Offshore grade
1.	Moisture, % by mass			
	a) Minimum	5.00	–	–
	b) Maximum	12.00	12.00	12.00
2.	pH	9.00 to 10.50	–	–
3.	Gel formation index	To pass test	To pass test	To pass test
4.	Swelling power	To pass test	–	–
5.	Fineness			
	a) Dry - To pass through 150 micron IS sieve, % by mass, minimum	–	98.00	98.00
	To pass through 75 micron IS sieve, % by mass, minimum	95.00	90.00	–
	b) Wet - Retained on 150 micron IS sieve, % by mass, maximum	0.01	–	–
	To pass through 45 micron IS sieve, % by mass, minimum	90.00	98.00	–
6.	Viscosity at 30^{0} C, centipoise, min			
	a) Apparent	–	15.00	–
	b) Plastic	–	6.00	–

(Contd.)

Table - 3 (Concld.)

Sl. No.	Characteristic	Industry Type 1 Chemical & Rubber	Type 2* Oil-well drilling High grade	Offshore grade
7.	Filtration loss, ml, maximum	–	15.00	15.00
For Rubber Industry Only				
8.	Sand content, % by mass, maximum	–	2.00	2.00
9.	Loss on ignition (other than loss on drying), % by mass, maximum	6.00	–	–
10.	Matter soluble in water, % by mass, maximum	4.00	–	–
11.	Copper (as CuO), % by mass, maximum	0.01	–	–
12.	Manganese (as MnO), % by mass, maximum	0.01	–	–

** This material shall also have a yield of 90 barrels, which shall be determined by the number of barrels (181-litre capacity) of mud of 15-centipoise viscosity obtained from 1,000 kg bentonite dispersed in water and aged for 24 hours.*

Table – 4 : BIS Specifications of Bentonite for Ceramic Industry {IS:12621-1988 (Second amedment, Reaffirmed 2011)}

Sl. No.	Characteristic	Requirement
1.	Free moisture content at 105 ± 2°C, % by mass, max	6.0
2.	Residue on 106 micron IS sieve, % by mass, max	Nil
3.	Grit content on 45 micron IS sieve, % by mass, max	1.0
4.	Loss on ignition, % by mass	8 to 12
5.	Silica (as SiO_2), % by mass	48 to 55
6.	Alumina (as Al_2O_3), % by mass	18 to 28
7.	Iron oxides (as Fe_2O_3), % by mass, max	4
8.	Titanium oxide (as TiO_2), % by mass, max	3
9.	Oxides of iron (as Fe_2O_3) and titanium (as TiO_2) together, % by mass, min	6
10.	Water of plasticity, % by mass	45 to 60
11.	Swelling power after 24 hours	15 to 20
12.	Calcium oxide (as CaO), % by mass, max	3
13.	Magnesium oxide (as MgO), % by mass, max	3
14.	Oxides of calcium (as CaO) and magnesium (as MgO), together, % by mass, max	5
15.	Viscosity at 30°C, centipoise, min	4.5

Note: *All tests except for Sl. No. 1 shall be carried out on dry basis.*

CONSUMPTION

The consumption of bentonite in 2010-11 increased slightly to 112,400 tonnes from 105,800 tonnes in the previous year. Foundry industry accounted for 48% consumption, followed by, oil well drilling 20%, pelletisation 14% and chemical industry 7% (Table-5).

Table - 5 : Reported Consumption of Bentonite 2008-09 to 2010-11 (By Industries)

(In tonnes)

Industry	2008-09	2009-10(R)	2010-11(p)
All Industries	**108300**	**105800**	**112400**
Alloy steel	900 (2)	900 (2)	900 (2)
Ceramic	700 (7)	700 (7)	700 (7)
Chemical	1500 (2)	7500 (3)	7500 (3)
Fertiliser	3300 (1)	3300 (1)	3300 (1)
Foundry[(e)]	52500 (22)	54300 (23)	54300 (23)
Iron & Steel	3900 (2)	3100 (2)	2500 (2)
Oil -well drilling	17400 (2)	24400 (2)	22400 (2)
Pelletisation (iron & steel)	10900 (2)	7000 (2)	16200 (2)
Pesticide	4600 (1)	-	-
Refractory	4600 (11)	4600 (12)	4600 (12)
Others (electrode, ferro-alloys, paint, sugar, petroleum refining and textile)	++ (13)	++ (13)	++ (13)

Figures rounded off. Data collected on non-statutory basis.
Figures in parentheses denote the number of units in organised sector reporting consumption.*
*(*Includes actual consumption and/or estimates made wherever required).*
In addition, substantial quantity has also been consumed in civil construction of which data is not available.

INDUSTRY

There were about 30 pulverising units in Gujarat and 27 in Rajasthan. The processing plants of bentonite owned by Neelkanth Chemical Work at Akli, Barmer and Jodhpur in Rajasthan produce about 25,000 tpy sodium bentonite.

The Ashapura Minechem Pvt. Ltd, Kachchh, Gujarat has a bentonite pulverising plant having a capacity of 60,000 tpy near Bhuj, Kachchh district. The plant can produce 90% 200-mesh powder. The company also has a new Pellet Strength Test (PST) grade bentonite plant having a capacity of 100,000 tpy near Bhuj. It produces 90% minus 63- micron powder which is supplied to the iron ore pelletisation industry. It also has mining and mineral prcoessing facilities in the states of Karnataka, Kerala, Andhra Pradesh and Odisha. The company produced 10,606 tonnes bentonite granules, 117,471 tonnes bentonite powder, 263,546 tonnes bentonite processed lumps, 11,060 tonnes bentonite unactivated lumps and 13,597 tonnes attapulgite lumps in 2010-11. Production during 2009-10 was 16,579 tonnes granules, 50,993 tonnes powder, 159,789 tonnes processed lumps, 96,312 tonnes unactivated lumps and 5,912 tonnes attapulgite lumps. The plant had an installed capacity over 7 million tpy of processed industrial mineral of standard product specification, against which the production of processed minerals was 0.94 million tonnes and 1.31 million tonnes in 2009-10 and 2010-11, respectively.

Ashapura Volclay is a joint venture between Ashapura Group, India's leading bentonite exporter, and Illinois-based Amcol International Corp., one of the USA's top bentonite producers. The company is producing bleaching clays from its plant in Bhuj in Kachchh district, Gujarat since 2001. This plant has 30,000 tpy capacity to produce attapulgite-bentonite product. The blended clay is in demand particularly in the domestic market for bleaching of light-coloured vegetable oils, such as sunflower, groundnut and cotton seed oils. The company is in the process of expanding its production capacity of acid activated bleaching clay. Ashapura is on way to become world's third largest bleaching clay producer in terms of capacity.

Gimpex Ltd has a processing plant with capacity of 45,000 tpy in Kachchh region of Gujarat producing sodium and calcium bentonite. It is reported that in addition to Gimpex Ltd, Jumbo Mining, Star Bentonite Group, Fonadwell Minechem and Gexmin Co. also produce processed bentonite.

WORLD REVIEW

The global production of bentonite in 2010 was around 13.7 million tonnes. The USA was the largest producer with an estimated output of around 4 million tonnes followed by China with 3.4 million tonnes. Other major producers were Greece, Turkey, Mexico, Russia, Japan, Brazil, Germany, India and Italy (Table - 6).

FOREIGN TRADE

Exports of bentonite increased considerably to 628,612 tonnes in 2010-11 from 457,079 tonnes in the previous year. Major buyers were Malaysia & Brazil (13% each), Ukraine (12%) Indonesia (11%) and UAE (6%) (Table-7).

Imports of bentonite decreased slightly to 2,301 tonnes in 2010-11 from 2,378 tonnes in the previous year. Imports were mainly from USA (41%) and China (29%) (Table-8).

Table – 6 : World Production of Bentonite (By Principal Countries)

(In '000 tonnes)

Country	2008	2009	2010
World: Total	**15800**	**14400**	**13700**
Brazil	340	264	300[(e)]
China[(e)]	3300	3400	3400
Germany	414	326	363
Greece	1580	1500	845
India[(e)]	662	538	214
Italy	281	292	150[(e)]
Japan	435	432[(e)]	432[(e)]
Mexico	375	511	591
Russia[(e)]	460	460	460
Turkey	683	753	718
USA	4900	3650[(e)]	4000[(e)]
Other countries	2370	2276	2277

Source: *World Mineral Production, 2006-2010.*

Table – 7 : Exports of Bentonite (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**457079**	**1252043**	**628612**	**1672201**
Ukraine	30550	103647	78465	241341
Brazil	23393	75688	81884	212356
Malaysia	56936	101375	83141	151804
Indonesia	97297	168325	70305	137070
Australia	7119	44831	23363	87991
Saudi Arabia	24266	70177	27066	87345
UAE	22760	55972	36384	83627
China	6707	26616	14268	62347
Italy	23252	35858	25099	39390
Unspecified	3927	20779	23680	40850
Other countries	160872	548775	164957	528080

Table – 8 : Imports of Bentonite (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**2378**	**74132**	**2301**	**74759**
USA	1161	44723	934	33745
China	410	9803	662	16549
UK	48	3289	44	4422
France	13	1966	27	4304
Brazil	-	-	40	3143
Spain	80	3341	55	2651
Turkey	124	1640	188	2448
Indonesia	139	2286	140	2255
Italy	317	5218	138	2184
Thailand	2	343	6	969
Other countries	84	1523	67	2089

FUTURE OUTLOOK

The Indian bentonite industry is expected to perform better in the coming years because of emerging demand for oil clarification and cat litter. The biggest market for bentonite in both North America and European countries are foundry, cat litter, iron ore pelletising and drilling. Civil engineering and environmental applications, such as land fills require bentonite for use as a sealant and lubricant. The global bleacing clay market is estimated at 860,000 tpy of which 700,000 tpy is used for bleaching edible oils, 150,000 tpy for petroleum and the remaining 10,000 tpy for clarifying beverages, such as wines and fruit juices.

Bentonite is among the exportable mineral commodities in India. Bentonite is exported both in unprocessed (crude) and processed (including activated) forms. Though, export of crude bentonite account for a higher quantity, the exports of processed bentonite fetch higher value than the crude bentonite. There is a pressing need to develop different processing techniques that suit our available resources, inorder to make our products match the international standards. There is scope to establish bentonite processing granulation and paint-grade processed bentonite units in the country to meet the indigenous demand as well as demand in the international market.

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

BORON MINERALS

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

19 Boron Minerals

Boron minerals occur mostly as borates which are deposited from volcanic gases or hot springs near volcanic activities. The deposits, predominantly of borax and sassolite are formed as a result of drying up of shallow saline and alkaline tertiary lakes called 'Playa'. The principal boron minerals are borax, hydrated sodium borate ($Na_2O.2B_2O_3.10H_2O$), kernite (rasorite), hydrated sodium borate ($Na_2O.2B_2O_3.4H_2O$), colemanite, hydrated calcium borate ($Ca_2B_6O_{11}.5H_2O$), and ulexite, hydrated sodium calcium borate ($NaCaB_5O_9.8H_2O$). Besides the above four boron minerals of commercial importance, two minerals; viz, sassolite (H_3BO_3), the natural boric acid and boracite ($Mg_3B_7O_{13}Cl$) are less important.

Borax is not produced in India presently. However, it was obtained since early times from the Salt Lakes in Jammu & Kashmir in India and Tibet. The domestic requirements of boron minerals are met solely through imports of crude borate which is refined in the country for producing borax and boric acid.

RESOURCES

Economically workable deposits of borax have not been established in the country so far. The only deposit of little economic significance is reported from Puga Valley in Leh district, Jammu & Kashmir. As per the UNFC system, total resources of borax as on 1.4.2010, are estimated at 74,204 tonnes in Jammu & Kashmir. All resources are of reconnaissance category, viz, UNFC Code 334. Occurrences are also reported from Surendranagar district, Gujarat and Nagaur district, Rajasthan. The bittern obtained from Sambar Lake in Jaipur district, Rajasthan, also contains about 0.5% borax.

USES

Glass and porcelain industries are the major consumers of borax and boric acid. It is an essential component of heat-resisting borosilicate glass, glass fibres and industrial & optical glass. In glass, enamels and ceramics, it controls thermal expansion, improves durability, assists melting processes and adds to inorganic colours and decorations.

Borax is used in medicine (boric powder), leather processing, adhesive, corrosion inhibition, ferrous wire manufacture, flame-proofing and timber preservation.

Borax is used as a flux in the manufacture of artificial gems like, cubic boron nitride, (commercially called 'Borazon') which equals diamond in hardness and boron carbide, titanium boride and tungsten boride which are next to diamond in hardness.

As a fluxing agent, it is used in brazing, welding and soldering. Its easy solubility and property to soften hard water find applications in soaps, cleaners & detergents and for water treatment. Because of its mild alkalinity and germicidal nature, it is used in manufacturing toothpastes and mouth washes. In cosmetics, borax is used as an antiseptic and emulsifying agent. As a decolourising agent, it is used in vanaspati industry. In textile industry, borax is used as a decolourising agent as well as for maintaining the alkalinity of solutions used for producing rayons. It prevents mould formation in citrus fruits. In agriculture, borax is used as an essential plant nutrient.

Boron compounds are used for fertilizers, algicides, herbicides and insecticides. Borax and boric acid are used in fire-retardant treatment and as food grain preservative, respectively.

Borate ester is used as dehydrating agent, special solvent and catalyst in chemical industry. In nuclear reactor, boron acts as neutron absorber. "Boron neutron capture therapy", a form of radiochemotherapy, is becoming increasingly important for treatment of certain forms of cancers and boron neutron capture synovectomy for treatment of arthritis.

Borates are consumed mainly in glass fibre for insulations and textile-grade fibre. Borates are also used as anti-knock agents in gasoline. Diborane (gas), pentaborane (liquid), and decaborane (solid) are potential jet and rocket engine fuels. Boron hydride also has potential value as rocket fuel. The high energy fuel value imparted by the addition of boron compounds has given considerable strategic significance to borates. Another use of borates is the invention of oxgano-sodium borate (liquibor) for use in hydraulic brake fluids.

Substitutes

Substitutions for boron minerals in several applications are in vogue. Substitutes in applications such as soaps, detergents, enamels and insulations are available. In detergents, boron compounds can be replaced with chlorine and enzymes. Lithium compounds can be used to make enamels and glass products. Insulation substitutes include cellulose, foams and mineral wools. Substitution of borosilicate glass by plastic materials may reduce the use of boron.

Technical Possibilities

Improvements made in evaporating brine solutions are widening the choice of source. Production of boric acid through solution mining of colemanite is a possibility.

A proprietary process called 'Hydrogen on Demand' has been developed using water and sodium borohydride. Hydrogen from the system can be used in fuels cells or internal combustion engines. A longer-life battery based on boron has also been designed. Synthetic diamond containing about 3% boron which is normally a semiconductor becomes superconductor at 4^{o}K. Boron-doped diamond thus has numerous possible applications as it can carry electricity without resistance.

Environmental Concern

Natural borates are not very toxic to animals but can be toxic to plants even though low levels of boron are essential for plant life. Boron-hydrogen compounds known as boranes which do not occur in nature are highly toxic and have posed problems in some industrial applications. Environmental concerns have hastened substitution in soaps and detergents. In Europe, borates continue to be listed under hazardous substances and the risk evaluated for their safety under conditions of normal handling and use related to classification and labelling already exists. The US Food and Nutrition Board announced that the essentiality data on boron was adequate to establish a daily tolerable Upper Intake Level (UL) at 20 mg boron.

INDUSTRY

In borax manufacturing process, crude sodium borate is dissolved in water, charged, oxidised, crystallised and centrifuged. Centrifuged material is then dried to get borax decahydrate.

Crude calcium borate lumps are crushed and wet-ground with mother liquor to make slurry. This slurry is decomposed with sulphuric acid to give calcium sulphate and boric acid. Boric acid is separated by filtration, purified, cooled and centrifuged to produce boric acid granules which are powdered as per demand.

Borax Morarji Ltd, Ambernath, Thane district, Maharashtra, engaged in refining of imported crude borates to produce borax and boric acid has installed capacities of 25,000 tpy borax and 8,000 tpy boric acid. National Peroxide Limited at Vadavali, Thane district, Maharashtra, produces sodium perborate which is used as a bleaching agent. The installed capacity of that plant is 1,200 tonnes per year. The company produced sodium perborate to the tune of 97 tonnes (tetrahydrate) and 311 tonnes (monohydrate) during 2010-11 as against 56 tonnes and 368 tonnes, respectively during 2009-10. Indo Borax and Chemical Limited operates borax and boric acid plants at Pithampur, Madhya Pradesh. However, plant capacity is not available.

Ferro-boron is a boron ferro-alloy containing 0.2% to 24% boron used primarily to introduce small quantities of boron into speciality steels. Domestic production of ferro-boron was 90 tonnes each, in 2009-10 and 2010-11, respectively.

CONSUMPTION

The reported consumption of borax in the organised sector remained static at 23,800 tonnes in 2009-10 and 2010-11. Chemical and glass industries were the major consumers accounting for about 95% borax consumption (Table-1).

Table – 1 : Reported Consumption of Borax, 2008-09 to 2010-11 (By Industries)

(In tonnes)

Industry	2008-09	2009-10(R)	2010-11(P)
All Industries	**23900**	**23800**	**23800**
Ceramic	800(6)	800 (5)	800(5)
Chemicals@	19900 (5)	19900 (5)	19900(5)
Glass	2500 (25)	2500 (22)	2500(22)
Graphite products	200 (23)	100 (7)	100(7)
Others (abrasive, paint, paper, pharmaceutical, refractory, textile and vanaspati)	500 (16)	500 (12)	500(12)

Figures rounded off. Data collected on non-statutory basis. Figures in parentheses denote the number of units in organised sector reporting consumption.*
(Includes actual reported consumption and/or estimates made wherever required).*
@ Includes consumption of ulexite and colemanite.

WORLD REVIEW

The estimated world reserves of boron minerals are about 210 million tonnes in terms of boric oxide. Countries with sizeable resources are Argentina, Turkey, Russia, USA, China and Peru. The world reserves of boron minerals are given in Table-2.

Turkey, USA, Chile, Argentina and Russia are the major producers of boron minerals. China and Peru also have substantial ore production. These countries contributed about 5.11 million tonnes to world production.

In Turkey, Government-owned Eti Maden operated processing plants at Bandirma and Kirka. A large tincal deposit at Kirka is the only commercial sodium borate deposit known in Turkey. Besides, Bigadic mine produces colmanite and ulexite, Emet mine produces colemanite and Kestelec mine produces colemanite, probertite and ulexite. Turkey was the world's largest producer of boron ore in 2010. Comibol of Bolivia is planning to develop the Salar de Uyuni salt flats for future borate production. A pilot plant is to be established for boric acid plant of 20,000 tpy capacity. Borax Argentina SA (a subsidiary of Rio Tinto plc) is Argentina's leading producer and exporter to USA. Borax Argentina mined at three deposits, Tincalayu mine being the largest open-pit mine. These operations produce about 100,000 tpy ore. In Chile, Quimica del Borax (Quiborax), Rio Grande, produces about 450,000 tpy ulexite. Quiborax also has an 80,000 tpy boric acid plant and 40,000 tpy capacity granular ulexite plant. In China, deposits of borates in Hunan, Jilin, Qinghai and Liaoning provinces are operated. Eighty per cent production is reported from Qinghai Province.

The world production of borates from 2008 to 2010 is given in Table-3.

Table – 2 : World Reserves of Boron (By Principal Countries)

(In '000 tonnes of boric oxide)

Country	Reserves
World: Total (rounded)	**210000**
Argentina	2000
Bolivia	NA
Chile	35000
China	32000
Iran	1000
Kazakhstan	NA
Peru	4000
Russia	40000
Turkey	60000
USA	40000

Source: *Mineral Commodity Summaries, 2012.*

Table – 3 : World Production of Borates (By Principal Countries)

(In '000 tonnes)

Country	2008	2009	2010
Argentina	790	500	500
Chile	591	613	504
China(e)	280	290	300
Peru	350	187	293
Russia(e)	400	400	400
Turkey	2193	1687	1910
USA(e)	1150	1200	1200

Source: *World Mineral Production, 2006-2010.*

FOREIGN TRADE

Exports

Exports of borax (total) decreased to 1,388 tonnes in 2010-11 from 1,654 tonnes in the previous year. Exports in 2010-11 comprised natural borate 581 tonnes, sodium borate 545 tonnes and other borates 262 tonnes. Exports were mainly to Kenya (24%) and Malaysia (18%). Exports of boric acid also decreased to 690 tonnes in 2010-11 from 804 tonnes in the previous year. Exports were mainly to USA (53%). In 2010-11, exports of boron decreased drastically to 29 tonnes from 356 tonnes in the previous year. Exports were mainly to Chinese Taipei /Taiwan (83%) (Tables 4 to 9).

Imports

Imports of borax (total) increased to 112,225 tonnes in 2010-11 from 78,003 tonnes in the previous year. Imports in 2010-11 comprised natural borate 48,401 tonnes, sodium borate 57,107 tonnes and other borates 6,717 tonnes. Borax was mainly imported from Turkey (43%), USA (25%), Bolivia (15%) and Argentina (8%). Imports of boric acid increased to 9,407 tonnes in 2010-11 from 7,786 tonnes in the previous year. Boric acid was imported mainly from Turkey (55%) and USA (34%). In 2010-11, import of boron was negligible as compared to one tonne in the previous year. (Tables 10 to 15).

Table – 4 : Exports of Borax : Total (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**1654**	**41690**	**1388**	**49512**
USA	266	12191	132	11929
Malaysia	125	3180	247	6935
Sri Lanka	8	267	20	5684
Saudi Arabia	60	1768	132	3869
China	-	-	56	3417
New Zealand	18	987	40	2209
Kenya	370	3282	336	2090
Bangladesh	298	4131	22	1790
Iran	1	3	53	1760
Nigeria	71	2010	100	1551
Other countries	437	13871	250	8278

Table – 5 : Exports of Natural Borate (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**942**	**9342**	**581**	**6391**
Kenya	370	3278	329	1945
Nigeria	69	1962	100	1545
Nepal	86	779	17	484
Saudi Arabia	++	1	7	446
Uzbekistan	-	-	25	423
Cameroon	50	346	38	403
Ivory coast/Cote D' Ivoire	-	-	30	286
USA	1	18	3	257
Mozambique	-	-	3	116
Vietnam	-	-	1	91
Other countries	366	2958	28	395

Table – 6 : Exports of Sodium Borate (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**584**	**21039**	**545**	**19557**
Malaysia	125	3180	231	6443
USA	229	8373	59	3828
Saudi Arabia	60	1767	105	2860
New Zealand	18	987	40	2209
Iran	++	2	48	1297
Bangladesh	-	-	18	1249
Myanmar	-	-	21	545
Costa Rica	-	-	2	336
Nepal	7	369	5	270
Kenya	++	3	7	145
Other countries	145	6358	9	375

Table – 7 : Exports of Borax : Other Borates (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**128**	**11309**	**262**	**23564**
USA	36	3800	70	7844
Sri Lanka	3	107	15	5578
China	-	-	56	3417
Turkey	-	-	14	1508
Belgium	20	1199	14	982
Myanmar	-	-	20	674
Sudi Arabia	-	-	20	563
Bangladesh	37	3460	4	541
Oman	10	515	15	529
Australia	13	1235	++	69
Other countries	9	993	34	1859

Table – 8 : Exports of Boric Acid (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**804**	**18451**	**690**	**34660**
USA	632	10703	363	17004
Kenya	35	929	46	2692
Nepal	13	576	22	2272
Nigeria	7	552	42	1818
Yemen Republic	++	2	15	1346
Sri Lanka	5	428	57	1318
UAE	12	229	20	1195
Cameroon	-	-	14	970
Sudan	-	-	14	997
Congo, People's Rep. of	++	3	18	662
Other countries	100	5029	79	4464

Table – 9 : Exports of Boron (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**356**	**84795**	**29**	**6722**
Chinese Taipei/ Taiwan	298	68828	24	5962
USA	11	2460	2	448
Bangladesh	-	-	2	244
Nepal	-	-	1	63
Yeman Republic	-	-	++	5
Other countries	47	13507	-	-

Table – 10 : Imports of Borax: Total (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**78003**	**1873097**	**112225**	**2427019**
Turkey	37281	828425	48494	973587
USA	18061	519971	27670	729620
Argentina	8730	214638	8694	196349
Bolivia	5599	62433	16645	191024
Spain	3227	92426	4261	115790
China	996	55525	1671	78206
Russia	4	15673	343	26260
Malaysia	51	1568	552	20491
Austria	105	5492	372	18002
Chile	2034	19242	1620	16547
Other countries	1915	57704	1903	61143

Table – 11 : Imports of Natural Borate (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**30690**	**571010**	**48401**	**801445**
Turkey	11066	208896	18003	332144
Argentina	8705	213912	8548	191618
Bolivia	5599	62433	16645	191024
Spain	1610	40996	2178	48344
Chile	2034	19242	1620	16547
China	96	1243	372	6298
Italy	-	-	373	5814
USA	283	5059	287	4093
Denmark	-	-	252	2877
Malaysia	25	183	120	2641
Other countries	1272	19046	3	45

Table – 12 : Imports of Sodium Borate (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**42314**	**1070370**	**57107**	**1347556**
USA	16863	457408	26951	671363
Turkey	23608	554961	26637	563212
Spain	1617	51430	2051	65733
Malaysia	-	-	264	9146
Italy	-	-	142	7636
Saudi Arabia	-	-	240	5168
China	++	6	164	3807
Argentina	25	725	125	3705
UK	174	5403	37	3167
Korea, Rep. of	-	-	100	2418
Other countries	27	437	396	12201

Table – 13 : Imports of Borax : Other Borates (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**4999**	**231717**	**6717**	**278018**
Turkey	2607	64568	3854	78230
China	900	54275	1135	68100
USA	915	57504	432	54164
Russia	4	15673	304	25339
Austria	105	5492	372	18002
Malaysia	26	1385	168	8704
Germany	125	14044	112	6052
Finland	-	-	34	4290
Slovenia	192	10067	48	2363
Australia	1	472	44	2171
Other countries	124	8237	214	10603

Table – 14 : Imports of Boric Acid (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**7786**	**282304**	**9407**	**314416**
Turkey	5100	178860	5130	169595
USA	1965	71743	3179	108630
Argentina	199	7049	450	14856
Peru	365	18682	431	13846
China	11	596	103	3487
Malaysia	-	-	105	3328
Finland	-	-	4	387
Germany	1	39	4	218
Netherlands	42	1499	1	67
Switzerland	++	6	++	2
Other countries	103	3830	-	-

Table – 15 : Imports of Boron (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**1**	**2252**	**++**	1027
China	++	572	++	640
UK	-	-	++	349
Germany	1	155	++	29
Japan	-	-	++	9
Other countries	++	1525	-	0

FUTURE OUTLOOK

Increased usage of ceramic tiles will keep consumption of boron minerals in end uses like enamels, frits and glazes. Demand as a fertilizer will remain high, whereas, usage in soaps and detergents will be low because of environmental concerns. Some cars have been replacing metal parts with reinforced fibreglass plastic parts of reduced weight to increase the efficiency of gasoline consumption. This will enhance the demand of borax for the production of fibre glass.

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

CADMIUM

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

20 Cadmium

Cadmium is present generally in zinc ore deposits as greenockite (CdS). The principal source of cadmium is zinc the ore, sphalerite. Other sulphides and sulphosalts may also carry small amounts of the metal.

In India, cadmium is recovered as a by-product in zinc smelting and refining. The concentration of cadmium in sphalerite, the principal ore of zinc, ranges from 0.03 to 9.0 wt%. In zinc concentrate at Rampura Agucha, cadmium is 0.18% while in lead concentrate, it is 150 ppm. There are no separate resources of cadmium.

INDUSTRY

The total installed capacity for recovering cadmium was 913 tonnes of which HZL accounted for 833 tonnes. Binani Zinc Ltd reported the remaining 80 tonnes capacity (Table-1). HZL produces cadmium of high quality casted in the form of pencils weighing from 250 g to 500 g. The purity is 99.95% Cd, max at Debari, 99.97% Cd, max at Vizag and 99.99% Cd, min at Chanderiya plants. HZL has plans to conduct R&D for production of high purity cadmium during 2011-12. High purity cadmium is typically used for nuclear shielding applications.

Table – 1 : Installed Capacity for Recovery of Cadmium

Unit	Location	Installed capacity (tpy)
Total		**913**
1. HZL, Debari Zinc Smelter	Debari, Dist. Udaipur, Rajasthan.	250
2. HZL, Vizag Zinc Smelter	Visakhapatnam, Andhra Pradesh.	115
3. HZL, Chanderiya Lead-Zinc Smelter	Chanderiya, Dist. Chittorgarh, Rajasthan.	468
4. Binani Zinc Ltd	Binanipuram, Dist. Ernakulam, Kerala.	80

USES

Cadmium is used to control the fissionable elements in nuclear reactors. Along with nickel, it is used in electrical storage batteries. Cadmium-based bearing alloys are used in high-speed internal combustion engines. Copper-cadmium alloys possess high strength, high conductivity and high resistance to abrasion and therefore, the alloys are used in electric transmission wires. The main use of cadmium is in electroplating wherein it can be applied as a very thin coating to protect iron, steel, copper alloys and other metals and alloys from corrosion. Cadmium sulphide forms brilliant golden yellow, orange-red, or reddish brown pigments used in paint, enamel, soap, rubber, glass and ceramic glazes. Some cadmium salts are also used in photographic films and in lithography. Cadmium sheet is used to shield radiation measurement and control devices from slow neutrons.

PRODUCTION

Production of cadmium recovered as a by-product of zinc smelting in 2010-11 was 550 tonnes. It decreased by 1% as compared to that in the previous year. The entire production was reported under private sector (Tables -2 and 3).

Table – 2 : Production of Cadmium 2008-09 to 2010-11 (By States)

(Quantity in tonnes; value in ₹ '000)

State	2008 -09		2009-10		2010-11(P)	
	Qty	Value	Qty	Value	Qty	Value
India	**507**	**127919**	**553**	**105211**	**550**	**104958**
Kerala	37	9909	68	12900	57	10400
Rajasthan	470	118010	485	92311	493	94558

Table – 3 : Production of Cadmium, 2009-10 and 2010-11
(By Sector/States/Districts)

(Quantity in tonnes; value in ₹ '000)

State/District	Smelter	2009-10		2010-11(P)	
		Quantity	Value	Quantity	Value
India		**553**	**105211**	**550**	**104958**
Private sector		553	105211	550	104958
Kerala		**68**	**12900**	**57**	**10400**
Ernakulam	Binani	68	12900	57	10400
Rajasthan		**485**	**92311**	**493**	**94558**
Chittorgarh Udaipur	HZL Chanderiya & Debari	485	92311	493	94558

SUBSTITUTES

Suitable replacements of cadmium in all uses, especially in pigments and plating are being contemplated and enforced owing to the pollution hazards associated with the use of cadmium. Hitachi Maxwell, Sanyo Electric and Matsushita Battery Industrial are reportedly experimenting on nickel-hydrogen (Ni-H) batteries so as to replace nickel-cadmium (Ni-Cd) batteries, especially in view of the growing concern over cadmium pollution. Lately, Ni-Cd batteries, in some applications, are replaced with lithium ion and nickel metal hydride batteries. However, higher costs of these substitutes restrict their uses. Cadmium in plating applications can be substituted by coatings of zinc or vapour-deposited aluminium. Cerium sulphide is used as a replacement for cadmium pigments mostly for plastics. Cadmium Telluride (CdTe) flexible thin film solar cells are an alternative to traditional crystaline silicon solar cells and are suitable for commercial roof top applications and large scale ground mounted utility systems. CdTe photovoltaic cells are potentially a safe, environmentally friendly application for cadmium.

In India, cadmium is consumed in industries like paint, glass and chemical.

HEALTH AND SAFETY

Cadmium in all its chemical forms is considered highly toxic to living species as it does not decompose and is ingested easily through food, water and air but cannot be excreted. It is both bioaccumulated and biomagnified. Ingested cadmium accumulates in liver, kidney, pancreas and thyroid. Excessive exposure to cadmium has been linked with respiratory insufficiency (via occupational exposure) and renal disturbance (via environmental and occupational exposure). Itai-itai is the most severe stage of chronic cadmium poisoning. Cadmium has also been implicated in the development of cancer of various types.

During the last decade, regulatory pressure to reduce or even eliminate the use of cadmium has gained momentum in many developed countries. The world recommended target guidelines for cadmium as a residual heavy metal below which no major risk is expected which could have significant or adverse impact on aquatic biota or human use, is 0.1 mg/l. In the USA, Federal and State agencies regulate cadmium content in the environment. In the EU, despite the directives such as, Restriction of Hazardous Substances in Electrical and Electronic Equipment Directive and others, aimed at eliminating use of cadmium in products, the regulatory emphasis is shifting from elimination and prohibition to proper management of risks present. Cadmium present in CRT screens, printer inks, toners etc. is known to cause health hazards affecting the kidneys and causing flue like symptoms and muscular pain.

In India, the silver jewellery industry is an important cottage industry. Silver is mixed with cadmium and then used to make silver jewellery.

During this process there is a formation of cadmium fumes and the workers inhale the fumes. Cadmium is a neurotoxic and nephrotoxic heavy metal and there are no national policies to prevent exposure to such chemicals which results cases of cadmium induced peripheral neuropathy, nephropathy and decreased bone density.

WORLD REVIEW

Cadmium is extracted from zinc ores and concentrates, and other materials like scrap. Zinc-to-cadmium ratios in typical zinc ores range from 200:1 to 400:1. The world reserves of cadmium are estimated at 0.64 million tonnes in terms of metal content, located mainly in India (20%), China (14%), Australia (10%), Peru (7%), USA (6%) and Kazakhstan (5%). The world reserves of cadmium by principal countries are furnished in Table - 4.

Table – 4 : World Reserves of Cadmium (By Principal Countries)

(In tonnes of metal content)

Country	Reserves
World: Total (rounded)	**640000**
Australia	61000
Canada	18000
China	92000
India	130000
Kazakhstan	35000
Mexico	48000
Peru	45000
Poland	16000
Russia	21000
USA	39000
Other countries	130000

Source: *Mineral Commodity Summaries, 2012.*

The world production of cadmium was estimated at 22,300 tonnes in 2010. Most of the world's primary cadmium (approximately 55%) was being produced in Asia and the Pacific. China, Republic of Korea, Japan, Canada, Mexico, Kazakhstan, Russia and USA were the important producers.

World's secondary cadmium production accounted for 20% of the total metal production. Most secondary metal was produced at Ni-Cd battery recycling facilities in Asia, Europe and the United States. In Japan, Ni-Cd battery recyclers included Kansai Catalyst Company Limited, Mitsui Mining and Smelting Company Limited and Toho Zinc Company Limited. In Europe, Ni-Cd battery recycling took place at Accurac GmbH's facility in Germany, Soft AB's Plant in Sweden and Societe Nauvelle D'Affiinage des Metaux's recycling facility in France. China, Belgium and Japan are by far the world's largest consumers of cadmium. Almost all cadmium is utilised in the production of Ni-Cd batteries. Belgium was a significant consumer of refined cadmium and consumed 4,800 to 7,200 tonnes per year of refined cadmium, accounting for almost 40% of global output mostly for production of cadmium compounds. The world production of cadmium during 2008 to 2010 by principal countries is furnished in Table-5.

Table – 5 : World Production of Cadmium (By Principal Countries)

(In tonnes)

Country	2008	2009	2010
World : Total	**21500**	**20100**	**22300**
Australia[e]	350	370	350
Canada	1409	1299	1357
China[e]	6964	7000	7200
Germany[e]	420	250	300
Japan	2126	1824	2053
Kazakhstan[e]	1000	1000	1000
Korea, Rep. of	3090	2500	4166
Mexico	1550	1510	1464
Netherlands	530	490[e]	580[e]
Peru	371	289	357
Russia	800	700	700
USA	777	633	637
Other countries	2113	2235	2136

Source: *World Mineral Production, 2006-2010.*

FOREIGN TRADE

Exports

In 2010-11, exports of cadmium (including waste & scrap) were at 14 tonnes compared to 53 tonnes in the previous year. Exports were mainly to Singapore, Bangaladesh and Italy (Table - 6).

Imports

Imports of cadmium (including waste & scrap) decreased in 2010-11 to 655 tonnes from 968 tonnes in the previous year. The imports comprised 572 tonnes unwrought, powders and 82 tonnes scrap besides nominal quantity of cadmium and alloys in 2010-11. Imports were mostly from Republic of Korea, Japan and Mexico (Table 7-10).

Table – 6 : Exports of Cadmium (Including Waste & Scrap) (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**53**	**11864**	**14**	**13708**
Singapore	-	-	2	4365
Bangladesh	-	-	12	3640
Italy	5	1121	++	2916
UK	-	62	++	1842
USA	-	-	++	460
Israel	-	476	++	270
Sri Lanka	-	-	++	144
Bahrain	2	216	++	37
UAE	1	241	++	33
Other countries	45	9748	++	1

Table – 7 : Imports of Cadmium (Including Waste & Scrap) (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**968**	**160628**	**655**	**122567**
Korea, Rep. of	615	101873	463	86423
Japan	146	21620	130	23333
Mexico	40	4804	60	11517
China	1	820	1	630
Canada	-	-	1	306
Malaysia	-	-	++	195
Belgium	-	-	++	105
Germany	++	40	++	30
USA	1	502	++	28
Other countries	165	30969	-	-

Table – 8 : Imports of Cadmium & Alloys (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**33**	**10120**	**1**	**342**
Canada	-	-	1	306
USA	1	341	++	29
Germany	++	23	++	7
Other countries	32	9756	-	-

Table – 9 : Imports of Cadmium : Unwrought, Powders (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**807**	**128617**	**572**	**106673**
Korea, Rep. of	548	88762	381	70873
Japan	101	14866	130	23333
Mexico	20	2028	60	11516
China	1	820	1	630
Malaysia	-	-	++	195
Belgium	-	-	++	105
Germany	++	17	++	21
Other countries	137	22124	-	-

Table – 10 : Imports of Cadmium & Scrap (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**128**	**21891**	**82**	**15552**
Korea, Rep. of	67	13111	82	15550
Germany	-	-	++	2
Other countries	61	8780	-	-

FUTURE OUTLOOK

The cadmium market in the world is in a state of uncertainty. While the primary cadmium supply is on decrease, there is a modest rise in production through recycling. Though, cadmium consumption in various applications is clamoured with concerns over its toxicity and hazardous effect on human health and environment, the production of cadmium as a by-product will however continue as long as lead and zinc are produced.

However, demand for cadmium may increase owing to several new market opportunities for Ni-Cd batteries, particularly in industrial applications. Ni-Cd battery power is used in electrical vehicles as also in a limited number of hybrid electrical vehicles.

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

CALCITE

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

21 Calcite

Calcite is a carbonate of calcium ($CaCO_3$) containing 56% CaO and 44% CO_2. It is one of the important industrial minerals also known as 'Calc Spar'. Pure crystallised transparent variety of calcite is known as 'Iceland Spar' which is used as Nicol prism in optical instruments using polarised light.

RESOURCES

The availability of calcite is abundant. As per UNFC system, the total resources of calcite as on 1.4.2010 are estimated at about 20.94 million tonnes of which about 2.66 million tonnes (13%) are proved and probable reserves. Of the total resources, chemical grade accounts for 22% and glass & ceramic grade about 4%. The remaining 74% resources fall under unclassified and other grades.

Rajasthan has the largest share (50%) of calcite resources, followed by Andhra Pradesh (42%) and Madhya Pradesh (6%). The remaining resources are located in Karnataka, Gujarat, Haryana, Tamil Nadu and Uttar Pradesh (Table - 1).

PRODUCTION, STOCKS & PRICES

The production of calcite at about 39 thousand tonnes in 2010-11 decreased by 20% as compared to that in the previous year. There were 3 primary mines along with two associated mines in 2010-11 as against two primary & one associated mines in the previous year. Ninety six percent of the total production was reported by two producers in the private sector, Rajasthan was the only state producing calcite in both the years (Tables - 2 to 4).

The mine-head stock of calcite at the end of 2010-11 was 5,783 tonnes as against 6,508 tonnes at the beginning of the year (Table -5).

The average daily labour employment in 2010-11 was 35 as against 24 in the previous year. Prices of calcite are furnished in the General Review on 'Prices'.

Table – 2 : Principal Producers of Calcite, 2010-11

Name & address of producers	Location of mine	
	State	District
Wolkem Industries Ltd, E - 101, Mewar Industrial Area, Udaipur-313 003, Rajasthan.	Rajasthan	*Sirohi Udaipur
Kalpana Minerals & Chemicals, Ashok Vatika, N.H.8, Sukher, Udaipur-318 004, Rajasthan.	Rajasthan	Udaipur

** Producing calcite as an associated mineral with wollastonite.*

Table – 1 : Reserves/Resources of Calcite as on 1.4.2010
(By Grades/States)

(In tonnes)

Grade/ State	Reserves				Remaining resources								Total resources (A+B)
	Proved STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
		STD121	STD122			STD221	STD222						
All India : Total	**1265135**	**38525**	**1360678**	**2664338**	**665454**	**227265**	**3126218**	**9122235**	**1236864**	**3805598**	**97476**	**18281110**	**20945448**
By Grades													
Chemical	503146	38017	186673	727836	348621	132342	1713928	-	-	1750993	-	3945884	4673720
Glass & Ceramic	-	-	804	804	52869	94923	108265	20250	67395	494177	-	837879	838683
Poor / Low	-	-	-	-	-	-	-	-	70310	134220	-	204530	204530
Others	544820	508	963270	1508598	27216	-	826693	500	-	22813	-	877222	2385820
Unclassified	193208	-	209931	403139	14763	-	184969	8557000	56921	949902	-	9763555	10166694
Not-known	23961	-	-	23961	221985	-	292363	544485	1042238	453493	97476	2652040	2676001
By States													
Andhra Pradesh	3267	500	-	3767	-	-	104970	8562700	5200	122148	-	8795018	8798785
Gujarat	-	-	-	-	-	-	-	-	-	12380	-	12380	12380
Haryana	-	-	-	-	166900	-	183900	-	-	-	-	350800	350800
Karnataka	-	-	-	-	-	-	64	-	14400	51865	-	66329	66329
Madhya Pradesh	-	-	-	-	215327	82577	194333	20250	180226	400791	97476	1190980	1190980
Rajasthan	1261868	38025	1360678	2660571	283227	144688	2642951	539285	1037038	3090782	-	7737971	10398542
Tamil Nadu	-	-	-	-	-	-	-	-	-	116632	-	116632	116632
Uttar Pradesh	-	-	-	-	-	-	-	-	-	11000	-	11000	11000

Figures rounded off.

Table – 3 : Production of Calcite, 2008-09 to 2010-11
(By State)

(Qty in tonnes; value in ₹ '000)

State	2008-09		2009-10		2010-11(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**67284**	**22729**	**49309**	**16980**	**39370**	**13048**
Rajasthan	67284	22729	49309	16980	39370	13048

Table – 4 : Production of Calcite, 2009-10 and 2010-11
(By Sector/State/Districts)

(Qty in tonnes; value in ₹ '000)

State/District	2009-10			2010-11(P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India	**2(1)**	**49309**	**16980**	**3(2)**	**39370**	**13048**
Private sector	2(1)	49309	16980	3(2)	39370	13048
Rajasthan	**2(1)**	**49309**	**16980**	**3(2)**	**39370**	**13048**
Sirohi	(1)	17502	7438	(1)	12183	5109
Udaipur	2	31807	9542	3(1)	27187	7939

Figures in parentheses indicate the number of associated mines of wollastonite.

Table – 5 : Mine-head Stocks of Calcite, 2010-11 (P)
(By State)

State	At the beginning of the year	At the end of year
India	**6508**	**5783**
Rajasthan	6508	5783

MINING AND MARKETING

All calcite mines in the country are worked manually by opencast methods confined to shallow depths except the semi-mechanised Belkapahar Wollastonite and Calcite Mine of Wolkem Industries Ltd in Sirohi district, Rajasthan. There are certain difficulties in the mining of transparent crystals because transparency is damaged by application of pressure during mining which causes internal imperfections and cracks. Therefore, adequate care is taken during mining so that final marketable products can be produced with maximum recovery.

Calcite is usually marketed after pulverising or some initial processing and grinding in fine powder size ranging from 200 to 300 mesh. In Rajasthan, Wolkem India Ltd, the principal mining company, markets its products under three different trade names; viz, Calstar 1-5 (snow-white powder with 100% whiteness), Calsun 1-5 (snow white powder with 98.4% whiteness) and Belsun 1-5 (white powder with 95% whiteness). Besides, super snow-white micronised products (Calcron and Addon) of extremely high brightness and whiteness (25 to 5 micron) and ultra fine slurries and powder (FMT) with top size of 2 micron are also marketed by the company.

USES AND SPECIFICATIONS

Use of calcite is dictated by highest purity of $CaCO_3$, as high as +98%, with minimum inclusions and highest brightness. Its applications are in varying sizes from coarse to as fine as 10 to 2 microns. Various grades of calcite products marketed by Wolkem India Ltd contain $CaCO_3$ 95-98.5%, MgO 0.2-0.4%, SiO_2 0.3% and Fe_2O_3 0.03 -0.15%.

Calcite is one of the important ingredients required in glass and ceramic industries for imparting glaze and also as a flux. In pulverised form, it is used as a filler in rubber goods, textile and as an extender in paints and as a carrier in insecticides. Other uses are in the manufacture of mortar, cement, bleaching powder, and preparation of fat lime, soaps, detergents, plastics, polymers, etc.The $CaCO_3$ content in calcite used in glass industry is 95% (min) and in ceramic industry 97%. Calcium oxide is a mild flux and makes the glass stick to the articles shaped by its harding nature. Generally, 54% (min) CaO is used. In ceramic industry, super-white calcite of 30 mesh is used generally; while in glass industry, powder size ranges from 20 to 80 mesh.

The transparent crystal of calcite (Iceland Spar) free from flaw is most valued in the optical industry for the manufacture of Nicol prism. However, polarised films and lenses are fast replacing Nicol prisms. 'Iceland Spar' used in optical instruments, like polarising microscopes, should have a high degree of purity and perfect crystalline structure. The mineral must be at least 2.54 cm long and 1.27 cm thick (2 inch cube is preferred), colourless, perfectly transparent and free from cloudy inclusions, cavities or foreign substances. It should be free from internal iridescence caused due to incipient cracks along cleavage planes and from twinning other than parallel to the base.

The specifications of calcite for various industrial uses are given in Table-6. BIS has prescribed IS : 15751-2007 as specification for use of calcite in ceramic industry.

Table – 6 : Specifications of Calcite Used in Different Industries

Constituent	Chemical	Cosmetic	Electrode	Glass	Ceramic
$CaCO_3$	99	97	95	95	95
Fe	0.5	200 ppm	–	–	–
Cu	–	10 ppm (max)	–	–	–
Mn	–	100 ppm (max)	–	–	–
As (max)	2 ppm	–	–	–	–
Pb	10 ppm	–	–	–	–
Chlorides	–	–	–	–	0.005 (max)
P	–	–	0.01	–	–
S	–	–	0.035	–	–
Iron & titanium	–	–	–	–	0.5
Fe_2O_3	–	–	–	0.15	–
$MgCO_3$	–	–	–	2.00	–
Moisture	–	0.2 (max)	–	–	–
SiO_2	–	–	2	–	–

Note: *Figures relate to percentages, unless otherwise stated.*

CONSUMPTION

The reported consumption of calcite at 66,900 tonnes in 2010-11 was 4% higher than in the preceding year. Paint industry accounted for about 46% consumption, followed by ceramic (28%), glass (18%) and pesticides (4%), etc. Industrywise consumption of calcite is given in Table-7.

FOREIGN TRADE

Exports of calcite increased to 1,212 tonnes in 2010-11 from 674 tonnes in 2009-10. Exports were mainly to Nepal and Iraq (Table - 8).

In 2010-11, imports of calcite increased to 143,164 tonnes from 111,887 tonnes in the previous year. Imports were mainly from Malaysia (85%), Vietnam (8%), Oman (3%) and China (2%) (Table - 9).

**Table – 7 : Reported Consumption of Calcite
2008-09 to 2010-11
(By Industries)**

(In tonnes)

Industry	2008-09	2009-10(R)	2010-11 (P)
All Industries	**59400**	**64200**	**66900**
Cement	700(1)	700(1)	700(1)
Ceramic	8900(32)	16300(29)	18600(29)
Electrical	700(3)	700(2)	700(2)
Electrode	600(12)	600(11)	600(11)
Glass	14800(24)	12200(20)	12200(20)
Paint	30400(32)	30500(30)	30500(30)
Pesticide	2600(4)	2600(4)	2600(4)
Pharmaceutical	500(2)	500(2)	500(2)
Others (abrasive & refractory)	200(5)	200(6)	600(7)

Figures rounded off. Data collected on non-statutory basis. Figures in parentheses denote the number of units in organised sector reporting consumption.*
*(*Includes actual reported consumption and/or estimates made wherever required).*

**Table – 8 : Exports of Calcite
(By Countries)**

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**674**	**3644**	**1212**	**5488**
Nepal	526	2612	822	3358
Iraq	-	-	150	691
Bangladesh	68	675	54	446
Sri Lanka	24	131	72	440
Kuwait	-	-	20	203
Liberia	-	-	61	180
USA	-	-	-	131
Djbouti	-	-	13	31
Other countries	56	226	20	8

Table – 9 : Imports of Calcite
(By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**111887**	**368852**	**143164**	**430793**
Malaysia	88395	277838	121399	339198
Vietnam	4836	22360	11718	55616
China	7790	42855	3420	16324
Oman	10578	23970	4540	11600
Germany	15	168	338	1719
Egypt	-	-	500	1328
Thailand	150	1036	181	1265
Australia	-	-	500	1073
Turkey	25	144	156	831
Unspecifi ed	-	-	312	1386
Other countries	98	481	100	453

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

CEMENT

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

22 Cement

The cement industry in India after being delicensed in 1991 has shown remarkable growth. India has emerged as the second largest country in the world after China in the production of cement. Cement is a basic construction material in housing, infrastructure and large projects for social development like irrigation dams, hospitals, roads, etc. It has become synonymous with construction and per capita consumption of cement is accepted as an important index of the country's economic growth.

In terms of quality, technology, productivity and efficiency, India compares well with the best in the world. The Indian cement industry plays a key role in the national economy, generating substantial revenue for State and Central Governments as well as employment. Cement is the basic building material in India and is used extensively in urban housing, industrial sector and developing infrastructure.

India exported about 3.61 million tonnes cement valued at ₹ 955 crore (including 1.14 million tonnes clinker and 0.17 million tonnes white cement) in 2010-11 to Nepal, Sri Lanka, Iraq, UAE, Maldives, Egypt etc.

In 2010-11, there were 171 large cement plants having total annual installed capacity of 290.48 million tonnes in addition to mini and white cement plants having total estimated capacity of 6 million tonnes per annum. The total installed capacity for cement in the country was thus about 296.48 million tonnes per annum. In 2010-11, the annual installed capacity of large cement plants has risen by 19.71million tpy to 290.48 million tpy from 270.77 million tpy in 2009-10.

Production of cement by large plants also rose to an estimated 210.28 million tonnes from 200.95 million tonnes in 2009-10. The production from mini and white cement plants is estimated at 6 million tonnes in 2010-11. Thus the estimated domestic production of cement was 204.95 million tonnes in 2009-10 and 216.28 million tonnes in 2010-11 (Table-1). Three cement plants, having a total capacity of 9,90,000 tonnes per year produced white cement. Most of these capacities are modern and based on the energy-efficient dry process technology.

There were as many as 112 plants with a million tonnes or more capacity. There was only one central public sector undertaking in the cement sector, i.e., CCI which had 10 operating units, spread over eight States/Union Territories. Except for Bokajan, Rajban and Tandur units, remaining cement plants are lying closed for about a decade or more. There were five large cement plants owned by various State Government Undertakings like Tamil Nadu Cement, Malabar Cements and Mawmluh Cherra Cement Ltd. The Jammu & Kashmir Minerals' cement plant was closed. The companywise annual installed capacities of large cement plants are given in Table-2. Regionwise and Statewise installed capacities and production of large cement plants are given in Table-3.

Table – 1 : Cement Industry in India, 2010-11

(In '000 tonnes)

	No. of Units	Installed Capacity (e)	Production (e)
i) Large Plants (CMA)	141	238398	169004
ii) ACC Ltd*	17	27083	21143
iii) Ambuja Cements*	13	25000	20129
Total: Large Plants	**171**	**290481**	**210276**
Mini & White Cement	365	6000	6000
Grand Total: All India		**296481**	**216276**

Source: *Cement Manufacturers' Association and Annual Reports, 2011 of ACC and Ambuja Cements Ltd.*
** Relates to Calendar year 2010.*

Table – 2 : Companywise Annual Installed Capacities, 2010-11 (Large Cement Plants)

Company	Plant	No. of plants	Annual installed capacity (million tonnes)
ACC Ltd	Chaibasa, Chanda, Jamul, Kymore, Lakheri, Thondebhavi, Madukkarai, Sindri, Wadi I & II,, Gagal I & II, Damodar Cement Works, Tikaria (G),, Bargarh Cement Works, Kudithini	17	28.68
Birla Corp. Ltd	Birla Vikas & Satna, Birla Cement & Chanderia, Durgapur (G), Rae Bareli (G), Durga Hitech (G)	7	5.78
CCI Ltd	Adilabad, Akaltara, Bokajan, Charkhi-Dadri, Kurkunta, Mandhar, Neemuch, Rajban,Tandur, Delhi (G)	10	3.85
Andhra Cements	Vizag (G), Nadikude-Durga Cement	2	1.42
J.K. Group	Nimbahera, Mangrol, Gotan, Muddapur, Lakshmi Cement, Lakshmi Cement-Kalol (G)	6	12.27
Century Textiles	Century Cement, Maihar Cement, Manikgarh Cement	3	7.80
India Cements	Sankarnagar, Sankaridurg, Chilamkur Works, Dalavoi, Visaka Cement, Yerraguntla, Raasi Cement, Vallur(G), Parli(G), Trinetra Cement	10	15.85
Tamil Nadu Cement	Alangulam, Ariyalur	2	0.90
Madras Cements	Ramasamyraja Nagar, Jayantipuram, Alathiyur Works I & II, Ariyalur, Uthiramerur(G), Salem(G), Kolaghat(G)	7	12.72
Mehta Group	Saurashtra Cement, Gujarat Sidhee Cement	2	2.70
HMP Cements Ltd	Porbandar, Shahabad	2	0.67
Ultra Tech Cement Ltd	Rajashree, Hotgi (G), Vikram, Aditya I & II, Rawan, Reddipalyam, ACW, JCW(G), HCW, Gujarat, APCW-I & II, Jafrabad, Magdalla (G), Ratnagiri (G), ARCW (G), Bhatinda(G), WBCW (G), Dadri(G), Panipat (G),Ginigera (G), Kotputli, Aligarh (G)	22	48.75
Ambuja Cements Ltd	Ambuja Cement, Gajambuja Cement, Ambuja Cement-Himachal Pradesh (2), Ambuja Cement Ropar (G); Ambuja Cement Rabriyawas, Ambuja Cement-Bhatinda (G), Maratha Cement; Ambuja Cement Roorkee (G); Ambuja Cement Bhatapara, Ambuja Cement Sankrail (G); Ambuja Cement Magdella (G); Ambuja Cement Farakka (G)	13	27.35
Jaypee Cement Ltd	Jaypee Rewa, Jaypee Bela, Jaypee Sadva Khurd (G), Jaypee Ayodhya (G), Dalla, Chunar (G), Jaypee Panipat (G), Jaypee Sidhi, Jaypee Kutch, Jaypee Wanakbori (G), Jaypee Roorkee(G), Jaypee Bagheri, Bhilai Jaypee	13	22.95
Kesoram Industries	Kesoram Cement, Vasvadatta Cement	2	7.25
Mangalam Cement	Mangalam Cement, Neer Shree Cement	2	2.00

(Contd.)

Table-2 (Concld.)

Company	Plant	No. of plants	Annual installed capacity (million tonnes)
Orient Paper Industries	Orient Cement, Orient Cement-Jalgaon (G)	2	5.00
Penna Cement Industries	Penna Tadippatri I & II, Penna Ganeshpahad, Penna-Boyareddypalli Ltd, Penna -Tandur	4	6.50
Prism Cement	Prism Cement I & II	1	5.60
Lafarge India (P) Ltd	Arasmeta, Sonadih, Jojobera (G), Mejia (G)	4	6.55
Malabar Cements	Malabar Cements, Malabar Cements (G)	2	0.62
Binani Cement	Binani Cement Sirohi, Binani Cement Sikar (G)	2	6.25
Rain Cements Ltd	Rain Comdt. Unit I, Rain Comdt. Unit LN-1, Rain Comdt. Unit LN-2	2	4.00
KCP Ltd	KCP Ltd-Macherla, Maktyala	2	2.35
OCL India Ltd	OCL India-Rajgangpur, OCL India-Kapilas (G)	2	5.35
Dalmia Cements	Dalmia-Dalmiapuram, Dalmia-Kadapa, Dalmia - Ariyalur	3	9.00
Cement Manu. Co. Ltd	Cement Manu. Co. Ltd, Megha T&E (P) Ltd (G)	2	1.27
Chettinad Cement	Chettinad-Karur, Chettinad Karikkali, Chettinad-Ariyalur	3	10.50
Zuari Cement Ltd	Zuari Cement, Sri Vishnu Cement	2	3.40
Heidelberg Cement (I) Ltd,	HCIL - Ammansandra, Damoh, Jhansi (G), Dolvi (G)	4	3.10
Shree Cement	Shri - Beawar, Ras, Khushkhera(G), Suratgarh(G), Roorkee(G), Jaipur (G)	6	13.39
Others*	Shree Digvijay-Sikka, Khyber Inds. (P) Ltd, Lemos Cement, Kistna, Bagalkot Cement & Ind. Ltd, J&K Ltd, Kalyanpur Cement, KCP Ltd, Mawmluh Cherra, Panyam Cements, Sone Valley, Meghalaya Cements Ltd, Shriram Cements, Sanghi Industries Ltd, My Home Industries, Meghalaya Cements Ltd, Anjani Portland Cements	12	11.29
	Grand Total	**171**	**294.43**

Figures rounded off. ***Source:*** *Cement Manufacturers' Association, New Delhi.*

* *In addition, the following plants produced white cement:*

(i) Grasim Industries Ltd (White Cement Division), Kharia Khangar, Jodhpur district, Rajasthan (560,000 tpy);

(ii) J.K. White Cement Works, Gotan, Nagaur district, Rajasthan (400,000 tpy); and

(iii) Travancore Cements Ltd (a Kerala Government Undertaking), Muhamma, Alappuzha district, Kerala (30,000 tpy).

(G): *Grinding Unit.*

The total production of cement reached to about 216.28 million tonnes in 2010-11, a growth of about 5.5% over the preceding year. In 2010-11, the annual installed capacity of three white cement plants was 9.90 lakh tonnes. Out of these, major producer J.K. White Cement Works Ltd produced 3.51 lakh tonnes white cement and the Travancore Cement Ltd., produced 14,695 tonnes white cement. The mini-cement plants were meant to tap scattered limestone reserves, mostly in Andhra Pradesh, Gujarat, Rajasthan and Madhya Pradesh.

Data on overall capacity, production and growth in cement industry are given in Table-4.

Table – 3 : Regionwise/Statewise Installed Capacities and Production, 2009-10 and 2010-11 (Large Cement Plants) *

(In million tonnes)

Region/State	No. of plants	Annual Installed capacity 2010-11	Production 2009-10	Production 2010-11
Northern Region	**30**	**51.56**	**34.14**	**37.94**
Haryana	3	2.97	2.03	1.93
Punjab	1	1.75	1.74	1.48
Rajasthan	19	40.86	29.74	30.92
Himachal Pradesh	2	1.95	0.33	2.07
Delhi	1	0.50	Nil	Nil
Jammu & Kashmir	2	0.53	0.16	0.14
Uttarakhand	2	3.00	0.14	1.40
Eastern Region	**23**	**29.14**	**21.39**	**23.16**
Assam	1	0.20	0.15	0.13
Meghalaya	4	1.76	1.54	1.55
Bihar	1	1.00	0.68	0.76
Jharkhand	1	3.40	3.46	3.50
Odisha	3	6.35	4.01	4.50
West Bengal	5	4.80	2.78	3.38
Chhattisgarh	8	11.63	8.77	9.34
Southern Region	**53**	**96.56**	**59.29**	**59.95**
Andhra Pradesh	26	47.25	29.44	28.97
Tamil Nadu	18	34.38	20.86	20.63
Karnataka	7	14.32	8.57	9.78
Kerala	2	0.62	0.42	0.58
Western Region	**17**	**30.52**	**20.84**	**21.71**
Gujarat	10	18.72	11.49	12.18
Maharashtra	7	11.80	9.35	9.53
Central Region	**18**	**30.61**	**25.09**	**26.24**
Uttar Pradesh	8	8.33	5.88	7.05
Madhya Pradesh	10	22.28	19.21	19.19
Grand Total	**141**	**238.40***	**160.75***	**169.00***

Source: *Cement Manufacturers' Association, New Delhi. Figures rounded off individually, totals may not add up*
** Excluding ACC Ltd, having annual installed capacity 27.08 million tonnes (production of cement 21.14 million tonnes during 2010) and Ambuja Cements Ltd having annual installed capacity of 25.0 million tonnes (production of cement 20.13 million tonnes) in 2010.*

Table – 4 : Capacity, Production and Growth in Cement Industry, 2006-07 to 2010-11

(In million tonnes)

Year	Capacity growth: Annual capacity	Growth	% Growth	Production growth: Production	Growth	Growth%
2006-07	177.83	6.93	4.06	161.66	13.85	9.37
2007-08	209.40	31.57	17.75	172.31	10.65	6.58
2008-09	230.61	21.21	10.13	185.61	13.30	7.72
2009-10	276.77	46.16	20.02	204.95(e)	19.34	10.42
2010-11	296.48(e)	19.71	7.12	216.28(e)	11.33	5.53

Source: *Cement Manufacturers' Association, ACC Ltd and Ambuja Cements Ltd.*

Keeping pace with the physical growth of the industry, tremendous strides have been made in technological upgradation and assimilation of latest technology. Upgrading by converting wet process plants to semi-dry and full dry process has resulted in economy of fuel and power consumption. Wet process capacity which accounted for 97% in 1950 was brought down to 3% by 2005. Dry process accounted for 96% and semi-dry process 1 per cent.

A large number of mega plants with capacity of one million tonnes and above, possessing the latest technological features like roller process, vertical roller mills, process control equipment and efficient pollution control devices have emerged in different parts of the country. The induction of advanced technology has helped the industry immensely to conserve energy & fuel and to save substantially the raw materials.

India is producing different varieties of cements like Ordinary Portland Cement (OPC), Portland Pozzolana Cement (PPC), Portland Blast Furnace Slag Cement (PBFSC), Oil-well Cement, Rapid Hardening Portland Cement, Sulphate Resistant Portland Cement (SRPC) and White Cement. BIS covers two types of PPC, viz. IS 1489 (Part1): 1991 (reaffirmed 2009)Flyash-based and IS 1489 (Part 2):1991 (Reaffirmed 2009) Calcined clay-based. PPC is suitable for all general construction, particularly for marine & hydraulic construction and other mass concrete structures. Portland Slag Cement (PSC)-IS 455:1989 (Reaffirmed 2009) is particularly useful for marine works. BIS specifies three grades of OPC (i) IS 269:1989 (Reaffirmed 2008) i.e. 33 grade suitable for all general constructions, particularly for masonry and plastering works (ii) IS 8112:1989 (Reaffirmed 2009) i. e. 43 grade is particularly suitable for high strength concrete work, and (iii) IS 12269:1987 (Reaffirmed 2008) i.e. 53 grade suitable for specialised work such as precast concrete, prestressed concrete, long span structures/ bridges, tall structures, etc. All these varieties of cement are produced strictly conforming to the BIS specifications for maintaining high quality. The Cement Quality Control Order dated 12 February 2003 issued under the BIS Act ensures quality of cement produced and sold in the market. Some cement plants have set up dedicated jetties for promoting bulk transportation and export.

The cement capacity in the country is mostly concentrated near the main raw material source; i.e., limestone. Other important raw material is coal (0.25 tonne required per tonne of cement). Many cement plants are situated near the coal belts in eastern Madhya Pradesh, primarily due to two reasons, namely, (i) less freight cost incurred to transport coal, and (ii) inability of domestic coal producers to supply complete requirement of cement plants due to fall in production and prioritised supply to power plants. However, limestone reserves have been the primary consideration in location of plants. Presence of clusters of capacity and the high transportation cost make the cement market regional in nature with the producers supplying cement to areas around the location of the plant.

Operating Cost

Power, coal and freight constitute about 15-20% each of the total cement cost while capital cost (interest and depreciation) forms 20-30 percent. Although the industry is largely under private sector, Government controls more than 40% of the cost. Power, coal and freight costs are all regulated by Government bodies, such as, State Electricity Boards, Coal Monopolies and the Railways.

Power is a major parameter that influences the operating cost. Grid power purchased from SEBs is costlier than captive power from coal-based plants by more than 25-30 percent. Where conditions are favourable, setting up captive wind power farms has become a realistic option for cement plants with operating cost at ₹ 0.50 per unit (kWh) power excluding capital cost, interest and depreciation.

Coal Distribution

Coal being a low value, bulky product with regional concentration of deposits entails incurrence of freight costs that constitute a substantial part in the final cost of cement. Rail is the predominant form of transport with road transport used by plants located close to pitheads. The Government in its notification to the cement industry has permitted cement plants to operate their own captive coal mines. Many cement plants have expressed interest in taking up coal blocks on lease and operating the mines for coal. As proposed by the Government, cement is one of the core sectors for which captive mining blocks would be allocated.

Power Availability

The industry's average energy consumption is estimated to be about 725 kcal/kg clinker thermal energy and 80 kWh/t cement electrical energy. The best thermal and electrical energy consumption presently achieved by the Indian cement industry is about 667 kcal/kg clinker and 67 kWh/t cement which are comparable to the best reported figures of 660 kcal/kg clinker and 65 kWh/t cement in a developed country like Japan. Since the controls were lifted, aggregate power requirements have grown rapidly with rising cement capacity without commensurate growth in power generating capacity in the country. To offset the power crisis situation, many cement plants have set up installations for captive power generation. Further, as part of reform process in coal sector, the Government has also permitted 100% FDI in captive coal blocks in cement sector along with power and steel to facilitate and augment power availability.

Freight Costs

Logistics in the cement sector affect freight costs to a large extent. The basic raw materials for manufacturing cement such as, limestone and coal are low value high bulk material and, as a result, entail huge freight cost which form the single largest cost component, usually accounting for 33% of the variable costs. During 1990s, the most significant developments were the emergence of big plants and formations of clusters of cement plants. These clusters, typically located far away from the major consumption centres meant that cement has to be transported over very long distances. The Indian Railways transported 93.15 million tonnes cement in 2009-10 as against 86.24 million tonnes in 2008-09, as a part of revenue earning freight traffic. Alternatively, the cost-conscious manufacturers have attempted to use sea route for transportation as sea route is cost-effective and could benefit coast-based manufacturers.

Cost Control

Cement producers of the country have continuously attempted to lower the cost by various methods like:

- improved efficiency by increasing usage of captive power;
- locating units closer to the market place;
- increasing production of blended cement;
- availing of various State incentives like sales tax exemption; power tariff; exemption/ concession (Himachal Pradesh and Tamil Nadu);
- conversion from wet to dry process, wherever possible, depending on quality of limestone; and
- enhanced capacities to achieve economy of scale. (Expansion is the preferred route. A new plant costs thrice the cost of expansion).

Environment

Ministry of Environment and Forests has notified the emission standards for cement plants in 1987, which was subsequently revised in February, 2006. In India, the permissible stack dust emissions from various sources for existing cement plants is 1.50 mg/Nm3 and 100 mg/Nm3 for plants located in critically polluted areas. However, the limit for new plants in our country is 50 mg/Nm3 which is at par with some of the developed countries. All large plants have provided necessary air pollution control equipment to control dust emissions. Thermal power stations use bituminous or sub-bituminous coal and produce large volumes of fly ash. Fly ash is a fine glass like powder recovered from gases created by coal-fired electric power generation. These micron sized earth elements consist primarily of silica, alumina and iron. When mixed with lime and water the fly ash forms a cementitious compound with properties very similar to portland cement. For producing one tonne of cement about 0.2 tonnes of fly ash can be used. It not only reduces the cost of cement using fly ash by 5 to 10% but also saves on transportation & disposal of materials and 30 to 40% of land required for the power projects towards ash handling. A 1,000 MW project requires around 1,000 acres for ash dykes for a 25 year period for storing of fly ash.

At present, about 95 million tonnes fly ash is being generated annually. It is estimated that about 32% utility of fly ash can be made in cement industry. Promoting use of fly ash would be an environment-friendly measure without sacrificing the quality of OPC.

Reliance Power Ltd (RPL) is understood to have plans for setting up a 20 million tpy cement plant near Satna in Madhya Pradesh. NTPC is also learnt to have plans to manufacture cement near six of its power plants through joint ventures. Grasim Industries Ltd, Ultratech Cement Ltd, Sanghi Cement Ltd, India Cement Ltd, Zuari Cement Ltd and My Home Industries Ltd, among others are learnt to have evinced interest to set up greenfield cement plants in the vicinity of 4,000 MW each ultra power projects in order to utilise the fly ash that would be generated from them.

Industrial wastes such as petcoke, tar waste and by-products such as red mud from aluminium industries, ferrous and non-ferrous slag from steel and other industries, phospho-chalk and phospho-gypsum from fertilizer industries, lime sludge from paper and sugar industries, carbide sludge from carbide industries and phosphorus furnace slag, etc. are now finding use in manufacture of cement. Cement plants in India utilised about 27% of fly ash generated by thermal power plants and almost all the granulated slag generated by steel plants in 2010-11.

Ready-Mix Concrete Industry

Ready-mix concrete (RMC) is a relatively nascent market in India accounting for only about 0.5% of the demand. RMC is ready-to-use concrete blend of cement, sand and aggregate and water mixed in convenient proportion. It was first launched in Mumbai a few years ago and is gaining ground in other metros in India. RMC is a corollary to bulk handling and transportation of cement. It has several advantages. It is produced under controlled conditions and hence has consistency in quality and it can be directly powered in the required form, saving time and improving the quality of construction.

POLICY

Foreign Trade Policy (FTP) for 2009-14 was announced on 27.08.2009 and came into force w.e.f. 27.08.2009. The Export & Import Policy incorporated in the FTP for cement is free. The import of cement includes portland cement, white cement, aluminous cement, slag cement, super sulphate cement and similar hydraulic cements, whether or not coloured or in the form of clinkers, under ITC (HS) Code 2523 is free. The export of cement is also free.

Development Council for Cement Industry

Development Council for Cement Industry has been set up under Section 6 of the Industrial (Devlopment & Regulation) Act,1951. The activity of the Council is funded through the cess collected from Cement Manufacturers in terms of the Cement Cess Rules,1993. The Cement Council promotes development of the cement industry by providing funds for development projects in areas of base level activities of National Council for Cement & Building Materials, and R&D, improving productivity by reducing cost, optimum utilisation of raw materials, modernisation of cement plants, improvement of environment, standardisation and quality control progress, bulk supply and distribution of cement, training and upgradation of skill in cement industry.

WORLD REVIEW

The cement production in 2010 was estimated at 3,310 million tonnes. China (1,880 million tonnes) was the largest producer in the world, contributing about 57% to the world output, followed by India (210 million tonnes), USA (67 million tonnes) and Japan (52 million tonnes) (Table-5).

FOREIGN TRADE

Exports

Export of cement (total) increased considerably to 3.61 million tonnes in 2010-11 from 2.69 million tonnes in 2009-10. In 2010-11, exports of portland grey cement were 2.20 million tonnes and those of cement clinker 1.14 million tonnes in the total cement exports. Exports of portland white cement and other cements were 1.65 lakh tonnes and 1.05 lakh tonnes, respectively. Exports of cement in 2010-11 were mainly to Nepal (49%), Sri Lanka (26%), Iraq (5%), Egypt & Maldives (3% each) (Tables - 6 to 10).

Imports

Cement imports in 2010-11 decreased sharply to 1.1 million tonnes from 2.11 million tonnes in 2009-10. In 2010-11, imports of grey cement were 7.8 lakh tonnes, those of cement clinker 1.84 lakh tonnes, other cements 1.24 lakh tonnes and white cement about 8 thousand tonnes. Main suppliers in 2010-11 were Pakistan (54%), Bangladesh (26%) and China (16%) (Tables - 11 to 15).

Table-5 : World Production of Cement
(By Principal Countries)

(In '000 tonnes)

Country	2008	2009	2010
World: Total (rounded)	2840000	2800000	3310000
Brazil	51900	53000	59100
China	1390000	1400000	1880000
Egypt	40000	40000	48000
France	21700	21000	-
Germany	33600	33000	29900
India**	177000	180000	210000
Indonesia	37000e	37000	22000e
Iran	44400	45000	50000
Italy	43000	43000	36300
Japan	62800	60000	51500
Korea, Rep. of	53900	53000	46000
Mexico	47600	45000	34500
Pakistan	39000	40000	30000
Russia	53600	55000	50400
Saudi Arabia	31800	32000	42300
Spain	42100	42000	23500
Thailand	35600	35000	36500e
Turkey	51400	51000	62700
USA*	87600	72800	67200
Vietnam	37000e	37000	50000
Other countries (rounded)	459000e	450000	480000

Source: 1 Mineral Commodity Summaries, 2011 & 2012
**Includes Puerto Rico*
***India's cement production in 2008-09, 2009-10 and 2010-11 was 185.61 million tonnes. 204.95(e) million tonnes and 216.28(e) million tonnes respectively.*

Table – 6 : Exports of Cement : Total (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**2689485**	**6657266**	**3612062**	**9554773**
Nepal	1351941	3416817	1766895	5236164
Sri Lanka	206250	442858	932251	1864054
Iraq	175150	474169	189982	472490
Maldives	21935	56446	108910	449607
South Africa	28079	115624	71941	229522
Saudi Arabia	9884	39790	47043	197662
Egypt	17335	33292	110758	168119
UAE	50636	157719	54004	145337
Mozambique	65038	122069	52811	109922
Madagascar	41736	78179	58421	108353
Other countries	721501	1720303	219046	573543

Table – 7 : Exports of Cement (Portland Grey) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**1478108**	**3823614**	**2203854**	**6173343**
Nepal	439989	1388465	1059496	3464368
Sri Lanka	170657	359325	661612	1384502
Iraq	175150	474169	189982	472490
Maldives	20042	49487	107902	445391
South Africa	16366	50300	53049	135351
Madagascar	41630	77612	58365	108029
Yemen Rep.	251454	559409	37603	68690
Libya	-	-	13452	25894
Sudan	27117	78639	6627	17969
Unspecified	-	-	8000	18360
Other countries	335703	786208	7766	32299

Table – 8 : Exports of Cement (Portland White) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**83241**	**398033**	**165559**	**711446**
Saudi Arabia	8583	35943	46949	195589
Nepal	25312	115656	25847	124760
South Africa	11703	65304	18652	90698
UAE	17584	78911	21644	88446
Sri Lanka	1288	5991	20162	46478
Thailand	1893	10168	8505	45134
Nigeria	5045	27518	7628	41350
Kenya	3814	17760	3913	19702
Chinese Taipei/ Taiwan	2063	8771	2904	12635
Tanzania	1175	6108	2292	8733
Other countries	4781	25903	7063	37921

Table – 9 : Exports of Cement Clinker (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**1012735**	**2051773**	**1137873**	**2321265**
Nepal	804457	1635425	601281	1409033
Sri Lanka	19084	35345	248401	426793
Egypt	17335	33292	110758	168119
Mozambique	64600	119364	49500	90528
Argentina	-	-	38808	67791
UAE	32700	75832	32340	56744
Mauritania	-	-	35773	54971
Bangladesh	11243	33513	13469	33402
Chile	-	-	7533	13841
USA	5	834	2	29
Other countries	63311	118168	8	14

Table – 10 : Exports of Cement (Others) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**115401**	**383846**	**104776**	**348719**
Nepal	82183	277271	80271	238003
Myanmar	-	-	9709	28368
Netherlands	-	-	900	13029
Bangladesh	6014	19181	4773	11660
Italy	1	17	1231	10881
Sudan	4215	13737	1599	9958
Sri Lanka	15221	42198	2076	6281
Iran	-	-	170	6140
Maldives	1893	6958	914	3761
South Africa	10	21	240	3473
Other countries	5864	24463	2893	17165

Table – 11 : Emports of Cement-Total (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**2111997**	**5683270**	**1095624**	**3526386**
Pakistan	652060	1936300	594481	1688541
Bangladesh	169586	624565	289084	1056092
China	568757	1371538	177999	542014
Germany	1161	18593	7422	74223
UAE	5983	38777	4800	31086
Malaysia	17854	51762	8896	29920
France	1010	29934	994	28767
Netherlands	976	25525	1264	24779
Bhutan	3061	9520	3278	12367
UK	266	6707	307	6760
Other countries	691283	1570049	7099	31837

Table – 12 : Imports of Cement (Portland Grey) (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**726409**	**2222213**	**780180**	**2366507**
Pakistan	640791	1901690	585526	1655978
Bangladesh	83232	310394	186780	686683
Bhutan	2338	6932	2738	10009
China	-	-	700	2055
Sri Lanka	-	-	700	2043
Ireland	-	-	700	1929
Netherlands	-	-	700	1929
USA	-	-	700	1929
Afghanistan	-	-	516	997
Unspecified	-	-	420	1195
Other countries	48	3197	700	1760

Table – 13 : Imports of Cement (Portland White) (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**19371**	**77218**	**7910**	**50230**
UAE	5836	37276	4760	30004
Pakistan	1663	8323	2885	15102
UK	260	5446	240	4347
China	4	68	25	776
Other countries	11608	26105	++	1

Table – 14 : Imports of Cement Clinker (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**1257105**	**2799931**	**184033**	**420351**
China	558946	1225200	172533	383740
Malaysia	17854	51762	8894	29890
Korea Rep. of	97197	225390	1912	4660
Pakistan	839	2061	280	801
Bangladesh	-	-	100	360
Afghanistan	-	-	163	281
Denmark	-	-	1	5
Unspecified	-	-	150	614
Other countries	582269	1295518	-	-

Table – 15 : Imports of Cement (Others) (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**109112**	**583908**	**123501**	**689298**
Bangladesh	86354	314171	102204	369049
China	9807	146270	4741	155443
Germany	1161	18593	7422	74223
France	1010	29934	994	28767
Netherlands	976	25525	564	22850
Pakistan	8767	24227	5790	16659
USA	15	361	78	3160
UK	6	1261	67	2413
Bhutan	723	2588	540	2358
Unspecified	-	-	123	2488
Other countries	293	20978	978	11888

FUTURE OUTLOOK

The cement industry is vital for the development of infrastructure all over the world as no other material is likely to be its substitute in the near future. Infrastructure and industrial activity, real estate business and investment in core sectors mainly drive the demand for cement. Some emerging markets for cement demand are concrete roads, concrete canal lining and rural construction (housing). Over 65% demand for cement arises from construction sector.

The country is self-sufficient in cement. Most of the cement plants in India have the state-of-the-art technology and production facilities. The liberalisation policies for cement industry have helped in achieving the strong growth of the cement sector. Cement industry is going ahead with a modification and upgradation of technology particularly in energy conservation.

The Working Group on Cement Industry constituted by the Planning Commission for the 12th Five-Year Plan period has projected a demand growth at the rate of 10.75% per annum during the plan period at an expected 9% GDP growth rate. The Working Group expects that the additional installed capacity requirement would be 139.7 million tonnes by 2017 and 1035.3 million tonnes by 2027.

Based on the demand growth projection the consumption of cement by the end of the 12th five year plan would be between 366.9 million tonnes and 397.4 million tonnes assuming growth rates of 9.75% to 10.75% during the Plan period.

The production and installed capacity estimated at 479.3 million tonnes and 407.4 million tonnes , respectively, (with a capacity utilisation of 85% in 2016-17). Reviewing the technology status of the Indian Cement Industry, the Working Group has observed that although the modern cement plants have incorporated the latest technology, yet there is scope for further improvement in the areas of in-pit crushing and conveying, pipe conveyors, co-processing of waste derived/hazardous combustible wastes as fuel, neurofuzzy expert system, cogeneration of power, multi chamber/dome silos, bulk transport of cement, palletizing and shrink wrapping for packing & despatch.

The Working Group has observed that the cement industry's average energy consumption is estimated to be about 725 kcal/kg clinker thermal energy and 80 kWh/t cement electrical energy. It is expected that the industry's average thermal energy consumption by the end of 12th Plan (Year 2016-17)) will come down to about 710 kcal/kg clinker and the average electrical energy consumption will come down to 78 kWh/t cement with continued efforts by all concerned. The Working Group has taken into consideration the following alternate energy sources/fuels having good potential in the present context of Indian economics to either partially or fully substitute coal in cement manufacure in the coming years, namely, pet coke, lignite, natural gas , and bio-mass wastes including fruit of Jatropha Carcus, Pongamia and Algae. The Report states that the cement industry in India has the potential to utilise the entire hazardous waste generation of the country, if found suitable.

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

CHROMITE

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

23 Chromite

Chromite is an oxide of chromium and iron. The chemical composition of chromite is $FeO.Cr_2O_3$ or $Fe Cr_2O_4$. Chromite contains 68% Cr_2O_3 and 32% FeO with Cr : Fe ratio of about 1.8 : 1. Chromite is the only commercial source of chromium. It occurs as a primary mineral of ultrabasic igneous rocks and is normally associated with peridotite, pyroxenite, dunite and serpentinite. Worldwide, high-alumina chromite, largely from podiform deposits is used in refractory applications while iron-rich ores, largely from stratiform deposits are utilised in metallurgical and chemical applications.

RESOURCES

As per UNFC system, total resources of chromite in the country as on 1.4.2010 are estimated at 203 million tonnes, comprising 54 million tonnes reserves (27%) and 149 million tonnes remaining resources (73%). More than 93% resources of chromite are located in Odisha, mostly in the Sukinda valley in Cuttack and Jajpur districts. Minor deposits are scattered over Manipur, Nagaland, Karnataka, Jharkhand, Maharashtra, Tamil Nadu and Andhra Pradesh. Gradewise, charge-chrome grade accounts for 36% resources followed by ferro-chrome grade (19%), beneficiable grade (17%) and refractory grade 5%. Low, others, unclassified and not-known grades together account for 23% (Table-1).

EXPLORATION & DEVELOPMENT

GSI undertook scout drilling in the areas south of Raibola-Kanheipal in Dhenkanal district, Odisha within the transition zones of Eastern Ghat Mobile Belt (EGMB) and Iron Ore Super Group (IOSG) rocks, south of Sukinda ultramafic complex. The host rocks are exposed in old mining pits scattered within a strike length of 1.5 km and width of 100 metres in NW-SE direction.

Similarly, investigation was taken up in Kondapalli-Gangineni area in Krishna & Khammam districts of Andhra Pradesh to assess its potentiality. The host rocks are pyroxenite, granulite and charnockite with enclaves of pyroxenite. In Koduru village, a mappable body of pyroxenite measuring 28 m x 17 m indicated presence of chromite. In Kondapalli area, chromite occurs as lenses, bands, pockets & disseminations in lenticular bodies of pyroxenite. In the old open-cast quarries, in situ chromite was noticed.

Directorate of Geology, Odisha conducted exploration in Kakudia area in Jajpur district, to locate anomaly zone by geophysical prospecting and geochemical sampling. The area forms part of area south of Mahagiri Hills in Sukinda. As a result a high contour closure in NE-SW direction was deciphered. Chemical analysis of samples was in progress. Core drilling was done in a lease of IDCOL. FACOR and OMC Ltd conducted exploration in their leases. The details are given in Table-2.

PRODUCTION, STOCKS & PRICES

The production of chromite at 4.26 million tonnes during 2010-11 increased by 24% as compared to the previous year owing to improved market condition and demand.

The number of reporting mines was 21 in 2010-11 as compared to 22 in the preceding year. Six principal producers operating 11 mines together accounted for 92% of the total production during the year. The contribution of 10 mines, each producing more than 100,000 tonnes per annum, was more than 96% of the total production.

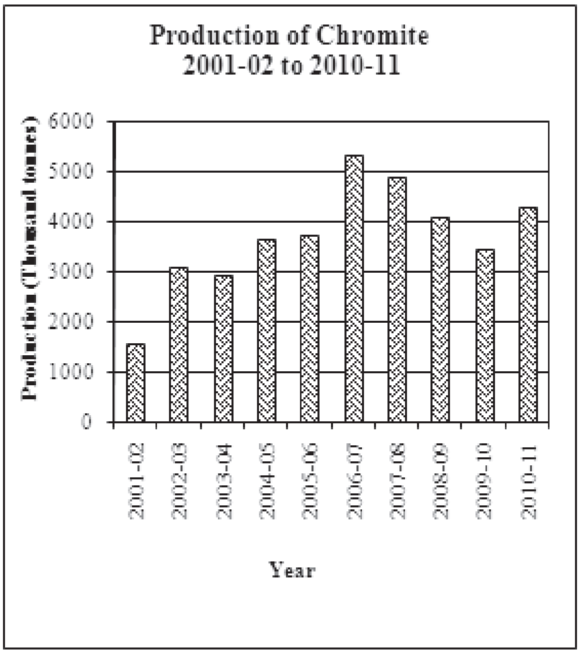


Table – 1 : Reserves/Resources of Chromite as on 1.4.2010 (By Grades/States)

(In '000 tonnes)

Grade/State	Reserves				Remaining resources								Total resources (A+B)
	Proved STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
		STD121	STD122			STD221	STD222						
All India : Total	**31652**	**7165**	**15153**	**53970**	**1371**	**1407**	**4431**	**31787**	**36525**	**52497**	**21359**	**149377**	**203347**
By Grades													
Refractory	4074	923	704	5701	547	-	-	15	240	3262	-	4064	9765
Charge-chrome	10984	868	9565	21417	495	1107	1679	6332	29840	11508	-	50961	72378
Low	26	27	-	53	-	-	-	-	-	3713	-	3713	3766
Beneficiable	8245	2912	2668	13825	255	279	710	12457	1843	5610	-	21154	34979
Ferro-chrome	6304	1689	1353	9346	74	20	88	12805	2794	13280	-	29061	38407
Others	175	746	-	921	-	-	-	168	15	-	-	183	1104
Unclassified	1844	-	863	2707	-	-	1953	9	1778	14963	21359	40062	42769
Not-known	-	-	-	-	-	1	1	-	16	161	-	179	179
By States													
Andhra Pradesh	-	-	-	-	-	-	-	-	15	172	-	187	187
Jharkhand	-	-	-	-	-	-	-	15	98	623	-	736	736
Karnataka	333	395	17	745	250	218	96	-	20	303	-	887	1632
Maharashtra	53	23	-	76	5	-	-	43	67	441	-	556	632
Manipur	3	21	52	76	-	-	-	-	529	6052	-	6581	6657
Nagaland	-	-	-	-	-	-	-	-	-	3200	-	3200	3200
Odisha	31263	6725	15085	53073	1116	1189	4335	31722	35796	41431	21359	136948	190021
Tamil Nadu	-	-	-	-	-	-	-	7	-	276	-	283	283

Figures rounded off.

Table- 2 Details of Exploration Activities for Chromite, 2010-11

Agency/ State/ District	Location/ Area/ Block	Mapping Scale	Mapping Area (sq km)	Drilling No. of bore-holes	Drilling Meterage	Sampling (No.)	Remarks Reserves/Resources estimated
GSI **Andhra Pradesh** Krishna & Khammam	Kondapalli Gangineni Koduru	-	-	-	-	24	Reconnaissance Stage (G-4) investigation was taken up. Cr_2O_3 content was 20.82% to 43.04% from samples from Kondapalli area.
Odisha Dhenkanal	Raibola-Kanheipal	-	-	-	-	-	Reconnaissance Stage (G-4) investigation was taken up. A few patches of intensely silicified serpentinite were noted in western part of areas under investigation. Chromite here occurs in weathered & silicified serpentinite as discrete grains, laminae & bands with width up to 70 cm.
Directorate of Geology							
Odisha Jajpur	Kakudia area	1:2000	1.125	-	-	482	About 94.265 cu m pitting was done & samples sent for analysis.
		1:200	1.25	-	-	-	Magnetic data on a 50 x 10 m grid was collected & interpreted.
Jajpur	Tailangi mine of IDCOL	-	-	-	100.25	204	Core drilling was done.
OMC Ltd **Odisha**							
Jajpur	South Kaliapani lease	1:2000 1:1000	1.5 0.015	11	814.5	311	About 273,400 tonnes resources were estimated and band II South flank was proved to a depth of 60 mts.
-do-	Kaliapani lease	-	-	15	4048	205	No resources were proved in Bhimatanagar. Exploration continuing were north of Damasa nala and south of quarry III.
Keonjhar	Bangur lease	1:200	0.04	33	5143.6	1887	About 150,000 tonnes of chromite resources were estimated.
Dhenkanal	Kathpal lease	-	-	4	730.50	-	Exploration was for proving ore continuity.

(Contd)

Table - 2 (Concld.)

Agency/ State/ District	Location/ Area/ Block	Mapping Scale	Mapping Area (sq km)	Drilling No. of bore-holes	Drilling Meterage	Sampling (No.)	Remarks Reserves/Resources estimated
FACOR Ltd **Odisha** Keonjhar	Boula mine	-	-	84	1229.8	268	Drilling was to locate faulted ore segments & geo-tech studies. The total resources as on March 2011 were estimated at 50.10 lakh tonnes grading 31.54% Cr_2O_3.
Dhenkanal	Kathpal mine	1: 200 1: 500 1:2000	- - -	93	4992.1	162	Surface drilling was by 16 holes with total metreage of 3665.3 m and underground by 77 holes and total metrage of 1326.8 m. Resources as on 1. 4. 2011 were 4.98 lakh tonnes grading 45.14% Cr_2O_3 and remaining resources 12.119 lakh tonnes grading 44. 47 % Cr_2O_3.
Jajpur	Ostapal mine	1:2000	72.84	10	214	68	The total resources estimated as on 1. 4. 2011 were at 55.58 lakh tonnes grading 40. 42 % Cr_2O_3.

The share of public sector in total production was 29% in 2010-11 as compared to that of 18% in the previous year. About 30% of the total production was reported from captive mines in the current year as compared to 34% in the previous year.

Odisha continued to be the major producing state of chromite, accounting for 99.8% production during 2010-11. The remaining production was reported from Karnataka.

Gradewise analysis of production during 2010-11 reveals that 52% & above Cr_2O_3 lumps and fines accounted for 18% {lumps (marginal) and fines 18%}, 40%-52% Cr_2O_3, for 27% (lumps 3% and fines 24%), below 40% Cr_2O_3 for 38% (lumps3% and fines 35%) and chromite concentrates 17% of the total production (Tables - 3 to 7).

Mine-head stocks of chromite at the end of 2010-11 decreased by 3% to 1,277 thousand tonnes as compared to 1,323 thousand tonnes at the beginning of the year. Out of the total mine head stocks about 98.9% were held in Odisha (Tables - 8A & 8B).

The average daily employment of labour in chromite mines during 2010-11 was 5,480 against 6,735 in the previous year. Domestic prices of chromite are furnished in the General Review on Prices.

Chromium Metal

Production of chromium metal was reported by ACME Ferro Alloys Pvt. Ltd during 2010-11 to the tune of 1,595 kg (Tables - 9 & 10).

Table – 3 : Principal Producers of Chromite 2010-11

Name & address of producer	Location of mine	
	State	District
The Tata Steel Ltd, Bombay House, Fort, Homi Mody Street, Mumbai – 400 001, Maharashtra.	Odisha	Jajpur
The Orissa Mining Corporation Ltd, 'OMC House', Post Box No. 34, Bhubaneswar – 751 001, Odisha	Odisha	Dhenkanal and Jajpur
Balasore Alloys Ltd, Balgopalpur, Balasore – 756 020, Odisha.	Odisha	Jajpur
Indian Metal & Ferro Alloys Ltd, Bomikhal, P.O. Rasulgarh, Bhubaneswar – 751 010, Odisha.	Odisha	Jajpur and Keonjhar
Ferro Alloys Corporation Ltd, D.P. Nagar, P.O. Randia - 756 135, Dist. Bhadrak, Odisha.	Odisha	Jajpur and Keonjhar
IDCOL Ferro Chrome & Alloys Ltd, Ferro Chrome Project-755 020 Jajpur Road, Dist. Jajpur, Odisha.	Odisha	Jajpur

Table – 4 : Production of Chromite, 2008-09 to 2010-11(P) (By States)

(Qty in tonnes; value in ₹'000)

State	2008-09		2009-10		2010-11(P)	
	Qty	Value	Qty	Value	Qty	Value
India	**4073479**	**22633627**	**3425580**	**10453620**	**4262207**	**22955675**
Karnataka	4115	36475	6483	30856	8491	36851
Maharashtra	–	–	66	489	-	-
Odisha	4069364	22597152	3419031	10422275	4253716	22918824

Table – 5 : Gradewise Production of Chromite, 2009-10 (By Sectors, States and Districts)

(Qty in tonnes; value in ₹'000)

State/ District	No. of mines	Production by Grades : Cr_2O_3 Content							Total	
		Below 40%		40% - 52%		52% & Above				
		Lumps	Fines	Lumps	Fines	Lumps	Fines	Concentrates	Quantity	Value
India	**22**	**155728**	**1270035**	**127458**	**832845**	**80**	**482880**	**556554**	**3425580**	**10453620**
Public sector	8	7945	48319	714	201393	80	321416	31513	611380	3272273
Private sector	14	147783	1221716	126744	631452	_	161464	525041	2814200	7181347
Karnataka	**3**	**6251**	**227**	_	**5**	**–**	**–**	**–**	**6483**	**30856**
Hasan	3	6251	227	_	5	–	–	–	6483	30856
Maharashtra	**1**	**66**	_	_	_	_	_	_	**66**	**489**
Bhandara	1	66	_	_	_	_	–	–	66	489
Odisha	**18**	**149411**	**1269808**	**127458**	**832840**	**80**	**482880**	**556554**	**3419031**	**10422275**
Dhenkanal	1	391	-	17463	2216	-	-	-	20070	121622
Jajpur	13	103822	1269808	81088	807127	-	482880	556554	3301279	9920652
Keonjhar	4	45198	_	28907	23497	80	_	_	97682	380001

Table – 6 : Gradewise Production of Chromite, 2010-11 (P)
(By Sectors, States and Districts)

(Qty in tonnes; value in ₹'000)

State/ District	No. of mines	Production by Grades : Cr_2O_3 Content							Total	
		Below 40%		40% - 52%		52% & Above				
		Lumps	Fines	Lumps	Fines	Lumps	Fines	Concentrates	Quantity	Value
India	**21**	**133733**	**1495217**	**138780**	**1024328**	**48**	**749777**	**720324**	**4262207**	**22955675**
Public sector	8	8471	214901	0	447763	0	**477280**	107383	1255798	10894034
Private sector	13	125262	1280316	138780	576565	**48**	272497	612941	3006409	12061641
Karnataka	**3**	**8471**	**20**	**–**	_	**–**	**–**	_	**8491**	**36851**
Hassan	3	8471	20	–	_	–	–	_	8491	36851
Odisha	**18**	**125262**	**1495197**	**138780**	**1024328**	**48**	**749777**	**720324**	**4253716**	**22918824**
Dhenkanal	1	3271	–	15382	1817	–	–	–	20470	151921
Jajpur	13	58729	1495197	82548	984905	48	749777	720324	409152	22252198
Keonjhar	4	63262	–	40850	37606	–	–	–	141718	514705

Table – 7 : Production of Chromite, 2009-10 and 2010-11((P)
(By Frequency Groups)

(Qty in tonnes)

Production group	No. of mines		Production for the group		Percentage in total production		Cumulative percentage	
	2009-10	2010-11	2009-10	2010-11	2009-10	2010-11	2009- 10	2010-11
Total	**22**	**21**	**3425580**	**4262207**	**100.00**	**100.00**	**100.00**	**100.00**
Up to 10000	9	8	13724	17706	0.40	0.42	0.40	0.42
10001 - 100000	7	3	454838	134341	13.28	3.15	13.68	3.57
100001 - 200000	1	5	132424	557245	3.87	13.07	17.55	16.64
200000- 300000	2	3	466359	791677	13.61	18.57	31.16	35.21
300000 and above	3	2	2358235	2761238	68.84	64.79	100.00	100.00

Table – 8 (A) : Mine – head Stocks of Chromite, 2010-11
(At the beginning of the year)
(By States/Grades)

(In tonnes)

State	Stocks by Grades: Cr_2O_3 Content							Total
	Below 40%		40% -52%		52% and above			
	Lumps	Fines	Lumps	Fines	Lumps	Fines	Concentrates	
India	**58698**	**959983**	**47932**	**144158**	**594**	**18776**	**92519**	**1322660**
Karnataka	8591	287	-	-	-	-	-	8878
Maharashtra	135	-	-	-	-	-	-	135
Odisha	49972	959696	47932	144158	594	18776	92519	1313647

Table – 8 (B) : Mine – head Stocks of Chromite, 2010-11(P)
(At the end of the year)
(By States/Grades)

(In tonnes)

State	Stocks by Grades: Cr_2O_3 Content							Total
	Below 40%		40% -52 %		52% and above			
	Lumps	Fines	Lumps	Fines	Lumps	Fines	Concentrates	
India	**57599**	**919185**	**26859**	**144949**	**275**	**42184**	**85635**	**1276686**
Karnataka	13456	204	-	-	–	–	-	13660
Maharashtra	125	–	-	-	–	–	-	125
Odisha	44018	918981	26859	144949	275	42184	85635	1262901

Table – 9 : Principal Producer of Chromium Metal 2010-11

Name & address of producer	Location of mine	
	State	District
ACME Ferro Alloys Pvt. Ltd, 30, C.D.E. C-Sector Industrial Area, Ratlam-457 001, Mahya Pradesh.	Mahya Pradesh	Ratlam

Table – 10 : Production of Chromium Metal 2008-09 to 2010-11

(In kg)

Year	Quantity
2008-09	NA
2009-10	NA
2010-11(P)	1595

MINING & TRANSPORT

Chromite is mined mostly by opencast method in the country. In OMC's opencast mines, the bench height is less than 6 m and the bench width is more than 10 m in mechanised quarry. The bench height and width is 1.5 m and 2 m, respectively, in the manual quarry. The mining machinery deployed in OMC mines include I.R. & wagon drills for drilling 100 mm dia holes, excavation by Poclain of 1.00 m^3 to 3.70 m^3 capacity, dozers of 15' blade, loader excavator of 1.70 m^3 and dumpers of 16-18 m^3 capacity. In some quarries tippers and pay loaders are used in addition to manual means. The motive power is provided by electric generators of 75-160 KVA and portable diesel generators of 5 KVA capacity. In South Kaliapani (quarry D) mine of OMC, the 14 m wide main haulage road was proposed to align with a circular path. The haulage road for removing overburden from quarry face to dump was also to be partially aligned. The altered position will be permanent.

Underground mines are confined to Byrapur in Karnataka and Boula & Kathpal mines in Odisha. A proposal was under consideration to convert Nausahi chromite mines of Indian Metals and Ferro Alloys Ltd (IMFA) into an underground mine. For this purpose, development of inclines from the existing quarry bottom was started. Tata Steel was also contemplating to convert a part of Sukinda chromite mine into an underground mine for which rock mechanics studies by South African consultant have been carried out. Chromite ore body extending to 300 m depth is mined by underground method since 1967 at Byrapur in Hassan district of Karnataka. Here cut-and-fill method of stoping is practised. In Sukinda valley, chromite has been mined to a maximum depth of about 63 m by opencast method. The maximum overburden to ore ratio is 15:1. In the two underground mines in Odisha-one at Kathpal of M/s Ferro Alloys Corporation Ltd and other at Bangur of IMFA - sub-level stoping with parallel/ ring hole blasting with delayed firing is practised. Construction of cement concrete barrier has been planned to provide a base for the fill material at 30 m interval in the dip direction. In Sukinda area, deposits of chromite lying below 100 m depth may have to be exploited by highly specialised underground mining techniques.

OMC was also developing underground mine near Bangur in Baula-Nuasahi chromite belt close to IMFA mining operations. Though positive results were obtained from drilling, systematic exploration was yet to be taken up. OMC's chromite mines at Kaliapani, Sukrangi, Kalarangi, Kathpal and Bangur, all in Odisha, make it one of the leading chromite producers of the country. Chrome ore of very high grade (+58% Cr_2O_3) is produced here. The chrome ore beneficiation plant at Kaliapani with a total production capacity of 84,000 tonnes concentrates is designed to upgrade low-grade ore below 33% Cr_2O_3. Keeping in view the increasing demand for chrome concentrates, OMC is in the process of doubling the capacity of this plant.

Transportation of the ore from mines to railway sidings is done through trucks and from railway sidings to various consuming centres by railway wagons. In South Kaliapani mine of OMC, the width of haul road was more than 3 times the width of tipper/ dumpers plying in the quarry and in some places one way traffic was provided as and when needed. Important loading stations for chromite in the country are Jajpur-Keonjhar Road in Odisha and Tiptur in Karnataka. Export of chromite is through Paradip port. However, small quantities of lumpy chromite ore are imported to meet the needs of ferro-alloys industry in the country.

Research and Development

The Institute of Minerals & Material Technology (IMMT), Bhubaneswar (CSIR) conducted roasting studies for Tata Steel Ltd, Sukinda to recover the chromite values from plant tailings and based on the results pilot plant column was designed & installed at the COB plant. Laboratory tests indicated possibility of recovery of 44% Cr_2O_3 from a feed grade of 17-18% Cr_2O_3. Chromite overburden material from different mining sites in Sukinda district was collected for dry beneficiation studies by wet & dry processes to find nickel concentration. The feed sample of COB containing 0.9% Ni was enriched to 0.95% in - 45 micron fraction.

In a study conducted for Ferro Alloys Corp. Ltd, investigations were conducted to improve the chrome-iron ratio of chromite concentrates of COB plant and recovery of chromite value lost in the plant tailings. The result of investigation indicates that a commerical grade concentrate can be recovered by combination of hydro cyclones and gravity tables.

OMC Ltd executed an agreement with M/s HWMIPL for a new stand-alone chrome ore beneficiation (COB) plant of feed capacity of 1.5 lakh tpy to upgrade low grade chrome ore to high grade as well as a tailing pond for the existing and new COB plant at South Kaliapani mine.

Modification of existing COB plant to enhance its effciency was also under consideration at Kaliapani mine.

Environmental Problems

Management of waste dump in Sukinda valley is the major environmental concern. These overburden dumps modify the land topography, affect the drainage system, prevent natural succession of plant growth resulting in acute problems of soil erosion and environmental pollution.

Normally, waste dumps are maintained up to a height of 20-30 m with 30 m terrace width and slope angle of 25 to 35^{o}. Toe-wall, garland drain, terracing and plantation along the slope are some of the common measures that are being adopted for waste dump management. Neem, Chakunda, Accacia, Mahul, Sal, Mango, Cashew, Arjuna, Babul, Amla, Bahada, Jamun, etc. are the species used in afforestation over dead dump slopes, dump terrace, along the haul roads and safety zones in the mines.

The major source of environmental pollution in Odisha is the hexavalent chromium generation, especially in case of friable ore. The hexavalent chromium contamination of the local water bodies is a major concern because of its carcinogenic properties. The pumped out water from the mine needs to be doused with ferrous sulphate solution before being discharged. The water is then neutralised with addition of lime. The Mining Research Cell, Indian Bureau of Mines, during 2008-09 had carried out a study for the attenuation of hexavalent chromium in Sukinda chrome belt by bio-remediation technology which is apparently environment-friendly. This study was a S&T Project in association with Utkal University.

Environmental problems related to chromium processing are limited. Chromium, in its trivalent (Cr^{3+}) oxidation state as found in chromite and other natural minerals, is an essential nutrient. Its principal function is to maintain normal glucose metabolism. Chromium deficiencies can lead to problems in insulin circulation as well as possible risk of cardiovascular disease. Hexavalent form of chromium (Cr^{6+}) which is used widely in chemical compounds has been implicated in skin rashes and lung cancer.

CONSUMPTION

The reported consumption of chromite in the organised sector increased by 25.4% from 2,159,500 tonnes in 2009-10 to 2,708,100 tonnes in 2010-11. Almost entire consumption (98.9%) was in ferro-alloys/charge-chrome industry. In addition to above, chromite in substantial quantities is also consumed in small-scale ferro-chrome units for which information is lacking. Besides, nominal consumption is reported by refractory industry and a negligible amount by others. Data on consumption of chromite, ferro-chrome & ferro-chrome-silicon from 2008-09 to 2010-11 are given in Tables -11 to 13.

Table – 11: Reported Consumption of Chromite 2008-09 to 2010-11 (By Industries)

(In tonnes)

Industry	2008-09	2009-10(R)	2010-11(P)
All Industries	**2161500**	**2159500**	**2708100**
Chemical	4800(2)	4800(2)	4200(2)
Ferro-alloys (including charge-chrome)	2132000[(e)]	2310000[(e)]	2678000[(e)]
Refractory (including iron & steel)	23700(22)	23900(24)	24400(23)
Others (foundry, ceramic, glass)	1000(6)	800(6)	900(6)

Figures rounded off. Data collected on non-statutory basis. Figures in parentheses denote the number of units in the organised sector reporting consumption.*
*(*Includes actual reported consumption and/or estimates made wherever required).*
Small scale sector is also producing ferro-chrome for which data is not available.

Table – 12 : Reported Consumption of Ferro-chrome 2008-09 to 2010-11 (By Industries)

(In tonnes)

Industry	2008-09	2009-10(R)	2010-11(P)
All Industries	**228800**	**272700**	**273300**
Alloy steel	33300(12)	37800(12)	37800(12)
Electrode	++(1)	++(1)	++(1)
Foundry	500(9)	400(9)	400(9)
Iron & steel	195000 (11)	234500(13)	235100(13)

Figures rounded off.
Data collected on non-statutory basis.
Figures in parentheses denote the number of units in the organised sector reporting consumption.*
*(*Includes actual reported consumption and/or estimates made wherever required).*

Table – 13 : Reported Consumption of Ferro-chrome-silicon, 2008-09 to 2010-11 (By Industries)

(In tonnes)

Industry	2008-09	2009-10(R)	2010-11(P)
All Industries	**460**	**460**	**460**
Alloy Steel	460(1)	460(1)	460(1)

Figures rounded off. Data collected on non-statutory basis.
Figures in parentheses denote the number of units in the organised sector reporting consumption.*
*(*Includes actual reported consumption and/or estimates made wherever required).*

USES

In metallurgy, chromite is used in the manufacture of chromium metal and various alloys with iron, nickel, cobalt, tungsten, molybdenum, etc. Chromium imparts additional strength, hardness and toughness to its alloys. It also shows resistance to corrosion to steel abrasion, reduces oxidation and flow of electricity. Stainless steel, high-speed tool steel, corrosion and heat-resistant steel are some of the important varieties of chromium steel. Ferro-chrome is of two types: (i) high carbon (containing 4-8% carbon) and (ii) low carbon (containing up to 2% carbon). The amount of chromium used in steel varies with the purpose. Low chromium steels (less than 5% chromium and small amount of nickel) are used in rails, automobiles, armour plates, armour piercing projectiles, etc. Intermediate chromium steels (3-12% Cr and small amounts of W, Mo or Si) are used in high-speed tools, valves for engines and other equipment requiring resistance to abrasion, corrosion and oxidation. Chromium steels include stainless steels (12-18% Cr) and super-stainless steels (12-30% Cr and 7-10% Ni) which are used for cutlery and cooking utensils and in aircraft and high-speed trains, respectively. Chromium (17%) with iron (83%) is also used as ferritic stainless steel to manufacture coins.

Chromite is used in refractory industry because of its resistance to corrosion, high temperature and ability to withstand sudden temperature changes and its chemically neutral character. The ore is used in the form of lumps, bricks or cement in linings, specially of steel furnaces.

Chromite is used for manufacturing important chromium compounds like chromates and bichromates of sodium and potassium, chromium pigments like chromic oxide green and chromic acid which, in turn, are used in chromium-plating solution.

Chromium is an essential trace element for human health. However, some of its compounds are highly toxic and carcinogenic. Environment concerns have reportedly reduced the use of chromite refractories and chromium chemicals.

SUBSTITUTES

Development of substitutes of chromium tends to be deterred by cost performance or the customer appeal of the chromium. There are no substitutes in the stainless steel or super-alloys. Boron, manganese, nickel and molybdenum can be substituted in alloy steels and cast irons. Base metal alloys can sometimes be used in place of stainless steel. Dolomite is an alternative for some refractory bricks. Cadmium yellow is one of the several alternative pigments. However, it is not environmentally acceptable and nickel and zinc are possible substitutes for the protection of decorative coatings.

SPECIFICATIONS

The specifications of chromite vary for different end-use industries. The Cr:Fe ratio is one of the important factors to be considered before deciding the end-use of the mineral. The IS specifications for metallurgical, refractory, chemical and foundry industries are given in Tables 14- 17.

Table – 14 : IS Specifications of Chromite for Metallurgical Industry (IS : 10818-1984) (Reaffirmed in 2008)

Sl. No.	Characteristic (on dry basis)	Grade (%)			
		Low carbon ferro-chrome	High carbon ferro-chrome	Silico-chrome	Charge-chrome
1.	Cr_2O_3 percent, min	48	48	48	44
2.	Total iron percent, max. (as FeO)	15	16	15	18
3.	Al_2O_3 percent	13	13	13	10
4.	SiO_2 percent, max	5	8	10	12
5.	CaO percent, max	5	5	5	5
6.	MgO percent, max	14	16	14	12
7.	Sulphur* (as SO_3) percent, max	0.1	0.1	0.1	0.14
8.	Phosphorus* (as P_2O_5) percent, max	0.005	0.02	0.02	0.2
9.	Cr:Fe, min	3:1	2.8:1	3:1	1.6:1
10.	MgO : Al_2O_3	–	1:4	–	–

**Sulphur* (as SO_3) *and phosphorus* (as P_2O_5) *may be determined as agreed upon by the supplier and the purchaser.*

Table – 15 : IS Specifications of Chromite for Refractory Industry (IS : 10819-1999) (First Revision Reaffirmed, 2010)

a) Chemical

Sl. No.	Characteristic (on dry basis)	Grade - I (percent by mass)	Grade - II (percent by mass)	Grade - III (percent by mass)
1.	Loss on ignition	1.5 max	1.5 max	1.5 max
2.	Cr_2O_3	52 min	50 min	48 min
3.	Total iron (as FeO)	16 max	18 max	18 max
4.	SiO_2	3 max	7 max	9 max
5.	MgO	15 max	15 max	15 max

b) Physical

All the refractory grades of chromite are hard, massive, fine-grained, serpentine-free lumpy ores and in the size range -50 mm to (+) 50 mm.

Table - 16: IS Specifications of Chromite for Chemical Industry (IS : 4737-1982; First Revision, Reaffirmed 2011)

Sl. No.	Characteristic (on dry basis)	Requirement %
1.	Chromic oxide (as Cr_2O_3), percent by mass, min	44.0
2.	Total iron (as FeO), percent by mass, max	20.0
3.	Alumina (as Al_2O_3), percent by mass, max	14.0
4.	Silica (as SiO_2), percent by mass, max	7.0
5.	Lime (as CaO), percent by mass, max	3.0
6.	Magnesia (MgO), percent by mass, max	14.0

Table – 17 : IS Specifications of Chromite Sand for Foundries (IS : 6788-1973; Reaffirmed 2008)

a) Chemical

Sl. No.	Constituent (on dry basis)	Requirement (%)
1.	Cr_2O_3	44 min
2.	Fe_2O_3	26 max
3.	SiO_2	4 max
4.	CaO	0.5 max
5.	MgO	As agreed
6.	Clay	0.75 max
7.	LOI	1.0 max
8.	Moisture	0.5 max
9.	pH value	Between 7.0 and 9.0

b) Physical

The material shall be of two grades, namely, fine and coarse. The shape of grains should be mostly sub-angular and the fusion point should not be below 1800°C. The fineness of the two grades of chromite sand shall conform to the following requirement:

I.S. Sieve	Fraction Retained on	
	Fine Grade (F) (%)	Coarse Grade (C) (%)
710 micron	–	5 max
500 micron	–	10 max
355 micron	–	10-25
250 micron	3 max	10-25
212 micron	18 max	10-20
150 micron		10-20
106 micron	70 min	7-20
75 micron		12 max
Pan	12 max	6 max

INDUSTRY

Chromite is used chiefly in metallurgical industry for manufacture of ferro-alloys; e.g., ferro-chrome, charge-chrome and silico-chrome which are used as additives in making stainless steel and special alloy steel. Ferro-alloys are the essential ingredients for the production of high quality special alloy steel as well as mild steel. The demand for ferro-alloys is associated with the production of alloy steel.

Production of ferro-chrome/charge-chrome was mainly reported by Ferro Alloys Corp. Ltd, Shri Vasavi Industries Ltd, Balasore Industries Ltd, Tata Steel Ltd & Indian Metals & Ferro-Alloys Ltd. As per the Indian Ferro Alloys Producers' Association, 890,916 tonnes and 1030,000 tonnes of ferro-chrome/charge-chrome was produced in 2009-10 and 2010-11, respectively. The production of low carbon ferro-chrome was 2,000 tonnes in 2010-11 as compared to 2,007 tonnes in 2009-10. Tata Steel Ltd, Ferro Alloys Corporation Ltd, and Indian Charge-chrome Ltd were amongst the major producers of charge-chrome in India. The charge-chrome contains 50 to 60% chromium and 6 to 8% carbon. Hard lumpy chromite is used for high-carbon ferro-chrome while friable ores and fine briquettes are used for low-carbon ferro-chrome. Briquette fines along with lumpy ores were also consumed in charge-chrome plants.

The important plants which produce chromite based refractories were Tata Steel Ltd (formerly OMC Alloys), Orissa Industries Ltd, Burn Standard Co. Ltd, Bhilai Refractories Ltd, Joglekar Refractories and Ceramics (P) Ltd, and Associated Ceramics Ltd.

Ferro-chrome when added to steel imparts hardness, strength and augments its stainless characteristics. Carbon content clasifies the ferro-chrome alloy into high carbon (6-8%), medium carbon (3-4%) and low carbon (1.5-3%) although chromium content in all the three grades is around 60-70 percent. Around 2.5 tonnes chrome ore with an estimated power consumption of 4,500 kWh is required to produce one tonne of ferro-chrome.

Ferro Alloys Corpn. Ltd, Garividi, Andhra Pradesh; GMR Technologies & Ind. Ltd, Srikakulam, Andhra Pradesh; Jindal Steel & Power Ltd, Raigarh, Chhattisgarh; Standard Chrome Ltd, Raigarh, Chhattisgarh; SAL Steel, Kachchh-Bhuj, Gujarat; Balasore Alloys Ltd, Balasore, Odisha; IDCOL Ferro Chrome Plant, Jajpur Road, Odisha; Indian Metals & Ferro Alloys Ltd, Theruballi, Odisha; Jindal Stainless Ltd, Dubari, Odisha; Nava Bharat Ferro Alloys Ltd, Dhenkanal, Odisha;Utkal Manufacturing Services Ltd, Choudhwar, Odisha; Rawat Ferro Alloys, Cuttack, Odisha; Rohit Ferro Tech. P. Ltd, Bishnupur, West Bengal and Sri Vasavi Ind. Ltd, Bishnupur, West Bengal are the major ferro-chrome producers.

A sizeable quantity is also produced by units in the small-scale sector

Tata Steel Ltd, FACOR and Indian Charge Chrome Ltd, the three major producers of charge-chrome in the country are 100% export-oriented, having a total capacity of 182,500 tpy. Tata Steel with its charge-chrome plant at Bamnipal, Odisha, has a capacity of 55,000 tpy. FACOR has a capacity of 65,000 tpy charge-chrome at its Randia Plant, Bhadrak district, Odisha. Indian Charge Chrome Ltd (merged with Inian Metals & Ferro Alloys Limited), Cuttack district, Odisha has an installed capacity of 62,500 tpy

Vishnu Chemicals Ltd has plants at Medak, Visakhapatnam (Andhra Pradesh) and Bhilai (Chhattisgarh) to produce chromium chemicals. Sodium dichromate capacity at its plants is reported to be 70,000 tpy. There were two producers of chromium chemicals in small quantities in the organised sector; namely, Tamil Nadu Chromates and Chemicals Ltd and Krebs & Cie (India) Pvt. Ltd.

Plantwise specifications of chromite in respect of major user industries are given in Table - 18.

Table – 18 : User's Specifications of Chromite in Major Consuming Industries

Industry/Name and location of plant	Specifications of ore consumed
FERRO-CHROME/CHARGE-CHROME	
Andhra Pradesh	
Andhra Ferro Alloys Ltd, Kothavalasa, Dist. Vizianagram.	NA
Facor-Alloys Corp. Ltd, Shreeram Nagar, Dist. Vizianagram.	Lumps : Cr_2O_3 42% size: +25-75 mm SiO_2 : 10% Cr: Fe Fines : Cr_2O_3 46% -6 mm SiO_2 : 7% Cr : Fe : 2.6 Friable : 42% Cr_2O_3
JSL Ltd, (formerly Jindal Stainless Steel Ltd,) Jindal Nagar, Dist. Vizianagram.	Lumps : Cr_2O_3 38% Cr:Fe : 2.9
Nav Bharat Ventures Ltd, Paloncha, Dist. Khammam.	Lumps : Cr_2O_3 28-42% Fines : Cr_2O_3 48-50%, 52-54%
GMR Technologies & Industries Ltd, Ravivalasa, Dist. Srikakulam.	Lumps Cr_2O_3- 38-45% Fines Cr_2O_3- 45-55 %
VBC Ferro Alloys Ltd, Rudragram, Dist. Medak.	Lumps : Cr_2O_3 36-52%
Chhattisgarh	
Jindal Steel & Power Ltd, Raigarh.	Lumps : Cr_2O_3+38% Cr:Fe : 2.9 Fines : Cr_2O_3+52%, Cr:Fe : 2.6
Deepak Ferro Alloys Ltd, Urla, Dist. Raipur.	Lumps : Cr_2O_3 36-40% Fines : Cr_2O_3 48-52%

(Contd.)

Table - 18 (Concld.)

Industry/Name and location of plant	Specifications of ore consumed
Odisha	
Balasore Alloys Ltd, (formerly Ispat Alloys Ltd,) Balgopalpur, Dist. Balasore.	Lumps : Cr_2O_3 38-45% Fines : Cr_2O_3 45-48% (medium grade), 48-52% (high grade), 52-55% (super high grade)
Ferro Alloys Corp. Ltd, Charge Chrome Division, Randia, Dist. Bhadrak.	Lumps : Cr_2O_3 42% ; size +25 - 75mm Friable : Cr_2O_3 46% ; size - 6 mm Briquettes : Cr_2O_3 42% (includes fines , friable and conc.)
IDCOL Ferro Chrome & Alloys Ltd, Jajpur Road.	Cr_2O_3 : 42-52% Cr:Fe : 3.0, SiO_2 6% max
Indian Metals & Ferro Alloys Ltd, (Formerly, Indian Charge Chrome Ltd) Choudwar, Dist. Cuttack.	Cr_2O_3 : 40-48% SiO_2 : 15% max
Indian Metals & Ferro Alloys Ltd, Therubali, Dist. Raygada,	Lumps & Fines
Tata Steel Ltd, (Formerly OMC Alloys Ltd) Bamnipal, Dist. Keonjhar.	Cr_2O_3 : 47% min Size : 0-40 mm
West Bengal	
Rohit Ferro Tech Ltd, Bishnupur, Dist. Bankura.	NA
Shri Vasavi Industries Ltd, Dist. Bankura.	NA
REFRACTORY	
Chhattisgarh	
SAIL Refratories Unit, Maruda Dist. Durg.	Friable lumps : Cr_2O_3 : 52-54% min, SiO_2 : 5% max
Vishva Vishal Engineering Ltd, Bhilai, Durg.	Cr_2O_3 : 50% SiO_2 : 4.5% max Fe_2O_3 : 8%
Jharkhand	
Associated Ceramics Ltd, Chirkunda, Dist. Dhanbad.	NA
Maithan Ceramics Ltd, Dhanbad.	NA
Maharashtra	
Joglekar Refractories & Ceramics (P) Ltd, Rabale, Dist. Thane.	Lumps Cr_2O_3 44% min, CaO < 2%, Fe_2O_3 < 21% Imported sand - 30 to +85 mesh, Cr_2O_3 45% min, SiO_2 < 1%, Fe_2O_3 < 27%
Odisha	
Orissa Industries Ltd, Lathikata Works, Sundergarh.	Cr_2O_3 : 52-54% Fe_2O_3 : 15-18% max SiO_2 : 3-5%
IFGL Refractories Ltd, Kalunga, Dist. Sundergarh.	Cr_2O_3 : 55% min, -16 to +22 mesh
TRL Krosaki Refractories Ltd, Belpahar.	Cr_2O_3 : 48-50% min SiO_2 : 5-9% min
Tamil Nadu	
Burn Standard Co. Ltd, Salem.	Cr_2O_3 : 52-54% min SiO_2 : 3-5% max Fe_2O_3 : 15-18% max
C. Nataraj Ceramics & Chem. Industry Dalmiapuram, Dist. Triruchirapalli	Lumps, Cr_2O_3 + 44%. Fe_2O_3 -25%
CHEMICALS	
Odisha	
Krebs & Cei (India) Ltd, Kalma, Dist. Mayurbhanj.	Cr_2O_3 : 48-55%
Vishnu Chemicals Ltd, Somajiguda, Hyderabad.	NA

TRADE POLICY

The Ministry of Commerce and Industries, Department of Commerce, had come out with the new Foreign Trade Policy (FTP) for the period 2009-2014. As per the present Export-Import Policy as amended and effective from 05.6.2012, the imports of chromium ore lumps, friable ores and concentrates are freely allowed. The export policy on chromite is as follows:

Tariff Item HS Code	Item	Export Policy	Nature of restriction
26100000	(a) Chrome ore other than (i) beneficiated chrome ore fines/concentrates (maximum feed grade to be less than 42% Cr_2O_3); and (ii) those categories of chrome ores mentioned as permitted through STEs (State Trading Enterprises)	Restricted	Exports permitted under licence other than categories given below
26100030 26100040	(b) Beneficiated chrome ore fines/concentrates (maximum feed grade to be less than 42% Cr_2O_3)	STE	Export through MMTC Ltd
26100030	(c) Chrome ore lumps with Cr_2O_3 not exceeding 40%	STE	Export through MMTC Ltd
26100090	(d) Low silica friable/fine ore with Cr_2O_3 not exceeding 52% and silica exceeding 4%	STE	Export through MMTC Ltd
2610 0090	(e) Low silica friable/fine chromite ore with Cr_2O_3 in the range from 52 to 54% and silica exceeding 4%	STE	Export through MMTC Ltd

WORLD REVIEW

World resources of shipping-grade chromite are more than 12 billion tonnes, sufficient to meet conceivable demand for centuries. US chromium resources are mostly in Stillwater Complex in Montana. Other countries which possess sizeable quantities of resources are Finland, India, Russia, Turkey, Brazil and Albania. About 88% of world's 480 million chromium reserves are concentrated in Kazakhstan (46%) and South Africa (42%). The available data on world reserves of chromite are shown in Table - 19.

The world production of chromite increased from 23.5 million tonnes in 2009 to 30 million tonnes in 2010. South Africa was the leading producer, contributing about 36% to the total world production, followed by Kazakhstan (29%) and India (14%). Other significant producers were Turkey, Brazil, Finland and Zimbabwe (Table - 20).

Consumers of chromite are resorting to vertical integration of the industry. Consequently, the ferro-chromium producing capacities are migrating from stainless steel producing countries to chromite producing countries.

Similarly, upgradation of technological and beneficiation processes such as agglomeration of ore, pre-heating and pre-reduction of furnace feed, closed-furnace technology and recovery of chromium from slags are being followed worldwide.

Table – 19 : World Reserves of Chromite (Shipping Grade) (By Principal Countries)

(In '000 tonnes)

Country	Reserves
World: Total (rounded)	**(>)480000**
India*	54000
Kazakhstan	220000
South Africa	200000
USA	620
Other countries	NA

Source: *Mineral Commodity Summaries, 2012.*

* *India's total resources of chromite as per National Mineral Inventory as on 1.4.2010 (provisional) are 203 million tonnes of which 54 million tonnes are under reserves category.*

Table – 20 : World Production of Chromium Ores and Concentrates (By Principal Countries)

(In '000 tonnes)

Country	2008	2009	2010
World : Total	**23600**	**23467**	**30000**
Brazil (e)	706	700	700
Finland	614	247	598
India*	4073	3413	4262
Kazakhstan	3552	8059	8594
Russia	913	416	-
South Africa	9683	6865	10871
Turkey	1886	1770	1904
Zimbabwe	442	194	510
Other countries	1830	1803	2561

Source: *World Mineral Production, 2006-2010.*

* *Production of chromite in India in 2008-09, 2009-10 and 2010-11 was 4.07 million tonnes, 3.43 million tonnes and 4.26 million tonnes, respectively.*

Albania

DCM DECOmetal produced in its three furnaces at Elbasan high-carbon and low-carbon ferro-chromium. The company planned to increase its capacity of low carbon ferro-chrome from 18,000 to 33,000 tpy. Areas in northen Albania viz. Tropoje and Kukes were explored by Albanian Minerals and Bytyci Shpk for chromite ore. Similarly, Empire Mining Corporation (Canada) explored areas by drilling in Bulqiza chromite mining district near the town of Bulqiza. JAB Resoureces Ltd (Australia) explored in Bregu I Bibes, Kalimash and Zogaz areas.

Canada

Cliffs Natural Resources Inc (USA) acquired Freewest Resources Canada Inc and its chrome ore resources in Ontario. About 1 to 2 million tpy ore was planned for production from its mine to produce 400,000 to 800,000 tpy of ferro-chromium to be used in alloys or stainless steel.

Finland

Outokumpu was leading producer of ore and alloys of chromium. It had reportedly 37 million tonnes of proven ore grading 26% Cr_2O_3 and 13 million tonnes of indicated resources grading 30% Cr_2O_3 and 73 million tonnes of inferred resources grading 29% Cr_2O_3 . It idled its Kemi mine, alloy work and stainless steel melt shop due to weak demand.

Kazakhstan

Eurasian natural resources corporation plc (ENRC) was the leading producer of ore and alloys in the country . It constructed a second 700,000 tpy pelletising plant by investing $ 40 million and worked on installation of a direct current furnace at Aktobe with 44,000 tpy capacity by investing $ 590 million for completion by 2012.

South Africa

South Africa was a leading chromium ore and alloy producing country in the world . It also produced chromium chemicals and stainless steel. AMCOL International Corporation acquired interest in other producer companies and planned to mine chromite from surface before going to underground levels in the Ruighoek chrome project in the western lobe of Bushveld igneous complex. Rustenberg Minerals Development Company Ltd (RMDC) developed shaft to mine underground ore reserves of Zeerust mine due to depletion of surface reserves.Chromex Mining plc started 40,000 t/month processing facility at the stellite open- cast mine on western lobe of Bushveld complex. Tata steel reported production at 118,327 tonnes from its two 75000 tpy furnaces at Richards Bay from 63,479 tonnes in the previous year.

Zimbabwe

Zimbabwe Alloys reprocessed chromite ore dumps, improved chromium recovery in the furnace & recovered chromium from slags. In the begining i.e. during 1953 fines were not suitable as furnace feed and metal was not recovered from slag. Consequently, these materials were stockpiled. Use of briquetted recovered chromite ore fines resulted in production improvement, power and ore specific consumption, chromium recovery and chrome ore specific consumption.

FOREIGN TRADE

Exports

Exports of chromite decreased to 0.17 million tonnes in 2010-11 from 0.69 million tonnes in the previous year. Out of total chromite exported in 2010-11, bulk share of about 60% was of chromite concentrate while chromite lumps and other chromite together accounted for 40%. Exports were mainly to China (87%) and Japan (13%). In 2010-11, about 22 tonnes of chromium & alloys and scrap was exported mainly to Indonesia and USA (Tables - 21 to 25). The exports of ferro-chrome are covered in 'Ferro-alloys' review.

Imports

Imports of chromite decreased to 86 thousand tonnes in 2010-11 from 96 thousand tonnes in the previous year. Out of total quantity of chromite imported in 2010-11, lumpy chromite accounted for 93% while concentrate and other forms accounted for remaining 7%. Imports were mainly from Oman (65%), Saudi Arabia (14%), UAE (11%), and Turkey (8%). Imports of chromium & alloys in 2010-11 were 706 tonnes compared to 640 tonnes in the previous year. Imports were mainly from Russia and UK (80%) (Tables - 26 to 30). The imports of ferro-chrome are covered in 'Ferro-alloys' review.

Table – 21 : Exports of Chromite : Total (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**689081**	**8012506**	**172866**	**2860676**
China	618976	7189030	149908	2468087
Japan	25000	340374	22750	389397
South Africa	-	-	196	2992
Malayasia	-	-	2	110
UAE	36	3300	10	90
UK	-	-	-	-
Other coutnries	45069	479802	-	-

Table – 22 : Exports of Chrome Ore Lumps (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**29784**	**192175**	**55711**	**855744**
China	29784	192175	55711	855744

Table – 23 : Exports of Chrome Ore Concentrates (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**508831**	**5737336**	**102870**	**1760961**
China	471639	5332125	79924	1368572
Japan	-	-	22750	389397
Korea, Rep. of	36618	396440	-	-
Netherlands	574	8770	-	-
South Africa	-	-	196	2992
Other countries	++	1	-	-

Table – 24 : Exports of Chrome Ore (Others) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**150466**	**2082995**	**14285**	**243971**
China	117553	1664730	14273	243771
Malaysia	-	-	2	110
UAE	36	3300	10	90
Belgium	25	1563	-	-
Germany	++	3	-	-
Japan	25000	340374	-	-
Kenya	++	6	-	-
Nepal	27	24	-	-
Poland	40	472	-	-
USA	7785	72522	-	-
Other countries	++	1	-	-

Table – 25 : Exports of Chromium & Alloys and Scrap (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**7**	**4770**	**22**	**14454**
Indonesia	2	1271	6	3763
USA	++	48	4	2493
UAE	–	–	3	2095
UK	1	296	2	1512
Saudi Arabia	1	525	2	1229
Israel	1	399	2	1067
Latvia	-	-	1	681
Iran	-	-	++	518
Kenya	1	306	1	332
Bahrain	-	-	1	292
Other countries	1	1925	++	472

Table – 26 : Imports of Chromite : Total (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**95842**	**860966**	**86456**	**904750**
Oman	28417	221648	56076	475726
Saudi Arabia	21707	268383	12074	214249
UAE	34523	257698	9622	112381
Turkey	9356	95448	6953	74532
China	137	4468	359	9441
USA	-	-	542	5874
Iran	1520	9941	456	4750
Singapore	-	-	80	1347
Nigeria	-	-	54	1288
Chinese Taipei /Taiwan	-	-	60	1196
Other countries	182	3380	180	3966

Table – 27 : Imports of Chrome Ore Lumps (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**89050**	**760112**	**80573**	**782223**
Oman	26109	200996	56076	475726
UAE	34523	257698	9622	112381
South Africa	17438	194414	6830	107435
Turkey	9356	95448	6872	72734
USA	-	-	542	5874
Iran	1520	9941	456	4750
China	80	1306	96	1557
Nigeria	-	-	54	1288
Morocco	-	-	25	477
Other countries	24	309	++	1

Table – 28 : Imports of Chrome Ore Concentrates (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**14**	**2408**	**13**	**2866**
China	14	2408	13	2866

Table – 29 : Imports of Chrome Ore (Others) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**6778**	**98446**	**5870**	**119661**
South Africa	4269	73969	5244	106814
China	43	753	250	5018
Turkey	-	-	18	1799
Singapore	-	-	80	1347
Chinese Taipei /Taiwan	-	-	60	1196
UK	-	-	48	1034
Australia	-	-	48	935
Germany	50	916	32	855
Japan	-	-	27	663
Other countries	2416	22808	-	-

Table – 30 : Imports of Chromium & Alloys and Scrap (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**640**	**258723**	**706**	**404055**
Russia	421	144501	566	302627
UK	149	64986	57	36109
USA	10	14658	26	25976
Japan	5	8605	12	14220
China	28	13487	23	10017
Korea, Rep.of	++	26	10	5150
Germany	3	2909	2	4598
Netherlands	11	3883	8	3638
Chinese Taipei /Taiwan	++	122	++	480
Singapore	++	138	1	447
Other countries	13	5408	1	793

FUTURE OUTLOOK

An Expert Committee constituted by the Ministry of Steel, Government of India had recommended the need of detailed exploration in all the potential areas in Odisha, Karnataka and ophiolite belt of North-Eastern region with a view to prognosticate resources to a depth of 500 m in Sukinda belt and estimation of resources in all other potential areas. Ferro-chromium production being electrical energy intensive, the location of such plant will reflect a cost balance between raw materials and electrical energy supply.

The Report of the Working Group 12th Plan Period, Planning Commission, has estimated chromite production at about 5.01 million tonnes by 2011-12 and 7.37 million tonnes by 2016-17 at 8% growth rate. The apparent consumption is estimated at 2.74 million tonnes by 2011-12 and4.35 million tonnes by 2016-17 at 8% growth rate. The Working Group has also made following recommendations :- (i) Chromite resources are located to the tune of 90% in Odisha, predominantly in Sukinda Valley. The mines are going deeper and ore is becoming friable at lower levels. Exploration of deep seated ore bodies needs to be carried out on urgent basis. (ii) Exploration efforts also need intensification to identify more deposits of chromite in the country. Underground mining technology needs to be promoted. (iii) Development of suitable technology needs to be developed for beneficiation of low grade, friable chromite ore (30% Cr_2O_3) fines which are available in sizeable quantity in India. (iv) Further restrictions on exports of chromite ore/concentrates are desirable in view of the limited resources in India and increasing demand for steel industry.

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

COAL & LIGNITE

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

24 Coal & Lignite

Coal plays a pivotal role in sustainable development. It is the most widely used energy source for electricity generation and an essential input to most steel production. As estimated by the World Coal Association, coal currently fuels 41% of the world electricity and this proportion is set to remain static over the next 30 years. About 70% of the world's steel production is based on coal. As per Integrated Energy Policy Committee of Planning Commission, coal will remain India's most important energy source till 2031-32 and possibly beyond. In India, about 77% coal output is consumed in power sector. In addition, other industries like cement, fertilizer, chemical, paper and thousands of medium and small-scale industries are dependent on coal for their process and energy requirements. The production of coal at 532.04 million tonnes in 2009-10 increased marginally to 532.69 million tonnes in 2010-11. The production of lignite at 37.73 million tonnes in 2010-11 increased by 10.75% from 34.07 million tonnes in the previous year. India ranks 3rd in world coal production.

RESOURCES

Coal

The Indian coal deposits are primarily concentrated in the Gondwana sediments occurring mainly in the eastern and central parts of Peninsular India, although Gondwana coal deposits also occur in Assam and Sikkim in north eastern part of the country. The Tertiary coal-bearing sediments are found in Assam, Arunachal Pradesh, Nagaland and Meghalaya. As a result of exploration carried out by GSI, CMPDI and other agencies, 285.86 billion tonnes (including that estimated in Sikkim) coal resources to 1,200 m depth have been established in the country as on 1.4.2011. Out of these resources, 114 billion tonnes were proved reserves, 137.47 billion tonnes were indicated reserves and the remaining 34.39 billion tonnes were in inferred category. Of the total resources, prime-coking coal was 5.31 billion tonnes, medium-coking & semi-coking were 28.16 billion tonnes and non-coking coal including high sulphur was 252.39 billion tonnes. Statewise/coalfield-wise and statewise/typewise reserves of coal as on 1.4.2011 are given in Tables-1 & 2, respectively.

Lignite

Indian lignite deposits occur in the Tertiary sediments in the southern and western parts of peninsular shield particularly in Tamil Nadu, Puducherry, Kerala, Gujarat, Rajasthan and Jammu & Kashmir. The total known geological reserves of lignite as on 1.4.2011 were about 40.91 billion tonnes. About 80% reserves are located in Tamil Nadu with about 32.89 billion tonnes. Other states where lignite deposits have been located are Rajasthan, Gujarat, Jammu & Kashmir, Kerala, West Bengal and the Union Territory of Puducherry. Statewise/districtwise reserves of lignite as on 1.4.2011 are given in Table - 3.

Table – 1 : Reserves of Coal as on 1.4.2011
(By States/Coalfields)

(In million tonnes)

State/Coalfield	Proved	Indicated	Inferred	Total
All India : Total	**114001.60**	**137471.10**	**34389.51**	**285862.21**
Gondwana Coalfields*	**113407.79**	**137371.76**	**33590.02**	**284369.57**
Andhra Pradesh/ Godavari Valley	**9296.85**	**9728.37**	**3029.36**	**22054.58**
Assam/Singrimari	–	**2.79**	–	**2.79**
Bihar/Rajmahal	–	–	**160.00**	**160.00**
Chhattisgarh	**12878.99**	**32390.38**	**4010.88**	**49280.25**
Sohagpur	94.30	10.08	–	104.38
Sonhat	199.49	2463.86	1.89	2665.24
Jhilimili	228.20	38.90	–	267.10
Chirimiri	320.33	10.83	31.00	362.16
Bisrampur	849.15	765.55	–	1614.70
East Bisrampur	–	164.82	–	164.82
Lakhanpur	455.88	3.35	–	459.23
Panchbahini	–	11.00	–	11.00

(Contd.)

Table - 1 (Contd.)

State/Coalfield	Proved	Indicated	Inferred	Total
Hasdeo-Arand	1369.84	3425.01	384.50	5179.35
Sendurgarh	152.89	126.32	–	279.21
Korba	4980.58	5936.50	838.58	11755.66
Mand-Raigarh	4177.90	17041.44	2552.72	23772.06
Tatapani-Ramkola	50.43	2392.72	202.19	2645.34
Jharkhand	**39760.73**	**32591.56**	**6583.69**	**78935.98**
Raniganj	1538.19	466.56	31.55	2036.30
Jharia	15077.57	4352.49	–	19430.06
East Bokaro	3351.87	3929.57	863.32	8144.76
West Bokaro	3629.03	1349.04	34.42	5012.49
Ramgarh	446.27	545.15	58.05	1049.47
North Karanpura	9499.42	5708.86	1864.96	17073.24
South Karanpura	2748.09	2048.56	1480.22	6276.87
Aurangabad	213.88	2279.82	503.41	2997.11
Hutar	190.79	26.55	32.48	249.82
Daltongunj	83.86	60.10	–	143.96
Deogarh	326.24	73.60	–	399.84
Rajmahal	2655.52	11751.26	1715.28	16122.06
Madhya Pradesh	**8871.31**	**12191.72**	**2062.70**	**23125.73**
Johilla	185.08	104.09	32.83	322.00
Umaria	177.70	3.59	–	181.29
Pench-Kanhan	1405.24	789.61	316.78	2511.63
Patharkhera	290.80	88.13	68.00	446.93
Gurgunda	–	47.39	–	47.39
Mohpani	7.83	–	–	7.83
Sohagpur	1725.91	4926.55	190.36	6842.82
Singrauli	5078.75	6232.36	1454.73	12765.84
Maharashtra	**5489.61**	**3094.29**	**1949.51**	**10533.41**
Wardha Valley	3426.98	1405.46	1424.07	6256.51
Kamthi	1276.14	1204.88	505.44	2986.46
Umrer	308.41	–	–	308.41
Nand Bander	468.08	483.95	–	952.03
Bokhara	10.00	–	20.00	30.00
Odisha	**24491.71**	**33986.96**	**10680.21**	**69158.88**
Ib-River	8057.54	8611.31	5847.64	22516.49
Talcher	16434.17	25375.65	4832.57	46642.39
Sikkim/Rangit Valley	**–**	**58.25**	**42.98**	**101.23**
Uttar Pradesh/Singrauli	**866.05**	**195.75**	–	**1061.80**
West Bengal	**11752.54**	**13131.69**	**5070.69**	**29954.92**
Raniganj	11638.27	7750.71	4443.91	23832.89
Barjora	114.27	–	–	114.27
Birbhum	–	5380.98	611.78	5992.76
Darjeeling	–	–	15.00	15.00
Tertiary Coalfields	**593.81**	**99.34**	**799.49**	**1492.64**
Assam	**464.78**	**42.72**	**3.02**	**510.52**
Makum	432.09	20.70	–	452.79
Dilli-Jeypore	32.00	22.02	–	54.02
Mikir Hills	0.69	–	3.02	3.71
Arunachal Pradesh	**31.23**	**40.11**	**18.89**	**90.23**
Namchik	31.23	40.11	12.89	84.23
Miao Bum	–	–	6.00	6.00

(Contd.)

Table - 1 (Concld.)

State/Coalfield	Proved	Indicated	Inferred	Total
Meghalaya	**89.04**	**16.51**	**470.93**	**576.48**
West Darangiri	65.40	–	59.60	125.00
East Darangiri	–	–	34.19	34.19
Balphakram-Pendenguru	–	–	107.03	107.03
Siju	–	–	125.00	125.00
Langrin	10.46	16.51	106.19	133.16
Mawlong Shelia	2.17	–	3.83	6.00
Khasi Hills	–	–	10.10	10.10
Bapung	11.01	–	22.65	33.66
Jayanti Hills	–	–	2.34	2.34
Nagaland	**8.76**	**–**	**306.65**	**315.41**
Borjan	5.50	–	4.50	10.00
Jhanzi-Disai	2.00	–	0.08	2.08
Tiensang	1.26	–	2.00	3.26
Tiru Valley	–	–	6.60	6.60
DGM	-	-	293.47	293.47

Source: *Coal Directory of India, 2010-11, Coal Controller's Organisation, Kolkata.*
** Including Sikkim.*

Table – 2 : Reserves of Coal as on 1.4.2011 (By States/Types)

(In million tonnes)

State/Type of coal	Proved	Indicated	Inferred	Total
All India : Total	**114001.60**	**137471.10**	**34389.51**	**285862.21**
Prime-coking	4614.35	698.71	–	5313.06
Medium-coking	12572.52	1200132	1880.23	26454.07
Semi-coking	482.16	1003.29	221.68	1707.13
Non-coking	95738.76	123668.44	31488.11	250895.31
High sulphur	593.81	99.34	799.49	1492.64
Andhra Pradesh/Non-coking	**9296.85**	**9728.37**	**3029.36**	**22054.58**
Arunachal Pradesh/ High sulphur	**31.23**	**40.11**	**18.89**	**90.23**
Assam	**464.78**	**45.51**	**3.02**	**513.31**
Non-coking	–	2.79	–	2.79
High sulphur	464.78	42.72	3.02	510.52
Bihar/Non-coking	–	**–**	**160.00**	**160.00**
Chhattisgarh	**12878.99**	**32390.38**	**4010.88**	**49280.25**
Semi-coking	70.77	99.25	–	170.02
Non-coking	12808.22	32291.13	4010.88	49110.23
Jharkhand	**39760.73**	**32591.56**	**6583.69**	**78935.98**
Prime-coking	4614.35	698.71	–	5313.06
Medium-coking	12008.03	10422.71	1607.40	24038.14
Semi-coking	223.34	471.55	53.45	748.34
Non-coking	22915.01	20998.59	4922.84	48836.44
Madhya Pradesh	**8871.31**	**12191.72**	**2062.70**	**23125.73**
Medium-coking	354.49	1560.11	272.83	2187.43
Non-coking	8516.82	10631.61	1789.87	20938.30
Maharashtra/Non-coking	**5489.61**	**3094.29**	**1949.51**	**10533.41**
Meghalaya/High sulphur	**89.04**	**16.51**	**470.93**	**576.48**
Nagaland/High sulphur	**8.76**	**–**	**306.65**	**315.41**
Odisha/Non-coking	**24491.71**	**33986.96**	**10680.21**	**69158.88**
Sikkim/Non-coking	**–**	**58.25**	**42.98**	**101.23**
Uttar Pradesh/Non-coking	**866.05**	**195.75**	**–**	**1061.80**
West Bengal	**11752.54**	**13131.69**	**5070.69**	**29954.92**
Medium-coking	210.00	18.50	–	228.50
Semi-coking	188.05	432.49	168.23	788.77
Non-coking	11354.49	12680.70	4902.46	28937.65

Source: *Coal Directory of India, 2010-11, Coal Controller's Organisation, Kolkata.*

Table – 3 : Reserves of Lignite as on 1.4.2011
(By States/Districts)

(In million tonnes)

State/District	Area/Lignite field	Proved	Indicated	Inferred	Total
All India : Total		**6145.84**	**25794.26**	**8965.76**	**40905.86**
Gujarat		**1243.65**	**318.70**	**1159.70**	**2722.05**
Kachchh	Panandhro & Panandhro Extn., Barkhan-Dam, Kaiyari Block-A & B,Mata-No-Madh, Umarsar, Lakhpat-Dhedadi, Akrimota,Jhularai-Waghapadar, Hamla-Ratadia, Pranpur.	300.61	91.40	33.09	425.10
Bharuch	Bhuri, Valia, Bhaga, Luna, Pansoli, Nani Pardi, Bhimpur, etc. Rajpardi (CGM) by MECL and Rajpardi (GMDC leasehold) by MECL.	724.76	118.59	491.23	1334.58
Bhavnagar	Kharsalia, Rampur, Hoidad, Bhuteshwar, Surka, etc.	–	–	299.17	299.17
Surat	Tadkeswar, Dungra, East of Kamraj-Vesma, Nani Naroli, Tadkeswar block-Mongrol, Mandvi, Vastan, Ghala, etc.	218.28	108.71	336.21	663.20
Jammu & Kashmir		–	**20.25**	**7.30**	**27.55**
Kupwara	Nichahom, Nichahom-Budhasung	–	20.25	7.30	27.55
Kerala		–	–	**9.65**	**9.65**
Kannur	Madayi, Kadamkottumala, Kayyur and Nileswaram	–	–	9.65	9.65
Rajasthan		**1166.96**	**2148.72**	**1519.61**	**4835.29**
Bikaner	Palana, Barsinghsar, Gurha East & West, Bholasar, Bithnok Main & East Extn., Gadiyala, Girirajsar, Raneri, Mandal Chaman, Hadda, Badhnu, Hira-ki-Dhani, Chak-Vijaisinghpura, Kuchore (Napasar), Riri, Latamdesar Bada, East of Riri, Bania, Kuchaur-Athuni, Sarupdesar-Palana west, Palana East, Gigasar-Kesardesar, Ambasar-Gigasar, Girirajsar Extn., Bapeau, Bigga-Abhaysingpura. Diyatra, Pyau, Deshnok-Ramsar-Sinthal, Borana.	558.73	226.59	295.66	1080.98
Barmer	Kapurdi, Jalipa, Bothia (Jalipa N Ext.), Giral, Jogeswartala, Sonari, Sachcha-Sauda, Bharka, Bothia-Bhakra-Dunga, Sindhari East & West, Kurla, Chokla North, Mahabar-Shivkar, Mithra, Hodu, Nimbalkot,Nimbalkot North, Nagurda, Nagurda East, Munabao, Kawas Gravity Block and South of Nimbla.	495.23	1861.56	1073.72	3430.51
Jaisalmer & Barmer	Kuuri	–	–	13.80	13.80
Nagaur	Kasnau-Igiar, Matasukh, Mokala, Nimbri-Chadawatan, Kaprion-ka-Dhani, Merta Road & Meeranagar, Indawar, Kuchera, Lunsara and Phalki.	113.00	60.57	60.35	233.92
Jalore	Sewara	–	–	76.08	76.08

(Contd.)

Table - 3 (Concld.)

State/District	Area/Lignite field	Proved	Indicated	Inferred	Total
Tamil Nadu		**3735.23**	**22900.05**	**6257.64**	**32892.92**
Cuddalore	NLC Leasehold areas, South of Vellar (Srimushnam), Veeranam (Lalpettai), Eastern part of NLC leasehold area, Kullanchavadi, Kudikadu, Bhuvanagiri-Kullanchavadi, Eastern part of Neyveli, Bahur*,West of Bahur*.	2831.00	2530.74	1199.78	6561.52
Ariyalur	Meensuruti Jayamkondamcholapuram, Michaelpatti of Nayveli Lignite Field	904.23	302.50	481.07	1687.80
Thanjavur & Thiruvarur	Mannargudi-central, Mannargudi-NE Mannargudi-NE Extn., Mannargudi SE, Melnattam-Araharam of Mannargudi Lignite Field	–	17248.06	3123.46	20371.52
Thanjavur	Mannargudi-NW & SW, Maharajapuram Orattanadu-Pattukottai, Vadaseri (Orattanadu-Pattukottai), Madukkur-Anaikkadu Veppanagulam-Kasangadu	–	2290.71	72.66	2363.37
Thanjavur & Nagappattinam	Alangudi, Pandanallur, Tiruumangaichcheri, Nachiyarkudi and Thirumangalam of Mannargudi Lignite Field	–	359.21	1108.24	1467.45
Ramanathapuram	Misal, Bogalur and Tiyanur of Ramanathpuram Lignite field	–	168.83	272.43	441.26
Puducherry	Bahur & West of Bahur of Neyveli Lignite Field	–	**405.61**	**11.00**	**416.61**
West Bengal	Rakshitpur, Mahalla	–	**0.93**	**0.86**	**1.79**

Source: *Coal Directory of India, 2010-11, Coal Controller's Organisation, Kolkata.*

** Both blocks cover parts of Tamil Nadu and Puducherry.*

EXPLORATION & DEVELOPMENT

The agencies engaged in exploration for coal during 2010-11 were mainly GSI, CMPDI, MECL and State Directorates of Geology & Mining. For lignite, exploration was carried out by GSI, MECL, NCL, DMG, Rajasthan and GMDC Ltd.

GSI carried out exploration for coal in Gondwana basins of Andhra Pradesh, Chhattisgarh, Madhya Pradesh, Maharashtra, Odisha and West Bengal to identify additional resources of power-grade coal and superior-grade coking coal. As a result of exploration carried out, additional resources of 2,641.63 million tonnes coal were assessed in 2010-11 (as on 1.4.2011). GSI extensively continued its exploration for lignite in West Bengal, Rajasthan and Tamil Nadu, keeping in view the high demand for accelerated growth of power and industrial sectors. As a result of exploration carried out, additional resources of 125.759 million tonnes lignite were assessed in 2010-11 (as on 1.4.2011). Details of additional resource estimation and exploration activities for coal & lignite by GSI are given in Tables - 4(A) and 4(B), respectively.

MECL carried out 29,918.00 m exploratory drilling for coal on behalf of Ministry of Coal during the year 2010-11 in Andhra Pradesh, Maharashtra and Chhattisgarh and undertook about 133,047.00 m contractual drilling for coal on behalf of National Thermal Power Corporation (NTPC), Chhattisgarh Mineral Development Corporation (CMDC), CMPDI, APMDC-OMC and APMDC and established 3,246.203 million tonnes coal resources in 2010-11.

MECL conducted exploration for lignite in Neyveli Lignite Field in Tamil Nadu and Barmer, Bikaner and Jaisalmer Lignite Fields in Rajasthan on promotional basis on behalf of Ministry of Coal and completed 51,796.40 m drilling in

2010-11. About 19.109 million tonnes lignite resources were established by MECL during 2010-11. Particulars of exploratory drilling carried out for coal & lignite and additional resources estimated by MECL are summarised in Tables - 5(A) and 5(B), respectively.

DGM, Maharashtra estimated 249.28 million tonnes coal resources in 2010-11 in Chandrapur, Wardha, Nagpur and Yavatmal districts. DGM, Chhattisgarh estimated 80.15 million tonnes coal resources of probable category during 2010-11 in Raigarh and Korba districts. Directorate of Geology, Jharkhand carried out exploration for coal during 2010-11 in Latehar and Ramgarh districts. DMG, Rajasthan carried out exploration for lignite during 2010-11 in Bikaner and Barmer districts and estimated 0.06 million tonnes of geological reserves. GMDC conducted exploration and estimated 107 million tonnes lignite geological resources in 2010-11. Directorate of Geology, Odisha carried out exploration for coal during 2010-11 in Angul, Jharsuguda and Sundergarh districts. WBMDTC also carried out exploration for lignite in Bardhaman district in West Bengal in the same period. Details on exploration carried out by the various state Directorates and state undertakings are given in Table-6.

CMPDI in its exploration programme for 2010-11 laid emphasis on proving power-grade and superior-grade non-coking coal in CIL and non-CIL blocks. A total of 4,91,791m of exploratory drilling was achieved by CMPDI and its contractual agencies during 2010-11 which includes 2,68,059 m in departmental drilling (that comprised 1,318 m in promotional blocks, 2,01,016 m in CIL blocks, 64,685 m in non-CIL/captive mining blocks and 1,040 m for consultancy work) and 2,23,732 m conducted through outsourcing to concerned Departments of State Governments & MECL(MoU), as well as through tender notifications (for CIL and non-CIL blocks). During 2010-11, CMPDI and its contractual agencies conducted exploration in 96 blocks/mines spread over 22 coalfields situated in 7 states namely, Raniganj (7 blocks/mines), Rajmahal (1), Jharia (4), West Bokaro (5), Ramgarh (2), Tawa valley/Patharkheda (6), Pench Kanhan (1), Kamptee (2), Nand-Bander (1), Wardha (8), Singrauli (7), Sohagpur (10), Sendurgarh (1), Johilla (1), Mand Raigarh (13), Korba (4), Hasdo-Arand (1), Bisrampur (5), Sonhat (1), Talcher (9), Ib valley (5) and Makum (2). Out of 96 blocks/mines, 18 were Non-CIL/Captive blocks, 2 promotional blocks, one consultany block and 75 CIL blocks/mines. Apart from it, promotional drilling has also been taken up in 21 blocks over 10 coalfileds. CMPDI took up drilling activity in 65 blocks/mines while Contractual agencies awarded the job by way of tendering/MOU undertook drilling operations in 31 blocks/mines

SCCL in its detailed exploration undertaken during 2010-11, established proved reserves of coal that were estimated at 51.66 million tonnes as against 74.57 million tonnes reported in the previous year. Thus, the total proved reserves rose to 9,487.44 million tonnes as on 31.3.2011 in Godavari Valley Coalfield, Andhra Pradesh.

Table – 4 (A) : Additional Resources Estimated by GSI for Coal and Lignite, 2010-11 (as on 1.4.2011)

(In million tonnes)

State/Coalfield/Block	Additional resources
COAL	
Chhattisgarh	***522.70***
A. Mand-Raigarh Coalfield	
(i) Phutamura	85.82
B. Tatapani-Ramkula Coalfield	
(i) Reonti	279.46
C. Hasdo Arand Coalfield	
(i) Saidu	157.42
Jharkhand	***188.232***
A. South Karanpura Coalfield	
(i) Binja	126.76
B. East Bokaro Coalfield	
(i) Muditoli	61.472
Madhya Pradesh	***352.45***
A. Sohagpur Coalfield	
(i) Merkhi	81.08
B. Singrauli Coalfield	
(i) Tendudol	271.37
Odisha	***1476.17***
A. Talcher Coalfield	
(i) Jamujhari-Brahmanbil	1476.17
West Bengal	***102.08***
A. Raniganj Coalfield	
(i) Nabasan	102.08
Total	**2641.632**
LIGNITE	
Rajasthan	***0.50***
A. West Coast Lignite field	
(i) Phalki	0.50
Tamil Nadu	***124.624***
A. East Coast Lignite field	
(i) Bogalur	124.624
West Bengal	***0.635***
A. Birbhum Coalfield	
(i) Mahalla	0.635
Total	**125.759**

Table – 4 (B) : Details of Exploration Activities conducted by GSI for Coal & Lignite, 2010-11

State/Coalfield/ Lignite Field	Area/Block	Exploration details
COAL		
Andhra Pradesh		
Godavari Valley Coalfield	Narayanapuram-Pattayyagudem	Two prominent coal carbonaceous shale zones (BH-7 and BH-8) of Lower Kamthi Formation namely BH-7 was intersected at 557.55 m depth. The cummulative coal content is about 4.98 m to 10 splits (ranging from 0.30 m to 1.00 m). Borehole BH-8 intersected (zone-C of 40.00 m thick and zone-B of 26.55 m thick) and Seam zone-A of Barakar Formation (72.60 m thick) having cumulative coal thickness of 25.50 m in 6 split sections between 414.00 m and 641.40 m depths.
	Bugga-Khammamtogu	Two regional interbanded coal-carbonaceous shale zones of Barakar Formation and Talchir Formation with cumulative thickness of 2.30 m and 7.31 m were recorded at very shallow depth between 23.40 m and 39.41 m. Three local seams of 0.70 m to 0.76 m thickness between 97.64 m and 103 m depths have been identified.
	Vutasamudram-Venkatapuram area	Two boreholes were drilled in Upper Kamthi Formation so far.
Chhattisgarh		
Mand-Raigarh Coalfield	Nawagaon block	Ten regional Barakar coal seam/zones (Seam I to X, in ascending order) have been intersected between the depths of 45.37 m and 457.18 m. The important seams are Seam I, IV, VI, VII and VIII with cumulative thickness of coal ranging from less than a metre to 10.46 m. Seam IV is the thickest seam and was intersected between the depths of 24.43 m and 425.04 m. Cumulative coal thickness of Seam I and IV varies from 2.35 m to 10.46 m.
	Teram block	In Barakar Formation, ten regional coal seams (Seam III to XII in ascending order) with cumulative thickness ranging from less than 0.50 m to 13.74 m were intersected between the depths of 202.88 m and 477.50 m. Among these, the important seams are Seam V, VI and IX. The thickest seam, seam VI, was intersected between the depths of 328.72 m and 424.54 m. The seam is highly banded in nature and its cumulative thickness ranges from 11.90 m to 13.74 m.
Hasdo-Arand Coalfield	Korja block	Four regional Barakar coal seams/zones (Seam III to VI in ascending order) have been intersected between depths of 97.10 m and 188.65 m within Barakar Formation. Coal Seam/zone IV and V are considered to be significant because of their cumulative coal thickness which ranges from 6.20 m to 7.75 m. Seams/zones IV and V are represented by Composite Section with coal split varying in thickness from 0.30 m to 4.10 m. Four local coal seams (Seam L1 to L4 in ascending order) have been recorded between depths of 258.95 m and 341.85 m within Lower Member of Barakar Formation. Thickness of individual split section varies from 0.15 m to 4.10 m.
Tatapani-Ramkola Coalfield	Reonti (West) block	Six regional Barakar coal seams (I to VI) and few local coal seams varying in cumulative thickness from less than a metre to 29.78 m were intersected between 491.77 m and 841.20 m depths. Seams I to V are important because of their thickness and persistance. The seams IV and V are represented by four to five split sections with the cumulative thickness being 29.78 m and 12.22 m, respectively.
Madhya Pradesh		
Singrauli Coalfield	Sarai (East) area	Seven regional coal seams of Barakar Formation ranging from 1.05 m to 3.35 m were intersected between 259.69 m and 493.13 m of shallow depths. Out of these, Seam VI and VII are relatively thick (3.35 m and 2.15 m, respectively).
Pench Valley Coalfield	Payalidhana Sector	Five regional Barakar coal seams with individual seam thickness ranging from 1.00 m to 3.05 m were intersected between 282.24 m and 319.44 m depth. Total cumulative coal thickness of coal is 13.79 m.
Sohagpur Coalfield	Merkhi block	To establish developmental pattern of superior grade Barakar coal seams at shallow depth.

(Contd.)

Table - 4 (B) (Contd.)

State/Coalfield/ Lignite Field	Area/Block	Exploration details
Sohagpur Coalfield	Devanitola block	Four regional Barakar coal seams (I to IV) and two local coal seams (L1 and L2) varying in thickness from 0.63 m to 7.25 m were intersected between 101.90 m to 285.15 m depths. Cumulative thickness of the regional and local seams ranges from 11.90 m to 16.31 m. Out of these four seams, seam III is the thickest with maximum cumulative thickness of 7.25 m.
	Amiliha block	Four regional Barakar coal seams (I to IV) varying in thickness from 0.30 m to 3.75 m were intersected between 178.45 m and 343.70 m depths. The thickest seam III varying in thickness from 2.56 m to 3.75 m was intersected between 145.75 m and 285.95 m depths. Seam III is used as a key horizon for correlation of coal seams. Cumulative thickness of the seams so far recorded in two boreholes varies from 4.52 m to 9.79 m and occurs between 178.45 m and 351.55 m depths.
	Pachri block	Four regional Barakar coal seams (I to IV with few local seams) varying in individual seam thickness from 0.35 m to 3.30 m were intersected between 138.60 m and 328.70 m depths. Seam III is the thickest with two split sections having a cumulative thickness ranging from 2.47 m to 3.30 m. Cumulative thickness of all the coal seams vary from 7.00 m to 8.50 m and coal resource of 200 million tonnes from this block is prognosticated. Seam III being thickest and composite in nature, generally occurs 80 m to 100 m below.
Johilla Coalfield	Naurozabad (North) area	The contact between Parsora Formation and Pali Formation is in progress.
Maharashtra		
Wardha Valley Coalfield	Dewala-Mangli block Yavatmal	Two boreholes were drilled in Barakar Formation. The work is in progress.
Odisha		
Talcher Coalfield	Simlisahi-Kunjabiharipur	Ten regional coal seam zones of Barakar Formation (II to XI) with cumulative thickness ranging from 2.65 m to 56.09 m were intersected between 278.70 m to 638.78 m depths. Coal zone III and IX are prominent and Seam III is the thickest seam zone having a cumulative coal thickness varying from 38.36 m to 56.09 m.
	Harichandrapur block	Ten regional coal seam zones of Barakar Formation (II to IX) varying in cumulative thickness from 0.92 m to 56.19 m were intersected between 13.95 m to 386.89 m depths. Coal seam zone II is thickest having cumulative thickness ranging from 26.52 m to 56.19 m.
	Nuagaon North area	Five regional Barakar coal seam zones (II, III and VI to VIII block combined) seam zone I of Karharbari Formation were intersected from 161.49 m and 363.60 m.depths. Coal seam zone III is the thickest with a cumulative thickness of 19.94 m. The cumulative thickness of seam II is 15.78 m and seam I of Karaharbari is 3.21 m.
	Korara-Danara sector	One borehole of Karharbari Formation drilled to a depth of 313.50 m intersected the basal Barakar conglomerate zone. Work is in progress.
Ib River Coalfield	Piplimal-Khairkuni block	Two regional Barakar coal seam zones namely, Rampur and Ib with cumulative coal thickness varying from 35.40 m and 4.47 m were intersected between 410.54 m and 472.00 m roof depths. Investigation was completed.

(Contd.)

Table - 4 (B) (Concld.)

State/Coalfield/ Lignite Field	Area/Block	Exploration details
West Bengal		
Raniganj Coalfield	Bhabaniganj east area	One borehole progressed from 328.50 m to 497.20 m and intersected the Barren Measure/Barakar and Barakar/basement contacts at 402.30 m and 486.90 m depth, respectively. In this borehole, one coal seam of 5.60 m thickness has been intersected at 464.30 m depth. Another borehole progressed to 341.70 m and intersected the Raniganj Formation/Barren Measure contact at 83.55 m depth.
	South of Hingla River	One borehole intersected the Barren Measure/Barakar and Barakar/basement contacts at 202.60 m and 266.05 m depths, respectively. One coal seam of 1.85 m thickness was intersected at 254.95 m depth. Second borehole progressed to 363.65 m depth and intersected Barren measure/Barakar contact at 323.95 m depth.
Birbhum Coalfield	Dhobbanpur sector	Two boreholes have been completed. The first borehole intersected five Barakar coal seams (0.70 m to 4.70 m thick) with a cumulative thickness of 11.65 m at depths ranging from 440.75 m to 512.45 m. The second borehole intersected Tertiary claystone and fine grained sandstone followed downwards by Rajmahal and Barakar Formations.
	Gazipur area	A total of 737.70 m of drilling has been completed in two boreholes. The second borehole intersected ten Barakar coal seams ranging in thickness from 0.50 m to 2.50 m (cumulative thickness 10.30 m) in the depth range from 479.95 m to 615.65 m. The third borehole recorded 235.15 m of Tertiaries and 180.70 m of Rajmahal Trap.
LIGNITE		
Tamil Nadu		
Ramnad-sub-basin in Ramanathapuram district	Bogalur east block	Two regionally persistent lignite seams, viz, seam I and seam II with maximum thickness of 17.5 m and 4.6 m, respectively were identified. A tentative inferred resource of 180 million tonnes was estimated within 400 m depth.
	Uttarakosamangai block	Exploration work is scheduled to be taken up during Oct. 2011 to delineate lignite bearing areas and to assess the resource potentiality.
Rajasthan		
Nagaur south sub-basin in Nagaur district	Phalki north area	Three lignite seams varying in thickness from 0.20 m to 3.50 m were intersected between 176.50 m and 205.50 m depths. The grade belongs to lignite 'B' category. The work is in progress.

Table – 5 (A) : Exploration of Coal & Lignite by MECL, 2010-11

State/Coalfield	Block	Drilling (m)
COAL		
(A) Promotional on behalf of Ministry of Coal	**Total**	**29918.00**
Andhra Pradesh	**Total**	**9637.45**
Godavari Valley Coalfield	Dip side of Venkatapuram	9637.45
Chhattisgarh	**Total**	**14271.00**
Mand Raigarh Coalfield	Bhalumura	1269.90
	Dolesara	4748.50
	Basin Patherpur(SE)	4914.40
	Karichapar	3338.20
Maharashtra	**Total**	**6009.55**
(i) Umrer Coalfield	Khapri	689.10
	Gumgaon	2929.25
	Sukuli	607.20
(ii) Wardha Coalfield	Temurda	1784.00
(B) Contractual	**Total**	**133047.00**
Chhattisgarh	**Total**	**111937.20**
A. Mand Raigarh Coalfield		
(i) On behalf of CMPDI	Sayang(C)A	4053.80
(ii) On behalf of CMPDI	Sayang(E)A	3802.85
(iii) On behalf of CMPDI	Chirra NE A	4120.45
(iv) On behalf of CMDC	Gare Pelma	12179.15
(v) On behalf of CMPDI	Boro-Sayang (E)	9860.80
(vi) On behalf of CMPDI	Chirra NE B	7870.20
(vii) On behalf of M/s Mahatamil	Gare Palma Sec-II	29503.30

(Contd.)

Table - 5 (A) (Concld.)

State/Coalfield	Block	Drilling (m)
B. Bishrampur Coalfield		
(i) On behalf of CMPDI	Ghugra	11486.15
C. Singrauli Coalfield		
(i) On behalf of CMPDI	Dongrital	2076.00
(ii) On behalf of CMPDI	Patpaharia	1936.00
(iii) On behalf of CMPDI	Makri Burka	9074.00
(iv) On behalf of APMDC	Suliyari	15974.50
Odisha	**Total**	**21109.80**
A. Jharia Coalfield		
(i) On behalf of CMPDI	Kapuriya	6841.50
(ii) On behalf of CMPDI	Singra	7204.40
(iii) On behalf of CMPDI	Nagda	520.00
(iv) Production support On behalf of CMPDI		3067.80
(v) On behalf of NTPC	Pakri-Burwadi	2871.80
B. Talcher Coalfield		
On behalf of APMDC-OMC	Nuagaon-Telishahi	604.30
LIGNITE		
(A) Promotional on behalf of Ministry of Coal	**Total**	**51796.40**
Rajasthan	**Total**	**36714.40**
Barmer Lignite field	North Kurla-Magni-ki-Dhani	3877.30
	Kurla East	9446.60
Bikaner Lignite field	Kolasar Gravity block	11834.40
	Bangarsar-Jaimalsar	1108.10
Jaisalmer Lignite field	Jaisalmer	10448.00
Tamil Nadu	**Total**	**15082.00**
Neyveli Lignite field	Sattanur	678.00
	Ramnad (Rajsingmangalam)	9467.00
	Sikkal	4937.00

Table – 5(B) : Additional Resources Estimated by MECL for Coal & Lignite, 2010-11

(In million tonnes)

State/Coalfields/District/Block		Additional Resources
COAL	**Total**	**3246.203**
Chhattisgarh	**Total**	**1750.992**
Mand Raigarh Coalfield		
Garepelma Sec-I, Dist. Raigarh		1122.276
Banai block, Dist. Raigarh		628.716
Maharashtra	**Total**	**160.715**
Umrer Katol Sub Basin		
Khapri block, Dist. Nagpur		48.406
Sukli block, Dist. Nagpur		59.814
Gumgaon, Dist. Nagpur		52.495
Madhya Pradesh	**Total**	**144.766**
Sohagpur Coalfield		
Chaka North block, Dist. Shahdol		144.766

(Contd.)

Table - 5(B) (Concld.)

State/Coalfields/District/Block		Additional Resources
Odisha	**Total**	**904.597**
Talcher Coalfield		
Nagaon-Telisahi block, Dist. Angul		904.597
West Bengal	**Total**	**285.133**
Ranigaj Coalfield		
Kulti block, Dist. Bardhaman		172.980
Sitarampur, Dist. Bardhaman		112.153
LIGNITE	**Total**	**19.109**
Rajasthan	**Total**	**19.109**
Bikaner		
Bangarsar-Jalmalsar block		19.109

Table – 6 : Details of Exploration for Coal and Lignite by State Directorates of Geology & Mining and State Undertakings, 2010-11

Agency/State/ District	Location	Geological mapping		Drilling		Remarks Reserves/resources estimated
		Area (sq km)	Scale	Boreholes	Meterage	
COAL						
DGM						
Chhattisgarh						
Raigarh	Dhaurabhata Gare sector 1A	50	1:50,000	06	1535.25	About 29 million tonnes of resources were estimated of C to G grade.
Korba	Saila block	250 2.0	1:50,000 1:4,000	08	1191.85	Since commencement of work, a total of 51.15 million tonnes of resources were estimated.
Dte. of Geology						
Jharkhand						
Latehar	Jalta-Parsahi (Latehar Coal block)	–	1:4,000	08	2248.50	–
Ramgarh	Burhakhap (Ramgarh Coalfield)	0.58	1:4,000	06	1270.50	Resources yet to be established.
DGM						
Maharashtra						
Chandrapur	Takli	–	1:5,000	–	1416.00	About 37.39 million tonnes of resources were estimated so far.
-do-	Wislon block	–	1:5000	–	1102.50	About 9.49 million tonnes of resources were estimated (total 21.30 million tonnes so far).

(Contd.)

Table - 6 (Contd.)

Agency/State/ District	Location	Geological mapping Area (sq km)	Geological mapping Scale	Drilling Boreholes	Drilling Meterage	Remarks Reserves/Resources estimated (in million tonnes)
Chandrapur	Nandori	-	1:5,000	–	2179.50	About 170.95 million tonnes of resources were estimated (total 180 million tonnes in reserves so far).
-do-	Panewadala block	-	1:5,000	–	242.10	About 14.19 million tonnes of resources were estimated so far.
-do-	Chalbardi	-	1:5,000	-	343.00	About 1.28 million tonnes of resources were estimated.
Wardha	Shekapur	–	1:5,000	–	738.00	About 8.16 million tonnes of resources were estimated so far.
Nagpur	Makardhokda block-V (Davha-Phukeshwar)	10.00	1:5,000	–	900.70	About 1.23 million tonnes of resources were estimated (total 8.97 million tonnes so far).
-do-	Nand-Panjrepar	4.00	1:5,000	–	3261.41	About 5.10 million tonnes of resources were estimated. (total 24.98 million tonnes so far).
Yavatmal	Ashtona Kothurna	22.00	1:5,000	–	677.35	About 0.99 million tonnes of resources were estimated.
-do-	Dara-Parsoda	11.00	1:5,000	–	1310.80	About 0.50 million tonnes of resources were estimated (total 8.56 million tonnes so far.)
Dte. of Geology Odisha						
Angul	ALB blocks of Talchir Coalfield	-	-	13	2077.70	-
-do-	North of Arakhpal & Shirampur blocks of Talchir Coalfield	-	-	02	372.30	-
Jharsuguda	Madhupur block of Ib River Coalfield	-	-	11	2103.80	-
-do-	Kudopalli village, Himgir-Rampur Colliery of Ib River Coalfield	-	-	03	279.60	
Sundergarh	Manoharpur block Ib River Coalfield	-	-	06	1205.00	-

(Contd.)

Table - 6 (Concld.)

Agency/State/ District	Location	Geological mapping Area (sq km)	Scale	Drilling Boreholes	Meterage	Remarks Reserves/Resources estimated (in million tonnes)
West Bengal Mineral Dev. & Trading Corpn. Ltd. (WBMDTCL)						
Bardhaman	Kulti coal block of Raniganj	8.75	1:2,000	12	14253.40	Exploration is under progress.
-do-	Sitarampur coal block	2.00	1:2,000	14	8249.45	-do-
-do-	Ichhapur coal block	2.00	1:2,000	29	25141.90	-do-
LIGNITE						
DMG, Rajasthan						
Bikaner	N/V Kenya-Ki-Basti	250.00	1:50,000	01	162.00	About 0.06 million tonnes of resources were estimated on the basis of visual estimation of core.
-do-	Surpura	–	1:50,000	01	24.00	Lignite was not encountered in borehole.
Barmer	Bandra	5.50	1:50,000	–	–	Not computed.
GMDC, Gujarat						
Kachchh	N/V Panandhro	–	1:50,000	–	–	Resources were not estimated (Balance of reserves of lignite is approximately 12.30 million tonnes).
Bhavnagar	Surka (N)	–	–	15	2553.00	About 107 million tonnes of lignite resources were estimated.
Neyveli Lignite Corpn. Ltd. (NLC)						
Rajasthan						
Barmer	Kurla east	–	–	27	9446.60	Exploration is underway.
-do-	Magne-Ki-Dhani	–	–	13	3877.30	-do-
Bikaner	Kolasar gravity block	–	–	46	12941.80	-do-
Jaisalmer	Ramgarh	–	–	51	10447.70	-do-
Tamil Nadu						
Ramnad	Rajasingmangalam	-	-	28	9467.00	Work is completed. The reserves available in this block are suitable for UCG/CBM study.
-do-	Sattaur	-	-	2	678.0	Work is completed. Block has not mineral potentials one.
-do-	Sikkal	-	-	9	4937.00	Work is completed. This block has got substantial lignite resources.

Production, Stocks and Prices

COAL

Production

The provisional total production of coal in 2010-11 was around 532.7 million tonnes which was higher by 0.1% as compared to the previous year. Chhattisgarh continued to be the largest coal producing state with a share of about 21.4% followed closely by Jharkhand and Odisha with contributions of 20.4% and 19.3%, respectively, to the national output. Next in order of share in the total production were Madhya Pradesh (13.3%), Andhra Pradesh (9.6%), Maharashtra (7.4%), West Bengal (4.1%) and Uttar Pradesh 2.9%. The remaining (1.6%) coal production was accounted for by Arunachal Pradesh, Assam, Jammu & Kashmir and Meghalaya.

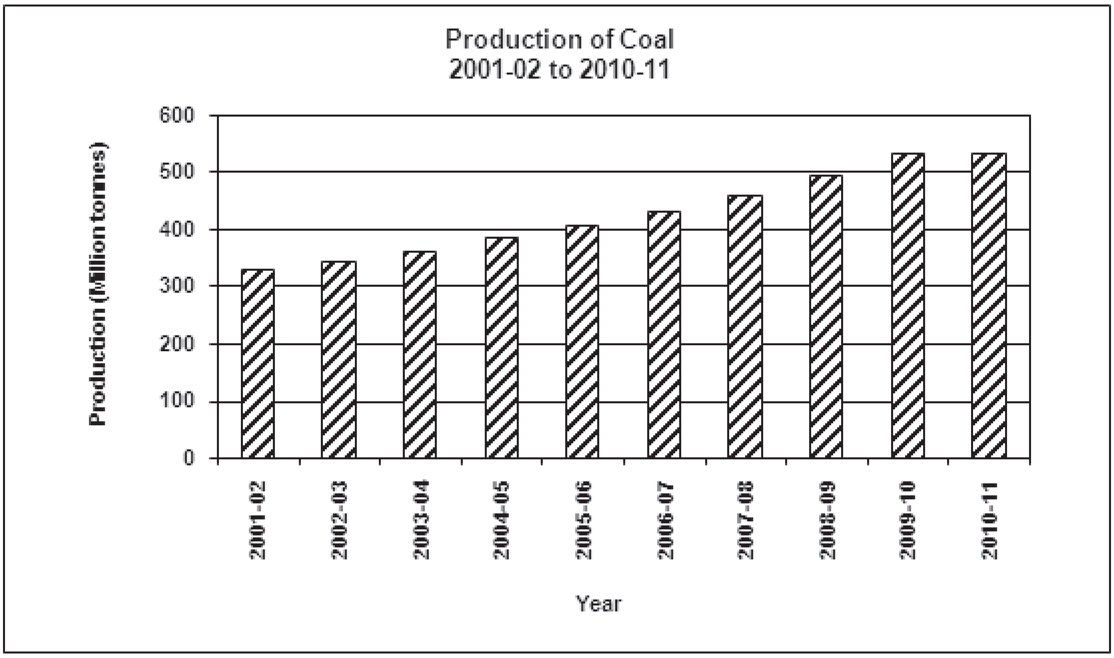
During the year 2010-11, coal mining was confined mainly to the public sector which contributed 91% to the national production. In 2010-11, of the total production of coal, 9.3% was coking coal and the rest 90.7% was non-coking coal. As in the earlier years, bulk of the coking coal production i.e. about 85.8% was reported from the public sector. Gradewise analysis of coking coal in 2010-11 revealed that washery grade IV had the maximum share at 71.4%, followed by washery grade III (20.5%), washery grade II (3.5%) and steel grade II (3.1%). The remaining 1.5% production of coking coal was of steel grade I, washery grade I and semi-coking grade I. Out of the total production of coking coal in India, bulk quantity i.e. 98.8% was produced in Jharkhand followed by Madhya Pradesh with 0.8%. The remaining 0.4% was contributed by Chhattisgarh and West Bengal.

During 2010-11, excepting 8.4% production, the balance entire production of non-coking coal (91.6%) came from the public sector. Out of the total non-coking coal production, 44% was of F grade, followed by 25.1% of E grade, 11.5% of C grade, 9.5% of D grade and 5.0% of B grade. The remaining 4.9% production was contributed by A grade, G grade and ungraded varieties of non-coking coal. Chhattisgarh was the largest producing state of non-coking coal in 2010-11 which alone accounted for 23.5% of the national output. Next in order were Odisha with a contribution of (21.2%), Madhya Pradesh (14.6%), Jharkhand (12.4%), Andhra Pradesh (10.6%), Maharashtra (8.1%), West Bengal (4.5%) and Uttar Pradesh (3.2%). The remaining 1.9% production came from the states of Assam, Arunachal Pradesh, Jammu & Kashmir. and Meghalaya,

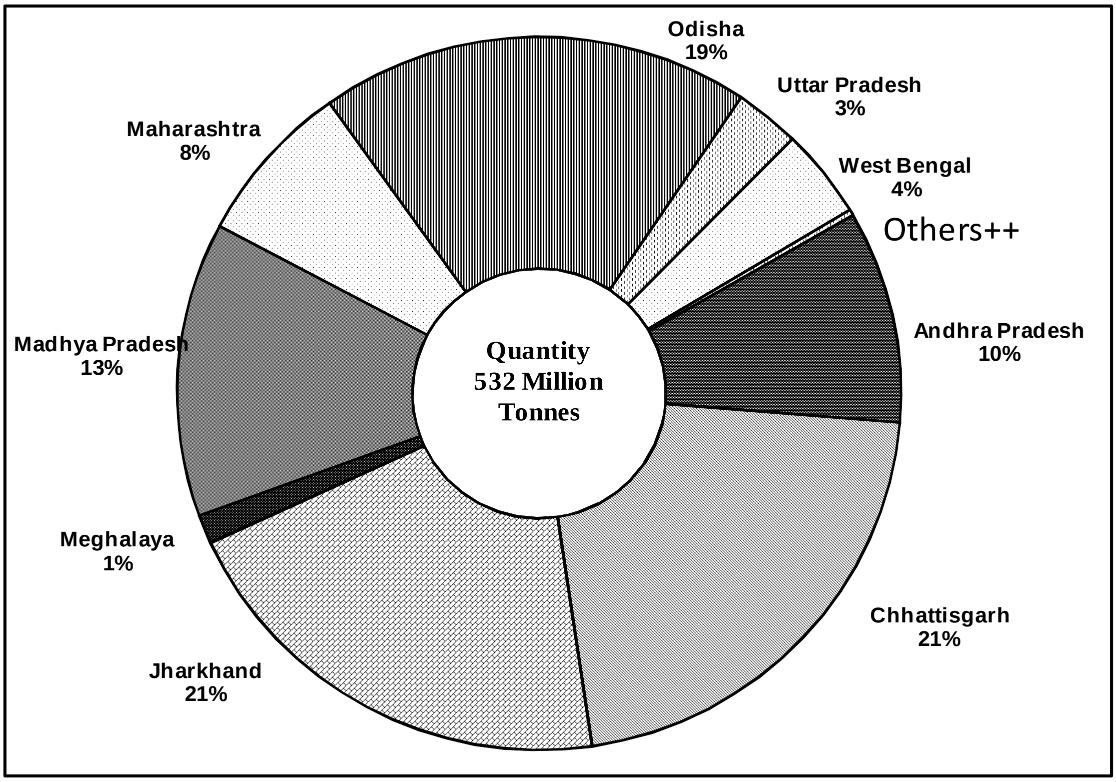
There were 559 coal mines (as on 31.03.2011) in India which reported production in 2010-11. Out of these, 174 mines were located in Jharkhand, West Bengal had 98 mines, Madhya Pradesh (71), Chhattisgarh (62), Maharashtra (55), Andhra Pradesh (50) and Odisha (28). The remaining 21 mines were located in the states of Arunachal Pradesh, Assam, Jammu & Kashmir, Meghalaya and Uttar Pradesh. In 2009-10, there were 12 large mines each producing more than 10 lakh tonnes of coal during the year and these mines accounted for 34.4% of the total production. The bulk of the production i.e. 54.1 % was contributed by 147 mines with annual output ranging between 5,00,001 to 10 lakh tonnnes. About 11 % of the total coal production was shared by 288 mines whose individual production per year varied between 50,001 to 5 lakh tonnes. Only 0.4 % of the production was contributed by 113 small mines each producing up to 50,000 tonnes per annum (Tables - 7 to 12).

Despatches

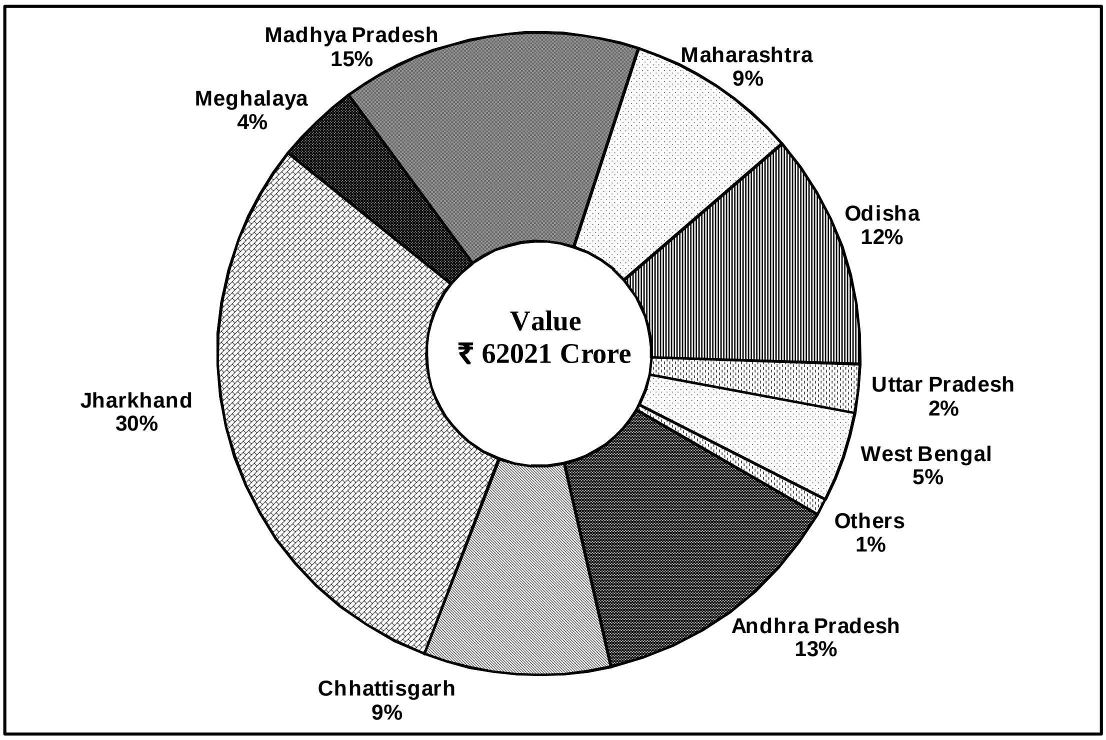
Despatches of raw coal at 523.5 million tonnes in 2010-11 were higher by around 1.9% as compared to those in the previous year. Chhattisgarh was the leading state in the despatches in 2010-11 and accounted for 20.9% of the total despatches. The states next in order were Jharkhand (20.4%), Odisha (19.9%), Madhya Pradesh (13.3%), Andhra Pradesh (9.6%), Maharashtra (7.3%), West Bengal (4.1%) and Uttar Pradesh (2.9%). The remaining 1.6% despatches was shared by Assam, Arunachal Pradesh, Jammu & Kashmir and Meghalaya.



Quantity of Production of Coal in Different States in 2010-11



Value of Production of Coal in Different States in 2010-11



Statewise analysis revealed that despatches except from Madhya Pradesh, Maharashtra and West Bengal, increased in 2010-11 as compared to the previous year (Table-13).

Of the total despatches of raw coal effected in 2010-11, a sizable share of 73% was made to the electricity sector. As much as 3.3% was made to the steel industry, 3.2% to the sponge iron industry, 2.7% to the cement industry, 0.6% to the fertilizer, 0.5% to the paper & pulp industry, 0.3% to the cokeries and 0.2% to other basic metal sector. The remaining 16.2% was made for other priority sectors including textile & rayons and chemical (Table-14).

Stocks

The mine-head stocks of coal at the end of the year 2010-11 were 72.2 million tonnes which was 11.3% more than that at the beginning of the year. Bulk of the coal stocks (about 98.4%) at the end of the year was accounted for by the mines located in the states of Jharkhand, Odisha, Chhattisgarh, Maharashtra, Madhya Pradesh, Andhra Pradesh and West Bengal (Table - 15).

Prices

Domestic prices of coal during 2007-08 to 2010-11 are furnished in the General Review on 'Prices'.

LIGNITE

Production and Despatches

During the year 2010-11, the production of lignite at 37.73 million tonnes increased by 10.7% in comparison to that of the previous year. The production from Tamil Nadu accounted for 61.3%. The share of Gujarat in lignite production was 34.6% and that of Rajasthan was 4.1%.

Out of total 14 mines of lignite that were in operation during 2010-11, seven are located in Gujarat and three in Tamil Nadu and four in Rajasthan (Tables - 16 and 17).

The quantum of despatches of lignite was 37.7 million tonnes undertaken during the year 2010-11 which was higher by around 9.5% as compared to that in the previous year (Table - 18).

Stocks

Stocks of lignite at the end of 2010-11 were 610 thousand tonnes as against 565 thousand tonnes at the beginning of the year (Table- 19).

Table – 7 : Number of Coal Mines, 2009-10 & 2010-11 (By States)

State	No. of Mines	
	2009-10 #	2010-11 $
India	**560**	**559**
Andhra Pradesh	49	50
Arunachal Pradesh	1	1
Assam	7	7
Chhattisgarh	60	62
Jammu & Kashmir	7	7
Jharkhand	174	174
Madhya Pradesh	75	71
Maharashtra	55	55
Meghalaya	1	1
Odisha	26	28
Uttar Pradesh	5	5
West Bengal	100	98

 # Relates to number of mines as on 31.3.2010.
$ Relates to number of mines as on 31.3.2011.

Table – 8 : Production of Coal, 2008-09 to 2010-11
(By Sectors/States)

(Quantity in '000 tonnes; value in ₹ '000)

State	2008-09		2009-10		2010-11(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**492757**	**455370200**	**532042**	**513182500**	**532694**	**620210400**
Public sector	450115	418973800	484040	461918400	485061	525347400
Private sector	42642	36396400	48002	51264100	47633	94863000
Andhra Pradesh	44546	55682500	50429	67373100	51333	81106100
Arunachal Pradesh	142	323800	251	894300	299	1106000
Assam	1009	2707900	1113	3965200	1101	4072600
Chhattisgarh	101922	67873600	109953	50308300	113824	58256200
Jammu & Kashmir	11	57800	23	18600	24	22400
Jharkhand	96272	96741700	105917	140529500	108949	185716200
Madhya Pradesh	71325	78404100	74074	84933100	71104	93673600
Maharashtra	38705	47850300	41005	50887500	39336	53628800
Meghalaya	5489	12514900	5767	20545600	6974	25796800
Odisha	98402	51725700	106409	58751300	102565	73545300
Uttar Pradesh	12029	8747200	13968	15067800	15526	15122300
West Bengal	22905	32740700	23133	19908200	21659	28164100

Source: *Coal Directory of India, 2010-11, Coal Controller's Organisation, Kolkata.*

Table – 9 : Production of Coal, 2008-09 & 2009-10(U)
(By Frequency Groups)

Production group (tonnes)	No. of mines #		Production for the group ('000 tonnes)#		Percentage in total production #		Cumulative percentage	
	2008-09$	2009-10$	2008-09	2009-10	2008-09	2009-10	2008-09	2009-10
All Groups	**561**	**560**	**487268**	**526276**	**100.00**	**100.00**	**100**	**100**
0-10000	55	48	63	54	0.01	0.01	0.01	0.01
10001-25000	16	19	310	356	0.06	0.07	0.07	0.08
25001-50000	52	46	1916	1638	0.39	0.31	0.46	0.39
50001-100000	71	74	5513	5496	1.13	1.04	1.59	1.43
100001-300000	156	157	29676	30507	6.09	5.80	7.68	7.23
300001-500000	66	57	25418	22082	5.22	4.20	12.90	11.43
500001-1000000	133	147	251563	284968	51.63	54.15	64.53	65.58
1000001 & above	12	12	172809	181175	35.47	34.42	100.00	100.00

 # Excluding Meghalaya. *$ Relates to mines as on 31.03.2010.*
Source: Coal Controller's Organisation, Kolkata.

Table – 10 : Production of Coal, 2009-10 & 2010-11
(By Grades and by Sectors)

(In '000 tonnes)

Grade	2009-10			2010-11(P)		
	Total	Pub. Sec.	Pvt. Sec.	Total	Pub. Sec.	Pvt. Sec.
All Grades	**532042**	**484040**	**48002**	**532694**	**485061**	**47633**
Coking	**44413**	**37200**	**7213**	**49547**	**42510**	**7037**
ST-I	109	109	–	263	263	–
ST-II	1380	1380	–	1558	1558	–
W-I	297	297	–	235	235	–
W-II	1868	1589	279	1757	1752	5
W-III	10068	8135	1933	10165	8016	2149
W-IV	30524	25523	5001	35399	30516	4883
SC-I	167	167	–	170	170	–
SLV1	–	–	–	–	–	–
Non-coking	**487629**	**446840**	**40789**	**483147**	**442551**	**40596**
A	10692	4925	5767	12182	5208	6974
B	25827	24836	991	24023	24017	6
C	56147	51902	4245	55581	50293	5288
D	50518	44179	6339	45710	39737	5973
E	117855	113115	4740	121227	117231	3996
F	219097	206141	12956	212693	203228	9465
G	7099	1348	5751	10612	1718	8894
Ungraded	394	394	–	1119	1119	–

***Note**: Meghalaya Coal has not been graded by Coal Controller. For statistical purpose, grade may be treated as ‘A’/’B’ non-coking coal.*

Table – 11 (A) : Production of Coking Coal, 2009-10
(By States and by Grades)

(In '000 tonnes)

State	All-Grades	ST-I	ST-II	W-I	W-II	W-III	W-IV	SLV1	SC-I
India	**44413**	**109**	**1380**	**297**	**1868**	**10068**	**30524**	–	**167**
Chhattisgarh	150	–	–	–	–	–	–	–	150
Jharkhand	43666	74	1380	297	1323	10068	30524	–	–
Madhya Pradesh	545	–	–	–	545	–	–	–	–
West Bengal	52	35	–	–	–	–	–	–	17

Table – 11 (B) : Production of Coking Coal, 2010-11
(By States and by Grades)

(In '000 tonnes)

State	All-Grades	ST-I	ST-II	W-I	W-II	W-III	W-IV	SLV1	SC-I
India	**49547**	**263**	**1558**	**235**	**1757**	**10165**	**35399**	**–**	**170**
Chhattisgarh	163	–	–	–	–	–	–	–	163
Jharkhand	48945	234	1558	235	1354	10165	35399	–	–
Madhya Pradesh	403	–	–	–	403	–	–	–	–
West Bengal	36	29	–	–	–	–	–	–	7

Table – 12 (A) : Production of Non-coking Coal, 2009-10
(By States and by Grades)

(In '000 tonnes)

State	All-Grades	A	B	C	D	E	F	G	Ungraded
India	**487629**	**10692**	**25827**	**56147**	**50518**	**117855**	**219097**	**7099**	**394**
Andhra Pradesh	50429	34	729	7394	9444	17377	13795	1285	371
Arunachal Pradesh	251	251	–	–	–	–	–	–	–
Assam	1113	1113	–	–	–	–	–	–	–
Chhattisgarh	109803	1252	8259	4413	2847	–	89003	4029	-
Jammu & Kashmir	23	–	–	–	–	–	–	–	23
Jharkhand	62251	193	658	9611	9495	25475	16756	63	–
Madhya Pradesh	73529	1249	2843	27271	9758	32408	–	–	–
Maharashtra	41005	–	407	2262	12065	26271	–	–	–
Meghalaya	5767	5767	–	–	–	–	–	–	–
Odisha	106409	–	232	238	1734	6153	96330	1722	–
Uttar Pradesh	13968	–	–	100	4336	9532	–	–	–
West Bengal	23081	833	12699	4858	839	639	3213	–	–

Table –12 (B) : Production of Non-coking Coal, 2010-11 (By States and by Grades)

(In '000 tonnes)

State	All-Grades	A	B	C	D	E	F	G	Ungraded
India	**483147**	**12182**	**24023**	**55581**	**45710**	**121227**	**212693**	**10612**	**1119**
Andhra Pradesh	51333	051	695	8155	11068	16830	11775	1718	1041
Arunachal Pradesh	299	299	–	–	–	–	–	–	–
Assam	1101	1101	–	–	–	–	–	–	–
Chhattisgarh	113661	1244	8149	3870	2797	–	88707	8894	–
Jammu & Kashmir	24	–	–	–	–	–	–	–	24
Jharkhand	60004	289	493	8929	5970	26233	18090	–	–
Madhya Pradesh	70701	1503	2807	27054	8867	30470	–	–	–
Maharashtra	39336	–	340	2107	8676	26836	1377	–	–
Meghalaya	6974	6974	–	–	–	–	–	–	–
Odisha	102565	–	210	222	1790	10528	89815	–	–
Uttar Pradesh	15526	–	–	228	5868	9430	–	–	–
West Bengal	21623	721	11329	5016	674	900	2929	–	54

Table – 13 : Despatches of Raw Coal, 2009-10 & 2010-11 (By States)

(In '000 tonnes)

State	2009-10	2010-11(P)
India	**513792**	**523465**
Andhra Pradesh	49266	50046
Arunachal Pradesh	226	245
Assam	1071	1102
Chhattisgarh	106921	109562
Jammu & Kashmir	17	25
Jharkhand	99863	106637
Madhya Pradesh	73481	69443
Maharashtra	40743	38240
Meghalaya	5767	6974
Odisha	100591	104359
Uttar Pradesh	13587	15393
West Bengal	22259	21439

Table –14 : Despatches of Raw Coal, 2009-10 & 2010-11 (By Priorities)

(In '000 tonnes)

Priority	2009-10	2010-11 (P)
Total	**513792**	**523465**
Steel	18359	17199
Sponge Iron	17259	17019
Chemical	578	509
Electricity	378242	382119
Cement	14362	14182
Cokeries	215	1427
Paper & pulp	2335	2432
Fertilizer	2626	2942
Textile & Rayons	272	275
Other Basic metal	742	1166
Others	78802	84195

Note: *Steel includes direct feed & coking washery for metallurgical use and steel (boilers); non-coking washery and bricks included in others.*

Table – 15 : Mine-head Stocks of Coal, 2010-11 (By States)

(In '000 tonnes)

State	At the beginning of the year	At the end of the year
India	**64863**	**72192**
Andhra Pradesh	1224	2413
Arunachal Pradesh	49	104
Assam	294	293
Chhattisgarh	7015	9731
Jammu & Kashmir	8	4
Jharkhand	24933	27128
Madhya Pradesh	2498	4391
Maharashtra	2701	3793
Odisha	23409	21611
Uttar Pradesh	664	798
West Bengal	2068	1926

Table – 16 : Production of Lignite, 2008-09 to 2010-11 (By Sector/States)

(Quantity in '000 tonnes; value in ₹'000)

	2008-2009		2009-10		2010-11(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**32421**	**36877900**	**34071**	**37756000**	**37733**	**43307200**
Public sector	32140	36558271	33760	37411363	36780	42213416
Private sector	281	319629	311	344637	953	1093784
Gujarat	10114	8926300	10526	7013700	13064	13480300
Rajasthan	999	1160000	1207	479400	1525	1071600
Tamil Nadu	21308	26791600	22338	30262900	23144	28755300

Table – 17 : Number of Lignite Mines 2009-10 & 2010-11 (By States)

State	No. of Mines	
	2009-10	2010-11
India	**13**	**14**
Gujarat	7	7
Rajasthan	3	4
Tamil Nadu	3	3

Table – 18 : Despatches of Lignite 2009-10 & 2010-11 (By States)

(In '000 tonnes)

State	2009-10	2010-11
India	**34430**	**37685**
Gujarat	10411	13079
Rajasthan	1207	1525
Tamil Nadu	22812	23081

Table – 19 : Mine-head Stocks of Lignite, 2010-11 (By States)

(In '000 tonnes)

State	At the beginning of the year	At the end of the year
India	**565**	**610**
Gujarat	155	139
Rajasthan	–	–
Tamil Nadu	410	471

MINING & MARKETING

Coal

Coal mining in the country is being carried out by opencast and underground methods. Opencast mining contributed over 90% of total production whereas rest of the production (about 10%) comes from underground mining. These mines are mostly semi-mechanised or mechanised. The machinery commonly deployed is drill machines, load-haul-dumper (LHD), ventilation fans, pumps for dewatering, haulage for transport, etc. In order to arrest the decline in production from a few underground mines, "mass production technology" by introducing 'continuous miner' is being practised. Modern roof-bolting technology with "flexibolts" up to 5 m length; 'smart bolting' for cost reduction of roof support; introduction of mechanised roof bolting using hydraulic bolts for difficult roof are new technology absorptions in Indian Underground Coal Mining. Mechanised Long wall mining (long wall powered support) has also been introduced in a limited scale which yield higher output with high percentage recovery (70-80%). In opencast mines, machinery like draglines, dozers, shovels, dumpers and graders are deployed for various operations.

The latest policy pursued by CIL is to encourage technology upgradation through Global Tender. Global tender approach has been used towards introduction of high productivity with the use of Continuous Miners, at SECL and WCL.

There are eight coal producing companies in the public sector. Out of these, Eastern Coalfields Limited (ECL), Bharat Coking Coal Limited (BCCL), Central Coalfields Limited (CCL), Western Coalfields Limited (WCL), South-Eastern Coalfields Limited (SECL), Mahanadi Coalfields Limited (MCL), Northern Coalfields Limited (NCL) and North-Eastern Coalfields Limited (NEC) are subsidiary companies of Coal India Ltd (CIL), a Government of India undertaking. The Singareni Collieries Company Limited (SCCL) is a joint venture of the Government of India and the Government of Andhra Pradesh. CMPDI is a subsidiary of CIL which is engaged in surveying, planning and designing work with a view to optimise coal production.

BCCL is the major producer of prime-coking coal (raw and washed). Medium-coking coal is also produced in Mohuda and Barakar areas. In addition to production of hard coke and soft coke, BCCL operates a number of sand gathering plants, a network of aerial ropeways for transport of sand and nine coal washeries, namely, Dugda-I, Dugda-II, Bhojudih, Patherdih, Mahuda, Sudamdih, Barora, Moonidih and Madhuband.

CCL operates mines in Bokaro, Ramgarh, Giridih and North and South Karanpura Coalfields in Jharkhand and four coal washeries, namely, Kathara, Swang, Rajrappa and Kedla. Its products included medium-coking coal (raw and washed), non-coking coal, soft coke and hard coke.

WCL operates coal mines located in Pench, Kanhan and Patharkheda Coalfields in Madhya Pradesh and Wardha Valley & Kamthi Coalfields in Maharashtra. This company largely meets the requirements of industries and power stations in the western region of the country.

ECL covers Raniganj Coalfields in West Bengal and Mugma and Rajmahal Coalfields in Bihar. It produced and supplied coal to the loco and other industries which required relatively higher grades of coal.

The coalfields of Chhattisgarh, viz, Korba (East & West), Baikunthpur, Chirimiri, Hasdeo, Sohagpur, Jamuna-Kotma and Johilia are under SECL. This subsidiary continued to be the leading producer of CIL.

NEC is responsible for development and production of coal in the North-Eastern States. The present mining activities are confined to Arunachal Pradesh, Assam and Meghalaya. The area has large proven reserves of low ash, high calorific value coal but because of its high sulphur content, it cannot be used directly as metallurgical coal.

SCCL operates coal mines in Andhra Pradesh producing non-coking coal. The coal requirements of consumers in south are mostly met by this company.

MCL had been incorporated as another subsidiary company of CIL. Its area of jurisdiction comprises Talcher and Ib Valley Coalfields of Odisha.

NCL covers the entire Singrauli Coalfields situated in Madhya Pradesh and Uttar Pradesh.

Jharkhand State Mineral Development Corporation Ltd (JSMDC), Damodar Valley Corporation (DVC) and Jammu & Kashmir Minerals Ltd (JKML) are the State Government undertakings engaged in coal mining. IISCO steel plant of SAIL is the only public sector steel unit operating captive mines for coal. Bengal Emla Coal Mines Ltd (BECML), Jindal Steel & Power Ltd (JSPL), Hindalco and Tata Steel are the companies, operating captive mines in the private sector.

As on 31.3.2011, there were 559 operating mines for coal in the country, out of which 203 were opencast while 325 were underground mines. The remaining 31 were mixed collieries. There were 533 public sector mines and 26 mines in private sector (Table-20). Thrust is now given to further increase production from opencast mines where the gestation period is comparatively shorter. In 2010-11, share of production of raw coal from opencast mines was 89.7% against 10.3% from underground mines (Table-21). Production of coal by different mining technologies employed is furnished in Table-22. The overall output per man shift (OMS) in 2010-11 was 4.74 tonnes as against 4.48 tonnes in 2009-10.

Table – 20 : Number* of Coal Mines, 2010-11 (By Sectors/States)

State	No. of collieries			
	OC	UG	Mixed	Total
All India	**203**	**325**	**31**	**559**
Public sector	184	318	31	533
Private sector	19	7	–	26
Andhra Pradesh	14	36	–	50
Arunachal Pradesh	1	–	–	1
Assam	3	4	–	7
Chhattisgarh	21	40	1	62
Jammu & Kashmir	–	7	–	7
Jharkhand	72	75	27	174
Madhya Pradesh	21	48	2	71
Maharashtra	32	23	–	55
Meghalaya	–	1	–	1
Odisha	17	11	–	28
Uttar Pradesh	5	–	–	5
West Bengal	17	80	1	98

Source: *Coal Directory of India, 2010-11, Coal Controller's Organisation, Kolkata.*

** As on 31.3.2011*

Note: *OC - Opencast UG - Underground.*

Table – 21 : Production of Raw Coal

(In million tonnes)

Year	Production from open-cast mines (% share)	Production from under-ground mines (% share)	Total production
2008-09	433.79 (88%)	58.97 (12%)	492.76
2009-10	473.52 (89%)	58.52 (11%)	532.04
2010-11	477.84 (89.7%)	54.85 (10.3%)	532.69

Source: *Coal Directory of India, 2010-11*
Coal Controller's Organisation, Kolkata.

Table – 22 : Production of Coal, 2010-11 (By Technologies)

(In million tonnes)

Technology adopted	Production	Percentage of total
All India : Total	**532.694**	**100**
Opencast (Total)	***477.839***	***89.70***
Mechanised	470.460	98.50
Manual	7.379	1.50
Underground (Total)	***54.855***	***10.30***
Conventional B&P	8.045	14.70
Mechanised B&P	42.501	77.50
Conventional LW	-	-
Mechanised LW	1.048	1.90
Other methods	3.261	5.90

Source: *Coal Directory of India, 2010-11,*
Coal Controller's Organisation, Kolkata.

Note: *B&P - Board-and-pillar; LW - Longwall*

As coking coal was deregulated with effect from 1.4.1996, distribution is done by CIL/coal companies. The Government of India has amended provisions of Colliery Control Order 1945 and Colliery Control Order 2000 has been notified, according to which, the price & distribution of all grades of coal with effect from 1.1.2000 have been deregulated.

Coal movements by coastal shipment to southern and western regions through Haldia, Paradip and Vizag ports were continued. Major portion of the despatches was through railways, followed by roads, Merry-Go-Round System, belt conveyor, ropeways and sea route.

Lignite

Out of the fourteen opencast working mines, three are owned by Neyveli Lignite Corporation (NLC), five by Gujarat Mineral Development Corporation Ltd (GMDCL), three by Rajasthan State Mines & Minerals Limited (RSMML), and one mine each by Gujarat Industries Power Co. Ltd (GIPCL), Gujarat Heavy Chemicals Ltd (GHCL) & VSLPPL. Sectorwise, thirteen mines are under public sector and the remaining one is under private sector i.e. GHCL. NLC shared maximum production during the period under review. The NLC mines are a part of an integrated complex consisting of three opencast lignite mines (10.5 million tpy + 10.5 million tpy + 3 million tpy), 3 thermal power plants (600 MW+ 420 MW+1470 MW) and a carbonisation and briquetting plant (262,000 tpy) producing carbonised briquettes, commercially called “Leco”. The third mine having 3 million tpy capacity feeds an independent power project of 250 MW. Capacity increase of Mine-II from 10.5 million tpy to 15 million tpy with the installation of 2x250 MW units has been approved by the Ministry of Coal. The new Barsingsar Thermal-cum-Mine Project of NLC in Bikaner district in Rajasthan will have 2.1 million tpy lignite capacity to feed the 2x125 MW thermal project. The mine is expected to produce 1.79 million tonnes lignite per annum by 2012-13. The NLC's mines are highly mechanised. Electric-powered equipment like bucket-wheel excavators, fabric & steel cord belt conveyors, tippers and spreaders are used in their opencast mines for excavation, transportation and refilling of overburden. The Neyveli Lignite Mines is the largest opencast mine in the whole country with eco-friendly technology. Hydraulic shovels & dumpers are used only for auxiliary works. Mobile Transfer Conveyor (MTC) of capacity 4420 cu m/hr, stacker of 4000 t/hr capacity and reclaimer of 2000 t/hr capacity are also deployed.

Policy–Captive Coal and Lignite Block Allocation

Under the Coal Mines (Nationalisation) Act, 1973, coal mining was originally reserved for the public sector exclusively. The said Act was amended from time to time to allow: (a) captive mining by private companies engaged in production of iron and steel and sub-lease for coal mining to private parties in isolated small pockets not amenable to economic development and not requiring rail transport (amended in 1976); (b) private sector participation in coal mining as linkage for power generation, for washing of coal obtained from a mine or for other end-uses to be notified by Government from time to time (amended on 9.6.1993), in addition to existing provision for the production of iron and steel; (c) mining of coal for production of cement (amended on 15.3.1996) and (d) mining of coal for production of syn-gas obtained through coal gasification (underground and surface) and coal liquefaction (amended on 12.7.2007).

The Central Government, a Government Company (including a State Government company), a Corporation owned, managed and controlled by the Central Government can undertake coal mining without the restriction of captive use.

The allocation of coal blocks to private parties is done through the mechanism of an Inter-Ministerial and Inter-Govermental body called Screening Committee.

As regards allocation of small and isolated blocks are concerned, a new policy is being formulated in consultation with the Ministry of Law and Justice and the stake holders for allocation of such blocks.

With the progressive allocation of coal blocks, the number of coal blocks available for allocation is declining, while the number of applicants per block in increasing, as the demand for coal keeps increasing. This has made selection of an applicant in respect of a block difficult and vulnerable to criticism on the ground of lack of transparency and objectivity.

While efforts are on hand to continuously add blocks to the captive list, it is also expected that the demand for blocks would remain far ahead of supply. Therefore, there is an urgent need to bring in a process of selection that is not only objective but also demonstrably transparent. Auctioning through competitive bidding is one such acceptable selection process.

With a view to bringing in more transparency, the Mines and Minerals (Development and Regulation) Amendement Act, 2010 for introduction of competitive bidding system for allocation of coal blocks for captive use, has been passed by the both Houses of Parliament and it has been notified in Gazette of India (Extraordinary) on 9th September, 2010. The Amendment Act seeks to provide for grant of reconnaissance permit, prospecting licence or mining lease in respect of an area containing coal and lignite through auction by competitive bidding, on such terms and conditions as may be prescribed. This, would however, not be applicable in the follwing cases: where such area is considered for allocation to a Government company or corporation for mining or such other specified end use; where such area is considered for allocation to a company or corporation that has been awarded a power project on the basis of competitive bids for tariff (including Ultra Mega Power Projects).

The Government has finalised rules for allocation of blocks through the competitive bidding and same are notified on 2.2.2012. The commencement of the Amendment Act has been notified on 13.2.2012.

The Ministry of Power proposes to set up four Ultra Mega Power Projects (UMPP) with capacity of 4000 MW each, through tariff-based competitive bidding. The Ministry of Coal has allocated at Moher, Moher-Amlori Extension and Chhatrasal coal blocks (750 million tonnes) for the proposed UMPP to be set up at Sasan in Madhya Pradesh; Meenakshi, Meenakshi-B and dip side of Meenakshi coal blocks (885.24 million tonnes) for the proposed UMPP and Bankhui (800 million tonnes) for the proposed first additional UMPP to be set up in Odisha; Kerandari BC coal block (972 million tonnes) for the proposed UMPP to be set up in Jharkhand and Puta Parogia (692.16 million tonnes)and Pindrakhi (421.51 million tonnes) coal blocks for the proposed UMPP to be set up in Chhattisgarh.

At present, captive coal blocks are only allotted to companies in power, iron & steel, Government commericial, private commercial & cement and coal to oil sectors. Till 31.3.2011, a total of 206 coal blocks with 49,258 million tonnes geological reserves have been allotted in various states (Table-23). Similarly, 27 captive lignite blocks with 1,996.8 million tonnes geological reserves have been allocated in Gujarat (12) and Rajasthan (15) till 31.3.2011. Of these, 5 blocks are allocated for power generation and 7 blocks for commercial end use in Gujarat. In Rajasthan, the allocation of 10 blocks is for power and 5 for commercial end use.

Table – 23 : Allotment of Captive Coal Blocks, (Till 31.3.2011) (Statewise)

(In million tonnes)

State	No.of Coal Blocks	Geological Reserves
Total	**206**	**49258.0**
Arunachal Pradesh	1	27.0
Andhra Pradesh	4	237.2
Chhattisgarh	39	8954.7
Jharkhand	58	15175.5
Madhya Pradesh	25	3352.4
Maharashtra	26	1090.0
Odisha	33	16267.1
West Bengal	20	4154.2

Source: *Coal Directory of India, 2010-11, Coal Controller's Organisation, Kolkata.*

Coal Bed Methane (CBM) and Underground Coal Gasification (UCG)

In terms of Govt. of India, CBM Policy 1997, consortium of CIL and ONGC has been allotted 2 blocks–one each in Raniganj and Jharia coalfield for development of Coal Bed Methane. So far, 26 CBM blocks have been allotted to various operations for exploration and exploitation of CBM. Ten more blocks were offered in the 4th round of bidding concluded in October, 2009.

Under the guidelines for conducting underground coal gasification and allocation of blocks issued on 13.7.2009, five lignite blocks and two coal blocks have been identified for allocation.

FOREIGN COLLABORATION

To meet the country's growing demand for coal, Coal India Limited (CIL) is looking for foreign collaboration with the following objectives:

(a) bringing in proven technologies and advanced management skills for running underground (UG) and opencast (OC) mines and in coal preparation for efficient management of the Indian coal industry and development of necessary skills by way of appropriate training, etc.;

(b) exploration and exploitation of coal bed methane and in situ gasification of coal;

(c) locating overseas companies, interested in joint ventures for overseas operations, in the field of coal mining with special thrust on coking coal mining; and

(d) exploring financial assistance for import of equipment and other investment needs for coal industry.

Keeping these objectives in view, Joint Working Group on coal had been set up with a number of countries such as UK, France, Russia, USA, Poland, Germany, Australia and China. The priority areas, inter alia, include acquiring modern technology for mass production in underground and opencast mining, methodology of undergound mining in difficult geological conditions including steep seams, fire and subsidence control, mines safety, coal preparation, use of washery rejects for power generation, exploitation of coal bed methane from working mines and abandoned mines, coal gasification, application of geographical information system (GIS), environmental mitigation and emission trading, overseas ventures for sourcing coking coal, etc. Training of CIL personnel for effective adaptation of the state-of-the-art technologies, available with the developed countries, is also a prime subject of focus.

COAL WASHERIES

Presently 19 coal washeries (15 in public sector and 4 in private sector) with 32.80 million tonnes per annum capacity produced about 6.96 million tonnes of coking coal in 2010-11. Similarly, 35 coal washeries with 111.61 million tonnes capacity produced about 21.38 million tonnes non-coking coal during the year. In public sector, BCCL operates 9 coking coal washeries (Dugda II, Bhojudih, Patherdih, Sudamdih, Barora, Moonidih, Mahuda, Madhubann and Dugda-I), CCL operates 4 washeries (Kathara, Swang, Rajrappa and Kedla), WCL one (Nandan) and SAIL operates one (Chasnala) whereas 4 washeries (West Bokaro-II, West Bokaro-III, Jamadoba and Bhelatand) were operated by Tata Steel Ltd, in private sector. In public sector, 9 non-coking coal washeries (three each in BCCL & CCL, two in SCCL and one in NCL) were operational, whereas in private sector, 26 non-coking coal washeries were in operation. Production of washed coking coal during 2010-11 was about 3.79 million tonnes in Public Sector and 3.17 million tonnes in Private Sector.

By and large, ash content in raw coal used by washeries varied between 24 and 33%. The ash content in the washed coal and middlings produced by washeries ranged from 19 to 22% and 35 to 40%, respectively. The rejects in most washeries contained over 50% ash. The capacity and production of washed coking/non-coking coal is shown in Tables - 24 to 27, respectively.

Table – 24 : Production of Washed Coking Coal, 2009-10 & 2010-11 (Sectorwise/Companywise)

(In '000 tonnes)

	2009-10	2010-11
All India : Total	**6547.0**	**6955.0**
Public Sector	**3499.0**	**3785.0**
BCCL	1329.0	1549.0
CCL	1396.0	1453.0
WCL	248.0	191.0
SAIL	526.0	592.0
Private Sector	**3048.0**	**3170.0**
Tata Steel Ltd	3048.0	3170.0

Source: *Coal Directory of India, 2010-11, Coal Controller's Organisation, Kolkata.*

Table – 25 : Capacity of Washed Coking Coal, 2010-11 (Sectorwise/Companywise)

Coalfield/washery	State	Raw coal capacity (In '000 tpy)
Grand Total		**32800**
Public Sector	**Total**	**27140**
BCCL		**14550**
Dugda-I	Jharkhand	2500
Dugda-II	-do-	2000
Bhojudih	-do-	1700
Patherdih	-do-	1600
Sudamdih	-do-	1600
Barora	-do-	420
Moonidih	-do-	1600
Mahuda	-do-	630
Madhubann	-do-	2500
CCL		**9350**
Kathara	-do-	3000
Swang	-do-	750
Rajrappa	-do-	3000
Kedla	-do-	2600

(Contd.)

Table - 25 (Concld.)

Coalfield/washery	State	Raw coal capacity (In '000 tpy)
WCL		**1200**
Nandan (Pench-Kanhan)	Madhya Pradesh	1200
SAIL		**2040**
Chasnala	Jharkhand	2040
Private Sector	**Total**	**5660**
Tata Steel Ltd		**5660**
West Bokaro-II	Jharkhand	1800
West Bokaro-III	-do-	2100
Jamadoba	-do-	900
Bhelatand	-do-	860

Source: *Coal Directory of India, 2010-11, Coal Controller's Organisation, Kolkata (except totals).*

Table – 26 : Production of Washed Non-coking Coal : 2009-10 & 2010-11 (Sectorwise/Companywise)

(In '000 tonnes)

	2009-10 (R)	2010-11
All India : Total	**39028.9**	**21384.7**
Public Sector	**11247.0**	**12367.0**
BCCL	301.0	314.0
CCL	7424.0	8063.0
NCL	3522.0	3339.0
SCCL	-	651.0
Private Sector	**27781.9**	**9017.7**
JSPL	1766.4	1927.0
BLA Ind. Ltd	293.6	256.0
Aryan Coal Beneficiation Pvt. Ltd	14959.6	1527.0
Aryan Energy Pvt. Ltd	61.0	50.0
Bhatia International Ltd	2467.0	1700.0
Global Coal & Mining Pvt. Ltd	2239.7	2540.0
Kartikey Coal Washeries Pvt. Ltd	782.3	900.0
Spectrum Coal & Power Ltd	5145.2	-
Earth Minerals Co. Ltd	67.1	117.7

Source: *Coal Directory of India, 2010-11, Coal Controller's Organisation, Kolkata.*

Table – 27 : Capacity of Washed Non-coking Coal, 2010-11 (Sectorwise/Companywise)

Washery/Location	Coalfield	State	Raw Coal Capacity (In '000 tpy)
Grand Total			**111610**
Public Sector	**Total**		**23200**
BCCL			
Jharia Coalfield, Jharkhand			**3980**
Dugda-I	Jharia	Jharkhand	1000
Lodna	Jharia	Jharkhand	480
Madhuban	Jharia	Jharkhand	2500
CCL			
East Bokaro Coalfield, Jharkhand			**11720**
Gidi	East Bokaro	Jharkhand	2500
Piparwar	N. Karanpura	Jharkhand	6500
Kargali	S. Karanpura	Jharkhand	2720
NCL			**4500**
Bina Deshelling	Bina	Uttar Pradesh	4500
SCCL			**3000**
Manuguru	Khammam	Andhra Pradesh	1500
Ramagundam	Khammam	Andhra Pradesh	1500
Private Sector	**Total**		**88410**
Jindal Steel & Power Ltd			**6000**
Pit Head Washery (JSPL)	Mand Raigarh	Chhattisgarh	6000
BLA Industries Pvt. Ltd			**330**
BLA Washery	Dharmasthal	Madhya Pradesh	330
Aryan Coal Beneficiation Pvt. Ltd			**26960**
Chakabuwa	Korba	Chhattisgarh	6000
Dipka	Korba	Chhattisgarh	12000
Pander Pauni	Ballarpur	Maharashtra	3000
Gevra	Korba	Chhattisgarh	5000
Binjhri	Korba	Chhattisgarh	960
Aryan Energy Pvt. Ltd			**2600**
Indaram	Ramagundam	Andhra Pradesh	600
Talcher	Talcher	Odisha	2000
Bhatia International Ltd			**6000**
Wani	Wardha	Maharashtra	2000
Ghugus	Wardha	Maharashtra	4000
Global Coal & Mining Pvt. Ltd			**5000**
Ib Valley	Ib Valley	Odisha	1500
Ramagundam	Ramagundam	Andhra Pradesh	1000
Talcher	Talcher	Odisha	2500
Gupta Coal field & Washeries Ltd			**13920**
Sasti	Wardha	Maharashtra	2400
Ramagundam	Ramagundam	Andhra Pradesh	2400
Ghugus	Wardha	Maharashtra	2400
Gondegaon	Kamptee	Maharashtra	2400
Majri	Wardha	Maharashtra	2400
Wani	Wardha	Maharashtra	1920
Kartikay Coal Washeries Pvt. Ltd			**13000**
Wani	Wardha	Maharashtra	13000
Spectrum Coal & Power Ltd (ST-CLI)			**5200**
Korba	Korba	Chhattisgarh	5200

Contd.

Table -27 (Concld.)

Washery/Location	Coalfield	State	Raw Coal Capacity (In '000 tpy)
Indo Unique Flames Ltd			**5400**
Nagpur	Wardha	Maharashtra	600
Punwat	Wardha	Maharashtra	2400
Wani	Wardha	Maharashtra	2400
Earh Minerals Company Ltd			**4000**
Talcher	Jharsuguda	Odisha	4000

Source: *Coal Directory of India, 2010-11, Coal Controller's Organisation, Kolkata (Except totals).*

CLASSIFICATION AND GRADES

Indian coal is classified into two main categories, namely, coking and non-coking. Coking coal is a type of coal from which, on carbonisation, coke suitable for use in metallurgical industries, particularly in iron and steel industries, can be produced. Parameters determining coking property of coal are coking index, volatile matter (VM %), vitrinite %, crucible swell no., fluidity, reflectance, etc. Although for commercial gradation, ash percentage is the sole criterion, for semi-weakly-coking coal, along with ash percentage, moisture percentage too is considered as an added criterion. For non-coking coal, an empirical formula is used to determine Useful Heat Value (UHV) of coal in kcal/kg.

The classification of coal as per the Ministry of Coal is given in Table - 28. Changing, grading and pricing of thermal coal from the existing Useful Heat Value (UHV) system to the international practice of Gross Calorific Value (GCV) system is under consideration of Ministry of Coal. A Pilot Study on migration from UHV to GCV-based gradation of coal has been completed by CFRI. The draft report is being overviewed by a Committee comprising members from Ministry of Coal, CEA, NTPC, CIL and CFRI.

Table – 28 : Classification of Coal

Sl. No	Class	Grade	Grade/Specification
1.	Non-coking coal produced in all states other than Assam, Arunachal Pradesh, Meghalaya and Nagaland	A	Useful Heat Value exceeding 6200 kcal per kg.
		B	Useful Heat Value exceeding 5600 kcal per kg but not exceeding 6200 kcal per kg
		C	Useful Heat Value exceeding 4940 kcal per kg but not exceeding 5600 kcal per kg.
		D	Useful Heat Value exceeding 4200 kcal per kg but not exceeding 4940 kcal per kg.
		E	Useful Heat Value exceeding 3360 kcal per kg but not exceeding 4200 kcal per kg.
		F	Useful Heat Value exceeding 2400 kcal per kg but not exceeding 3360 kcal per kg.
		G	Useful Heat Value exceeding 1300 kcal per kg but not exceeding 3360 kcal per kg.
2.	Non-coking coal produced in Arunachal Pradesh, Assam, Meghalaya and Nagaland	A	Useful Heat Value between 6200 and 6299 kcal per kg and corresponding ash plus moisture content between 18.85 and 19.57%.
		B	Useful Heat Value between 5600 and 6199 kcal per kg and corresponding ash plus moisture content between 19.58 and 23.91% Ash content not exceeding 15%.
3.	Coking coal	Steel Grade I	Ash content exceeding 15% but not exceeding 18%.
		Steel Grade II	Ash content exceeding 18% but not exceeding 21% .
		Washery Grade I	Ash content exceeding 21% but not exceeding 24%.
		Washery Grade II	Ash content exceeding 24% but not exceeding 28%.
		Washery Grade III	Ash content exceeding 28% but not exceeding 35%.
		Washery Grade IV	
4.	Semi-coking and weakly–coking coal	Semi-coking Grade I	Ash plus moisture content not exceeding 19%.
		Semi-coking Grade II	Ash plus moisture content exceeding 19% but not exceeding 24%.
5.	Hard coke	By-product Premium	Ash content not exceeding 25%.
		By-product Ordinary	Ash content exceeding 25% but not exceeding 30%.
		Beehive Premium	Ash content not exceeding 27%.
		Beehive Superior	Ash content exceeding 27% but not exceeding 31%.
		Beehive Ordinary	Ash content exceeding 31% but not exceeding 36%.

CONSUMPTION

Thermal power plants, Iron & Steel and Cement continued to be the major consuming industries for coal in India. Sizeable quantities are also consumed by the railways, collieries and as a domestic fuel. Data regarding consumption in these sectors are not available. However, industrywise despatches of coal are given in Table - 29.

Table – 29 : Despatches* of Coal 2008-09 to 2010-11 (By Industries)

(In million tonnes)

Industry	2008-09	2009-10	2010-11
Total	**489.17**	**513.79**	**523.46**
Iron & steel[1]	17.77	18.57	18.63
Sponge iron	19.78	17.26	17.02
Fertilizer	2.43	2.63	2.94
Cement	13.12	14.36	14.18
Electricity	377.27	378.24	382.20
Others (Chemical, base metals, paper & pulp, textile & rayon, bricks, etc.	58.80	82.73	88.49

Source: *Coal Directory, 2008-09, 2009-10 and 2010-11.*
* *Data on consumption is not available.*
1 *Includes direct feed, cokeries and boilers.*

DEMAND & SUPPLY

XII[th] Plan Demand Projections

(Million tonnes)

Sl. No.	Sector	2016-17
1	Steel & Coke Oven	67.20
2	Power (Utility)	682.08
3	Power (Captive)	56.36
4	Cement	47.31
5	Sponge Iron	50.33
6	Others	77.22
	Total	**980.50**

XII Plan Supply Projections

(Million tonnes)

Source	2016-17
CIL	556.40
SCCL	57.00
Others	101.60
Total Indigenous Supply	**715.00**
Import - Coking	35.50
Non-coking	230.00
Total Imports	**265.50**

Source: Report of the Working Group for Coal & Lignite for XII Plan.

WORLD REVIEW

World proved coal reserves were estimated at 860.94 billion tonnes at the end of 2011 of which, 404.76 billion tonnes (47%) is classified as anthracite & bituminus coal and 456.18 billion tonnes (53%) as sub-bituminous coal & lignite (Table-30). World production of coal and lignite increased from about 6.85 billion tonnes in 2009 to 7.15 billion tonnes in 2010. China continued to be the largest producer of coal and lignite in 2010 with about 45% share in total world production, followed by USA (13%), India (7%), Australia (6%) and Russia & Indonesia (4% each). The remaining 21% of the total world coal production was from other producing countries (Table-31). Global primary energy consumption fell by 1.1% over the preceding year. Asia Pacific and the Middle East has increased coal consumption during the year.

Table – 30 : World Proved Coal Reserves at the end of 2011 (By Principal Countries)

(In million tonnes)

Country	Anthracite and bituminous coal	Sub-bituminous coal and lignite	Total
World : Total	**404762**	**456176**	**860938**
Australia	37100	39300	76400
Brazil	–	4559	4559
Canada	3474	3108	6582
China	62200	52300	114500
Colombia	6366	380	6746
Germany	99	40600	40699
India*	56100	4500	60600
Indonesia	1520	4009	5529
Kazakhstan	21500	12100	33600
Poland	4338	1371	5709
Russian Federation	49088	107922	157010
South Africa	30156	–	30156
Ukraine	15351	18522	33873
USA	108501	128794	237295
Other countries	8969	38711	47680

Source: *BP Statistical Review of World Energy, June 2012.*
* *India's reserves of coal as on 1.4.2011 are estimated at 285.86 billion tonnes to a depth of 1,200 m and those of lignite at 40.91 billion tonnes.*

Table – 31 : World Production of Coal and Lignite (By Principal Countries)

(In Million tonnes)

Country	2008	2009	2010
World : Total	**6815**	**6849**	**7153**
Australia			
Hard coal	333	350	356
Brown coal	66	68	69
Bulgaria			
Brown Coal & lignite	29	27	29
Canada			
Hard coal	58	52	58
Lignite	10	11	10
China			
Hard coal	2802	2973	3240
Colombia			
Hard coal	74	73	74
Czech. Rep.			
Bituminous coal	12	11	11
Brown Coal	47	45	44
Germany			
Hard coal	19	15	14
Brown coal	175	170	169
Greece			
Lignite	65	62	54
India			
Hard coal	493	532	499
Lignite	32	34	35
Indonesia			
Hard coal	240	255	275
Kazakhstan			
Hard coal	106	87	90
Korea Democratic Rep.			
Coal all form	25	25	25
Mexico			
Bituminous coal	16	13	16
Poland			
Hard coal	84	78	76
Lignite	60	57	57
Romania			
B. Coal & lignite	35	29	29
Russia			
Hard coal	326	298	317
South Africa			
Hard coal	252	251	255
Thailand			
Lignite	18	16	18
Turkey			
Hard coal	3	4	4
Lignite	86	82	74
Ukraine			
Hard coal	78	55	55
United Kingdom			
Bituminous coal	18	18	18
USA			
Hard coal	997	895	893
Lignite	69	66	65
Vietnam			
Anthracite	40	44	44
Other Countries	147	153	180

Source*: World Mineral Production, 2006-2010.*
Hard coal *– Including anthracite, bituminous & sub-bituminous coal.*
** India's production of coal and lignite during 2010-11 was 532.7 million tonnes and 37.7 million tonnes, respectively.*

As estimated by the 'World Coal Association', coal currently fuels 41% of the world electricity and this proportion is set to remain static over the next 30 years. About 70% of the world's steel production is based on coal. The World Coal Institute in its report "Coal Meeting the Climate Challenge: Technology to reduce Greenhouse Gas Emission" released in 2007, outlined two primary ways of reducing CO_2 emission from coal use. The first is by carbon capture and storage (CCS) which can reduce 80-90% CO_2 emission into atmosphere and second is storing CO_2 in geological formations. CCS is now acknowledged as the only technology that can significantly reduce emissions from fossil fuel power stations and other industrial plants. International Energy Agency has emphasised need to install CCS on coal-fired plants by 2030. With the widespread deployment of CCS, fossil fuels will become an important part of solution rather than part of the problem.

Australia

Australia is the world's fourth largest producer and world's leading exporter of coal. Queensland and New South Wales were Australia's leading coal producing States and accounted for more than 95% of the country's total output. New South Wales and Queensland are its major coal exporting States; however, to sustain export growth, the contry's infrastructure would require singificant expansion and upgrading so that minerals for export could be transported from inland to port terminals. A carbon tax and mineral resource rent tax would not affect Australian mineral investment significantly. Australia is expected to remain a major mineral and fuel exporting country. The infrastructure bottlenecks held back Australia's mineral exports, especially coal, while a number of new infrastructure projects were underway. One additional 90 million tonnes per year of new coal terminal port capacity has been scheduled to come for 2014. At Newcastle, New South Wales, Port Waratah Coal Services expanded its Kooragang Terminal capacity by 13 million tonnes per year to 102 million tonnes per year and planned a further increase to 113 million tonnes per year. The Newcastle

Coal Infrastructure Group planned to add a 30 million tonnes per year terminal in 2010. The total combined terminal capacity in the states of New South Wales and Queensland would be 448 million tonnes per year.

China

Coal consumption had increased to meet the high demand for industrial and power generation. Coal was the primary source of energy and two-thirds of the country's electricity was produced by coal-fired plants. About 50% of the country's total coal output was consumed by the power sector. China's coal production continued to increase in 2010 because of an increase in demand for coal in industrial sector. However, owing to high coal and coking coal prices in the domestic market and weak international coal prices, coastal coking coal producers imported a large volume of coal. The Government continued to close small coal mines to reduce fatalities. In the long-term, several large companies are expected to produce coal along with small mines.

Indonesia

Indonesia was the world's second ranked exporter and leading producer of coal. Central Kalimantan Province held reserves of 1,400 millon tonnes of high-quality metallurgical coal. The Province produced 1.5 millon tonnes per year of high-grade coal from 15 coal mining companies. Operations at the Jorong coal mine on Kalimantan Island were resumed in August 2010 by PT Indo Tambangraya Megah Tbk.

BHP Billiton planned to develop the 774-million tonnes of Maruwai deposit in East and Central Kalimantan Provinces to produce 6 million tonnes per year of combined thermal and coking coal by 2014 and to expand output to between 15 and 20 million tonnes per year. PT Marunda Graha Mineral planned to increase production at its MGM coking coal mine by 25% to 2 million tonnes per year. Minerals Energy Commodities Holdings (MEC) of the United Arab Emirates expected a coal railway to start operating at the end of 2012 when its coal mine in East Kalimantan Province begins producing at a rate of 1 million tonnes per year of coal; the company planned to begin exporting 14 million tonnes of coal to Chinese and Indian power producers beginning in 2013.

FOREIGN TRADE

Exports

In 2010-11, exports of coal increased about 75% to 4.33 million tonnes from 2.47 million tonnes in the previous year. Exports of coke also increased to 0.65 million tonnes in 2010-11 from 0.13 million tonnes in 2009-10. Coal was mainly exported to China (53%), Bangladesh (27%), Nepal (16%) and Japan (4%). Coke was exported predominantly to Brazil (50%), Bhutan (20%), Turkey (12%) and USA (6%). Exports of lignite were negligible and there was no export of coal gas in 2010-11 (Tables - 32 to 35).

Imports

Imports of coal decreased slightly by 6% to 69 million tonnes in 2010-11 from 73 million tonnes in the previous year. Imports of coke also decreased by 37% to 1.49 million tonnes in 2010-11 from 2.36 million tonnes in the previous year. Coal was mainly imported from Indonesia (52%), Australia (25%) and South Africa (16%) whereas coke was imported mainly from China (47%), Australia (15%), USA (12%) and Russia & Japan (6% each). Imports of lignite were negligible while imports of briquettes of coke/semi-coke were 100 tonnes in 2010-11 (Tables - 36 to 39).

Table – 32 : Exports of Coal (Excl. Lignite) (By Countries)

Country	2009-10 Qty ('000 t)	2009-10 Value (₹'000)	2010-11 Qty ('000 t)	2010-11 Value ('₹.000)
All Countries	**2471**	**5208101**	**4327**	**11516365**
China	55	186610	2301	7024285
Bangladesh	1449	3339022	1159	2462446
Nepal	794	753265	681	1201472
Japan	++	2	178	803884
Bhutan	55	194618	8	19970
UAE	++	830	++	1847
Saudi Arabia	–	–	++	1010
Germany	++	6	++	379
UK	++	26	++	342
N. Mariana Is	–	–	++	214
Other countries	118	733722	++	516

Table – 33 : Exports of Coal : Lignite (By Countries)

Country	2009-10 Qty ('000 t)	2009-10 Value (₹' 000)	2010-11 Qty ('000 t)	2010-11 Value (₹ '000)
All Countries	**++**	**6397**	**++**	**9834**
Egypt	–	–	++	3991
UAE	++	4738	++	2108
Iran	–	–	++	1181
Myanmar	–	–	++	1123
Indonesia	–	–	++	738
Turkey	–	–	++	443
El Salvador	–	–	++	172
Bangladesh	–	–	++	76
Germany	–	–	++	2
Other countries	++	1659	–	–

Table – 34 : Exports of Coal Gas, etc. (Except Gaseous Hydrocarbons) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**8621**	**412734**	–	–
Other countries	8621	412734	–	–

Table – 35 : Exports of Coke (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**127251**	**2057266**	**650394**	**9912439**
Brazil	38500	673869	322500	6041576
Turkey	–	–	79500	1466169
USA	1	18	36000	692982
Bhutan	21823	222845	132336	480002
Pakistan	15770	254097	20249	372486
Netherlands	–	–	19800	357291
Bahrain	6055	83184	14243	185576
Korea Rep. of	200	3364	6401	129949
South Africa	1833	34809	4366	92476
Nepal	428	6605	10190	23579
Other countries	42641	778475	4809	70353

Table – 36 : Imports of Coal (Excl. Lignite) (By Countries)

Country	2009-10 Qty ('000 t)	2009-10 Value (₹ '000)	2010-11 Qty ('000 t)	2010-11 Value (₹'000)
All Countries	**73257**	**391798228**	**68918**	**415494801**
Australia	22837	183802972	17273	181449036
Indonesia	32165	115473599	35944	134788133
South Africa	14492	62269478	11214	57272632
USA	1400	13303028	1770	19829296
New Zealand	1059	9976882	795	7703847
Russia	146	1382492	424	4216902
Vietnam	188	1694285	241	2580766
China	45	235500	242	1752587
Philippines	671	2235122	261	801774
Unspecified	–	–	333	1783374
Other countries	254	1424870	421	3316454

Table – 37 : Imports of Coal : Lignite (By Countries)

Country	2009-10 Qty ('000 t)	2009-10 Value (₹'000)	2010-11 Qty ('000 t)	2010-11 Value (₹ '000)
All Countries	**++**	**1053**	++	310
Canada	++	1053	++	310

Table – 38 : Imports of Coke (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹.'000)	2010-11 Qty (t)	2010-11 Value (₹.000)
All Countries	**2355535**	**33310985**	**1490210**	**31203551**
China	86146	1794164	700574	16211830
Australia	305417	4305050	222309	3910751
USA	94395	1254991	176142	3069805
Russia	587398	8516623	89619	1748398
Japan	281043	4004989	85975	1330033
Poland	384121	5131822	43730	1061862
Vietnam	18614	307955	41092	942376
Colombia	176962	2594249	36527	826659
Bosnia-Hrzgovin	–	–	29083	656986
UK	477	8663	29071	643591
Other countries	420962	5392479	36088	801260

Table – 39 : Imports of Briquettes of coke, semi-coke of Coal (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**23**	**581**	**100**	**685**
Mozambique	-	-	100	685
Other countries	23	581	-	-

FUTURE OUTLOOK

The XII Plan Working Group for Coal & Lignite has assessed a coal demand of 980.50 million tonnes by terminal year i.e. 2016-17. The indigenous coal supply projection in the terminal year is projected to be 715 million tonnes. The demand-supply gap emerging from these projections would be 265.50 million tonnes, which will be met by imports of 35.50 million tonnes of coking coal and 230 million tonnes of non-coking coal.

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

COBALT

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

25 Cobalt

Cobalt is an important strategic alloying metal having irreplaceable industrial applications. Cobalt is associated mostly with copper, nickel and arsenic ores.

RESOURCES

Occurrences of cobalt are reported from Singhbhum district, Jharkhand; Kendujhar and Jajpur districts, Odisha; Jhunjhunu district, Rajasthan; Tuensang district, Nagaland; and Jhabua and Hoshangabad districts, Madhya Pradesh. Cobalt associated with lateritic nickel deposit in Sukinda area, Odisha and copper slags are two possible secondary resources of cobalt along with sea-bed multimetal nodules.

As per UNFC system, resources of cobalt in terms of ore as on 1.4.2010 are estimated at 44.91 million tonnes of which about 69%, i.e. 30.91 million tonnes are estimated in Odisha. The remaining 31% resources are in Jharkhand (9 million tonnes) and Nagaland (5 million tonnes). Resources of cobalt as per UNFC system are furnished below in Table-1.

USES

Major use of cobalt is in metallurgical applications, in special alloy/super alloy industry, in magnets and cutting tools industries. Cobalt-based super alloys normally contain 45% or more cobalt while nickel and iron-based super alloys contain 8 to 20% cobalt. Cobalt oxide is used in chemical applications such as catalyst, dyes and pigments, paint driers/adhesives and glass & ceramics. Cobalt catalyst, mostly cobalt acetate, is used in terephthalic acid (TPA) and di-methyl-terephthalate (DMT) manufacture.

Super alloys made of cobalt have improved strength and wear & corrosion-resistance characteristics at elevated temperatures. Another use of cobalt-based super alloys is in turbines for pipeline compressors. Hard-facing or cutting tools with cobalt alloys provide greater resistance to wear, heat, impact and corrosion. Cobalt powder finds an important application as a binder in the production of cemented tungsten carbides for heavy-duty and high-speed cutting tools. Cobalt powder is used for bonded tools for diamond industry. Cobalt is also used to promote the adherence of enamel to steel in appliances, and also of steel to rubber for manufacturing steel-belted tyres. Cobalt-molybdenum-alumina compound is used as catalyst in hydrogenation and for petroleum desulphurisation. Elemental Cobalt-60 (radioactive isotope, a production of atomic pile) is used in industrial radiography and therapeutics. Cobalt can retain ferromagnetic property up to a temperature of 1,100°C, highest for any metal. It is used in manufacturing of Alnico magnets, magnetic recording media, soft magnetic material, alloys for spacecraft, etc. The use of cobalt-rare earth permanent magnet will continue where specific advantages of reliability and good performance are required. Other significant uses of cobalt are in battery electrodes, airbags in automobiles, etc.

Table – 1: Reserves/Resources of Cobalt Ore as on 1.4.2010
(By States)

(In million tonnes)

State	Reserves total (A)	Remaining resources					Total Resources (A+B)
		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
All India	–	**30.63**	**2**	**0.28**	**12**	**44.91**	**44.91**
Jharkhand	–	–	2	–	7	9	9
Nagaland	–	–	–	_	5	5	5
Odisha	–	30.63	–	0.28	–	30.91	30.91

RESEARCH & DEVELOPMENT

National Metallurgical Laboratory, Jamshedpur has developed a process route comprising reductive roast and ammonia leaching for the extraction of these strategically important metals from the sea nodules. Due to various reasons, the Co recovery was never more than 60% though Cu and Ni extractions were more than 90% in this process. Laboratory scale experiments have shown that cobalt recovery can be improved with certain additives during leaching. Some of them were found to be effective in enhancing cobalt recovery, without affecting Cu and Ni recovery.

IMMT (formerly RRL), Bhubaneswar had been engaged in extraction of cobalt along with nickel from lateritic nickel/chromite overburden of Odisha through microbial route using acidophilic micro-organism. Up to 35% Ni and 50% Co recovery was achieved. In a span of 60 days, 70% Ni and 60% Co was recovered. The technology was to be scaled up to 10 tonnes with support from OMC. IMMT was granted a patent in India for an improved process for dissolution of nickel-cobalt mixed sulphides. Further developments have not been reported.

HZL carried out R&D with a view to technology absorption in respect of production of cobalt oxide from waste residue of zinc smelter, Debari in Udaipur district, Rajasthan.

INDUSTRY & PRODUCTION

Presently, there is no production of cobalt in the country from indigenous ores. The refined production of cobalt was reported to be around 858 tonnes in 2008, 1,001 tonnes in 2009 and 1,187 tonnes in 2010 from imported feed material. The remaining demand of cobalt is met through imports.

Refining capacity of cobalt in India is estimated at about 2,560 tonnes per year. Of these, Nicomet Industries Ltd and Rubamin Ltd were India's leading producers of cobalt cathodes and compounds. Installed capacity for cobalt at Nicomet is 1,000 tpy. Another cobalt refinery, Conic Metals Ltd, Mumbai which produced cobalt sulphate and carbonate reportedly remained closed since 2001.

The refiners source the heterogeneite-type cobalt ores from the Democratic Republic of Congo and other countries. The units manufacture high-purity cobalt metal and salts, viz, sulphate, acetate, oxide, chloride, carbonate and nitrate of cobalt. Cobalt metal powder is reportedly recovered from cemented carbide scrap by Sandvik Asia Ltd at its pilot plant in Pune, Maharashtra. In addition, spent cobalt catalysts from plants producing DMT, TPA and oxo alcohols are also understood to be reprocessed by several small cobalt chemical processors. However, information on reprocessing of cobalt from scrap is not available. It is expected that recycled cobalt would continue to be used for domestic supply.

SUBSTITUTES

Cobalt is used in specialised applications and is difficult to be substituted. Potential substitutes include barium or strontium ferrites, neodymium-iron-boron or nickel-iron alloys in magnets; nickel, cermets or ceramics in cutting and wear-resistant materials; nickel-based alloys or ceramics in jet engines; nickel in petroleum catalysts; rhodium in hydroformylation catalysts; and cerium, lead, manganese, iron, or vanadium in paints. Presently, about one-third of cobalt is replaced by cobalt-manganese-nickel in lithium-ion batteries.

TRADE POLICY

As per the Foreign Trade Policy 2009-2014, imports of cobalt ores & concentrates under heading no. 2605 and cobalt alloys and its products under heading no. 8105 are allowed freely, except cobalt waste & scrap (ITC-HS Code No. 8105 3000) which are restricted.

WORLD REVIEW

The world cobalt reserves are estimated at 7.5 million tonnes of metal content. Cobalt reserves are mainly in Democratic Republic of Congo (DRC) which contributes 45% to the total reserves. Besides, major reserves are located in Australia, Cuba, New Caledonia, Zambia and Russia. Majority of these reserves are in nickel-bearing laterite deposits and rest in nickel-copper sulphide deposits hosted in mafic and ultramafic rocks in Australia, Canada and Russia and in sedimentary copper deposits of Congo (DRC) and Zambia. Several million tonnes of potential resources of cobalt are also contained in sea-bed manganese nodules. Exploitation of cobalt-bearing manganese nodules from the deeper parts of the sea may be witnessed in the present century. The world reserves of cobalt are given in Table-2.

Table – 2 : World Reserves of Cobalt (By Principal Countries)

(In '000 tonnes of metal content)

Country	Reserves
World: Total (Rounded)	**7500**
Australia	1400
Brazil	87
Canada	130
China	80
Congo, Dem. Rep. (Kinshasa)	3400
Cuba	500
Morocco	20
New Caledonia	370
Russia	250
USA	33
Zambia	270
Other countries	990

Source: *Mineral Commodity Summaries, 2012.*

The world mine production of cobalt in terms of metal content increased to 105,000 tonnes in 2010 from 64,000 tonnes in the previous year. Democratic Republic of Congo (DRC) was the principal producer contributing about 67%, followed by China (6%), Zambia & Australia (5% each), Canada & Cuba (4% each) and Russia (2%) (Table-3).

Table – 3 : World Mine Production of Cobalt (By Principal Countries)

(In tonnes of metal Content)

Country	2008	2009	2010
World: Total	**69000**	**64000**	**105000**
Australia	5770	5365	4819
Brazil	1215	1200(e)	1200(e)
Canada	8953	3919	4568
China	6630	6000	6500
Congo, Dem. Rep.	32,300	35,500	70000
Cuba	3175	3500(e)	3721
Morocco	1791	1600	1582
New Caledonia	869	913	1656
Russia	2502	2352	2460
Zambia	3841	1535	5134
Other countries	1954	2116	3360

Source: *World Mineral Production, 2006-2010.*

Australia

In December, Norilsk announced that it planned to restart production from the Lake Johnston nickel sulphide mine and mill during the first half of 2011.

Belgium

Umicore's 2010 cobalt refinery production increased due to greater availability of scrap resulting from higher prices and higher levels of downstream production. Umicore converted cobalt metal, residues and other cobalt-bearing materials into a wide range of cobalt speciality products, including metal powders, hydroxides, oxides, salts and compounds. Umicore was building an industrial scale recycling facility for spent rechargeable batteries and battery manufacturing scrap in Hoboken, Belgium.

China

China's total production of refined cobalt made it the world's leading producer. Most of the production was from imported ores, concentrates and semirefined materials. Umicore was expanding the production capacity of its plant in Jiangmen, China.

Congo (Kinshasa)

Congo(Kinshasa) was the world's leading producer of mined cobalt. Some of Congo(Kinshasa)'s ores and concentrates were exported, some were processed to semi-refined materials such as cobalt carbonate, cobalt hydroxide or cobalt bearing alloys and some were refined to cobalt metal. In an effort to encourage refining of copper and cobalt materials in the country, the Government of Congo(Kinshasa) prohibited the export of unrefined minerals. The Governor of Katanga Province, where copper and cobalt were mined, then signed a law that allowed companies to export concentrates if they paid a tax of $60/tonne.

Boss Mining mined copper-cobalt ore from open pits in the Mukondo Mountain, Disele and Kabolela North deposits and produced concentrates containing 8,273 tonnes of cobalt, compared with 6,697 tonnes in 2009. By year end, Boss Mining had completed construction of a new cobalt solvent extraction - electrowinning (SX-EW) plant at Luita and expected to begin producing cobalt metal in 2011. Cu-Co Resources Ltd comissioned a cobalt beneficiation plant at its Kisanfu property in the Kolwezi mining district. The commercial plant, which was expected to produce 3,000 tonnes of cobalt in concentrates during the second half of 2011, was an expansion of a small pilot plant built by the company.

Finland

Talvivaara Mining Co. Plc continued to ramp up and optimise production from its polymetallic sulphide mine and bioheap-leaching operation in Sotkamo in central Finland. As part of its plan to increase the operation's production capacity, the company added a second production line to its metal recovery plant.

Japan

Sumitomo planned to increase Niihama's production capacity to accomodate the nickel-cobalt mixed sulphide feed that would be generated from its Taganito project in the Philippines. Umicore began construction on a new battery material plant in Kobe.

New Caledonia

Vale nearly completed the commissioning of its Vale New Caledonia project in the southern tip of New Caledonia's main island. The project, which was originally called Goro, comprised a nickel-cobalt-laterite mine, high pressure acid leaching processing plant and refinery. Vale expected to ramp up production during a 3 year period to reach the nominal production capacity of 60,000 tpy of nickel contained in nickel oxide and 4,600 tpy of cobalt contained in cobalt carbonate.

South Africa

The Nkomati nickel sulphide mine produced 667 tonnes of cobalt in 2010, two times the 333 tonnes produced in 2009. The increase resulted from progress on the Nkomati large scale expansion project. At full steady-state production, forecast for 2013, the mine was expected to produce 1,000 tpy of cobalt in concentrates.

Some of South Africa's PGM operations produced cobalt sulphate at its base metal refinery near Rustenburg, Northwest Province. The company was increasing the nickel capaciaty of the refinery to 33,000 tpy from 21,500 tpy; an equivalent increase in cobalt capacity was expected. Impala Platinum Ltd produced cobalt metal powder at its base-metals refinery near Springs, Gauteng Province. Two other platinum producers - Lonmin plc and Northam Platinum Ltd operatead base-metal refineries and produced semi-refined nickel sulphate containing cobalt.

Uganda

Kasese Cobalt Co Ltd produced cobalt cathode from stockpiled pyrite concentrates using a bacterial leaching-SX-EW process at its cobalt refinery in southwestern Uganda.

Zambia

Konkola Copper Mines Plc (KCM) planned to expand the cobalt production cpacity of the smelter. NFC Africa Mining plc made investments at its Luanshya Copper Mine operation, which included upgrading the concentrator at the Baluba copper-cobalt mine.

Zimbabwe

Bindura Nickel Corp. developed plans to resume production from the Trojan mine and concentrator. Cobalt hydroxide was one of the products from the company's refinery. Aquarius Platinum Ltd produced 79 tonnes of cobalt from its Mimosa platinum mine compared to 74 tonnes in 2009. The concentrates were refined by Impala in South Africa.

FOREIGN TRADE

Exports

In 2010-11, export of cobalt ores & concentrates increased to 51 tonnes to China from a modest 1 tonne to Nepal in the preceding year. Exports of cobalt and alloys including waste and scrap also increased to 264 tonnes in 2010-11 as against 187 tonnes in the previous year. Out of the total exports in 2010-11, exports of cobalt and alloys were 258 tonnes and those of cobalt waste & scrap were 6 tonnes. Exports were mainly to Netherlands (41%), USA (40%), Rep. of Korea (10%) and Belgium (4%) (Tables - 4 to 7).

Imports

Imports of cobalt ores and concentrates decreased to 5,041 tonnes in 2010-11 from 9,590 tonnes in the previous year. Imports were mainly from Zaire/ Democratic Rep. of Congo (74%) and People's Rep. of Congo (22%). Imports of cobalt and alloys increased to 726 tonnes in 2010-11 from 597 tonnes in the previous year. Imports in 2010-11 were mainly from People,s Rep. of Congo (16%), Zambia (15%), USA, Canada (11% each) and Belgium (10%). Imports of a very small quantity of cobalt waste and scrap is reported in 2010-11. However, imports of cobalt in the form of cobalt powder, other articles and unwrought cobalt also took place (Tables 8 to 12).

Table – 4 : Exports of Cobalt Ores & Conc. (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**1**	**6**	**51**	**3733**
China	–	–	51	3732
Netherlands	–	–	++	1
Other countries	1	6	–	–

Table – 6: Exports of Cobalt & Alloys (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**168**	**338720**	**258**	**418944**
Belgium	10	35047	10	17435
Indonesia	++	270	1	2538
Iran	1	1458	2	6601
Japan	-	-	5	2902
Korea, Rep. of	13	30836	25	53612
Malaysia	++	21	1	1591
Netherlands	101	197792	106	187118
UK	-	-	5	2620
USA	26	43372	102	142509
Unspecified	15	27634	-	-
Other countries	2	2290	1	2018

Table – 5 : Exports of Cobalt & Alloys (Including Waste and Scrap) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**187**	**340757**	**264**	**422752**
Netherlands	101	197792	106	187118
USA	43	44860	102	142995
Korea, Rep. of	13	30835	25	53612
Belgium	10	35047	10	17435
Iran	1	1458	2	6601
Japan	–	–	11	5022
UK	–	–	5	2620
Indonesia	++	270	1	2538
Malaysia	++	21	1	1591
Switzerland	–	–	++	1201
Other countries	19	30474	1	2019

Table – 7 : Exports of Cobalt Waste & Scrap (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**19**	**2037**	**6**	**3808**
Japan	-	-	6	2120
Switzerland	-	-	++	1201
USA	17	1487	++	486
Other countries	2	550	++	1

Table – 8 : Imports of Cobalt Ores & Conc. (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**9590**	**1327248**	**5041**	**1515404**
Congo, People's Rep. of	3012	626713	1109	1059679
Zaire Rep./Congo, Dem. Rep. of	5864	547582	3719	370673
USA	22	8619	95	27283
Uganda	–	–	21	13639
UK	–	–	4	3097
Unspecified	123	41426	93	41033
Other countries	569	102908	–	–

Table – 9: Imports of Cobalt & Alloys
(By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**597**	**1158986**	**726**	**1573775**
France	20	58692	42	215900
USA	48	105324	83	199181
Congo, People's Rep. of	35	60084	116	198037
Belgium	59	154368	75	175067
Zambia	82	122609	107	161706
Canada	55	97713	77	146093
Japan	9	15620	37	91319
UK	26	58569	40	82158
Norway	160	307417	30	67523
China	6	16838	23	50671
Other countries	97	161752	96	186120

Table – 10 : Imports of Cobalt Powders
(By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**74**	**191366**	**149**	**359282**
Belgium	44	114841	58	144068
USA	14	31157	28	71459
UK	3	7339	16	35108
China	2	6257	14	29493
Finland	3	8143	7	17702
France	4	11261	6	17262
Netherlands	-	-	5	9317
Japan	4	7496	2	6218
Singapore	++	814	2	4454
Unspecified	++	963	9	17143
Other countries	++	3095	2	7058

**Table – 11 : Imports of Cobalt (Other Articles)
(By Countries)**

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**122**	**260889**	**332**	**726642**
France	11	33080	30	184070
USA	32	69215	55	127543
Congo, People's Rep. of	5	6690	72	106486
Zambia	13	21258	67	106397
Canada	10	16863	28	54271
UK	18	41305	23	44558
South Africa	4	8682	17	31692
Japan	-	-	11	16151
Belgium	12	31971	10	14461
China	3	7611	5	12647
Other countries	14	24214	14	28366

**Table – 12 : Imports of Cobalt (Unwrought)
(By Countries)**

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**401**	**706731**	**245**	**487851**
Congo, People's Rep. of	30	53394	44	91551
Canada	45	80574	48	90084
Japan	5	8124	24	68950
Norway	160	306995	30	67523
Zambia	69	101352	40	55309
Australia	6	13096	17	30678
Morocco	25	33313	15	27546
Belgium	3	7556	7	16538
France	5	14352	6	14569
Unspecified	23	35862	5	8548
Other countries	30	52113	9	16555

FUTURE OUTLOOK

Due to specialised nature of applications and difficulty in substitution, the future demand of cobalt is likely to follow an increasing trend. The bulk demand for cobalt in the world would be in cemented carbides used in cutting tools, catalysts in petrochemical industry, drying agent in paint industry and in super alloys used mainly in jet engine parts. The demand of cobalt is supposed to go up with use of super-alloys in civil aviation, catalysts for gas-to-liquid production of synthetic liquid fuels, rechargeable batteries for hybrid electric vehicles, cellular telephones, aerospace and energy generation industries which use cobalt-bearing super alloy gas turbine engine parts. During the last year, global demand for lithium-ion batteries has grown rapidly as a result of the increase in demand for mobile phones, portable PCs & electronic devices. In India, cobalt will find major applications in metallurgy due to greater demand in special alloys/super alloys and in cutting tools and as an alloy in permanent magnets. Cobalt powder demand will continue to grow for bonded tools in diamond industry.

India does not have any primary cobalt resources. Two possible secondary sources are nickel-bearing laterite deposits in Odisha and declining copper slag produced by HCL, which have been under R&D studies for commercial applications over the years. Recovery in small quantities of cobalt from wastes like cutting-tool scrap and beta-naphtha cake from the zinc industry was carried out in the late 1980s. In addition, conversion of spent catalysts from plants producing TPA, DMT and the oxo-alcohols was also carried out as a regular source of cobalt though, these were mostly recycled. The cobalt refiners in India have catered to the market for chemical applications or where the cobalt metal or salt is dissolved and converted to cobalt oxide for cutting tools application.

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

COPPER

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

26 Copper

Copper is an important non-ferrous base metal having wide industrial applications, ranging from defence, space programme, railways, power cables, mint, telecommunication cables, etc. India is not self-sufficient in the resources of copper ore. In addition to domestic production of ore and concentrates, India imports copper concentrates for its smelters. The domestic demand of copper and its alloys is met through domestic production, recycling of scrap and to some extent by imports.

HCL, a Public Sector undertaking, is the only integrated producer of primary refined copper in India that utilises both indigenous and imported concentrates as well as imported and indigenous scrap.

Production of primary copper based on indigenous ore is characterised by high energy consumption because of low-scale operation and minimal automation. The low-grade quality of Indian copper ores and nature of ore bodies (narrow width and flatter inclinations), do not make large-scale mechanisation in underground mines a viable proposition. Hindalco Industries Ltd (unit of Birla Copper) and Sterlite Industries (India) Ltd, the major copper producers in the Private Sector rely solely on imported copper concentrates. These companies own copper mines in other countries as well. Another Private Sector company, Jhagadia Copper Ltd, also produces copper based on secondary route.

A substantial quantity of copper metal is also produced through indigenous and imported scrap. Copper scrap is traded in the form of new scrap generated from copper smelters, copper workings as well as old scrap recovered from electrical motors, electronic equipment, cables, wires, utensils, etc.

The domestic production of copper ore as well as concentrates in 2010-11 increased by 11% and 10%, respectively, over the previous year. However, there was a decline of 20% in the production of copper (blister) and 7% in the production of continuous cast wire rods (CCWR). The production of copper cathodes decreased by 4% during the same period.

RESOURCES

The total resources of copper ore as on 1.4.2010 as per UNFC system are estimated at 1.56 billion tonnes. Of these, 394.37million tonnes (25.30%) fall under 'reserves' proved (STD111 category) and probable (STD121 & STD122 categories) while the balance 1164 million tonnes (74.69%) are 'remaining resources' (under feasibility (STD211), pre-feasibility (STD221 & STD222), measured (STD331), indicated (STD332) and inferred (STD333 categories). Of the total ore resources, 2.64 million tonnes (0.16 %) comprise ore containing 1.85% Cu or more and 676.57 million tonnes (43.38%) of 1% to below 1.85% Cu grade With regard to reserves, there were no reserve above 1.85% Cu grade; however, 381.69 million tonnes fall under 1% to below 1.85% Cu grade.

The total copper metal content in the resources is 12.29 million tonnes of which 4.77 million tonnes constitute reserves.

Largest resources of copper ore to a tune of 777.17 million tonnes (49.86%) are in the state of Rajasthan followed by Madhya Pradesh with 377.19 million tonnes (24.2%) and Jharkhand with 288.12 million tonnes (18.49%). Copper resources in Andhra Pradesh, Gujarat, Haryana, Karnataka, Maharashtra, Meghalaya, Odisha, Sikkim, Tamil Nadu, Uttarakhand and West Bengal accounted for about 8% of the total all India resources (Table-1).

EXPLORATION & DEVELOPMENT

GSI, MECL, DMG Rajasthan, Directorate of Geology, Odisha and HCL were engaged in the exploration of base metals in 2010-11. DMG Rajasthan carried out exploration in the districts of Ajmer, Bhilwara, Rajsamand, Sirohi, and Udaipur. MECL carried out exploration in Chittorgarh district of Rajasthan and HCL carried out exploration in Jhunjhunu district, Rajasthan. GSI carried out exploration in the states of Gujarat, Haryana, Maharashtra, Meghalaya, Rajasthan and Sikkim. Details of exploration activities conducted for copper in 2010-11 are given in Table-2.

Table – 1 : Reserves/Resources of Copper as on 1.4.2010
(By Grades/States)

(In '000 tonnes)

Grade/State	Reserves				Remaining resources								Total resources (A+B)
	Proved STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
		STD121	STD122			STD221	STD222						
All India : Total													
Ore	**133388**	**127100**	**133884**	**394372**	**15781**	**21323**	**12429**	**147989**	**224976**	**741588**	**-**	**1164086**	**1558458**
Metal	**1604.73**	**1508.36**	**1655.24**	**4768.33**	**213.01**	**223.01**	**23.45**	**1453.04**	**1686.84**	**3918.99**	**-**	**7518.34**	**12286.67**
By Grades													
Ore with 1.85 % & above Cu	-	-	-	-	-	62	-	430	813	1336	-	2641	2641
Ore with 1.00 % to below 1.85 % Cu	125287	127100	129311	381698	12406	19031	168	76053	46391	140398	-	294447	676145
Ore with (+) 0.50% to below 1.00% Cu	557	-	31	588	-	2230	2008	23366	85012	504366	-	616982	617570
Ore with (-) 0.50% Cu	7544	-	4542	12086	3375	-	10253	48140	92760	95488	-	250016	262102
By States													
Andhra Pradesh													
Ore	-	-	-	-	686	666	105	-	5791	1000	-	8248	8248
Metal	-	-	-	-	6.88	9.12	1.05	-	97.45	8.32	-	122.82	122.82
Gujarat													
Ore	-	4955	845	5800	-	-	-	129	-	7131	-	7260	13060
Metal	-	80.75	13.78	94.53	-	-	-	0.69	-	113.38	-	114.07	208.60
Haryana													
Ore	-	-	-	-	-	2230	-	-	-	30678	-	32908	32908
Metal	-	-	-	-	-	11.82	-	-	-	101.80	-	113.62	113.62
Jharkhand													
Ore	16540	49127	21151	86818	11720	17990	-	74857	64488	32252	-	201307	288125
Metal	163.04	448.83	196.91	808.78	202.76	194.30	-	869.43	606.35	412.65	-	2285.49	3094.27
Karnataka													
Ore	836	1301	373	2510	-	-	2008	1750	6833	20434	-	31025	33535
Metal	8.78	17.56	4.31	30.65	-	-	11.24	22.00	65.77	99.61	-	198.62	229.27
Madhya Pradesh													
Ore	90909	71481	35929	198319	-	-	-	49650	33700	95519	-	178869	377188
Metal	1218.18	957.84	467.08	2643.10	-	-	-	155.75	104.70	916.02	-	1176.47	3819.57

(Contd.)

Table - 6 : (Concld.)

Grade/State	Reserves				Remaining resources								Total resources (A+B)
	Proved STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
		STD121	STD122			STD221	STD222						
Maharashtra													
Ore	-	-	-	-	-	-	-	-	9399	3811	-	13210	13210
Metal	-	-	-	-	-	-	-	-	89.65	43.05	-	132.70	132.70
Meghalaya													
Ore	-	-	-	-	-	-	-	-	880	-	-	880	880
Metal	-	-	-	-	-	-	-	-	9.00	-	-	9.00	9.00
Nagaland													
Ore	-	-	-	-	-	-	-	-	-	2000	-	2000	2000
Metal	-	-	-	-	-	-	-	-	-	15.00	-	15.00	15.00
Odisha													
Ore	-	-	-	-	-	-	-	1420	2536	2095	-	6051	6051
Metal	-	-	-	-	-	-	-	21.69	21.06	20.69	-	63.44	63.44
Rajasthan													
Ore	25103	228	75585	100916	3375	-	10253	16513	100256	545858	-	676255	777171
Metal	214.73	3.29	973.16	1191.18	3.37	-	10.25	320.48	686.60	2179.09	-	3199.79	4390.97
Sikkim													
Ore	-	8	-	8	-	437	63	300	-	150	-	950	958
Metal	-	0.09	-	0.09	-	7.77	0.91	8.47	-	4.23	-	21.38	21.47
Tamil Nadu													
Ore	-	-	-	-	-	-	-	200	590	-	-	790	790
Metal	-	-	-	-	-	-	-	1.08	2.73	-	-	3.81	3.81
Uttarakhand													
Ore	-	-	-	-	-	-	-	3170	390	660	-	4220	4220
Metal	-	-	-	-	-	-	-	53.45	1.44	5.15	-	60.04	60.04
West Bengal													
Ore	-	-	-	-	-	-	-	-	113	-	-	113	113
Metal	-	-	-	-	-	-	-	-	2.09	-	-	2.09	2.09

Figures rounded off.

Table – 2 : Details of Exploration Activities for Copper, 2010-11

Agency/ State/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
GSI							
Gujarat							
Banaskantha	Amlimal area (South Delhi Fold Belt)	G-4 Stage (Reconnaissance Stage)	-	-	-	-	Indications of mineralisation in the form of malachite, azurite stains, specks and stringers of pyrite with occasional chalcopyrite in the cherty quartzite and amphibolite. Work is in progress
Haryana							
Mahendragarh	West of Bakrija	G-3Stage (Prospecting Stage)	1	203.15	-	34	To assess the potential of copper mineralisation to the west of Bakrija. Analysis of core samples did not indicate any significant values of copper.
Maharashtra							
Chandrapur	Nai Dilli-Dighori and Lal Heti Dugula (Archaean gneissic terrain)	–	–	–	–	-	To establish the northern strike continuity of Thane-Vasana copper and associated basemetal mineralisation. Soil samples from Dugala area indicated presence of sulphide mineralisation. Geo-chem. sampling on 100 x 50 m grid was conducted.
Gadchiroli	Ghanpur Mudholi Block (West Bastar Craton)	G-3 (Prospecting Stage)	-	-	-	-	To establish the potential zone of copper mineralization. The target of spill over drilling achieved. Chemical analytical results are awaited.
Meghalaya							
East Garo Hills	Simsang Diwa village (Archaean geissic complex)	G-4 Stage (Reconnaissance Stage)	5	-	-	-	To assess base metal potential in the area. No significant sulphide mineralised zone could be delineated.
Rajasthan							
Alwar	Mundiyawas-Khera area (North Delhi Fold Belt).	Detailed	-	Scout drilling	-	-	To evaluate potential of copper and precious metal mineralisation. Sampling were carried out. The analytical results are awaited.
Bhilwara	Karoi Rajpura area, (Pur-Banera Belt.)	G-4 stage (Reconnaissance Stage)	-	-	–	–	Evidences of copper mienralisation in the form of malachite stains and as specks, pods, stringers and veins of chalcopyrite, bornite and covellite. A copper mineralised zone having a strike length of about 300 m and width varying from 80 m to 130 m with an average grade of 0.34% copper was delineated.

(Contd.)

Table - 2 (Contd.)

Agency/ State/ District	Location Area/ Block	Mapping Scale	Mapping Area (sq km)	Drilling No. of boreholes	Drilling Meterage	Sampling (No.)	Remarks Reserves/Resources estimated
Rajasthan (Contd.)							
Bhilwara	Northern part of Salampura Block, (Pur-Banera Belt)	G-3 stage (Prospecting stage)	-	–	–	-	To assess the basemetal potential between Pur-Dariba copper prospect and Gurla basemetal prospect. Boreholes intersected 8 mineralised zone having about 5% to 6% total sulphides(V/E). Zone-II, IV,VI & VII are rich in sphalerite and galena with minor chalcopyrite. The other zones are rich in pyrite and pyrrhotite. Analytical results of core samples are awaited.
Bhilwara	Kamalpura and Devpura Blocks, (Pur-Banera belt)	G-4 stage (Reconnaissance Stage)	-	-	-	-	To identify the target areas for basemetal mineralisation.
Jaipur	Dholpura area (North Delhi Fold Belt)	G-4 stage 1:25000	-	-	-	-	To assess the extent and potential basemetal and associated gold mineralisation in the Rialo group of rocks. The channel/bedrock samples indicated Cu values from < 5 ppm to 686 ppm (max.). Only 3 samples from old workings with Malachite stains show 0.1% to 0.18% Cu. The Pb values range from <25 ppm to 100 ppm (max.) and Ag values are < 5 ppm.
Jaipur	Dhantali Block	G-3 stage (Prospecting Stage)	–	–	–	–	To evaluate the potential of basemetal and gold in North Delhi Fold Belt. The work was temporarily suspended due to environmental reasons.
Pali	Trans Aravalli area	G-4 stage (Reconnaissance Stage)	-	-	-	-	To assess the polymetallic mineral potential of the Dhani granite. Analytical results show Fe-35% and REE >2% for Dhani granite.
Sikar	West of Nanagwas area (North Delhi Fold Belt)	G-4 Stage (Reconnaissance Stage)	-	-	-	-	To delineate the zones of basemetal mineralisation and associated precious metals. Surface indications of sulphide mineralisation manifested by malachite stains and specks of unaltered bornite pyrite in amphibole marble and in thin quartz vein. The analytical results are awaited.

(Contd.)

Table - 2 (Contd.)

Agency/ State/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
Rajasthan(Contd.)							
Sikar	Dariba North Block (North Delhi Fold Belt)	G-4 stage (Reconnaissance Stage)	-	-	-	-	To delineate the zones of basemetal mineralisation and associated precious metals in Dariba-Baleshwar area.Surface indications of mineralisation are manifested by malachite stains and specks of unaltered sulphides in ambhibole and dolomitic marble. The analytical results are awaited.
Tonk	Janula-Danota in Agucha-Malpura-Chaksu Belt.	G-4 stage (Reconnaissance Stage)	-	-	-	-	To evaluate the belt covered by airborne and geochemical anomalies by detailed geological mapping for base metal mineralisations.
Sikkim West District (Part)	Chakung-Jugdum area	G-4 stage (Reconnaissance Stage)	-	-	-	-	To assess the basemetal and gold potentiality of the area. Sulphide mineralisation in the area associated with Goraubathan formation where pyrite and chalcopyrite occur as fine dissemination within quartz vein. In Buxa formation mineralisation occurs in the form of malachite stains more profusely near the contact of Ranjit pebble bed. The work is in progress.
Dte. of Geology Odisha							
Mayurbhanj	North of Kesharpur	1:25000 1:2000	115 1	27 pits $79m^3$ Trench	-	53 Geo chemi-cal- 27	To trace possible extension of Singhbhum shear zone to delineate anomalous zone of copper mineral-isation.The sheared hornblende-chlorite schist hosts copper mineralisation at the contact with granite & gneiss. Results of chemical analysis awaited.
DMG Rajasthan							
Ajmer	Around Village Kirap, Ratangarh Rajpura Teh. Beawar	1:50000 1:10000	100 10	-	-	29	Intermittently exposed gossan zone was located at the contact of impure limestone and quartzite in about 80m.Analysis of samples are awaited.
Rajsamand & Bhilwara	Khedala Barach Teh.Bhim N/V Thadiya Teh. Asind	1:2000	0.5	-	-	20	A ferruginous, brecciated gossan zone is extending for a strike length of 1150 m with width 30 m - 40 m NE of Thadiya village is indicative of base metal occurrence.

(Contd.)

Table - 2 (Concld.)

Agency/ State/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
Rajasthan (Contd.)							
Rajsamand & Bhilwara	N/V Sunarkui Modela,Chippla etc., Teh Bhim and Asind	-	-	1	72	10	Indication of basemetal mineralisation is along a thin ferrugenous,sheared gossan zone within dolomite exposed for more than 1500 m. strike length N/V Sunarkui.
Sirohi	N/V Watera Teh. Pindwara	1:10000 1:200	10 1	- -	- -	20 -	Malachite staining in rocks for a length of 500 m. Gossan of 70x30 m dimension present. Pyrite, pyrrhotite and chalcopyrite seen in well cutting.
Udaipur	Kodarwalia, Kun, Punja ki Bhagal Teh Lasadia	-	-	1	90	47	In borehole stringers and specks of pyrite and chalcopyrite observed. Analysis awaited.
MECL							
Rajasthan							
Chittorgarh	Wari block	1:1000	1.50	23	3994	1077 (Primary) 44 (Comp.)	Nine mineralised zones have been deciphered in the block with total resources of 2.56 m x 1.09% Cu in 332 category. The ore also contains Ni-168 ppm (Av.) and Co-161 ppm (Av.).
HCL							
Rajasthan							
Jhunjhunu	Kolihan copper Deposit,Khetri Teh..Khetri (Khetri Copper Belt)		-	-	-	-	Reserves to a tune of 17.70 million tonnes with Cu-1.32% (Av.) estimated. (Measured 9.28 million tonnes with Cu-1.18%; Indicated 0.20 million tonnes with Cu-1.56%; and Inferred 0.64 million tonnes with Cu-1.44%.)
Jhunjhunu	Khetri mine Gothra, Teh. Khetri	-		2	267.40	225	Total reserves of 56.97 million tonnes of grade Cu-1.37% (Av.) were established. (Measured 6.47 million tonnes Cu-1.10%; Indicated 8.06 million tonnes Cu-1.46%; Inferred 42.44 million tonnes Cu-1.39%.)

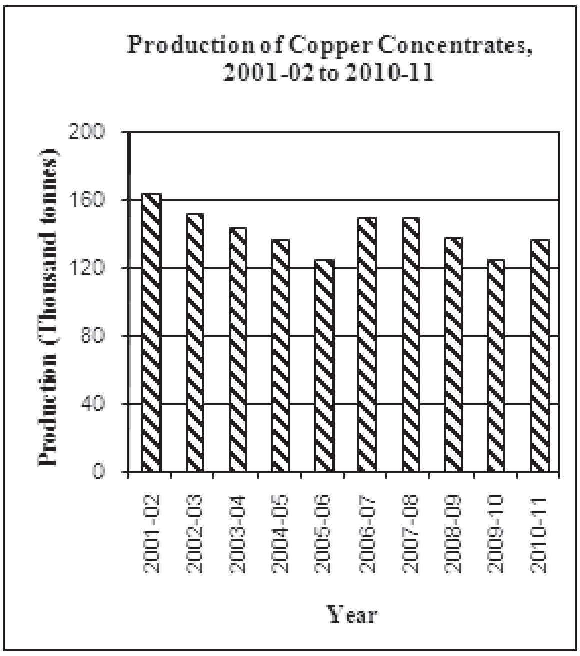
PRODUCTION & PRICES

Copper Ore and Concentrates

The production of copper ore at 3.62 million tonnes in 2010-11 increased by 11% as compared to that in the previous year.

The metal content in the ore produced in 2010-11 works out to 35,477 tonnes as against 30,748 tonnes in 2009-10. During the year under review, 3.61 million tonnes of ore was treated for obtaining copper concentrates as against 3.29 million tonnes in 2009-10.

Production of copper concentrates at 136,856 tonnes in 2010-11 increased by about 10% as compared to that in the previous year. Madhya Pradesh was the leading producer of copper concentrates, accounting for about 58% of the production during 2010-11, followed by Rajasthan with 33% and Jharkhand with 9% production. The number of reporting mines was 4 in both the years (Tables - 3 to 7).



Grade Analysis

Copper content in the ore produced during 2010-11 was 0.98% Cu as against 0.94% in the previous year 2009-10. All India average metal content of ore treated in 2010-11 works out to 0.97% Cu as against 0.94% in the preceding year. The copper content in the ore treated varied from state to state. It was 0.93% Cu in Rajasthan, 1.00% Cu in Madhya Pradesh and 0.88% Cu in Jharkhand. The average metal content in the concentrate produced works out to 23.16% Cu in 2010-11 as against 22.87% Cu in the previous year. The grade of copper concentrate produced in Madhya Pradesh in 2010-11 was 25.91% Cu while that of Jharkhand was 25.02% Cu and Rajasthan 17.85 % Cu (Tables - 4 to 7).

The average daily employment of labour in copper mines in 2010-11 was 3,471 as against 2,611 in the preceding year.

Copper Metal

Hindustan Copper Ltd produces copper metal from the ore and concentrates produced from their captive mines and plants as well as from imported concentrates. Sterlite Industries (India) Ltd and Hindalco Industries Ltd produce copper metal from imported copper concentrates.Copper metal producers are indicated in Table-8.

The production of copper blister decreased by 20% and copper continuous cast wire rods (CCWR) registered a decrease of 7% in 2010-11. Similarly in the production of copper cathodes a marginal decrease of 4% was recorded during the year, 2010-11. Production of copper electrolytic wire bars was not reported during last five years (Tables -9 to 12).

Prices of copper are furnished in the General Review on 'Prices'.

Table – 3 : Principal Producer of Copper Concentrates, 2010-11

Name and address of the producer	Location of mine	
	State	District
M/s Hindustan Copper Ltd, Tamra Bhavan, 1, Ashutosh Chowdhury Avenue, Post Box No. 10224, Kolkata – 700 019.	Madhya Pradesh	Balaghat
	Rajasthan	Jhunjhunu
	Jharkhand	Singhbhum (East)

Table – 4 : Production of Copper Ore, 2009-10 and 2010-11 (By States)

(In tonnes)

State	2009-10			2010-11(P)		
	Ore produced	Cu%	Metal content	Ore produced	Cu%	Metal content
India	**3271169**	**0.94**	**30748**	**3615038**	**0.98**	**35477**
Jharkhand	387843	0.88	3413	396841	0.88	3488
Madhya Pradesh	1975938	0.95	18752	2246597	1.01	22617
Rajasthan	907388	0.95	8583	971600	0.96	9372

Table – 5 : Copper Ore Treated, 2009-10 and 2010-11 (By States)

(In tonnes)

State	2009-10			2010-11(P)		
	Ore treated	Cu%	Metal content	Ore treated	Cu%	Metal content
India	**3289451**	**0.94**	**30970**	**3606873**	**0.97**	**35003**
Jharkhand	382939	0.87	3332	391161	0.88	3437
Madhya Pradesh	1962745	0.95	18587	2249831	1.00	22572
Rajasthan	943767	0.96	9051	965881	0.93	8994

Table – 6 : Production of Copper Concentrates 2008-09 to 2010-11

(By States)

(Quantity in tonnes; value in ₹'000)

State	2008-09		2009-10		2010-11(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**137514**	**4091113**	**124577**	**3809462**	**136856**	**5469271**
Jharkhand	11415	338694	13080	402092	12904	428308
Madhya Pradesh	57575	1802506	64913	1926362	78779	2499132
Rajasthan	68524	1949913	46584	1481008	45173	2541831

Table – 7 : Production of Copper Concentrates, 2009-10 and 2010-11 (By Sector/States/Districts)

(Quantity in tonnes; value in ₹ '000)

State/District	2009-10				2010-11(P)			
	No. of mines	Quantity	Cu %	Value	No. of mines	Quantity	Cu %	Value
India/Public sector	**4**	**124577**	**22.87**	**3809462**	**4**	**136856**	**23.16**	**5469217**
Jharkhand/ Singhbhum (East)	1	13080	26.03	402092	1	12904	25.02	428308
Madhya Pradesh/ Balaghat	1	64913	26.35	1926362	1	78779	25.91	2499132
Rajasthan/ Jhunjhunu	2	46584	17.16	1481008	1	45173	17.85	2541831

Table – 8 : Producers of Copper, 2010-11

Name and address of the producer	Location: State	Location: District
M/s Hindustan Copper Ltd, Tamra Bhavan, 1, Ashutosh Chowdhury Avenue, Post Box No. 10224, Kolkata – 700 019.	Rajasthan Maharashtra Jharkhand	Jhunjhunu Raigad Singhbhum (East)
M/s Hindalco Industries Ltd, Century Bhawan, Dr. Annie Besant Road, Mumbai – 400 025, Maharashtra.	Gujarat	Bharuch
M/s Sterlite Industries (India) Ltd. Copper Division, 1/1/2,Chinchpada, Silvassa-396 830, Dadra & Nagar Haveli (U.T.)	Tamil Nadu Dadra & Nagar Haveli (U.T.)	Thoothukudi Chinchpada (Silvassa)
Jhagadia Copper Ltd,* 747, GIDC Industrial Estate, Post Box No. 14, P.O. Jhagadia – 393 110, Dist. Bharuch, Gujarat.	Gujarat	Bharuch

* *Production of copper from secondary route.*

Table – 9 : Production of Copper, 2008-09 to 2010-11

(In tonnes)

Year	Copper blister	Copper cathodes	Copper electrolytic wire bars	Copper CCWR*
2008-09	29472	513640	-	314425
2009-10	17864	532865	-	312447
2010-11(P)	14245	512124	-	290734

** CCWR - Continuous Cast Wire Rods.*

Table – 10 : Production of Copper (Blister), 2009-10 and 2010-11 (By States/Plant)

(Quantity in tonnes)

State	Plant	2009-10		2010-11	
		Quantity	Value	Quantity	Value
India		**17864**	**–**	**14245**	**-**
Jharkhand	Surda ICC	17864	–	14245	-

Table – 11 : Production of Copper (CCWR), 2009-10 and 2010-11
(By States/Plants)

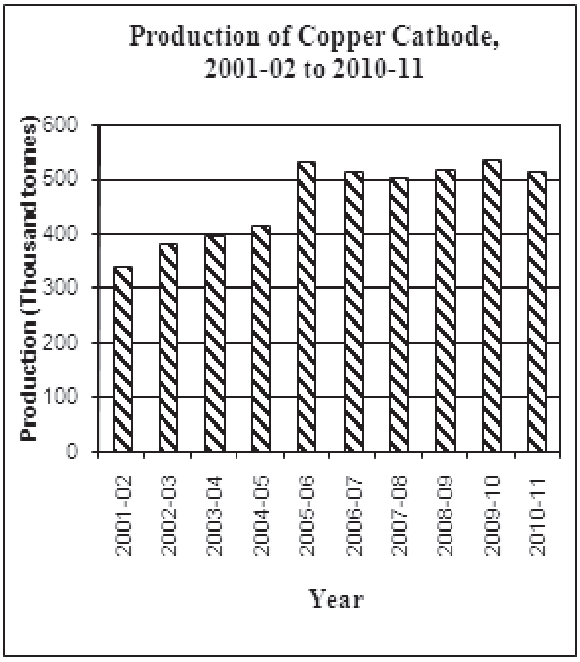
(Quantity in tonnes; value in ₹ '000)

State	Plant	2009-10		2010-11	
		Quantity	Value	Quantity	Value
India		**312447**	**100987199**	**290734**	**113580892**
Gujarat	Hindalco	129457	44413400	143529	57223062
Maharashtra	HCL Taloja	41999	14864500	13321	6310100
Tamil Nadu	Sterlite	140991	41709299	133884	50047730

Table – 12 : Production of Copper (Cathodes), 2009-10 and 2010-11
(By States/Plants)

(Quantity in tonnes; value in ₹ '000)

State	Plant	2009-10		2010-11	
		Quantity	Value	Quantity	Value
India		**532865**	**158204331**	**512124**	**190516536**
Gujarat		336854	100368562	335762	124964580
	Hindalco	333360	99533194	335762	124964580
	Jhagadia (SWIL)	3494	835368	-	-
Jharkhand	Surda ICC	15868	5035362	13653	5078385
Tamil Nadu	Sterlite	180143	52800407	162709	60473571



MINING & MILLING

HCL, a Public Sector Enterprise of Government of India has integrated operations encompassing mining, beneficiation, smelting, refining & casting of refined copper metal and also recovery of by-products. It operates the Indian Copper Complex (ICC) in Jharkhand, the Khetri Copper Complex (KCC) in Rajasthan, Malanjkhand Copper Project (MCP) at Malanjkhand in Balaghat district, Madhya Pradesh and Taloja Copper Project (TCP) in Maharashtra. Copper ore is being treated by froth flotation process to produce more than 16% copper in concentrate. The concentrate is then smelted by flash-smelting technique of Outokumpu of Finland at Khetri to produce 99.9% copper.

Hindustan Copper Ltd

Mining methods adopted in Khetri and Kolihan underground mines of HCL are sub-level open stoping and blasthole stoping. In sub-level open stoping, sub-levels are developed at vertical intervals of 18 to 20 m and a crown level is developed 9 m below upper main level. Width of the stope across the ore body is governed by its thickness. Stope drilling is done by 57 mm dia. BBC 120F drifter machine. A slot raise is prepared within the stope limit connecting crown level to extraction level. Slot raise is then widened to full width of the stope. Stope rings are blasted using the free face of the slot. When blasting of stope rings is completed, stope pillar rings are blasted. After completion of the stope and pillar rings, rib and crown pillars are blasted at a time. After recovery of rib pillar and crown pillar ore, the sill pillar is blasted from hanging wall to foot wall. HCL has also developed post-pillar method of mining for adoption in flatly dipping wide ore bodies. This has resulted in higher production rates compared to room and pillar stopes.

Another mining method is Blast hole stoping method, wherein, a drill level is prepared between two main levels leaving a crown pillar of 9 to 15 m. Slot raise, slot, stope and rib pillar are drilled by Cubex 165 mm dia. machine. Trough, sill and crown pillar drilling are done by BBC120F drifter machine. Sequence of blasting remains the same as in the sub-level open stoping method. The advantages of this method is excellent fragmentation and overall reduction in the cost of mining. Trackless mining development has helped in rapid development of mines enabling higher levels of production comparable to international standards.

HCL has a total of 3.8 million tpy ore capacity, that includes 1.4 million tpy at KCC, (includes production capacity of Khetri, Kolihan, and Banwas mines which is under development) 2.0 million tpy at MCP and 0.4 million tpy at ICC.The company operates concentrator plants in Khetri, Rajasthan with a capacity of 2.02 million tpy, Ghatsila, Jharkhand with 1.55 million tpy capacity and Malanjkhand, Madhya Pradesh with 2.0 million tpy capacity.

Khetri Copper Complex (KCC), Khetrinagar, Jhunjhunu District, Rajasthan

KCC has two projects under the complex at Khetri, Kolihan in Jhunjhunu district which presently are in operation. It operates two underground mines namely, Khetri and Kolihan with combined capacity of one million tpy. The proposed expansion of Khetri & Kolihan mines and development of Banwas deposit will increase ore production from 1.0 million tonne to 3.1 million tonnes per annum. Work for mine construction & development on Banwas mine has started in May 2010. The work is expected to complete by 2014.

KCC has also a concentrator plant having a capacity of 2.02 million tonnes per year and a smelter with capacity of 31 thousand tonnes per year at Khetri in Jhunjhunu district, Rajasthan. It has facilities to recover gold, silver, nickel and sulphuric acid. KCC smelter has been shutdown due to economic consideration since December, 2008.

However, HCL is contemplating suspension of operation at Precious Metal Recovery (PMR) plant, as export of anode slimes containing gold and silver directly is found to be economically advantageous.

Indian Copper Complex (ICC), Ghatsila, East Singhbhum District, Jharkhand

All mines at Indian Copper Complex (ICC), Jharkhand were earlier closed on economic considerations. Out of the closed mines at ICC, company has since re-opened the mine at Surda in association with an Australian Mining Company, viz. M/s Monarch Gold Co. Ltd/IRL. The mine has started production of copper ore and its beneficiation into copper concentrate from January, 2008. The plan envisages increase in the depth of the mine and enhancement of production capacity from 0.4 million tonne per annum to 0.9 million tonne per annum. Company has also initiated action to reopen closed mines at Singbhum Copper Belt of ICC namely, Rakha and Kendadih mines to produce 1.5 million tonnes and 0.21 million tonne of ore per annum respectively. It is proposed to develop an underground mine at Chapri-Sideshwar to produce 1.5 million tonnes of ore per annum at an estimated capital expenditure of Rs 468 crore. Detailed project report for development of Chapri-Sideshwar mine has been prepared and Board has approved the proposal.

Malanjkhand Copper Project (MCP), Malanjkhand, Balaghat District, Madhya Pradesh

MCP has the largest hard rock open-pit mechanised mine in the country at Malanjkhand, Balaghat district, Madhya Pradesh, having an annual capacity to produce 2 million tonnes ore with a matching concentrator plant. It is the single largest copper deposit in the country contributing 80% to the HCL's total copper ore production. Prominent deposits in MCP are Malanjkhand, Shitalpani, Gidhri Dhorli, Jatta and Garhi Dongri. The concentrates produced by this plant are sent to KCC and ICC for smelting. It is proposed to expand the production of Malanjkhand mine from 2 million tonne to 5 million tonne per annum by developing an underground mine below the existing open cast mine.

Green Field Exploration

The Company has applied 20 fresh prospecting, mining and reconnaissance permit (RP) in the State of Rajasthan, Jharkhand and Madhya Pradesh. The status of the fresh lease applications is given below:

i) Prospecting Licence (PL) has been applied for the two areas at Baniwali-ki Dhani in Sikar district of Rajasthan for an area of 36.07 sq km and another for 8.65 sq km. Government of Rajasthan has granted an area of 36.07 sq km in favour of HCL. PLis yet to be executed.

ii) Mining Lease application has been submitted for Dhobani Pathargora Intervening Block and has already been scrutinised at the district level.

iii) RP in the district of Balaghat is in the process of finalisation by the Government of Madhya Pradesh.

iv) The other areas applied for Mining Lease are in the state of Jharkhand at Dhatkidli Trildih Block in the adjoining district of Saraikala and Nandup-Talsa Block.

In addition, M/s. Sterlite Industries has been making attempts to have copper exploration/mining activities started within the country; however, it has not yet been able to start any mining activity in India.

INDUSTRY

HCL, a public sector company, and now a Miniratna (Category 1) company, was the only producer of primary refined copper till 1997. The metal capacity of its two integrated smelters was around 51,500 tpy. However, the annual installed capacity of cathode production is 49,500 tonnes for cathode production. The other two producers of primary copper from imported concentrates are M/s Hindalco Industries Ltd and Sterlite Industries of Vedanta Group, having annual capacities of 500,000 tonnes and 400,000 tonnes of refined copper, respectively. Jhagadia Copper Ltd (formerly SWIL Ltd) with 50,000 tpy capacity of copper cathodes and additional capacity of 20 thousand tpy of copper anode is a producer of copper through secondary route. Besides, continuous cast wire rod plants are operated by HCL, Sterlite and Hindalco. In addition, M/s TDT presently Alchemist Metals Ltd, Rewari, Haryana and M/s Finolex also have continuous cast wire rod plants based on imported copper. Details regarding smelter capacity and production of copper cathode are given in Table - 13.

Table – 13 : Capacity and Production of Copper Smelters

(In '000 tonnes)

Smelter/Location	Annual Capacity	Production*	
		2009-10	2000-11(P)
TOTAL	**1001.5**	**532.86**	**512.12**
1. Hindustan Copper Ltd**	51.5	15.87	13.65
i) Khetri Copper Complex,** Dist. Jhunjhunu, Rajasthan.	31	Nil	Nil
ii) Indian Copper** Complex, Ghatsila, Dist. East Singhbhum, Jharkhand.	20.5	15.87	13.65
2. Sterlite Industries (India) Ltd, Thoothukudi, Tamil Nadu.	400	180.14	162.71
3. Hindalco Industries Ltd, Dahej, Dist. Bharuch, Gujarat.	500	333.36	335.76
4. Jhagadia Copper Ltd, (Formerly SWIL Ltd), Dist. Bharuch, Gujarat.	50	3.49	Nil

** Copper cathodes.*
*** Metal capacity. However, the cathode capacity of HCL is 49,500 tonnes;(KCC: 31000 tonnes and ICC : 18,500 tonnes).*

Public Sector Plants

Hindustan Copper Ltd

i) *Khetri Copper Complex (KCC)*

This smelter with a capacity of 31,000 tpy is located at Khetri in Jhunjhunu district, Rajasthan. KCC smelter has been shutdown due to economic consideration since December, 2008. Khetri facility requires more than 3.3 million tonnes of ore for processing. As against this, in-house ore production at Khetri is about 1 million tonnes, for running the plant to full capacity, concentrate has to be transported partly from Malanjkhand and the balance from other geogrphies. Both the methods are not financially viable. Import of concentrate is not viable due to low Treatment charge/Refining charge (Tc/Rc) charges. The Company on a dynamic basis will take into account the Tc/Rc in the international market and captive production of ore at Khetri and availability of water before taking a final decision on its re-opening.

ii) *Indian Copper Complex (ICC)*

A 20,500-tpy of metal capacity (18,500 tonnes cathode capacity) smelter is located at Ghatsila, East Singhbhum district, Jharkhand. In addition, the Complex consists of 8,400-tpy wire bar casting plant, 54,000-tpy sulphuric acid plant and a brass rolling mill. There is also a precious metal recovery plant for recovery of gold, silver, selenium, tellurium, nickel sulphate, copper sulphate, etc. A pilot plant with a capacity to produce one tonne nickel cathodes per month was also set up at ICC. The plant is currently being scaled up to a production capacity of 5 tonnes per month of nickel cathodes.

iii) *Taloja Copper Project(TCP)*

The plant with a capacity of 60,000 tpy continuous cast wire rods (CCWR) is located at Taloja in Maharashtra was commissioned in December,1989. The Wire rod unit produces continuous cast wire rod of size 8mm, 11mm, 12.5 mm, 16 mm and 19 mm, based on Southwire (SCR-2000) technology, USA. Excess plant capacity to the extent of about 40,000 tonnes is lying idle at TCP for want of input cathodes. In order to utilise its surplus capacity and thereby reduce its overall cost, TCP undertakes job work for tolling of cathodes for other organisations. Long term strategy for the plant should involve manufacturing of value added products and job order which would be key to its survival and viability.

Private Sector Plants

The status of private sector smelter plants is as follows:

i) Sterlite Industries (India) Ltd

The Sterlite Industries (India) Ltd having an installed smelter capacity of 400,000 tpy copper anodes is located at Thoothukudi in coastal Tamil Nadu. It is based on 'Isasmelt' technology using imported concentrates. A new cathode refinery of 205,000 tpy and 90,000 tpy rod plant have also been built at Thoothukudi for exports from nearby ports. The company has set up a copper refinery of 195,000 tpy copper cathodes capacity and 150,000 tpy rod mill at Chinchpada, Silvassa in the Union Territory of Dadra & Nagar Haveli. Anode from Thoothukudi are refined at Silvassa for domestic market. Besides copper, the company also manufactures sulphuric acid, phosphoric acid, gold and silver as by-products.

ii) Hindalco Industries Ltd (Birla Copper)

The company's smelter located at Dahej, Bharuch district, Gujarat, has a capacity of 500,000 tpy. The smelter is based on Outokumpu technology. A part of cathodes production is used for producing continuous cast wire rods. In the process of extraction of copper metal, sulphuric acid, phosphoric acid, gold and silver are recovered as by-products. The entire requirement of copper concentrates was met through imports from Australia, Indonesia, Papua New Guinea, Chile, Argentina and Canada.

iii) Jhagadia Copper Ltd (formerly SWIL Ltd)

SWIL Ltd has been renamed Jhagadia Copper Ltd w.e.f. 5-1-2006 and its smelter has been installed at Jhagadia in Bharuch district of Gujarat.The plant has been set up in technical collaboration with Boliden Contech AB of Sweden. This scrap-based electrolytic smelter for production of cathodes has a capacity of50,000 tonnes per year along with additional 20,000 tpy capacity for production of copper anodes. The plant has stopped production temporarily from August 2009.

iv) Metdist

This Company was in the process of setting up a smelter with a capacity of 150,000 tpy copper cathodes at Rampara-Rajula in Amreli district, Gujarat, in technological collaboration with Mitsubishi, Japan. The project has been withheld.

RECYCLING OF COPPER

The recycling of copper scrap is gaining importance worldwide simply because of the fact that the recovery of copper metal from scrap requires much less energy than the recovery from primary source and secondly it saves the natural resources. In India, maximum amount of scrap is recycled through direct melt route. While some of the industries do take adequate measures in scrap processing, some simply melt the scrap. Direct melting has serious environment implications. Also, the quality of metal produced in such melting shops can be inferior and may create safety hazards as well as inefficient use of electricity for the user industries. Overall, thus, India lacks organised set up for recycling including collection and processing of scrap.

As per ICSG (International Copper Study Group) the recovery of secondary copper in the entire world was 3.25 million tonnes in 2010 as compared to 2.84 million tonnes in the previous year.

As per Central Pollution Control Board as on 13.5.2010, there were 35 units operating in different states with a combined capacity of 2,42,321 tpy for handling different types of scrap and 132 units with combined capacity of 5,17,515 tpy which recover copper along with other metals. As per the estimates made in the recently published Market Survey on Copper by IBM, production of 1,06,573 tonnes of secondary copper, all in organised sector is estimated in the country.

CONSUMPTION & USES

The per capita consumption of copper in India is currently at 0.5 kg per annum as compared to China's per capita consumption of 4.6 kg per annum and to that of 10 kg of developed nations and 2.4 kg in the entire world. India's per capitia consumption is likely to be moderate and has many strides to cover so as to match that of China. As per one forecast, the per capita consumption of copper in India will be 3 kg in 2025. Electrical/Electronic Industry is by far the largest consumer of copper, where it is used in the form of cables, winding wires as it is the best non-precious metal conductor of electricity and is safe for electrical distribution system from high voltage transmission cables to micro-circuits. Copper also has relatively high creep strength as compared to other commonly used materials. In Electronic Industry, semi-conductor manufacturers have launched a revolutionary 'copper chip'. By using copper for circuitry in silicon chips, microprocessors are able to operate at higher speeds, using less energy. Copper heat sinks help to remove heat from transistors and enable computer processors operate at peak efficiency. Copper is used in construction industry as plumbing, taps, valves and fittings components. In transportation industry copper is used in various components. According to an estimate by ICSG most cars contain an average of 20 kg copper and luxury & hybrid vehicles contain about 45 kg copper. Copper is extensively used in industrial machinery and equipment. It is used in a number of consumer products, such as, coinage, utensils, fixtures, etc. Large quantities of copper are consumed in making copper-based alloys, such as, brass and bronze.

SUBSTITUTES

Copper is vulnerable for substitution on grounds of price, technical superiority or weight. Aluminium is used as substitute for copper in various products, such as, electrical power cables, electrical equipment, automobile radiators and cooling/ refrigeration tubing. Optical fibre has substituted copper in some telecommunication applications. Plastics too is used as substitute for copper in water pipe, plumbing, fixtures and many structural applications.

WORLD REVIEW

The world reserves of copper metal are assessed at 690 million tonnes of copper content. Chile has the largest share, accounting for about 28% of world reserves, followed by Peru (13%), Australia (12%), Mexico & USA (5% each), China and Indonesia (4% each) (Table-14).

The world mine production of contained copper was 16.2 million tonnes in 2010, as against 15.9 million tonnes in 2009. Chile continued to be the largest producer of copper in 2010 with 33% share followed by Peru (8%), China & USA (7% each) and Indonesia (5%) (Table-15).

As per the estimate of ICSG, the share of electrical and telecommunication industry in total consumption is 56%, followed by Transport (8%), consumer durables (7%), Building and Construction (7%), General Engineering goods (6%) and other industries including Process Industries (16%).

Although major commodity derivatives markets are located in the western region, global market takes cues and price direction from the trend in demand - supply from Asia.

Table – 14 : World Reserves of Copper (By Principal Countries)

(In '000 tonnes of copper content)

Country	Reserves
World: Total (rounded)	**690000**
Australia	86000
Canada	7000
Chile	190000
China	30000
Congo (Kinshasa)	20000
Indonesia	28000
Kazakhstan	7000
Mexico	38000
Peru	90000
Poland	26000
Russia	30000
USA	35000
Zambia	20000
Other countries	80000

Source : *Mineral Commodity Summaries, 2012.*

Table – 15 : World Mine Production of Copper (By Principal Countries)

(In '000 tonnes of metal content)

Country	2008	2009	2010
World: Total	**15600**	**15900**	**16200**
Australia	886	856	870
Canada	608	494	525
Chile	5328	5394	5419
China	1093	1062	1191
Indonesia	655	988	878
Kazakhstan	422	406	381
Mexico	246	241	270
Peru	1268	1276	1247
Poland	430	439	426
Russia	705	676	703
USA	1308	1204	1129
Zambia	600	698	819
Other countries	2051	2166	2342

Source: *World Mineral Production, 2006-2010.*

Australia

OZ Minerals Ltd (Melbourne, Australia) began production at its Prominent Hill Mine. It is expected to produce 110,000 tpy of copper in concentrate for at least 4 years.

Chile

Escondida is the world's largest copper mine. Codelco (Corporacion Nacional del cobre de Chile) regained its position as leading global mine producer of copper. Expansion of the Al Norte (Xstrata) and Codelco Norte Smelters was completed.

China

China is the largest cosumer of copper in the world. In terms of production as well, it accounts about 22% of world's capacity which includes mine, refinery and smelting operations.

Expansion of the Guixi (Jiangxi Copper Corp.) Jinchuan (Jinchuan Nonferrous Metals Group) and Tongling II (Tongling Nonferrous Metal Corp.) smelters were completed. The greenfield Baiyin Electrolytic Refinery (Baiyin Nonferrous Metals) was constructed to match existing smelter capacity of 100,000 tpy. Its projected capacity of 300,000 tpy was expected to exceed the proposed expansion of Baiyin smelter to 200,000 tpy.

Congo (Kinshasa)

Capacity continued to increase at several mines that began production in 2007, including 15,000 tpy of additional concentrate production capacity at the Frontier Mine (First Quantum Minerals Ltd, Vancouver); 30,000 tpy of additional electrowon capacity at the Kamoto Mine (Katanga Mining Ltd, Baar, Switzerland); 60,000 tpy of additional electrowon capacity at the Luita Mine (Central African Mining and Exploration Co., London); and16,000 tpy of additional electrowon capacity at the Ruashi II Mine (Metorex Ltd, Johannesburg, South Africa). The Tenke Fungarume Mine (57.75% owned by FCX), which along with Prominent Hill were the only significant greenfield start-ups in 2009, began production in March 2009 and was expected to reach full capacity of 115,000 tpy in 2010.

USA

In the United States, mine and refinery production continued to decline in 2010 owing to mine cutbacks instituted at year end 2008 and lower ore grades. The White Pine electrolytic refinery in Michigan that treated imported anode closed in August. U.S. copper mine production was expected to rise by more than 100,000 tonnes in 2011 owing to expansion and restoration of cutbacks. Domestic consumption of refined copper rose by about 5% in 2010 but remained below the 2008 level.

Zambia

The Kansanshi Mine (First Quantum Minerals) increased concentrate and electrowon capacities by 15,000 tpy and 30,000 tpy, respectively; the Lumwana Mine (Equinox Minerals Ltd, Perth, Australia and Toronto) reached capacity of 170,000 tpy following a delayed start-up in 2008.

FOREIGN TRADE

Exports

The export of copper from India is in the forms of copper ore & concentrates, refined copper, copper & alloys, brass & bronzes, scrap, cement copper, mattes and powder & flakes.

Export of copper ores and concentrates decreased sharply to 8,187 tonnes in 2010-11 as against 40,422 tonnes in 2009-10. Exports were almost entirely to Belgium (98%). Export of refined copper increased sharply to 781,743 tonnes in 2010-11 from 199,842 tonnes registered in 2009-10. China was the largest importer of copper from India with a share of 75% followed by UAE (12%) Saudi Arabia and Thailand (4% each). (Tables-16 to 23).

Imports

The imports of copper in the country are in the form of copper ore and concentrates, refined copper, copper & alloys, brass & bronzes, scrap, cement copper, mattes, blister, worked (bars, rods & plates), etc.

During the year 2010-11, imports of copper ores and concentrates were slightly lower at 1,902,026 tonnes as compared to 2,187,460 tonnes in 2009-10. Chile with a share of 31% was the leading supplier followed by Australia (24%), Indonesia (11%) and Iran & Brazil (9% each). Imports of refined copper decreased in 2010-11 at 8,055 tonnes as against 11,543 tonnes in 2009-10. Sri Lanka with 14% share was the major supplier. UK, Australia and Malaysia contributed 9% each followed by Ukraine (7%). (Tables - 24 to 33).

Table – 16 : Exports of Copper Ores & Conc. (U) (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**40422**	**286841**	**8187**	**370999**
Belgium	39823	284473	8018	364008
China	-	-	112	4885
UAE	-	-	50	2024
Sri Lanka	-	-	7	72
U K	++	2	++	8
Netherlands	-	-	++	2
Other countries	599	2366	-	-

(U): Under reference

Table – 17 : Exports of Refined Copper (U) (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**199842**	**58344444**	**781743**	**317110308**
China	81423	24439613	586071	238687401
UAE	31001	8562253	95161	37050873
Saudi Arabia	30827	8338611	32065	13859617
Thailand	13374	4135693	29011	11237219
Singapore	13648	4094319	12394	5397780
Malaysia	10681	3105342	8069	3159209
Oman	2699	809073	6360	2407641
Chinese Taipei/ Taiwan	7645	2337032	4593	1761763
Egypt	494	154594	2880	1640452
Vietnam	2100	653975	883	381807
Other countries	5950	1713939	4256	1526546

(U): Under reference

Table – 18 : Exports of Copper & Alloys (Including Brass & Bronze) : Total (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**303749**	**85146161**	**973501**	**367165694**
China	86235	25655923	587044	239206282
UAE	38151	10496958	100044	38956442
Saudi Arabia	44364	12332442	48594	20761184
Malaysia	14673	4327009	34806	14400368
Thailand	16066	4960879	35923	13672789
Singapore	17109	5099655	15806	6769989
Hong Kong	7269	1999219	88889	3443241
Sri Lanka	6693	1969967	8411	3217561
Belgium	416	111986	60514	3130820
USA	6960	1811266	8352	2753734
Other - countries	65813	16380857	65118	20853284

Table – 19 : Exports of Copper (Scrap) (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**2250**	**530500**	**3169**	**1153590**
Germany	568	158598	1920	684148
Korea, Rep. of	98	24880	577	229120
Spain	194	42624	240	81602
Japan	167	46123	160	71767
Philippines	81	16894	89	30063
Latvia	-	-	40	15234
China	759	144980	39	11038
Portugal	150	42383	21	6110
Mongolia	-	-	19	5505
Malaysia	-	-	17	4999
Other countries	233	54018	47	14004

Table – 20 : Exports of Copper & Alloys (U) (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**274690**	**77997519**	**942931**	**357585954**
China	84613	25308381	586651	239089589
Saudi Arabia	43133	11975879	47432	20378425
UAE	36054	9941965	98363	38386815
Singapore	16944	5054187	15669	6721269
Thailand	15649	4847354	35561	13572572
Malaysia	13900	4123724	33939	14158967
Chinese Taipei/ Taiwan	7729	2361791	4694	1798143
Hong Kong	6988	1922482	8577	3370675
Sri Lanka	6242	1874070	7922	3064379
Oman	5482	1607515	6822	2599995
Other countries	37956	8980171	97301	14445125

(U): Under reference

Table – 21 : Exports of Brass & Bronze (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**26565**	**6571018**	**27158**	**8387685**
Australia	1185	325773	1272	428044
Canada	2367	381343	1812	408001
Germany	1718	388201	1870	474534
Italy	643	168805	528	223470
Malaysia	773	203194	850	236404
Pakistan	771	201470	767	225643
Saudi Arabia	1202	352422	1138	379076
UAE	1908	518528	1656	564350
UK	1436	310507	1568	523502
USA	3818	991791	4306	1253316
Other countries	10744	2728984	11391	3671345

Table – 22 : Exports of Brass & Bronze (Scrap) (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹'000)
All Countries	**225**	**44365**	**224**	**33494**
Hong Kong	-	-	131	15822
Netherlands	-	-	25	6148
Saudi Arabia	14	456	24	3025
UAE	118	17156	9	2471
Belgium	2	1078	3	1071
USA	1	686	5	1070
Congo, People's Rep. of	-	-	2	979
China	-	-	22	745
Nigeria	-	-	2	532
Germany	84	22174	++	430
Other countries	6	2815	1	1201

Table – 23 : Exports of Copper (Cement Copper Precipitated) (By countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	-	-	1	244
UAE	-	-	1	221
South Africa	-	-	++	22
Other countries	-	-	++	1

Table– 24 : Imports of Copper Ores & Concentrates (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (` '000)
All Countries	**2187460**	**189675846**	**1902026**	**200234533**
Chile	610144	44296728	598173	58573179
Australia	444228	40938529	448977	49366539
Indonesia	452962	50593706	209671	24924438
Brazil	135097	8924781	165370	17475191
Iran	166711	12722250	170811	17367656
Papua New Guinea	20865	1994888	52995	7262161
South Africa	84606	7079730	81304	7180174
Peru	61288	5009399	50669	5629680
Thailand	11056	769271	52051	4639570
Turkey	8650	616946	28691	2340556
Other countries	191853	16729618	43314	5475389

Table – 25 : Imports of Refined Copper (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**11543**	**3363394**	**8055**	**3029044**
Sri Lanka	222	72378	1154	417642
UK	125	31611	741	315381
Australia	2440	711732	748	294024
Malaysia	320	99110	705	266205
Ukraine	707	237763	588	210153
Austria	449	142268	496	189254
Poland	75	18337	354	172250
Nigeria	371	104457	434	144716
Zambia	1370	378336	381	117352
Russia	509	130093	268	110176
Other countries	4955	1437309	2186	791891

Table – 26: Imports of Copper & Alloys (Including Brass & Bronze) : Total (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**205591**	**55366184**	**260108**	**85717042**
UAE	23534	6331168	34663	11964422
China	15264	4677683	26645	8968545
Germany	16869	5309779	19274	6896949
Malaysia	12799	3875761	16588	6234667
Australia	12472	3545532	14401	5311554
UK	13107	2893711	15003	3837570
Russia	12296	3260592	10185	3730805
Korea, Rep. of	9400	3054776	9015	3385628
Saudi Arabia	6645	1480598	9986	2893325
USA	6160	1537774	8450	2661522
Other countries	77045	19398810	95898	29832055

Table –27 : Imports of Copper & Alloys (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**110169**	**34138378**	**140163**	**51176534**
China	13355	4118809	22978	7805893
UAE	9837	3085575	16515	6079289
Australia	11681	3378800	13848	5149691
Malaysia	10393	3310816	12768	5135827
Russia	12136	32288848	9968	3651935
Korea, Rep. of	8896	2898590	8604	3266018
Germany	7224	2766561	6985	3191870
Thailand	3883	1274992	4281	1938612
Chile	743	215807	4069	1610922
Bhutan	5384	1133491	5610	1508543
Other countries	26637	8726089	34537	11837934

Table – 28 : Imports of Copper (Scrap) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**24214**	**6407313**	**39651**	**14423261**
UAE	8063	2258013	11887	4443835
Saudi Arabia	2297	647994	5015	1797102
Germany	256	62529	2149	795111
Benin	157	29982	1784	668947
Kuwait	573	153711	1600	602069
UK	1607	482539	1593	573246
Bahrain	1100	3137661	1471	56948
France	265	65590	1340	547738
Malaysia	1056	284650	1471	490058
Romania	376	77822	1200	449045
Other countries	8464	2030817	10141	3486629

Table – 29 : Imports of Copper & Alloys (Scrap) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**27**	**3879**	**-**	**-**
Egypt, A Rep.	27	3879	-	-

Table – 30 : Imports of Brass & Bronze (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**14626**	**4570432**	**16714**	**6022873**
Germany	3913	1481697	3596	1510720
China	1854	554229	3302	1085744
Nepal	2179	569960	1682	620440
Japan	728	280360	849	396741
Malaysia	355	104635	1117	329020
USA	629	171054	935	324290
Chinese Taipei/Taiwan	1030	251511	1076	295736
Canada	546	196103	316	137676
Italy	155	74302	251	129622
UAE	434	85427	347	126308
Other countries	2803	801154	3243	1066576

Table – 31 : Imports of Brass & Bronze (Scrap) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**56555**	**10246182**	**63580**	**14094374**
UK	10564	2077139	11899	2572150
Germany	5476	998993	6544	1399249
UAE	5200	902154	5914	1314990
Saudi Arabia	3931	733154	4879	1072130
USA	3165	559575	3452	833606
Netherlands	2074	405972	2854	631304
Bangladesh	2702	499860	2211	565330
Denmark	1917	334682	1818	395015
Spain	1599	304563	1418	317836
Sweden	2043	337903	1362	300106
Other countries	17884	3092187	21229	4692658

Table – 32 : Imports of Copper (Cement Copper Precipitated) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**2177**	**212716**	**147**	**21437**
Congo, People's Rep. of	++	++	73	11681
Korea, Rep. of	++	++	26	5042
Unspecified	39	6459	48	4714
Other countries	2138	206257	-	-

Table – 33 : Imports of Copper & Alloys (Excluding Brass & Bronze and Scrap) (By Items)

Item	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Items	**110169**	**34138378**	**140163**	**51176534**
Blister & other unrefined copper	2252	490305	2034	768599
Copper & alloys: worked (bars, rods, plates, etc.)	35997	11782162	42580	16678942
Copper & alloys: worked, NES	3348	1464731	12054	3216671
Copper & alloys: unwrought	1394	388302	1791	695372
Copper matte	294	35721	30	12937
Copper powder & flakes	476	287805	697	425771
Copper refined: copper worked	53820	15997048	69630	25065630
Electroplated anode of nickel	443	142068	3310	1229305
Master alloys of copper	602	186842	82	54263
Refined copper	11543	3363394	8055	3029044

FUTURE OUTLOOK

India's refined copper consumption has increased at 10% per annum over the last four years. The demand of copper by 2015-16 is estimated at 1,227 thousand tonnes at 8% GDP growth rate against a projected production of 1,347 thousand tonnes of refined copper during the same period.

As per the feedback from the end user industries, high growth in copper demand is likely to be from sectors like Electrical, Transport (auto and railways), Air conditioner and Refrigerator (ACR) Manufacturers and Consumer durable manufacturing sector and the newer potential end use sectors emerging including gas supply, plumbing tube, solar water heater and desalination.

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

CORUNDUM AND SAPPHIRE

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

27 Corundum and Sapphire

Corundum is the crystalline form of aluminium oxide. Its hardness is next to diamond and for this reason, it is used mainly in manufacturing abrasive material and also as a precious stone. In sintered form, it is used in special refractory crucibles. As far as natural corundum production is concerned it is too less to meet the demand all over the world and therefore, synethetic corundum is used widely.

Ruby and sapphire are the transparent gem varieties of corundum. The principal properties of pleasing and uniform colour, ability to take high polish, amenability to cutting and shaping without developing secondary flaws like cracks, etc. and durability make the varieties of corundum gem to near gemstones. Gem corundum other than red is generally called sapphire. Ruby is rose-red carmine or purple, which is often called pigeon's blood-red. True sapphire is blue, the best stone being a velvety cornflower blue called "Kashmir blue". Other colours of sapphire include white, yellow or green, violet and pinks.

RESOURCES

Corundum is found in metamorphosed shales and some unsaturated igneous rocks. It is found in association with kyanite and sillimanite in Assam, Meghalaya and Maharashtra. It occurs in syenites and ultrabasic rocks in Andhra Pradesh. A few outcrops of pegmatites containing corundum occur in Bastar district, Chhattisgarh and Morena district, Madhya Pradesh. Occurrences of sapphire are reported from Katamalkailakat-Baberi-Amera, Bhujipadar and Ghumur-Sargigunda belts in Kalahandi district, Odisha. Ruby is reported from Jillingdhar in Kalahandi district, Odisha. Besides, occurrences are also reported from Bengaluru, Chickmagalur, Hassan, Mysore, Shimoga and Tumkur districts in Karnataka. In Mysore area, bright red ruby crystals were reported to be embedded in a thin layer of white surrounding rock.

Precious and semi-precious varieties of corundum have also been reported from Tamil Nadu in Kangeyam belt stretching over Karur and Kulithalai tehsils in Tiruchirapalli district, and Vedachandur tehsil in Dindigul district.

As per UNFC System as on 1.4.2010, the total resources of corundum were estimated at 740,792 tonnes of which 598 tonnes were placed under reserves category and bulk, i.e., 740,194 tonnes under 'remaining resources' category. The total resources of corundum are located in Karnataka (87%), Andhra Pradesh (10%) and Rajasthan (2%), besides Tamil Nadu and Chhattisgarh. The total resources of industrial grade and semi-precious grade were 710,323 tonnes and 909 tonnes, respectively.

The total resources of ruby were estimated at 5,348 kg of which 236 kg were placed under reserves category and the balance 5,112 kg under 'remaining resources' category. The entire resources are in Odisha. The total resources of sapphire were estimated at 450 kg, all placed under 'remaining resources' category in Jammu & Kashmir (Table - 1).

PRODUCTION, STOCKS AND PRICES

Corundum

No production of corundum was reported during the year 2010-11 as against 6,600 kg reported by a silllimanite mine of Maharashtra State Mining Corporation during the previous year.

Mine-head stocks at the end of the year were 3,490 kg as against 10,490 kg at the beginning of the year.

Ruby

There was no production of ruby in 2009 - 10 as also in 2010-11 due to temporary closure of the sole public sector mine in Odisha.

Table - 1 : Reserves/Resources of Corundum as on 1.4.2010
(By Grades / States)

(In tonnes)

Grade/State	Reserves				Remaining Resources								Total
	Proved	Probable		Total	feasibility	Pre-feasibility		Measured	Indicated	Inferred	Reconnai	Total	Resources
	STD111	STD121	STD122	(A)	STD211	STD221	STD222	STD331	STD332	STD333	STD334	(B)	(A+B)
All India : Total	-	**310**	**288**	**598**	**5824**	**763**	**115167**	**13**	**38**	**92389**	**526000**	**740194**	**740792**
By Grades													
Semi-precious	-	1	-	1	-	12	-	-	1	895		908	909
Industrial	-	309	288	597	-	751	105874	-	28	77073	526000	709726	710323
Others	-	-	-	-	-	-	-	-	-	4	-	4	4
Unclassified	-	-	-	-	-	-	11	13	1	2533	-	2558	2558
Not-known	-	-	-	-	5824		9282	-	8	11883	-	26997	26997
By States													
Andhra Pradesh	-	-	-	-	5824	7	9282	-	-	62007	-	77120	77120
Chhattisgarh	-	310	288	598	- -			-	-	288	-	288	886
Karnataka	-	-	-	-	-	756	105885	13	38	14169	526000	646861	646861
Rajasthan	-	-	-	-	-	-	-	-	-	11925	-	11925	11925
Tamil Nadu	-	-	-	-	-	-	-	-	-	4000	-	4000	4000
RUBY (In kg)													
All India : Total	143	-	93	236	-	-	3165	286	38	1623	-	5112	5348
By Grades													
Unclassified	143	-	93	236	-	-	3165	286	38	1623	-	5112	5348
By States													
Odisha	143	-	93	236	-	-	3165	286	38	1623	-	5112	5348
SAPPHIRE (In kg)													
All India : Total	-	-	-	-	-	-	-	-	-	**450**	**-**	**450**	**450**
By Grades													
Unclassified	-	-	-	-	-	-	-	-	-	450	-	450	450
By States													
Jammu & Kashmir	-	-	-	-	-	-	-	-	-	450	-	450	450

Table – 2 : Principal Producers of Corundum, 2010-11

Name & address of producer	Location of mine	
	State	District
*Maharashtra State Mining Corporation, Udyog Bhawan, Civil Lines, Nagpur - 440 001. Maharashtra	Maharashtra	Bhandara

** Associated with sillimanite.*

Table – 3 : Production of Corundum, 2008-09 to 2010-11 (By States)

(Qty in kg; value in ₹'000)

State	2008-09		2009-10		2010-11(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**21000**	**63**	**6600**	**20**	**-**	**-**
Maharashtra*	21000	63	6600	20	-	-

** Associated with sillimanite.*

Table – 4 : Production of Corundum, 2009-10 and 2010-11 (By Sector/States/Districts)

(Qty in kg; value in ₹'000)

State	2009-10			2010-11 (P)		
	No. of mines	Quanity	Value	No. of mines	Quanity	Value
India	**(1)**	**6600**	**20**	**-**	**-**	**-**
Private sector	(1)	6600	20	–	-	-
Maharashtra	**(1)**	**6600**	**20**	**-**	**-**	**-**
Bhandara	(1)	6600	20	-	-	-

** Figures in parentheses indicate number of associated mine with sillimanite.*

Table – 5 : Mine-head Stocks of Corundum, 2010-11 (P) (By States)

(In kg)

State	At the beginning of the year	At the end of the year
India	**10490**	**3490**
Maharashtra*	10490	3490

** Associated with sillimanite.*

MINING AND MARKETING

The only semi-mechanised mine reporting production of corundum was in Bhandara district, Maharashtra. The semi-precious varieties are recovered along with industrial grades in Bhopalpatnam in Bastar district in Chhattisgarh. After washing, stones are hand-picked and sorted out by visual observation, considering their ability to take polish. Semi-precious stones are sold to Ratnaparishkar Kendra (Khadigram Udyog Parishad) and to other craft centres at Jagdalpur, Chhattisgarh. The industrial variety is supplied to the local units and to the abrasive factory at Hanumana in Rewa district, Madhya Pradesh.

Cutting and polishing of indigenous and imported ruby and sapphire is carried out mainly in Jaipur, Rajasthan.

CONSUMPTION

Corundum is used in abrasives, such as grinding wheels, papers and cloths, mortor and wiredrawing and grinding powder. It is used in special refractories because of its high melting point.

The total reported consumption of corundum in organised sector in 2010-11 was 240 tonnes of which, 100 tonnes was in refractory, 140 tonnes in abrasive industries (Table -6).

Table – 6 : Reported Consumption of Corundum 2008-09 to 2010-11 (By Industries)

(In tonnes)

Industry	2008-09 (R)	2009-10 (R)	2010-11(P)
All Industries	**170**	**170**	**240**
Abrasive	70 (1)	70 (1)	140(1)
Refractory	100 (1)	100 (1)	100 (1)

Figures rounded off.
Data collected on non-statutory basis.
Figures in parentheses denote the number of units in organised sector reporting consumption.*
(Includes actual reported consumption and/or estimates made wherever required.)*

WORLD REVIEW

Production of good quality rubies has been reported from Afghanistan, Myanmar and Madagascar. Most of the production is exported to Thailand for cutting. Vietnam continued to produce various ranges of rubies from finest red to pinkish red . Pakistan and Afghanistan produced a moderate quantity of finely-coloured rubies and pink sapphires. Thailand imports large number of stones from neighbouring countries like Myanmar, Vietnam, Cambodia as also from Madagascar, Somalia, Kenya and Tanzania. Australia produced small quantities of rubies from many areas.

Sapphires were extensively mined in Sri Lanka, Myanmar and Madagascar. Nigeria, Australia, Thailand and China also produce sapphires.

FOREIGN TRADE

Exports of corundum (natural) decreased to 412 tonnes in 2010-11 from 6,807 tonnes in the previous year. Qatar was the main buyer in 2010-11. Exports value of uncut ruby and sapphire increased to ` 465 lakh in 2010-11 from ` 83.3 lakh in the previous year. Exports were mainly to Switzerland (Tables - 7 & 8).

Imports of corundum (natural) were nil in 2009-10 and 2010-11. Imports of ruby and sapphire (Uncut) increased to 16 tonnes valued at ` 37.13 crore in 2010-11 from 4 tonnes valued at ` 31.33 crore in the previous year. Imports were mainly from Thailand, Tanzania, Kenya and Sri Lanka (Table - 9).

Table – 7 : Exports of Corundum (Natural) (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**6807**	**34137**	**412**	**2527**
Qatar	1537	7487	412	2527
Other countries	5270	26650	-	-

Table – 8 : Exports of Ruby and Sapphire : Uncut (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**++**	**8332**	**1**	**46510**
Switzerland	-	-	1	42661
USA	++	1479	++	166
Thailand	++	508	++	1006
Germany	-	-	++	1358
Hong Kong	-	-	++	667
Sri Lanka	-	-	++	508
Denmark	-	-	++	103
Japan	-	-	++	41
Other countries	++	6345	-	-

Table – 9 : Imports of Ruby and Sapphire : Uncut (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**4**	**313259**	**16**	**371299**
Thailand	1	51612	7	183386
Hong Kong	2	117165	1	45724
Tanzania	++	8791	2	39061
USA	++	458	1	25626
Brazil	-	-	++	22388
Guinea	1	3438	1	14826
Kenya	++	8652	2	11955
Zambia	++	1396	++	8214
Germany	++	152	++	4498
Sri Lanka	++	3560	2	2787
Other countries	++	118035	++	12834

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

CRYOLITE

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

28 Cryolite

Cryolite is a double fluoride of sodium and aluminium with chemical composition Na_3AlF_6. Cryolite, an uncommon mineral of very limited natural distribution was only found in large quantities on west coast of Greenland. This natural deposit was exhausted in 1987. It is an important raw material for extraction of aluminium from alumina. It has a low index of refraction close to that of water. Synthetic cryolite is used as electrolyte in the reduction of alumina to aluminium due to non-availability of natural cryolite all over the world. Composition and properties of synthetic cryolite are the same as those of natural cryolite but synthetic cryolite is often deficient in sodium fluoride. Chiolite is another sodium aluminium fluoride mineral having the chemical composition $5NaF.3AlF_3$.

INDUSTRY

Synthetic cryolites are obtained by adopting several processes. The selection of the process depends upon the availability and cost of raw materials. The simplest and most common method of obtaining synthetic cryolite is by reacting hydrofluoric acid with soda ash and alumina hydrate. Hydrofluoric acid is produced by reacting acid grade fluorite with sulphuric acid and by-product gypsum is obtained in this process. In the secondary reaction between hydrofluoric acid and sodium chloride brine, sodium fluoride and hydrochloric acid are produced. In the primary reaction, dry aluminium hydroxide reacts with hydrofluoric acid to produce aluminium fluoride which reacts with sodium fluoride produced earlier and forms synthetic cryolite.

Besides fluorite, by-product fluorine gas emanating from plants of phosphatic fertilizer and phosphoric acid has emerged as an important alternative source for hydrofluoric acid and other fluorine chemicals including cryolite and aluminium fluoride. Rock phosphate usually contains 7-8% CaF_2. In terms of fluorine, it works out to 3-4% which is liberated at the time of acidulation of rock phosphate with sulphuric acid. Fluorine combines with silica to form silicon tetrafluoride which when scrubbed with water forms fluorosilicic acid. By recycling, 18-24% fluorosilicic acid is obtained, which serves as a raw material for manufacturing various fluoro-chemicals including synthetic cryolite. From fluorosilicic acid, fluorine values are precipitated as sodium fluorosilicate by treating it with sodium salts. Sodium fluorosilicate becomes starting point for the production of synthetic cryolite.

For manufacture of synthetic cryolite from sodium fluorosilicate, two routes are generally adopted in the country. In the first route, sodium fluorosilicate is reacted with ammonia and in other route, sodium fluorosilicate is reacted with soda ash. Fertilizers & Chemicals Travancore Ltd (FACT), Udyogmandal, Kochi, Kerala, follows the ammonia route, whereas, Dharamsi Morarjee Chemicals Co. Ltd, Ambarnath, Maharashtra, follows the soda ash route.

Important known units producing synthetic cryolite with their installed capacities are given below. The production data for these units are not available:

1. Navin Fluorin Industries, Bhestan, Surat, Gujarat.
2. Tanfac Industries Ltd (formerly Tamil Nadu Fluorine and Allied Chemicals Ltd), Kudikadu, Cuddalore, South Arcot, Tamil Nadu (3,000 tpy).
3. Adarsh Chemical & Fertilizer Ltd, Udhana, Surat, Gujarat (540 tpy).
4. Premier Fertilizers Ltd, Chennai, Tamil Nadu (540 tpy).

Also, it is understood that Triveni Chemicals, S.B. Chemicals, Jay Intermediates & Chemicals (Vapi, Gujarat), Madras Fluorine Pvt. Ltd (Manali, Chennai, Tamil Nadu), and Tarun Fluo-Chem Pvt. Ltd, Delhi are in the manufacture of synthetic cryolite besides other fluorine chemicals. They also manufacture potassium cryolite (K_3AlF_6) which is a foundry flux and used in welding chemicals and explosives.

The total installed capacity of aluminium fluoride in organised sector was 27,000 tonnes per annum. Production of aluminium fluoride was 11,550 tonnes in 2009-10.

SPECIFICATIONS

The Indian Standard Specifications of cryolite for use in aluminium industry defined vide IS - 5893 : 1989 (Second Revision; reaffirmed 2008) are as follows:

Constituents (on dry basis)	Specification
F	53% min
Na	31 to 34%
Al	13 to 15%
SiO_2	0.20% max
Fe_2O_3	0.10% max
CaF_2	0.06% max
Al_2O_3	1.00% max
SO_3	0.50% max
P_2O_5	0.01% max
Loss on Ignition (LOI)	0.50% max
NaF/AlF_3(by mass)	1.45 max (ratio required to maintain in acidic region)

Note: i) *LOI is to be determined at 550°C for 60 minutes.*
ii) *Moisture should not be more than 0.20% when determined at 110 ± 5°C.*

Cryolite obtained as a by-product during phosphate manufacture when utilised in the aluminium industry, necessary precautions are observed as even 0.01% in the electrolyte could cause 1-1.5% reduction in current efficiency in the production process of aluminium.

CONSUMPTION

The reported annual consumption of cryolite remained static at 18,400 tonnes from 2008-09 to 2010-11 almost all of which was in aluminium metal extraction industry. Negligible consumption was also reported by abrasive, electrical and electrode industries (Table-1).

Table – 1 : Reported Consumption of Cryolite 2008-09 to 2010-11 (By Industries)

(In tonnes)

Industry	2008-09	2009-10(R)	2010-2011(P)
All Industries	**18400**	**18400**	**18400**
Aluminium	18400 (6)	18400 (6)	18400 (6)
Others (abrasive, electrical and electrode)	++ (4)	++ (4)	++ (4)

Figures rounded off. Data collected on non-statutory basis. Figures in parentheses denote the number of units in organised sector reporting consumption.*
(Includes actual reported consumption and or estimates made wherever required)*

USES AND TECHNOLOGY

The commercial application of cryolite is confined mainly to aluminium metallurgy where it is used as electrolyte in the reduction of alumina to aluminium metal by the Hall process. Alumina is a bad conductor of electricity and its melting point is 2,348 °C. It is very expensive to carry out electrolysis at this temperature. To facilitate electrolysis, alumina is dissolved in molten cryolite as it lowers the melting point. Further, addition of certain additives such as, aluminium fluoride improve the physical and electrical properties of the electrolyte besides lowering the melting point. The amount that is added is, however, limited as it also causes reduction in electrical conductivity. Addition of fluorite (CaF_2) further depresses the melting point with less adverse effect on conductivity. In contrast to this advantage, too much CaF_2 raises the density of the melt closer to that of liquid aluminium metal, thus inhibiting the separation of metal from electrolyte. The substituent, sodium fluoride, though known to improve the density and conductivity, also affects current efficiency. A compromise made on all these factors has led to the following general composition of bath to be in use – 80-85% cryolite, 5-7% AlF_3, 5-7% CaF_2, 0-7% LiF and 2-8% Al_2O_3. The electrolyte bath tends to deplete AlF_3 content of cryolite during the process. Hence, the composition of the electrolyte has to be adjusted regularly by addition of AlF_3.

In aluminium refining, high density electrolyte capable of floating aluminium is required. For this purpose, barium fluoride can also be used to raise density. Aluminium fluoride can be used to improve current efficiency of cryolite bath.

Other metallurgical uses of cryolite are in aluminizing steel, in compounding of welding rod coatings and as fluxes. In glass, cryolite functions as a powerful flux because of its excellent solvent power for oxides of silicon, aluminium & calcium and for its ability to reduce melt viscosity at lower melting temperatures. Cryolite is used as a filler for resin-bonded grinding wheels in abrasive industry to give longer life. Sodium fluoride (NaF) or fluorosilicic acid may also be used for this purpose. Cryolite is used in certain nitrocellulose-based gun propellants required in small-calibre weapons, cannons and small & large rockets.

The future of cryolite, as it may seem, is entirely dependent upon its use in the aluminium industry. It is learnt that some US firms have registered success in their research and pilot plant tests for production of aluminium directly from the mineral bauxite without the intermediate process of reduction cell. Viability of this may probably eliminate the use of cryolite in the days to come.

FOREIGN TRADE

Exports

In 2010-11, exports of cryolite & chiolite decreased to 24 tonnes from 101 tonnes in the previous year. Malaysia was the main buyer in 2010-11 (Table - 2).

Imports

Imports of cryolite (artificial) in 2010-11 decreased drastically to 8,176 tonnes from 21,330 tonnes in the previous year. Canada (38%), Australia (29%), Netherlands (9%) and Iceland (8%) were the main suppliers (Table - 3).

Table – 2 : Exports of Cryolite and Chiolite (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**101**	**2597**	**24**	**454**
Malaysia	24	488	23	345
UAE	73	2002	1	86
Kenya	++	21	++	11
Germany	-	-	++	10
Sri Lanka	-	-	++	1
Cuba	-	-	++	1
Other countries	4	86	-	-

Table – 3 : Imports of Cryolite and Chiolite
(By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**21330**	**336149**	**8176**	**146530**
Canada	8295	115793	3067	37514
Australia	2829	45907	2373	25773
China	279	14076	568	24874
Italy	-	-	408	20671
Japan	81	4454	363	13668
Iceland	-	-	686	11584
Netherlands	1664	29433	698	11575
Germany	17	1163	13	868
Unspecified	-	-	++	3
Other countries	8165	125323	-	-

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

DIAMOND

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

29 Diamond

India is known for its diamond cutting & polishing business especially for small sized diamonds. Most of the world's business comes to India, particularly to Surat in Gujarat. Indian diamond industry handles 80% of the global polished diamond market. India depends largely on imports of rough gem diamonds for its cutting and polishing industry as there is only one producer in Madhya Pradesh and the production is negligible to meet the cutting and polishing industry's requirements. The cut and polished diamonds are re-exported. Diamond has been the most valuable among gems for more than 2,000 years. Being the hardest natural substance known, industrial variety diamonds are used in grinding, drilling, cutting and as polishing tool. In addition, diamond exhibits highest thermal conductivity amongst minerals and has high electrical resistivity making it suitable for application in semiconductors. The prices of gem diamonds depend upon their rarity, weight, quality, shape and flawlessness.

Diamond has a high refractive index and strong dispersion which gives it exciting brilliance when cut as a faceted stone. Gem diamonds are transparent and colourless or show faint shades of different colours. The transparent water-clear diamonds are known as "first water" or "blue-white". When yellowish or honey colour tinge is present, they are termed as off-colour stones. The industrial diamonds are dark brown in colour. Diamonds with green, blue or red shades are rare and attract higher price than the common varieties.

Flawless stones of good colour are employed in gem trade while off-colour, flawed & defective stones, chips & cuttings as well as small grains & dust are used in industry. Industrial grade diamond, i.e., diamond that does not meet gem quality standards in terms of colour, clarity, size or shape and those that are produced as a by-product of mining for gem diamonds continue to be used principally as abrasives in many applications despite their initial cost. Although diamond is more expensive than the other abrasive materials, it is more cost-effective in numerous industrial processes because it lasts longer than any other material.

Broadly, industrial diamonds have three varieties viz, 'ballas' which is mass of minute diamond crystals difficult to cleave, 'bort' is grey to black and massive, flawed or irregular in shape and 'carbonado' is black, opaque and without cleavage.

RESOURCES

Diamond occurrences are reported since pre-historic times in the country. Presently, diamond fields of India are grouped into four regions:

1) South Indian tract of Andhra Pradesh, comprising parts of Anantapur, Cuddapah, Guntur, Krishna, Mahaboobnagar and Kurnool districts;
2) Central Indian tract of Madhya Pradesh, comprising Panna belt;
3) Behradin-Kodawali area in Raipur district and Tokapal, Dugapal, etc. areas in Bastar district of Chhattisgarh; and
4) Eastern Indian tract mostly of Odisha, lying between Mahanadi and Godavari valleys.

As per the UNFC system as on 1.4.2010 all India resources of diamond are placed at around 31.92 million carats. Out of these, 1.04 million carats are placed under reserves category and 30.88 million carats under remaining resources category. By grades, about 2.37% resources are of gem variety, 2.63% of industrial variety and bulk of the resources (95%) are placed under unclassified category. By states, Madhya Pradesh accounts for about 90.20% resources followed by Andhra Pradesh 5.71% and Chhattisgarh 4.08% (Table - 1).

EXPLORATION & DEVELOPMENT

GSI continued exploration activities for search of kimberlite, the source rock of diamond, in Andhra Pradesh, Karnataka and Tamil Nadu. Directorate of Geology, Odisha, explored areas in Nuapada district. Details of exploration activities by GSI and State Directorate of Geology, Odisha are furnished in Table -2.

Table –1 : Reserves/Resources of Diamond as on 1.4.2010
(By Grades/States)

(In carats)

State/Grades	Reserves				Remaining resources								Total resources
	Proved STD111	Probable STD121	Probable STD122	Total (A)	Feasibility STD211	Pre-feasibility STD221	Pre-feasibility STD222	Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	(A+B)
All India:Total	**1045318**	-	-	**1045318**	-	-	-	**304601**	**1524317**	**29047514**	-	**30876432**	**31921750**
By Grades													
Gem	-	-	-	-	-	-	-	158819	1017	596929	-	756765	756765
Industrial	-	-	-	-	-	-	-	41664	223	798936	-	840823	840823
Unclassified	1045318	-	-	1045318	-	-	-	104118	1523077	27651649	-	29278844	30324162
By States													
Andhra Pradesh	-	-	-	-	-	-	-	200483	1524317	98155	-	1822955	1822955
Chhattisgarh	-	-	-	-	-	-	-	-	-	1304000	-	1304000	1304000
Madhya Pradesh	1045318	-	-	1045318	-	-	-	104118	-	27645359	-	27749477	28794795

Figures rounded off.

Table-2: Details of Exploration Activities for Diamond, 2010-11

Agency/ State/ District	Location/ Area/ Block	Mapping Scale	Mapping Area (sq km)	Drilling No. of bore-holes	Drilling Mete-rage	Samp-ling (No.)	Remarks Reserves / Resources estimated
GSI **Andhra Pradesh** Mahaboobnagar Nalgonda & Ranga Reddy	Amangal & Bhimanpali Block	1:50,000	550	-	-	112	The study area is a part of Eastern Dharwar Craton. Around 80 to 100 kg stream sediment samples were collected from suitable trap sites from 4th and 5th order streams for regional study & from 1st, 2nd & 3rd order streams for detailed sampling. The samples were examined under stereo microscope for kimberlite indicator mineral.
Karnataka Raichur	(Raichur Kimberlite field)	Reconnaissance stage investigation					Stream sediment samples were collected. Two suspected Cr-diopside grains were recovered. Aero-magnetic anomaly zone is under investigation.
Kolar	Bengaluru Penukonda Block	1:50,000	-	-	-	-	Regional ground evaluation of Aero-magnetic and Aero Radiometric anomalous zone is under process. Geological traverse using scintillometer was taken. A high radiometric value of >1m R/hr compared to 0.2m R/hr bge was observed in a leucogranite quarry north of Masalahalli. West of Kachanayakkanahalli and Chellammakotikonda high radiometric value of 1mR/hr high were observed. Suspected uravite/tharianite crystals were found within pegmatite body. Work is in progress.
Chhattisgarh Bilaspur	Raigarh – Bilaspur Belt	Reconnaissance stage investigation					A suspected kimberlite /lamproitic rock is reported. Pink,purple and orange red garnets(pyrope) spinels and ilmenite were observed and selected for SEM-EDX/EPMA studies. The work is in progress.
-do-	Agasmai and Bargarh						A no.of small faults offsetting the Kansapather sandstone were observed.
	NW of village Barra						Fault scrap with slickenslides in Lohardih sand stone was observed. Stream sediment samples were collected from streams flowing along the fault zone cutting across the contact of basement of Gondwana/Chhattisgarh supergroup Rocks a total of 33 grains of illmenite and garnet were reported from stream samples, and samples were sent for SEM-EDX studies. Work is in progress.

(Contd.)

Table-2 (Concld.)

Agency/ State/ District	Location	Mapping		Drilling		Sampling (No.)	Remarks and reserves/Resourcese estimated
		Scale	Area (sq km)	No. of borehole	Meterage		
Madhya Pradesh Chhatarpur, Sagar, Tikamgarh	-	-	-	-	-	-	Regional ground evaluation of Aero-geophysical anomalies (G-4) was continued to delineate priority block to locate possible KCR bodies and other type of mineralisation.
Uttar Pradesh	-	-	-	-	-	-	No specific lineaments and magnetic breaks have been found. Stream samples were collected from streams from magnetic breaks and lineaments.
Directorate of Geology Odisha							
Nuapada	Supli Valley	-	-	-	-	29.5 tonnes of bulk samples	The area under investigation from a part of Bastar Cratonic complex which consists of grey gneisses intruded by gabbro, dolerite, porphyritic granite, medium grained pink granite, pegmatite and quartz vein, olivine lamproite in different phases. Scanning for any diamond Indicator Mineral within suspected ultrabasic rock is in progress.
-do-	Village-	1:25,000 Darrim-	10.0 1:2,000	- 0.15	-	27	Archaean basement rocks like undagranite gneiss is intruded by gnewer granite, basic and ultrabasic rocks and overlained in patches by metasediments. Cratonic basement rocks are also intruded by acid, basic and ultrabasic rocks.
NMDC **Madhya Pradesh**							
Tikamgarh	Tikamgarh	1:50,000	-	-	-	348 stream samples	-

PRODUCTION & STOCKS

Production of diamond at 19,774 carats in 2010-11 as against 16,891 carats in the previous year showed a rise of 17%. There were two operating mines, both in public sector located in Panna district of Madhya Pradesh. The mine operated by NMDC Ltd contributed almost entire production of diamond and a very small quantity of production was reported by the mine operated by Department of Geology and Mining, Government of Madhya Pradesh.

Out of the total output, gem variety constituted 8% and the remaining 92% was of off-colour and dark brown varieties of industrial grade (Tables 3 to 5).

Mine- head stocks at the end of 2010-11 were 1,601 carats as against 7,122 carats at the begining of the year (Table-6).

The average daily employment of labour during 2010-11 was 518 as against 952 in the

Table – 3 : Producer of Diamond, 2010-11

Name & address of producer	Location of Mine	
	State	District
NMDC Ltd 10-3-311-/A, Castle Hills, Masab Tank, Hyderabad-500 028, Andhra Pradesh.	Madhya Pradesh	Panna
Director of Geology & Mining, Government of Madhya Pradesh, Khanij Bhavan, 29-A, Arera Hill, Bhopal - 462 016, Madhya Pradesh.	Madhya Pradesh	Panna

Table – 4 : Production of Diamond, 2008-09 to 2010-11 (By State)

(Quantity in carats; value in ₹ '000)

State	2008-09		2009-10		2010-11	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**536**	**4537**	**16891**	**116279**	**19774**	**152651**
Madhya Pradesh	536	4537	16891	116279	19774	152651

Table – 5 : Production of Diamond, 2009-10 to 2010-11 (By Sector/State/District/Grades)

(Quantity in carats; value in ₹'000)

State/District	2009-10					2010-11				
	No. of mines	Quantity			Value	No. of mines	Quantity			Value
		Gem (rough & uncut)	Industrial*	Total			Gem (rough & uncut)	Industrial*	Total	
India	**2**	**5556**	**11335**	**16891**	**116279**	**2**	**1599**	**18175**	**19774**	**152651**
Public sector	2	5556	11335	16891	116279	2	1599	18175	19774	152651
Madhya Pradesh	**2**	**5556**	**11335**	**16891**	**116279**	**2**	**1599**	**18175**	**19774**	**152651**
Panna	2	5556	11335	16891	116279	2	1599	18175	19774	152651

** Includes off-colour and dark-brown varieties of diamond.*

Table – 6 : Mine-head Stocks of Diamond, 2010-11 (P)
(By State)

(In carats)

State	At the beginning of the year	At the end of the year
India	**7122**	**1601**
Madhya Pradesh	7122	1601

MINING & PROCESSING

Majhgawan in Madhya Pradesh is a fully mechanised mine operated by NMDC. It is worked by opencast method in tuff rock by deploying 4.1 cu m hydraulic shovel and 40-tonne dumpers in combination. The mine benches have been designed with a height of about 10 m. Few benches are of 4-5 m height too. Drilling is done by 4-inch diameter drills and charged with slurry explosives, and about 40-50 holes are blasted at a time with delay pattern. The capacity of the mine is about 30,000 carats per year. Diamonds are also recovered from conglomerate and gravel beds at shallow depths by small operations on the basis of annual permits granted by Diamond Officer, Government of Madhya Pradesh.At Majhgawan, kimberlite rock after mining is stock piled for weathering action and then is fed to crushing plant. It is processed through Heavy Media Separation System in processing plant for recovery of diamond. Recently, X-ray diamond sorter has been installed for sorting of diamonds from ore by which recovery of raw diamonds has increased to 98%.

Diamond Mining Factors

Grade: Grade is the weight of diamond expressed as carats per tonne (ct/t) of ore. It varies widely from one mine to another but generally falls somewhere between 0.3 and 1.3 ct/t. One carat is equivalent to 0.2 gram.

Size (weight) of rough diamonds in deposit: Individually, rough diamonds can range from microweight to stones weighing more than 1,000 carats. Depending on the mine, the average size of rough diamonds recovered can weigh from 0.01 ct (about 1 mm) to more than 0.7 ct. Many mines in the world show on an average about 0.4 to 0.5 ct per stone. It is interesting to note that the number of stones larger than 2 ct (0.4 g) produced at mines are very small (about 400,000 stones per year).

INDUSTRY

Indian diamond industry enjoys respect and credibility in the world market, particularly for small diamonds used in jewellery. Indian diamond manufacturing standards are reckoned as the best in the world. Indian artisans can polish small diamonds economically and efficiently. India may become a Trading Centre for rough and polished diamonds in near future. Surat in Gujarat is the main centre of the cutting and polishing industry.

There are over 10,000 diamond processing units in Surat. Most of them now use computerised cutting machines. With 800,000 strong workforce and deployment of the latest technology, India continues to be the dominant player in the world diamond cutting and polishing industry. According to India's Gem & Jewellery Export Promotion Council (GJEPC), India has further strengthened its world dominance. India has processed 60% of the world's diamonds during 11th plan (2007-12) by value compared to 50% in the 10th Plan (2002-07). In terms of caratage, India's share was 85% during 11th Plan compared to 80% in the 10th Plan.

India is maintaining its leading position in the world market because of the combination of pragmatic policies of the Government and sustained efforts of exporters. Policy changes, such as, creation of Special Economic Zones (SEZ) will boost the export performance further. Several diamond polishing companies have already established offices in India for trading in rough and polished diamonds. India obtains rough diamonds from Belgium, UK, Hong Kong, UAE, Israel, etc. Indian diamond traders seek opportunities to establish direct trade ties with mining countries and companies. The Indian diamond industry is looking for more supply of rough diamonds at competitive rates directly from the producers to maintain its lead in the world market.

CONSUMPTION

Industrial diamonds are mostly consumed by manufacturers of drill bits, grinding tools and stone cutting and polishing machines. Though many small-scale sector units operate in cutting and polishing trade, it is difficult to get a reliable data on consumption of industrial diamonds. Demand of industrial diamonds is mostly met by imports.

SUBSTITUTES

Synthetic Diamond

Today, market for industrial diamond is dominated by synthetic stones, first developed in 1950s. Synthetic diamonds, manufactured using high pressure and high temperature methods compete as an abrasive mineral with natural industrial diamonds and also with manufactured materials like silicon carbide (SiC), alumina (Al_2O_3), tungsten carbide (WC) and carbide boron nitrate (CBN). Synthetic diamonds being marketed are mostly 0.6 - 0.8 mm and smaller in size. Synthetic Diamond Abrasives (SDA) are used for sawing, drilling or milling hard stones, concrete aggregate, refractory materials, masonry and asphalt. In general, large crystals are used for cutting softer materials and smaller crystals for tougher jobs. Synthetic diamonds now account for bulk supply of industrial diamonds and are preferred over natural diamonds because their quality can be controlled to suit customer requirements.

Synthetic diamonds were produced earlier by using graphite with a metal catalyst under very high pressure & temperature.

A process which needs relatively low pressure for production of synthetic diamonds is chemical vapour deposition (CVD). This process involves depositing tiny crystals of diamond on a film which can be built in complicated shapes and used at desired places or instruments such as machine part, heat conductors in micro circuit, shortwave UV, microwave sources and radiation detectors. In future, CVD can be a substitue for silicon in computer industry. In USA, developments have taken place in CVD method of growing 100% pure diamond using microwave plasma technology to make this method more economical, as also to grow larger crystals.

POLICY

Import of diamond under Heading No.7102, whether or not worked, but not mounted or set, fall under `free' category as per the Export-Import Policy 2009-2014. Foreign Direct Investment (FDI) in diamond mining up to 100% is admissible for automatic approval of Reserve Bank of India.

WORLD REVIEW

The world reserves of industrial diamond are about 600 million carats located mainly in Congo (Kinshasa) (25%), Botswana (22%), Australia (18%), South Africa (12%) and Russia (7%). The world reserves of diamond are given in Table-7.

The total world production of diamond increased by 11% from 121 million carats in 2009 to 135 million carats in 2010. The principal producers were Russia (26%), Botswana (20%), Democratic People's Rep. of Congo (15%), Canada (9%), Australia & South Africa (7% each) and Angola & Zimbabwe (6% each) (Table-8). Zimbabwe increased the output of diamond sharply to more than 8.7 times while Botswana showed increase to the tune of 55%, Namibia (57%) and South Africa (45%). Decrease in output was noticed in Guinea (46%), Angola (40%), Ghana (13%), Australia (7%) and Democratic People's Rep. of Congo (5%). Natural diamonds are cut in 52 countries. The major diamond cutting centres in the world are Antwerp in Belgium, Ramatyyan in Israel, New York in USA and Surat in India.

Table – 7 : World Reserves of Diamond (Industrial) (By Principal Countries)

(In million carats)

Country	Reserves
World : Total (rounded)	**600**
Australia	110
Botswana	130
China	10
Congo (Kinshasa)	150
Russia	40
South Africa	70
USA	NA
Other countries	85

Source: *Mineral Commodity Summaries, 2012.*

Table – 8 : World Production of Diamond (By Principal Countries)

(In '000 Carats)

Country	2008	2009	2010
World: Total	**165200**	**121100**	**135000**
Angola	8907	13828	8362
Australia	15670	10795	9998
Botswana	32595	17734	27556
Canada	14803	10946	11773
Congo, Dem. People's Rep.of	33402	21298	20166
Ghana	598	354	309
Guinea	3098	697	374
Namibia	2435	940	1476
Russia	36925	34759	34857
Sierra Leone	371	400	437
South Africa	12901	6119	8868
Zimbabwe	797	963	8435
Other countries	2698	2267	2389

Source: *World Mineral Production, 2006-2010.*

ANGOLA

Trans Hex signed a mining contract and took on the management of the project, which is located about 80 kilometers northeast of Lucapa in Lunde Norte Province. Indicated resources from the west bank of the Luana River were estimated to be about 3 million carats and inferred resources were estimated to be about 10 million carats. In October, ENDIAMA announced the inauguration of the project, which was expected to produce about 3,000 carats per month during its first phase. The Luxinge project, which is located in Lunda Norte Province, covers an area of about 160 sq km and contains resources estimated at about 1.1 million carats of rough diamond.

BOTSWANA

Debswana Diamond Company Ply. Ltd (DDCL) was the worlds's leading diamond producer, by value, with mining operations at Damtshaa, Jwaneng, Letlhakane and Orapa. The Orapa pipe was the world's second ranked diamond-producing pipe after the Argyle diamond-producing pipe in Australia. The Jwaneng open pit mine was the richest diamond mine in the world in terms of the value of recovered diamond.

Lucara Diamond Corp. of Canada announced acquisition of African Diamond including the AK6 project, which was an advanced, high-value diamond development project located in the Letlhakane/Orapa kimberlite district. The AK6 project was on schedule for commissioning towards the end of 2011. AK6 was considered to be capable of producing 1 million carats per year.

The De Beers Group and the Government were planning for expansion at the Jwaneng Mine. Named Cut-8, the expansion would extend the Jwaneng Mine's life by 7 years from 2017 to 2024. The expansion would involve more than doubling the mine's depth to 650 m to create a 'super pit'. Cut-8 would enable DDCL to continue current producing levels to 2024 to sustain the mine.

DDCL announced that it would reopen the Damtshaa Mine in 2012 following a 3 year shutdown. The mining was planned to operate at full capacity when reopened. Lucara Diamond started construction at the BK11 Mine after being granted a 12 year mining license for the project. The BK11 Mine was expected to produce an estimated 1 million carats of diamond on commissioning.

CANADA

Early-stage diamond exploration was underway at numerous sites in Alberta, British Columbia, Northwest Territories, Nunavut Territory, Ontario, Quebec, and Saskatchewan. Advanced Canadian diamond projects included the Gahcho Kue project, located in the Northwest Territories, where a feasibility study was completed. The Renard project was being explored by a joint venture of Diaquem Inc and Les Diamants Stornoway Inc. In Saskatchewan, a prefeasibility study was completed for the Star-Orion South diamond project, and a final feasibility study was expected to be completed in 2011.

GUINEA

Stellar Diamond plc of United kingdom (formerly West Aftican Diamond plc) owned the Bomboko alluvial diamond deposit and the Mandala Mine (located between the Macenta and the Keroune districts in southeastern Guinea). Inferred resources at Bomboko were estimated to be 41,000 carats. Geologic mapping was underway and potential resources areas were identified for trial mining. In 2010, Stellar began to upgrade its Bomboko plant and planned to install an x-ray flow sort machine in the fourth quarter of 2010. Production at the Mandala Mine began in April 2009. Measured resources at Mandala were estimated to be 147,000 carats at an average grade of 0.69 carat per cu m and indicated resources wsere estimated to be 529,000 carats at an average grade of 0.69 carat per cu m. During the year, the company made the decision to expand the mining, processing and diamond recovery capacity at both the mines.

FOREIGN TRADE

Exports

Value of exports of diamond increased to ₹ 117,912 crore in 2010-11 from ₹85,942 crore in the previous year. Diamond (mostly cut) alone accounted for more than 99% exports in terms of value. The share of industrial diamonds and diamond powder was ₹ 19 crore and ₹ 250 crore, respectively. Exports were mainly to UAE (40%), Hong Kong (28%), USA (14%), Belgium (8%) and Israel (4%) (Tables- 9 to 12).

Imports

In 2010-11, imports value of diamond more than doubled to ₹ 152,791 crore from ₹ 74,441 crore in the previous year. Uncut diamond shared the bulk, i.e., about 99.9% of imports. Imports of industrial diamond and diamond powder were about 104 thousand carats and 136 million carats, respectively, valued at ₹ 84.6 crore and ₹ 49 crore. Imports were mainly from UAE (40%), Belgium and Hong Kong (21% each), USA (5%), Israel (4%) & UK(3%) (Tables -13 to 16).

Table – 9 : Exports Value of Diamond : Total (By Countries)

Country	2009-10 Value (₹ '000)	2010-11 Value (₹ '000)
All Countries	**859420958**	**1179119264**
UAE	253989495	470944914
Hong Kong	260518017	333158956
USA	150650963	168071436
Belgium	76503185	92284920
Israel	35283339	43469035
Thailand	12543993	15320085
Japan	10327771	10732763
Singapore	16156922	6583028
Switzerland	3093676	6135634
Australia	4680981	5009665
Other countries	35672616	27408828

Note : *Quantity not given due to partial coverage; value figures, however, have full coverge.*

Table – 10 : Exports of Diamond (Industrial) (By Countries)

Country	2009-10		2010-11	
	Qty (Carat)	Value (₹ '000)	Qty (Carat)	Value (₹ '000)
All Countries	**770352**	**1058591**	**923182**	**191097**
Belgium	558999	241573	537798	98183
UAE	84510	325996	143646	69505
Israel	-	-	132027	4889
Ireland	-	-	26524	4248
USA	25051	2932	20726	3386
China	50000	1357	19300	2291
UK	1000	782	26987	2210
Vietnam	-	-	1000	1797
Japan	220	432	2145	909
Unspecified	295	627	10000	1635
Other countries	50277	484892	3029	2044

Table – 11 : Exports of Diamond (Mostly Cut) (By Countries)

Country	2009-10		2010-11	
	Qty (Carat)	Value (₹ '000)	Qty (Carat)	Value (₹ '000)
All Countries	**66090838**	**851256380**	**78994450**	**1176426881**
UAE	18141623	250839164	27460018	470875409
Hong Kong	22202264	258996060	24463534	333158956
USA	7708866	150596899	9578753	168068049
Belgium	7917255	73598328	7598724	92186737
Israel	1019436	34964440	1370215	43464146
Thailand	1188321	12541361	1362144	15320085
Japan	2599841	10303013	2845847	10731854
Singapore	1952764	16156922	401001	6583028
Switzerland	206792	3092186	481745	6135634
Australia	110948	4667904	286994	5009665
Other countries	3042728	35500103	3145475	24893318

Table – 12 : Exports of Diamond Powder (By Countries)

Country	2009-10 Qty ('000 Carat)	2009-10 Value (₹ '000)	2010-11 Qty ('000 Carat)	2010-11 Value (₹ '000)
All Countries	**16961**	**7105987**	**27362**	**2501286**
UAE	2370	2824335	7631	1162400
Belgium	4781	2663284	5772	826483
Israel	1272	318899	2364	146733
Hong Kong	4797	1043930	2170	136810
UK	1058	38731	2374	70158
USA	1199	51132	2467	61750
Japan	124	24326	208	26403
Germany	79	4208	813	19489
Ireland	385	10203	600	11142
Unspecified	2	14200	314	7040
Other countries	894	112739	2649	32878

Table – 13 : Imports Value of Diamond : Total (By Countries)

Country	2009-10 Value (₹'000)	2010-11 Value (₹'000)
All Countries	**744408663**	**1527908912**
UAE	257281908	606726990
Belgium	215321884	318899401
Hong Kong	137614618	318889040
USA	35515405	69349787
Israel	31475499	53816683
UK	37566718	50331278
Russia	7299795	19192262
Switzerland	3826897	4470808
Canada	899199	2813427
Unspecified	826507	70884877
Other countries	16780233	12534359

Note: *Quantity not given due to partial coverage; value figures, however, have full coverge.*

Table – 14 : Imports Value of Diamond Industrial (By Countries)

Country	2009-10 Qty (Carat)	2009-10 Value (₹ '000)	2010-11 Qty (Carat)	2010-11 Value (₹ '000)
All Countries	**2216**	**1031716**	**104159**	**845847**
Hong Kong	1	861398	33568	336337
UAE	1	67005	51967	316003
Belgium	–	–	12587	147357
USA	–	–	5891	41896
Canada	–	–	102	2836
Israel	–	–	4	1292
France	3	660	40	125
Other countries	2211	102653	++	1

Table – 15 : Imports of Diamond Powder (By Countries)

Country	2009-10 Qty ('000 Carat)	2009-10 Value (₹ '000)	2010-11 Qty ('000 Carat)	2010-11 Value (₹ '000)
All Countries	**107077**	**385662**	**136271**	**489903**
China	91071	260647	114160	343524
Ireland	4149	45582	3515	35243
USA	3794	32227	3630	32072
Belgium	1149	11117	1615	20363
Hong Kong	2503	3839	7052	19260
Korea, Rep.of	1605	13715	1290	10863
UAE	135	583	988	6645
German	813	2803	1861	6271
Unspecified	357	7334	111	2573
Switzerland	367	2783	290	2237
Other countries	1134	5032	1759	10852

Table – 16 : Imports of Diamond (Mostly Uncut)
(By Countries)

Country	2009-10		2010-11	
	Qty (Carat)	Value (₹'000)	Qty (Carat)	Value (₹000)
All Countries	**130101282**	**742991285**	**182227342**	**1526573162**
UAE	28553735	257214320	47736910	606410987
Belgium	60942681	215310767	75436769	318752044
Hong Kong	15196064	136749381	24813044	187552703
USA	2413370	35483178	3399247	69307891
Israel	3971928	31475499	5461742	53815391
UK	12299089	37560054	13328658	50331278
Russia	2210400	7298007	6299330	19192262
Switzerland	1373723	3824114	1066262	4470808
Canada	781089	899199	1335082	2810591
Unspecified	62737	819173	2092737	70884877
Other countries	2296466	16357593	1257561	12044330

FUTURE OUTLOOK

Private companies like De Beers India and Rio Tinto India, based on the good geological database provided by GSI, were granted RPs for diamond exploration. The total area covered under RP is 1,40,000 sq km. The major focus was in the states of Andhra Pradesh, Chhattisgarh, Karnataka and Madhya Pradesh. Total expenditure in diamond exploration in the last ten years by the said two major private players is almost US$ 100 million, of which Rio's investment is US$ 70 million.

The diamond industry in the country currently employs over 8 lakh artisans who areexperts in cutting and polishing of small diamonds and are now in a position to process full range of sizes and qualities of gemstones using latest technology.

The Indian cutting and polishing sector is facing growing competition from China and due to the fact that the producing African countries are demanding a greater share of processing of roughs within their countries. Thus according to a KPMG analysis, by 2015, India's share in value terms will come down to 49.3% of the world diamond roughs from the present 65%. In the same period China's share is expected to grow to 21.3%, Russia to 7.1%, South Africa to 5.5%, Israel to 4.7% and the US to 1.4%.

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

DIASPORE

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

30 Diaspore

Diaspore is a dimorphous form of boehmite, with chemical composition $Al_2O_3.H_2O$ (betamonohydrate of aluminium). It is an important constituent of bauxite. Because of its good refractory properties, it is used chiefly for making high-alumina refractory bricks. It is also used as a filler in plastic industry.

RESOURCES

Diaspore occurs as thin veins, stringers and geode-like bodies in association with pyrophyllite in Uttar Pradesh and Madhya Pradesh. The host rock mainly comprises granite, quartz and pyrophyllite of Bundelkhand Super Group, and as a common constituent of bauxite in Jammu & Kashmir.

As per UNFC System of resource classification, the total resources of diaspore as on 1.4.2010 are placed at 5.98 million tonnes of which about 63% are located in Madhya Pradesh, 37% in Uttar Pradesh and a nominal quantity in Jammu & Kashmir. About 2.86 million tonnes (48%) of these resources are placed under reserves category. Out of the total resources, more than 76% are grouped under refractory grade, less than 1% in ceramic grade, while 23% resources fall under unclassified, not-known and other grades (Table - 1).

PRODUCTION, STOCKS & PRICES

The production of diaspore at 26,905 tonnes in 2010-11 increased by 5% as compared to that in the previous year.

The entire production of diaspore was reported as an associated mineral by 18 pyrophyllite mines in 2010-11. Five principal producers accounted for 89% of the total production during the year. The private sector contributed almost entire production.

Uttar Pradesh was the leading producer of diaspore contributing about 55% output. The remaining 45% production was reported from Madhya Pradesh (Tables - 2 to 4).

Mine-head stocks of diaspore at the end of 2010-11 were 6,307 tonnes as against 5,380 tonnes at the beginning of the year (Table -5). Prices of diaspore are furnished in the General Review on 'Prices'.

Table – 3 : Production of Diaspore, 2008-09 to 2010-11
(By States)

(Qty in tonnes; value in ₹'000)

State	2008-09		2009-10		2010-11(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**24642**	**23384**	**25569**	**27422**	**26905**	**25468**
Madhya Pradesh	10180	7410	11042	8540	11995	6970
Uttar Pradesh	14462	15974	14527	18882	14910	18498

Table –1 : Reserves/Resources of Diaspore as on 1.4.2010 (By Grades/States)

(In tonnes)

Grade/State	Reserves				Remaining resources								Total resources (A+B)
	Proved STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
		STD121	STD122			STD221	STD222						
All India : Total	**1469687**	**1106296**	**283691**	**2859674**	**187821**	**714316**	**488395**	**248880**	**133360**	**1306306**	**46068**	**3125144**	**5984818**
By Grades													
Ceramic	5646	6274	3137	15057	-	-	-	-	-	252	-	252	15309
Refractory-I	1459674	706699	134619	2300992	11659	156266	80350	545	-	531597	-	780415	3081407
Refractory-II	4367	345830	17785	367982	171443	347331	156025	199559	44381	205550	-	1124289	1492271
Unclassified	-	-	57531	57531	-	3178	23080	-	6502	6422	46068	85250	142781
Not-known	-	-	-	-	-	4522	3290	-	9950	10966	-	28728	28728
Others	-	47493	70619	118112	4719	203019	225650	48776	72527	551519	-	1106210	1224322
By States													
Jammu & Kashmir	-	-	-	-	-	-	-	-	566	711	-	1277	1277
Madhya Pradesh	719609	562818	174476	1456903	51764	386086	349488	248335	132794	1081412	46068	2295947	3752850
Uttar Pradesh	750078	543478	109215	1402771	136057	328230	138907	545	-	224183	-	827922	2230693

Figures rounded off.

Table – 2 : Principal Producers* of Diaspore, 2010-11

Name and address of producer	Location of mine	
	State	District
The Ishwar Industries Ltd Charankamal, 7, Ishwarnagar, Mathura Road, New Delhi–110 065.	Uttar Pradesh	Lalitpur
Jindutta Minerals Pvt. Ltd Post Box No. 27, Dhadari, Dist. Chhatarpur–471 001, Madhya Pradesh.	Madhya Pradesh	Chhatarpur
J.K.Minerals C1 & C2 Industrial Estate, Gwalior Road, Jhansi-284 003, Uttar Pradesh.	Uttar Pradesh	Jhansi Lalitpur
Khajuraho Minerals Post Box No.25, Chhatarpur-471 001 Dist. Chhatarpur Madhya Pradesh.	Madhya Pradesh	Chhatarpur
Eastern Minerals 35,Vivekanand Marg,Cantt. P. O. Jhansi–284 002, Dist. Jhansi, Uttar Pradesh.	Madhya Pradesh	Tikamgarh Chhatarpur

* *Produced as an associated mineral with pyrophyllite.*

Table – 4 : Production of Diaspore, 2009-10 and 2010-11 (By Sectors/States/Districts)

(Qty in tonnes; value in ₹'000)

State/District	2009-10			2010-11(P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India	**(22)**	**25569**	**27422**	**(18)**	**26905**	**25468**
Public sector	(1)	138	104	(1)	53	36
Private sector	(21)	25431	27318	(17)	26852	25432
Madhya Pradesh	**(15)**	**11042**	**8540**	**(10)**	**11995**	**6970**
Chhatarpur	(8)	8214	4971	(6)	9494	4738
Shivpuri	(1)	2117	3176	(1)	1264	1711
Tikamgarh	(6)	711	393	(3)	1237	521
Uttar Pradesh	**(7)**	**14527**	**18882**	**(8)**	**14910**	**18498**
Jhansi	(2)	277	192	(3)	641	545
Lalitpur	(3)	12554	16794	(3)	12907	16443
Mahoba	(2)	1696	1896	(2)	1362	1510

Figures in parentheses indicate the number of associated mines with pyrophyllite.

Table – 5 : Mine-head Stocks of Diaspore, 2010-11(P)
(By States)

(In tonnes)

State	At the beginning of the year	At the end of the year
India	**5380**	**6307**
Madhya Pradesh	988	1534
Uttar Pradesh	4392	4773

MINING AND MARKETING

Diaspore is normally mined manually by opencast method. Mining has been carried out to a depth of 25 m along with mineral pyrophyllite in the mines. The average Al_2O_3 content in the mined ore ranges between 42 and 72% and Fe_2O_3 between 0.7 and 4.45%.

Chhatarpur, Shivpuri and Tikamgarh districts in Madhya Pradesh and Lalitpur, Jhansi and Mahoba districts in Uttar Pradesh are the mining centres of diaspore in the country.

CONSUMPTION

Diaspore mainly finds application in the manufacture of high alumina refractories either by itself or by bonding with flint or plastic clay as per content of alumina needed in the finished product. The domestic refractory manufacturers use indigenous diaspore, analysing Al_2O_3 56 to 62%, Fe_2O_3 1 to 4% , TiO_2 0.8 to 1.5%., PCE (Orton) 36 (min) and of size between 75 and 150 mm. In 2010-11, about 13,300 tonnes diaspore was consumed mostly in refractory industry. A very negligible quantity was consumed in ceramic industry. The consumption of diaspore decreased by 5% as compared to previous year (Table - 6).

In addition to its industrial applications, diaspore is also used for making decorative items such as small figurines, lampshades, flower-vase, etc.

Table – 6 : Reported Consumption of Diaspore 2008-09 to 20010-11
(By Industries)

(In tonnes)

Industry	2008-09	2009-10(R)	2010-11(p)
All Industries	**13100**	**14000**	**13300**
Ceramic	++(1)	++(1)	++(1)
Refractory	13100(18)	14000 (18)	13300(16)

Figues rounded off.
Data collected on non-statutory basis.
Figures in parentheses denote the number of units in organised sector reporting consumption.*
*(*Includes actual reported consumption and/or estimates made wherever required.)*

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

DIATOMITE

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

31 Diatomite

Diatomite is extremely fine grained and highly absorbent. Each particle is porous and has honeycomb like structure. It is also called 'Kieselguhr'. It has a chemical composition SiO_2. nH_2O which is similar to opal or hydrous silica. A workable diatomite deposit of significance has not been established in the country. Almost the entire domestic requirement of diatomite is met through imports.

RESOURCES

The occurrences of diatomite are reported from Gujarat, Rajasthan, Tamil Nadu, Andhra Pradesh and Camorta & Trinicutta Islands in Andaman and Nicobar. As per UNFC system, the total resources of diatomite as on 1.4.2010 are estimated at 2.89 million tonnes, all of which fall under remaining resources. The total resources are distributed in Rajasthan (72%) and Gujarat (28%) (Table - 1).

Table – 1: Reserves/Resources of Diatomite as on 1.4.2010 (By Grades/States)

(In '000 tonnes)

Grades/State	Reserves Total (A)	Remaining resources: Feasibility STD211	Remaining resources: Inferred STD333	Remaining resources: Total (B)	Total resources (A+B)
All India: Total	–	**634**	**2251**	**2885**	**2885**
By Grade					
Unclassified	–	634	2251	2885	2885
By States					
Gujarat	–	–	811	811	811
Rajasthan	–	634	1440	2074	2074

Figures rounded off.

PRODUCTION

Production of diatomite has not been reported since 1991-92. Pandava and Khadraliya areas in Bhavnagar district, Gujarat were the producing areas prior to 1991-92.

USES

Commercial diatomite contains 85-94% SiO_2, 1 to 7% Al_2O_3, 0.4 to 2.5% Fe_2O_3, 0.1 to 0.5% TiO_2, 0.03 to 0.2% P_2O_5, 0.3 to 3% CaO, 0.3 to 1% MgO, 0.2 to 0.5% Na_2O, 0.3 to 0.9% K_2O and 0.1 to 0.2% organic matter and soluble salts.

Diatomite is commonly used after calcination in plate and frame filter units. Processed diatomite finds a wide range of applications due to its properties like diatom skeletal structure and constitution, low bulk density, soluble impurities, high absorptive capacity for liquids, large surface area, low thermal conductivity, mild abrasive nature and chemical inertness.

The most important use of diatomite is as a filter aid, especially for colloidal or solid solutions like beverage, fruit juice, syrup, oil and antibiotics and for water treatment to remove amoebic cysts and blood-fluke larvae. Life-saving drugs like tetracycline and insulin are filtered through diatomite. The use of diatomite in filtration applications is on the decline as ceramic & polymeric and carbon membrane technologies are increasingly adopted. However, its applications as an absorbent of vegetable oil, polyethylene, rayon liquors and as a flattening agent in paint, plastic, rubber, drugs, toothpaste, polishes and chemicals are on the rise. Diatomite is utilised for safe handling and storage of hazardous chemicals like sulphuric acid. Besides, diatomite is used as an abrasive in metal polishing in automobiles and toothpastes, pozzolanic admixtures in cement industry and animal feed stuff conditioners and explosives. It is also used as a coating material in the manufacture of ammonium nitrate fertilizer which is hygroscopic. The coating of diatomite keeps the material in granular form. Diatomite clay is the new revolution in hydroponics. In pharmaceuticals, it is used to filter syrups and other bulk drugs in liquid form. In oil industry, before packing it is used to filter oil to give it a shine and to remove any suspended impurity. Beer is filtered through diatomite before packing to remove molasses. Filter candles are made from diatomite filter aids for drinking water purification. Processed diatomite granules, 15 to 50 mm, are used in denim wash (commonly known as stonewash) to give it shine and design. It is also used as caking agent in fertilizers and pesticides and as filler for paints and plastics. Potable water treatment and biological filteration are areas of expansion in diatomite consumption.

SUBSTITUTION

Many substances are used as substitutes for diatomite. However, the unique properties of diatomite assure its continuance in many applications. Expanded perlite and silica sand are considered as viable substitutes of diatomite for filtration purposes. As filler material, substitutes such as talc, ground silica sand, ground mica, clay, perlite, vermiculite and ground limestone are widely in use. For thermal insulation, various clays and special brick, mineral wool, expanded perlite and exfoliated vermiculite are used.

WORLD REVIEW

The world reserves of crude diatomite are large to meet the market demands. The USA has the largest reserves at 250 million tonnes and China follows with 110 million tonnes (Table -2). The USA also remained the largest producer, consumer and exporter of processed diatomite for filtration use in the world. The world's largest producing district in terms of volume is near Lompoc, CA in USA. These deposits could meet all of the world's current diatomite demand for hundreds of years.

Owing to the large world reserves and near stability in demand, diatomite will probably remain available for the forseeable future.The economic stability of the mineral commodity was largely owing to its use as a filtration medium. The total world diatomite production increased to 1.79 million tonnes in 2010 from 1.73 million tonnes in the previous year. The USA continued to dominate world production accounting for about 33% output followed by China (22%). Production in Denmark (9%) was mostly of molar, an impure mixture that includes diatomite. Other important producers of diatomite in 2010 were, Japan(6%), Mexico (5%) and Commonwealth of Independent States (4%), respectively (Table - 3).

Table – 2: World Reserves of Diatomite (By Principal Countries)

(In '000 tonnes)

Country	Reserves
World: Total (rounded)	**Large**
Argentina	NA
China	110000
Commonwealth of Independent States	NA
Denmark (processed)	NA
France	NA
Japan	NA
Mexico	NA
Spain	NA
USA	250000
Other countries	NA

Source: *Mineral Commodity Summaries, 2012.*

Table – 3: World Production of Diatomite (By Principal Countries)

(In '000 tonnes)

Country	2008	2009	2010
World : Total	**2044**	**1727**	**1787**
China ^{e}	440	440	400
Commonwealth of Independent States ^{e}	80	80	80
Denmark (Molar)*	210	168	166
France	75	75	75
Japan ^{e}	115	110	110
Mexico	129	81	92
Spain @	46	29	64 ^{e}
USA	764	575	595
Other countries	185	169	205

Source: *World Mineral Production, 2006-2010.*
Note: * *Molar is an impure diatomite containing a large proportion of clay.*
@ *Including Tripoli.*

FOREIGN TRADE

Exports of diatomite were 4,558 tonnes in 2010-11 as against 1,146 tonnes in the previous year. Exports were mainly to Saudi Arabia and Denmark. Exports of kieselguhr decreased to 79 tonnes in 2010-11 from 123 tonnes in the previous year. Exports were mainly to Saudi Arabia and Germany. There were no exports of tripoli earth in 2009-10 and 2010-11 (Tables - 4 & 5).

Imports of diatomite were 1,510 tonnes in 2010-11 as against 1,584 tonnes in the previous year. Imports were mainly from USA. Imports of kieselguhr were 156 tonnes in 2010-11 compared to 195 tonnes in the previous year. Imports of kieselguhr were mainly from Belgium. Imports of tripoli earth were 19 tonnes in 2010-11 as against 39 tonnes in the previous year. The entire imports of tripoli earth were from USA (Tables-6 to 8).

Table – 4: Exports of Diatomite (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**1146**	**11025**	**4558**	**40147**
Saudi Arabia	249	2124	3613	31596
Denmark	771	7487	360	3416
Philippines	-	-	212	1361
South Africa	-	-	176	1103
Oman	18	387	36	711
Iraq	-	-	16	601
UAE	-	-	48	442
China	36	371	35	364
Ethiopia	-	-	8	28
Unspecified	-	-	51	487
Other countries	72	653	3	38

Table – 5: Exports of Kieselguhr (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**123**	**1017**	**79**	**935**
Saudi Arabia	-	-	51	481
Germany	-	-	27	342
Mauritius	2	90	1	112
Other countries	121	927	-	-

Table – 6: Imports of Diatomite (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**1584**	**46387**	**1510**	**47906**
USA	1494	44358	1366	44421
Canada	20	486	58	1673
China	70	1451	50	901
Spain	-	-	20	427
Thailand	-	-	4	317
Kenya	-	-	12	167
Other countries	++	92	-	-

Table – 7: Imports of Kieselguhr (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**195**	**6337**	**156**	**5670**
Belgium	174	5796	147	4845
Spain	12	310	9	824
Other countries	9	231	++	1

Table – 8: Imports of Tripoli Earth (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**39**	**930**	**19**	**486**
USA	39	930	19	486

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

DOLOMITE

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

32 Dolomite

Dolomite ($CaCO_3.MgCO_3$) theoretically contains $CaCO_3$ 54.35% and $MgCO_3$ 45.65% or CaO 30.4%, MgO 21.9% and CO_2 47.7%. However, in nature, dolomite is not available in this exact proportion. Hence, in commercial parlance, the rock containing 40-45% $MgCO_3$ is usually called dolomite. It is grouped under flux and construction minerals and is important for iron & steel and ferro-alloys industries.

RESOURCES

Dolomite occurrences are widespread in the country. As per UNFC system, as on 1.4.2010 total resources of dolomite are placed at 7,730 million tonnes, out of which 738 million tonnes are placed under reserves category and the balance 6,992 million tonnes under remaining resources category. Gradewise, BF/sintering grade accounts for 26% resources followed by SMS (17%), refractory (9%), BF & SMS mixed (4%) and glass (3%). Others, unclassified, not-known and BF, SMS & refractory mixed grades together account for the remaining 38% resources. Major share of about 91% resources was distributed in eight states: namely, Madhya Pradesh (29%), Andhra Pradesh (15%), Chhattisgarh (11%) Odisha and Karnataka (9% each), Gujarat (7%), Rajasthan (6%) and Maharashtra (5%). The remaining 9% resources are distributed in Arunachal Pradesh, Jharkhand, Haryana, Sikkim, Tamil Nadu, Uttarakhand, Uttar Pradesh and West Bengal. Gradewise and Statewise reserves/resources of dolomite are given in Table-1.

EXPLORATION & DEVELOPMENT

In 2010-11, DGM Karnataka and DMG Rajasthan were carried out exploration in Tumkur district, Karnataka and Udaipur district in Rajasthan respectively. MECL was carried out exploration in West Kameng district in Arunachal Pradesh. Details of exploration activities for dolomite are furnished in Table- 2.

PRODUCTION AND STOCKS

The production of dolomite in 2010-11 at 5,065 thousand tonnes decreased by 14% as compared to that in the previous year due to shortage of labour and pending enviromental clearance for certain mines.

There were 116 reporting mines in 2010-11 as against 123 in the previous year. Besides, production of dolomite was reported by 40 associated mines in 2010-11 as against 49 in previous year. About 74% of total production was contributed by 12 principal producers. About 23% production of dolomite was also reported as an associated mineral primarily with kaolin, limestone, magnesite and steatite. Six mines producing more than 2 lakh tonnes annually accounted for 60% of the total production in 20109-11.

The share of public sector in 2010-11 was 48% as against 44% in the previous year. Chhatisgarh, the leading producing state of dolomite accounted for 27% of total production in 2010-11, followed by Odisha (22%), Andhra Pradesh (21%) Jharkhand and Karnataka (8% each). The remaining 14% was jointly shared by Gujarat, Madhya Pradesh, Maharashtra, Rajasthan and Uttarakhand (Tables- 3 to 6).

Mine-head stocks of dolomite at the end of the year 2010-11 was 1,661 thousand tonnes as against 1,689 thousand tonnes at the beginning of the year (Table-7).

The average daily employment of labour in 2010-11 was 2,203 as against 2,554 in the previous year. The price of dolomite are furnished in General Review on I

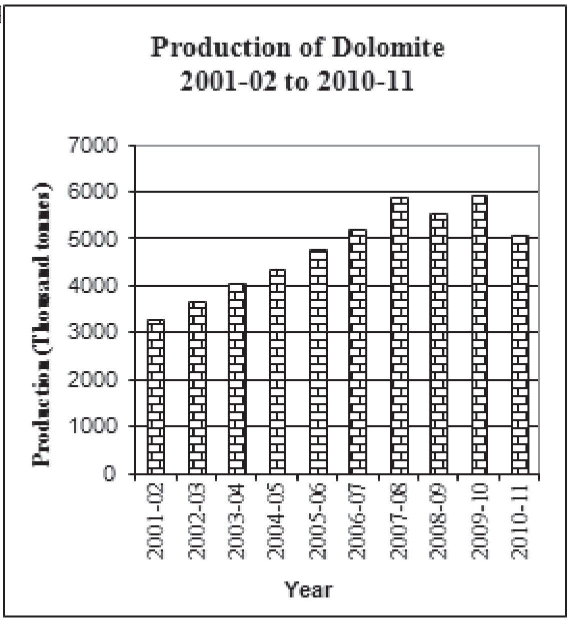


Table – 1 : Reserves/Resources of Dolomite as on 1.4.2010
(By Grades/States)

(In '000 tonnes)

Grade / State	Reserves				Remaining resources								Total resources
	Proved	Probable		Total	Feasibility	Pre-feasibility		Measured	Indicated	Inferred	Reconnaissance	Total	
	STD111	STD121	STD122	(A)	STD211	STD221	STD222	STD331	STD332	STD333	STD334	(B)	(A+B)
All India : Total	**431567**	**157442**	**149176**	**738185**	**149971**	**227173**	**316967**	**268726**	**687617**	**5189186**	**152732**	**6992372**	**7730557**
By Grades													
B.F./Sintering	207281	83881	25479	316641	45429	43062	113656	164974	408117	864387	32000	1671625	1988266
S.M.S.(O.H.)	44650	7846	15066	67562	23166	6920	21150	17629	47059	863949	341	980214	1047776
S.M.S.(L.D.)	14461	22526	61720	98707	692	5345	13778	7077	6253	142997	288	176430	275137
S.M.S.(O.H.& L.D mixed)	41180	6856	1683	49719	1938	39432	6729	30718	4000	184201	969	267987	317706
B.F. & S.M.S. mixed	52637	574	2267	55478	-	18469	1086	17340	33998	204851	-	275744	331222
Refractory	17847	3320	7043	28210	31536	67633	45021	-	-	524101	-	668291	696501
B.F., S.M.S.& Refractory	-	9215	10662	19877	-	1797	1258	-	-	5387	-	8442	28319
Glass	6855	12204	4692	23751	7352	21187	40019	2093	1297	129269	-	201217	224968
Others	33437	9970	13371	56778	6069	2289	18228	20651	46548	81251	23354	198390	255168
Unclassified	6160	745	4507	11412	30971	18471	34523	8162	58389	614525	-	765041	776453
Not-known	7059	307	2685	10051	2819	2570	21519	82	81956	1574268	95780	1778994	1789045
By States													
Andhra Pradesh	55507	2082	10708	68297	50324	2851	29135	554	132589	896855	1848	1114156	1182453
Arunachal Pradesh	-	-	-	-	-	-	-	-	204	77633	-	77837	77837
Chhattisgarh	41628	12984	6225	60837	19289	50384	24355	150795	24837	514235	1950	785845	846682
Gujarat	20130	1962	9803	31895	9556	26745	77285	20263	63780	295948	-	493577	525472
Haryana	-	-	-	-	5371	5149	3722	-	-	15247	-	29489	29489
Jharkhand	22700	-	-	22700	-	350	-	-	54	18330	-	18734	41434
Karnataka	86077	31399	10889	128365	18585	7826	15391	8519	17578	465852	-	533751	662116
Madhya Pradesh	26637	28553	27244	82434	17893	85680	67042	17250	291229	1601188	115087	2195369	2277803
Maharashtra	22741	11987	13325	48053	5612	1028	3569	7000	18050	337511	-	372770	420823
Odisha	119853	44549	2710	167112	19558	27887	76634	40387	39474	268930	33063	505933	673045
Rajasthan	34309	9601	20250	64160	3559	5598	19484	16502	25480	324604	784	396011	460171
Sikkim	-	-	-	-	-	-	-	-	-	2756	-	2756	2756
Tamil Nadu	-	-	-	-	-	-	-	2010	135	-	-	2145	2145
Uttar Pradesh	-	-	-	-	-	12622	-	3500	-	66230	-	82352	82352
Uttarakhand	1985	1798	22	3805	224	1052	349	1946	981	199592	-	204144	207949
West Bengal	-	12528	48000	60528	-	-	-	-	73226	104275	-	177501	238029

Figures rounded off.

Table – 2 : Details of Exploration Activities for Dolomite, 2010-11

Agency State/ District	Location/ Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
DGM							
Karnataka Tumkur	N/v Melanahalli	-	-	7	642.0		Reserves were not estimated.
DMG							
Rajasthan Udaipur	Iswal, Piprach, Jhalanka guda	1:10,000 1:2,000	20.0 4.0	-	-	60	Resources were not estimated due to incomlete receipt of analytical results.
MECL							
Arunachal Pradesh West Kameng	Rupa block	1:5,000	1.0	4	266.50	147	Rupa dolomite is of BF/SMS grade.Dolomite is grey white & black in colour with qaurtzite intercalation. Strike length of the deposit was found to be 2 sq km. Boreholes have intersected dolomite at various vertical depth ranging from 79 m - 105 m. Available chemical analysis was : Mg0 - 19.50% - 22.20%, Ca0 - 28.42% - 32.20% & $Si0_2$ - 0.36% - 6.64%.

Table – 3 : Principal Producers of Dolomite, 2010-11

Name & address of producer	Location of mine	
	State	District
Steel Authority of India Ltd., Ispat Bhavan, P.B.No. 3049, Lodhi Road, New Delhi – 110 003.	Chhattisgarh Jharkhand	Bilaspur Garhwa
*Bisra Stone Lime Co, A. G., Sourav Abason, Sector II, Saltlake, Kolkata – 700 091	Odisha	Sundergarh
Rastriya Ispat Nigam Ltd, Visakhapatnam Steel Plant, Visakhapatnam – 530 031, Andhra Pradesh	Andhra Pradesh	Khammam
Tata Steel Ltd., Bombay House , 24 Homi Modi Street, Mumbai 400 001	Odisha	Sundergarh
*South West Mining Ltd. 3rd floor, "The Estate '' # 121, Dickenson Road, Banglore – 560042 Karnataka.	Andhra Pradesh	Khammam
Manish Singh Banafer, P.O. Janjgir-Champa, Distt. Janjgir-Champa, Chhattisgarh	Chhattisgarh	Janjgir-Champa
Mysore Minerals Ltd., 39- M.G. Road, Bengaluru -560 001 Karnataka.	Karnataka	Bagalkot

Contd.

Table-3 (Concld.)

Name & address of producer	Location of Mines	
	State	District
Raikar Mineral Mining & PProcessing Inds., Raikar House, Bagalkot-587 001 Karnataka	Karnataka	Bagalkot
A. Sekhar Reddy, 20-1-2, Kondepeta, Dhone Mandal, Distt. Kurnool- 518 222 Andhra Pradesh	Andhra Pradesh	Kurnool
Associated Mining Co, Nanak House, H-2/133, Narmada Nagar, Dist. Bilaspur, Chhatisgarh.	Chhattisgarh	Bilaspur
Dolomite Mining Corpn. Khamaria Shakti Road , PO- Janjgir-Champa, Distt- Janjgir-Champa, Chhattisgarh	Chhattisgarh	Janjgir-Champa
# Khetan Business Corporation Pvt. Ltd, Old Bus Stand, NNathdwara Rajasthan.	Rajasthan	Rajsamand

Table – 5: Production of Dolomite, 2009-10 & 2010-11
(By Sectors/States/Districts)

(Qty in tonnes; value in ₹000)

State/District	2009-10 No. of mines	2009-10 Quantity	2009-10 Value	2010-11 (P) No. of mines	2010-11 (P) Quantity	2010-11 (P) Value
India	**123(49)**	**5911759**	**1672224**	**116(40)**	**5064875**	**1504152**
Public sector	6(1)	2616918	1039315	6(1)	2448788	1050830
Private sector	117(48)	3294841	632909	110(39)	2616087	453322
Andhra Pradesh	**15(13)**	**1577072**	**317824**	**14 (11)**	**1072132**	**276549**
Anantapur	4 (4)	58606	8171	4 (4)	40525	5593
Cuddapah	1	1900	190	1	570	57
Khammam	1	600642	178991	1	517893	191362
Kurnool	9(9)	915924	130472	8 (7)	513144	79537
Chhattisgarh	**24**	**1286514**	**335580**	**23**	**1387985**	**301339**
Bilaspur	12	1072624	300797	11	1077851	259273
Durg	9	46450	9248	8	39764	4009
Janjgir-Champa	3	167440	25535	3	253270	35492
Raigarh	-	-	-	1	17100	2565
Gujarat	**15(1)**	**346234**	**50554**	**12**	**84477**	**10094**
Bhavnagar	(1)	1520	456	-	-	-
Vadodara	15	344714	50098	12	84477	10094
Jharkhand	**1**	**422019**	**379817**	**1**	**429866**	**386879**
Garwah	1	422019	379817	1	429866	386879
Karnataka	**15(8)**	**385041**	**55044**	**15(10)**	**423490**	**65720**
Bagalkot	12(5)	330105	47908	12(8)	373320	59043
Belgaum	3(1)	48596	6026	3 (1)	48230	6192
Tumkur	(2)	6340	1110	(1)	1940	485
Madhya Pradesh	**42(2)**	**277017**	**36190**	**43(3)**	**243052**	**30079**
Balaghat	4	9340	1224	6	13744	1490
Chhindwara	1	191	29	1	14000	1030
Jabalpur	4(1)	27007	2057	4(1)	18922	2190
Jhabua	9	44944	5720	11	46566	5495
Katni	3(1)	11945	1118	1(2)	11182	934
Khargeon (W.Nimar)	1	13550	2033	1	19364	3250
Mandla	16	151529	21610	16	90131	12021
Seoni	4	18511	2399	3	29143	3669
Maharashtra	**5(5)**	**76625**	**15566**	**5(3)**	**76907**	**12655**
Chandrapur	1	123	10	1	4372	1189
Nagpur	3	12556	3043	3	12164	2648
Yavatmal	1(5)	63946	12513	1(3)	60371	8818
Odisha	**4(9)**	**1316371**	**450677**	**2(2)**	**1137103**	**388671**
Sundergarh	4(9)	1316371	450677	2(2)	1137103	388671
Rajasthan	**2(10)**	**224803**	**30966**	**1 (10)**	**206287**	**31826**
Rajasamand	(5)	136278	16504	(5)	133729	19743
Sikar	1(1)	348	35	(1)	88	9
Udaipur	1(4)	88177	14427	1 (4)	72470	12074
Uttarakhand	**(1)**	**63**	**6**	**(1)**	**3576**	**340**
Pithoragarh	(1)	63	6	(1)	3576	340

Figures in parentheses indicate number of associated mines with clay (others), kaolin ,limestone, magnesite and steatite.

Table -4 : Production of Dolomite, 2008-09 to 2010-11

(Qty in tonnes; value in ₹ '000)

State	2008-09		2009-10		2010-11 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**5509237**	**1554731**	**5911759**	**1672224**	**5064875**	**1504152**
Andhra Pradesh	1254886	277705	1577072	317824	1072132	276549
Chhattisgarh	1317858	361156	1286514	335580	1387985	301339
Gujarat	169447	22962	346234	50554	84477	10094
Jharkhand	301341	271207	422019	379817	429866	386879
Karnataka	354015	52262	385041	55044	423490	65720
Madhya Pradesh	199377	25986	277017	36190	243052	30079
Maharashtra	94896	16849	76625	15566	76907	12655
Odisha	1616347	502265	1316371	450677	1137103	388671
Rajasthan	147123	19807	224803	30966	206287	31826
Uttarakhand	53947	4532	63	6	3576	340

Table -6 : Production of Dolomite, 2009-10 & 2010-11 (P)
(By Frequency Groups)

(Qty in tonnes)

Production group	Number of mines		Production for the group		Percentage in total production		Cumulative percentage	
	2009-10	2010-11	2009-10	2010-11	2009-10	2010-11	2009-10	2010-11
All Groups	**123(49)**	**116(40)**	**5911759**	**5064875**	**100.0**	**100.0**	-	-
Up to 1000	24(12)	28(9)	11660	11038	0.20	0.22	0.20	0.22
1001-5000	28(15)	32(15)	112403	135577	1.90	2.68	2.10	2.90
5001-10000	10 (3)	10(4)	92840	98034	1.57	1.93	3.67	4.83
10001-50000	45(15)	34(9)	1275882	994737	21.58	19.64	25.25	24.47
50001-200000	12(2)	8(1)	988287	783351	16.72	15.47	41.97	39.94
Above-200000	4 (2)	4 (2)	3430687	3042138	58.03	60.06	100.0	100.0

Figures in parentheses indicate number of associated mines with clay (others), kaolin, limestone, magnesite and steatite.

Table -7 : Mine-head Stocks of Dolomite, 2010-11 (P)
(By States)

(In tonnes)

State	At the beginning of the year	At the end of the year
India	**1689371**	**1661153**
Andhra Pradesh	344336	459021
Chhattisgarh	238948	104860
Gujarat	22156	8395
Jharkhand	26402	30296
Karnataka	190453	213800
Madhya Pradesh	80022	70351
Maharashtra	47454	61176
Odisha	647911	591780
Rajasthan	91626	121438
Uttarakhand	63	36

MINING AND MARKETING

Dolomite mines are generally worked by opencast method of mining. Manual working is in vogue in most mines. However, a few mines are semi-mechanised.

Steel plants draw major supplies of dolomite for use as a flux and also as a refractory material. The requirement of low silica dolomite is increasing in steel plants at Bhilai, Rourkela, Visakhapatnam and Jamshedpur. However, the supply of such materials from indigenous sources is posing a problem. Therefore, Bokaro, Rourkela, Durgapur and Jamshedpur steel plants are drawing supplies of low silica dolomite from Bhutan for use in tar-bonded refractory bricks required for lining of LD furnaces and also for fluxing purposes.

Bhilai, Bokaro, Rourkela, Jamshedpur, Visakhapatnam and Bhadravati steel plants have captive mines. Besides, these plants draw supplies from private parties. Dolomite produced from Tulsidamar mine in Garhwa district, Jharkhand, is used mainly by Bokaro Steel Plant.

Dolomite produced in Tumkur district of Karnataka is supplied to the ferro-manganese plants at Dandeli, Uttar Kannad district. The VISP's steel plant at Bhadravati receives its supplies from Nerelekere mine in Bagalkot, Karnataka.

Dolomite of Baradwar and Hirri areas in Chhattisgarh is supplied to the steel plants at Bhilai, Bokaro and Rourkela besides foundry and glass manufacturing units. Birmitrapur, Panposh and Gomardih areas of Sundergarh district, Odisha, supplied dolomite to iron and steel plants at Durgapur, Rourkela, Burnpur and Jamshedpur. Dolomite from this region is also used by the ferro-manganese plants at Joda and Rayagada in Odisha. Low-silica dolomite from Jayanti area in Jalpaiguri district of West Bengal is supplied mainly to steel plants at Durgapur and Jamshedpur.

In Odisha and Rajasthan dolomite is supplied to the foundry and grinding units. The production from Vadodara district, Gujarat, is used for making chips and tiles. In Gujarat and Maharashtra, dolomite is used for making potteries and in ferro-alloys industry.

Dolomite produced in Jhabua district, Madhya Pradesh, is utilised by fertilizer, tile-making and grinding units. Dolomite of Jabalpur and Mandla districts is supplied to chips manufacturing units at Katni and Bhilai, respectively.

USES

Dolomite after calcination is used for refractory purposes (as a substitute of magnesite refractories) in linings of furnaces like basic open-hearth steel furnaces and basic Bessemer converters.

High purity dead-burnt dolomite bricks are required for lining LD furnaces while mini-steel plants generally require dolomite for fettling and refractory purposes.

Like limestone, dolomite is used as a flux in iron & steel, ferro-alloys and glass works. A few steel plants have dispensed with the use of dolomite in blast furnaces and its use in the preparation of self-furxing sinters is found adequate for blast-furnace charge.

It is useful in the recovery of magnesia and also in the manufacture of magnesium metal; for the manufacture of basic magnesium carbonate (termed 'technical carbonate'), 'block magnesia' or 'magnesia alba' used in pipe and boiler coverings and for other heat insulation, in pharmaceutical, rubber and chemical industries, and in the manufacture of paper, leather, glass, potteries and high-magnesium limes. In agriculture, it is used as a soil conditioner to correct acidity. It finds use as a filler in fertilizers, paints & varnishes, for supression of dust in coal mines. It is not also as a building stone and in the making of floring tiles as chips & powder..

SPECIFICATIONS

Generally, insolubles like SiO_2, Fe_2O_3 and Al_2O_3 are considered deleterious constituents of dolomite for any industrial use. It is essential that these insolubles should be as low as possible. High purity dolomite with less than one per cent insolubles is preferred for making refractory bricks which are used in the lining of LD furnaces.

Similarly, high-grade dolomite containing as low iron as possible (less than 0.15%) is required in glass industry. The IS specifications of dolomite for use in glass industry are given in Table-8. The general specifications of dolomite consumed in different steel plants are given in Table-9. Specifications for flux grade dolomite for use in iron & steel industry have been revised and are prescribed in IS : 10346 - 2004 (second revision, Reaffrmed 2009) while specification of dolomite for refractory industry are prescribed in IS : 14296 - 1995 (Reaffirmed 2010). IS : 15366 - 2003 (Reaffirmed 2009) lays down the specifications of dolomite for paint industry

CONSUMPTION

Dolomite is consumed by iron & steel, ferro-alloys, fertilizer, glass, alloy steel and other industries. The total consumption of dolomite in 2010-11 was 5.94 million tonnes. It increased by 2% from that in the year 2009-10, mainly in sponge iron industry. Iron & steel industry was the major consumer of dolomite in 2010-11 accounting 75%, followed by sponge iron (17%) and cement & ferro-alloys (2% each). The remaining quantity was utilised by other industries, such as alloy steel, glass, fertilizer, paint, refractory, etc. (Table - 10).

Table – 8 : Specifications of Limestone and Dolomite for Glass Industry (IS : 997-1973; First Revision; Reaffirmed 2008)

Constituent	Requirement on dry basis (per cent)
Lime (as CaO)	53.00 (min)*
Total lime and magnesia (as CaO + MgO)	54.50 (min)
Silica (as SiO_2)	2.50 (max)
Total iron (as Fe_2O_3)	
(a) Calcite or marble	0.05 (max)
(b) Limestone	0.10 (max)
(c) Dolomitic limestone and dolomite	0.15 (max)

**In case of dolomitic limestone and dolomite, requirement of lime as CaO may be fixed by mutual agreement between the purchaser and supplier.*

Table - 10: Reported Consumption of Dolomite, 2008-09 to 2010-11 (By Industries)

(In tonnes)

Industry	2008-09	2009-10(R)	2010-11(P)
All Industries	**5555400**	**5802400**	**5942200**
Alloy steel	19900(5)	42400(5)	53800(5)
Cement	102300(4)	107200(4)	110500(4)
Ceramic	9700(5)	17800(6)	20100(6)
Cosmetic	300(1)	700(1)	400(1)
Ferro-alloys	104400(23)	102500(25)	126500(26)
Fertilizer	9500(4)	12100(4)	11300(4)
Foundry	1300(5)	1900(5)	1900(5)
Glass	81900(29)	83100(29)	82200(29)
Iron & steel 1/	4798500(26)	4363700(30)	4455300(30)
Paint	27700(12)	27800(11)	27800(12)
Refractory	63400(2)	63400(3)	63400(3)
Sponge iron	335900(28)	979200(35)	988400(35)
Others (Chemical, electrical, electrode and rubber)	600(6)	600(6)	600(6)

Figures rounded off. Data collected on non-statutory basis. Figures in parentheses denote the number of units in organised sector reporting consumption.*
*(*Includes actual reported consumption and/or estimates made wherever required).*
1/ The figures for iron & steel and pelletisation (iron & steel) added.

Table – 9 : General Specifications of Dolomite Consumed in Different Steel Plants

(In Per cent)

Plant	Constituent	SP/BF	SMS	Refractory
Bhilai Steel Plant	MgO	19 (min)	19 (min)	19 (min)
	CaO	29 (min)	29 (min)	29 (min)
	SiO_2	4 (max)	3.5 (max)	3.5 (max)
	Size	10-60 mm	10 to 30 mm	30-60 mm
Bokaro Steel Plant	MgO	1.65-22.0	–	–
	CaO	23.2-34.8	–	–
	SiO_2	1.0-20.0	–	–
	Size	25-75 mm	30-50 mm	5 to 25 mm
Rourkela Steel Plant	MgO	19 (min)	20 (min)	21 (min)
	CaO	–	–	-
	SiO_2	–	2.5 (max)	1.5 (max)
	Al_2O_3	–	1.5 (max)	0.75 (max)
	Fe_2O_3	–	1.0 (max)	1.0 (max)
	AI	8 (max)	–	–
	Size	up to 6 mm	40 to 80 mm	–
Durgapur Steel Plant	MgO	19.5 (min)	20 (min)	–
	CaO	–	30-35	–
	SiO_2	6 (max)	1.5 (max)	–
	Al_2O_3	–	0.8 (max)	–
	Fe_2O_3	–	1.0 (max)	–
	AI	10 (max)	–	–
	LOI	–	44.0	–
	Size	15-50 mm	30-60 mm	–
IISCO Steel Plant	MgO	19.5 (min)	20.0 (min)	–
	SiO_2	–	1.5 (max)	–
	Size	25 to 75 mm	3 to 20 mm	–
Tata Steel Ltd	MgO	20 (min)	20 (min)	20 (min)
	SiO_2	–	3.45	1.7 (max)
	AI	6 (max)	6 (max)	1.5 (max)
	Size	20 to 75 mm	25 to 50 mm	5 to 25 mm
Visvesvaraya Iron & Steel Plant	MgO	–	21-22	–
	CaO	–	30-31	–
	SiO_2	–	1-1.70	–
	Size	–	10 to 50 mm	–
Visakhapatnam Steel Plant	MgO	18.0 (min)	21.0 (min)	–
	CaO	28.0 (min)	30.0 (min)	–
	SiO_2	4.0 (max)	1.0 (max)	–
	LOI	44.95	46.00	–
	Size	6 to 80 mm	25-50 mm & 5 to 25 mm	–
JSW Steel Ltd	CaO + MgO	–	>45	–
	MgO	–	>19	–
IDCOL, Kalinga Iron Works	MgO	19.50 (min)	–	–
	AI	8.00 (max)	–	–
	Size	25-75 mm	–	–
Kirloskar Ferrous Industries Ltd	MgO	19 (min)	–	–
	CaO	28 (min)	–	–
	SiO_2	3 (max)	–	–
	Al_2O_3	1 (max)	–	–
	P	0.05 (max)	–	–
	Size	10 to 40 mm	–	–
Visa Steel Ltd	CaO	28% (min)	–	–
	Size	4-8 mm	–	–
		10-50 mm	–	–
KIOCL Ltd	MgO	19.0 (min)	–	–
	CaO	29.0 (min)	–	–
	SiO_2	3.5 (max)	–	–
	LOI	43.0 (min)	–	–
	Size	10-40 mm		
Neelachal Ispat Nigam Ltd	MgO	19.5 (min)	–	–
	Size	Up to 60 mm	–	–

Note: *SP: Sinter plant; BF: Blast furnace; SMS: Steel melting shop; AI: Acid insolubles*

FOREIGN TRADE

Exports

Exports of dolomite increased slightly to 22,871 tonnes in 2010-11 from 18,707 tonnes in 2009-10. Exports were mainly to Nepal (56%), Bangladesh (27%) and Malaysia (6%) in 2009-10 (Table - 11).

Table – 11 : Exports of Dolomite (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ 000)	Qty (t)	Value (₹ '000)
All Countries	**18707**	**46616**	**22871**	**62679**
Nepal	10679	20934	12927	24853
Bangladesh	3017	5432	6105	18341
Malaysia	514	3100	1298	7196
UAE	420	2777	732	3680
Ujibouti	544	3194	439	1961
Kenya	-	-	184	1140
Oman	432	2070	203	1100
Sudan	-	-	129	968
Saudi Arabia	-	-	231	903
Yemen Republc	-	-	216	718
Other countries	3101	9109	407	1819

Imports

Imports of dolomite increased considerably to 611,833 tonnes in 2010-11 from 450,979 tonnes in 2009-10. Imports were mainly from UAE (61%) and Thailand (36%) (Table - 12).

Table – 12 : Imports of Dolomite (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹ '000)
All Countries	**450979**	**991241**	**611833**	**1395183**
Thailand	295922	652553	222205	743080
UAE	-	-	374538	363966
Italy	5235	118115	10154	219654
Philippines	24150	31861	4300	54275
China	10232	4868	168	6310
Spain	148	933	290	4554
UK	318	3381	97	1395
Austria	–	–	60	1305
Norway	57	856	19	549
Switzerland	2	109	1	67
Other countries	114915	178565	1	28

FUTURE OUTLOOK

Over 95% of the total production of dolomite finds outlet mainly in iron and steel and allied industries. The importance of high purity dead-burnt dolomite bricks for lining LD furnances has gained ground due to LD processs of steel making. At the same time, a few of the steel plants have dispensed with the use of dolomite in blast furnace. Dolomite used in the preparation of self-fluxing sinters is found adequate for the blast furnace charge. Mini-steel plants generally require dolomite for fettling and refractory purposes only.

The resources of the refractory grade dolomite in the country are meagre and this type of material is in short supply but very much required for making tar-bonded dolomite bricks. Therefore, intensive search is needed in non-Himalayan regions for locating deposits of massive non-crystalline dolomite, containing less than 2.5% R_2O_3 for use in tar-dolomite bricks required for lining of LD steel furnaces. The Sub-Group - II of the Working Group on Minerals for the 12th Plan has recommended the exploration of low silica dolomite in the states of Andhra Pradesh and Odisha may be initiated by the State DGMs.

The Sub-Group has estimated the apparent domestic demand of dolomite at 6.15 million tonnes by 2011-12 and at 9.46 million tonnes by 2016-17 at 9% growth rate.

Indian Minerals Yearbook 2011
(Part- II)

50th Edition

DUNITE & PYROXENITE

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

33 Dunite & Pyroxenite

Dunite is a monomineralic ultrabasic rock consisting of more or less pure olivine. Dunite typically contains 36 to 42% MgO and 36 to 39% SiO_2. Pyroxenite is also an ultrabasic rock consisting of pyroxenes; i.e., predominantly ferromagnesian minerals other than olivine. Olivine is a commercial source of magnesia combined with silica for use in metallurgy, fertilizer, etc. There is a rising trend in use of dunite and pyroxenite in sintering and as a fluxing agent in blast furnace in place of dolomite.

RESOURCES

In India, occurrences of dunite are reported in association with other ultrabasic rocks in chrysotile-bearing areas of Jharkhand and Karnataka; chromite-bearing areas in Odisha, Karnataka, Jharkhand and Nagaland and magnesite-bearing areas in Karnataka and Tamil Nadu. As per the UNFC system, total resources of dunite in the country as on 1.4.2010 are estimated at about 185 million tonnes of which 17 million tonnes constitute reserves (about 15 million tonnes proved reserves and 2 million tonnes probable reserves) and 168 million tonnes remaining resources. Dunite resources are located mainly in Tamil Nadu (63%) and Karnataka (17%). The remaining 20% resources are in Jharkhand, Odisha and Nagaland. Reserves/resources of dunite are furnished in Table-1.

The occurrences and production of pyroxenite are reported from Jajpur and Singhbhum (East) districts of Odisha and Jharkhand, respectively. However, no resource estimates are available.

EXPLORATION

During the course of Platinum Group of Elements (PGE) investigations, GSI conducted preliminary exploration in 2010-12 in the pyroxenite bearing basic/ultrabasic/ultramafic rocks in parts of Maharashtra & Tamil Nadu and also during the investigation for gold & chromite mineralisation in parts of Jharkhand & Andhra Pradesh, respectively. The details of exploration are given in Table - 2.

PRODUCTION, STOCKS AND PRICES

Dunite

Dunite is mainly obtained incidental to mining of magnesite. Its production at 18,591 tonnes during 2010-11 decreased by 74% as compared to that in the previous year mainly due to non-availability of sale permit to Karya magnesite mines leading to stoppage in production of dunite.

The production of dunite was reported from only one primary mine which was in public sector located in Chickmagalur district of Karnataka. In addition, dunite was also obtained as an associated mineral from public sector magnesite mines located in Salem district of Tamil Nadu and Mysore district of Karnataka. Thus, the entire production of dunite during the year was reported from public sector only (Tables - 3 to 5).

Mine-head stocks of dunite at the end of 2010-11 were 5,460 tonnes as against 7,042 tonnes at the beginning of the year (Table - 6).

Average daily employment of labour in the sole primary mine of dunite was 7 during 2010-11 as against 3 in the preceding year. Prices of dunite are furnished in General Review on 'Prices'.

Table – 3: Producers of Dunite, 2010-11

Name and address of producer	Location of mine	
	State	District
Tamil Nadu Magnesite Ltd,* 5/53, Omalur Main Road, Jagir Ammapalayam, Salem – 636 302, Tamil Nadu.	Tamil Nadu	Salem
Mysore Minerals Limited,* 39-Mahatma Gandhi Road, Bengaluru, Karnataka.	Karnataka	Mysore
Steel Authority of India Ltd, Visvesvaraya Iron & Steel Plant, Bhadravati – 577 301, Karnataka.	Karnataka	Chickmagalur

* *Producing dunite as an associated mineral with magnesite.*

Table – 1: Reserves/Resources of Dunite as on 1.4.2010
(By Grades/States)

(In '000 tonnes)

Grade/ State	Reserves				Remaining resources								Total resources (A+B)
	Proved STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
		STD121	STD122			STD221	STD222						
All India: Total	**14894**	**-**	**2243**	**17137**	**130**	**4717**	**107597**	**24516**	**1164**	**21471**	**8637**	**168231**	**185368**
By Grades													
Grade-I	6005	-	1326	7331	130	-	37569	24516	780	11007	2157	76158	83489
Grade-II	5551	-	917	6468	-	4717	70028	-	384	5664	6480	87273	93741
Unclassified	3337	-	-	3337	-	-	-	-	-	4800	-	4800	8137
By States													
Jharkhand	373	-	570	943	130	-	140	607	780	6121	8637	16415	17358
Karnataka	3718	-	223	3940	-	-	-	23909	-	4149	-	28058	31998
Nagaland	-	-	-	-	-	-	-	-	-	4800	-	4800	4800
Odisha	3337	-	-	3337	-	4717	5267	-	384	627	-	10995	14333
Tamil Nadu	7466	-	1450	8916	-	-	102190	-	-	5773	-	107963	116879

Figures rounded off.

Table-2 : Details of Exploration Activities forPyroxenite,2010-11

Agency/ State/ District	Location/ Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks
		Scale	Area (sq km)	No. of bore-holes	Meterage		
GSI							
Andhra Pradesh Krishna & Khamman	Eastern Ghat (area between Kondapalli&Gangineni)	--	--	--	--	--	Reconnaissance stage investigation (G-4) during FS 2010-12 for chromite mineralisation was taken up in the area. The rock types encountered in Kondapalli and surrounding areas are pyroxenite, granulite &charnockite with enclaves of pyroxenite. The work is in progress.
Jharkhand Saraikela Kharswan	Rudia-Largadih Balidih block	--	--	--	--	--	In the course of gold investigation during prospecting stage (G-3) during FS 2010-12, the Rudia block was observed to comprise lithopackages of mafic (meta-basalt) / ultramafic (pyroxenite). The work is in progress.
Maharashtra Sindhudurg	Kankavali Janoli area	Large	--	--	--	--	Chromitiferous meta-pyroxenite exposedwith width of nearly 8 m has been delineated during reconnaissance stage investigation (G-4).
Chandrapur	Heti	--	--	--	--	--	During prospecting stage (G-3) investigation, two parallel mineral-isedgabbro-norite-pyroxenitebod-ies with anomalous PGE values have been mapped intermittently for a stretch of 600 m in this block.
Tamil Nadu	Solavanur and Karappadi block	--	--	--	--	--	Seven meta-pyroxenite bands with a cumulative thickness of 18.5 m have been delineated during the Reconnaissance stage for PGE investigation (G-4).
-do-	Mallanayakan Palayam block	--	--	03	--	--	Three boreholeshave been drilled in this block to intersect the meta-pyroxenite bands. The work is in progress.
-do-	Muttupalaiyam Ultramafic belt	1:12,500	163	--	--	64 & 53	Meta-pyroxenite bands have been demarcated during Reconnaissance (G-4) stage investigation for PGM in FS 2010-12. The work is in progress.
MECL							
Odisha Sundergarh	Rajabasa block, 65 km from Rourkela Railway Station	1:5,000	0.20	05	441.50	84	Exploration for high magnesium flux ultramafic rocks was taken up in 2011. The boreholes have intersected ultramafic bodies like dunite, pyroxenite, etc. having thickness of 7-16 m.

Table – 4 : Production of Dunite, 2008-09 to 2010-11 (By States)

(Qty in tonnes; value in ₹'000)

State	2008-09		2009-10		2010-11 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**50935**	**23482**	**71642**	**19281**	**18591**	**5196**
Karnataka	32550	7486	37346	8830	1971	360
Tamil Nadu	18385	15996	34296	10451	16620	4836

Table – 5: Production of Dunite, 2009-10 and 2010-11 (By Sectors/States/Districts)

(Qty in tonnes; value in ₹'000)

State/District	2009-10			2010-11 (P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India	**1(3)**	**71642**	**19281**	**1(2)**	**18591**	**5196**
Public sector	1(2)	57792	14780	1(2)	18591	5196
Private sector	(1)	13850	4501	-	-	-
Karnataka	**1(1)**	**37346**	**8830**	**1(1)**	**1971**	**360**
Chickmagalur	1	1996	170	1	1101	146
Mysore	(1)	35350	8660	(1)	870	214
Tamil Nadu	**(2)**	**34296**	**10451**	**(1)**	**16620**	**4836**
Salem	(2)	34296	10451	(1)	16620	4836

** Figures in parentheses indicate the number of associated mines producing magnesite.*

Table – 6: Mine-head Stocks of Dunite 2010-11(P) (By States)

(In tonnes)

State	At the beginning of the year	At the end of the year
India	**7042**	**5460**
Karnataka	2511	3381
Tamil Nadu	4531	2079

Table – 7: Principal Producers of Pyroxenite 2010-11

Name and address of producer	Location of mine	
	State	District
* Tata Steel Ltd, Bombay House, 24-Homi Mody Street, Mumbai - 400 001.	Odisha	Jajpur
Pravat Kumar Aditya Deo, 605/5, Radha Colony, Khasmahal, Tata Nagar, Singhbhum East-831 002 Jharkhand.	Jharkhand	Singhbhum East

** Associated mine with chromite.*

Pyroxenite

The total production of pyroxenite at 240,412 tonnes in 2010-11 decreased by 14% over the previous year. There were three reporting mines during both the years. Besides, production of pyroxenite was reported as an associated mineral by one chromite mine which contributed about 77% of the total output (Tables - 7 to 10).

The mine-head stocks at the beginning of 2010-11 was 28,767 tonnes as against 19,216 tonnes at the end of the year (Table - 11).

The average daily labour strength employed in pyroxenite mines in 2010-11 was 121 as against 129 in the previous year.

Table – 8: Production of Pyroxenite, 2008-09 to 2010-11

(By States)

(Quantity in tonnes; value in ₹'000)

State	2008-09		2009-10		2010-11 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**281785**	**139143**	**279332**	**152371**	**240412**	**121639**
Jharkhand	50875	13297	49638	13176	54987	13798
Odisha	230910	125846	229694	139195	185425	107841

Table – 9: Production of Pyroxenite, 2009-10 & 2010-11

(By Sectors/States/Districts)

(Quantity in tonnes; value in ₹'000)

State/District	2009-10			2010-11 (P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India	**3(1)**	**279332**	**152371**	**3(1)**	**240412**	**121639**
Private sector	3(1)	279332	152371	3(1)	240412	121639
Jharkhand	**3**	**49638**	**13176**	**3**	**54987**	**13798**
Singhbhum (East)	3	49638	13176	3	54987	13798
Odisha	**(1)**	**229694**	**139195**	**(1)**	**185425**	**107841**
Jajpur	(1)	229694	139195	(1)	185425	107841

Figures in parentheses indicate number of associated mines.

Table – 10 : Production of Pyroxenite, 2009-10 & 2010-11
(By Frequency Groups)

(Quantity in tonnes)

Production group	No. of mines		Production for the group		Percentage in total production		Cumulative percentage	
	2009-10	2010-11	2009-10	2010-11	2009-10	2010-11	2009-10	2010-11
Total	**3(1)**	**3(1)**	**279332**	**240412**	**100.00**	**100.00**	**-**	**-**
Up to 10000	1	1	9311	8334	3.33	3.47	3.33	3.47
10001-50000	2	2	40327	46653	14.44	19.40	17.77	22.87
50001 and above	(1)	(1)	229694	185425	82.23	77.13	100.00	100.00

Figures in parentheses indicate number of associated mines.

Table – 11: Mine-head Stocks of Pyroxenite, 2010-11 (P)
(By States)

(In tonnes)

State	At the beginning of the year	At the end of the year
India	**28767**	**19216**
Jharkhand	7355	4338
Odisha	21412	14878

USES

Dunite and pyroxenite are preferred as flux to dolomite as a source of MgO in sintering and also in iron and steel industry. Main benefits of olivine over dolomite in slag conditioning are: higher MgO content, no requirement of preheat treatment, reduced energy consumption, lower coke consumption, reduced slag volume and lower CO_2 emissions. Presence of higher amount of silica in dolomite leads to lower sinter basicity (i.e. CaO/SiO_2) at around 2.5 than 3.5 of dolomite and the phases in sinter change to those having better reducibility. The net result is a reduction in the resistance of the cohesive zone to gas flow in the blast furnace leading to drop in fuel rate and higher productivity. In addition, the magnesium silicates do not call for calcination (unlike the carbonates) and thus lowers energy requirement in the blast furnace. At Tata Steel, about 20 kg pyroxenite is added directly for a tonne of hot metal in the blast furnace burden while limiting the MgO content in sinter to 1.5-1.7 percent.

Olivine helps to condition the slag as well as to control the basicity through reduction of alkali recirculation. Its higher reaction temperature reduces low temperature breakdown and swelling of burden, thus maintaining permeability and reducing coke consumption. The olivine may be added directly to the blast furnace charge as lump (10 to 40 mm), a sinter feed (3 to 6 mm), or mixed with low silica iron ore fines and pressed into pellets. When lump is added directly to the furnace, olivine can replace partly limestone and dolomite flux in the reduction of iron ore. In comparison with dolomite, olivine has a higher MgO content (requires less material for a given MgO level), MgO: SiO_2 ratio (allows MgO levels to be raised without changing the basicity of the slag) and lower LOI, i.e. 0.3-0.7% (conserves the energy required to drive off unwanted carbon dioxide). As a sinter feed, olivine reduces the sintering temperature by 100^{0}C max, thus producing harder sinter and less fines. Olivine is added directly to the iron ore as a flux during the formation of the pellets so that the fluxed pellets swell less, reduce more quickly and have a narrower melting range. However, on the other side, high silica content in olivine restricts its use to low silica iron ores because a high total silica content creates excessive slag formation.

Dunite is well suited as a refractory having low and uniform coefficient of thermal expansion, good resistance to thermal shock, spalling and slag attack, a high green strength and resistance to metal attack. Dunite may be calcined in rotary kilns at 1,650^{0}C for refractory and foundry applications. Other uses of olivine are as loose-grainshot blasting abrasive, filtration media, in mineral wool production, filler in speciality paints, asphalt, mastics and weighing agent in concrete oil poduction platforms. Olivine also contributes magnesia and iron as nutrients to the soil.

SPECIFICATIONS

Olivine should contain 45 to 51% MgO, 40 to 43% SiO_2, 7 to 8% Fe_2O_3, 0.2 to 0.8% CaO and 1.8 to 2% Al_2O_3 and TiO_2, MnO, Cr_2O_3, NiO and CaO for various uses. For blast furnace use, olivine should contain 47 to 48% MgO with 10 to 40 mm lump size. For foundry use, the size should be AFS 20, 30, 60, 90, 120 and for flour, filler and fertilizer grades, size recommended is up to 0.8 mm, up to 0.02 mm and less than 0.1 mm, respectively.

As per the end use grade classification, the reserves of 'fresh' and 'weathered' dunite had been classified as Gr. I and Gr. II, respectively. However, it was recommended to also assign chemical specification to these grade based on the experience of Tata Steel Ltd and GSI as given below:

Grade	MgO%	SiO_2%	LOI%	Cr_2O_3%
Grade-I	41.12	33.41	12.74	below 1
Grade-II	32.44	29.16	24.09	–

For steel and alloy manufacturing, pyroxenite lumps as well as fines/dust are being consumed. Tata Steel is a major supplier of pyroxenite to the ferro-alloy manufacturers. The specifications of pyroxenite as per Indian Ferro Alloys Producers Association (IFAPA) are as follows:

Grade	MgO%	SiO_2%	Al_2O_3%	CaO%	Cr_2O_3%
Grade-1	34 min	36-39max	1-2	1-3 min	1 min
Grade-2	34.38	35	1-2	1 max	3.5 - 6

BIS has adopted IS: 7297-1974 (reaffirmed 2008) as specification for olivine sand for use in steel foundries.

CONSUMPTION

Dunite is being consumed almost entirely by the refractory industry. Reported consumption of dunite in the organised sector was 6,100 tonnes in the year 2010-11, an increase of 45% from the previous year. Entire consumption was in Refractory industry; iron and steel industry did not report consumption (Table - 12).

Table - 12: Reported Consumption of Dunite 2008-09 to 2010-11 (By Industries)

(In tonnes)

Industry	2008-09	2009-10(R)	2010-11(P)
All Industries	**5300**	**4200**	**6100**
Iron & Steel	1100(1)	- (1)	- (1)
Refractory	4200(4)	4200(4)	6100(4)

Figures rounded off. Data collected on non-statutory basis. Figures in parentheses denote the number of units in organised sector reporting consumption.*

*(*Includes actual reported consumption and/or estimates made wherever required).*

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

EMERALD

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

34 Emerald

Emerald has decorative value because of its superb colours. It shows various colours like yellowish-green, bluish-green or blue. However, the unique velvety green colour of fine emerald places it among the most precious stones.

Emerald, a transparent, pale-green to sea-green variety of beryl, is chemically a complex silicate of aluminium and beryllium. Aquamarine, being blue-green to light-blue is the other gemstone variety of beryl. The hardness of emerald is 7.5 and aquamarine 7.5 to 8 on Mohs' scale. These minerals have specific gravity of 2.63 to 2.80 and are doubly refractive having 1.58 RI.

RESOURCES

Occurrences of emerald are reported from Rajasthan, Odisha, Tamil Nadu and Andhra Pradesh. However, reserves have not been estimated so far. In Rajasthan, emerald occurs at a number of places in Udaipur, Rajsamand and Ajmer districts. Emerald-bearing zones are found along 195-km long ultramafic rocks. The bands of vermiculite-actinolite schist with tourmaline are seen occasionally at the contact of pegmatites with emerald-bearing schist. In Ajmer district, emerald-bearing zones are located at Gudas and Bubani. Commercial deposits of emerald are reported from Tikhi, Kalaguman, Kanj-ka-Kheda, etc. areas in Rajsamand district.

In Odisha, occurrences of emerald are reported from Bira-Mohorajpur belt in Bolangir district, which extends into Sambalpur and Dhenkanal districts. Ghuchapada and Barmal prospects in Bolangir district are the potential areas.

In Eastern Ghat belt of Visakhapatnam district, Andhra Pradesh, pegmatite veins containing beryl and aquamarine, besides other gemstones are reported from several places.

PRODUCTION

Production of emerald has not been reported since 1983.

MINING AND MARKETING

In Ajmer-Rajsamand belt of Rajasthan, emerald occurrences are confined to the upper fringes of pegmatites. Emerald was mined manually by opencast method in the past. The pits were worked at shallow depths. The stones collected during mining were sorted out according to size, shape and quality. The stones so collected were deposited with the State Government under the supervision of DMG officials and mine owners. Crude emerald was sold by public auction.

The beauty of rough stone is enhanced by skillful cutting and polishing into faceted or rounded form for use in jewellery. The rough stones are sorted out to determine the angles to which facets can be cut. They may be sawed or polished in any direction according to shape, size and colour to be retained. After the shape and size are determined, the next process of 'pre-shaping' is done. The third and important process 'calibration' gives the pre-shaped stone a definite proportion and size. The process that follows is 'faceting' and 'polishing'. The aim of this process is to achieve maximum internal reflection enhancing the beauty of stone. Emeralds are generally given a step-cut or cabochon-cut.

Jaipur in Rajasthan is the major centre for processing emeralds. Like diamonds, uncut emerald is imported and part of it is exported after processing. Emerald is next to diamond (uncut) amongst precious and semi-precious stones, being imported and re-exported after cutting and polishing.

WORLD REVIEW

World production of emerald is reported mainly from Colombia, Pakistan and Afghanistan. In Africa, Nigeria, Mozambique, Madagascar and Zimbabwe are other important emerald producing countries.

In recent years Madagascar, was a globally significant producer of gem stone that included emerald, ruby and sapphire. Emerald was produced near Mananjary. Societe Orgaco of France mined the emerald (536 kg Heavan's gift) in matrix at the Morafeno mine near Mananjary and exported it to Reunion.

Aquamarines: A few aquamarine gems are found in gravels at Magok in Myanmar. Aquamarine is also produced in Namibia, Sri Lanka, Mozambique, Madagascar, Nigeria, South Africa and Brazil.

FOREIGN TRADE

Exports

In 2010-11, exports value of emerald (cut & uncut) decreased to ₹ 377.52 crore from ₹ 482.64 crore in the previous year. The share of cut emerald was about 99% and that of uncut emerald was merely 1% in 2010-11. Exports were mainly to Hong Kong (33%), USA (25%), Thailand (11%) and Singapore (9%) (Tables - 1 to 3).

Imports

In 2010-11, imports value of emerald (cut and uncut) increased to ₹ 495.71 crore from ₹ 390.56 crore in the previous year. The share of uncut emerald in total value was 48% and that of cut emerald was 52% in 2010-11. Imports were mainly from Hong Kong (33%), Thailand (15%), Zambia (13%) and Brazil (9%) (Tables - 4 to 6).

Table – 1 : Exports Value of Emerald (Cut & Uncut) : Total (By Countries)

(Value in ₹'000)

Country	2009-10	2010-11
All Countries	**4826365**	**3775168**
Hong Kong	1064951	1230878
USA	1100039	943215
Thailand	364483	422552
Singapore	887043	352436
Germany	160099	133981
Japan	133548	117344
Switzerland	95602	102798
UAE	53117	96913
Italy	152671	60738
UK	584115	50708
Other countries	230697	263605

Note: *Quantity not given due to partial coverage; value figures, however, have full coverage.*

Table – 2 : Exports of Emerald (Cut) (By Countries)

Country	2009-10		2010-11	
	Qty ('000 Crt)	Value (₹'000)	Qty ('000 Crt)	Value (₹'000)
All Countries	**14213**	**4505533**	**17179**	**3722857**
Hong Kong	2592	1032641	2842	1230878
USA	5249	1088040	5127	943215
Thailand	2091	364483	4340	422552
Singapore	1118	887014	1224	352436
Germany	394	159976	621	133981
Japan	985	133548	1543	117344
Switzerland	111	95602	132	102798
UAE	41	52513	110	96913
Italy	648	152671	480	60738
UK	290	311488	93	50708
Other countries	694	227557	667	211294

Table – 3 : Exports of Emerald (Uncut) (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**1**	**320832**	**4**	**52311**
Hong Kong	++	32310	4	34250
Israel	++	2920	++	6959
UK	1	272627	++	5123
Italy	-	-	++	4231
Thailand	-	-	++	795
Germany	++	123	++	503
USA	++	11999	++	425
Sri Lanka	-	-	-	25
Other countries	++	853	-	-

Table – 4 : Imports Value of Emerald (Cut & Uncut) (By Countries)

(Value in ₹'000)

Country	2009-10	2010-11
All Countries	**3905599**	**4957091**
Hong Kong	1147483	1618235
Thailand	939354	828235
Zambia	421113	660394
USA	283898	442244
Brazil	511502	431627
South Africa	1068	280220
UK	190708	138683
UAE	161621	74298
Unspecified	34171	263609
Other countries	214681	219546

Note: *Quantity not given due to partial coverage; value figures, however, have full coverage.*

Table – 5 : Imports of Emerald (Cut) (By Countries)

Country	2009-10		2010-11	
	Qty ('000 Crt)	Value (₹'000)	Qty ('000 Crt)	Value (₹'000)
All Countries	**2946**	**2343509**	**3945**	**2562232**
Hong Kong	772	907561	1242	1058550
Thailand	1929	862533	1949	736390
USA	120	242456	352	299049
Sri Lanka	19	26488	67	69978
Germany	29	74574	14	26416
UAE	25	150883	12	22824
UK	11	12411	56	22453
Israel	15	7669	16	11042
Japan	3	6854	43	8909
Unspecified	4	9860	166	263193
Other countries	19	42220	28	43428

Table – 6 : Imports of Emerald (Uncut)
(By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**78**	**1562090**	**51**	**2394859**
Zambia	19	410435	17	655689
Hong Kong	11	239922	3	559685
Brazil	28	511502	11	430469
South Africa	++	516	12	280220
USA	11	41442	3	143195
UK	1	178298	++	116230
Thailand	6	76821	4	91845
UAE	++	10738	1	51474
Israel	++	21441	++	20911
Belgium	++	15180	++	17248
Other countries	2	55795	++	27893

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

FELSPAR

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

35 Felspar

Felspars are one of the most abundant rock-forming minerals in the earth's crust, comprising a complex series of aluminosilicates with varying amounts of potassium, sodium, calcium and sometime barium. Common amongst these are the potash felspars called orthoclase and microcline ($K_2O.Al_2O_3.6SiO_2$), sodium felspar called albite ($Na_2O.Al_2O_3.6SiO_2$) and calcium felspar called anorthite ($CaO.Al_2O_3.2SiO_2$). The sodium and calcium felspars form a continuous series of solid solutions and are together termed plagioclase felspars. Though felspars occur in a variety of colours, pink, brown and grey felspars are known to be common.

RESOURCES

As per the UNFC system, the total resources of felspar in the country as on 1.4.2010 are estimated at about 132 million tonnes of which 44 million tonnes (33%) are reserves and 88 million tonnes (67%) are remaining resources. In terms of grades, pottery/ceramic grade accounts for 61%, others/unclassified & not-known grades 31% and glass grade for 8% of the total resources. By States, Rajasthan alone accounts for about 66% of the total resources followed by Andhra Pradesh (16%), Tamil Nadu (7%), Bihar (4%) and West Bengal (3%) (Table - 1).

EXPLORATION

The Directorate of Mines & Geology, Government of Rajasthan carried out exploration for felspar in 2010-11 near Village Tikhi, district Rajsamand over an area of 20 sq km. Mapping on 1:10,000 scale was carried out and 17 samples were collected and analysed. The said area is occupied by biotite-schist, granite, gneisses, migmatites intruded by pegmatites & ultrabasic rocks. In general, the strike length varied from 50-200 m with width varying from 2-50 m.

PRODUCTION & STOCKS

The production of felspar at 472 thousand tonnes in 2010-11 decreased by 5% as compared to the preceding year, due to temporary discontinuance of some mines.

There were 70 reporting mines in 2010-11 as against 72 mines in the previous year. Besides, the production of felspar was also reported from 49 mines as an associated mineral primarily with quartz and mica. Nine mines, each producing more than ten thousand tonnes annually, accounted for approximately 67% of the total production in 2010-11. Ten principal producers reported 76% of the total production during the year under review.

Rajasthan was the leading producing state contributing 51% production followed by Andhra Pradesh 43%, Jharkhand 3%, Tamil Nadu 2% and the remaining 1% was contributed by West Bengal & Karnataka (Tables 3 to 5).

The mine-head stocks of felspar at the end of the year 2010-11 were 232 thousand tonnes as against 219 thousand tonnes at the beginning of the year (Table - 6).

The average daily employment of labour strength in 2010-11 was 703 as against 686 in the previous year.

MINING & MARKETING

Felspar is won chiefly from pegmatites. Mining is carried out, generally, by opencast method. Significant output of felspar is obtained as an associated mineral during mining of quartz, mica and to some extent beryl. Bhilwara and Ajmer districts in Rajasthan and Mahaboobnagar and Nellore districts in Andhra Pradesh are the important mining areas in the country.

The pegmatite bodies are exposed by the removal of top soil and overburden. It is then broken either manually or by drilling and blasting.

Table – 1 : Reserves/Resources of Felspar as on 1.4.2010
(By Grades / States)

(In tonnes)

	Reserves				Remaining Resources								Total Resources (A+B)
	Proved STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
		STD121	STD122			STD221	STD222						
All India : Total	**24,545,334**	**8,278,221**	**11,679,685**	**44,503,240**	**14,672,107**	**4,427,797**	**12,967,154**	**4,191,330**	**9,874,858**	**41,549,070**	**149,895**	**87,832,212**	**132,335,451**
By Grades													
Glass	2,127,308	413,588	610,399	3,151,295	1,530,128	389,984	3,732,761	103,662	107,681	1,736,097	24,050	7,624,363	10,775,658
Pottery / Ceramic	20,007,984	6,425,719	9,721,028	36,154,731	11,367,336	3,080,724	6,946,326	2,539,406	1,951,784	19,203,824	-	45,089,400	81,244,131
Others	702,228	106,195	218,541	1,026,964	478,077	17,139	181,017	203,637	51,876	350,587	1,800	1,284,133	2,311,097
Unclassified	617,465	1,202,352	623,834	2,443,651	1,025,842	704,054	1,371,461	85,003	143,852	12,767,336	-	16,097,547	18,541,198
Not-known	1,090,349	130,367	505,883	1,726,599	270,725	235,896	735,590	1,259,622	7,619,664	7,491,225	124,045	17,736,767	19,463,366
By States													
Andhra Pradesh	5,469,094	408,487	2,301,765	8,179,346	2,504,362	274,566	2,181,547	60,776	5,476,671	2,975,298	145,995	13,619,215	21,798,561
Bihar	-	-	35,147	35,147	-	-	-	-	4,195	4,871,499	-	4,875,694	4,910,841
Haryana	-	-	-	-	-	-	-	-	-	72,164	-	72,164	72,164
Jharkhand	5,675	-	274,971	280,646	-	40,766	279,433	32,510	120,388	881,045	-	1,354,142	1,634,788
Karnataka	119,525	69,575	107,055	296,155	-	-	-	25,000	135,133	177,300	3,900	341,333	637,488
Madhya Pradesh	-	-	-	-	-	-	-	-	-	339,851	-	339,851	339,851
Maharashtra	228,655	-	91,462	320,117	-	-	423,180	-	-	485,606	-	908,786	1,228,903
Meghalaya	-	-	-	-	-	-	-	-	-	37,449	-	37,449	37,449
Rajasthan	18,083,327	7,793,709	8,837,983	34,715,019	9,839,519	4,042,309	9,666,832	3,154,174	668,648	25,859,733	-	53,231,215	87,946,234
Tamil Nadu	613,184	6,450	31,302	650,936	2,328,227	70,156	416,162	18,870	69,822	5,447,875	-	8,351,112	9,002,048
Uttar Pradesh	-	-	-	-	-	-	-	-	-	200,000	-	200,000	200,000
West Bengal	25,874	-	-	25,874	-	-	-	900,000	3,400,000	201,250	-	4,501,250	4,527,124

Figures rounded off

Table – 2 : Principal Producers of Felspar, 2010-11

Name and address of producer	Location of mine	
	State	District
Shri Modi Levigoted Koli Pvt. Ltd., Opposite Rly Station, Neem ka Thana-332 713, Sikar, Rajasthan.	Rajasthan	Sikar
Shri Vijaya Gimpex Mining Pvt. Ltd, Gimpex House, 181, Linghi Chetty Street, Chennai – 600 001, Tamil Nadu.	Andhra Pradesh	Mahaboobnagar
B. Narasimhulu, Plot No. 144, Sri Durga Estates, Deepti Srinagar Colony, Chandranagar, Hyderabad, Andhra Pradesh.	Andhra Pradesh	Mahaboobnagar

(Contd.)

Table - 2 (Concld.)

Name and address of producer	Location of mine	
	State	District
M/s Sadhna Minerals, 1/116, Masthanvali Complex, Anil Nagar, N.H.-5, Chillkur-524 412, Gudur bypass Road, Nellore, Andhra Pradesh.	Andhra Pradesh	Nellore
Shrimati Anjana Jain C/o:Hakim Ali Khan, Bhagat Chouraha, 9th Press Complex, Chawani Road, Beawar, Ajmer, Rajasthan	Rajasthan	Ajmer
Jaikishan Baldua, Govind Bhawan, Pratap Nagar, Beawar, Ajmer, Rajasthan.	Rajasthan	Bhilwara
Brijkishor Yadao, Sutarkhana Mohalla, Nasirabad, Ajmer, Rajasthan.	Rajasthan	Ajmer

Table – 3 : Production of Felspar, 2008-09 to 2010-11 (By States)

(Qty in tonnes; Value in ₹ '000)

State	2008-09		2009-10		2010-11(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**534032**	**97651**	**496997**	**98648**	**472041**	**99377**
Andhra Pradesh	309352	61164	214406	51429	204518	51148
Jharkhand	10815	1864	10778	1904	15607	2288
Karnataka	573	120	3100	651	1024	383
Maharashtra	587	103	-	-	-	-
Rajasthan	208131	497	265212	43083	239924	41477
Tamil Nadu	3078	1065	451	117	7980	2357
West Bengal	1496	838	3050	1464	2988	1724

Table - 4 : Production of Felspar, 2009-10 & 2010-11 (By Frequency Groups)

(Qty in tonnes)

Production Group	No. of mines		Production for the group		Percentage in total production		Cumulative percentage	
	2009-10	2010-11	2009-10	2010-11	2009-10	2010-11	2009-10	2010-11
All Groups	**72(38)**	**70(49)**	**496997**	**472041**	**100.00**	**100.00**	**-**	**-**
Up to 500	21(14)	31(14)	5076	5865	1.02	1.24	1.02	1.24
501-1000	13(10)	9(10)	16521	14282	3.33	3.03	4.35	4.27
1001-3000	15(3)	12(16)	35292	50669	7.10	10.74	11.45	15.01
3001-5000	9(7)	4(6)	57803	40702	11.63	8.62	23.08	23.63
5001-10000	5(4)	6(2)	64726	43907	13.02	9.30	36.10	32.93
10001 & above	9	8(1)	317579	316616	63.90	67.07	100.00	100.00

Figures in parentheses indicate number of mines of felspar with mica & quartz.

Table – 5 : Production of Felspar, 2008-09 & 2009-10
(By Sectors/States/Districts)

(Qty. in tonnes, value in Rs.'000)

State/District	2009-10			2010-11(P)		
	No.of mines	Quantity	Value	No.of mines	Quantity	Value
India	**72(38)**	**496997**	**98648**	**70(49)**	**472041**	**99377**
Private sector	71(38)	493897	97997	67(49)	471011	98993
Public sector	1	3100	651	3	1030	384
Andhra Pradesh	**16(14)**	**214406**	**51429**	**19(23)**	**204518**	**51148**
Mahaboobnagar	8(3)	181675	43812	11(6)	151888	39229
Nalgonda	2	71	11	2	5803	870
Nellore	6(11)	32660	7606	5(16)	40837	9956
Rangareddy	-	-	-	1(1)	5990	1093
Jharkhand	**3(6)**	**10778**	**1904**	**3(6)**	**15607**	**2288**
Deoghar	(1)	1958	274	(1)	3639	418
Dumka	(1)	648	136	(1)	2651	447
Hazaribagh	1	603	118	1	885	134
Jamtara	1	1294	162	1	*	*
Latehar	1(4)	6275	1214	1(4)	8432	1289
Karnataka	**1**	**3100**	**651**	**2**	**1024**	**383**
Bengaluru	1	3100	651	2	1024	383
Rajasthan	**52(14)**	**265212**	**43083**	**45(13)**	**239924**	**41477**
Ajmer	14(6)	66381	8927	19(6)	65821	9005
Alwar	(1)	273	82	(1)	9	3
Bhilwara	24(4)	66663	11599	20(3)	37223	7442
Jaipur	-	-	-	(1)	4781	956
Rajsamand	11(1)	13954	1765	4(1)	7817	1297
Sikar	3	111956	19215	2	123608	22608
Tonk	(2)	5985	1495	(1)	665	166

(Contd.)

Table- 5 (Concld.)

(Qty. in tonnes, value in Rs.'000)

State/District	2009-10			2010-11(P)		
	No.of mines	Quantity	Value	No.of mines	Quantity	Value
Tamil Nadu	**(3)**	**451**	**117**	**1(6)**	**7980**	**2357**
Dindigul	(1)	33	23	(1)	16	5
Madurai	(1)	18	6	(2)	695	312
Coimbatore	(1)	400	88	-	-	-
Salem	-	-	-	(3)	7263	2039
Tiruvarur	-	-	-	(1)	6	1
West Bengal	**(1)**	**3050**	**1464**	**(1)**	**2988**	**1724**
Birbhum	(1)	3050	1464	(1)	2988	1724

Figures in parentheses indicate number of associated mines of felspar with mica & quartz.

Table – 6 : Mine-head Stocks of Felspar, 2010-11 (P) (By States)

(In tonnes)

State	At the beginning of the year	At the end of the year
India	**219497**	**231689**
Andhra Pradesh	171458	187280
Jharkhand	1411	2705
Karnataka	1515	2690
Madhya Pradesh	11	11
Maharashtra	3654	-
Rajasthan	41337	38153
Tamil Nadu	7	754
West Bengal	104	96

The broken materials are then sorted out and sized. Crushed felspar is separated mechanically by suitable screens to meet market requirements. The general demand is for 30/80 mesh, 100 mesh, 150 mesh, 180 mesh, 200 mesh and 250 mesh material. Washing is sometimes done to upgrade the product by removing clay, etc. The processed felspar is bagged and despatched to different consignees.

The processing of felspar involves usually flotation or magnetic separation to remove accessory minerals like mica, garnet, ilmenite and quartz. Silica in the form of quartz in pegmatites and silica sand in felspathic sand deposits are obtained as co-products of mining. Though in some applications, presence of silica is advantageous, most users require extremely pure and finely-ground grades of felspar. Glass grade felspar is usually the most coarse material. The filler application demands finely-ground material. A modern processing plant located at Kodthal in Mahaboobnagar district of Andhra Pradesh and 12 processing plants in Rajasthan cater to ceramics and glass industries.

USES

Potassium felspar obtained from pegmatites is used traditionally as a source for alumina and alkali in ceramic and glass industries which account for more than 90% consumption. It also finds use as functional filler in paint, plastic, rubber and adhesive; as a bonding agent in abrasives; and in the manufacture of artificial teeth, fertilizer and white cement. Certain varieties of felspar (like moonstone) are used as semi-precious stones.

In Ceramic Industry, felspar is used as fluxing agent which facilitates softening, melting and wetting of batch constituents. The flux controls the degree of vitrification of the ceramic body during firing. Potash felspar has technical advantages over sodium felspar. After clay, felspar is the biggest ingredient in the raw material batch for ceramic bodies. Typical felspar contents are < 25% in earthenware, 25-35% in sanitaryware, 15-30% in whiteware, 10-55% in floor and wall tiles and 30-55% in electrical porcelain. For Glass Industry, the alkali content in felspar acts as a flux, which not only facilitates lowering the glass batch melting temperature but also cuts production cost. The mineral is primarily added for alumina content which varies from 0.05% for flat glass, 8% for container glass, 11% for some speciality glasses and up to 18% for insulation fibreglass.

In the Abrasive Industry, plagioclase felspar is used as a mild abrasive material in scouring powders because of its semi-conchoidal fracture, although its hardness is 6 on Mohs' scale. In Refractory Industry, felspar is used as one of the batch constituents in the manufacture of acid-proof refractories. In Welding Electrode Industry, felspar is used as a flux which acts as an arc stabiliser and helps in weld-pool protection.

Physical properties like good dispersability, chemical inertness, stable pH, low free silica content and brightness of 89-95% improve the filler properties of finely-ground felspar materials.
.

SPECIFICATIONS

The BIS specifications of potash felspar and soda felspar for use in Glass and Ceramic industries are as per IS: 9749-2007. The producers prefer following specifications for the various ceramic products:

Sanitaryware

K_2O 11-14%, Na_2O 2-7%, SiO_2 62-68%, Al_2O_3 16-20%, Fe_2O_3 0.25% (max). The deleterious constituents are TiO_2 and MgO.

Insulators

K_2O 11-12.5%, Na_2O 2-3% (4% max), SiO_2 64.5-68%, Al_2O_3 17-21%, Fe_2O_3 0.48% (max) (but Fe_2O_3 less than 0.1% is accepted).

Ceramic Tiles

K_2O 9%, Na_2O 4%, Al_2O_3 18% (min), Fe_2O_3 1% (max), K_2O+Na_2O 14% (max). Both sodium and potassium felspars are used.

Crockeryware

K_2O 12-15%, Na_2O 3.69%, SiO_2 63.05%, Al_2O_3 19.56% and Fe_2O_3 0.10%.

Glass

The physical requirements specified are that of the material in powder form prepared from natural felspar which should be free from foreign matter; moisture shall not exceed 2% by mass; specific gravity should be between 2.5 and 2.7; PCE should be 8 to 10 orton (1,225 ºC-1,260 ºC), and fired-colour shall be glassy-white and free from specks.

However, the producers accept felspar analysing 10% K_2O + Na_2O, 64-68% SiO_2, 15-19% Al_2O_3 and 0.15% Fe_2O_3.

Refractory

There is no BIS specification for felspar for use in Refractory Industry. The Industry prefers potash felspar analysing 11 to 12% Na_2O_3+K_2O, 60 to 70% SiO_2, 20 to 24% Al_2O_3, 1.5% Fe_2O_3, 0.8% LOI, 4 to 6 orton PCE and 2.5 to 10 cm material.

Abrasive

Felspar in both powder and lump forms is used and white or pink mineral is preferred. As per the users in the organised sector, felspar analysing SiO_2 65%, Al_2O_3 18%, Na_2O + K_2O 10% (max), Fe_2O_3 0.45%, MgO 0.5%, CaO 0.6% and LOI 2% (max),

Electrode

Potash felspar, analysing 12 to 14% K_2O, 1 to 3% Na_2O, 63 to 67% SiO_2, 17 to 20% Al_2O_3 and below 0.3% Fe_2O_3, is preferred.

INDUSTRY

Ceramic Industry in India is about a century old and has formed a sizeable industrial base. It comprises ceramic tiles, sanitaryware and crockery items. The industry has its base both in large and small-scale sectors with wide variance in type, size, quality and standard. Manufacturing units are spread all-over India. The state-of-the-art ceramic goods are manufactured in the country. The domestic technology is of international standard. During the last two decades, there has been a phenomenal growth in the field of technical ceramics to meet specific demands of industries like high alumina ceramic, cutting tools and other structural ceramics.

As per the data from Department of Industrial Policy & Promotion, Ministry of Commerce & Industries, there are at present 16 ceramic glazed tiles units in the organised sector with an annual installed capacity of 21 lakh tonnes and about 200 units in SSI sector. The production of ceramic tiles in 2010-11 was estimated at 391 million sq m. This sector accounts for about 2.5% of the world ceramic tile production. The demand of ceramics is expected to increase with the growth in the Housing Sector.

Sanitary and pottery items are also produced by both large and small-scale sectors. Sanitaryware has been growing at 5% per annum during the last two years. There were 7 units of sanitaryware with an installed capacity of about 143 thousand tonnes per annum in the Organised Sector and about 210 units, with total 53,000 tonnes per annum capacity in the Small-scale Sector. The production of sanitaryware in 2010-11 was estimated at 480 thousand tonnes in the Organised Sector. There are 16 units of potteryware in the Organised Sector, having a total installed capacity of 43,000 tpy. In the Small-scale Sector, there are over 1,400 plants with a capacity of 3,00,000 tonnes per annum. The production of potteryware in 2010-11 was estimated at about 80 thousand tonnes in the organised Sector.

The Glass Industry comprises containers, hollowware, tableware, float glass, vacuum flasks, refills, laboratory glassware, fibre glassware, etc. Float glass and glass fibre are classified as high priority items. Most of the other items are reserved for SSI.

There has been a growing acceptability for indian flat glass products in the global market. Indian manufacturers have been successful in finding new untapped markets. There is rapid technology upgradation taking place in fibre glass composites and the scope and demand for glass fibre products are likely to grow particularly due to growth in the Petrochemical Sector and ever increasing demand for its allied products.

The production of bottles/bottle glassware during 2010-11 (upto December 2010) was 7,95,881 tonnes.

Firozabad in Uttar Pradesh, popularly known as `Glass City of India', is the chief centre of small-scale glass production units. These units make the most innovative items of glass which are exported to different parts of the world. This town accounts for about 70% production in the Small-scale Sector.

CONSUMPTION

Felspar is used mainly in ceramic, glass and cement industries. Minor quantity of felspar is consumed by refractory, abrasive and electrode industries. Total consumption of felspar in 2010-11 was estimated at 405,400 tonnes in the Organised Sector. Of the total consumption, the Ceramic Industry accounted for 84%, Glass Industry about 13% and remaining 3% by Cement, Refractory, Abrasive and Electrode Industries (Table - 8).

WORLD REVIEW

World resources of felspar are large and adequate enough to meet the anticipated world demand and hence quantitative data on resources of felspar in granites, pegmatites and felspathic sands have not been compiled. The world production of felspar was estimated at 22.28 million tonnes in 2010. Major producers were Turkey (23%), Italy (21%) and China (11%) (Table-9).

Table – 8 : Reported Consumption of Felspar 2008-09 to 2010-11 (By Industries)

(In tonnes)

Industry	2008-09	2009-10(R)	2010-11(P)
All Industries	**334400**	**426900**	**405400**
Abrasive	600(3)	600(3)	600(3)
Cement	11200(5)	15900(6)	10600(6)
Ceramic	268400(49)	356200(49)	338600(49)
Coal washery	++(1)	++(1)	++(1)
Electrode	300(11)	200(11)	200(11)
Glass	52900(50)	52800(50)	54000(50)
Refractory	1000(16)	1000(16)	1400(16)

Figures rounded off. Data collected on non-statutory basis. Figures in parentheses denote the number of units in organised sector reporting consumption.*
*(*Includes actual reported consumption and/or estimates made wherever required).*

Table – 9 : Production of Felspar (By Principal Countries)

(In '000 tonnes)

Country	2008	2009	2010
World : Total	**22910**	**20415**	**22275**
China(e)	2400	2400	2400
Czech Republic	488	431	388
Egypt	169	354	406
France	650	650	650
India	532	455	445(e)
Iran	502	634	635
Italy	4727	4700	4700
Japan(e) @	700	700	700
Korea, Rep. of	344	623	496
Malaysia	457	410	439
Mexico	446	348	399
Poland	599	445	392
Portugal	230	362	122
Spain	690	597	692
Thailand	671	719	642
Turkey	6500	4000	5200
USA	680	550	570(e)
Other countries	2125	2037	2999

@ Including weathered granite felspar
***Source:** World Mineral Production, 2006-2010.*

FOREIGN TRADE

Exports

Exports of felspar (natural) increased to 342 thousand tonnes in 2010-11 from 316 thousand tonnes in the previous year. Exports were mainly to Bangladesh (21%), Indonesia (17%) and Vietnam (12 %). Exports value of felspar (cut & uncut) decreased to ₹ 1.28 crore in 2010-11 from ₹ 5.6 crore in 2009-10. Exports of felspar (cut & uncut) were mainly to Hong Kong (28%), USA (25%) and Germany (22%) (Tables - 10 to 13).

Imports

Imports of felspar (natural) increased drastically to 20,409 tonnes in 2010-11 from 7,281 tonnes in 2009-10. Imports were mainly from Thailand, Malaysia and Mongolia. In 2010-11, imports value of felspar (cut & uncut) increased to ₹ 65.31 lakh from ₹ 15.60 lakh in the previous year. In 2010-11, imports value of uncut felspar was of ₹ 26.50 lakh and that of cut felspar was ₹ 38.81 lakh. Imports of felspar (uncut) were mainly from Hong Kong, while, imports of felspar (cut) were mainly from USA, Hong Kong and Thailand (Tables - 14 to 17).

Table – 10 : Exports of Felspar (Natural) (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**315549**	**1074155**	**342280**	**1156358**
Indonesia	41000	146830	57366	197599
Bangladesh	90257	224461	70173	171946
Vietnam	27202	123774	40879	162240
Malaysia	35879	116251	28080	100632
Thailand	30598	110842	26569	97138
China	10725	41584	21036	82221
Iran	15587	68987	19564	78232
Chinese Taipei/ Taiwan	13481	54966	14683	57375
UAE	18429	50076	18276	53811
Turkey	6977	14931	19929	46486
Other countries	25414	121453	25725	108678

Table – 11 : Exports of Felspar (Cut & Uncut) (By Countries)

Country	2009-10 Qty	2009-10 Value (₹'000)	2010-11 Qty	2010-11 Value (₹'000)
All Countries	**	**50612**	**	**12842**
Hong Kong		3446		3566
USA		14389		3247
Germany		13929		2882
Israel		342		1246
Chinese Taipei/ Taiwan		3968		605
France		975		485
China		-		270
Vietnam		-		157
Denmark		509		156
Italy		102		106
Other countries		12952		122

*** Quantity not given due to partial coverage. Value figures however have full coverage.*

Table – 12 : Exports of Felspar (Cut) (By Countries)

Country	2009-10 Qty ('000 Carat)	2009-10 Value (₹ '000)	2010-11 Qty ('000 Carat)	2010-11 Value (₹'000)
All Countries	**358**	**50497**	**222**	**12541**
Hong Kong	3	3446	1	3565
USA	58	14280	46	3247
Germany	209	13929	135	2882
Israel	-	342	18	1246
Chinese Taipai/ Taiwan	10	3968	10	605
France	1	975	7	485
Vietnam	-	-	++	157
Denmark	1	509	5	156
Italy	-	102	++	106
Thailand	27	2742	++	92
Other countries	49	10204	-	-

Table – 13 : Exports of Felspar (Uncut) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**++**	**115**	**++**	**301**
China	–	–	++	270
USA	–	110	++	23
Canada	–	–	++	5
Australia	++	3	++	3
Other countries	-	2	++	++

Table – 14 : Imports of Felspar (Natural) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**7281**	**32129**	**20409**	**64063**
Thailand	6300	14850	18818	43693
Malaysia	483	7929	882	10720
Mongolia	-	-	500	7508
Spain	97	1333	114	1072
China	370	6901	49	596
Belgium	-	-	21	278
Turkey	-	-	24	159
UK	11	140	1	35
Portugal	-	-	++	2
Other countries	20	976	-	-

Table – 15 : Imports of Felspar (Cut & Uncut) (By Countries)

Country	2009-10 Qty	2009-10 Value (₹'000)	2010-11 Qty	2010-11 Value (₹'000)
All Countries	**	**1560**	**	**6531**
Hong Kong		277		2650
U S A		5		2050
Hong Kong		277		553
Thailand		-		531
Madagascar		-		315
Italy		-		199
Sri Lanka		-		146
Czech Republic		-		86
Other countries		1001		1

*** Quantity not given due to partial coverage., value figures, however, have full coverage.*

Table – 16 : Imports of Felspar (Cut)
(By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**++**	**288**	**3**	**3881**
USA	++	5	1	2050
Hong Kong	++	277	1	553
Thailand	-	-	1	531
Madagascar	-	-	++	315
Italy	-	-	++	199
Sri Lanka	-	-	++	146
Czech Republic	-	-	++	86
Other countries	++	6	++	1

Table – 17 : Imports of Felspar (Uncut)
(By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**3**	**1272**	**1**	**2650**
Hong Kong	-	-	1	2650
Other countries	3	1272	-	-

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

FERRO-ALLOYS

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

36 Ferro-alloys

Ferro-alloys are one of the important inputs in the manufacture of alloys and special steel. Ferro-alloys impart special properties to steel. The function of the alloy is to increase resistance to corrosion, to improve hardness & tensile strength at high temperatures, wear & abrasion resistance, to increase creep strength, etc. The growth of Ferro-alloys Industry is, thus, linked with the development of the Iron and Steel Industry, Foundry Industry and to some extent Electrode Industry. The principal ferro-alloys are of chromium, manganese and silicon. The product series consists mainly of ferro- manganese, silico-manganese, ferro-silicon and ferro-chrome.

Ferro-alloys are classified into two main categories viz, bulk ferro-alloys and noble ferro-alloys. Due to high cost of power, Ferro-alloys Industry has not been functioning to its full capacity. Ferro-alloys Industry spends 40 to 70% production cost on power consumption. The power consumption per tonne of ferro-alloys production in the country varied from 3,000 to 12,000 kWh.

At present, major portion of the ferro-alloys produced is exported. Ferro-manganese, silico-manganese, ferro-silicon, high carbon ferro-chrome and charge-chrome are exported after meeting the domestic requirements. India has sufficient raw materials of good quality, highly-skilled technical manpower and the latest equipment technology for production of ferro-alloys.

INDUSTRY, PRODUCTION, DEVELOPMENT AND CONSUMPTION

As per Indian Ferro-Alloys Producers' Association (IFAPA), the total installed capacity of bulk ferro-alloys Industry in India is estimated at 4.65 million tonnes per annum and for noble ferro-alloys it is 50,000 tonnes per annum. The Industry is reported to be working at about 60-65% capacity utilisation. The details are given in Table-1.

Table – 1 : Capacity of Ferro-alloys Industry in India

(In tonnes per annum)

Ferro-alloy	Installed capacity
Total	**4650000**
Bulk Ferro-alloys:	**4600000**
Manganese alloys	2750000
Chrome alloys	1600000
Ferro-silicon	250000
Noble Ferro-alloys:	**50000(e)**

Source: *Indian Ferro-Alloys Producers' Association (IFAPA), Mumbai.*

The Ferro-alloys Industry is spread all over the country. It was established as an ancillary industry to cater to the growing needs of the domestic Steel Industry. Most of the ferro-alloy units have been set up in Andhra Pradesh, Chhattisgarh, Jharkhand, Karnataka, Madhya Pradesh, Maharashtra, Odisha and West Bengal because of availability of the raw material. Recently, the Industry has further spread to the North-Eastern Region of India. In Meghalaya, a number of small units producing ferro-silicon and ferro-silico-manganese have come up. The production of various ferro-alloys, as reported by IFAPA is given in Table-2.

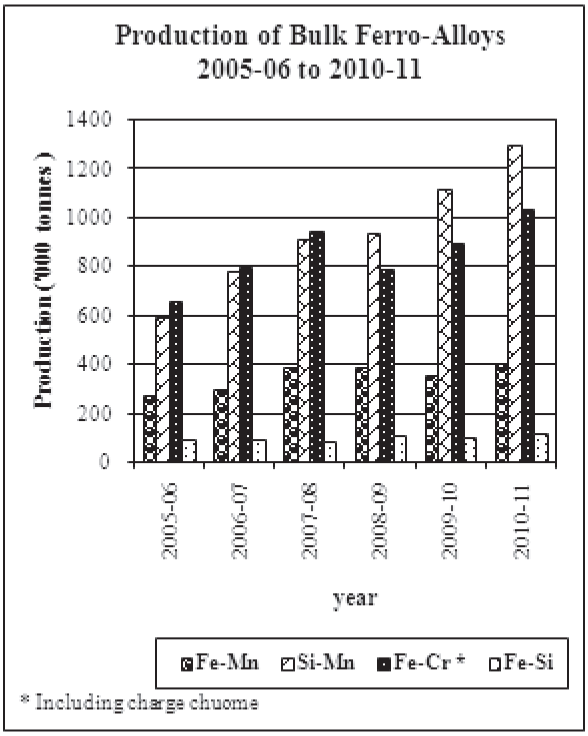
The overall production in 2010-11 has increased substantially by 15.71% to 2.88 million tonnes from 2.49 million tonnes in 2009-10. The ferro-alloys units have incorporated the latest technology in order to use non-metallurgical grade ores, both lumps and fines, after necessary beneficiation and agglomeration. The units have also incorporated the effective pollution control measures in the form of gas cleaning, deoxidising and waste heat recovery.

Table – 2 : Production of Ferro-alloys, 2008-09 to 2010-11

(In tonnes)

Ferro-alloy	2008-09	2009-10	2010-11
Total (A) + (B)	**2251737**	**2493633**	**2885360**
A) Bulk Ferro-alloys	**2224502**	**2462775**	**2852000**
HC Ferro-manganese	372286	341883	390000
MC Ferro-manganese	8386	8222	8000
LC Ferro-manganese	5775	6018	6000
Silico-manganese	889434	1066485	1250000
MC Silico-manganese	24087	24108	24000
LC Silico-manganese	22368	25454	25000
Ferro-silicon	110742	97682	117000
HC Ferro-chrome/charge-chrome	790072	890916	1030000
LC Ferro-chrome	1352	2007	2000
B) Noble Ferro-alloys	**27235**	**30858**	**33360**
Ferro-molybdenum	2112	2822	3050
Ferro-vanadium	1501	1389	1500
Ferro-tungsten	150	150	150
Ferro-silico-magnesium	13400	17132	18500
Ferro-aluminium	8170	7017	7600
Ferro-silico-zirconium	37	120	120
Ferro-titanium	1561	1929	2100
Ferro-boron	83	90	90
Ferro-nickel-magnesium	221	209	250

Note: *HC: High carbon MC: Medium carbon LC: Low carbon*
Source: *Indian Ferro-Alloys Producers' Association (IFAPA), Mumbai.*



BULK FERRO-ALLOYS

Bulk ferro-alloys consist of principal alloys, viz, ferro-manganese, silico-manganese, ferro-chrome, charge-chrome and ferro-silicon.

Ferro-manganese/Silico-manganese

Ferro manganese is produced as high carbon ferro-manganese with 72-82% Mn, 6-8% C and 1.5% Si, medium carbon ferro-manganese with 74-82% Mn, 1-3% C and 1.5% Si, and low carbon ferro-manganese with 80-85% Mn, 0.1-0.7% C and 1-2% Si. Manganese in the form of ferro-manganese is added for hardening and desulphurisation of steel. Nav Bharat Ferro Alloys Ltd, Paloncha, Andhra Pradesh; Chhattisgarh Electricity Co. Ltd, Raipur, Chhattisgarh; Indsil Energy & Electro Chemicals Ltd, Raipur, Chhattisgarh; Ispat Godavari, Raigarh, Chhattisgarh; Monet Ispat Ltd, Raipur, Chhattisgarh; Union Ferro, Raigarh, Chhattisgarh; Prakash Industries, Raigarh, Chhattisgarh;

'Tirumala Balaji Alloys Pvt. Ltd, Raigarh, Chhattisgarh; Vandana Global Ltd, Raipur, Chhattisgarh; SAL Steels Ltd, Gandhidham, Gujarat; Anjaneya Ferro Alloys Ltd, Mihijam, Jharkhand; Gautam Ferro Alloys Ltd, Ramgarh, Jharkhand; Shivam Iron & Steel Co. Pvt. Ltd, Giridih, Jharkhand; Sandur Manganese & Iron Ores Ltd, Sandur, Karnataka; Indsil Electromelt Ltd, Palakkad, Kerala; Chandrapur Ferro Alloys Plant (formerly Maharashtra Electrosmelt Ltd), Chandrapur, Maharashtra; Nagpur Power Ind. Ltd, Kanhan, Maharashtra; Natural Sugar & Allied Ind. Ltd, Osmanabad, Maharashtra; Adhunik Meghalaya Steels Pvt. Ltd, Bymihat, Meghalaya; Meghalaya Sova Ispat Ltd, Meghalaya; Shayam Century Ltd, Meghalaya; Tata Steel Ltd, Joda, Odisha; Bhaskar Shrachi Alloys Ltd, Durgapur, West Bengal; Cosmic Ferro Alloys Pvt. Ltd, Bankura, West Bengal; Dayal Ferro Alloys Ltd, Ramgarh, West Bengal; Haldia Steels Ltd, Burdwan, West Bengal; Impex Ferro Tech Ltd, Burdwan, West Bengal; Maithan Alloys Ltd, Burdwan, West Bengal; Modern India Con-Cast Ltd, Birhampur, West Bengal; Sharp Ferro Alloys Ltd, Durgapur, West Bengal; Shri Gayatri Minerals Ltd, Bihnupur, West Bengal; Shayam Ferro alloys Ltd, Burdwan, West Bengal; and Sova Ispat Ltd, Durgapur, West Bengal are the major producers of ferro-manganese/silico-manganese.'

Silico-manganese, a combination of 60-70% manganese, 10-20% silicon and 20% carbon is used as substitute to low carbon ferro-manganese in the Steel Industry. It consumes around 4,750 to 5,250 kWh power per tonne of silico-manganese produced. Silico-manganese has emerged as a more important alloy than ferro-manganese. The country, thus, has emerged as a leading producer of silico-manganese. Silico-manganese was also produced by a number of small-scale ferro-alloy producers.

The total production of ferro-manganese in 2009-10 was about 356,100 tonnes which increased to about 404,000 tonnes in 2010-11. Consumption of ferro-manganese was reported at 122,800 tonnes in 2010-11.

The production of silico-manganese (including medium carbon & low carbon silico-manganese) which was about 1,116,000 tonnes in 2009-10 increased to 1,299,000 tonnes in 2010-11. In 2010-11, the total consumption of silico-manganese by all industries has been reported at 199,800 tonnes.

Ferrro-chrome/Charge-chrome

Ferro-chrome when added to steel imparts hardness, strength and augments its stainless characteristics. Carbon content classifies the ferro-chrome alloy into high carbon (6-8%), medium carbon (3-4%) and low carbon (1.5-3%), although chromium content in all the three grades is around 60-70%. Around 2.5 tonnes chrome ore with an estimated power consumption of 4,500 kWh is required to produce one tonne of ferro-chrome.

FACOR Alloys Ltd, Garividi, Andhra Pradesh; GMR Technologies & Ind. Ltd, Srikakulam, Andhra Pradesh; Jindal Steel & Power Ltd, Raigarh, Chhattisgarh; Standard Chrome Ltd, Raigarh, Chhattisgarh; SAL Steel, Kachchh-Bhuj, Gujarat; Balasore Alloys Ltd, Balasore, Odisha; IDCOL Ferro Chrome Plant, Jajpur Road, Odisha; Indian Metals & Ferro Alloys Ltd, Therubali, Odisha; Jindal Stainless Ltd, Duburi, Odisha; Nava Bharat Ferro Alloys Ltd, Dhenkanal, Odisha; Utkal Manufacturing Services Ltd, Choudhwar, Odisha; Rawat Ferro Alloys, Cuttack, Odisha; Rohit Ferro Tech. P. Ltd, Bishnupur, West Bengal and Sri Vasavi Ind. Ltd, Bishnupur, West Bengal are the major ferro-chrome producers. A sizeable quantity is also produced by units in the small-scale sector.

Tata Steel Ltd, FACOR and Indian Charge Chrome Ltd, the three major producers of charge-chrome in the country are 100% export-oriented, having a total capacity of 182,500 tpy. Tata Steel with its charge-chrome plant at Bamnipal, Odisha, has a capacity of 55,000 tpy. FACOR has a capacity of 65,000 tpy charge-chrome at its Randia Plant, Bhadrak district, Odisha. Indian Charge Chrome Ltd (merged with Indian Metals & Ferro Alloys Limited), Cuttack district, Odisha has an installed capacity of 62,500 tpy.

The production of high carbon ferro-chrome/ charge-chrome which was 890,900 tonnes in 2009-10 increased to 1,030,000 tonnes in 2010-11. The production of low carbon ferro-chrome has remained static at around 2000 tonnes in 2009-10 & 2010-11. The consumption of ferro-chrome in 2010-11 was reported at 273,300 tonnes.

Ferro-silicon

Ferro-silicon contains about 75-90% silicon and minor amounts of iron, carbon, etc. It is produced by using quartzite, iron ore, coke and electrode paste. Around 1.75 to 2 tonnes quartzite is required to produce one tonne of ferro-silicon. A very high consumption of power, i.e., 9,000 to 10,000 kWh is required to produce one tonne ferro-silicon. It is a powerful deoxidising agent and its major applications are in electrical steel used for transformers and dynamos, alloy steel for tools & automobile valves, in iron casting and mineral dressing.

Bharat Alloys & Energy Ltd, Kurnool, Andhra Pradesh; VBC Ferro Alloys, Medak, Andhra Pradesh; SMS Smelters Ltd, Lekhi, Arunachal Pradesh; Visvesvaraya Iron & Steel Plant, Bhadravati, Karnataka; Silical Metallurgic Pvt. Ltd, Palakkad, Kerala; Jayantia Alloys, Meghalaya and Indian Metals & Ferro Alloys Ltd, Therubali, Odisha are the major producers of ferro-silicon. Small-scale producers of ferro-silicon are also in operation in Kerala and Tamil Nadu. In Meghalaya, three units have sprung up that produce ferro-silicon.

The production of ferro-silicon which was around 97,700 tonnes in 2009-10 increased to 117,000 tonnes in 2010-11.The domestic consumption of ferro-silicon in the organised sector was 42,900 tonnes in 2010-11.

NOBLE FERRO-ALLOYS

Noble ferro-alloys are one of the vital additive inputs required especially in production of alloy and special steel. Noble ferro-alloys also refer to alloys used in small quantities and are relatively expensive compared to bulk ferro-alloys. These are used in the production of steel as deoxidant and alloying agents.

These high temperature alloys impart strength, resistance and stability within a temperature range from 260 to 1200^{o} C. These alloys are used generally in turbine engines, power plants, furnaces and all pollution control equipment. Noble ferro-alloys include ferro-vanadium, ferro-titanium, ferro-nickel, ferro-molybdenum, ferro-tungsten and ferro-niobium. In India, noble ferro-alloys are mostly manufactured through alumino-thermic process.

Ferro-nickel

Production of ferro-nickel was not reported in the organised sector. However, production of 209 tonnes & 250 tonnes of ferro-nickel-magnesium was reported in 2009-10 and 2010-11, respectively.

The reported consumption of ferro-nickel in 2010-11 was 2,133 tonnes.

Ferro-molybdenum

There were five important units, namely, Mehra Ferro-alloys, Electro Ferro-alloys Pvt. Ltd, India Thermit Corporation, Dandeli Steel & Ferro-alloys Ltd and Eastern Metals & Ferro-alloys Ltd. The all India production which was 2,822 tonnes in 2009-10 increased to 3,050 tonnes in 2010-11. The consumption reported in 2010-11 was 992 tonnes.

Ferro-tungsten

Production of ferro-tungsten has remained static at 150 tonnes in 2009-10 & 2010-11. The reported internal consumption was 18 tonnes for the year 2010-11.

Ferro-vanadium

Production of ferro-vanadium in 2009-10 which was 1,389 tonnes increased to 1,500 tonnes in 2010-11. The reported consumption in 2010-11 was 960 tonnes.

Others

Misra Dhatu Nigam Ltd (A Govt. of India Enterprise), Hyderabad, produced chiefly cobalt, molybdenum, titanium and tungsten-based super-alloys.

The production details of various types of bulk ferro-alloys and noble ferro-alloys in 2008-09 to 2010-11 are furnished in Table - 2.

Information on plantwise capacity of principal ferro-alloys in India together with general specifications of products is given in Table-3. Consumption of principal alloys by different industries are detailed in Table-4.

Table – 3 : Statewise, Plantwise Capacity and Specifications of Principal Ferro-alloys Produced in India

Name & location of the plant	Product	Specifications	Installed capacity (tpy)
Andhra Pradesh			
Andhra Ferro-alloys Ltd Srinivasanagar, Dist. Vizianagaram	HC ferro-chrome	Cr: 60-65% max, Si: 2-4% max, C: 6-8% max, P: 0.040% max, S: 0.040% max	20000
	Silico-manganese	Mn: 60% min, C: 2.5% max, Si: 14% min, P 0.3 % max, S: 0.035% max	
FACOR Alloys Ltd Shreeramnagar, Garividi Dist. Vizianagaram	HC ferro-manganese	Mn: 70-80%, C:6-8% Si: 1-5 % max P: 0.35% max S: 0.05% max Size: 25-150 mm +/- 10% Corresponding ISI specification: IS 1171-2011	72500 (For all ferro-alloys)
	Ferro-chrome	Cr: 60-63%, Si: 3-4%, C: 6-8%, P: 0.03-0.05% (max), S: 0.03-0.05% (max)	
	Silico-manganese	Mn: 60-70%, Si: 16-20% C: 2.0% max, S: 0.03%, P: 0.3 %, Size: 10 - 150 mm +/- 10% Corresponding ISI specification: IS 1470-1990	
	Ferro-silicon	Si: 60-80%, C: 0.15% max, P: 0.05%, S: 0.05% max, Al : 1-15% max, Size: 25-150 mm +/- 10% Corresponding ISI specification: IS 1110-2011	
	Ferro- silicon- maganesium	Mg: 4-30%, Si: 44-55 %, Al: 1.00%, Ca: 1.0-4.0%,	
	Silico-chrome	NA	
	Other ferro-alloys	NA	
Jindal Stainless Ltd (Ferro Alloys Division) Jindal Nagar, Kothavalasa Dist.Vizianagaram .	HC ferro-chrome	Cr: 62%, Si: 2.5%, C: 7-8%, P: 0.040%,	40000
GMR Technologies & Industries Ltd Village Ravivalasa Dist. Srikakulam.	LC ferro-manganese MC ferro-manganese HC ferro-manganese	Mn: 60%, Si: 16%, S: 0.05%, P: 0.5%	25000 (Total)
	Silico-manganese	–	–
	Ferro-silicon	–	–
	LC ferro-chrome	Cr: 60-68%,	–
	HC ferro-chrome	Si: 2.0 to 4% , S: 0.05 (max) ,	–
	Silico-chrome	P: 0.03%, S: 0.05%	

(Contd.)

Table - 3 (Contd.)

Name and location of the plant	Product	Specifications	Installed Capacity (tpy)
VBC Ferro Alloys Ltd Village Rudraram Patancheru Mandal Dist. Medak.	Ferro-silicon Ferro-chrome Silico-manganese/ Ferro-manganese	– –	10000 27000 31500
Nav Bharat Ferro-Alloys Ltd E.M.D., Paloncha, Kothagudem Dist. Khammam.	HC ferro-chrome	Cr: 60% (min), Si: 3-4% (max), C: 6-8%, P: 0.03% (max), S: 0.03% (max)	12491
	Silico-manganese	Mn: 60-70%, Si: 15-16% (min), C: 2% (max), P: 0.03% (max), Si: 0.03% (max)	9581
	Ferro-silicon	Si: 40-45%/70-75%/75-80%, Al: 0.5% (max)/1.25% (max), C: 0.15% (max), P: 0.05% (max), S: 0.05% (max)	9309
Sree Sarda Alloys Ltd Ravivalsa, Tekkali Mandal Dist. Srikakulam.	Ferro-chrome	NA	6000
Chhattisgarh			
Hira Group of Industries Jain Carbides & Chemical Ltd (i) Unit 1, Urla, Dist. Raipur.	HC ferro-manganese	Mn: 70-75%, Si: 1.5% (max), C: 6-8% (max), P: 0.40% (max), S: 0.05% (max)	7000
	Silico-manganese	Mn: 60-65%, Si: 13-17% (max), C: 2.5% (max), P: 0.35% (max), S: 0.03% (max)	20000
(ii) Unit-2	HC ferro-manganese Silico-manganese	 Mn: 60-65%	14000 12000
(iii) Hira Ferro Alloys Ltd Urla, Dist. Raipur.	HC ferro-manganese	Mn: 70-75%, Si: 1.50% max, C: 6-8 %, P: 0.30% max, S: 0.05% max	61,500
	Silico-manganese	Mn: 60-65%, Si: 14-17%, C: 2.0% max, P: 0.35% max, S: 0.05% max	
(iv) Alok Ferro-Alloys Ltd Raipur.	Silico-manganese	NA	18000
INDSIL Energy & Electrochemical Ltd Raipur, Chhattisgarh	HC ferro-manganese	N A	25000
	Silico-manganese	Mn: 55% (min), Si: 23-27%, C: 0.1 % (max)/0.2% (max)/0.3% (max), S: 0.02% (max), P:0.15% (max)	21500
Sarda Energy & Minerals Ltd (Formerly Raipaur Alloys & Steel Ltd.)	Ferro-manganese Silico-manganese	– –	66000 –
Chhattisgarh Electricity Co. Ltd Siltara, Raipur.	HC ferro-manganese	Mn: 70-75%, Si: 1.5-2.0%, C: 6.0-8.0%, P: 0.35-0.40%, S: 0.05 (max)	36000
	Silico-manganese	Mn: 60-65% , Si: 15-20%, C: 2.0-2.5%, P : 0.3-0.35 %, S: 0.05% (max)	NA

(Contd.)

Table - 3 (Contd.)

Name & location of the plant	Product	Specifications	Installed capacity(tpy)
Nav-chrome Ltd Urla Industrial Area Dist. Raipur.	HC ferro-manganese Silico-manganese HC ferro-chrome	NA NA NA	21560 14700
Deepak Ferro Alloys Ltd Urla Industrial Area Raipur.	Ferro-manganese HC ferro-manganese MC ferro-manganese LC ferro-manganese	Std. Specified	5000
	Silico-manganese Ferro-Silicon		5000 –
	Ferro-chrome LC ferro-chrome HC ferro-chrome	 NA Cr: 60-70%, Si: 2 to 4%, S : 0.05%, C: 6 to 8%	5000
	Silico-chrome Others	- -	- -
Jindal Steel & Power Ltd Kharsia, Raigarh.	HC Ferro-chrome	Cr: 60-66%, C: 6 to 8%, Si: 4% (max), P: 0.050 (max), S: 0.050 (max),	36000
	Silico-manganese	Mn: 60%, Si: 15%, P: 0.3% max	-
Goa			
Karthik Alloys Ltd	NA	NA	4100
Gujarat			
Essel Mining & Industries Ltd Vapi, Dist. Valsad.	Ferro-vanadium	V: 50%, C: 0.1% (max), S and P: 0.05% each, Al: 1.5%	400
	Ferro-molybdenum	Mo: 60%, C: 0.1%, S: 0.08%, P: 0.06%, Al: 0.5%	1200
	Ferro-titanium	NA	600
Electro Ferro-Alloys (Pvt.) Ltd Ahmedabad, Gujarat.	Ferro-molybdenum Ferro-silico-zirconium	NA	300
Baroda Ferro-Alloys Dist. Panchmahals.	HC ferro-chrome	NA	3500
Haryana			
Haryana Ferro-Alloys Ltd	–	–	2500
Jharkhand			
Anjaney Ferro Alloys Ltd, Mihijam Dist. Dumka.	Ferro-silicon Silico-manganese Ferro-manganese	NA NA NA	NA NA NA
Bihar Foundary & Casting Ltd (Unit Gautam Ferro Alloys)	Silico-mangnese	Si: 14%, Mn : 60%	34000
Gautam Ferro-Alloys Ltd	–	–	5500
Karnataka			
Sandur Manganese & Iron Ores Ltd Vyasanakere, Dist. Bellary (Plant closed since 1.8.1998)	HC ferro-manganese Silico-manganese Ferro-silicon	–	29100 20000 24000
Dandeli Steel & Ferro Alloys Ltd Dandeli, Dist. Uttar Kannada.	Ferro-manganese	Mn: 70-75%, C: 0.1%, Si: 2.4%, P : 0.15%, S: 0.05%, Size: 37 mm	6000
	MC ferro-manganese	Mn: 70-75%, C: 1.5%, P: 0.25%, Si: 2%, S: 0.05%	

(Contd.)

Table - 3 (Contd.)

Name & location of the plant	Product	Specifications	Installed capacity(tpy)
S.R. Chemicals & Ferro-alloys KIADB Honaga, Belgaum	LC Ferro-manganese	Mn: 70%, C: 0.1%, P: 0.12%	25
Thermit Alloys (Pvt.) Ltd N-7, Industrial Estate Shivamogga.	Ferro-manganese Silico-manganese Ferro-chrome Ferro-silicon Silico-chrome	NA NA NA NA NA	1200
Kerala			
The Silical Metallurgic Ltd Wayalur, Dist. Palakkad.	Silico-manganese	Mn: 70-75%	3600
INDSIL Electrosmelts Ltd Pallatheri, Dist. Palakkad.	Silico-manganese Ferro-silicon	NA NA	NA NA
INDSIL Hydro Power & Manganese Ltd Palakkad, Kerala	Silico-manganese	Mn: 55% (min), Si: 23-27%, C: 0.1 % (max)/0.2% (max)/0.5% (max), S: 0.02% (max), P: 0.15% (max)	14400
Shri Laxmi Electro Smelters (Pvt.) Ltd. Industrial Development Area Erumathala, P.O. Aluva - 683 105.	Ferro-silicon	NA	NA
Madhya Pradesh			
MOIL Ltd (formerly Manganese Ore (India) Ltd) Ferro-manganese Plant Bharweli (Manjhara), Dist. Balaghat.	HC ferro-manganese	Mn:78±1%, P: 0.35% (max), C: 6.8%	10000
Jalan Ispat Castings Ltd Industrial Area Meghnagar, Dist. Jhabua.	Silico-manganese	Mn: 60-65%, Si: 15-20%, C: 2% (max), P: 0.35%	12000
Crescent Alloys Pvt. Ltd Seoni.	Ferro-silicon Ferro-manganese	N.A. N.A.	4500 (Total)
Maharashtra			
Chandrapur Ferro Alloy Plant,(erstwhile Maharashtra Electrosmelt Ltd) Chandrapur - 442 401.	HC ferro-manganese	Mn: 70-74 % and 74-78% , Si: 1.5% (max), C: 6.8%, P: 0.43%. (max)	100000 (Total)
	MC ferro-manganese	Mn : 70-74% and 74-78% , Si: 2% max, C: 1 - 3% , P: 0.4% max	
	LC ferro-manganese	Mn: 70-74% and 74-78% , Si: 2% (max), C: 1.5% max, P: 0.4% max,	
	Silico-manganese	Mn: 60-65% and 65% Min, Si: 15-20%, C: 2 % max, P: 0.35% max	
Nagpur Power & Industries Ltd P.O. Khandelwalnagar Dist. Nagpur.	Silico-manganese HC ferro-manganese	Mn: 60-65%, P: 0.35% Mn: 70-75%, P: 0.4%	NA NA
Bharat Pulverising Mills Ltd Andheri, Mumbai.	Ferro-molybdenum Ferro-tungsten Ferro-vanadium	NA NA NA	200 (Total)

(Contd.)

Table - 3 (Contd.)

Name & location of the plant	Product	Specifications	Installed capacity (tpy)
Sunbel Alloys Co. of India Ltd Thane-Belapur, Mumbai.	Ferro-molybdenum Ferro-silicon Ferro-tungsten Ferro-vanadium	NA NA NA NA	300 (Total)
Natural Sugar and Allied Ind. Ltd, Sainagar, Ranjani, Dist. Osmanabad.	HC Ferro-manganese	Mn: 70-75%, Si: 2-2.5%, P: 0.4%, C: 6-8%	(5 MVA)
	Silico-manganese	Mn: 60-65%, Si: 13-15%, P: 0.3%, C: 2-2.5%	(6 MVA)
Odisha			
Ferro Alloys Corporation Ltd Ferro Chrome Plant Randia D. P. Nagar Randia, Dist. Bhadrak.	HC ferro-chrome/ Charge-chrome	Cr: 60-64%, Si: 3-4%, C: 6-8%, P: 0.03-0.05% (max), S: 0.03-0.05% (max)	65000
Tata Steel Ltd, Ferro Manganese Plant, Joda, Dist. Keonjhar	HC ferro-manganese Silico-manganese	Mn: + 70%, C: 6-8 %, Si :0.3-2%, P: 0.2-0.4%, Mn: 46-48%, Si: 14.56%, P: 0.197%	50400
Tata Steel Alloys Ltd, Ferro Alloy Plant Cuttack.	Ferro-chrome		50000
Tata Steel Ltd, Charge-chrome Plant Bamnipal, Dist. Keonjhar.	Charge-chrome	Cr: 60 (min), Si: 4% (max) , C: 8% (max), P: 0.03% (max) , S: 0.03% (max)	55000
Balasore Alloys Ltd, Balgopalpur, Dist. Balasore. (Formerly Ispat Alloys Ltd)	HC ferro-chrome	Cr: 60-63% Si: 3.5% (max) C: 8.0% (max) Grade I Cr: 57-60% S: 4.0% (max) C: 8.0% (max) Grade II	100000
Jeypore Sugar Co. Ltd, (Ferro-manganese Plant) Dist. Rayagada.	HC ferro-chrome	Cr: 60-65%, P: 0.055%, C: 2%, S: 0.05%, Si: 4%, Fe: Balance	22000
	Silico-manganese	Mn: 60-65%, Si: 15-18%, C: 2% max.	22000
IDCOL Ferro Chrome & Alloys Ltd Jajpur Road, Dist. Jajpur.	HC ferro-chrome	Cr: 62-65%, Si: 1.5 to 8%, C: 8% (max)	18000
Indian Charge Chrome Ltd, (merged with Indian Metals & Ferro Alloys Limited)	HC ferro-chrome/ Charge-chrome	Cr: 60%	62500
Indian Metals & Ferro Alloys Ltd (IMFA), Therubali, Dist. Rayagada.	Ferro-silicon HC ferro-chrome	Si: 70-75%, Cr: 60%	61000 275000
Superb-Metalalloys (Pvt.) Ltd Rairangpur, Dist. Sundergarh	Ferro-columbium Ferro-molybdenum Ferro-tungsten Ferro-vanadium	NA	300 (Total)

(Contd.)

Table - 3 (Contd.)

Name & location of the plant	Product	Specifications	Installed Capacity (tpy)
Puducherry			
The Silical Metallurgic Ltd	Ferro-silicon	–	10560
	Ferro-silicon-magnesium	–	1800
VSK Ferro Alloys Ltd Thuthipet.	Ferro-silicon	Si: 72.3%, C: 0.15%, S: 0.051%, Mn: 0.55%, P: 0.042%, Fe: 26.13%	3000
Snam Alloys (Pvt.) Ltd Kariamanikam, Dist. Puducherry.	Ferro-silicon Ferro-silicon-magnesium	NA	12000
Punjab			
Mehra Ferro-Alloys Verka, Amritsar.	Ferro-molybdenum Ferro-vanadium Ferro-titanium Ferro-tungsten Ferro-boron	NA	300 (Total)
Sikkim			
Akshay Ispat & Ferro Alloys Ltd, Mamring, Namchi, Dist. South Sikkim.	Ferro-silicon	NA	6000
Uttar Pradesh			
The India Thermit Corp. Ltd Fazalganj, Kanpur.	Ferro-molybdenum Ferro-titanium Ferro-chrome Ferro-boron Chromium metal LC ferro-manganese Ferro-vanadium	NA	300 (Total)
Hindustan Ferro-Alloys Hamirpur.	Ferro-siIlicon	NA	3200
West Bengal			
Bhaskar Shrachi Alloys Ltd, Durgapur	Silico-manganese	Si: 15%	24000
Cosmic Ferro Tech. Ltd, Bishnupur, Dist: Bankura.	HC ferro-manganese	Mn: 66-71%, Si: 1.4% C: 6.5-7%, P: 0.3%	45375
	Silico-manganese	Mn: 61-65%, Si: 15.5% C: 1.9%, P:0.28%	
Sri Gayatri Minerals Pvt. Ltd, WBIIDC Growth Centre, Bishnupur, Bankura.	HC silico-manganese	Mn: 60-65% & 65% min, Si: 15% min & 16% min, C: 2% max, P: 0.3 max, S: 0.03 max	24000
Karthik Alloys Ltd (I & II) Durgapur.	MC silico-manganese	Mn: 54-56%, C: 0.2-0.5% Si: 22-25% P: 0.15-0.2, S: 0.05%	19000
	LC silico-manganese	Mn: 53-55%, C: 0.15-0.2% Si: 25-28% P: 0.15-0.2%, S: 0.05%	NA
Maithan Alloys Ltd, Burdwan.	Ferro-manganese Silico-manganese Ferro-chrome	NA	52600 (Total)
Monnet Ferro Alloys Ltd Burdwan.	Silico-manganese	NA	12500
Shyam Ferro Alloys Ltd Burdwan.	HC silico-manganese HC ferro-manganese HC ferro-chrome	NA	100000 (Total)

(Contd.)

Table - 3 (Concld.)

Name & location of the plant	Product	Specifications	Installed capacity(tpy)
Srinivasa Ferro Alloys Ltd Durgapur,Burdwan.	HC ferro-manganese	Mn: 70-74%, 74-76% Si: 1.5% max C: 6-8% P: 0.25,0.30 and 0.40 max, S: 0.03 max	10800
	HC silico-manganese	Mn: 60-65% & 65% min Si: 15% min & 16% min C: 2% max P: 0.3% max, S: 0.03% max	23400
	LC silico-manganese	NA	5400
Shri Vasavi Industries Ltd WBIIDC Industrial Growth Centre, Bishnupur, Dist. Bankura.	HC ferro-chrome	Cr: 58-60%, Si: 2-4%, C: 8% max, P: 0.05% max S: 0.05% max	45000 (16MVA 1No. & 12MVA 1 No.)
Modern India Con-Cast Ltd, WBIIDC Industrial Growth Centre, Bishnupur, Dist. Bankura.	Bulk ferro-alloys	–	22000
Rohit Ferro Tech. Ltd Bishnupur, Dist. Bankura	HC ferro-chrome	Cr: 60% (min), C: 8% (max) Si: 3.5% (max), P: 0.03% (max) S: 0.04% (max)	45375

Note: *HC : High carbon. MC: Medium carbon. LC: Low carbon.*
Source: *Information collected by IBM on non-statutory basis.*

Table – 4 : Reported Consumption of Principal Ferro-alloys, 2010-11 (P) (By Industries)

(In tonnes)

Ferro-alloy	Iron & steel	Alloy steel	Sponge iron	Foundry	Electrode	Ferro-alloys	Total
Ferro-aluminium	297 (2)	52(1)	–	–	–	–	349
Ferro-chrome	235100(13)	37800(12)	–	400(9)	++(1)	–	273300
Ferro-chrome-silicon	–	460(1)	–	-	-	-	460
Ferro-manganese	113700(14)	7900(10)		700(19)	500(9)	–	122800
Ferro-molybdenum	240(9)	695(8)	–	57(9)	–	–	992
Ferro-nickel	–	2133(4)	–	–	–	–	2133
Ferro-niobium	851(4)	2(2)	–		–	–	853
Ferro-phosphorus	263(3)	20(2)	–	10(1)	–	–	293
Ferro-silicon	36600(20)	4100(7)	-	2200(21)	++(2)	++(1)	42900
Ferro-silicon-magnesium				13(2)			13
Ferro-titanium	1030(9)	216(6)	–	4(1)	–	–	1250
Ferro-tungsten	–	18(2)	–	–	–	–	18
Ferro-vanadium	886(10)	68(5)		6(2)	–	–	960
Silico-manganese	196500(21)	3100(5)	–	200(3)	–	–	199800

Note: *Figures rounded off. Data collected on non-statutory basis. Figures in parentheses denote the number of units in the organised sector reporting* consumption. Data collected on non-statutory basis.*
(Includes actual consumption and / or estimates made wherever required)*

ENVIRONMENTAL ASPECTS AND FUTURE SCOPE

Studies reveal that depending on the ferro-alloy manufactured, waste generation per day in 35 tpd and 50 tpd ferro-silicon and ferro-chrome plants respectively, may be in the following range:

Silica fines: 7 to 8 tonnes/day

Fe-Cr slag (fined boulder): 40 tonnes/day

Charcoal & coke fines: 7 to 8 tonnes/day

To utilise the waste from ferro-alloys industries, a typical Fe-Si or Fe-Cr manufacturing unit can provide material for 10 small-scale units for manufacturing bricks and each unit can produce 2,400 bricks per day. Other units which can be set up are board-and-briquette-making units. The utilisation of waste materials by converting them into building materials will result in bringing down the building material cost, and therefore, lead to conservation of natural resources like clay and sand.

Domestic vanadium sludge is used for producing ferro-vanadium by Essel Mining & Industries Ltd, Gujarat.

The implementation of the Kyoto Protocol by European Union provides significant opportunities for Ferro-alloys Industry in India to implement CO_2 reduction technologies, which could be traded in terms of carbon credits. Installation of an electricity generation facility driven by CO-rich furnace gas is an obvious means by which CO_2 saving could be achieved.

WORLD REVIEW

The top ferro-alloy producing countries were China, South Africa, India, Kazakhstan and Russia. Estimated world production of bulk ferro-alloys of chromium, manganese and silicon was about 34.1 million tonnes in 2010 as compared to that of 29.3 million tonnes produced in 2009. The world production of ferro-alloys for principal countries during the years 2008 to 2010 are given in Table-5. The markets for the bulk alloys like high carbon ferro-manganese, silico-manganese, ferro-silicon and high carbon ferro-chrome showed varied responses to the fluctuations in steel and stainless steel production which seem to have had influences as per the different circumstances that prevailed in different markets.

World production of various ferro-alloys in principal producing countries is furnished in Table-5.

Table - 5 : World Production of Ferro-alloys, 2008 to 2010
(By Principal Countries)

(In tonnes)

Country	Ferro-alloy	2008	2009	2010
Australia	FeMn	128000	-	-
	FeSiMn	126000	-	-
	Silicon metal[e]	33000	33000	33000
Brazil	FeCr	209273	108893	-
	FeSiCr	13674	1750	13100
	FeSiMg	30800	18300	33600
	FeMn	149900	44600	87150
	FeSiMn	238000	109500	218650
	FeNi	26300	31600	23850
	FeNb	81600	48900	77250
	FeSi	183000	175000	247300
	Others	47800	21200	36650
Canada	FeNb[e]	6644	6000[e]	6000[e]
	FeSi[e]	70000	70000	70000

Contd.

Table- 5 (concld..)

(In tonnes)

Country	Ferro-alloy	2008	2009	2010
China	FeCr	1505800	1813000	-
	FeSiCr	72300	116000	-
	Others	16722000	20171000	-
Colombia	FeNi	126638	153628	145239
Dominican Republic	FeNi	47408	-	-
Finland	FeCr	233550	123310	238000
Georgia	FeSiMn	123468	112016	203464
Greece	FeNi	83200	4 1300	40000[e]
Iceland	FeSi	107882	112992	114230
India*	FeAl	8170	70 17	7600
	FeCr	817239	892923	1032000
	FeSiMg	13400	171 32	18500
	FeMn	384577	356123	404000
	FeSiMn	891458	1116047	1299000
	FeMo	2162	2822	3050
	FeSi	99595	97682	117000
	FeTi	1661	1929	2100
	FeV	1501	1389	1500
	Others	541	569	610
Japan	FeCr	13888	7698	16208
	FeMn	431181	361375	453265
	FeSiMn	58884	49205	49865
	FeMo	4554	3598	4615
	FeNi	301361	284884	348420
	FeV	3477	2560	4190
	Others	14478	12957	16374
Kazakhstan	FeCr	1220315	977235	1189593
	FeSiCr	133828	51576	144936
	FeSiMn	179939	181776	203778
	FeSi	54964	30028	4456
	Others	1473	1205	1283
New Caledonia	FeNi	148960	156553	165506
Norway	FeMn[e]	130000	130000	130000
	FeSiMn	273485	250000[e]	250000[e]

Contd.

Table- 5 (concld..)

(In tonnes)

Country	Ferro-alloy	2008	2009	2010
	FeSi	185344	233974	235000[e]
	Others[e]	60000	60000	60000
Russia	Spiegeleisen[e]	7000	7000	7000
	FeCr	475686	235600	-
	FeSiCr	72050	8285	-
	FeMn[e]	110000	110000	110000
	FeSiMn[e]	40000	40000	40000
	FeNi[e]	39503	40000	40000[e]
	FeSi[e]	850000	850000	850000
	Others[e]	34000	34000	34000
South Africa	FeCr	3268659	2341754	2346132
	FeMn[e]	498000	265000	517000[e]
	FeSiMn[e]	263000	140000	273000[e]
	FeSi	137000	110000	128000[e]
	FeV[e]	19000[e]	13000	19000[e]
Sweden	FeCr	118700	31100	64400
Ukraine	FeMn	361501	135339	285643
	FeSiMn	958667	771950	1000329
	FeNi	97848	76487	102940
	FeSi	201706	193034	253801
	Others	43127	23882	28546
USA	FeSi	287000	245000	280000
Venezuela	FeMn[e]	15000	15000	15000
	FeSiMn[e]	35000	35000[e]	35000[e]
	FeNi	42300	40113	39000[e]
	FeSi[e]	92000	83000[e]	83000[e]
Zimbabwe	FeCr	145430	72223	146378
	FeSi	1612	603	-

***Source**: World Minenral Production, 2006-2010.*

Note: FeAl : Ferro-aluminium; FeCr : Ferro-chrome; FeSiCr : Ferro-silico-chrome; FeSiMg : Ferro-Silico-magnesium; FeMn : Ferro-manganese; FeSiMn : Ferro-silico-manganese; FeMo : Ferro-molybdenum; FeNi : Ferro-nickel; FeNb : Ferro-niobium; FeSi: Ferro-silicon; FeTi : Ferro-titanium; FeV : Ferro-vanadium.

* India's production of ferro alloys during 2008-09, 2009-10 and 2010-11 is furnished in Table 2.

FOREIGN TRADE

Exports

In 2010-11, exports of ferro-alloys increased to 22,40,354 tonnes valued at ₹ 13,392 crore from 8,62,769 tonnes valued at ₹4,139 crore in the previous year. In terms of quantity, exports of ferro-chrome accounted for 58%, followed by ferro-silico-manganese (31%), ferro-manganese (5%), ferro-silico-chrome (2%) and ferro-silicon (2%) in 2010-11. The other ferro-alloys together accounted for remaining 2% of exports. Exports were mainly to China (33%), Rep. of Korea and Japan (15% each), Italy (7%) and Netherlands (6%) (Tables 6 to 24).

Imports

Imports of ferro-alloys increased from 2,08,973 tonnes valued at ₹1,863 crore in 2009-10 to 2,25,263 tonnes valued at ₹2,523 crore in 2010-11. In terms of quantity, imports of ferro-silicon accounted for about 60% followed by ferro-manganese (17%), ferro-chrome (10%) and ferro-nickel (3%). Other ferro-alloys together accounted for remaining 10% of imports in 2010-11. Imports were mainly from Bhutan (34%), followed by China (19%), South Africa (14%) and Russia (12%) (Tables 25 to 42).

Table – 7 : Exports of Ferro-Boron (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**3**	**629**	**1**	**157**
Latvia	–	–	1	95
Saudi Arabia	–	–	++	44
Kenya	–	–	++	12
USA	–	–	++	5
Other countries	3	629	++	1

Table – 6 : Exports of Ferro Alloys : Total (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**862769**	**41394476**	**2240354**	**133915094**
China	292379	13105035	728609	43081986
Korea, Rep. of	122533	5881230	340700	20904859
Japan	114013	5937997	326588	20725618
Netherlands	44114	2139266	139329	8604846
Italy	65039	3000745	148282	8331390
Chinese Taipei/ Taiwan	36422	1845370	86393	4933468
Turkey	11002	536191	77952	4325835
USA	2111	165196	55583	3317101
Ukraine	10852	527735	32206	1884196
Iran	3910	184452	27645	1787615
Other countries	160394	8071259	277067	16018180

Table – 8 : Exports of Ferro-Chrome (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**471953**	**21848549**	**1305855**	**81673185**
China	290386	12998441	699798	42540768
Korea, Rep. of	94289	4397977	290838	17865080
Japan	49201	2575797	124357	9916607
USA	1589	112487	50009	3140824
Netherlands	4773	173952	48523	2775997
Chinese Taipei/ Taiwan	5383	243483	20579	1257100
Italy	2387	99336	17749	1120985
Korea, Dem. People's Rep. of	7073	347970	14700	890914
Belgium	2319	111777	8519	333639
Nigeria	–	–	6828	280913
Other countries	14553	787329	23955	1550358

Table – 9 : Exports of Charge-Chrome (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**++**	**3**	**6**	**1074**
Morocco	–	–	6	1074
Other countries	++	3	–	–

Table – 10 : Exports of Ferro-Manganese (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**66521**	**3388350**	**120053**	**7282192**
Iran	2236	110703	24063	1561894
Chinese Taipei/ Taiwan	10252	579196	22343	1272736
Italy	5482	292246	13428	742326
Saudi Arabia	1946	91244	7800	591597
Netherlands	6636	317351	8517	519798
Pakistan	6910	308375	7822	422282
Japan	1644	84431	5111	338158
Latvia	1600	80710	4534	258980
Korea, Rep. of	2140	103661	3845	226754
Turkey	747	40757	3976	216095
Other countries	26928	1379676	18614	1131572

Table – 11: Exports of Ferro-Molybdenum (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**1766**	**237214**	**2719**	**685808**
Netherlands	1120	141693	2211	610924
UAE	458	60791	86	22160
Singapore	8	7506	100	14308
Chile	-	-	24	7840
Oman	11	451	44	5546
Finland	-	-	30	5482
Jordan	20	2310	80	4638
Israel	++	3	13	3366
Indonesia	-	-	34	2696
Malaysia	22	585	17	2287
Other countries	127	23875	80	6561

Table – 12 : Exports of Ferro-Nickel (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**++**	**9**	–	–
Nepal	++	9	–	–
Other countries	–	–	–	–

Table – 13 : Exports of Ferro-Niobium (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**118**	**23717**	**1815**	**33681**
Bhutan	–	–	1697	18372
Nepal	15	510	77	5518
Israel	11	2024	10	5376
Libya	–	–	20	1828
Turkey	++	40	1	1072
Finland	–	–	10	921
Indonesia	–	–	++	517
Germany	–	–	++	40
USA	–	–	++	37
Other countries	92	21143	–	–

Table – 14 : Exports of Ferro-Phosphorus (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**11**	**740**	**233**	**6184**
Korea, Rep. of	–	–	136	3454
Netherlands	–	–	97	2301
UK	10	667	++	429
Other countries	1	73	++	++

Table – 15 : Exports of Ferro-Silico-Chrome (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**–**	**–**	**50476**	**878413**
China	–	–	27841	479882
Japan	–	–	22625	398274
Nepal	–	–	10	256
Other countries	–	–	++	1

Table – 16 : Exports of Ferro-Silico-Magnesium (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**3597**	**242902**	**3988**	**310083**
Brazil	635	46042	1165	85569
Turkey	850	58250	877	66046
Iran	–	–	234	25360
Slovenia	109	7891	288	24853
Saudi Arabia	145	10538	228	16886
Sri Lanka	172	9506	198	15986
Oman	10	697	180	15185
Italy	15	1090	172	12519
Portugal	144	9945	144	11292
Czech Republic	105	7497	146	10183
Other countries	1412	91446	356	26204

Table – 18 : Exports of Ferro-Silicon (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**20106**	**1156561**	**50011**	**3681465**
Netherlands	5422	293541	20664	1479303
Italy	4490	242461	16219	1224715
Brazil	981	70390	1656	125400
Belgium	1591	87469	1860	119714
Turkey	210	16910	1444	106075
Poland	422	22854	1086	75664
Japan	12	980	901	67416
Luxembourg	–	–	749	48451
Slovenia	719	44179	590	44929
Kenya	242	14445	565	40705
Other countries	6017	363332	4277	349093

Table – 17 : Exports of Ferro-Silico-Manganese (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**298301**	**14469837**	**699585**	**39222936**
Japan	62603	3244507	173274	9995250
Italy	52665	2365612	100564	5220999
Turkey	8614	391989	68736	3749847
Netherlands	25826	1195650	59271	3208620
Korea, Rep. of	25882	1368295	45571	2799136
Chinese Taipei/ Taiwan	20734	1018310	43262	2386536
Ukraine	8939	446817	31709	1853752
Latvia	3668	173141	26055	1460733
Thailand	15179	690044	19479	1102258
Syria	–	–	12017	689274
Other countries	74191	3575472	119647	6756531

Table – 19 : Exports of Ferro-Titanium (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**6**	**881**	**46**	**4926**
Korea, Rep of	–	–	20	1855
Chile	2	269	7	788
Netherlands	–	–	4	587
UAE	–	–	4	467
Turkey	1	88	2	281
Finland	–	–	3	213
Malaysia	–	–	1	179
Belgium	–	–	1	164
Israel	1	273	1	150
Other countries	1	151	2	132

Table – 20 : Exports of Ferro-Tungsten (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**1**	**232**	**15**	**1408**
Finland	–	–	12	1019
Philippines	++	46	3	371
USA	–	–	++	18
Other countries	1	186	–	–

Table - 21 : Exports of Ferro-Vanadium (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**29**	**6729**	**169**	**23247**
Netherlands	–	–	16	6451
Iran	10	2088	50	5278
Venezuela	–	–	40	3983
Mauritius	–	–	27	1900
UAE	3	528	6	1544
New Zealand	–	–	10	1268
Turkey	++	182	7	1165
Finland	–	–	1	576
Israel	++	2	7	314
Jordan	++	141	++	251
Other countries	16	3788	5	517

Table – 22 : Exports of Ferro-Columbium (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**1**	**82**	**46**	**3276**
Israel	–	–	26	2358
Finland	–	–	20	918
Other countries	1	82	–	–

Table – 23 : Exports of Ferro-Zirconium (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value ₹. '000)
All Countries	**1**	**262**	**26**	**1684**
Brazil	–	–	25	1425
Netherlands	–	–	1	259
Other countries	1	262	–	–

Table – 24 : Exports of Ferro-Alloys (Others) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**355**	**17779**	**5310**	**105375**
USA	–	–	4350	69188
Japan	120	3521	320	9912
Italy	–	–	150	9847
Korea, Rep of	–	–	290	8431
Sudan	++	3	40	2054
Israel	13	960	22	1847
Sri Lanka	4	209	47	918
Saudi Arabia	–	–	9	626
Netherlands	10	603	25	605
Cameroon	–	–	27	591
Other countries	208	12483	30	1356

Table – 25 : Imports of Ferro-Alloys: Total (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**208973**	**18630802**	**225263**	**25230287**
Bhutan	68031	3411035	76313	4472382
China	26313	2257004	42959	4116187
Russia	29615	2577942	26558	2811788
Brazil	3073	1232297	4929	2528662
Japan	5325	729524	2668	2073678
South Africa	20215	1077742	32309	1627168
Greece	1540	319569	1588	1324761
Korea, Rep. of	8942	955898	3057	976554
Norway	6851	592686	9201	947714
Colombia	841	181053	2359	864303
Other countries	38227	5296052	23322	3487090

Table – 26 : Imports of Ferro-Boron (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**263**	**35288**	**429**	**58265**
China	262	34228	381	53671
Argentina	–	–	48	4594
Other countries	1	1060	–	–

Table – 27 : Imports of Ferro-Chrome (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**17226**	**1827839**	**22412**	**3041559**
Russia	9235	1016278	13522	1903995
Kazakhstan	2200	196684	2607	308819
China	3551	391389	1876	256285
South Africa	1149	93093	1472	198071
Brazil	331	34433	1482	185973
USA	66	11121	386	38809
Sweden	24	2917	187	24772
Germany	41	9887	133	22516
Turkey	42	7915	172	21211
UK	32	9756	43	16628
Other countries	555	54366	532	64480

Table – 28 : Imports of Charge-Chrome (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**500**	**16354**	**2503**	**125126**
South Africa	500	16354	2503	125126

Table – 29 : Imports of Ferro-Manganese (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**28604**	**1700420**	**38929**	**2140883**
South Africa	16228	741484	25708	1005111
Norway	4919	389117	6887	675311
Korea, Rep. of	6568	518283	2188	185698
China	105	9730	1283	109978
Bahrain	558	28956	1324	62628
Russia	90	3567	257	24947
Germany	–	–	297	16983
Malaysia	–	–	381	16082
Japan	2	485	252	13088
Netherlands	21	1939	105	10617
Other countries	113	6859	247	20440

Table – 30: Imports of Ferro-Molybdenum (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**1109**	**1320615**	**963**	**1443459**
Korea, Rep. of	26	30820	438	647191
China	31	42399	228	336452
Netherlands	110	137065	47	80366
Mexico	83	104254	38	76705
Chile	127	157175	54	76223
USA	51	57412	51	69068
Russia	357	405166	33	51019
Hong Kong	–	–	22	41279
Belgium	114	135378	20	23408
Vietnam	–	–	20	21605
Other countries	210	250946	12	20143

Table – 31 : Imports of Ferro-Nickel (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**21019**	**3465442**	**6862**	**4892738**
Japan	4399	601087	2335	2027345
Greece	1540	319569	1274	1302935
Columbia	841	181053	2359	864303
New Caledonia	691	142022	284	286037
China	11	1294	207	197349
France	++	302	100	101540
Netherlands	–	–	8	7280
Hong Kong	–	–	++	67
USA	61	11504	++	65
Unspecified	800	119140	295	105817
Other countries	12676	2089471	–	–

Table – 32 : Imports of Ferro-Niobium (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹. '000)
All Countries	**769**	**1171887**	**1432**	**2221360**
Brazil	639	997400	1317	2054218
Singapore	108	139824	87	118096
UK	17	25105	15	22926
Canada	–	–	7	13138
Germany	–	–	2	5262
Thailand	–	–	2	4116
Malaysia	–	–	2	3604
Other countries	5	9558	–	–

Table – 33 : Imports of Ferro-Phosphorous (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**1138**	**25771**	**1749**	**38095**
China	1110	22442	1328	27265
Vietnam	-	–	231	4262
Sweden	9	2131	33	2944
UK	13	644	22	830
UAE	–	–	39	812
Iran	–	–	42	777
Unspecified	–	-	54	1203
Other countries	6	554	++	2

Table – 34 : Imports of Ferro-Silico-Chrome (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**7**	**997**	**16**	**2156**
Japan	2	618	6	1164
China	5	379	10	992

Table – 35 : Imports of Ferro-Silico-Manganese (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**1377**	**61995**	**1642**	**87831**
South Africa	400	17592	1350	60016
China	30	2197	100	8798
Russia	–	–	30	6402
Poland	26	2178	28	3106
Mexico	–	–	20	2150
Iceland	–	–	20	2038
Georgia	290	10473	43	1977
Argentina	–	–	20	1837
Bahrain	81	3889	25	1091
Ghana	–	–	6	415
Other countries	550	25666	++	1

Table – 36 : Imports of Ferro-Silico-Magnesium (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**1523**	**109062**	**1597**	**139830**
China	1027	75513	827	68113
Brazil	237	17990	251	26113
Canada	–	–	186	16117
Iceland	63	5505	147	12594
UK	–	–	106	9282
Norway	21	1966	26	2738
Ireland	–	–	20	2046
Germany	–	–	21	1746
South Africa	8	627	13	1081
Other countries	167	7461	–	–

Table – 37 : Imports of Ferro-Silicon (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**125138**	**7025516**	**135094**	**8660391**
Bhutan	68031	3411035	76313	4472382
China	15798	1062222	32716	2224755
Russia	17404	896247	12493	768829
France	3224	393089	2795	312117
Norway	1523	163019	2288	269665
Iran	2223	124418	1820	114005
Argentina	976	89482	748	69946
Egypt	254	13771	966	66756
South Africa	1802	96300	1102	55828
Vietnam	60	4132	628	43852
Other countries	13843	771801	3225	262256

Table – 38: Imports of Ferro-Titanium (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**1843**	**227645**	**1658**	**397378**
UK	794	108227	996	254010
Russia	240	37822	204	54226
Canada	70	9531	81	20778
China	77	8069	81	19454
Ukraine	20	2990	53	13372
Netherlands	–	–	40	8072
Brazil	395	26391	126	7888
Germany	27	2793	16	7227
Korea, Rep. of	29	10027	14	4781
Unspecified	25	3803	20	4442
Other countries	166	17992	27	3128

Table – 39 : Imports of Ferro-Tungsten (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**20**	**24976**	**72**	**71671**
China	20	24976	55	64853
UK	–	–	15	3185
Hong Kong	–	–	2	3133
Singapore	–	–	++	500

Table – 40 : Imports of Ferro-Vanadium (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**881**	**948903**	**891**	**1005527**
China	188	222203	362	404374
South Africa	109	110018	161	181934
USA	151	105601	134	143719
Korea, Rep. of	50	42089	96	111701
Austria	161	190992	59	67250
Brazil	5	7116	39	49136
Japan	23	35850	12	16012
Malaysia	–	–	10	12830
Switzerland	–	–	8	10797
Netherlands	–	–	10	7428
Other countries	194	235034	++	346

Table – 41 : Imports of Ferro-Zirconium (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**193**	**22849**	**238**	**36640**
China	172	18894	238	36640
Other countries	21	3955	–	–

Table – 42 : Imports of Ferro-Alloys (Others) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**7363**	**645243**	**8775**	**865367**
Argentina	1292	112613	3351	325988
China	3926	341068	3266	305194
Brazil	320	35398	1476	173646
Canada	45	4083	436	34633
Australia	–	–	63	7647
Russia	1142	78595	19	2369
Iceland	41	3831	24	2235
Germany	1	820	1	1752
France	145	17673	5	646
Unspecified	2	451	130	10639
Other countries	449	50711	4	618

FUTURE OUTLOOK

Indian Ferro-alloys Industry is an important player in the international market. According to IFAPA, on an average, about 35 to 40% production is exported. The Industry output has always been surplus and meeting the demand of the domestic steel industry. India has also established itself as one of the major exporters of ferro-chrome and silico-manganese in the world. Presently, the boom in World Steel Production drove demand mainly for the bulk alloys of manganese and silicon and alloys of micro-alloying elements, vanadium and niobium.The rise in stainless steel production resulted in increase in demand for alloys of chromium ,nickel and molybdenm.

Indian Ferro-alloys Industry has a great future and it can compete with any country. India has advantage of having highly qualified and experienced technical personnel supported by skilled labour force. There is a need to encourage the Indian Ferro-alloys Industry for setting up captive power plants and also allot coal linkages for the same. The prospects for the Ferro-alloys Industry to grow are quite immense, provided innovations are made in the process technology and plant equipment design, and new cost-effective product mix is frequented at.

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

FIRECLAY

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

37 Fireclay

The name fireclay is given to a group of refractory clays which can withstand temperatures above pyrometric cone equivalent (PCE) - 19. Refractoriness and plasticity are the two main properties needed in fireclay for its suitability in the manufacture of refractory bricks. A good fireclay should have a high fusion point (>1,580^o C) and good plasticity. Fireclay containing high alumina and low iron oxide, lime, magnesia & alkalies is preferred by refractory manufacturers. The aluminous (kaolinitic) variety of fireclay is more refractory because of its hardness and density and absence of iron, giving it a white-burning colour. The absence of alkalies gives it a very high fusion temperature.

RESOURCES

India possesses substantial reserves of fireclay. The best deposits occur in association with the coal seams in the Lower Gondwana Coalfields of Andhra Pradesh, Jharkhand, West Bengal, Madhya Pradesh and Neyveli lignite fields in Tamil Nadu. Notable occurrences of fireclay, not associated with coal measures, are reported in Gujarat, Jabalpur region of Madhya Pradesh and Belpahar-Sundergarh areas of Odisha. The reserves of fireclay are substantial but reserves of high-grade (non-plastic) fireclay containing more than 37% alumina are limited.

Reserves and resources of fireclay as per UNFC system as on 1.4.2010 are estimated at 713.5 million tonnes. Out of these, 30.1 million tonnes are grouped under reserves category while the bulk, i.e., 683.4 million tonnes are classified under resources category. Out of 30.1 million tonnes reserves, 14.4 million tonnes are proved reserves and 15.7 million tonnes are probable reserves. Out of the total resources, Odisha accounts for 24% followed by Madhya Pradesh (17%), Tamil Nadu (16%), Jharkhand & Rajasthan (9% each) and Gujarat (8%). Gradewise, refractory-plastic grade accounts for 36% followed by refractory-unspecified (16%) and refractory-non-plastic/semi-plastic (15%). The remaining 33% are of others, unclassified and not-known grades (Table-1).

PRODUCTION, STOCKS & PRICES

The production of fireclay at 571 thousand tonnes in 2010-11 increased by 4% as compared to that in the previous year.

There were 51 reporting mines in both the years. Besides these primary mines, the production of fireclay was also reported as an associated mineral by 5 mines, which accounted for 3% of the total production during the year 2010-11. Nine principal producers contributed 80% of the total production. Eighteen fireclay mines each producing more than 5,000 tonnes annually together with 2 associated mines accounted for about 86% of the total production. Private sector mines reported 99% output of fireclay.

Rajasthan continued to occupy the first position among states with contribution of 67%, followed by Madhya Pradesh, Gujarat and West Bengal each contributing about 6%. The remaining 15% was the contribution of Tamil Nadu (5%), Jharkhand and Andhra Pradesh (4% each), Karnataka (2%) and Maharashtra (nominal) (Tables 2 to 5).

Mine-head stocks of fireclay at the end of 2010-11 were 396 thousand tonnes as compared to 255 thousand tonnes at the beginning of the year (Table - 6).

The average daily employment of labour during 2010-11 was 603 as against 548 in the preceding year. Domestic prices of fireclay are furnished in the General Review on 'Prices'.

MINING AND MARKETING

Practically, all the fireclay mines are worked manually. Most of the mines are small and worked by opencast method by forming benches in overburden and fireclay. Most of the refractory manufacturing units have their own captive mines.

The important marketing centres of fireclay are Mahumilan and Tori in Jharkhand, Than in Gujarat, Katni in Madhya Pradesh and Belpahar in Odisha. Water seepage beyond the depth of 6 m is the main problem commonly faced by most of the mine owners and as a result of which most of the mines are kept closed during rainy season.

Table – 1 : Reserves/Resources of Fireclay as on 1.4.2010
(By Grades/States)

(In '000 tonnes)

Grade/State	Reserves				Remaining resources								Total resources (A+B)
	Proved STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
		STD121	STD122			STD221	STD222						
All India : Total	**14,376**	**7,358**	**8,371**	**30,104**	**10,020**	**19,215**	**21,775**	**47,666**	**54,377**	**529,173**	**1,190**	**683,415**	**713,519**
By Grades													
Refractory-non-plastic/semi-plastic	2,914	390	1,337	4,642	3,959	11,953	1,743	807	1,180	86,235	-	105,876	110,518
Refractory-plastic	2,801	1,165	1,253	5,220	719	3,656	2,934	4,241	4,527	238,860	232	255,168	260,388
Refractory-unspecified	7,240	3,990	4,945	16,175	4,743	3,208	5,244	1,115	2,658	79,233	-	96,201	112,377
Others	580	1,664	542	2,786	579	204	1,920	7,236	4,137	45,096	125	59,297	62,084
Unclassified	704	17	293	1,013	-	-	5,097	59	30	5,679	-	10,865	11,878
Not- known	137	132	-	268	20	195	4,837	34,206	41,845	74,070	833	156,006	156,275
By States													
Andhra Pradesh	548	647	381	1,576	50	735	1,314	56	908	18,444	132	21,638	23,214
Assam	-	-	-	-	-	-	-	-	-	3,161	-	3,161	3,161
Bihar	-	-	-	-	-	-	-	-	-	44	-	44	44
Chhattisgarh	-	23	12	35	-	27	-	7,180	3,400	10,336	-	20,942	20,978
Delhi	-	-	-	-	-	-	-	6	13	45	-	64	64
Gujarat	276	29	132	437	1,175	635	923	638	962	53,526	-	57,859	58,295
Jharkhand	828	-	775	1,602	12	479	125	-	249	64,151	-	65,017	66,619
Karnataka	95	324	85	503	792	595	6,871	-	226	5,250	-	13,734	14,238
Kerala	-	-	-	-	-	-	-	8,200	51	9,929	-	18,181	18,181
Madhya Pradesh	2,167	2,026	269	4,462	829	3,747	5,690	1,582	2,823	101,081	100	115,852	120,314
Maharashtra	244	-	388	632	-	-	-	-	-	6,850	-	6,850	7,482
Meghalaya	-	-	-	-	-	-	-	-	-	10,999	-	10,999	10,999
Odisha	581	278	52	911	2,135	11,280	3,774	26,185	42,747	83,045	-	169,166	170,076
Rajasthan	8,543	659	5,000	14,202	195	1,071	583	2,256	2,580	45,536	-	52,221	66,423
Tamil Nadu	322	3,269	423	4,014	4,833	171	1611	1,561	-	102,069	-	110,244	114,258
Tripura	-	-	-	-	-	-	-	1	-	369	-	370	370
Uttar Pradesh	-	-	-	-	-	-	-	-	-	3,221	-	3,221	3,221
West Bengal	771	104	854	1,729	-	476	883	-	419	11,115	958	13,852	15,581

Figures rounded off.

Table – 2 : Principal Producers of Fireclay, 2010-11

Name & address of producer	Location of mine	
	State	District
Shanta Sales Corporation, 2-Kha-23, Jawahar Nagar, Bikaner -334 001, Rajasthan.	Rajasthan	Bikaner
Sampat Lal Daga, Bagree Mohalla, Bikaner-334 005, Rajasthan.	Rajasthan	Bikaner
Bikaner Ceramics Private Ltd, Industrial Area, Rani Bazar, Bikaner -334 001, Rajasthan.	Rajasthan	Bikaner
Rama Devi Sharma, 100,Industrial Area, Rani Bazar, Bikaner, Rajasthan.	Rajasthan	Bikaner
Mshabhai Ismailbhai Kalidia, Phulwadi, Thangadh Road, Surendranagar, Gujarat.	Gujarat	Surendranagar

(Contd.)

Table - 2 (Concld.)

Name & address of producer	Location of mine	
	State	District
Birbhum Kaolin & Allied (India) Pvt. Ltd, Post: Barasat – 743 201, Dist. 24-Parganas North, West Bengal.	West Bengal	Birbhum
Shri Natraj Ceramic & Chem.Ind. Ltd, Dalmiyapuram, Therani F/C Mines, Post: Kallakudi-621 651 Tamil Nadu.	Tamil Nadu	Perambalur
Lal Ugra Tranath Shahdeo, Ara Fireclay Mine, Kamata, Post: Chandwa, Latehar, Jharkhand.	Jharkhand	Latehar
Smt. R. Ponambal, Thirumathi Panruti, (Via) Kadambuliyur, Post: Keeliruppu - 671 030 Cuddalore, Tamil Nadu	Tamil Nadu	Cuddalore

Table – 3 : Production of Fireclay, 2008-09 to 2010-11
(By States)

(Qty in tonnes; value in ₹'000)

State	2008-09		2009-10		2010-11(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**495781**	**83416**	**548748**	**89680**	**571421**	**100245**
Andhra Pradesh	40615	8699	24540	5516	22166	4383
Gujarat	27275	1975	92868	9829	33110	2326
Jharkhand	12711	1652	16145	1912	23772	2910
Karnataka	7593	3555	5523	2949	12225	3797
Madhya Pradesh	48278	3911	34704	3193	36124	3719
Maharashtra	6786	509	6744	641	3064	346
Odisha	71865	18518	51312	16015	-	-
Rajasthan	191054	30920	247473	40580	381059	75587
Tamil Nadu	35920	7956	23260	4431	26960	3802
West Bengal	53684	5721	46179	4614	32941	3375

Table – 4 : Production of Fireclay, 2009-10 and 2010-11
(By Sectors/States/Districts)

(Qty in tonnes; value in ₹'000)

State/District	2009-10			2010-11 (P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India	**51(6)**	**548748**	**89680**	**51(5)**	**571421**	**100245**
Public sector	(1)	5523	2949	(1)	5125	2527
Private Sector	51(5)	543225	86731	51(4)	566296	97718
Andhra Pradesh	**7(1)**	**24540**	**5516**	**8(1)**	**22166**	**4383**
East Godavari	5(1)	20330	4342	6(1)	16722	2999
West Godavari	2	4210	1174	2	5444	1384
Gujarat	**9**	**92868**	**9829**	**5**	**33110**	**2326**
Kachchh	1	4685	539	1	1020	105
Surendranagar	8	88183	9290	4	32090	2221
Jharkhand	**6**	**16145**	**1912**	**6**	**23772**	**2910**
Dhanbad	2	1598	245	1	1090	131
Hazaribagh	1	1937	243	1	240	24
Latehar	3	12610	1424	4	22442	2755
Karnataka	**(1)**	**5523**	**2949**	**2(1)**	**12225**	**3797**
Hassan	(1)	5523	2949	(1)	5125	2526
Bengaluru	-	-	-	1	3900	273
Tumkur	-	-	-	1	3200	998
Madhya Pradesh	**8(1)**	**34704**	**3193**	**11(1)**	**36124**	**3719**
Katni	4	19825	1461	6	23694	2352
Satna	(1)	629	113	(1)	1460	146
Umaria	4	14250	1619	5	10970	1221
Maharashtra	**2**	**6744**	**641**	**2**	**3064**	**346**
Amravati	2	6744	641	2	3064	346
Odisha	**4(1)**	**51312**	**16015**	**-**	**-**	**-**
Cuttack	3	48700	15368	-	-	-
Jharsuguda	1	812	323	-	-	-
Bargarh	(1)	1800	324	-	-	-
Rajasthan	**7**	**247473**	**40580**	**10**	**381059**	**75587**
Bikaner	7	247473	40580	10	381059	75587
Tamil Nadu	**3**	**23260**	**4431**	**4**	**26960**	**3802**
Cuddalore	-	-	-	1	10140	1166
Perambalur	3	23260	4431	3	16820	2636
West Bengal	**5(2)**	**46179**	**4614**	**3(2)**	**32941**	**3375**
Bankura	3	8949	945	2	3575	423
Birbhum	2(2)	37230	3669	1(2)	29366	2952

Figures in parentheses indicate associated mines of kaoline and bauxite.

Table – 5 : Production of Fireclay, 2009-10 and 2010-11(P)
(By Frequency Groups)

(Qty in tonnes)

Production group	No. of mines		Production for the group		Percentage in total production		Cumulative percentage	
	2009-10	2010-11	2009-10	2010-11	2009-10	2010-11	2009-10	2010-11
All Groups	**51(6)**	**51(5)**	**548748**	**571421**	**100.00**	**100.00**	–	–
Up to 1000	6(1)	10	3833	3145	00.70	00.55	00.70	00.55
1001 to 5000	24(3)	25(3)	75754	74408	13.80	13.02	14.50	13.57
5001 to 10000	10(1)	5(2)	80283	48207	14.63	08.44	29.13	22.01
10001 & Above	11(1)	11	388878	445661	70.87	77.99	100.00	100.00

Figures in parentheses indicate the number of associated mines.

Table – 6 : Mine-head Stocks of Fireclay, 2010-11 (P)
(By States)

(In tonnes)

State	At the beginning of the year	At the end of the year
India	**254530**	**396003**
Andhra Pradesh	2402	4280
Gujarat	2979	886
Jharkhand	901	3381
Karnataka	29281	7456
Madhya Pradesh	15349	12068
Maharashtra	1365	-
Odisha	13805	1169
Rajasthan	181794	359823
Tamil Nadu	1943	2962
West Bengal	4711	3978

USES AND SPECIFICATIONS

Fireclays are used in the manufacture of bricks, blocks, retorts, crucibles, mortars, masses, etc. Low-grade material is used for manufacturing heavy sanitaryware, such as, pipes and bath tubs. Firebricks are used where heat generation is involved. Firebricks are used extensively in furnaces, kilns and ovens. Firebricks are required chiefly by metallurgical industries.

The fireclays are graded into: i) low duty ii) intermediate duty iii) high duty and iv) super duty, depending upon their capacity to withstand high temperature before melting. The low duty fireclay can withstand temperatures between 1,515 and 1,615 °C (PCE 19-28); intermediate duty fireclay up to 1650 °C (PCE 30), high duty fireclay up to 1700 °C (PCE 32) and super duty beyond 1,775 °C (PCE 35).

BIS has not standardised any specifications for fireclay. However, the erstwhile Director General of Technical Development Sub-committee on Refractory Raw Materials had recommended specifications as given in Table-7.

The Expert Group on Classification of Minerals with regard to their Possible Optimum Industrial Use,had recommended the following end-use classification of fireclay for refractory industry:

Type	Constituent		
	Al_2O_3	Fe_2O_3	PCE (orton)
Non-plastic/ semi-plastic	30% (min)	2% (max)	30 (min)
Plastic	18% (min)	3% (max)	18 (min)

Table – 7 : Specifications of Plastic and Non-plastic Fireclays

Grade	Constituent		
	Al_2O_3	Fe_2O_3	PCE (orton)
i) Non-plastic/Semi-plastic Fireclay			
Grade-I	35-40%	1.0% max	33 min
Grade-II	32-35%	1.0-1.5% max	32 min
Grade-III	30-32%	1.5-2.0% max	30 min
ii) Plastic Fireclay			
Grade-I	30-32%	1.0-1.5%	30 min
Grade-II	28-30%	2.0-3.0%	28 min
Grade-III	22-28%	1.0-2.0%	26 min
Grade-IV	18-20%	1.5-2.0%	18-21 min

Crude fireclay and other clays including kaolin (china clay) are also used in a few cement manufacturing plants to increase the alumina content in the raw meal and its plasticity.

CONSUMPTION

The total reported consumption of fireclay decreased slightly from 523,900 tonnes in 2009-10 to 517,600 tonnes in 2010-11. Cement industry was a major consumer of crude fireclay accounting for 47% consumption in 2010-11, followed by refractory (31%) and ceramic (15%) industries. The remaining 7% was consumed in other industries, i.e., iron & steel, pesticide, alloy steel, graphite products, foundry, sugar, etc. (Table - 8).

Table – 8 : Reported Consumption of Fireclay, 2008-09 to 2010-11 (By Industries)

(In tonnes)

Industry	2008-09	2009-10(R)	2010-11(P)
All Industries	**546300**	**523900**	**517600**
Alloy steel	800(10)	800(10)	800(10)
Cement	244500(3)	244500(2)	244500(2)
Ceramic	79500(55)	77200(55)	77200(54)
Foundry	200(23)	200(23)	200(23)
Graphite products	900(17)	900(18)	900(18)
Iron & steel	35000(4)	34600(6)	29100(6)
Pesticides	2900(2)	2900(2)	2900(2)
Refractory	182300(38)	162500(37)	161700(36)
Sugar	100(22)	100(24)	100(25)
Others (abrasive, glass, paper, textile, and vanaspati)	100 (21)	200(21)	200(21)

Figures rounded off. Data collected on non-statutory basis. Figures in parentheses denote the number of units in organised sector reporting consumption.*
(includes actual reported consumption and/or estimates made wherever required).*

FOREIGN TRADE

Exports

The exports of fireclay decreased slightly to 8,975 tonnes in 2010-11 from 9,315 tonnes in 2009-10. Exports were mainly to Kuwait, Bangladesh, Nepal, Iraq and Saudi Arabia. Exports of refractory bricks decreased to 196 thousand tonnes in 2010-11 from 359 thousand tonnes in 2009-10. Exports were mainly to Tunisia, Morocco, Nigeria, UK, Egypt, Malaysia, etc (Tables - 9 & 10).

Imports

Imports of fireclay in 2010-11 were 689 tonnes against 43 tonnes in the previous year, mainly from Thailand and China. Imports of refractory bricks increased to 366 thousand tonnes in 2010-11 from 294 thousand tonnes in the previous year. Imports were mainly from China (76%),Germany (6%) and Austria (3%) (Tables - 11 & 12).

Table – 9 : Exports of Fireclay (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**9315**	**23727**	**8975**	**22758**
Bangladesh	6239	9627	5690	8557
Kuwait	2	6	700	2819
Iraq	-	-	336	1607
Saudi Arabia	164	639	300	1544
Nepal	592	3290	334	1370
Gabon	-	-	140	883
Zambia	-	-	15	764
Cameroon	-	-	183	763
USA	43	217	56	714
Norway	160	870	181	637
Other countries	2115	9078	1040	3100

Table – 10 : Exports of Refractory Bricks (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**358699**	**2783213**	**195762**	**6006862**
Tunisia	139	2072	33372	1025613
UK	3801	77667	7540	684433
Malaysia	4375	133588	4528	301702
Egypt	7185	161750	6731	215000
Turkey	4833	176813	3246	195764
Finland	2341	58888	3443	175854
Indonesia	3836	106632	3637	158373
Morocco	2512	27800	9657	145923
Nigeria	8014	99288	7716	144619
Italy	1664	41860	2511	138667
Other countries	319999	1896855	113381	2820914

Table – 11 : Imports of Fireclay (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**43**	**720**	**689**	**10920**
China	37	538	241	6208
Thailand	-	-	345	2475
France	-	-	96	1481
Denmark	-	-	7	692
Germany	-	-	++	61
Japan	-	-	++	3
Other countries	6	182	-	-

Table – 12 : Imports of Refractory Bricks (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**293578**	**8993946**	**366310**	**10726152**
China	236602	6261109	278857	7347766
Germany	23070	1376490	21342	1150560
France	2102	87238	7393	643664
Austria	7326	420071	10155	542336
U S A	2721	100132	4331	160235
Turkey	2000	89717	2008	93667
Japan	4626	127560	1438	83526
Italy	1957	115704	1757	73662
UK	2093	82608	1423	67066
Unspecified	150	5632	2623	100349
Other countries	10931	327685	34983	463321

FUTURE OUTLOOK

Fireclay is one of the most important minerals used in the refractory industry. Almost the entire production in the country is consumed in the manufacture of refractories and about 80% of these refractories are used by the iron and steel industry. India has huge reserves of this mineral and there does not seem to be any problem of supply to the refractory industry in the future. However, a serious dearth is being felt in the refractory industry with respect to the availability of high grade fireclay analysing 37% and above Al_2O_3 and having Fe_2O_3 and fluxing impurities less than 2%. In view of this, deposits of high grade fireclay may be explored and delineated. Detailed exploration for deposits of high grade fireclay is necessary to meet the increasing demand from refractory industry.

Since fireclay is low-value high bulk mineral, there does not appear much prospect for increasing the exports. Use of fireclay in fireclay bricks as an export commodity should be encouraged.

The apparent domestic demand of fireclay is estimated at 480 thousand tonnes by 2011-12 and at 739 thousand tonnes by 2016-17 at 9% growth rate as per the Sub Group Report on 12th Plan, Planning Commission of India.

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

FLUORITE

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

38 Fluorite

Fluorite or fluorspar is the common name of the mineral having chemical composition calcium fluoride (CaF_2). It is a mineral with veritable bouquet of brilliant colours from hallmark colour purple to blue, green, yellow, colourless, brown, pink, black and reddish orange; and is rivalled in colour range only by quartz. It is an important commercial source of fluorine. Fluorite plays a vital role in the manufacture of aluminium, gasoline, insulating foams, refrigerants, steel and uranium fuel.

Mainly two grades of fluorite are involved in consumption and trade, namely, the acid grade containing more than 97% CaF_2 and the sub-acid grade analysing 97% or less CaF_2. The sub-acid grade includes metallurgical and ceramic grades and is commonly known as metallurgical grade. Fluorite production in the country is scarce. At the global level, the country has less production. Production of fluorite in the country is reported from the states of Gujarat, Maharashtra and Rajasthan.

In addition to the natural fluorite production, synthetic fluorite is recovered as by-product during uranium processing, petroleum alkylation and stainless pickling. The by-product, fluorosilicic acid, obtained from phosphoric acid plants while processing phosphate rock also supplements fluorite as a source of fluorine.

RESOURCES

As per the UNFC system, the total resources of fluorite in the country as on 1.4.2010 are estimated at 18.2 million tonnes. Out of these, 4.7 million tonnes are placed under reserves category (further classified into 4.6 million tonnes under proved category and 0.15 million tonnes under probable category). Remaining resources comprise 13.5 million tonnes.

By States, Gujarat accounts for 66% of the total resources having 12 million tonnes, followed by Rajasthan with 5.24 million tonnes (29%), Chhattisgarh 0.55 million tonnes (3%) and Maharashtra 0.42 million tonnes (2%). Gradewise, the resources are classified into marketable grade which accounted for 81% of the total resources, followed by low grade (17%) and unclassified grade (2%) (Table-1).

PRODUCTION, STOCKS & PRICES

The production of fluorite (total) at 7,544 tonnes in 2010-11 decreased considerably by 38% as compared to 13,781 tonnes in the previous year. The production of fluorite (graded) was 3,150 tonnes and that of fluorite (concentrates) 4,394 tonnes during the year under review.

There were three reporting mines in 2010-11. The entire output was reported from public sector. Fluorite (graded) was reported from Maharashtra & Rajasthan and concentrate from Gujarat only (Tables - 2 to 4).

The mine-head stocks of fluorite at the end of the year 2010-11 were 4,120 tonnes as against 3,854 tonnes at the beginning of the year (Table - 5).

The average daily labour strength employed in fluorite mines in 2010-11 was 97 as against 123 in the previous year. The domestic prices of fluorite are furnished in the General Review on 'Prices'.

Table – 11 : Reserves/Resources of Fluorite as on 1.4.2010 (By Grades/States)

(In tonnes)

Grade / State	Reserves				Remaining resources								Total resources (A+B)
	Proved STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
		STD121	STD122			STD221	STD222						
All India : Total	**4566234**	**-**	**146082**	**4712316**	**673889**	**745390**	**529966**	**1713833**	**6218421**	**3474906**	**145183**	**13501588**	**18213904**
By Grades													
Marketable	4566234	-	146082	4712316	673889	586080	364766	-	5757010	2449903	145183	9976831	14689147
Low	-	-	-	-	-	3790	9680	1710348	445660	1000003	-	3169481	3169481
Unclassified	-	-	-	-	-	155520	155520	3485	15751	25000	-	355276	355276
By States													
Chhattisgarh	-	-	-	-	65889	153132	9288	185485	5573	126088	-	545455	545455
Gujarat	4280000	-	-	4280000	-	-	-	-	5723360	2001920	-	7725280	12005280
Maharashtra	261843	-	104737	366580	-	-	-	-	-	52369	-	52369	418949
Rajasthan	24391	-	41345	65736	608000	592258	520678	1528348	489488	1294529	145183	5178484	5244220

Figures rounded off.

Table – 2 : Producers of Fluorite, 2010-11

Name and address of producer	Location of mine	
	State	District
Gujarat Mineral Development Corporation Ltd, Khanij Bhawan, 132-Ft. Ring Road, Vastrapur, Ahmedabad, Gujarat.	Gujarat	Vadodara
Maharashtra State Mining Corporation Ltd, Udyog Bhawan, Civil lines, Nagpur-440 001, Maharashtra.	Maharashtra	Chandrapur
Rajasthan State Mines and Minerals Ltd, C-89-90, Janpath, Lal Kothi, Jaipur-302 001 Rajasthan.	Rajasthan	Jalore

Table – 3 : Production of Fluorite (Graded and Concentrates), 2008-09 to 2010-11

(By States)

(Qty in tonnes ; value in ₹ 000)

State	2008-09		2009-10		2010-11(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
Fluorite (Total)						
India	**9990**	**104341**	**13781**	**119469**	**7544**	**81397**
Gujarat	6814	88715	8786	98855	4394	66412
Maharashtra	3176	15626	4931	20473	2552	13082
Rajasthan	-	-	64	141	598	1903
Fluorite (Graded)						
India	**3176**	**15626**	**4995**	**20614**	**3150**	**14985**
Maharashtra	3176	15626	4931	20473	2552	13082
Rajasthan	-	-	64	141	598	1903
Fluorite (Concentrates)						
India	**6814**	**88715**	**8786**	**98855**	**4394**	**66412**
Gujarat	6814	88715	8786	98855	4394	66412

Table – 4 : Production of Fluorite (Graded and Concentrates), 2009-10 and 2010-11 (By Sector/States/Districts)

(Qty in tonnes; value in ₹'000)

State/District	2009-10			2010-11(P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
Fluorite (Total) India/ Public Sector	**3**	**13781**	**119469**	**3**	**7544**	**81397**
Fluorite (Graded) India/ Public sector	**2**	**4995**	**20614**	**2**	**3150**	**14985**
Maharashtra/ Chandrapur	**1**	**4931**	**20473**	**1**	**2552**	**13082**
Rajasthan/ Jalore	**1**	**64**	**141**	**1**	**598**	**1903**
Fluorite (Concentrates) India/ Public sector	**1**	**8786**	**98855**	**1**	**4394**	**66412**
Gujarat/ Vadodara	**1**	**8786**	**98855**	**1**	**4394**	**66412**

Table – 5 : Mine-head Stocks of Fluorite 2010-11 (P) (By State)

(In tonnes)

State	At the beginning of the year	At the end of the year
India	**3854**	**4120**
Maharashtra	3854	4120

MINING

Ambadungar Fluorspar mine in Gujarat owned by GMDC is the largest fluorite mine in the country. Mining is carried out by opencast method, using heavy earth moving equipment of 0.9 cu m, 0.17 cu m hydraulic excavaters with 7 tonnes dumpers.

Maharashtra State Mining Corporation (MSMC) operates Dongargaon fluorite mines manually in Chandrapur district, Maharashtra. The run-of-mine was hand sorted for marketing.

When in operation, RSMML carries out semi-mechanised opencast mining in Karara, Tavidar and Lakhawas areas in Jalore district, Rajasthan. Fluorite of different grade is obtained manually by hand breaking and sorting method.

BENEFICIATION

Low grade fluorite produced is used after beneficiation in the industries. GMDC has a beneficiation plant of 500 tpd capacity located at Kadipani to produce acid grade (96% CaF_2) and metallurgical grade (90% CaF_2) fluorite. Besides, it has facility to produce MFC powder analysing 65 to 85% CaF_2 starch briquettes (81% CaF_2 min) and silicate briquettes (79% , CaF_2 min). Government of Gujarat has now accorded approval for setting up beneficiation plant at Kadipani, district Vadodara in joint venture with M/s Gujarat Fluoro Chemicals Ltd., Noida and M/s Navin Fluorine International, Mumbai.

RSMML has a Pilot Beneficiation Plant located at Village Verdha, about 28 km from Dungarpur to process the mineral rejects (-20% CaF_2) lying in the mine. The plant has 10-15 tpd capacity to produce fluorite powder analysing 80-85% CaF_2. No production was reported in 2010-11

The hand-picked high grade ore from Dongargaon mine of MSMC is beneficiated in a beneficiation plant by M/s SANBRO Corporation Ltd, situated at Waregaon, Koradi, Nagpur district, to produce fluorite concentrate.

CONSUMPTION

Fluorite consumption was 69,400 tonnes in 2010-11. The major consuming industry is the chemical industry which accounted for more than 81% of the total consumption reported. Industrywise consumption of fluorite is given in Table-6.

Table – 6 : Reported Consumption of Fluorite 2008-09 to 2010-11 (By Industries)

(In tonnes)

Industry	2008-09	2009-10(R)	2010-11(P)
All Industries	**70500**	**69900**	**69400**
Alloy steel	2800 (8)	2900 (9)	2100 (7)
Aluminium	100 (3)	100 (3)	100 (3)
Cement	8400 (4)	8900 (5)	9200 (5)
Chemical	56000 (4)	56000 (4)	56000 (4)
Electrode	300 (5)	300 (5)	300 (5)
Ferro-alloys	100 (3)	100 (3)	100 (3)
Foundry	100 (6)	100 (6)	100 (6)
Glass	100 (1)	100 (1)	100 (1)
Iron & steel	2600 (6)	1400 (6)	1400 (6)

Figures rounded off.
Data collected on non-statutory basis.
Figures in parentheses denote the number of units in organised sector reporting consumption.*
*(*Includes actual reported consumption and/or estimates made wherever required).*

SPECIFICATIONS

BIS has prescribed IS: 8587-1993 (First Revision, reaffirmed 2011) for acid grade fluorite for use in chemical industries, and IS: 4574-1989 (Second Revision, reaffirmed 2008) for fluorite in metallurgical industries.

USES

Acid grade fluorite is used as a feedstock in the manufacture of hydrofluoric acid (HF) and to produce aluminium fluoride (AlF_3). The major use of HF is for the production of a wide range of fluorocarbon chemicals, including hydrofluorocarbons (HFCs) hydrochlorofluorocarbons (HCFCs), and fluoropolymers. But, owing to environmental concerns, part of chlorofluorocarbons (CFCs) are replaced by HCFCs. HF is used in the manufacture of uranium tetrafluoride required to make nuclear fuel and fission explosives. It is also used in stainless pickling, petroleum alkylation, glass etching, oil & gas well treatment and as etcher/cleaner in electronic industry.

HF is used in the manufacture of a host of fluorine chemicals used in dielectrics, metallurgy, wood preservatives, herbicides, mouthwashes, decay-preventing dentifrices, plastics and water fluoridation.

AlF_3 manufactured from acid grade fluorite is used in electrolytic recovery of aluminium. On an average, world wide consumption of fluorides is about 21 kg for every tonne of aluminium produced. This ranged from 10 to 12 kg per tonne in a modern pre-baked aluminium smelter and about 40 kg in an old Soderberg smelter without scrubber.

Ceramic grade fluorite containing 85 to 95% CaF_2 is used in ceramic industry as a flux and as an opacifier in the production of float glass, white or opal glass and enamels.

Metallurgical grade fluorite is used primarily as fluxing agent by steel industry. It is added to slag to make it more reactive through increased fluidity. Fluorite of different grades is used in the manufacture of aluminium, cement and glass fibres. It is also used in the melt shop by foundry industry.

INDUSTRY

Many fluorine-based chemicals like hydrofluoric acid, aluminium fluoride, cryolite, sodium silicofluoride and hydrofluorosilicic acid were produced by chemical and fertilizer industries in the country.

In addition to material produced indigenously, substantial quantity of high grade fluorite was also imported to meet the demand of the fluorine-based chemical industries.

The Tanfac Industries Ltd, is a joint sector company of TIDCO and Aditya Birla Group, at Cuddalore, Tamil Nadu. It is engaged in the manufacture of inorganic fluorine-based chemicals, such as, aluminium fluoride, anhydrous hydrofluoric acid, sodium silico fluoride, ammonium bifluoride, potassium fluoride, cryolite and various other fluorine-based chemicals. The company has an annual installed capacity of 16,500 tonnes of aluminium fluoride, 66,000 tonnes of sulphuric acid, 14,000 tonnes of hydrofluoric acid and 3,500 tonnes of speciality fluorines.

The Navin Fluorine Industries Ltd, Surat, Gujarat, has an installed capacity of about 22,000 tpy of hydrofluoric acid. The Company produces a number of fluorine chemicals, namely, hydrofluoric acid, cryolite, aluminium fluoride and various other organic and inorganic fluorine-based chemicals.

Sterlite Industries (India) Ltd, a Vedanta Group Company, was planning to set up a high bulk density and low bulk density aluminium fluoride plant of 13,000 tpy capacity at or near Thoothukudi, Tamil Nadu as a joint venture. The plant will produce aluminium fluoride through hydro-fluorosilicic acid route.

Triveni Chemicals is engaged in manufacture of fluorides, fluoroborate, silico fluoride, etc. Similarly, Tarun Fluo-Chem Pvt Ltd manufactures fluoroborates, fluorides, dilute hydrofluoric acid, fluoroboric acid, fluorotitanic acid, etc. Others who manufacture fluorine chemicals were : SB Chemicals and Jay Intermidiates & Chemicals (Vapi, Gujarat) and Madras Fluorine Pvt. Ltd, Chennai, etc.

Apatite and rock phosphate containing 3 to 4% CaF_2 was another useful source for recovery of fluorine. Coimbatore Pioneer Fertilizer Ltd has reported production of sodium silicofluoride in the past. Hydrofluorosilicic acid producing units were Rashtriya Chemicals & Fertilizer Ltd, Mumbai whereas Dharamsi Morarji Chemical Co. Ltd, Ambernath, Maharashtra no longer report production of fluorine chemicals. Aluminium fluoride was being produced by Southern Petrochemical Industries Corporation Ltd, Thoothukudi, Tamil Nadu with an installed capacity of 2,560 tpy.

SUBSTITUTES

Olivine or dolomitic limestone was used as substitute for fluorite in Iron & Steel industry. The by-product fluorosilicic acid from phosphoric acid production was used as a substitute in aluminium fluoride production.

ENVIRONMENT

Fluorine attracts environmental concern. Use of fluorine in drinking water has begun to wane. Fluorine is toxic in high concentration but beneficial in low concentration. Although fluorine has been under attack ever since its use in water in 1949, the only significant health problem with which it has been linked was `Fluorosis', a disease that involves health defects and bone lesions. This problem is caused by concentration of fluoride that is much higher than the permissible levels in municipal water supplies. As per Indian Standards, the permissible limit of fluoride in the drinking water is 1.5 mg/l. "Defluoridisation by adsorption" is a common economical and efficient method for removal of excess fluoride from drinking water. Electrolytic precipitation based on use of aluminium salts and by electrochemical route, etc. are the other few methods used for defluoridisation.

Fluorine is at the centre of controversy in chlorofluorocarbons (CFCs), which cause depletion of atmospheric ozone layer that protects the earth from ultraviolet radiation, a major cause of skin cancer. The hydrofluorocarbon (HFC) and hydrochlorofluorocarbon (HCFC) compounds, which have been developed as an alternative to CFC, require more hydrofluoric acid than CFC and are expected to boost fluorite consumption. These above said gases are considered greenhouse gases and are being phased out. It is reported that even if CFC emission is stopped, the present level of these gases may take up to ten years to reach the upper atmosphere where they could persist for a century or more.

According to United Nations Environment Programme (UNEP) an international agreement to curtail illegal trade in CFC and other ozone depleting chemicals came into effect on 10 November 1999. The agreement, which was authorised through an amendment to the Montreal Protocol in 1997, requires nations to create licensing system for international sales of ozone depleting chemicals. Further, as a part of the Montreal Protocol, 129 nations agreed on a three-year funding package to enable developing countries to continue their efforts to phase out CFC and other ozone depleting chemicals and accordingly the Fund's Executive Committee approved major agreements with China and India to finance the shutdown of CFC production facilities in the two countries during the next ten years. The UNEP has prepared a Montreal Protocol Handbook that provides additional detail and explanation of the provisions. CIESIN's Thematic Guide on Ozone Depletion and Global Environmental Change presents an in-depth look at causes, human and environmental effects, and policy responses to stratospheric ozone depletion.

WORLD REVIEW

World total reserves of fluorite were 240 million tonnes. World reserves are concentrated mainly in South Africa (17%) and and Mexico (13%) followed by China (10%) and Mongolia (9%).

World production of fluorite in 2010 remained steady at 5.9 million tonnes. China (56%), Mexico (18%) and Mongolia (7%) were the principal producing countries.

Table – 7 : World Reserves of Fluorite (By Principal Countries)

(In '000 tonnes)

Country	Reserves
World: Total (rounded)	**240000**
China	24000
Kenya	2000
Mexico	32000
Mongolia	22000
Morocco	NA
Namibia	3000
Russia	NA
South Africa	41000
Spain	6000
USA	NA
Other countries	110000

Source: *Mineral Commodity Summaries, 2012.*

Table – 8 : World Production of Fluorite (By Principal Countries)

(In '000 tonnes)

Country	2008	2009	2010
World: Total	**6000**	**5900**	**5900**
Brazil@	63	44	64
China(e)	3250	3200	3300
Iran	62	71	70(e)
Kazakhastan	66	66(e)	66(e)
Kenya@	98	16	--
Mexico	1058	1046	1067
Morocco	57	72	90
Mongolia	335	460	400
Namibia	118	81	104(e)
Russia(e)	269(e)	240	250
South Africa	299	204(e)	200(e)
Spain	149	122	132
Other countries	176	278	157

Source: *World Mineral Production, 2006-2010.*
@ : Including beneficiated and directly shipped material.

Canada

Canada Fluorspar Inc. was to commence construction of fluorite project in St. Lawrence, New Foundland & Labrador following Federal and State environmental clearances in mid-2011. The project includes mill, tailings facilities and wharf The production was expected to commence in 2013.

China

China remained the leading producer of fluorite with 3.3 million tonnes. The Chinese Government issued a new policy concerning hydrogen fluoride called industrial admittance conditions for hydrogen fluoride and was designed to protect fluorspar resource. The policy imposes conditions of captive mines, minimum capacity, etc. on new entrants and expansions and also bars purphase of fluorite from unlicensed companies.

Mexico

Mexico is the world's second largest producer after China, producing more than a million tonnes of fluorite in 2010. Fluorita de Mexico S.A. de C.V.

(Coahuila) announced that it was in the process of developing new fluorite mining concessions near its main mine. The new operation would increase its present annual fluorite capacity of 140,000 tonnes by 30,000 - 40,000 tonnes. The new mines were expected to be operational by 2011-end.

Namibia

The production of acid-grade fluorspar from Okorusu Fluorspar Pvt. Ltd, rose to more than 95,000 tonnes in 2010 compared to 73,580 tonnes in 2009. The company which has always produced acid-grade fluorspar planned to commission a dense media separation plant to upgrade low grade fluorite ores.

South Africa

Maghreb Minerals planned to restart fluorspar production from Sallies Witkop Mine and intended to produce 125,000 tonnes per year of acidspar for the export market and a small amount of metspar for domestic markets.

Sweden

Tertiary Minerals completed study on its Storuman flourspar project. A fluorspar mine producing 100,000 tonnes per year of acid grade fluorspar with a mine life of 18 years was feasible as per the study.

FOREIGN TRADE

Exports

Exports of fluorite decreased to 345 tonnes in 2010-11 from 2,024 tonnes in the previous year. Exports were mainly to Kuwait (30%) and China & Saudi Arabia 17%. Exports of aluminium fluoride were 6,918 tonnes in 2010-11 compared to 8,128 tonnes in the previous year. Exports were mainly to New Zealand (48%), UAE (44%) and Japan (8%). Exports of hydrofluoric acid in 2010-11 were 1,317tonnes against 770 tonnes in the previous year. No exports of sodium fluoride were reported during 2009-10 & 2010-11. (Tables-9 to 11)

Imports

Imports of fluorite increased to 1.62 lakh tonnes in 2010-11 as compared to 1.47 lakh tonnes in the previous year. Imports were mainly from China (83%) and Kenya (12%). Imports of aluminium fluoride decreased to 13,988 tonnes in 2010-11 from 24,140 tonnes in the previous year. Imports were mainly from China (78%). Similarly, imports of hydrofluoric acid also decreased to 1,240 tonnes in 2010-11 from 2,692 tonnes in the previous year (Tables-12 to 14).

Table – 9 : Exports of Fluorite (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**2024**	**18121**	**345**	**3389**
Israel	47	1262	44	1023
Kuwait	-	-	104	816
Saudi Arabia	4	92	60	616
UAE	1	8	52	430
China	-	-	60	173
Latvia	-	-	3	86
Indonesia	-	-	3	80
Sudan	-	-	2	62
Korea, Rep.of	-	-	2	56
Nepal	30	187	15	45
Other countries	1942	16572	++	2

Table – 10 : Exports of Aluminium Fluoride (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**8128**	**477074**	**6918**	**331850**
New Zealand	4875	303321	3325	176928
UAE	1623	78619	3028	105233
Japan	250	21718	560	49417
South Africa	–	–	3	164
Yemen Republc	–	–	1	59
Bangladesh	–	–	++	21
UK	–	–	1	20
USA	-	–	++	8
Other countries	1380	73416	-	-

Table – 11 : Exports of Hydrofluoric Acid (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ 000)
All Countries	**770**	**50306**	**1317**	**64447**
Korea, Rep. of	18	707	630	28684
Singapore	38	3214	83	6385
Australia	89	9338	87	5496
Canada	18	709	130	5107
Thailand	34	1833	78	3580
Philippines	77	4306	53	3187
Turkey	48	2009	55	2828
Syria	88	5083	44	2520
USA	56	2320	57	2352
Israel	18	999	38	2000
Other countries	286	19788	62	2308

Table – 12 : Imports of Fluorite (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**147138**	**1971459**	**161925**	**2333963**
China	79775	1063344	134061	1958297
Kenya	45405	807050	19288	276809
Mongolia	745	9360	2384	34388
Thailand	18106	49289	3383	24770
Pakistan	1383	13628	1212	11903
Germany	160	4331	300	7360
Hong Kong	568	7570	262	3997
Iran	-	-	257	3510
Spain	234	3948	187	3146
UAE	-	-	226	2764
Other countries	762	12939	365	7019

Table – 14 : Imports of Aluminium Fluoride (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**24140**	**1062421**	**13988**	**659655**
China	22924	1013783	10879	525676
Indonesia	1214	48262	1895	73051
Italy	-	-	1214	60907
UK	++	11	++	11
USA	++	4	++	6
Germany	–	–	++	4
Other countries	2	361	-	-

Table – 13 : Imports of Hydrofluoric Acid (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**2692**	**132679**	**1240**	**84867**
China	2551	118987	1189	79759
Spain	-	-	37	2964
Chinese Taipei/ Taiwan	5	1034	10	1072
USA	1	315	1	375
Japan			++	309
Germany	97	10083	3	210
Phlippines	-	-	++	98
UK	2	117	++	61
Unspecified	34	1383	++	21
Other Countries	2	760	-	-

FUTURE OUTLOOK

The resources of fluorite in India are limited and grades of fluorite produced do not meet the specifications of the chemical industry which is the bulk consumer of fluorite. Ambadungar Fluorspar Mine of GMDC is the only domestic source of acid grade fluorite, slightly inferior in quality with high phosphorus content. Hence, to meet the requirements, the domestic chemical industry will have to depend both qualitatively and quantitatively, on imported fluorite in the coming years, both for direct use and for blending with the domestic acid grade fluorite.

As per the Report of the Working Group for 12th Plan period (2012-17) of the Planning Commission, the average total consumption of fluorite by all industies has been around 72,000 tonnes per annum. The Working Group has estimated the apparent domestic demand of fluorite at 185 thousand tonnes by 2011-12 and at 285 thousand tonnes by 2016-17 at 9% growth rate. The Working Group has recommended that cluster mining approach may be adopted in order to utilise the small deposits for further industrialisation of the mining area in the sector which will improve the workability of small mines. It has also suggested R&D for beneficiation and setting up of facilities to utilise fluorite from other parts of the country in the Chemical Industry.

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

FULLER'S EARTH

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

39 Fuller's Earth

Fuller's earth, like bentonite, is also known as 'bleaching clay' because of its inherent bleaching properties. Fuller's earth is non plastic clay that can be used to decolorise, filter and purify animal, mineral and vegetable oils and greases. It has great commercial importance like bentonite. Bentonite is a swelling-type clay but fuller's earth is a non-swelling-type clay. This property difference is because of their chemical composition. Bentonite contains sodium, whereas fuller's earth contains calcium. Calcium bentonite, more commonly called fuller's earth, can be converted into sodium bentonite by cation exchange process or acid activation.

RESOURCES

The total reserves/resources of fuller's earth as per UNFC system as on 1.4.2010 are placed at 256.7 million tonnes. Out of these, only 58,200 tonnes are placed under 'reserves' category while about 99.98% are placed under `resources' category. About 74% resources are located in Rajasthan. The remaining resources are in Andhra Pradesh, Arunachal Pradesh, Assam, Karnataka and Madhya Pradesh. The statewise reserves/ resources of fuller's earth are given in Table-1.

PRODUCTION

Fuller's earth is declared as minor mineral under Mines and Minerals (Development and Regulation) Act, 1957. The value of fuller's earth produced in India in 2009-10 at about ₹32 crore was highest ever recorded during the last five years. The production was reported from the states of Andhra Pradesh, Rajasthan and Madhya Pradesh.

Andhra Pradesh accounted for 57% in the total value of production of fuller's earth followed by Rajasthan with about 42% share and the remaining 1% was shared by Madhya Pradesh (Table - 2).

Table – 1 : Reserves/Resources of Fuller's Earth as on 1.4.2010
(By States)

(In tonnes)

Grade/State	Reserves			Remaining resources			Total resources (A+B)
	Proved STD111	Probable STD122	Total (A)	Indicated STD332	Inferred STD333	Total (B)	
All India : Total	**–**	**58200**	**58200**	**912340**	**255681539**	**256593879**	**256652079**
Unclassified Grade : Total	**–**	**58200**	**58200**	**912340**	**255681539**	**256593879**	**256652079**
By States							
Andhra Pradesh	–	–	–	–	25523983	25523983	25523983
Arunachal Pradesh	–	–	–	10700	20000000	20010700	20010700
Assam	–	–	–	–	18860000	18860000	18860000
Karnataka	–	58200	58200	551640	1471276	2022916	2081116
Madhya Pradesh	–	–	–	–	117200	117200	117200
Rajasthan	–	–	–	350000	189709080	190059080	190059080

Figures rounded off.

Table – 2 : Value of Production of Fuller's Earth 2007-08 to 2009-10 (By States)

(In ₹ '000)

State	2007-08	2008-09 (R)	2009-10 (P)
India	**99174**	**190745**	**328037**
Andhra Pradesh	85250	160487	186069
Karnataka	2517	4265	-
Madhya Pradesh	2783	1613	2928
Rajasthan	8624	24380	139040

Source: *State Governments*

USES

Fuller's earth is used usually after activation in bleaching, decolourising vegetable oils, petroleum, lubricants, greases etc. Recently, the growth in its consumption in this sector, has been affected because of advent of more sophisticated techniques in refining and due to availability of effective substitutes like activated bauxite and magnesium silicate. Fuller's earth is generally used in fertilizer industry. Consumption, however, is expected to rise in other unconventional uses as absorbent, cleaning oil spillage on factory floors, as carrier for insecticides and fungicides and as a mineral filler and extender.

CONSUMPTION

The consumption of fuller's earth was at 5,600 tonnes in 2010-11 (Table-3). Vanaspati industry, the largest consumer, accounted for about 91% consumption, followed by chemical industry with 5%. A sizeable quantity is consumed in rural and urban areas for non-industrial uses like plastering mud walls and washing of hair. However, the consumption data for such non-industrial purposes are not available.

Table – 3 : Reported Consumption of Fuller's Earth 2008-09 to 2010-11 (By Industries)

(In tonnes)

Industry	2008-09	2009-10(R)	2010-11(P)
All Industries	**5500**	**5600**	**5600**
Chemical	300(1)	300(1)	300(1)
Petroleum refining	200(4)	200(4)	200(4)
Vanaspati	5000(13)	5100(12)	5100(12)

Figures rounded off.
Data collected on non-statutory basis.
Figures in parentheses denote the number of units in organised sector reporting consumption.*
*(*Includes actual reported consumption and/or estimates made wherever required).*

WORLD REVIEW

The world production of fuller's earth increased marginally to 3.7 million tonnes in 2010 from 3.3 million tonnes in 2009. The USA was the top producer, accounted for about 62% of the world production. Other principal producers were Spain (16%), Senegal (6%), Mexico (5%) and Japan (3%) (Table-4).

Table – 4 : World Production of Fuller's Earth (By Principal Countries)

(In '000 tonnes)

Country	2008	2009	2010
World : Total*	**4000**	**3300**	**3700**
India[e]	29	-	-
Japan	110	110	110
Korea, Republic of	71	100	83
Mexico	66	108	170
Morocco	141	132	83
Pakistan	11	10	11
Senegal (Attapulgite)	167	181	204
South Africa (Attapulgite)	70	52	85
Spain (Attapulgite & Sepiolite)	765	595	586
USA	2510[e]	2010	2300
Other countries	60	02	68

Source*: World Mineral Production, 2006-2010.*
* *Including Attapulgite & Sepiolite.*

FOREIGN TRADE

There were no exports and imports of fuller's earth during 2010-11.

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

GALLIUM

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

40 Gallium

Gallium is a strategic metal used in opto-electronic and defence applications. It expands by 3.1% when it solidifies. There is no primary source of gallium in the country. It is generally recovered from sodium aluminate liquors obtained in Bayer's alumina process during aluminium production. A small quantity of gallium is also recovered from residues obtained during zinc processing in some countries. Gallium occurs in trace amount in bauxite & zinc ores and is partly recoverable. It can also be extracted from polymetallic ores by leaching and from coal ash and coal. Bauxite deposits in the country contain gallium and it is recovered during its processing.

USES

Gallium is the backbone of the electronic industry. Gallium based compounds, such as Gallium arsenide (GaAs) and Gallium nitride (GaN), are semiconductors used in the electronic industry. It is also used in the manufacture of memory cells.

Optoelectronic devices such as LEDs, laser diodes, photodetectors and solar cells manufactured from GaAs continued to be the principal consumer of gallium worldwide. In the near future, use of GaAs is expected to increase, especially in communication markets. Increased use of cellular communications and direct broadcast satellite applications are expected to increase the demand of gallium.

Gallium is used in gallium nitride laser diodes and light-emitting diodes (LED). The new gallium nitride devices are used in high density data storage (compact disk players and digital video disk players), high quality laser printing, communications and lighting. Gallium nitride power transistors operate at high voltages and with a higher power density than current GaAs devices.

Gallium is used in some high temperature thermometers and a eutectic alloy of gallium, indium and tin is widely available in fever thermometers, replacing mercury. It is also used as a component in low melting alloys and in creating brilliant mirrors. Gallium salts such as gallium citrate and gallium nitrate are used in medical imaging as radio contrast agents.

PRODUCTION

There is no large-scale gallium production in India. Gallium is recovered as a by-product while producing alumina. However, data on production is not available. As per Working Group Report of I2th Five Year Plan, India produced around 55 kg gallium in recent past. Two plants namely, Hindalco Industries Ltd at Renukoot, Uttar Pradesh and National Aluminium Co. Ltd, at Damanjodi Alumina Refinery, Odisha, recover gallium.

Hindalco

It is having a capacity for gallium recovery at 55 kg per year at its Renukoot plant. The sodium aluminate liquor obtained in the Bayer's alumina process contains 0.012% gallium by weight. It is electrolysed with mercury as cathode. The amalgam is leached and the resultant sodium gallate solution is further electrolysed to produce gallium of 99.99% purity.

NALCO

Production of Red mud was 20,08,702 tonnes and 20,10,140 tonnes in 2009-10 and 2010-11, respectively. Average gallium as Ga_2O_3 content in bauxite is 0.0085% from which gallium content in red mud is estimated to be about 0.009 to 0.010% after considering losses through product alumina as impurity.

SUBSTITUTES

Liquid crystals made from organic compounds are used in visual displays as substitutes for LED.

Researchers are also working to develop organic-based LED that may compete with GaAs in future. Indium phosphide components can be substituted for GaAs-based infrared laser diodes in some specific wavelength applications. The GaAs competes with helium-neon lasers in visible laser diode applications. Silicon is the principal competitor for GaAs in solar cell applications. GaAs-based integrated circuits are used in many defence applications because of their unique properties and there are no effective substitutes for GaAs in these applications. In some bipolar transistor applications, silicon-germanium may substitute GaAs.

WORLD REVIEW

The world resources of gallium in bauxite are estimated to be over one billion kilograms. Besides, substantial quantity is available in zinc reserves in the world. However, only a small fraction of the gallium content in bauxite and zinc ores is economically recoverable.

Data on world production of primary gallium is not available. However, the British Geological Survey has estimated total world primary gallium production to be about 95 tonnes, 78 tonnes and 106 tonnes in 2008, 2009 and 2010, respectively. China is believed to be leading producer followed by Germany, Kazakhstan, Ukraine, Rep. of Korea and Russia. Gallium was also recovered in Hungary & Japan. Refined gallium production including that from scrap refining was estimated at 235 tonnes. China, Japan, UK and USA were the principal producers of refined gallium. Gallium was recycled from new scrap in Canada, Germany, Japan, UK and USA. New Material Tehnologies and Roskill Information Services estimated worldwide gallium consumption at 280 tonnes in 2010. Neo Material estimated that 50% of gallium consumed worldwide in 2010 came from recycled sources.

The world demand has been strongest in optoelectronic applications, particularly in light-emitting displays. Because of the enhanced properties, GaAs-based integrated circuits are used in place of silicon in many defence applications. The cellular telephone market was responsible principally for the growth in the gallium consumption in the past few years.

China

China's primary gallium producers were Aluminium Corporation of China Ltd, Beijing Jia Semiconductor Material Co. Ltd, China Crystal Technologies Ltd, East Hope Mianchi Gallium Industry Co. and Zhuhai Fangyuan. China's total primary gallium production capacity in 2010 was estimated to be 141 tonnes. Capacity was expected to increase in 2011.

FUTURE OUTLOOK

With the vast bauxite resources, India has potential for increasing alumina production with greenfield export-oriented plants which can contribute substantially in meeting the domestic demand of gallium by establishment of gallium recovery units. The demand for gallium is likely to increase with the growth of electronic industry in the country. Strategic importance of gallium makes it imperative for development of indigenous technology and also collaboration with foreign countries for refining and production. Zinc deposits, as alternative source, may sometimes in future, become important when easily accessible sources are used up.

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

GARNET

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

41 Garnet

Garnet is the collective name for a group of minerals which forms an isomorphous series and crystallise in cubic system. Garnet is hard with sharp angular chisel-edged fracture, containing small amounts of free silica and exhibits high resistance to physical and chemical attacks. It is a resistant mineral and detritus grains are commonly found in sediments. It is used both as semi-precious stone and as abrasive. The hardness of garnets varies from 6.5 to 7.5 on Mohs' scale.

RESOURCES

In India, garnet deposits suitable for use in abrasive industry, occur in Andhra Pradesh, Chhattisgarh, Jharkhand, Kerala, Odisha, Rajasthan and Tamil Nadu. Gem variety of garnet occurs in Ajmer, Jaipur, Kishangarh, Tonk and Udaipur districts, Rajasthan; Krishna, Nellore and Warangal districts, Andhra Pradesh; and Coimbatore, Nilgiri and Salem districts, Tamil Nadu. Garnet is found to occur in beach sands along with ilmenite, rutile, sillimanite, etc. in the states of Kerala, Odisha and Tamil Nadu.

The total resources of garnet in India, as on 1.4.2010, as per UNFC system are placed at 56.96 million tonnes of which reserves in proved and probable categories together are 19.32 million tonnes. Of the total resources, about 21.56 million tonnes are of abrasive grade, whereas resources of semi-precious grade are 5,352 tonnes only. Tamil Nadu alone accounts for more than 59% of the total resources followed by Andhra Pradesh 33% and Odisha 6%. The remaining states together shared less than 2% (Table - 1).

EXPLORATION & DEVELOPMENT

During 2010-11, Directorate of Geology, Odisha carried out following exploration activities for heavy minerals (rutile, monazite, ilmenite, sillimanite, garnet, zircon, etc.) : (1) Hunda in Krushnaprasad Block of Puri district with 1.04 sq km mapping on 1:2,000 scale, 2,060 m auger drilling and 2,060 samplings. (2) Along coastal tract of Balikunda block of Jagsighpur district with 39 line km survey, 1,229 m auger drilling and 659 samplings.

PRODUCTION, STOCKS AND PRICES

Garnet (Abrasive)

Production of garnet (abrasive) at 2,058 thousand tonnes during 2010-11 increased by 30% as compared to that in the preceding year due to market demand. There were 62 reporting mines during 2010-11 as against 66 in the previous year. Besides production of garnet (abrasive) was reported as an associated mineral by one sillimanite mine in Odisha. Three principal producers accounted for about 87% of the total output during the period. The share of public sector in the total output was 2% in both the years 2009-10 and 2010-11.

About 92% of the total production was reported from Tamil Nadu, 7% from Andhra Pradesh and the remaining 1% production was reported from Odisha (Tables 2 to 4).

Mine-head stocks at the end of the year was 366 thousand tonnes as against 273 thousand tonnes at the beginning of the year (Table 5).

The average daily employment of labour during 2010-11 was 3,062 as against 4,091 in the previous year.

Prices of garnet are given in the General Review on 'Prices'.

Table – 2 : Principal Producers of Garnet (Abrasive), 2010-11

Name & address of producer	Location of mine: State	Location of mine: District
V. V. Mineral Keeraikaranthattu Tisaiyanvilai – 627 657 Thirunelveli, Tamil Nadu.	Tamil Nadu	Thirunelveli
Transworld Garnet India (P) Ltd, New No. 34, M. G. T. Road, Kalashetra Colony, Besant Nagar, Chennai - 600 090 Tamil Nadu.	Tamil Nadu	Thirunelveli
Beach Minerals Company Pvt. Ltd, 132, Tiruchendur Road, Kuttam – 627 651, Thirunelveli, Tamil Nadu.	Tamil Nadu	Thirunelveli

Table– 1 : Reserves/Resources of Garnet as on 1.4.2010 (P)
(By Grades / States)

(In tonnes)

	Reserves				Remaining resources							Total resources
	Proved STD111	Probable STD121	Probable STD122	Total (A)	Feasibility STD211	Pre-feasibility STD221	Pre-feasibility STD222	Measured STD331	Indicated STD332	Inferred STD333	Total (B)	(A+B)
All India : Total	**3252107**	**4712202**	**11360484**	**19324793**	**9270**	**81901**	**207041**	**117887**	**10226689**	**26995243**	**37638032**	**56962824**
By Grades												
Abrasive	3048526	4710071	11091469	18850066	214	39774	114044	102848	15645	2438410	2710935	21561001
Semi-precious	283	481	227	991	5	94	553	39	1293	2378	4361	5352
Others	-	-	5534	5534	9051	6033	-	-	-	215573	230657	236191
Unclassified	203298	1650	263254	468202	-	36000	394	15000	10208995	23951287	34211676	34679878
Not-known	-	-	-	-	-	-	92051	-	756	387596	480403	480403
By States												
Andhra Pradesh	2911387	4500	710000	3625887	9051	42033	-	-	8800000	6587776	15438860	19064747
Chhattisgarh	-	-	-	-	-	-	-	-	-	28800	28800	28800
Jharkhand	-	-	-	-	-	-	88303	-	-	21768	110071	110071
Kerala	-	-	45797	45797	-	-	-	100874	-	52190	153064	198861
Odisha	-	3185605	-	3185605	5	-	-	-	-	348000	348005	3533610
Rajasthan	6251	10700	9299	26250	214	39868	26687	2013	17694	85690	172167	198416
Tamil Nadu	334469	1511397	10595388	12441254	-	-	92051	15000	1408995	19871019	21387065	33828319

Figures rounded off

Table – 3 : Production of Garnet (Abrasive) 2008-09 to 2010-11 (By State)

(Qty in tonnes; value in ₹'000)

State	2008-09		2009-10		2010-11(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**1151241**	**565937**	**1580617**	**763377**	**2058266**	**1200146**
Andhra Pradesh	74988	7981	124756	48255	152013	174906
Odisha	11455	22360	11080	36209	18473	65689
Tamil Nadu	1064798	535596	1444781	678913	1887780	959551

Table – 4 : Production of Garnet (Abrasive), 2009-10 & 2010-11 (By Sectors/States/Districts)

(Qty in tonnes; value in ₹'000)

State	2009-10			2010-11 (P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India	**66(1)**	**1580617**	**763377**	**62(1)**	**2058266**	**1200146**
Public sector	1(1)	24474	102322	1(1)	33388	145857
Private sector	65	1556143	661055	61	2024878	1054289
Andhra Pradesh	**3**	**124756**	**48255**	**2**	**152013**	**174906**
Nellore	1	7	14	-	-	-
Srikakulam	2	124749	48241	2	152013	174906
Odisha	**(1)**	**11080**	**36209**	**(1)**	**18473**	**65689**
Ganjam	(1)	11080	36209	(1)	18473	65689
Tamil Nadu	**63**	**1444781**	**678913**	**60**	**1887780**	**959551**
Kanyakumari	6	67919	98828	4	168140	172103
Thiruchirapalli	6	145650	14565	5	121550	15802
Thirunelveli	49	1131622	510866	49	1450180	685150
Thoothukudi	2	99590	54654	2	147910	86496

Figures in parentheses indicate associated mine of sillimanite.

Table – 5 : Mine-head stocks of Garnet (Abrasive), 2010-11 (P) (By States)

(In tonnes)

State	At the beginning of the year	At the end of the year
India	**272838**	**365622**
Andhra Pradesh	3731	19232
Odisha	3609	9156
Tamil Nadu	265498	337234

Garnet (Gem)

No production of garnet (gem) has been recorded during 2010-11 due to non-availability of ore.

MINING & MARKETING

Garnet is obtained generally by digging small shallow pits barring a couple of places in Tamil Nadu where it is recovered from seashore. Mining is done manually with the help of pickaxes and spades. Drilling and blasting are not required as garnet is found in soft rocks. Fine abrasive garnet is recovered from processing of beach sands. The mining of beach sand is done by dry and wet dredging. In Heavy Upgradation Plant and Mineral Separation Plant, individual minerals including garnet are separated. The output from mines is graded into two varieties - abrasive and gem, depending upon the clarity of crystals. Clear, flawless and rich-colour crystals of garnet are sold as semi-precious stones after cutting and polishing.

USES & CONSUMPTION

Clear flawless and rich-coloured crystals of garnet are used as semi-precious stones. The principal variety among them are ruby, pyrope, deep-crimson almandine, orange-yellow grossularite, etc.

The most important industrial use of garnet is as an abrasive. About 90% production of abrasive garnet is used for manufacturing of garnet-coated papers, cloths and discs. The remaining 10% output is used in the form of loose grains for surfacing and polishing soft stones (marble, slate, soapstone, etc.). Garnet-coated abrasives are used in the form of belts, covers for drums, discs or as small sheets. It is used for cleaning spark plugs, paints, polishing and grinding of plate-glass, ceramic and wood. Other uses are in electronic and television industry for polishing glass and TV tubes. Garnet also finds its use in sand blasting where generally garnet of mesh size 16-24 is used.

Water jet cutting machines generally use finely ground 80-120 mesh size garnet as cutting medium with high pressure water. Owing to its inertness to a wide range of chemicals, it is used as filter medium for water and other liquids.

The apparent consumption of garnet (abrasive) during 2008-09, 2009-10 and 2010-11 was about 899 thousand tonnes, 1,409 thousand tonnes and 1,849 thousand tonnes, respectively.

WORLD REVIEW

World reserves of garnet are large and occur in a wide variety of rocks like gneisses, schists in crystalline limestone, pegmatites, serpentinites, vein deposits, etc. In addition, alluvial garnet also occurs in heavy minerals sand deposits throughout the world. Major garnet deposits are found in USA, Australia, China and India. Deposits of garnets are also located in Canada, Chile, Czech Republic, Pakistan, South Africa, Spain, Thailand and Ukraine.

In 2010, India produced about 50% of total global production, followed by China 33% and Austalia 11%. Russia and Turkey have started mining garnet in recent years.

World end uses of garnet and market shares are : abrasive blasting media 50%, abrasive grains for waterjet cutting 30%; water filtration 15%; and other end uses 5%.

The world reserves and production of industrial garnet are furnished in Tables - 6 and 7.

Table – 6 : World Reserves of Garnet (Industrial)
(By Principal Countries)

(In '000 tonnes of garnet)

Country	Reserve
World: Total (rounded)	**Moderate to Large**
Australia	Moderate to large
China	Moderate to large
India*	6700000
USA	5000000
Other countries	6500000

Source:*Mineral Commodity Summaries, 2012.*
** India's total UNFC resources of garnet as on 1.4.2010 are estimated at 56.96 million tonnes.*

Table – 7 : World Production of Garnet (Industrial)
(By Principal Countries)

(In tonnes)

Country	2008	2009	2010
World : Total	**1310000**	**1400000**	**1400000**
Australia	160000	160000	150000
China	400000	450000	470000
India	650000	700000	700000
USA	62900	56500	52600
Other countries	35500	36000	36000

Source: *Mineral Commodity Summaries, 2011 and 2012.*
** India's production of garnet during 2008-09, 2009-10 and 2010-11 was 1.15 million tones,1.58 million tonnes and 2.06 million tonnes, respectively.*

FOREIGN TRADE

Exports

Exports of abrasive garnet increased 22% to 209,326 tonnes in 2010-11 from 171,420 tonnes in 2009-10. Exports were mainly to UAE (20%), USA (11%), Saudi Arabia (7%) and Qatar (5%). Exports value of garnet (cut & uncut) decreased drastically in 2010-11 to ₹1.8 crore from ₹13.7 crore in the previous year. Out of total from cut and uncut garnet, more than 94% exports earnings were from cut garnet. Exports of cut variety were mainly to Thailand, Czech Republic and UK & USA (Tables - 8 to 11).

Imports

In 2010-11, imports of abrasive garnet increased drastically to 357 tonnes from 20 tonnes in the previous year. Imports value of cut and uncut garnet decreased in 2010-11 to ₹161 lakh from ₹238 lakh in 2009-10. Imports were mainly from Hong Kong (53%), USA (13%) and Brazil (10%) in terms of value. Out of the total imports In 2010-11, uncut garnet accounted for 66% value and the remaining 34% was accounted for by cut garnet (Tables - 12 to 15).

Table – 8 : Exports of Garnet (Abrasive) (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**171420**	**1470702**	**209326**	**1571489**
UAE	39281	339833	40946	309398
USA	8742	78868	23327	147531
Saudi Arabia	11376	83296	14479	103066
Kuwait	9130	77418	10119	86003
Australia	6465	58495	10003	80430
Qatar	23239	199199	11339	78458
Germany	7893	62552	10266	71463
UK	7840	68029	8449	67989
Malaysia	4930	40140	6894	57056
Italy	10931	100412	7666	53467
Other countries	41593	362460	65838	516628

Table – 9 : Exports Value of Garnet (Cut and Uncut) (By Countries)

Country	2009-10	2010-11
	Value (₹'000)	Value (₹'000)
All Countries	**137014**	**18450**
Thailand	2186	5300
Czech Republic	-	3749
USA	12468	3464
UAE	-	1903
UK	313	1570
Germany	53	1111
Japan	1426	804
China	417	335
Hong Kong	1948	-
Singapore	117750	-
Other countries	453	214

Note: *Quantity not given due to partial coverage; value figures, however, have full coverage.*

Table – 10: Exports of Garnet (Cut) (By Countries)

Country	2009-10		2010-11	
	Qty ('000 carats)	Value (₹ '000)	Qty ('000 carats)	Value (₹ '000)
All Countries	**103**	**135988**	**260**	**17257**
Thailand	22	2186	114	5139
Czech Republic	-	-	60	3749
U S A	12	12467	30	3372
UAE	-	-	4	1789
U K	-	-	35	1570
Japan	2	1426	6	804
Germany	-	-	11	762
Brazil	-	-	++	52
Estonia	-	-	++	20
Other countries	67	119909	-	-

Table – 11 : Exports of Garnet (Uncut) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**++**	**1026**	**1**	**1193**
Germany	++	53	1	349
China	++	417	++	335
Thailand	-	-	++	161
Malaysia	-	-	++	141
UAE	-	-	++	114
USA	++	1	++	92
Korea, Rep. of	-	-	++	1
Other countries	++	555	-	-

Table – 12 : Imports of Garnet (Abrasive) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**20**	**42**	**357**	**7490**
China	-	-	292	6360
UAE	20	42	52	895
Singapore	-	-	9	167
Australia	-	-	4	68

Table – 13 : Imports Value of Garnet (Cut & Uncut) (By Countries)

Country	2009-10 Value (₹'000)	2010-11 Value (₹'000)
All Countries	**23848**	**16114**
Hong Kong	3239	8524
Brazil	-	1670
USA	14555	2161
Sri Lanka	308	1215
Tanzania Rep.	-	737
Kenya	-	516
Thailand	2505	471
Unspecified	-	620
Other countries	3241	200

Note: Quantity not given due to partial coverage; value figures, however, have full coverage.

Table – 14 : Imports of Garnet (Cut) (By Countries)

Country	2009-10 Qty ('000 crt)	2009-10 Value (₹'000)	2010-11 Qty ('000 crt)	2010-11 Value (₹'000)
All Countries	**102**	**20065**	**21**	**5443**
Hong Kong	10	3239	11	1752
USA	86	14555	7	1512
Sri Lanka	++	300	1	1215
Thailand	6	1747	1	344
Unspecified	-	-	1	620
Other countries	++	224	-	-

Table – 15 : Imports of Garnet (Uncut) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**++**	**3783**	**3**	**10671**
Hong Kong	-	-	++	6772
Brazil	-	-	3	1670
Tanzania Rep.	-	-	++	737
USA	-	-	++	649
Kenya	-	-	++	516
Nigeria	++	1105	++	190
Thailand	++	758	++	127
Zambia	++	1061	++	10
Other countries	++	859	-	-

FUTURE OUTLOOK

Garnet has wide range of applications, such as in production of abrasives, sand blasting, water filtration materials and water-jet cutting. Domestic production of garnet is very high while the current domestic demand is limited and the major chunk is exported. India is likely to play a decisive role in the world market in future.

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

GOLD

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

42 Gold

Gold is a noble metal highly valued by mankind since antiquity as an adornment for cultural status and decorative purposes, as possessions that symbolise wealth and for coinage. It is also owned as an investment. For most consumers, the motivations are intertwined. Gold is a relatively scarce metal in the world and a scarce commodity in India. Properties of gold which make it useful in industry are malleability, ductility, colour, resistance to corrosion, high electrical conductivity, reflecting power and therapeutic effects of some of its salts. India is a minor producer of gold but has huge demand in the country mainly in jewellery and ornament sector. The domestic demand is mainly met through import of gold.

RESOURCES

As per UNFC system, as on 1.4.2010, the total resources of gold ore in the country were estimated at 493.69 million tonnes. Out of these, 24.12 million tonnes were placed under reserves category and the remaining 469.57 million tonnes under remaining resources category. Total resources of gold (primary), in terms of metal, stood at 659.84 tonnes. Out of these, 110.54 tonnes were placed under reserves category and 549.30 tonnes under remaining resources category. The resources include placer-type gold ore in Kerala estimated at 26.12 million tonnes containing 5.86 tonnes gold metal.

By States, largest resources in terms of gold ore (primary) are located in Bihar (45%) followed by Rajasthan (23%) and Karnataka (22%), West Bengal (3%), and Andhra Pradesh & Madhya Pradesh (2% each). Remaining 3% resources of ore are located in Chhatisgarh, Jharkhand, Kerala, Maharashtra and Tamilnadu. In terms of metal content, Karnataka remained on top followed by Rajasthan, Bihar, Andhra Pradesh, Jharkhand, etc. (Table-1).

EXPLORATION & DEVELOPMENT

GSI, HGML and DMG, Rajasthan carried out exploration for gold in 2010-11. Gold, along with other minerals continued to be the principal thrust area for exploration by GSI in Andhra Pradesh, Jharkhand, Karnataka, Chhatisgarh, Rajasthan, Uttar Pradesh and Uttarakhand.

HGML conducted exploration in its mining lease areas viz, Hutti, Hira-Buddini and Uti Gold Mines in Raichur district in Karnataka. DMG, Rajasthan carried out exploratory work in Udaipur, Sirohi and Rajsamand district. Details of exploration activities undertaken in 2010-11 by various exploration agencies are furnished in Table - 2.

PRODUCTION AND STOCKS

The production of gold ore at 727 thousand tonnes in 2010-11 increased by 40% as compared to that in the previous year. The quantity of ore treated increased from 619 thousand tonnes to 631 thousand tonnes registering a rise of 2% as compared to previous year. Four mines reported production of gold ore in 2010-11, same as in 2009-10.

The average grade of gold ore produced during 2010-11 was 5.21 g/t as against 5.41 g/t in 2009-10, whereas, the average grade of ore treated during 2010-11 was 3.58 g/t as against 3.79 g/t in 2009-10.

Total poduction of gold (primary) in 2010-11 at 2,239 kg increased by 7% as compared to that in the preceding year. No production of secondary gold was reported since 2007-08 from domestic ores.

Karnataka was the leading producer of gold accounting for 99% of production. The remaining production was reported from Jharkhand (Tables - 3 to 7).

In addition, around 9,114 kg and 6,961 kg secondary gold was recovered during 2009-10 and 2010-11, respectively from imported concetrates by Birla Copper Complex of Hindalco Industries Ltd at Dahej in Bharuch district, Gujrat.

Sterlite Group is currently exporting the anode slimes and not producing gold within the country. The total production of gold bullion is furnished in Table - 8.

The average daily employment of labour strength in 2010-11 was 3,761 as against 3,210 in the previous year.

Table – 1 : Reserves/Resources of Gold as on 1.04.2010
(By Grades/States)

(In tonnes)

State/Grade	Reserves				Remaining resources								Total resources (A+B)
	Proved STD111	Probable STD121	Probable STD122	Total (A)	Feasibility STD211	Pre-feasibility STD221	Pre-feasibility STD222	Measurred STD331	Indicated STD332	Interred STD333	Reconnsaissance STD334	Total (B)	
All India :Total													
Ore (Primary)	16045673	7215335	863529	24124537	1823133	790000	1104647	38101248	70154052	213408962	144188333	469570375	493694912
Metal (Primary)	71.02	31.77	7.75	110.54	5.54	2.49	4.35	144.47	143.92	188.22	60.31	549.3	659.84
Ore (Placer)	-	-	-	-	-	-	-	-	2552000	23569000	-	26121000	26121000
Metal (Placer)	-	-	-	-	-	-	-	-	2.29	3.57	-	5.86	5.86
By States													
Andhra Pradesh													
Ore (Primary)	-	-	-	-	655133	-	889515	8059000	55000	2616699	-	12275347	12275347
Metal (Primary)	-	-	-	-	2.45	-	3.57	16.93	0.17	12.6	-	35.72	35.72
Bihar													
Ore (Primary)	-	-	-	-	-	-	-	-	-	128884860	94000000	222884860	22884860
Metal (Primary)	-	-	-	-	-	-	-	-	-	21.6	16.0	37.6	37.6
Chhattisgarh													
Ore (Primary)	-	-	-	-	-	-	-	-	600000	4241033	-	4841033	4841033
Metal (Primary)	-	-	-	-	-	-	-	-	1.8	3.71	-	5.51	5.51
Jharkhand													
Ore (Primary)	38059	-	-	38059	-	-	-	-	5164277	2949012	-	8113289	8151348
Metal (Primary)	0.13	-	-	0.13	-	-	-	-	3.73	8.87	-	12.6	12.73 (Contd.)
Karnataka													
Ore (Primary)	16007614	7215335	863529	24086478	1168000	790000	215132	24979968	8204595	12003638	37355000	84716333	108802811
Metal (Primary)	70.89	31.77	7.75	110.41	3.09	2.49	0.78	120.7	28.67	27.2	43.66	226.59	337.0

(Contd.)

Table - 1 (Contd.)

Grade/State	Reserves				Remaining resources								Total resources
	Proved	Probable		Total	Feasibility	Pre-feasibility		Measurred	Indicated	Interred	Reconnsaissance	Total	
	STD111	STD121	STD122	(A)	STD211	STD221	STD222	STD331	STD332	STD333	STD334	(B)	(A+B)
Kerala													
Ore (Primary)	-	-	-	-	-	-	-	462280	96180	-	-	558460	558460
Metal (Primary)	-	-	-	-	-	-	-	0.17	0.03	-	-	0.2	0.2
Ore (Placer)	-	-	-	-	-	-	-	-	2552000	23569000	-	26121000	26121000
Metal (Placer)	-	-	-	-	-	-	-	-	2.29	3.57	-	5.86	5.86
Madhya Pradesh													
Ore (Primary)	-	-	-	-	-	-	-	-	5841000	1947000	-	7788000	7788000
Metal (Primary)	-	-	-	-	-	-	-	-	6.18	2.22	-	8.4	8.4
Maharashtra													
Ore (Primary)	-	-	-	-	-	-	-	-	-	1517000	-	1517000	1517000
Metal (Primary)	-	-	-	-	-	-	-	-	-	3.55	-	3.55	3.55
Rajasthan													
Ore (Primary)	-	-	-	-	-	-	-	4600000	50193000	59182720	-	113975720	113975720
Metal (Primary)	-	-	-	-	-	-	-	6.67	103.34	107.47	-	217.48	217.48
Tamil Nadu													
Ore (Primary)	-	-	-	-	-	-	-	-	-	67000	-	67000	67000
Metal (Primary)	-	-	-	-	-	-	-	-	-	1.0	-	1.0	1.0
West Bengal													
Ore (Primary)	-	-	-	-	-	-	-	-	-	-	12833333	12833333	12833333
Metal (Primary)	-	-	-	-	-	-	-	-	-	-	0.65	0.65	0.65

Figures rounded off.

Table – 2 : Details of Exploration for Gold, 2010-11

Agency/ State/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
GSI							
Jharkhand							
Saraikela-Kharswan	Rudia –Largadih –Balidih (North Singhbhum Mobile Belt)	-	-	-	-	-	Prospecting stage investigation (G-3) was taken up during FS 2010-12, Sulphides occur in the form of stringers and disseminations in brecciated ferruginous quartzite and the associated volcanogenic sili-ceous tuffs. The sulphides comprise pyrite, pyrrhotite, arsenopyrite, sphalerite & chalcopyrite with the first two constituting 70% of the total sulphide. Occasional visible gold specks are associated with sulphides. The work is in progress.
Ranchi	Lungtu- Parasi-Sindauri-Ghanshyampur (Sindauri-Ghanshyampur)	-	-	-	-	-	Prospecting stage investigation (G-3) was taken up during FS 2010-12 to assess the gold potentiality of the area. The associated thin white coarse grained quartz vein which is limonitic in nature is gold bearing. The geochemical samples (BRS) indicated gold values ranging from 50 ppb to 1.5 ppm. The work is in progress.
East and West Singhbhum	Tilaitanr-Sobhapur	-	-	-	-	-	Prospecting stage investigation (G-3) was continued to assess the gold, nickel & chromium potentiality of the area. The rock types exposed in the area include interbanded sequence of phyllite, tuffaceous phyllite, banded iron formation and chlorite schist. The sulphide mineralisation is present in the form of pyrite and chalcopyrite within the quartz veins and veinlets, which intrudes the phyllitic unit along foliation. The work is in progress.
Andhra Pradesh							
Mahaboob-nagar & Kurnool	Area west of Remeta	1:12500	68	-	-	-	Reconnaissance stage investi-gation (G-4) was taken up during FS 2010-12. The work is in progress.
Cuddapah	Tellakonda (Veligallu greenstone belt)	1:2000	1.3	-	-	-	Prospecting stage investigation (G-3) was taken up during FS 2010-12. Five numbers of trenches have been made. Two samples have indicated 295 ppb and 45 ppb Au. One bed-rock sample of the quartz reef near the canal indicated 65 ppb Au. Samples from first borehole have indicated gold value of 0.78 g/t x 5 m and 0.298 g/t x 2 m. The work is in progress.

(Contd.)

Table - 2 (Contd.)

Agency/ State/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
Bihar							
Gaya and Nalanda	Bathani area (Munger-Rajgir Group of rocks)	-	-	-	-	-	Reconnaissance stage investi-gation (G-4) was taken up during FS 2010-12. The mapped area comprises phyllitic tuff, BIF, brecciated BIF which suffered deformation resulting in fault gauge and slickenside. Phyllite –quartzite association is dominant in Rajgir meta-sediments. The work is in progress.
Jamui	Sono area Sukhnar basin in Gosari-Ghutwe block	-	-	-	-	-	Prospecting stage investigation (G-3) was taken up during FS 2010-12 to assess the gold potentiality. So far, three trenches 2010-12 to assess the gold have been excavated and samplings have been completed. The trench no. T-2 has exposed a few lenses of ferruginous quartzite having specks of sulphide minerals, especially arsenopyrite, within schistose amphibolites. The work is in progress.
Chhattisgarh							
Raipur	Sonakhan belt in Palasapali area, West of Bhanwarpur.	Large scale mapping	-	-	-	14 trench samples and 5 bedrock samples	Reconnaissance stage investi-gation (G-4) was taken up. The work is in progress.
Karnataka Tumkur	Ajjanahalli Block-D and Block-E	1:12500 1:1000	9 0.5	06	-	407	Prospecting stage investigation (G-3) was taken up in Block–D. The gold assay value of ADG-5 (Zone-V) is 0.58 g/t / 2.00 m, for ADG-6 the average assay values are 1.16 g/t / 1.5 m (Zone-IV) and 1.17 g/t / 1.00 m (Zone-V), respectively. The maximum value recorded in Zone-VI is 0.45 g/t over a width of 0.50 m. In ADG-7 (Zone-IV) the average assay value is 0.87g/t over width of 1.5 m (the maximum value recorded is 1.19 g/t / 0.50 m) and part of analytical result received for ADG-8 (Zone–VIII) is 0.30 g/t Au x 1.00 m. Potential auriferous BIF bands were delineated. The BIF is sheared, with quartz carbonate veins/ veinlets, highly limonitised, having oxidised sulphides often noticed in the form of vugs and cavities. The work is in progress.

(Contd.)

Table - 2 (Contd.)

Agency/ State/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
Chitradurga and Tumkur	Adivala-Obalapura and Mavinamadu	Large Scale Mapping	78	-	-	105 bedrock samples and 149 trench samples	Reconnaissance stage investigation (G-4) was taken up to assess the auriferous nature & locales of possible gold mineralisation. A total of six BIF bands were delineated during LSM. The width of the band varies from 2 m to 6 m. Five disseminations of pyrite, arseno-pyrite, chalcopyrite & pyrrhotite have been noticed. Auriferous zones have been iden tified in the western most and central BIF bands. The work is in progress.
	Bhairapura and Hosahalli (Jalagaragundi, Siddarahalli, Honnahatti and Singanamane area)	-	-	-	-	-	Reconnaissance stage investi-gation (G-4) was taken up during FS FS 2010-12 to assess the auriferous nature & locales of possible gold mineralisation. Auriferous zone has been identified at the contact of granite gneiss and metabasalt. Trench samples analysed gold values upto 11.26 ppm. A total of 6 samples collected from old dumps have analysed gold values ranging from 0.86 ppm to 2.19 ppm. Surface mani-festations of auriferous sulphide mineralisation is noticed in the form silicification, limonitisation, sulphide dissemination, carbonitisation and leaching within quartz-chlorite schist and quartz carbonate rock associated with talc-chlorite schist. The work is in progress.
Rajasthan							
Banswara	Jagpura block (Bhukia gold belt)	-	-	-	-	-	Prospecting stage investigation (G-3) was taken up during 2010.12 to delineate the potential zones for gold & associated base metal mineralisation. The gold analysis of the samples from 2 channels indicated average gold values of 1.72 ppm x 16 m and 5 ppm x 5 m, respectively. The work is in progress.
	Gundelapara NW Block	-	-	-	-	-	Prospecting stage investigation (G-3) was taken up. In borehole GNW-1, three mineralised zones were intersected from 24.0 m to 48.0 m (24.0 m x 5 -10% sul-phides in visual estimates); 50.75 m to 54.90 m (4.15 m x 4-5% sulphides in visual estimates) and from 68.10 m to 106.0 m (37.90 m X 5-10% sulphides in visual estimates). Within third minera-lised zone, a 10.20 m zone of massive to semi massive (> 60 to 30%) sulphide zone was inter-sected from 85.70 m to 95.90 m depths. The work is in progress.

(Contd.)

Table - 2 (Concld.)

Agency/ State/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
Uttarakhand							
Rudra-prayag	Lameri-Ratura area (Lameri area, Tilni area and Tilni-Koteshwar)	-	-	-	-	-	Reconnaissance stage investigation (G-4) was taken up during FS 2010-12 to delineate & assess the auriferous mineralised zones. Three sulphide mineralised zones have been delineated. Gold flakes up to 1 mm size have been recorded from stream sediment samples. Bedrock and stream sediment samples indicated gold values up to 475 ppb and 200 ppb, respectively. The work is in progress.
Uttar Pradesh							
Sonbhadra	Chakoriya-Charka area	large-scale mapping	-	-	-	-	Reconnaissance stage investigation (G-4 stage) was taken up for search of gold & associated mineralisation. The earlier studies in the area established auriferous nature of quartz veins. An auriferous mineralised zone has been located 500 m south of Parsoi village. Four grab samples from the mineralised zone have indicated gold values ranging between 2.65 ppm and 5.48 ppm and arsenic between 29.9% and 33.5%. The work is in progress.
DMG Rajasthan							
Udaipur	N/V Kun, Punjala ki Bhagal, tehsil Lasadia	-	-	01	90	47	In the borehole, stringers and specks of pyrite were observed. Results of geochemical analysis were awaited.
Rajsamand	N/v Sunarkui tehsil-Bhim	-	-	1	72	-	Results of geochemical analysis were awaited.
Sirohi	Tehsil Pindwara	RMS 1:10000 1:2000	100 10 01	-	-	20	About ½ km north of village Watera malachite staining was seen at places in rocks.
HGML Karnataka							
Raichur	Hutti Gold Mine, Hutti	1:400	-	-	Surface 5684 m U/G 1460 m	12035	A total of 9.25 million tonnes of resources of gold ore with 5.26 g/t Au were estimated.
	Hira Buddini Gold project, Buddini	1:400	-	-	-	1164	About 0.78 million tonnes resources of gold ore with 3.99 g/t Au were computed.
	Uti Gold Mine, Uti	1:2000	03	-	-	1435	Total mineable reserves are estimated at 2.18 million tonnes ore with 2.50 g/t to 2.91 g/t Au.

Table – 3 : Producers of Gold, 2010-11

Name and address of the producer	Location of the mine	
	State	District
The Hutti Gold Mines Co. Ltd, No. 6/13, Guruappa Avenue, Primrose Road Cross, Bengaluru - 560 025, Karnataka.	Karnataka	Raichur
Manmohan Industries (P) Ltd, Shantiniketan, 286, New Patliputra Colony, Patna, Bihar.	Jharkhand	Singhbhum East

Table –4 : Production of Gold Ore 2009-10 and 2010-11 (By States)

(In tonnes)

State	2009-10		2010-11 (P)	
	Ore Produced	Avg. Grade (g/t)	Ore Produced	Avg. Grade (g/t)
India	**517520**	**5.41**	**727020**	**5.21**
Jharkhand	5066	2.54	4035	3.38
Karnataka	512454	5.44	722985	5.22

Table - 5 : Gold Ore treated, 2009-10 and 2010-11 (By States)

(In tonnes)

State	2009-10		2010-11 (P)	
	Ore Produced	Avg. Grade (g/t)	Ore Produced	Avg. Grade (g/t)
India	**619193**	**3.79**	**630931**	**3.58**
Jharkhand	7644	2.19	4913	2.77
Karnataka	611549	3.81	626018	3.59

Table – 6 : Production of Gold, 2008-09 to 2010-11 (By States)

(Quantity in kg: value in ₹'000)

State	2008-09		2009-10		2010-11 (P)	
	Qty	Value	Qty	Value	Qty	Value
India	**2438**	**3152620**	**2084**	**3425814**	**2239**	**4302096**
Primary Gold	2438	3152620	2084	3425814	2239	4302096
Jharkhand	18	21883	14	21251	14	27946
Karnataka	2420	3130737	2070	3404563	2225	4274150

Table – 7 : Production of Gold, 2009-10 and 2010-11
(By Sectors/States/Districts)

(Quantity in kg.; Value in ₹ '000)

State/Disctrict	No. of mines	2009-10 Production		No. of mines	2010-11 (P) Production	
		Quantity	Value		Quantity	Value
India	**4**	**2084**	**3425814**	**4**	**2239**	**4302096**
Public sector	3	2070	3404563	3	2225	4274150
Private sector	1	14	21251	1	14	27946
Primary Gold	**4**	**2084**	**3425814**	**4**	**2239**	**4302096**
Jharkhand	**1**	**14**	**21251**	**1**	**14**	**27946**
Singhbhum East	1	14	21251	1	14	27946
Karnataka	**3**	**2070**	**3404563**	**3**	**2225**	**4274150**
Raichur	3	2070	3404563	3	2225	4274150

Gold Bullion

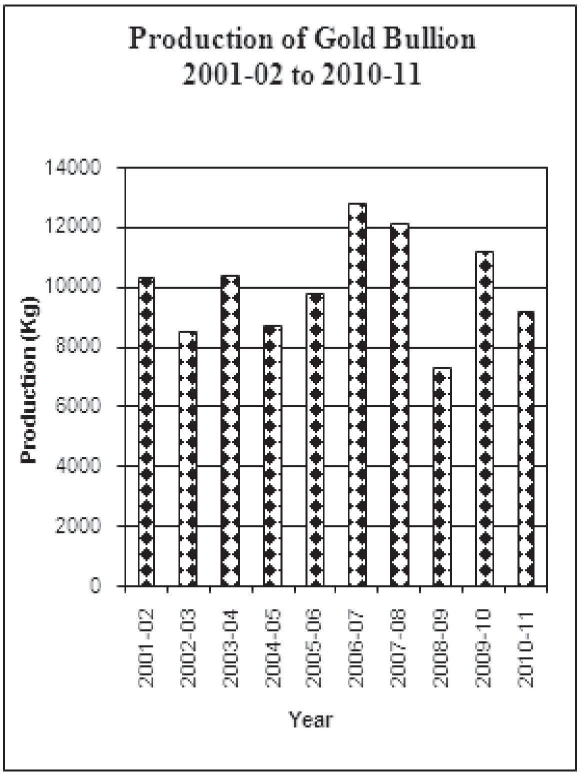
Production of gold bullion in India is reported both in primary and secondary forms. Total production of gold bullion during 2010-11 at 9,200 kg decreased by about 18% as compared to 11,198 kg in the previous year.

Table – 8 : Production of Gold Bullion*
2008-09 to 2010-11

(Quantity in kg.; Value in ₹ '000)

Year	Quantity	Value
2008-09	7309	9277886
2009-10	11198	17910044
2010-11 (P)	9200	17586827

* *Includes gold recovered as by-product from imported copper concentrates by Hindalco Industries Ltd in Gujarat.*



MINING & MILLING

Presently, HGML is the only public sector company producing gold in the country. Manmohan Industries Pvt. Ltd in private sector is also engaged in mine production of gold. HGML operates mines at Hutti, Uti and Hira-Buddini in Raichur district, Karnataka. The total installed capacity of these mines is 7.02 lakh tpy gold ore. Implementation of mechanisation of mining operations at Hutti mine was in progress. Exploratory developments were taken up in all reefs and cross-cutting in south shaft 3rd and 6th level is under way. Sub-level and LDBH stoping methods are employed to exploit the gold ore. The Uti mine is opencast and the ore from this mine is transported to Hutti mine for processing at the mills. The present capacity of the mine is 25,960 tpy of ore. As per the feasibility studies, opencast mining is viable and will be continued to 90 m vertical depth. Underground exploratory mining too is in progress. Several operations at Hira-Buddini gold unit, such as exploratory mine development and deepening and re-equipping of main shaft are in progress. The present production capacity of the mine is 20,050 tpy. Exploratory mine development using manual compressed air jackhammer drilling and electrical hoist for winding in the shaft too is presently underway. Based on the development work and feasibility, the locomotive loaders, wagon drills and other required machinery will be used to increase the OMS. Further forays to carry out detailed exploration by exploratory mine development are under consideration. The stoping preparation was in progress.

At the Hutti Mineral Treatment Plant, the r.o.m. of -8" size is crushed. The final product from crushing plant, i.e., -10 mm size is stored in a 1,500 tonnes capacity fine ore bin for subsequent treatment, i.e., grinding. The Milling/Grinding process of gold ore employs two distinct grinding techniques. In the first technique, grinding is done in two stages, i.e., primary grinding and then secondary grinding for further comminution. One primary mill and three tube mills constitute one stream of grinding in which pebble and smaller size balls are used as composite grinding media. There are two such streams and strake tables are used to collect coarse gold as concentrate for this circuit. In the second technique, grinding is done by four ball mills of different sizes and each of them is an independent circuit in which large size balls are used as grinding media. In these circuits, Knelson concentrator is used to collect coarse gold as concentrate. In all the milling techniques, cyclones are in closed circuit with the mills so as to get the required sizes (80% passing 75 micron) for the subsequent treatment process.

The concentrate collected from both the techniques is upgraded on James Table. The upgraded concentrates are roasted, magneted and finally smelted into bullion buttons.

All the cyclone overflow, i.e., finely ground ore in the form of slurry from the two streams of first technique and 4 streams of second technique join together in a distributor box from which finely ground ore slurry is fed to High Rate Thickener for thickening purpose. The thickened pulp (60% solid w/w) thus obtained from thickeners is subjected to cyanidation process in which cyanide accessible gold in slurry makes complexes with cyanide in presence of oxygen and dissolves in solution at high pH. To increase the oxygen potential of slurry, H_2O_2 is added in addition to compressed air. The cyanidation or leaching process is carried out in a series of mechanically agitated agitators of different sizes.

The cyanide leached pulp is then fed to two Carbon-in Pulp (CIP) plants. The CIP plants are of 1,000 tpd size each and are parallel in circuit. The objective of CIP plant is to absorb the dissolved gold in activated carbon from the solution.

The gold-loaded carbon is removed from the CIP plant periodically, subjected to acid and alkaline wash and then eluted in four elution columns with 1.0% NaOH and 0.1% NaCN solution at 95°C for a period of 60 hours. The solution is then passed through four electrowinning cells in which gold is deposited on steel wool cathodes.

The gold loaded steel wool cathodes are manually removed periodically, subjected to acid digestion, drying and smelting to obtain bullion buttons. The bullion buttons thus obtained from table concentrate and steel wool are cast into bullion bars weighing 4 to 11 kg and then despatched for sales.

Manmohan Industries, a private sector company, operates Kunderkocha mine in Singhbhum East district, Jharkhand. The mining is carried out by underground method.

In the past, gold was produced by the Central Government undertaking, namely, BGML. BGML earlier mined and processed the ore from Chigargunta reef in Chittoor district, Andhra Pradesh, Mysore mines of Kolar Gold Fields in Karnataka and Yeppamana mine in Anantapur district, Andhra Pradesh. All activities of BGML were stopped and BGML was closed w.e.f. 1.3.2001 under Section 25 (O) of the Industrial Disputes Act, 1947 in terms of Ministry of Labour, Government of India's order dated 29.1.2001. To augment gold production in the country, as per XI Plan document, Chigargunta and Bisanthan mines deserve active consideration for opening and commencement of operations.

DEVELOPMENT

HGML is the 40th member of the World Gold Council and the first one from India.

The Deccan Gold Mines Ltd (DGML), India's first and largest listed gold exploration company, collected rock and stream sediment samples and analysed them. DGML has plans for geophysical studies and drilling prospects at areas located in proximity to existing old mines and also at earlier explored areas in Hutti belt, Manglur belt, Dharwar-Shimoga belt in Karnataka; Attapadi Project in Kerala; and Ramgiri belt in Andhra Pradesh. The main prospects for gold at Ganajur and Karajgi have progressed into advanced stages of exploration and existence of high grade gold bearing zones in the prospect has been established. Exploration is being conducted in Hutti belt at various prospects, viz, in Hutti Mine north prospect, Hirenagnur prospect, southern and northern continuity of Uti mine lodes, Uti Temple prospect, Chinchergi prospect, Buttapur prospect and Yatkal prospect. In south Hutti RP block, the investigations are going on in Tuppadhur- Buddini prospect, Maski prospect, Ashoka prospect and Sanbal prospect.

DGML has a large portfolio of exploration prospects in the state of Andhra Pradesh, Kerala, Karnataka and Rajasthan.

Birla Copper Complex of Hindalco Industries Ltd situated at Dahej, District Bharuch, Gujarat has an installed capacity of 15 tpy for gold recovery from imported copper concentrates. In 2009-10, it produced 9.11 tonnes gold and about 6.96 tonnes in 2010-11.

HCL which recovers by-product secondary gold from indigenous copper ores at its ICC plant in Jharkhand has an installed capacity of 698 kg per annum gold recovery plant. This plant, however, did not report production since 2007-08.

Sterlite Industries (India) Ltd, has a copper smelter of 3 lakh tpy capacity at Thoothukudi, Tamil Nadu. The Company is in the process of obtaining world class technology for recovery of gold from copper concentrates and copper smelter by-products.

POLICY

Foreign Direct Investment (FDI) up to 100% in mining sector in respect of gold is eligible for automatic approval.

Gold being a specified mineral, Mineral Concessions, viz, reconnaissance permits (RP), prospecting licences (PL) and mining leases (ML) for gold are granted by the State Governments after prior approval of the Central Government.

In the revised Export-Import Policy, comprised in the Foreign Trade Policy (FTP), 2009-14, gold ores and concentrates are in freely importable category. Under Heading No.7108, the import of non-monetary gold metal also falls under Free category subject to RBI regulations, while import of gold metal in monetary form is restricted.

ENVIRONMENTAL CONCERNS

Gold is recovered from ores by two main methods, both of which affect environment.

Earlier, for recovery of gold, amalgamation processes were used in which ore was mixed with mercury that selectively dissolved gold which was then recovered by evaporation. Mercury from these operations was never recovered and remained as pollutant in many old mining areas. The cyanide process is based on the property of precious metals of forming soluble complex ions with cyanide anion. Cyanide does not dissolve quartz, iron oxides and other common gangue minerals and yields a relatively simple gold-bearing solution known as pregnant solution. In some gold mines, gold is dissolved from the ore by crushing and grinding followed by mixing with cyanide solution in large vats.

Gold is sometimes recovered from the pregnant solutions by adding zinc to form soluble zinc cyanide and precipitate of gold & silver. The pregnant solution can also be passed through activated carbon which absorbs dissolved gold. Gold from either process is cast into bars, bullion and dore (when it contains silver), which must be further refined to remove impurities, such as mercury, arsenic and copper. Some ores cannot be treated by cyanide processing as gold in them is in small inclusions or even by solid solutions in minerals, such as pyrite. This gold is generally recovered by roasting which converts pyrite into porous iron oxides containing small grains of gold that can be dissolved by cyanide.

Cyanide is a highly toxic compound. Although it is found in common plants, such as almond and cassava, concentration in solutions is higher and requires special handling. During ore treatment, pH of cyanide solution must be kept at about 11 to prevent cyanide from reacting with hydrogen ion to produce HCN, a deadly gas. Although less toxic substitutes of cyanide are known, it is not yet clear whether such substances will be cost-effective or environment-friendly.

DEMAND & CONSUMPTION

Jewellery accounted for major consumption of gold, i.e., 85%, followed by electronics 6%, medal and coins 2% and other sectors 7%. The Industrial demand for gold is dominated by Electrical Sector due to its excellent thermal and electrical properties, besides a significant amount is consumed in dentistry and medicine. Continuing research has discovered new applications for gold as catalyst and in nano-technology. No proper estimation of gold demand in the country could be attempted due to lack of proper consumption data of the end-use industry. However, from overall evaluation it is seen that India has a traditional and stable market for gold consumption. There is increase in demand from Ornamental and Electronic Sectors. A huge gap exists between demand and indigenous production which is likely to continue. Apparent consumption of gold in the country during 2010-11 was about 959.40 tonnes as compared to 839.23 tonnes reported in the preceding year.

SUBSTITUTES

Platinum and palladium substitute gold to some extent, but their use is influenced by price relationship and by an established consumer preference for gold. Silver can be a substitute, but it offers less resistance to corrosion. Gold-plated palladium and bright tin-nickel can be used in electronics. Titanium and chromium-based alloys can be used in dental work. High prices encourage substitutes, particularly base metal clad with gold in Electronic & Electrical Industry and in jewellery products. No metal or alloy substitute has all the properties of gold, and therefore, the emphasis is on reduction of gold content rather than substitution.

WORLD REVIEW

The estimated reserves of gold were about 51,000 tonnes of metal. The gold reserves are mainly located in Australia (15%), South Africa (12%), Russia (10%), Chile (7%), Indonesia & USA (6% each) Brazil (5%), China and Peru (4% each), and Uzbekistan (3%). The world reserves of gold are given in Table-9.

The world mine production of gold was estimated at 2,540 tonnes in 2010. China contributed about 13% in world's total mine production of gold followed by Australia (10%), USA (9%), Russia (8%), South Africa(7%), Peru (6%) and Indonesia and Canada (4% each) (Table-10).

Table – 9 : World Reserves of Gold (By Principal Countries)

(In tonnes of gold content)

Country	Reserves
World: Total (rounded)	**51000**
Australia	7400
Brazil	2400
Canada	920
Chile	3400
China	1900
Ghana	1400
Indonesia	3000
Mexico	1400
Papua New Guinea	1200
Peru	2000
Russia	5000
South Africa	6000
Uzbekistan	1700
USA	3000
Other countries	10000

Source: *Mineral Commodity Summaries, 2012.*

Table – 10 : World Mine Production of Gold (By Principal Countries)

(In tonnes of metal content)

Country	2008	2009	2010
World : Total	**2290**	**2464**	**2540**
Argentina	42	47	58
Australia	215	223	260
Brazil	54	56	58
Chile	39	41	39
Canada	97	97	98
China@	285	314	341
Colombia	34	48	54
Ghana	81	91	92
Indonesia	64	128	105
Papua New Guinea	67	68	67
Philippines	36	37	41
Peru	180	182	149
Mali	41	42	39
Mexico	50	62	79
Russia	184	205	201
South Africa	213	198	189
Tanzania	36	39	39
USA	233	223	228
Uzbekistan	73	73(e)	73(e)
Other countries	266	298	330

Source: *World Mineral Production, 2006-2010.*
@ Metal production.

Traditionally dominant gold producers viz, South Africa, USA and Canada are losing ground to new producers. Gold output declined in 2010 in Indonesia and Peru by 18% each and in South Africa by 5% as against the production of gold in year 2009. Gold production rose in 2010 mainly in Australia by 16% and China by 9% compared to the preceeding year. A number of new mines were developed or came on stream during 2010. In addition to primary production, recycling is a significant resource of gold, annually contributing to the world supply.

Prices

The gold prices since 2001 have increased steadily from average price of US $ 271 per troy ounce to around US $ 973 per troy ounce during 2009. The average price of gold in 2010 became US $ 1,226.66 per troy ounce and in 2011 reached a new all time high (average) of US $ 1,896.50 per troy ounce. The average price of gold during 2011 was US $ 1,573.16 per troy ounce, an increase of 28% over 2010 average price. Gold price soared to an all time high in 2011 on strong demand as precious metals are considered a safe investment in times of economic turmoil and rising inflation.

Australia

In 2010, ten mines started or restarted production. These mines included A1 Minerals Ltd's Brightstar Mine; Catalpa Resources Ltd's Edna May Mine, Exco Resources Ltd's and Polymetals Mining Ltd's White Dam Mine; GBM Gold Ltd's Inglewood Mine; Intergra Mining Ltd's Aldiss-Randalls Mine; La Mancha Resources Inc.'s White Foil Mine; Navigator Resources Ltd's Bronzewing Mine; Range River Gold Ltd's Mt. Morgans Mine; Regis Resources Ltd's Duketon Project; and Saracen Minerals Holdings Ltd's South Laverton Region Mine.

Burkina Faso

The increased production was partially due to the start up of IAMGOLD’s Essakane Mine which started production in July, 2010 and also due to a plant expansion programme at SEMAFO Inc.’s Mana Mine.

China

After merger of Eldorado Gold Corp. and Sino Gold Mining in 2009, three gold mines, two gold projects and several exploration projects in China were fully integrated. The production from the three mines namely Jinfeng, Tanjianshan and White Mountain together was 11,000 kg gold in 2010 which was 13% higher than that in 2009. Jinfeng is the second leading gold mine in China with 5,630 kg production in 2010.

Côte d'Ivoire

Randgold Resources Ltd started production from its Tongon Mine in 2010 end. The mine is slated to produce 8,000 kg in 2011.

Dominican Republic

Construction of the Pueblo Viejo project of Barrick and Goldcorp continued in 2010. The mine was scheduled to start producing in early 2012.

Kazakhstan

Kazzinc JCS' Vasilkovskoje mine was commissioned in mid -2010. It was expected to attend full capacity production of 12,000 kg per annum by mid- 2011.

Mexico

Production in 2010 rose higher than in 2009 mainly due to new mines coming on stream. Fresnillo plc began production from Soledad-Dipolos mine in early 2010. Santa Elena Mine of Silver Crest Mine Inc. started production in September 2010. El Aguila Project of Gold Resources Corp. began commercial production in July 2010, and was expected to reach 2,000 kg production by 2011.

Panama

Molejon gold mine of Petaquilla Minerals Ltd which began production towards 2009 end reached 1,300 kg production in 2010. With a planned heap leaching operation, production was expected to reach about 1,500 kg gold in 2012.

Phillippines

Gold production from mines in the Philippines increased in 2010 because start of production by CGA Mining Ltd's (Perth) Masbate Mine in 2009.

Russia

The leading gold producer in Russia was Polyus Gold Mining Co. reported higher output from that in 2009. The increase was attributed to start up of the Blagodatnoye Mine in the Krasnoyarsk Region and of the largest capacity gold mill in Russia.

South Africa

In 2010, the decline in South Africa's gold production from that in 2009 owing to decreased ore grades and closure of under producing shafts to decrease mining costs. In 2010, three companies operated mines that accounted for almost 80% of South African gold production.

The ramp up of Moab Khotsang Mine resulted in 18 % higher production over 2009. Modder East Mine of Gold One International Ltd which opened in mid-2009 produced 2,070 kg gold in 2010. First Uranium Corp. produced gold from its Ezulwini gold-uranium underground mine and from the Mines Waste Solutions (MWS).

FOREIGN TRADE

Exports

The export of gold ores and concentrates decreased to 2,625 kg in 2010-11 from that of the previous year. The entire exports were made to UAE. The exports of gold (non-monetary & monetary) increased to 49.5 tonnes in 2010-11 from 22.99 tonnes in the previous year. The exports in 2010-11 were mainly to UAE and Belgium in terms of volume and value (Tables - 11 to 17).

Imports

Imports of monetary and non-monetary gold which were 851.02 tonnes valued at ₹ 1,35,883.19 crore in 2009-10 increased to 969.74 tonnes valued at ₹ 1,84,728.75 crore in 2010-11. The share of non-monetary other unwrought forms was 94% in the total value of gold imported. Imports of gold were mainly from Switzerland (55%), followed by UAE (18%), South Africa (11%), and Australia (8%) in terms of volume (Tables - 18 to 22).

Table – 11 : Exports of Gold Ores & Conc. (U) (By Countries)

Country	2009-10		2010-11	
	Qty (kg)	Value (₹'000)	Qty (kg)	Value (₹'000)
All Countries	**7568**	**8121**	**2625**	**792**
Bangladesh	1500	15	-	-
Philippines	6068	8106	-	-
UAE	-	-	2625	792

(U) Under reference.

Table – 12 : Exports of Gold (Non-Monetary & Monetary) Total (U) (By Countries)

Country	2009-10		2010-11	
	Qty (kg)	Value (₹'000)	Qty (kg)	Value (₹'000)
All Countries	**22990**	**9827212**	**49537**	**5317442**
UAE	22938	9804073	17713	4075524
Belgium	-	-	14956	985947
Sweden	-	-	9300	188044
Hong Kong	14	17722	6017	40965
Singapore	-	-	1517	15815
USA	10	3237	22	8435
Canada	-	-	2	1224
France	2	637	3	1046
Kenya	25	67	1	238
Botswana	-	-	1	56
Other countries	1	1476	5	149

(U) Under reference.

Table – 13 : Exports of Gold (Non-monetary) (U) (By Countries)

Country	2009-10		2010-11	
	Qty (kg)	Value (₹'000)	Qty (kg)	Value (₹'000)
All Countries	**22989**	**9827107**	**49537**	**5317442**
Belgium	-	-	14956	985947
Canada	-	-	2	1224
France	1	532	3	1046
Hong Kong	14	17722	6017	40965
Kenya	25	67	1	238
Singapore	-	-	1517	15815
Sweden	-	-	9300	188044
UAE	22938	9804073	17713	4075524
USA	10	3237	22	8435
Unspecified	1	1476	-	-
Other countries	-	-	6	204

(U) Under reference.

Table – 14 : Exports of Gold, Non-Monetary: Other Semi-manufactured forms (By Countries)

Country	2009-10		2010-11	
	Qty (kg)	Value (₹'000)	Qty (kg)	Value (₹'000)
All Countries	**297**	**430703**	**62**	**67522**
UAE	271	407736	38	65130
Canada	-	-	2	1224
France	1	532	3	1046
USA	10	3237	18	66
Botswana	-	-	1	56
Other countries	15	19198	++	++

Table – 15 : Exports of Gold, Non-Monetary, Powder (By Countries)

Country	2009-10		2010-11	
	Qty (kg)	Value (₹'000)	Qty (kg)	Value (₹'000)
All Countries	**25**	**67**	**-**	**-**
Kenya	25	67	-	-

Table – 16 : Exports of Gold-Monetary (By Countries)

Country	2009-10		2010-11	
	Qty (kg)	Value (₹'000)	Qty (kg)	Value (₹'000)
All Countries	**1**	**105**	**-**	**-**
France	1	105	-	-

Table – 17 : Exports of Gold-Clad Metals/Base Metals, NES (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**1**	**1473**	**1**	**927**
USA	++	1254	++	734
Turkey	-	-	++	98
New Zealand	-	-	++	65
Nepal	1	44	1	30
Other countries	++	175	-	-

Table –18 : Imports of Gold (Non-Monetary & Monetary): Total (By Countries)

Country	2009-10 Qty (kg)	2009-10 Value (₹ '000)	2010-11 Qty (kg)	2010-11 Value (₹ '000)
All Countries	**851023**	**1358831868**	**969738**	**1847287525**
Switzerland	375134	601204521	537650	1025704859
UAE	160793	258777517	179052	341088079
South Africa	100775	158840113	104280	197279154
Australia	170825	271174817	73495	137466109
USA	18367	28662135	25898	48621504
Hong Kong	10579	17124039	9594	18352774
UK	5538	8644498	8757	17462221
Germany	163	182252	4246	8167267
China	131	191967	3330	6649743
Unspecified	502	772515	6046	12398653
Other countries	8216	13257494	17390	34097162

Table – 19 : Imports of Gold, Non-Monetary: Other Semi-manufactured forms (By Countries)

Country	2009-10		2010-11	
	Qty (kg)	Value (₹ '000)	Qty (kg)	Value (₹' 000)
All Countries	**4760**	**7638289**	**51961**	**102954219**
Switzerland	3775	6005393	40881	80681059
UAE	116	199164	4592	9086272
Australia	500	850361	1323	2990277
Germany	36	30151	1496	2904087
USA	103	183310	1392	2787929
China	-	-	705	1369453
UK	11	12311	300	592961
Sweden	1	309	249	459768
Finland	-	-	176	344229
Unspecified	100	157275	262	540719
Other countries	118	200015	585	1197465

Table – 20 : Imports of Gold, Non-Monetary: Other Unwrought Forms (By Countries)

Country	2009-10		2010-11	
	Qty (kg)	Value (₹' 000)	Qty (kg)	Value (₹' 000)
All Countries	**846231**	**1351140769**	**917775**	**1744333207**
Switzerland	371328	595146389	496769	945023800
UAE	160677	258578353	174460	332001806
South Africa	100775	158840113	104272	197264560
Australia	170325	270324457	72172	134475832
USA	18264	28478825	24505	45833521
Hong Kong	10533	17061859	9529	18225789
UK	5527	8632186	8457	16869260
China	131	191967	2625	5280290
Germany	126	152029	2749	5263136
Unspecified	402	615240	5784	11857934
Other countries	8143	13119351	16453	32237279

Table -21: Imports of Gold, Non-Monetary, Powder (By Countries)

Country	2009-10 Qty (kg)	2009-10 Value (₹'000)	2010-11 Qty (kg)	2010-11 Value (₹'000)
All Countries	**32**	**52810**	**2**	**99**
USA	-	-	1	54
Germany	1	71	1	45
Other countries	31	52739	-	-

Table-22: Imports of Gold-Clad Metals/Base Metals, NES (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**++**	**11849**	**++**	**522**
USA	++	6938	++	55
Unspecified	-	-	++	467
Other countries	++	4911	-	-

FUTURE OUTLOOK

India is a traditional and stable market for gold consumption. The present and future production of gold will not be sufficient to meet the ever increasing demand. Therefore, efforts will be required to reduce the gap between production and demand. The projected imports at the growth rate of 11% during 2012-17 are 9,305 tonnes at an average of 1,861 tonnes per year, as per the report of the Working Group for 12th Five Year Plan, Planning Commission of India.

As per the World Gold Council estimation, expected gold consumption in India during 2011 was 1,167 tonnes. During the 12th Plan period, gold production is projected at 28 tonnes from mines and 16 tonnes as by-product, totalling 44 tonnes by 2015-16 considering the expansion of existing producers and new mines in private sector viz, MSPL, Geomysore, Deccan Gold, etc.

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

GRANITE

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

43 Granite

Granite technically refers to a light-coloured granulose plutonic rock composed of felspars, plagioclase, quartz (felsic minerals) and minor amounts of mafic minerals, such as biotite, hornblende, pyroxene, iron oxides, etc. But, in the commercial parlance, the term granite has become synonymous with all those crystalline rocks which have pleasing colours, strength to bear the processes of quarrying and cutting & polishing and are used commonly for decorative purposes. Being more resistant to wear and tear as well as weathering, granite is most sought-after stone to be used as building as well as decorative stone. The fascination for granite is due to its taking mirror-like polish, high compressive strength, longevity and beauty. India possesses enormous deposits of all types of dimension stones. It is one of the largest producers of dimension stones in the world. The dimension stone industry employs over one million workforce. This industry plays a vital role in the economy of states like Tamil Nadu, Andhra Pradesh, Karnataka and Rajasthan. Rural economy of many developing states like Madhya Pradesh, Uttar Pradesh, Odisha and North-Eastern States is dependent on this industry.

The granite used for decorative purposes is a costly material in comparison with other materials. Hence, its utilisation and trade within the country has been at a low profile compared with the exports. With the emergence of the rich middle class and spurt in construction activity, the internal trade is on the rise.

Although granite is a minor mineral, it is a major contributor in foreign exchange earnings. India is the second largest exporter of raw granite after China and ahead of Brazil and South Africa. India ranked fifth in the export of processed (value added finished) product. Granite contributed 3.26% to the exports value of all ores and minerals in 2010-11. The exports value of granite was next only to diamond, iron ore and alumina during 2010-11.

RESOURCES

India is endowed with abundant resources of a wide variety of granite comprising over 200 shades. As on 1.4.2010, resources of granite dimension stone of all types are estimated at 46,230 million cubic metres. Of these resources, 264 million cubic metres (less than 1%) fall in reserves category while remaining 45,966 million cubic metres or about 99% fall in resources category.

Of the total granite reserves, about 36 million cubic metres of all grades fall under proved category while 228 million cubic metres fall under probable category. Ninety four percent reserves relate to coloured granite and the balance about 6% to black granite. About 98% reserves are located in Rajasthan, Odisha and Karnataka with a share of 42%, 30% and 26%, respectively.

Statewise breakup of total resources reveals that Karnataka & Rajasthan with about 20% each resources followed by Jharkhand (19%), Gujarat (18%), Andhra Pradesh (5%) and Madhya Pradesh (4%) together account for 86% resources. Gradewise classification reveals that about 7% of the total resources fall under black granite while 92% under coloured granite. About 1% resources are of unclassified grade.

The details of reserves/resources as on 1.4.2010 are given in Table-1.

PRIME VARIETIES OF INDIAN GRANITE

In the world market, there are nearly 300 varieties of granite. India supplies about 200 varieties. Out of these, prime varieties represent a wide spectrum of colour, texture and structure. These prime varieties have substantial resource base. Commercial names of granite are derived from area, colour, patterns, etc.

Karnataka specialises in the production of Ruby red, chilly red, cera grey, Kanakpura multicolour, Himalayan blue and Sira grey varieties of granite. Andhra Pradesh is famous for Black Galaxy, Srikakulam blue and black varieties of granite while Tamil Nadu is abundant in Jet-black and Tippu-white, Kashmir-white and Paradiso sea green varieties of granite. Odisha specialises in pink granite, silver grey, sea weed green, chilka blue, grey wave varieties of granite. Availability of varieties of granite in various states is given in Table- 2.

EXPLORATION & DEVELOPMENT

Keeping in view the increasing demand in both domestic and international markets for new varieties, DMG, Governments of Rajasthan & Karnataka were actively engaged in exploration activities. The details of work carried out by these State Directorates are summarised in Table - 3.

Table – 1 : Reserves/Resources of Granite (Dimension stone) as on 1.4.2010 (By Grades/States)

(In thousand cubic metres)

Grade/State	Reserves				Remaining resources								Total resources (A+B)
	Proved STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
		STD121	STD122			STD221	STD222						
All India : Total	**35741**	**201377**	**26574**	**263692**	**38462**	**51990**	**8234**	**837325**	**2063964**	**42499338**	**467296**	**45966608**	**46230300**
By Grades													
Black Granite	6936	6060	3909	16906	-	45690	1	50934	466039	2572581	23538	3158783	3175688
Coloured Granite	28805	195316	22665	246786	38462	6300	8233	786391	1276125	39843847	443518	42402875	42649661
Unclassified	-	-	-	-	-	-	-	-	321800	82911	240	404951	404951
By States													
Andhra Pradesh	-	-	-	-	-	-	-	-	-	2405890	-	2405890	2405890
Assam	-	-	-	-	-	-	-	-	800	583150	-	583950	583950
Bihar	-	-	-	-	-	-	-	-	179000	698612	-	877612	877612
Chhattisgarh	-	-	-	-	-	-	-	-	-	50057	-	50057	50057
Gujarat	-	-	-	-	-	-	-	-	-	8501947	-	8501947	8501947
Haryana	-	-	-	-	-	-	-	-	-	34000	-	34000	34000
Jharkhand	-	-	-	-	-	-	-	-	651300	8197110	26930	8875340	8875340
Karnataka	26363	19389	21836	67587	-	-	-	238	1231625	8012784	25659	9270306	9337893
Kerala	140	-	-	140	-	-	-	-	99	2570	-	2669	2808
Madhya Pradesh	-	160	-	160	-	-	-	-	-	1885924	108000	1993924	1994084
Maharashtra	-	-	-	-	-	6300	-	486925	-	665622	-	1158847	1158847
Meghalaya	-	-	-	-	-	-	-	-	-	-	286467	286467	286467
Odisha	-	80000	-	80000	-	-	-	330328	-	1432492	240	1763060	1843060
Rajasthan	5581	100380	4500	110461	38462	-	-	-	-	9021742	20000	9080204	9190665
Tamil Nadu	-	1448	238	1686	-	45690	8234	7	-	503818	-	557749	559435
Uttar Pradesh	-	-	-	-	-	-	-	-	-	494819	-	494819	494819
West Bengal	3658	-	-	3658	-	-	-	19827	1140	8802	-	29768	33426

Figures rounded off

Table – 2 : Varieties of Granite in Various States

State	Variety
Andhra Pradesh	Black Galaxy, Srikakulam blue, Steel grey, Paradiso, Anantapur grey, Silver Galaxy, etc.
Bihar	Tiger skin, Mayurakshi blue, Sawan rose, English teak, black-cheeta, etc.
Gujarat	Sonabadi grey, Balaram pink, Ajapur Galaxy, Godhra grey, Maharaja tiger-black, etc.
Haryana	Steel-grey porphyry, Purplish granite porphyry, Deep pink.
Karnataka	Ruby red, Fish Belly, Himalayan blue, Sira grey, Red multi, Tumkur porphyry, Hassan green, Magadi pink, Tiger black, etc.
Kerala	Tropical green, Paradiso, Kerala white, etc.
Maharashtra	Grey silk, Light pink, Jhansi red, etc.
Madhya Pradesh	Multicoloured, Black granite, etc.
Odisha	Berhampur blue, Silver grey, Seaweed green, Chilka blue, Red pearl, Jeypur and Keonjhar black, etc.
Rajasthan	Mokalsar green, Nagina green, Rosy pink, Blue Pearl, Chima pink, Bala flower, Platinum-white, etc.
Tamil Nadu	Kashmir white, Rawsilk, Paradiso, Pink multi, Colombo Juparana, Tiger skin, Kunnam black, Turaiyur blue, etc.
Uttar Pradesh	Ruby red, Jhansi red, Grey granite, Black granite, etc.
West Bengal	Bero pink porphyry, Streaky gneiss, Purulia black, Birbhum pink, Spotty black, etc.

Table – 3 : Details of Exploration for Granite during 2010-11

Agency/ State/ District	Location/ Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
DMG, Rajasthan							
Jodhpur	N/V Gangani Sevkikolan & Khurd Ummed Khangta	1:50,000 1:10,000	150.0 10.0	– –	– –	27	Occurrences of greyish granite were mapped at six places of following dimensions: 165x169 m, 75x75 m, 20x15 m, 30x15 m, 80x80 m, 550x300 m. Resources were not estimated.
Sikar & Jhunjhunu	Nand, Rijani, Maragsar, Rasora, Nandka Bas, etc	1:50,000 1:10,000 1:2,000	165.00 20.00 1.0	– - –	– - –	04	Granite has heen exposed over an area of 400 x100 x200 m N/V Nand & 350 x100 x200 m N/V Rijani.
Jalore	Around Bhinmal	1:50,000 1:10,000 1:4,000	115.00 10.0 1.0	– – -	- – –	-	The area available for the blockable granite was seen near Barta, Tavab, Nasoli kotkasta.

PRODUCTION

Granite is declared as a "Minor Mineral," under the MMDR Act, 1957 and falls under the purview of the State Governments. Therefore, precise data on production of granite are not available. The production of granite compiled from the data received from various states is given in Table-4.

Major production of granite in raw as well as processed form is generally from Tamil Nadu, Karnataka, Andhra Pradesh, Rajasthan, Gujarat, Uttar Pradesh and Odisha.

The important granite producing centres in Tamil Nadu are Dharmapuri, Erode, Madurai, Salem, Virudhunagar and Vilupuram districts. In Rajasthan, production centres are mainly spread in the districts of Jalore, Pali, Sirohi, Barmer, Ajmer, Jaisalmer, Jhunjhunu and Jodhpur. Karnataka is another important producer of granite varieties occurring in the districts of Bengaluru, Mysore, Gulbarga, Hassan, Raichur and Kolar. However, production data are not available from this State. The occurrences of granite have been reported from three districts of Uttar Pradesh, namely Lalitpur, Mahoba and Banda. However, almost all the production comes from Lalitpur district. In Andhra Pradesh, important mining areas are located in the districts of Chittoor, Anantapur, Kurnool, Prakasam, Srikakulam, Warangal, Karimnagar and Khammam. The granite resources of Gujarat are localised in the districts of Mehasana, Banaskantha, Sabarkantha, Panchmahal, Dahod, Vadodara, Amreli, Bhavnagar and Kachchh. Bihar, Kerala, Odisha and West Bengal also produce granite.

Details regarding production of processed granite are not available. However, it is presumed that the processed material exported can be taken as production level in the country with addition of 5 to 15% for internal use. It may be mentioned here that the country is in a position to produce the required quantity of granite to meet demand of both domestic as well as export markets.

MINING

Production of blocks of considerable size and weight is a special feature of granite mining. The process and equipment used for granite mining differ considerably from those used for mining other minerals. The mining of granite involves two important stages of operation: one is actual block splitting either from sheet rock or boulder and the other operation involves many items of works, such as removal of weathered zone or o verburden, opening of faces, lifting of cut blocks, transportation and many other ancillary work before and after the block splitting.

The actual block splitting from the sheet rocks or boulders is mainly done manually or in some

Table – 4 : Production of Granite, 2007-08 to 2009-10
(By States)

(Value in ₹'000)

State	Unit	2007-08		2008-09		2009-10 (P)	
		Quantity	Value	Quantity	Value	Quantity	Value
India			**17182571**		**18113989**		**18505752**
Andhra Pradesh	cu m	787557	14608299	761078	15463740	648789	13994677
Chhattisgarh	cu m	344	398	*	*	*	*
Gujarat	tonne	55139	11159	55139	11159	55139	11159
Jammu & Kashmir	tonne	-	-	56	13	69	16
Karnataka	cu m	124397	1461888	142887	1612651	228533	2486396
Kerala	tonne	1829	38583	737	29480	1109	47687
Madhya Pradesh	tonne	-	-	-	-	44424	113336
Rajasthan	tonne	362692	505297	358213	493766	760594	1339802
Tamil Nadu	cu m	216701	401297	170725	353180	174819	362679
Uttar Pradesh	cu m	24900	155650	24000	150000	24000	150000

Source: *State Governments.*

* *Data awaited from State Governments.*

Note: 1. *Figures have been repeated wherever necessary, due to non-availability of data.*

2. *This table does not contains data with reference to Daman & Diu, Gujarat, Haryana, Manipur, Meghalaya, Nagaland, Odisha and West Bengal due to non-receipt of data for consecutive three years.*

cases by semi-mechanised methods, whereas the other operations, such as removal of overburden, lifting and transportation of cut blocks, etc. are carried out by mechanised method. There are a very few mines which adopt the modern method of block splitting by using flame-jet burner and diamond wire saw for cutting. Heavy-duty derrick cranes of capacity to handle 50-tonne blocks from a depth of more than 60 m has brought revolution in granite quarrying by way of more output with less cost. The percentage recovery of granite is quite low and it varies from 5 to 15% because of unscientific mining method.

Efforts are being made in adopting more modern and scientific mining methods to enhance the recovery of dimensional blocks. For this purpose, 'Water Jet Cutting', a new technique is used. In this technique, water with tremendous pressure is passed through an orifice to form a jet. This jet is used to cut into the primary blocks as well as secondary blocks. The cutting loss in this process is minimum and there is no damage to adjacent block as in case of blasting.

PROCESSING INDUSTRY

The processing of granite in India is an age-old phenomenon and started in a small way in 1930s when some trimmed blocks as kerbstones were exported to UK. Since then, semi-hand-worked or hand-polished granite tomb stones found their acceptability in UK. Granite processing basically involves sawing or cutting of raw blocks into the tiles/slabs of required size & thickness and polishing of sawn-off surfaces. Other ancillary functions involve edge cutting, milling, boring and contouring for enhancing the quality and price of production. In India, the processing industry is in three sectors; namely, small-scale units, medium-scale units and 100% export-oriented units (EOU). The processing industry of granite in the country has been developed over the years. The share in exports of processed material has increased.

Centre for Development of Stones (CDOS), registered as a non-profit making society, is the common facilities centre for the entire stone industry, including granite being developed under the National Programme for Development of Stone Industry in India (NPDSI), which is a joint effort of Govt. of India, and United Nations Industrial Development Organisation (UNIDO). CDOS was set up as an autonomous organisation by Govt. of Rajasthan and Rajasthan State Industrial Development & Investment Corpn. Ltd (RIICO) at Jaipur, with an objective to develop, promote and support the dimensional stone sector and related industries in India. It also has testing centre for testing of stones as per international standards.

USES & SPECIFICATIONS

Uses

Granite is the most sought-after building stone since long. In the ancient times, the granite pillars and beams were preferred material to support the huge structures of temples and palaces and for making protective walls around them. With the invention of modern tools of greater hardness and polishing ability, the use of granite has rather increased for aesthetic values. The modern motorised tools of tungsten carbide and brazed diamond have enabled the user to cut & polish granite as per the specifications of the building sector. Presently, cut and polished granite slabs of 20 mm thickness are preferred for flooring, while tiles of 10 or 12 mm thickness are used for cladding. In addition to this, gravestones and monuments of various shapes and sizes are also in vogue. Because of the flexibility of the cutting tools, many artifacts of granite for decorative purposes are being made.

Granite also finds its application in making garden furniture, such as benches, fountains and many other articles which are used for landscaping and/or decorative purposes. The cut-to-size small blocks are used as cobblestone, kerbstone, road sidings and many other innovative uses.

Crude granites are utilised for structural purpose after little dressing & sizing whereas processed granites are used mostly in the construction of buildings and monuments and for interiors and exterior facing. Because of its superior wear resistance and non-denting quality, granite is used for various meteorological and engineering instruments, such as surface plates, straight edges, parallels, cubes, V blocks and work-mounting tables of co-ordinate measuring machines.

The surface plates are used as flat datum surface whenever precise measurements of dimensions and geometrical relationships are to be carried out. For this purpose, harder variety of granite is required so that it can bear the high-degree of grinding, polishing and calibration for achieving flat surface. It has been found that granite which is to be used for surface plates should have a close grain size, homogeneity, high density and hardness, uniform colour and low moisture absorption. The granite should be free from flaws.

Specifications

The properties of granite which are normally valued for exploitation are compressive strength, tensile strength, density, p-wave velocity, etc. For the marketability, other requirements like colour, texture, granularity, size, water absorption, porosity, hardness, moisture content, etc. are also essential. Raw blocks should be free from normal defects like fractures, joints, shears, hairline cracks, segregation, veins, etc.

The snippets of BIS specifications for granite are given below:

IS: 3316 - 1974 (First Revision; Reaffirmed 2008) Specifications for Structural Granite

This standard covers section, grading and strength requirements of structural granite for various constructional uses. The general requirements as per the specifications are that granite shall be free from flaws, injurious veins, cavities and similar imperfections that would impair its structural integrity and would affect adversely its strength and appearance. The strength requirements as per IS: 3316-1974 are as follows:

i) The compressive strength when tested according to IS: 1121 (Part 1) -1974 (Reaffirmed 2008) shall be not less than 1,000 kg/cm^2.

ii) The true specific gravity when tested according to IS:1122-1974 (Reaffirmed 2008) shall not be less than 2.6.

iii) The water absorption when tested according to IS: 1124-1974 (Reaffirmed 2008) shall not be more than 0.50%.

The shape of slabs shall be rectangular or square and of specified dimensions with a tolerance in length and breadth shall be 12 mm and thickness 1 mm. The dimensions of blocks for masonry shall be as specified. The tolerance shall be allowed 15 mm for facing blocks.

IS:14223 (Part 1) - 1995; (Reaffirmed 2012)–Specifications for Polished Building Stones: Part I Granite

This standard covers physical properties and finish requirements of polished granites used for various purposes. The general requirements as per the specifications are that the granite should be free from all imperfections and deleterious minerals that may interfere with the appearance, strength, structural integrity and its amenability to take good polish. Imperfections are mostly imparted by the textural variations which is a function of degree of uniformity and the distribution of the constituent minerals. Hairline cracks/joints, flower, moles, knots, white and dark lines due to segregation of light-coloured minerals in multicoloured granite and ferromagnesium minerals in light-coloured granites are considered to be the imperfections. Granite should be free from deleterious minerals, such as pyrite, marcasite, biotite, chlorite and ilmenite which interfere with the colour and appearance on weathering and also affect polishing characteristics.

The shapes of the slabs shall be rectangular or square and of specified dimensions with a tolerance in length and breadth shall be +2 mm and thickness +1 mm. The bottom face may be rough but the top surface shall be fine-polished and joint faces shall be dressed with the top surface without hollowness and spalling off.

The physical properties of granite shall conform to the requirements given in Table-5. Surface of the polished granite shall be mirror-finish without any hairline crack. The polish on the surface shall be checked with glassometer and shall not be less than 95%.

On the international scene, with the formulation of European Economy, the CEN Norm has come into force. As per CEN TC 246, various standards of stones have been formulated. The objectives of these standards are to oblige the companies to have the tests of the different stones being commercialised so as to allow the users the choice of the stone with desired physical characteristics according to its use. It is mandatory for every company doing business with European Union to mark their product with 'CE' marking from March 2004 onwards.

Table – 5 : Physical Properties of Granite as per IS : 14223 (Part 1) -1995 (Reaffirmed 2012)

Sl. No.	Characteristic	Requirements	
		Pink granite	Multicoloured & grey granites
1	Moisture content (%) (max)	0.15	0.15
2	Dry density (m/v)	2.58 to 2.63	2.60 to 2.68
3	Apparent specific gravity (min)	2.75	2.75
4	Water absorption (%) (max)	0.50	0.50
5	Porosity (%)	1.02 to 2.50	1 to 2
6	Compressive strength (kg/cm^2)	1000-1500	1300-2200
7	Tensile strength (kg/cm^2) (min)	90	90
8	Shear strength (kg/cm^2)	280-425	300-540
9	Hardness (Mohs' scale)	6 to 7	6 to 7
10	Hardness (Schmidt No.)	80-100	85-110
11	Hardness (Shore No.)	50-60	46 to 61
12	Ultrasonic pulse velocity	5000	5000
13	Resistance to wear	Not greater than 2 mm, on an average and 2.5 mm for any individual specimen	Not greater than 2 mm, on an average and 2.5 mm for any individual specimen

POLICY

Granite being a 'Minor Mineral' under the MMDR Act, 1957, the grant of various mineral concessions for granite is administered under the Minor Mineral Concession Rules of the respective State Governments. However, the Granite Conservation and Development Rules, 1999 aims at uniform rules for conservation, systematic development and scientific exploitation of granite resources. GCDR, 1999 inter alia, provides for:

Prospecting Licences (PL) prior to granting mining lease; Period of PL; Minimum and maximum period of mining lease and for renewals; Minimum and maximum area of lease; Preparation of scheme of prospecting ; Mining Plan to be prepared for grant of mining lease; etc.

As per the export-import policy for 2009-14 and the Foreign Trade Policy thereunder, the imports of granite monumental and building stone falling under heading No. 2516 (whether or not roughly trimmed or cut, by sawing or otherwise, into blocks or slabs of a rectangular shape) are restricted. On the other hand, worked granite blocks/tiles under sub-heading 680223 can be imported freely. There are no restrictions on exports of granite and items under Chapter 25 and Chapter 68.

ENVIRONMENT

The mining of granite started initially in the bouldery zone, had little damage to the environment. As more and more blocks in huge sizes were required to meet the demand, the sheet rock was approached by making cut in the ground and by removing top soil or overburden, which resulted in general degradation of environment.

Environmental problems are similar to any opencast mining operations. The general degradation of land due to unscientific and selective mining is a common feature. Besides air pollution causing breathing problems, the blasting and movement of heavy vehicles generate dust and aggravate air pollution in addition to noise pollution.

The processing of granite requires huge quantities of water for cutting and polishing. In some cases, kerosene and lime water are used as coolants for cutting purpose. Although most of the kerosene and lime is recycled, there are always chances of mixing these coolants with natural water courses.

Sludge generated during cutting needs proper disposal to avoid increased silting and pollution of the natural waterways.

For abating environmental pollution, guidelines have been spelt out in GCDR,1999. The technology for making artificial stone called Terrazzo will prove to be a boon for the utilisation of waste generated during mining and processing.

WORLD REVIEW

World dimension stone production including granite is estimated to be around 107 million tonnes in 2009, at about the same level as in 2008. The principal producers by volume were: China, India, Turkey, Iran and Italy which accounted for about 71% of the global production.

China

China is the main world producer and USA the main customer of granite. There are four main regions for natural stone production and handling imports and exports: the provinces of Shandong, Fujian, Sichuan and Guangdong. The key centres of Chinese stone processing have been created mainly in Shandong, Fujian and Guangdong. Their chief function is to process local and imported materials into products for decorative interior finishing. Large quantities of natural stones are also imported for processing into gravestones for the Japanese and Korean markets. China exported 8.04 million tonnes granite during 2010.

Brazil

Brazil is the largest producer of natural stone in the world and well-known for producing prime varieties like Juparna, Classico and Tijuca black, from quarries located at the outskirts of Rio. Major areas of production are in Minas Gerais where multicoloured granite is produced. The yellow Veneziano variety of granite is produced in Victoria State. The production of granite was estimated at 60 million cu m during 2010.

More than half the Brazilian production is being exported, mostly to the North American market. In terms of weight, around half the Brazilian natural stone exports include rough blocks of granite.

Italy

Italy has a broad, in-depth know-how of stone quarrying and processing based on centuries of experience, but in the mass production segment, it has been overtaken by China, India, Iran and Brazil. Production of granite fell by 32% to around one million tonnes in 2010 from 1.5 million tonnes in 2009.

USA

The natural stone market in USA has grown strongly in the past years. USA has gradually become second most important consumer of natural stone after China, in the world, in absolute figures.

In USA, dimensional granite was produced to the tune of 699,000 tonnes in 15 states, mainly in Georgia, Massachusetts, Vermont, North Carolina and New Hampshire. Besides, USA imported dimension stones from Brazil (43%), China (22%), India (14%) and Italy (3%) in terms of value.

FOREIGN TRADE

Exports

Granite is an important commodity amongst ores and minerals which is being exported from the country. It is mainly traded in the form of crude or roughly trimmed blocks; as cut blocks and slabs; and as polished blocks and tiles. The export value of granite (total) increased to ₹ 5,384 crore in 2010-11 from ₹ 4,994 crore in 2009-10 and contributed about 3.26% of all-India exports of minerals & ores, next only to diamond, iron ore and alumina exports. The share of granite (others) was 45% at ₹ 2,424 crore that of crude or roughly trimmed blocks was about 30% at ₹ 1,653 crore followed by granite (polished blocks/tiles) with 20% at ₹ 1072 crore, and granite (cut blocks/ slabs) 4% at ₹ 235 crore. China was the most important buyer for granite and its share in the total value of exports of granite was 34%, followed by USA (13%) and Italy (5%) (Tables - 6 to 10).

Imports

In 2010-11, imports of granite (total) increased to 55,554 tonnes from 51,214 tonnes in the previous year. Out of the total imports,31,300 tonnes were of crude and roughly trimmed granite, 2,375 tonnes of cut blocks/slabs, 6,207 tonnes of polished blocks/tiles and 15,672 tonnes of other granite. Granite was mostly imported from Norway (31%) and China (22%) (Tables - 11 to 15).

Table – 6: Exports of Granite : Total (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**3827668**	**49937324**	**4369384**	**53841248**
China	1913478	12209279	2568888	18445194
USA	233917	6850975	272739	6881536
Italy	172235	2421686	212547	2803526
Germany	70974	2789523	68455	2358547
Turkey	80657	1894020	103931	2224238
UK	54536	2146005	49448	1808760
Belgium	90366	2091351	80538	1736972
UAE	109642	2219047	86891	1638851
Hong Kong	280283	2099808	194547	1466031
Netherlands	36533	1314703	34854	1266347
Other countries	785047	13900927	696546	13211246

Table – 7: Exports of Granite (Crude or Roughly Trimmed) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**2598235**	**16165697**	**2829329**	**16529603**
China	1750589	10231794	2122797	11451266
Hong Kong	254189	1713576	178066	1274485
Italy	125603	932920	157772	1165786
Chinese Taipei/ Taiwan	143543	901614	122915	821000
Belgium	47382	365241	44452	329244
Spain	9635	77711	35200	295207
Vietnam	17980	139656	23285	203020
Croatia	12111	123313	23502	171757
Thailand	15769	177504	19724	166424
Norway	27583	185192	21494	125567
Other countries	193851	1317176	80122	525847

Table – 8 : Exports of Granite (Cut Blocks/Slabs) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**295794**	**2341327**	**353597**	**2354229**
China	122056	956924	232381	1590935
USA	57443	237686	67339	204397
Hong Kong	21229	214245	13327	129539
UAE	10280	150299	6698	86757
Chinese Taipei/ Taiwan	11996	120818	4720	73723
Germany	4063	22213	5017	28135
UK	6647	57791	3247	27105
Italy	4315	47691	1353	16043
Sri Lanka	393	4253	1101	15490
Vietnam	1137	13929	1075	13378
Other countries	56235	515478	17339	168727

Table – 9 : Exports of Granite (Others) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**726134**	**24710807**	**794214**	**24235840**
USA	120739	5149464	152034	5379804
Turkey	74248	1770595	98639	2162955
Germany	45961	1995671	43159	1706142
UK	39126	1847451	38928	1581638
UAE	76526	1682872	65665	1288689
Italy	32205	1075192	35926	1143141
Belgium	26910	1248470	27183	1089019
Netherlands	23128	968998	24318	956655
Canada	17959	780379	18265	748373
Poland	22200	666469	26792	727604
Other countries	247132	7525246	263305	7451820

Table – 10: Exports of Granite (Polished Blocks/Tiles) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**207505**	**6719493**	**392244**	**10721576**
China	26014	646880	207127	5265253
USA	34408	1373203	33704	1215483
Germany	16229	748259	14198	589598
Italy	10112	365883	17496	478556
Nigeria	11137	277374	16207	344222
Belgium	10443	427452	7890	310493
Netherlands	6952	308995	6798	278417
UAE	15568	334449	11038	235869
Poland	7693	200877	7694	199099
UK	5760	217696	5922	191006
Other countries	63189	1818425	64170	1613580

Table – 11: Imports of Granite: Total (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**51214**	**1016841**	**55554**	**1163349**
Norway	23972	444656	17452	323873
China	5873	135699	12426	262965
Brazil	2557	46669	6562	127325
Italy	2027	43298	3457	121606
Finland	3428	59171	4098	54203
Saudi Arabia	2877	79523	1762	53813
South Africa	3850	63523	2815	42873
Madagascar	618	20182	897	28411
Ukraine	2136	34260	1177	23615
Angola	1177	30052	1183	21606
Other countries	2699	59808	3725	103059

Table – 12 : Imports of Granite (Crude or Roughly Trimmed) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**33072**	**618697**	**31300**	**578086**
Norway	19611	367040	14837	263604
Brazil	1805	30628	4936	89012
Finland	2388	42228	3100	38560
South Africa	3077	50119	2368	33221
Italy	366	6412	1024	28928
Madagascar	618	20182	897	28411
Spain	409	8730	927	20596
Angola	1177	30052	1071	19341
Saudi Arabia	1499	26504	598	18529
Ukraine	1753	28137	608	14798
Other countries	369	8665	934	23086

Table – 13 : Imports of Granite (Cut Blocks/Slabs) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**3286**	**57671**	**2375**	**41510**
Italy	1129	16997	810	11009
Brazil	134	2623	594	10949
Finland	300	8028	381	7229
Ukraine	_	_	421	5989
USA	_	_	94	5112
Norway	1089	19980	42	657
France	70	1337	24	450
Singapore	_	_	9	114
Other countries	564	8706	++	1

Table – 14 : Imports of Granite (Polished Blocks/Tiles) (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**6267**	**159809**	**6207**	**157985**
China	366	14347	1778	53204
Norway	2755	49138	2096	45792
Brazil	347	7570	760	20262
Saudi Arabia	1279	52031	212	9446
South Africa	455	9354	351	8198
Sri Lanka	7	162	484	7123
Ukraine	78	1376	148	2829
Singapore	_	_	62	2410
Angola	_	_	112	2265
Italy	266	7057	61	1639
Other countries	714	18774	143	4817

Table – 15: Imports of Granite (Others) (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**8589**	**180664**	**15672**	**385768**
China	5293	117299	10584	208390
Italy	266	12833	1562	80030
Saudi Arabia	99	988	952	25839
Norway	517	8497	477	13820
Egypt	233	4324	345	9451
Brazil	271	5848	272	7102
Finland	583	6564	577	6831
USA	306	7501	118	5725
Korea, Rep. of	-	-	45	4176
Oman	-	-	140	3496
Other countries	1021	16810	600	20908

FUTURE OUTLOOK

India possesses one of the best granite deposits in the world having excellent varieties comprising over 200 shades. India acounts for over 20% of the world resources in granite. The total granite resources in India as on 1.4.2010 are: 46,230 million cu m. As per the Report of the Working Group for 12th Plan (2012-17), the Indian stone production during 2009-10 was 35,342 thousand tonnes, and in value terms, the estimated turnover of the Indian Dimensional Stone market in 2009-10 was of the order of ₹ 30,000 crore out of which the southern states accounted for ₹ 18,000 crore, Rajasthan ₹ 7000 crore, and the rest of India ₹5000 crore. Granite alone accounts for 2/3rd of the value of production.

As per the Report, the growth is continuing and the demand for granite, marble, sandstone and other dimensional stones and stone products is anticipated to grow at around 15% CAGR. A similar rate of growth in exports can also be achieved with the help of suitable policy framework, infrastructure and other facilities which are expected to be provided to the industry. The Working Group has recommended that there is a strong need for well-planned, concerted and dedicated efforts towards export promotion of Indian stones. The emphasis needs to be on popularisation of Indian stones in both the traditional markets and exploration of new avenues by strengthening the activities of the Centre for Development of Stones (C-DOS) in Rajasthan by upgrading it into a national centre of excellence. Alternative option for exporting granite and marble in processed form to maximise export earnings is to develop and promote artifacts and special decorative and ornamental items of high value addition. There is tremendous skill in the country, which can be explored and supported with special incentives. This can certainly bring about substantial foreign exchange addition, as well as significant employment generation.

The Working Group has observed that the present investment in dimensional stone industry in India is estimated at ₹ 20,000 crore. It is expected that given the right policy support, the total turnover of the sector estimated to be around ₹ 30,000 crore (2009-10) will increase to over ₹ 40,000 crore by 2012-13, and thereafter, double every five years considering an estimated growth rate of 15%. To sustain this growth, it is estimated that investment in this sector will have to go up to about ₹ 1,07,500 crore by 2022-23 (including foreign investment).

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

GRAPHITE

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

44 Graphite

Graphite, also known as plumbago or black lead, is a variety of naturally occurring carbon. It crystallises in hexagonal system and has a lamellar form, a grey- to-black metallic lustre and greasy feel. Natural graphite is divisible into two commercial varieties: (i) crystalline (flaky) graphite and (ii) amorphous graphite. Both flaky and amorphous varieties of graphite are produced in the country. The quality of graphite is dependent upon its physical qualities as well as carbon content. In addition to natural graphite, synthetic or artificial graphite is manufactured on a large-scale in electric furnaces, using anthracite or petroleum coke as raw feed. The latter is known as Calcined Petroleum Coke (CPC).

RESOURCES

Graphite occurrences are reported from various states but the deposits of economic importance are located in Andhra Pradesh, Jharkhand, Karnataka, Kerala, Odisha, Rajasthan and Tamil Nadu.

As per the UNFC system, the total resources of graphite as on 1.4.2010 are placed at about 174.85 million tonnes, comprising 8.03 million tonnes in the reserves category and 166.82 million tonnes under remaining resources category. Resources containing +40% fixed carbon constitute about 1.11 million tonnes and resources analysing 10-40% fixed carbon 22.69 million tonnes. Balance resources of 151.05 million tonnes fall under 'others', 'unclassified' and 'not-known' grades. Arunachal Pradesh accounts for 42% of total resources, followed by Jammu & Kashmir (36%), Jharkhand (7%), Tamil Nadu & Odisha (5% each). However, in terms of reserves, Tamil Nadu has leading share of about 45% followed by Odisha (41%) and Jharkhand (14%) (Table-1).

EXPLORATION & DEVELOPMENT

Exploration work has not been reported from GSI or State Directorates of Geology & Mining during 2010-11.

PRODUCTION STOCKS & PRICES

Production of graphite at about 115 thousand tonnes in 2010-11 decreased by 8% as compared to the preceding year due to less demand and temporary closure of mines in Odisha. The output of graphite is reported in terms of run-of-mine (r.o.m.) which contains varying carbon content.

In all, there were 20 reporting mines in 2010-11 as against 32 in the previous year. Eight principal producers accounted for 97% of the total output during the year. The share of public sector in the total output was 43% in 2010-11 as compared to 41% in the previous year.

About 87% of the total production in 2010-11 accrued from five mines, each producing more than 5,000 tonnes annually, while 10% was contributed by three mines, each in the production range of 3,000 to 5,000 tonnes per annum. The remaining 3% output was reported by 12 mines, each producing below 2,000 tonnes annually.

Tamil Nadu was the leading state contributing a major share of about 44% of the total output during 2010-11 followed by Jharkhand and Odisha contributing 39% and 17%, respectively (Tables - 2 to 5).

Mine-head stock at the end of the year 2010-11 was 75 thousand tonnes as against 70 thousand tonnes at the beginning of the year (Table - 6).

The average daily employment of labour during 2010-11 was 219 against 454 in the preceding year. Domestic prices of graphite are furnished in the General Review on 'Prices'.

Table – 1 : Reserves/Resources of Graphite as on 1.4.2010 (By Grades/States)

(In tonnes)

Grade/State	Reserves				Remaining resources								Total resources (A+B)
	Proved STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
		STD121	STD122			STD221	STD222						
All India : Total	**3685172**	**2266174**	**2080518**	**8031864**	**102173**	**1409511**	**3078665**	**224859**	**6603670**	**19736371**	**135662532**	**166817781**	**174849645**
By Grades													
+ 40% F.C.	58050	88770	67950	214770	7811	48157	604891	-	951	237190	-	899000	1113770
10-40% F.C.	3621687	598758	1988468	6208913	86237	477760	2361072	178703	2226024	10512356	636497	16478649	22687562
Others	5435	-	23452	28887	7500	18750	-	-	3300501	3297811	-	6624562	6653449
Unclassified	-	1549549	648	1550197	-	860223	112702	6320	5882	4467502	62107720	67560349	69110546
Not-known	-	29097	-	29097	625	4621	-	39836	1070312	1221512	72918315	75255221	75284318
By States													
Andhra Pradesh	-	-	-	-	-	-	1135	-	124759	301306	-	427200	427200
Arunachal Pradesh	-	-	-	-	-	-	-	-	-	-	72758257	72758257	72758257
Gujarat	-	-	-	-	-	-	-	-	2520805	835000	-	3355805	3355805
Jammu & Kashmir	-	-	-	-	-	-	-	-	-	1059520	61681035	62740555	62740555
Jharkhand	382036	72670	645823	1100529	47073	236783	1666551	2750	1855192	6798641	1203350	11810340	12910869
Karnataka	727	20820	1312	22859	7500	18750	-	-	18200	-	-	44450	67309
Kerala	-	-	-	-	-	8300	17762	134900	1088550	335818	-	1585330	1585330
Madhya Pradesh	-	-	-	-	-	-	-	-	-	1006660	-	1006660	1006660
Maharashtra	-	-	-	-	-	-	-	-	-	1160000	-	1160000	1160000
Odisha	495296	2172684	622933	3290913	-	1106192	1224811	11179	98665	2923002	19890	5383739	8674652
Rajasthan	-	-	-	-	47600	-	165920	-	250000	1450034	-	1913554	1913554
Tamil Nadu	2807113	-	810450	3617563	-	39486	2486	65330	647500	3866390	-	4621192	8238755
Uttarakhand	-	-	-	-	-	-	-	10700	-	-	-	10700	10700

Figures rounded off.

Table – 2 : Principal Producers of Graphite 2010-11

Name & address of producer	Location of mine	
	State	District
Tamil Nadu Minerals Ltd, 31, Kamarajar Salai, Chepauk, Chennai-600 005, Tamil Nadu.	Tamil Nadu	Sivagangai
K. K. Poddar, Poddar Niket, Bariaju Road, Ranchi, Jharkhand.	Jharkhand	Palamau
Orissa Manganese & Minerals (P) Ltd, 2/1 A, Sarat Bose Road, Kolkata, West Bengal	Jharkhand	Palamau
Pramod Kumar Agrawal, Shantikunj, Farm Road, Sambalpur, Odisha.	Odisha	Nuapara

(Contd.)

Table - 2 :(Concld.)

Name & address of producer	Location of mine	
	State	District
Singhania Commercial Co., M. S. Singhania, Jail Road, Daltonganj, Palamau, Jharkhand.	Jharkhand	Palamau
T.P. Minerals Pvt. Ltd, Hospital Road, Sambalpur, Odisha	Odisha	Rayagada
Sunandan Pradhan, Pradhan Industries, Telanga Bazar, Cuttack -9, Odisha.	Odisha	Rayagada
Suresh Kumar Bajaj, Opp. Shivajee maidan, Daltonganj, Palamau, Jharkhand.	Jharkhand	Palamau

Table – 3 : Production of Graphite, 2009-10 to 2010-11 (By States)

(Qty in tonnes; value in ₹'000)

State	2008-09		2009-10		2010-11(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**117767**	**46618**	**124625**	**53830**	**114836**	**47098**
Jharkhand	14405	5267	26714	9518	44536	15030
Odisha	42925	21828	46192	18636	20201	8456
Tamil Nadu	60437	19523	51719	25676	50099	23612

Table – 4 : Production of Graphite, 2009-10 and 2010-11 (By Sectors/States/Districts)

(Qty in tonnes; value in ₹ '000)

State/District	2009-10			2010-11(P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India	**32**	**124625**	**53830**	**20**	**114836**	**47098**
Public sector	1	50764	25382	1	49299	23178
Private sector	31	73861	28448	19	65537	23920
Jharkhand	**9**	**26714**	**9518**	**8**	**44536**	**15030**
Latehar	1	3550	959	1	1410	381
Palamau	8	23164	8559	7	43126	14649
Odisha	**21**	**46192**	**18636**	**10**	**20201**	**8456**
Bargarh	4	1193	479	1	*	*
Bolangir	10	29944	12245	5	275	165
Nuapada	4	10373	3946	1	11524	4321
Rayagada	3	4682	1966	3	8402	3970
Tamil Nadu	**2**	**51719**	**25676**	**2**	**50099**	**23612**
Madurai	1	955	294	1	800	434
Sivagangai	1	50764	25382	1	49299	23178

* *Only labour employment reported during the year.*

Table – 5 : Production of Graphite, 2009-10 & 2010-11(P)
(By Frequency Groups)

(Qty in tonnes)

Production group	No.of mines		Production for the group		Percentage In total production		Cumulative percentage	
	2009-10	2010-11	2009-10	2010-11	2009-10	2010-11	2009-10	2010-11
India	**32**	**20**	**124625**	**114836**	**100**	**100**	–	–
Up to 500	14	9	1097	305	0.88	0.26	0.88	0.26
501-1000	3	2	2502	1490	2.00	1.30	2.88	1.56
1001-2000	4	1	5863	1410	4.70	1.23	7.58	2.79
2001-3000	2	-	4032	-	3.24	-	10.82	2.79
3001-4000	3	2	10192	6872	8.18	5.98	19.00	8.77
4001-5000	2	1	9543	4910	7.66	4.28	26.66	13.05
Above 5001	4	5	91396	99849	73.34	86.95	100	100

Table – 6 : Mine-head Stocks of Graphite, 2010-11(P)
(By States)

(In tonnes)

State	At the beginning of the year	At the end of the year
India	**69666**	**75283**
Jharkhand	6161	8260
Odisha	30331	31503
Tamil Nadu	33174	35520

MINING & MARKETING

Graphite mines are mostly small and opencast barring a few underground mines. Water seepage beyond 6 m depth is the main problem faced by almost all mine owners in Odisha.

Active mining centres of graphite are in Latehar and Palamau districts in Jharkhand; Bargarh, Nuapada, Rayagada and Bolangir districts in Odisha and Madurai and Sivaganga districts in Tamil Nadu. In Jharkhand, mining activities are concentrated mostly around Sokara village in Palamau district. It is a disseminated deposit of flaky graphite containing 5 to 20% F.C. In Odisha, areas in and around Bolangir are the chief mining centres where several graphite grades are produced. At Bolangir, a few opencast workings are deeper than 45 m from surface and the r.o.m. from such mines generally contains 10 to 20% F.C. Sargipalli underground mine in Sambalpur district, operated by M/s T. P. Mineral Industries (TPMI), produced graphite, analysing up to 40% F.C. in the past.

Dangachacha mine, also owned by TPMI, is a promising opencast mine in which the r.o.m. contains 40% F.C. The ore from the mine is partially beneficiated in a 3,000-tpy plant. The remaining output is sold to other beneficiation plants nearby. Graphite of Bolangir and Sambalpur districts is utilised mostly by the graphite crucible industry while graphite worked earlier from Kalahandi district used to be despatched to foundry units. The technological changes in recent years have considerably reduced the use of graphite as a lubricant. However, recycled graphite is being used in producing clay-bonded graphite crucibles.

BENEFICIATION

Graphite occurs generally admixed with the country rocks and hence, it requires beneficiation for obtaining desired grade for various end-uses. Processes for graphite beneficiation depend upon nature and association of gangue minerals present. The common processes adopted are washing, sorting, tabling, acid leaching and froth flotation. Amongst these, froth flotation process is used widely as it helps in producing a fairly high-grade graphite concentrate. Sometimes, beneficiated concentrate is further enriched by chemical treatment (acid leaching, chlorination, etc.) to obtain a very high-grade concentrate containing 98 to 99% F.C.

The r.o.m., on an average, containing about 10% F.C. has to be invariably beneficiated before marketing. Indigenously fabricated equipment is used generally to upgrade the r.o.m. to produce marketable grade graphite which contains normally 70 to 80% F.C. About 92% F.C. product has been obtained by many producers after repeated cycles of beneficiation. Few plant owners claimed to have obtained product containing as high as 95% F.C.

Beneficiation plants in Odisha seem to have been designed for treating +10% F.C. graphite (r.o.m.). In practice, it is seen that lower grade graphite having +5% F.C. is blended with higher grades to meet the requirements of beneficiation plant; i.e., +10% F.C. Thus, low grade ore analysing +5% F.C. is also used.

Tamil Nadu Minerals Ltd (TAMIN) produced flaky graphite from a mine in Sivaganga area, Sivaganga district in Tamil Nadu. The beneficiation plant located adjacent to the mine site is designed to produce 9,240 tpy of natural graphite concentrate containing 96% F.C. with 92% recovery from r.o.m. A list of important beneficiation plants in the country is given below:

Beneficiation Plants in India

Andhra Pradesh

Srinivasa Graphite Crucible Industries, P. O. Amadalavalsa, Srikakulam.

Jharkhand

Chhota Nagpur Graphite Industries, Daltonganj.

Carbon and Graphite Products, Daltonganj.

New Chemicals and Metals Products Private Ltd, Hazaribag Road, Ranchi.

Contd.

Parijat Mining Industries (India) Private Ltd, Ranchi.

Carbon and Graphite Industries, Repala, Palamau.

Gujarat

Harikrupa Minerals, Chhota Udepur, Vadodara.

Farmsons Minerals Industries, Devgadhbaria, Panchmahals.

India Minerals, Kellanpur, District Vadodara.

M. S. Patel, Muthai, Jatpur Road, Vadodara.

Odisha

Agrawal Graphite Industries, Sambalpur.

Gandhamardhan Graphite Udyog, Sambalpur.

G. R. Graphite Industries, Sambalpur.

National Carbon Products, Sambalpur.

Lakshminarayan Makhanlal Company, Sambalpur.

Graphite International, Sambalpur.

Laxminaryan Girdharilal, Sambalpur.

G. P. Minerals Industries, Sargipalli, Sambalpur.

T. P. Minerals Private Limited, Sambalpur.

Indesmin Graphite, Titlagarh.

Pioneer Graphite, Titlagarh.

Trinath Pradhan, Patnagarh, Bolangir.

B. K. Agrawal, Padmapur Diamond Graphite Industries, Kartabanji.

Raimata Graphite Industries, Patnagarh, Bolangir.

Misrilal Dharamchand Jain, Bolangir.

Pradhan Industries, Rayagada.

Mangalam Graphite Industries, Bhubaneswar.

Tamil Nadu

Tamil Nadu Minerals Ltd (TAMIN), Sivaganga.

USES & SPECIFICATIONS

Traditional uses of graphite are in crucibles, foundries, pencils, etc. Now more sophisticated applications of graphite have emerged. Examples of such uses are in refractories, expanded graphite-based sealing gaskets, graphitised grease, braid, brushes, brake lining, etc. Graphite is used in bulk for producing certain products. It is also used in a minor amounts as a vital additive for producing other products. Foundry coatings are used to prevent fusion of liquid metal with the sand at the mould or core face. They are applied as coating by spraying or painting in the form of suspension or by dusting or rubbing as dry powders. Good quality graphite which is one of the materials for this purpose, does not peel off in flakes. On drying, it imparts a smooth surface to the casting.

The BIS has prescribed the following specifications of graphite for use in various industries :

IS: 1132-1985 (Reaffirmed 2008) - graphite for use in graphite crucible industry;

IS:1305-1984 (Reaffirmed 2012) - graphite for use in foundry coatings;

IS: 14852-2000 (Reaffirmed 2010) - flaky graphite for refractory industry;

IS: 495-1967 (First Revision, Reaffirmed 2007) - graphite flakes for lubricants;

IS: 62-2006 (First Revision, Reaffirmed 2011) - graphite for paints; and

IS: 2079-1982 (First Revision, Reaffirmed 2010) - graphite for pencil slips.

The specifications of graphite adopted by the industry for some uses are as follows :

Specifications of Graphite

End product	Percentage of graphite used	Quality of the graphite used	
		Fixed Carbon (F. C.)	Size (micron)
Mag-Carb refractories	12	87-90%	150-710
Alumina-Carb (graphitised) alumina refractories	8-10	85% min	150-500
Clay-bonded crucibles	60-65	+80	-20 to +100 mesh.
Silicon carbide crucibles	35	80-89%	+150
Expanded (or flexible) graphite foils and products based thereon (e.g. sealing gaskets in refineries, fuel pumps, automobiles)	100	90% min (preferably +99%)	250-1800
Pencils	50-60	+95- 98%	50 max

(Contd.)

(Concld.)

End product	Percentage of graphite used	Quality of the graphite used	
		Fixed Carbon (F. C.)	Size (micron)
Brake-linings	1-15	98% min	75 max
Foundry	–	40-70%	53-75
Batteries			
a) Dry cells	–	88% min	75 max
b) Alkaline	–	98% min	5-75
Brushes	–	Usually 99%	Usually less than 53
Lubricants	–	98-99%	53-106
Sintered products (e.g. clog wheels)	–	98-99%	5
Paint	Up to 75	50-55% 75% min	Amorph-ous powder flake
Braid used for sealing (e.g. in ship)	40-50	95% min	–
Graphitised grease (used in seamless steel tube manufacturing)	–	+99%	38 max
Recarburisation of steel	100	99%	Microni-sed
Colloidal graphite	100	99.9%	Colloidal

CONSUMPTION

Reliable consumption data on beneficiated graphite concentrates are not available. As per the information received from various graphite consuming units and estimates, the consumption of various grades of graphite during 2008-09 to 2010-11 ranged from 14,400 tonnes to 15,000 tonnes. Out of total reported consumption in 2010-11, the refractory industry accounted for 7,100 tonnes (47%), crucible industry 4,700 tonnes (31%) and foundry industry 1,000 tonnes (7%). Industrywise consumption data are given in Table - 7.

Table - 7 : Reported Consumption of Graphite 2008-09 to 2010-11 (By Industries)

(In tonnes)

Industry	2008-09	2009-10(R)	2010-11(P)
All Industries	**14400**	**14600**	**15000**
Dry cell battery	400(2)	400(3)	400(3)
Electrode	600(5)	600(5)	600(5)
Foundry(e)+	1000(6)	1000(6)	1000(6)
Graphite products (Crucible)(e) ++	4600(3)	4600(3)	4700(3)
Graphite products (pencil)	500(1)	500(1)	500(1)
Refractory	6600(24)	6800(23)	7100(23)
Others (asbestos products, chemicals, paint, paper, pesticide, pharmaceuticals, and rubber)	700(20)	700(17)	700(17)

Figures rounded off. Data collected on non-statutory basis.

Figures in parentheses denote the number of units in organised sector reporting consumption.*

*(*Includes actual reported consumption and/or estimates made wherever required).*

(e)+ Estimated consumption taken from Market Survey conducted by IBM.

Excludes consumption of graphite for beneficiation purposes estimated at 140,000 tonnes approximately.

(e)++Based on the information supplied by The All India Graphite Crucible Manufacturers Association, Rajahmundry (Andhra Pradesh) and field survey to Samalkot/Rajahmundry area by Mineral Economics Division, IBM, in March, 2007 and data received through non-statutory returns.

WORLD REVIEW

The world inferred resources of graphite are believed to exceed 800 million tonnes of recoverable reserves. However, world reserves of graphite have been placed at 77 million tonnes of which China alone holds 55 million tonnes; i.e., over 71%, followed by India (14%) and Mexico (4%) (Table-8).

World production of graphite was 2.1 million tonnes in 2010. China continued to be the leading producer, having a share of about 86%, followed by India (5%) and Brazil (4%) (Table-9).

Table – 8 : World Reserves of Graphite (Natural) (By Principal Countries)

(In '000 tonnes)

Country	Reserves
World : Total (rounded)	**77000**
Brazil	360
China	55000
India*	11000
Madagascar	940
Mexico	3100
Other countries	6400

***Source:** Mineral Commodity Summaries, 2010.*
Figures of Canada, North Korea, Norway, Romania, Sri Lanka, Ukraine are included with 'Other countries.
**India's total resources of graphite as per National Mineral Inventory as on 1.4.2010 are 175 million tonnes of which 8 million tonnes are categorised as reserves.*

Table – 9 : World Production of Graphite (Natural) (By Principal Countries)

(In '000 tonnes)

Country	2008	2009	2010
World : Total	**2400**	**2200**	**2100**
Brazil @	81	59	84
Canada	20	7(e)	20(e)
China #	1800	1800	1800(e)
India *	118	109	99(e)
Korea, Dem. P. R. of	30	30	30
Mexico	7	5	7
Russia	14	14	14
Ukraine(e)	8	8	8
Zimbabwe	5	2	1
Other countries	317	166	37

***Source:** World Mineral Production, 2006-2010*
@ Including beneficiated and directly shipped material.
 # Including flake graphite.
** Crude. India's production of graphite in 2008-09, 2009-10 and 2010-11 was 118 thousand tonnes, 125 thousand tonnes and 115 thousand tonnes, respectively.*

FOREIGN TRADE

Exports

In 2010-11, exports of graphite (natural) were 1,070 tonnes as compared to 1,048 tonnes in the previous year. Graphite (natural) was exported mainly to UK (17%), Germany (16%), Italy (12%) and UAE (6%). The exports of graphite (artificial) increased to 9,507 tonnes in 2010-11 from 7,286 tonnes in the previous year. Graphite (artificial) was exported mainly to Iran (41%), USA (16%) and Bhutan (11%).

The exports of graphite crucibles increased to 569 tonnes in 2010-11 from 272 tonnes in the preceding year while those of silicon carbide crucibles increased to 8,811 tonnes from 6,903 tonnes in the previous year. Tunisia and Malaysia were the main buyers of graphite crucibles. Silicon carbide crucibles were exported mainly to Germany, Egypt, UK, Iran and Indonesia. Exports of graphite bricks and shapes were at 190 tonnes in 2010-11 compared to 288 tonnes in the preceding year. Graphite bricks and shapes were mainly exported to Brazil, Denmark, Iraq, UAE and Argentina (Tables - 10 to 14).

Imports

Imports of graphite (natural) increased to 14,348 tonnes in 2010-11 from 12,780 tonnes in the preceding year. Imports of graphite (artificial) also increased to 15,903 tonnes in 2010-11 from 13,422 tonnes in the previous year. Graphite (natural) was mainly from China (86%). Imports of graphite (artificial) were mainly from China (47%), Poland (14%) and Norway (12%).

Imports of graphite bricks and shapes were 215 tonnes in 2010-11 as against 50 tonnes in the previous year. Imports were mainly from Netherlands and China. Imports of graphite crucibles increased to 5,743 tonnes in 2010-11 from 3,267 tonnes in the preceding year. China was the main supplier with 94% share. Imports of silicon carbide crucibles were 1,262 tonnes in 2010-11 as compared to 1,150 tonnes in the previous year. Imports were mainly from UK (23%), Germany (20%) and USA (15%) (Tables - 15 to 19).

Table – 10 : Exports of Graphite (Natural) (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**1048**	**81374**	**1070**	**69546**
UK	203	22089	178	17280
Germany	25	3215	171	11945
Italy	–	–	126	8025
New Zealand	11	2055	32	6640
Netherlands	47	6714	33	4247
UAE	118	5746	62	3654
Paraguay	–	–	49	3254
Australia	–	–	17	2624
Japan	5	3139	58	2232
Belgium	–	–	36	1894
Other countries	639	38416	308	7751

Table – 11 : Exports of Graphite (Artificial) (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**7286**	**373050**	**9507**	**542331**
Iran	3461	86402	3896	108436
Sweden	58	16710	332	74845
Germany	501	64648	270	73874
USA	828	69701	1502	70700
Bhutan	1007	24129	1075	27693
Korea, Rep. of	6	1350	121	25112
France	26	6305	147	17392
Netherlands	11	3081	174	16452
UK	13	4281	213	15690
Indonesia	1	486	68	14686
Other countries	1374	95957	1709	97451

Table – 12 : Exports of Graphite Bricks & Shapes (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**288**	**2470**	**190**	**4119**
Brazil	–	–	78	1315
Iraq	25	1403	22	1263
UAE	_	_	20	395
Egypt	–	–	11	384
Bangladesh	40	110	5	247
Argentina	_	_	20	181
Australia	–	–	1	167
Indonesia	_	_	3	90
Denmark	_	_	30	76
Other countries	223	957	++	1

Table – 13 : Exports of Graphite Crucibles (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**272**	**10831**	**569**	**37780**
Tunisia	_	_	340	27603
Malaysia	_	_	116	3986
Egypt	29	359	45	1871
Philippines	58	3539	19	1266
South Africa	7	585	6	752
Sweden	_	_	23	602
Germany	1	151	1	477
Netherlands	_	_	1	446
USA	_	_	1	339
Kenya	3	48	10	299
Other countries	174	6149	7	139

Table – 14 : Exports of Silicon Carbide Crucibles (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**6903**	**377106**	**8811**	**434517**
Iran	1254	61263	554	44853
Germany	442	37307	3141	40166
Korea, Rep. of	612	38426	308	36422
Egypt	397	28079	755	34617
USA	531	17444	331	31306
South Africa	403	21367	178	29717
UK	811	16491	575	25128
Indonesia	233	23966	531	22773
Turkey	529	23562	259	22756
France	83	13628	402	21202
Other countries	1608	95573	1777	125577

Table – 15 : Imports of Graphite (Natural) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**12780**	**395701**	**14348**	**460015**
China	11318	313333	12404	357456
Madagascar	484	26092	720	29247
Brazil	202	9955	400	20417
Germany	89	12926	119	15459
USA	119	9209	121	10545
Sri Lanka	137	6445	105	8023
UK	116	3102	33	2821
Korea, Rep. of	_	_	93	2472
Italy	23	2012	18	1515
Unspecified	8	220	100	2987
Other countries	284	12407	235	9073

Table – 16 : Imports of Graphite (Artificial) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**13422**	**1324733**	**15903**	**1548569**
China	7839	371595	7526	491808
Poland	_	_	2261	228455
USA	1037	366920	746	177767
Germany	386	123634	687	170299
Japan	254	87222	355	90258
Norway	1762	79674	1871	89105
France	522	82670	989	89025
UK	267	36994	359	65495
Netherlands	358	47673	486	55312
Unspecified	_	_	255	21973
Other countries	997	128351	368	69072

Table – 17 : Imports of Graphite Bricks & Shapes (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**50**	**1509**	**215**	**12535**
Netherlands	_	_	100	4911
Austria	–	–	18	3136
USA	_	_	11	2031
China	40	1128	71	1670
Germany	5	241	12	538
Belgium	_	_	2	218
Japan	4	82	1	31
Other Countries	1	58	_	_

Table – 18 : Imports of Graphite Crucibles (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**3267**	**118418**	**5743**	**142945**
China	3118	113537	5394	138444
Germany	60	1069	293	2166
France	84	3714	22	1283
Austria	_	_	21	838
USA	1	31	13	214
Other countries	4	67	–	–

Table – 19 : Imports of Silicon Carbide Crucibles (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**1150**	**48859**	**1262**	**45109**
UK	258	15508	285	12875
Germany	312	12475	250	10346
USA	158	5475	185	5823
Indonesia	3	72	100	4554
Czech Rep.	60	1765	127	3315
China	261	8736	56	2168
Singapore	_	_	16	1268
Japan	18	990	63	1234
Italy	54	1815	138	1184
Poland	4	232	16	819
Other countries	22	1791	26	1523

FUTURE OUTLOOK

The graphite reserves having +40% fixed carbon are rather limited in the country. Detailed exploration of graphite deposits in Odisha, Jharkhand, Jammu & Kashmir and Kerala should be carried out. Cost-effective beneficiation technologies for low-grade graphite ore need to be developed. Silicon carbide-graphite crucibles are being diversified and manufactured to improve upon the use of inferior grade material with less quantity and at the same time ensuring longer life of crucible. Consumption of various grades of graphite in the organised sector was in the range of 14,000 tonnes during the last three years. Out of the total consumption, the refractory (45%) and crucible industries (30%) accounted for 75% and foundry industry for 7%. The apperent domestic demand of graphite run of mine is estimated at 135,000 tonnes by 2011-12 and at 208,000 tonnes by 2016-17 at 9% growth rate by the Working Group for the 12th Plan, Planning Commission of India.

Some important higher applications have emerged in exfoliated graphite which are for making sealings, gaskets, braids and brushes. New products of synthetic graphite are graphite fibres/ropes and graphite insulation blankets. Carbon-composite materials are used in very high technology areas, such as aerospace and these advanced materials are produced in Hyderabad in a pilot plant. On world scenario, a potential large-volume end-use for natural graphite has emerged in heat sinks, also called spreader shield, which is a graphite foil material conducting heat only in two directions. It has thermal conductivity above aluminium and almost equal to copper. These are used for carrying away heat in laptop computers, flat-panel displays, wireless phones, digital video cameras, etc. The silicon carbide crucible industry should be encouraged to increase the exports of its products for increased margin of profits.

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

GYPSUM

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

45 Gypsum

Gypsum ($CaSO_4.2H_2O$) is a hydrated calcium sulphate used widely in industry because of its special property of losing three-fourth of the combined water of crystallisation when moderately heated (calcined) to about 130ºC. Besides, calcined gypsum when cooled, finely ground and made plastic with water can be spread out, cast or moulded to any desired surface or form. On drying, it sets into a hard rock-like form. Selenite is a colourless, transparent, crystalline variety of gypsum, whereas alabaster is a fine grained, massive variety, white or shaded in colour. Silky and fibrous variety of gypsum is called satin spar. Anhydrite ($CaSO_4$) is a calcium sulphate mineral found associated with gypsum commonly as a massive or fibrous mineral.

Gypsum that occurs in nature is called mineral gypsum. In addition to mineral gypsum, seawater and some chemical plants are sources of by-product marine gypsum and by-product chemical gypsum, respectively. The later is obtained as by-product phospho-gypsum or fluoro-gypsum, depending upon the source. Phosphoric acid plants are important sources of by-product phospho-gypsum.

Marine gypsum is recovered from salt pans during production of common salt in coastal region, particularly in Gujarat and Tamil Nadu. The recovery of by-product gypsum and marine gypsum together is substantial and is comparable with the production of mineral gypsum.

Synthetic gypsum is recovered via flue gas desulphurisation at some coal fired electric power plants in western countries.

RESOURCES

As per UNFC system, the total resources of mineral gypsum in India as on 1.4.2010 are estimated at 1,286 million tonnes of which 39 million tonnes have been placed under 'reserves' and 1,247 million tonnes under 'remaining resources' category.

Of the total resources, fertilizer/pottery grade accounts for about 82% and cement/paint grade 12%. The unclassified and not-known grades together account for 5% resources. The remaining one percent of resources is shared by surgical plaster and soil reclamation grades. By States, Rajasthan alone accounts for 82% resources and Jammu & Kashmir 14% resources. The remaining 4% resources are in Tamil Nadu, Gujarat, Himachal Pradesh, Karnataka, Uttarakhand, Andhra Pradesh and Madhya Pradesh (Table-1).

EXPLORATION & DEVELOPMENT

During 2010-11, in western part of Haryana, GSI carried out reconnaissance stage investigation (G-4) to assess the potential of gypsum in inter-dunal areas covered by a sediment. DMG, Rajasthan also carried out exploration in areas around Daboi, Piprali in Barmer district, Anandgarh, Rojri, Rawla and Faridsar in Bikaner & Sri Ganganagar district, Areas N/V Hemaguda, Sangarva, Khirodi, Sewara Lalji ki Dungari, Kalgi ki Beri & Sutharon ki Dhani in Jalore district.

The detail of exploration activities carried out by various agencies for gypsum are given in Table - 2.

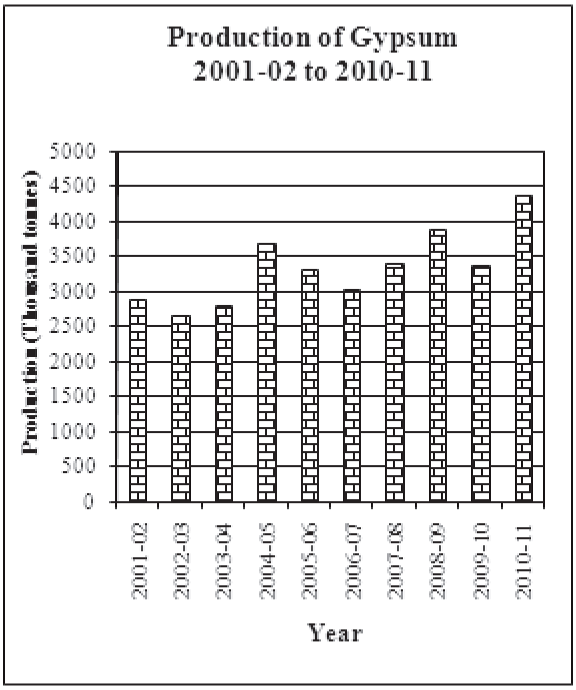


Table – 1 : Reserves/Resources of Gypsum as on 1.4.2010 (By Grades/States)

(In '000 tonnes)

Grade/State	Reserves				Remaining resources								Total resources (A+B)
	Proved STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
		STD121	STD122			STD221	STD222						
All India : Total	**22494**	**239**	**16363**	**39096**	**8502**	**73651**	**17659**	**8455**	**710853**	**428272**	**10**	**1247402**	**1286498**
By Grades													
Surgical plaster	776	-	-	776	-	1039	82	-	-	3773	-	4894	5670
Fertilizer/Pottery	8097	81	276	8454	2196	9185	270	7680	703244	320454	-	1043029	1051483
Cement/Paint	9955	158	16087	26200	6120	63035	14677	532	2876	39366	10	126616	152816
Soil reclamation	-	-	-	-	185	392	2573	100	206	7939	-	11395	11395
Unclassified	-	-	-	-	-	-	56	78	2943	33548	-	36625	36625
Not-known	3666	-	-	3666	-	-	-	66	1585	23191	-	24842	28508
By States													
Andhra Pradesh	-	-	-	-	-	-	-	-	-	404	-	404	404
Gujarat	9	5	24	38	-	-	-	-	-	15138	-	15138	15176
Himachal Pradesh	-	-	-	-	-	-	1365	-	-	3081	-	4446	4446
Jammu & Kashmir	1664	153	442	2259	4784	9785	6570	7680	-	146694	-	175513	177772
Karnataka	-	-	-	-	-	-	-	-	-	3784	-	3784	3784
Madhya Pradesh	-	-	-	-	-	-	-	-	-	69	-	69	69
Rajasthan	20821	81	15834	36736	3405	63397	3105	750	710604	237550	-	1018811	1055547
Tamil Nadu	-	-	64	64	313	469	6584	25	249	19540	10	27190	27254
Uttarakhand	-	-	-	-	-	-	35	-	-	2012	-	2047	2047

Figures rounded off

Agency/ State/ District	Location/ Area/ Block	Mapping Scale	Mapping Area (Sq. km.)	Drilling No. of bore-holes	Drilling Meter-age	Sampling (No.)	Remarks Reserves / Resources estimated
GSI Haryana							
Hissar and Bhiwani	Western part of Haryana	-	-	-	-	17	Reconnaissance stage investigation (G-4) was taken up during FS 2010-12 to assess the potential of gypsum in inter-dunal areas covered by alluvial/aeolian sediments. The area exhibits mild undulating topography with dense aeolian land forms, viz, sand dunes, sand sheets and inter-dune depressions with reported gypsum occurrences. Alluvial sediments are exposed in the northern part of the area. Three new gypsum occurrences have been located at Chhapar Jogiyan, Garanpura Naya and Balaharan ki Dhani. Three samples have been collected from a quarry west of Saharwa village for TL/OSL dating from sandy horizons below and above the gypsum bands to ascertain the age of gypsum formation. Assay results indicated 67%-85% $CaSO_4$ content in eight samples, 41%-58% $CaSO_4$ in five samples and 25%-34% in four samples. The work is in progress.
DMG Rajasthan							
Barmer	Daboi, Piprali	1:50000 1:10000 1:2000	250 11 3	-	-	-	Gypsum mineralisation is 0.3m– 1.0 m thick. The grade of the mineral was found to be more than 75% $CaSO_4.2H2O$. N/V Daboi gypsum is observed at ground level from 0.2 – 1.0 m and thickness varies from 3 - 7 m.
Bikaner and Sri Ganaga Nagar	Anandgarh, Rojri, Rawla, Faridsar	1:50000 1:10000 1:2000	325 11 02	-	-	20 (result awaited)	New gypsum occurrences of 200 m – 500 m horizontal extension and 1 – 2 m thickness were located. About 1 million tonnes of resources were estimated.

Contd.

Agency/ State/ District	Location/ Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves / Resources estimated
		Scale	Area (Sq. km.)	No. of bore-holes	Meter-age		
Jalore	Areas n/v Hemaguda, Sangarva , Khirodi, Sewara, Lalji ki Dungari, Kalgi ki Beri, and Sutharon ki Dhani	1:50000 1:10000 1:2000	100 10 01	-	-	20	Gypsum/gypsite & clay kankar belonging to recent to subrecent was seen at places. The occurrences of gypsum/gypsite 0.3 m - 0.7 m were seen n/v Hemaguda (500 m x 200 m), Sangarva (500 m x 300 m), Lalji ki Dungari (1 km x 0.5 km), Kalgi ki Beri (200 m x 100 m), and Sutharon ki Dhani (400 m x 300 m) under 0-2 m soil cover burden. Gypsum is white to yellowish white in colour and gypsitic in nature. About 0.83 million tonnes of resources were estimated.

PRODUCTION, STOCKS AND PRICES

Gypsum

The production of gypsum at 4.35 million tonnes in 2010-11 increased by 29% as compared to that in the previous year.

There were 29 reporting mines during the year as against 27 in the preceding year. Two principal producers together accounted for about 99% of the total production of gypsum in 2010-11. Six mines, each producing above 2 lakh tonnes annually contributed about 78% of total production. Three mines each producing between 1 to 2 lakh tonnes contributed about 9% of the total production, two mines each producing 50 thousand tonnes to one lakh tonnes contributed about 3% of total production and 15 mines each producing between 10 thousand to 50 thousand tonnes accounted for 10% of total production. Nominal production of gypsum was reported from 3 other mines each producing below 10,000 tonnes annually. Almost the entire production of gypsum was contributed by public sector and a nominal quantity of production was reported by private sector.

Rajasthan continued to be the leading producer, contributing 99% of total output. The rest 1% was contributed by Gujarat and Jammu & Kashmir (Tables - 3 to 6).

The mine-head stocks of gypsum at the end of 2010-11 were 58,461 tonnes as against 15,408 tonnes at the beginning of the year (Table - 7).

The average daily employment of labour strength in gypsum mines during 2010-11 was 349 as against 294 in the previous year.

Domestic prices of gypsum are furnished in the General Review on 'Prices'.

Selenite

The production of selenite was 6,728 tonnes in 2010-11 as against 14,598 tonnes during the preceding year. The entire production of selenite was reported by Rajasthan State Mines & Minerals Ltd (RSMML) operating 3 mines in Barmer & Bikaner districts of Rajasthan (Tables - 8 to 10).

The average daily employment of labour strength in selenite mines during 2010-11 was 25 as against 26 in the previous year. Domestic prices of selenite are furnished in the General Review on 'Prices'.

Table – 3 : Principal Producers of Gypsum 2010-11

Name and address of producer	Location of mine	
	State	District
Rajasthan State Mines & Minerals Ltd, Gypsum Division, Sadul Club Building, Bikaner- 334 001, Rajasthan	Rajasthan	Bikaner Sri Ganganagar Hanumangarh Jaisalmer Jalore Nagaur
FCI Aravali Gypsum & Minerals India Ltd, (formerly known as Fertilizer Corp. of India Ltd) Mangu Singh Rajvi Marg, Paota 'B' Road, Jodhpur-342010, Rajasthan.	Rajasthan	Bikaner Sri Ganganagar Jaisalmer

Table – 4 : Production of Gypsum, 2008-09 to 2010-11(P) (By States)

(Qty in tonnes; value in ₹'000)

States	2008-09		2009-10		2010-11 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**3876671**	**993465**	**3370322**	**1004631**	**4346700**	**1304004**
Gujarat	218	22	112	15	61	12
Jammu & Kashmir	4505	1352	33197	9959	37957	11387
Rajasthan	3871948	992091	3337013	994657	4308682	1292605

Table – 5: Production of Gypsum, 2009-10 & 2010-11(P) (By Sectors/States/Districts)

(Qty in tonnes; value in ₹'000)

State/District	2009-10			2010-11 (P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India	**27**	**3370322**	**1004631**	**29**	**4346700**	**1304004**
Public sector	22	3346281	998993	26	4331639	1299492
Private sector	5	24041	5638	3	15061	4512
Gujarat	**4**	**112**	**15**	**2**	**61**	**12**
Kachchh	4	112	15	2	61	12
Jammu & Kashmir	**2**	**33197**	**9959**	**2**	**37957**	**11387**
Doda	1	644	193	1	3019	906
Ramban	1	32553	9766	1	34938	10481
Rajasthan	**21**	**3337013**	**994657**	**25**	**4308682**	**1292605**
Bikaner	6	1943507	581497	7	2784563	835368
Sri Ganganagar	8	150297	42271	10	380265	114080
Hanumangarh	2	126990	38097	3	77681	23304
Jaisalmer	3	733388	220016	3	695632	208690
Jalore	1	69116	18661	1	21502	6451
Nagaur	1	313715	94115	1	349039	104712

Table – 5 : Production of Gypsum, 2009-10 & 2010-11 (P)
(By Frequency Groups)

(Qty. in tonnes)

Production group	No. of mines		Production for the group		Percentage in total production		Cumulative percentage	
	2009-10	2010-11	2009-10	2010-11	2009-10	2010-11	2009-10	2010-11
All Groups	**27**	**29**	**3370322**	**4346700**	**100.0**	**100.0**	–	–
Up to 10000	8	3	16072	3080	0.48	0.07	0.48	0.07
10001-50000	9	15	270447	428855	8.02	9.87	8.50	9.94
50001-100000	3	2	219478	140531	6.51	3.23	15.01	13.17
100001-200000	2	3	283432	400072	8.41	9.20	23.42	22.37
Above 200000	5	6	2580893	3374162	76.58	77.63	100.00	100.00

Table -7 : Mine-head Stocks of Gypsum, 2010-11 (P)
(By States)

(In tonnes)

State	At the beginning of the year	At the end of the year
India	**15408**	**58461**
Gujarat	390	416
Jammu & Kashmir	46	3
Rajasthan	14972	58042

Table – 8: Producers of Selenite, 2010-11

Name & Address of Producer	Location of Mines	
	State	District
Rajasthan State Mines & Minerals Ltd., Gypsum Division, Sadul Club Building, Bikaner –334 001 Rajasthan.	Rajasthan	Barmer Bikaner

Table – 9 : Production of Selenite, 2008-09 to 2010-11(P)
(By State)

(Qty in tonnes; value in ₹’000)

State	2008-09		2009-10		20010-11 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**15224**	**12940**	**14598**	**12408**	**6728**	**5719**
Rajasthan	15224	12940	14598	12408	6728	5719

Table – 10 : Production of Selenite, 2009-10 and 2010-11(P)
(By Sector/State/Districts)

(Qty in tonnes; value in ₹’000)

State/District	2008-09			2009-10 (P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India	**3**	**14598**	**12408**	**3**	**6728**	**5719**
Public sector	3	14598	12408	3	6728	5719
Rajasthan	**3**	**14598**	**12408**	**3**	**6728**	**5719**
Barmer	2	1214	1032	2	2172	1846
Bikaner	1	13384	11376	1	4556	3873

MINING AND MARKETING

Gypsum is mined out by opencast manual mining except in a few semi-mechanised mines in Rajasthan. The deposits are found at shallow depths and scattered over large areas. Production is classified into four grades based on the calcium sulphate ($CaSO_4.2H_2O$) content: (i) above 90%, (ii) 85 - 90%; (iii) 80 - 85%; and (iv) less than 80%.

High grade gypsum is mined in Bikaner and Jaisalmer districts of Rajasthan. Some gypsum mines in Bikaner district also produce crystalline variety (i.e.selenite). Gypsum from Rajasthan is despatched to cement plants in India spread over Rajasthan, Gujarat, Madhya Pradesh, West Bengal, Uttar Pradesh, Bihar, Jharkhand, Chhattisgarh, Himachal Pradesh, etc. Besides, a substantial quantity, containing 60-70% $CaSO_4.2H_2O$ is supplied to Punjab, Uttar Pradesh, Haryana, Delhi, etc. for reclaiming alkaline soil. A sizeable quantity of gypsum from mines in Barmer, Bikaner, Jaisalmer, Hanumangarh, Sri Ganganagar and Nagaur districts of Rajasthan is also supplied to the plaster of Paris units in Rajasthan, Uttar Pradesh, Haryana, Maharashtra, West Bengal and Delhi. Gypsum produced in Tamil Nadu in the past was mainly of cement grade and hence, was despatched to cement plants in southern India.

M/s Saint Gobain India Ltd (formerly known as India Gypsum Ltd) and Lafarge Boral Gypsum India Pvt Ltd are the market leaders and specialise in dry construction techniques. Its products are marketed under various brand names gypboard, gypsteel, Gyptone, Gyproc CalSica, Fibre Cement Board, Gyproc, Casaprano, Gyprex, Celotex, Certainteed, LaGypTM, etc.

USES AND SPECIFICATIONS

Cement, fertilizer (ammonium sulphate) and plaster of Paris are the three important industries in which gypsum is utilised. Gypsum of less purity in crushed form is utilised in portland cement manufacture for controlling the setting time of portland cement (i.e. as a retarder to prevent quick set). It is added to the clinker just before final grinding to finished cement. Proportion of gypsum in cement industry is 4-5% of the cement produced. Both, mineral and by-product gypsum are used in cement manufacture. Calcined gypsum finds use in manufacturing plaster of Paris. It is also used in manufacturing partition blocks, sheets and tiles, insulation boards for stucco and lattice works. Gypsum board is primarily used as a finish for walls and ceilings. It is also used as a binder in fast dry tennis court clay. Low grade gypsum is calcined and used as gypsum plaster after preparation of mortar. It is used for internal plastering and masonry work. Requirement of low-grade gypsum for use in building industry as per IS:12654-1989 (Reaffirmed 2010) is : $CaSO_4.2H_2O$ not less than 60%. In pottery, calcined gypsum is used for preparation of moulds in the production of sanitarywares. The used and discarded moulds are in turn again used as source of gypsum in cement and other industries. Low-grade gypsum is used in conditioning alkaline soil and as a manure in agriculture mainly for correcting black alkali soils. BIS has prescribed IS:6046-1982 (First Revision; reaffirmed 2008) for gypsum for agricultural use.

Selenite, a crystalline variety is used to a limited extent for gypsum plate for petrological microscopes, known as Sensitive Tint. It is also used in the ceramic industry for making moulds, to manufacture surgical grade plaster of Paris and also for producing white cement. Plaster of Paris industry requires high purity gypsum. Different grades of plaster of Paris are manufactured, depending upon the period for setting. For surgical plaster, a minimum 96% $CaSO_4.2H_2O$ grade gypsum is required. High-purity gypsum is utilised for manufacturing ammonium sulphate fertilizer. Ground pure white gypsum is also used as a filler in paper, paints and textile goods. Ground low grade gypsum is used in mine dusting, manufacture of blackboard chalks and as a filler in insecticides. Besides, gypsum is also used in other industries like pharmaceutical, textile and asbestos products.

Alabaster, a dense, massive, granular and translucent variety, is employed as ornamental stone in statuary and interior decoration.

BIS specification for by-product gypsum (IS: 10170-1982, reaffirmed 2008) lays down a minimum 70% content of $CaSO_4.2H_2O$ and maximum limit of 0.75% Na, 1.0% F and 15% free moisture on dry basis. The material should pass 2 mm sieve, but 50% of material should also pass through 0.25 mm (60 mesh) sieve. Specifications of mineral gypsum for different industries are given in Table-12. Table-13 gives the specifications of by-product gypsum for use in plaster, blocks and boards, as per IS:12679-1989, reaffirmed 2010. Besides, BIS has prescribed IS: 1290 - 1973 (Second Revision; reaffirmed 2011) for mineral gypsum.

BY-PRODUCT GYPSUM

Phospho-gypsum

Phospho-gypsum is produced as a by-product during the manufacture of phosphoric acid by wet process. Generally, a tonne of phosphoric acid production generates about 4 to 6 tonnes of phospho- gypsum. The principal manufacturing units of phospho-gypsum are given in Table-11. The production of phospho-gypsum reported by FACT, Ambalamedu, Kerala during 2010-11 was about 2.20 lakhs tonnes, that by Coromandal International Ltd, Tamil Nadu was 2.50 lakh tonnes, while Tata Chemicals Ltd reported 1.44 lakh tonnes. The estimated production of by-product phospho-gypsum by principal producers was around 3.50 million tonnes in 2009-10 and 3.60 million tonnes in 2010-11.

The purity of phospho-gypsum ranges from 77 to 98% $CaSO_4.2H_2O$. It contains about 0.2 to 0.7% total P_2O_5. Phospho-gypsum is mostly used in cement and fertilizer industries.

Fluorine and phosphate contents in by-product gypsum are considered deleterious. The phosphate content affects setting properties of cement and fluorine content causes ring formation in kiln. The limit generally specified for use in cement is 0.15% P_2O_5 maximum. Phospho-gypsum is radioactive due to the presence of naturally occurring uranium and radium in the phosphate ore. Phospho-gypsum contains about 1% P_2O_5, 1% F and 10 to 30 times more radon, none is desirable. These entities along with radon that were a scare in the 1980s resulted in a 1989 EPA (Environment Protection Agency, USA) ruling that phospho-gypsum is unsuitable for sale as common gypsum.

Fluoro-gypsum

Fluoro-gypsum is obtained as by-product during the manufacture of aluminium fluoride and hydrofluoric acid using fluorite. Navin Fluorine Industries, Bhestan, Surat district, Gujarat; Tanfac Industries Ltd Cuddalore, South Arcot district, Tamil Nadu and Aegies Chemical Ltd Dombivali, Thane, Maharashtra recover fluoro-gypsum in their chemical plants.

Boro-gypsum

By-product boro-gypsum is obtained at a plant which refines calcium borates (colemanite and ulexite) to produce borax and boric acid. Borax Morarjee Ltd, Ambarnath, Thane district, Maharashtra and Southern Borax Ltd, Chennai engaged in refining of borates were reporting production of by-product boro-gypsum, in the past. However, detailed information on production of boro-gypsum from these two plants is not available. National Peroxide Ltd, Kalyan, Maharashtra is producing sodium perborate; information on production of boro-gypsum, if any at this plant is not available.

Marine Gypsum

Marine gypsum is obtained as a by-product during the production of common salt by solar evaporation. The total production of marine gypsum as per the Salt Commissioner, Jaipur, was 233,163 tonnes in 2009-10 and 142,289 tonnes in 2010-11, reported from Gujarat and Tamil Nadu. Marine gypsum recovered from Gujarat showed 89.72-92.62% $CaSO_4.2H_2O$, 0.48 to 2.08% NaCl, 0.57% $MgCl_2$, 3.42% $MgSO_4$ and 3.48 to 7.65% insolubles.

Table – 11 : Principal Producers of Phospho-gypsum

State	Unit
Andhra Pradesh	Coromandel International Ltd, Visakhapatnam.
Gujarat	(i) Gujarat State Fertilizers and Chemicals Ltd, Fertilizernagar, Vadodara district.
	(ii) Hindalco Industries Ltd, P.O. - Dahej.
Kerala	(i) Fertilizers & Chemicals Travancore Ltd, Udyogmandal, Ernakulam district.
	(ii) Fertilizers & Chemicals Travancore Ltd, Ambalamedu, Ernakulam
Maharashtra	Rashtriya Chemicals & Fertilizers, Chembur, Mumbai.
Odisha	(i) Paradeep Phosphates Ltd
	(ii) IFFCO, Paradeep, district Jagatsinghpur.
Tamil Nadu	(i) Southern Petrochemical Industries Corporation Ltd, Thoothukudi.
	(ii) Coromandel International Ltd, Ennore, Thiruvallur.
	(iii)Sterlite industrie (India) Ltd, Thoothukudi.
West Bengal	Tata Chemicals Ltd, Haldia.

Table – 13 : Requirement of By-product Gypsum for Use in Plaster, Blocks and Boards (IS:12679 - 1989, Reaffirmed 2010)

Sl. No.	Characteristic	Requirement		
		Phospho-gypsum	Fluoro-gypsum	Marine-gypsum
1.	P_2O_5, % by mass, max	0.40	–	–
2.	F, % by mass, max	0.40	1.0	–
3.	Na_2O, % by mass, max	0.10	–	–
4.	K_2O, % by mass, max	0.20	–	–
5.	Organic matter, % by mass, max	0.15	–	–
6.	$CaSO_4.2H_2O$, % by mass, max	85.0	90.0*	85.0
7.	Cl as NaCl, % by mass, max	0.10	–	0.10
8.	pH of 10% aqueous suspension of gypsum, min	5.0	5.0	6.0

Note: ** Fluoro-gypsum shall be in anhydrous form (as $CaSO_4$).*

Table – 12 : Specifications of Mineral Gypsum in Different Industries

Constituent	Surgical plaster	Ammonium sulphate fertilizer	Pottery	Cement	Reclamation of soil	Extender in paints
Free water	1.0% (max)	–	1.0% (max)	–	–	0.5% (max) when heated for 2 hr. at 45^{0}C
CO_2	1.0% (max)	–	3.0% (max)	–	–	–
SiO_2 & other insoluble matter	0.7% (max)	6.0% (max)	6.0% (max)	–	–	–
Iron & aluminium oxide	0.1% (max)	1.5% (max)	1.0% (max)	–	–	–
MgO	0.5% (max)	1.0% (max)	1.5% (max)	3.0 (max)	–	–
$CaSO_4.2H_2O$	96.0% (min)	85-90% (min)	85.0% (min)	70-75% (80-85% for export quality cement)	70% (min)	75% (min)
NaCl	0.01% (max)	0.003% (max)	0.1% (max)	0.5% (max)	–	–
Na_2O	–	–	–	–	0.75% (max) (Na)	–
Fineness	–	–	–	–	Residue on 2 mm sieve : Nil & on 0.25 mm sieve : 50% (max)	Residue on 240 mesh B.S. test sieve : 0.5%
Oil absorption	–	–	–	–	–	Within 5% of the approved sample
Colour	–	–	–	–	–	Close match to the approved sample
Lead & its compounds (calculated as metallic lead)	–	–	–	–	–	0.5% (max) when lead-free gypsum is required
Physical form	–	–	–	–	–	In the form of dry powder
Microscopic form	–	–	–	–	–	Material should match entirely with the characteristics of gypsum crystals

CONSUMPTION

About 7.14 million tonnes gypsum in all forms was consumed in organised sector in 2010-11 as against 6.98 million tonnes in 2009-10. In addition, a substantial quantity of mineral gypsum as well as phospho-gypsum was used in agricultural sector for conditioning alkaline soil. The respective share of mineral gypsum, by-product phospho-& fluoro-gypsum, marine gypsum & plaster of paris moulds in total consumption in 2010-11 was about 47%, 48% and 5%, respectively.

Almost entire quantity of natural gypsum in 2010-11 was consumed in the manufacture of cement (99%). The remaining nominal consumption was in plaster of paris, asbestos products, ceramic, fertilizer, textile, pharmaceutical, paint and chemical industries. The entire quantity of marine gypsum and gypsum moulds was consumed in cement and ceramic industries, respectively. By-product gypsum was also almost entirely consumed for manufacture of cement and meagre consumption was in ceramic and fertilizer industries in 2010-11 (Table - 14).

Table- 14: Reported Consumption of Gypsum, 2008-09 to 2010-11

(By Industries & Categorywise)

(In tonnes)

Category	Industry	2008-09	2009-10(R)	2010-11 (P)
All Industries :	**Grand Total**	**6566513**	**6984192**	**7144560**
Natural-Gypsum :	**Total**	**2962100**	**3319800**	**3361100**
	Asbestos products	700(4)	700(4)	700(4)
	Cement	2948000(50)	3305700(57)	3347000(58)
	Ceramic	400(1)	400(1)	400(1)
	Fertilizer	100(1)	100(1)	100(1)
	Paint	++(2)	++(2)	++(2)
	Pharmaceutical	800(1)	800(1)	800(1)
	Plaster of Paris	12100(3)	12100(3)	12100(3)
	Textile	++(1)	++(1)	++(1)
By-Product-Gypsum :	**Total**	**3250600**	**3310400**	**3430200**
	Cement	3250000(64)	3309700(69)	3429600(69)
	Ceramic	600(1)	600(1)	600(1)
	Fertilizer	++(1)	100(1)	++(1)
Marine-Gypsum :	**Total**	**351113**	**351292**	**350560**
	Cement	351113(13)	351292(13)	350560(14)
Gypsum-Moulds :	**Total**	**2700**	**2700**	**2700**
	Ceramic	2700(5)	2700(5)	2700(5)

Figures rounded off. Data collected on non-statutory basis.
Figures in parentheses denote the number of units in organised sector reporting consumption.*
*(*Includes actual reported consumption and/or estimates made wherever required).*

INDUSTRY

Saint Gobain India Ltd (formerly known as India Gypsum Ltd) has been a pioneer in introducing light weight interior construction practices (Ceiling, drywall partition and gypsum plaster) and have plants located at Jind (Haryana), Wada (near Mumbai), Chennai and Bengaluru producing gypsum plaster boards and accessories. Lafarge Boral Gypsum India Pvt Ltd (LBGI) is also a market leader in designing, manufacturing and supplying gypsum board internal walls and ceiling solutions. They use mineral gypsum supplied from different mines of M/s Rajasthan State Mines & Minerals Ltd (RSMML) and M/s FCI Aravali Gypsum & Minerals India Ltd (FAGMIL) located mainly in Rajasthan.

Fertilizers & Chemicals Travancore Ltd's (FACT) joint project with Rashtriya Chemicals & Fertilizers Ltd (RCF) for manufacturing gypsum based building material is nearing completion and is expected to be commissioned shortly.

RCF has earmarked upon the manufacture of wall panels and other building materials from phospho-gypsum with Australian technology from M/s Rapidwall Building Systems Pvt Ltd, Australia (RBS). The project was set up at a cost of 81.10 crore, to utilise by-product phospho-gypsum produced in Trombay. It is a revolutionary and environment friendly, load bearing, prefabricated glass fiber reinforced walling system with broad construction applications. More than 500 wall panels were manufactured at Trombay and sucessfully tested at IIT, Chennai. The product has also received 'in principle' approval from Building Material Technology Promotion Council (BMTPC) under the Ministry of Housing and Urban Poverty Alleviation.

WORLD REVIEW

The world reserves of gypsum are large and adequate to meet the demand. The total reported production of gypsum in 2010 was about 141 million tonnes as against 139 million tonnes in 2009. China was the largest producer accounting for 26%, followed by Iran (10%), Thailand (8%), USA(6%), Mexico (5%), Spain (4%), France and India (3% each) (Table - 15).

FOREIGN TRADE

Exports

Exports of gypsum and plaster at 1,00,470 tonnes in 2010-11 and 1,00,520 tonnes in the preceding year were almost same. During the same period, export of alabaster was 74 tonnes against nil in the previous year. Gypsum & plaster were exported in bulk to neighbouring countries, viz, Bangladesh (51%) and Nepal (45%). Alabaster was exported to Nepal (Tables - 16 and 17).

Imports

Imports of gypsum & plaster increased marginally to 16,97,746 tonnes in 2010-11 from 15,48,701 tonnes in 2009-10. Imports of alabaster increased to 1,237 tonnes in 2010-11 from 413 tonnes in 2009-10. Gypsum & plaster were imported mainly from Thailand (55%), Iran (29%) and Oman (6%). Alabaster was imported from Oman (39%), Spain (32%) & Italy (29%). (Tables - 18 and 19).

Table – 15 : World Production of Gypsum (By Principal Countries)

(In '000 tonnes)

Country	2008	2009	2010
World: Total	**151100**	**139300**	**140700**
Australia	3615	3302	3268(e)
Canada@	5797	3540	2717
Chile	774	723	758
China	38000	37000	37000
Egypt@	2400	1035	84
France@	2339	3351	4500
Germany@	2112	1898	1822
India#	3877	3422	4489(e)
Iran	11251	13615	13500
Italy	1600	1600	1600
Mexico	6933	7543	6478
Russia	3600	2900(e)	2900
Spain	11956	8188	6000(e)
Thailand@	8989	9122	10663
United Kingdom (e)	1700	1700	1700
USA	14400	9400	9000(e)
Other countries	31757	30968	34221

Source: *World Mineral Production, 2006-2010* .

@ Including Anhydrite, # Including selenite.

* *India's production of gypsum and selenite during 2008-09, 2009-10 and 2010-11 was 3,892 thousand tonnes, 3,385 thousand tonnes and 4,353 thousand tonnes, respectively*

Table – 16: Exports of Gypsum & plaster (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**100520**	**114300**	**100470**	**134338**
Bangladesh	42460	55094	51126	69141
Nepal	54606	39548	45234	39804
Kenya	569	4853	331	3731
Saudi Arabia	21	448	521	2939
South Africa	560	1750	186	2453
Netherlands	-	-	25	2172
UK	201	1036	40	1884
N. Mariana Is.	-	-	1505	1801
China	794	1786	126	1602
Tanzania	-	-	79	1446
Other countries	1309	9785	1297	7365

Table – 17: Exports of Alabaster (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	-	-	**74**	**329**
Nepal	-	-	**74**	**329**

Table -18: Imports of Gypsum and Plaster

(By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**1548701**	**2212673**	**1697746**	**2212981**
Thailand	1033358	1356137	935292	1199952
Iran	407478	672775	496925	577849
Oman	103103	119074	101920	140394
Indonesia	16	118	40963	53823
USA	1553	30545	1485	42885
Afghanistan	-	-	29654	39620
Pakistan	-	-	14908	24820
China	1881	16001	1495	20982
Saudi Arabia	20	721	348	8069
Unspecified	-	-	73196	81445
Other countries	1292	17302	1560	23142

Table – 19 : Imports of Alabaster

(By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**413**	**7425**	**1237**	**19920**
Oman	-	-	476	9890
Spain	365	6527	398	6399
Italy	-	-	363	3631
Other countries	48	898	-	-

FUTURE OUTLOOK

India's domestic resources of gypsum are large enough to meet increased demand. The apparent domestic demand of gypsum is estimated at 5.66 million tonnes by 2011-12 and 8.71 million tonnes by 2016-17 at 9% growth rate as per the Report of the Working Group for 12th Plan, Planning Commission of India. .

India's main focus is the creation of more infrastructure with a view to infuse momentum in its economy and participation in its industrial development. These activities will keep the cement industry to grow and accordingly, the consumption of gypsum will increase, according to the Working Group.

Production of gypsum wallboard in India is negligible. Its light weight and other special characteristics could facilitate its utility as a light weight and attractive partition material that is increasingly used in high rise buildings. In view of the environmental problem arising from huge accumulation of phospho-gypsum at different fertilizer plants, exploring the possibilities of finding other plausible means for utilisation of phospho-gypsum has become a necessity. Low-grade gypsum being cheaper should be utilised more as a soil conditioner in the reclamation of alkaline soils.

As per the Report of the Working Group, steps would be necessary to find out suitable mining technology to exploit, deep-seated gypsum resources in Bhadvasi deposit, Nagaur district Rajasthan. State-of-the-art-technology needs to be adopted for the exploitation of deep-seated gypsum. Production of gypsum wall board which is negligible in India should be encouraged so that gypsum is used in value added form. .

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

ILMENITE & RUTILE

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

46 Ilmenite & Rutile

India is endowed with large resources of heavy minerals which occur mainly along coastal stretches of the country and also in inland placers. Heavy mineral sands comprise a group of seven minerals, viz, ilmenite, leucoxene (brown ilmenite), rutile, zircon, sillimanite, garnet and monazite. Ilmenite ($FeO.TiO_2$) and rutile (TiO_2) are the two chief minerals of titanium. Titanium dioxide occurs in polymorphic forms as rutile, anatase (octahedrite) and brookite. Though Brookite is not found on a large-scale in nature, it is an alteration product of other titanium minerals. Leucoxene is an alteration product of ilmenite and found associated with ilmenite.

RESOURCES

Ilmenite and rutile along with other heavy minerals are important constituents of beach sand deposits found right from Ratnagiri coast (Maharashtra) in the west to Odisha coast in the east. These minerals are concentrated in five well defined zones:

* Over a stretch of 22 km between Neendakara and Kayamkulam, Kollam district, Kerala (known as 'Chavara' deposit after the main mining centre).
* Over a stretch of 6 km from the mouth of Valliyar river to Colachal, Manavalakurichi and little beyond in Kanyakumari district, Tamil Nadu (known as MK deposit).
* On Chatrapur coast stretching for 18 km between Rushikulya river mouth and Gopalpur lighthouse with an average width of 1.4 km in Ganjam district, Odisha (known as 'OSCOM' deposit after IREL's Orissa Sands Complex).
* Brahmagiri deposit stretches for 30 km from Girala nala to Bhabunia villages with an average width of 1.91 km in Puri district, Odisha.
* Bhavanapadu coast between Nilarevu and Sandipeta with 25 km length and 700 m average width in Srikakulam district, Andhra Pradesh.

The AMD of the Department of Atomic Energy has been carrying out exploration of these mineral deposits. So far, about 3,579 km coastal tract and 128.92 sq km in the inland areas in Tamil Nadu and West Bengal have been investigated for over six decades by AMD. The ilmenite resource estimation for the areas explored up to 2006 has been almost completed and the resources are up from 461.37 million tonnes to 520.38 million tonnes (including leucoxene), inclusive of indicated, inferred and speculative categories. Resource estimation for the areas explored during 2006 to 2011 is under progress. The most significant deposits which are readily available and attract attention of industry for large-scale operations are as follows:

State/Deposit	Ilmenite reserve (In million tonnes)
Andhra Pradesh	
1. Amalapuram	15.57
2. Bhavanapadu Hukumpet	10.18
3. Kakinada (Phase I-VII)	29.62
4. Kalingapatnam	7.63
5. Narasapur	2.92
6. Nizampatnam	19.26
7. Srikurman	14.18
8. Visakhapatnam	3.60
Kerala	
1. Chavara	13.00
2. Chavara Eastern Extension	17.00
3. Chavara (Phase II)	49.00
Maharashtra	
Ratnagiri	3.04
Odisha	
1. Brahmagiri	61.10
2. Chatrapur	26.72
Tamil Nadu	
1. Kudiraimozhi	23.00
2. Navaladi-Periatalai	24.00
3. Sattankulam	14.48

Source: *Department of Atomic Energy, Mumbai.*

Table – 1 : Resources of Ilmenite and Rutile

(In million tonnes)

State	Total in situ #
Ilmenite* : Total	**520.38**
Andhra Pradesh	171.04
Bihar	0.73
Kerala	117.52
Maharashtra	3.74
Odisha	108.23
Tamil Nadu	117.07
West Bengal	2.05
Rutile : Total	**29.11**
Andhra Pradesh	10.30
Bihar	0.01
Kerala	7.24
Odisha	6.06
Tamil Nadu	5.31
West Bengal	0.19

Source: *Department of Atomic Energy, Mumbai.*
 # Inclusive of indicated, inferred and speculative categories.
** Including leucoxene.*

The average grade of total heavy minerals in these deposits is 10-25% of which 30-35% is ilmenite. The overall statewise reserves of ilmenite and rutile which occur together in beach sand deposits are given in Table - 1.

As per the UNFC system as on 1.4.2010 compiled by National Mineral Inventory (NMI) Unit of IBM, the total resources of titanium minerals are placed at 394 million tonnes comprising ilmenite (335.6 million tonnes), rutile (13.4 million tonnes), leucoxene (1.0 million tonnes), anatase (3.3 million tonnes) and titaniferous magnetite (40.6 million tonnes).

EXPLORATION & DEVELOPMENT

GSI carried out placer mineral investigations within the territorial waters of India in 2010-11. The surveys were conducted off Bhimunipatnam, Andhra Pradesh; and off Palur-Malud, Odisha.

Directorate of Geology, Odisha took up investigation during 2010-11 for heavy minerals (ilmenite, rutile, zircon, garnet, sillimanite, monazite, etc.) in beach sands in village Hunda, Krushnaprasad block in Puri district. Mapping over 1.04 sq km area on 1:2,000 scale was conducted along with 2,060 m auger drilling and collection of same number of samples during the year. Heavy mineral investigations were also taken up during 2010-11 in a 27-km long coastal tract in Balikunda block of Jagatsinghpur district. A total of 39 line km survey and 1,229 m in auger drilling were conducted and 659 samples were collected for heavy mineral study. Resources in the above areas are to be assessed.

The survey and exploration carried out by AMD during 2008-09, 2009-10 and 2010-11 included parts of West Bengal, Odisha, Andhra Pradesh, Tamil Nadu, Kerala, Karnataka, Gujarat and Maharashtra. The details of exploration activities carried out by AMD during 2010-11 are furnished in Table-2.

PRODUCTION AND PRICES

Ilmenite

The production of ilmenite at 663 thousand tonnes in 2010-11 decreased by 7% as compared to that in the preceding year. Tamil Nadu was the leading producer of ilmenite during the year under review, contributing 52% production followed by Odisha 31% and Kerala 17%.

Table – 2: Exploration Activities by AMD for Ilmenite, Rutile, Monazite, Zircon and other Heavy Minerals, 2010-11

Location	Activity		Results
	Reconnaissance survey (sq km)	Detailed survey (sq km)	
Parts of West Bengal, Odisha, Karnataka, Andhra Pradesh, Tamil Nadu and Gujarat	253.8 (Coastal tracts and) inland areas	8.28	Reconnaissance survey was undertaken to delineate potential heavy mineral concentrations along the coastal tracts: (a) Ghoga and Gopnath coast, Bhavnagar district, Gujarat - very narrow beaches with surfacial heavy mineral (HM) concentration of 5 to 20%. (b) Digha-Birampur coast, Midnapore district, West Bengal recorded HM concentration up to 10%; inland palaeo placers of this coast recorded concentration between 5-10%. (c) Beach sand between Gimagaria and Subarnarekha river, Balasore district, Odisha showed HM 5-15%. (d) Beach sand between Ennore and Pulicat Lake, Tiruvallur district, Tamil Nadu has 30% HM concentration. (e) Two to eight percent HM recorded along Bengre-Mulki coast, Mangalore & Dakshin Kannada districts, Karnataka. In addition to reconnaissance surveys, detailed survey was carried out in Malikipuram deposit, East Godavari district, Andhra Pradesh to upgrade the resources from inferred to indicated category. Further work is in progress.

***Source**: Department of Atomic Energy, Mumbai.*

Rutile

The production of rutile at 27 thousand tonnes in 2010-11 increased by 43% as compared to that in the previous year. Tamil Nadu was the leading producer of rutile accounting for 47% production followed by Odisha 30% and Kerala 23%.

Production and prices of ilmenite and rutile are furnished in Tables - 3 to 5.

Table – 3: Production of Ilmenite and Rutile 2008-09 to 2010-11 (By States)

(In tonnes)

State	2008-09	2009-10	2010-11(P)
ILMENITE			
India : Total	**588127**	**713605**	**663217**
Kerala	51151	133832	113240
Odisha	200056	210031	206139
Tamil Nadu	336920	369742	343838
RUTILE			
India : Total	**19098**	**18573**	**26593**
Kerala	3859	6607	5969
Odisha	10319	8033	8044
Tamil Nadu	4920	3933	12581

Table – 4 : Prices of Rutile 2008-09 to 2010-11

(₹ per tonne)

Year	Grade	Price	Remarks
IREL			
2008-09	Q/MK/OR	28000	Ex-works, bagged
(w.e.f. 29.5.2008)	Q/MK/OR	30000	Ex-works, bagged
(w.e.f. 1.7.2008)	Q/MK/OR	32000	Ex-works, bagged
(w.e.f. 1.9.2008)	Q/MK/OR	34000	Ex-works, bagged
(w.e.f. 15.11.2008)	Q/MK/OR	37000	Ex-works, bagged
2009-10	Q/MK/OR	37000	Ex-works, bagged
(w.e.f. 7.4.2009)	Q/MK/OR	41000	Ex-works, bagged
2010-11			
(w.e.f. 1.4.2010)	Q/MK/OR	41000	Ex-works, bagged
(w.e.f. 1.5.2010)	Q/MK/OR	35000	Ex-works, bagged
(w.e.f. 11.2.2011)	Q/MK/OR	37500	Ex-works, bagged
KMML			
2008-09	94.85% TiO_2	31007	–
2009-10	94.85% TiO_2	44500 to 50000	–
2010-11	-	NA	–
V.V. Mineral (Average)			
2008-09	NA	26613	–
2009-10	NA	34475	–
2010-11	NA	37565	–

Source: *Department of Atomic Energy, Mumbai.*
Note: *Q : Quilon; MK: Manavalakurichi; OR: Odisha*

Table – 5: Prices of Ilmenite 2008-09 to 2010-11

(₹ per tonne)

Period	Grade	Price	Remarks
IREL			
w.e.f. 1.4.2008	Q	4100	Ex-works, bagged
	Q	3775	Ex-works, loose
	MK	3875	Ex-works, bagged
	MK	3550	Ex-works, loose
	OR	3225	Ex-works, loose
w.e.f. 9.1.2009	Q	4500	Ex-works, bagged
	Q	4175	Ex-works, loose
	MK	4275	Ex-works, bagged
	MK	3950	Ex-works, loose
	OR	4625	Ex-works, loose
w.e.f. 14.2.2009	Q	5100	Ex-works, bagged
	Q	4700	Ex-works, loose
	MK	4450	Ex-works, loose
w.e.f. 7.4..2009	Q	4700	Ex-works, bagged
	MK	4450	Ex-works, loose
	OR	5000	Ex-works, loose
w.e.f. 1.4.2010	Q	4700	Ex-works, loose
	MK	4450	Ex-works, loose
	OR	4000	Ex-works, loose
w.e.f. 1.5.2010	Q	6000	Ex-works, loose
	MK	5000	Ex-works, loose
	OR	4000	Ex-works, loose
w.e.f. 2.6.2010	Q	5300	Ex-works, loose
	MK	5000	Ex-works, loose
	OR	4000	Ex-works, loose
w.e.f. 11.2.2011	Q	5700	Ex-works, loose
	MK	5400	Ex-works, loose
	OR	4000	Ex-works, loose
w.e.f. 1.3.2010	Q	5700	Ex-works, loose
	MK	5400	Ex-works, loose
	OR	4250	Ex-works, loose
KMML			
2008-09	59.88% TiO_2	3427	–
2009-10	NA	NA	–
2010-11	NA	NA	–
V.V. Mineral (Average)			
2008-09	Not specified	2905	–
2009-10	Not specified	3009	–
2010-11	NA	5940	–
BMC			
2008-09	TiO_2 : 48-50%	4700 (US$100)	f.o.b.Thoothukudi
	TiO_2 : >51%	5640 (US$120)	
2009-10	TiO_2 : 48-50%	4050 (US$90)	f.o.b.Thoothukudi
	TiO_2 : >51%	4950 (US$110)	
2010-11	TiO_2 : 48-50%	4500 (US$100)	f.o.b.Thoothukudi
	TiO_2 : >51%	5400 (US$110)	
DCW Ltd			
2008-09	NA	4435	–
2009-10	NA	4825	–
2010-11	NA	6375	–

Source: *Department of Atomic Energy, Mumbai.*
Note: *Q: Quilon; MK: Manavalakurichi; OR: Odisha*

MINING & PROCESSING

Mining and processing of beach sand is carried out by the IREL, a Government of India undertaking, KMML, a Kerala State Government undertaking and two private sector producers; viz, M/s V. V. Mineral, Thoothukudi (Tamil Nadu) and M/s Beach Minerals Co. Pvt. Ltd, Kuttam (Tamil Nadu). IREL is exploiting beach sand deposits located at Chavara in Kerala, Gopalpur in Odisha and Manavalakurichi in Tamil Nadu.

At IREL, Chavara, beach washings are inadequate to meet the full requirement of the plant. The unit, therefore, has adopted wet mining operations involving use of two Dredge and Wet Concentrator (DWC) of 100 tph capacity each to exploit the inland deposits away from the beaches. Chavara ilmenite is richest in TiO_2 content (75.8% TiO_2) and has great demand in India and abroad for manufacture of pigments.

At Manavalakurichi, deposit is spread over 300 hectares at Thuthoor-Ezudesam villages, Vilavancode tehsil, Kanyakumari district, Tamil Nadu. All the raw sand required to operate the separation plant at its full capacity is collected from nearby beaches by the fishermen of surrounding villages and supplied to the unit at cost. Deposits are also exploited by DWC of 100 tph capacity. Manavalakurichi is next to Chavara in terms of TiO_2 content which is more than 55%.

The sand deposits of OSCOM at Chatrapur in Ganjam district extend along the coast of Bay of Bengal with an average width of 1.4 km and average depth of 7.5 m. Mining operations involve suction dredging to 6 m depth below water level on a much larger scale (500 tph) augmented by a smaller sized (100 tph) supplementary. The ilmenite from OSCOM is inferior in grade in terms of TiO_2 content (50%) in comparison to Chavara and Manavalakurichi. The Synthetic Rutile Plant of OSCOM is presently not working. As a result, the majority of OSCOM ilmenite produced today is finding its way in the international market as feed stock for production of both slag grade and anatase grade pigment.

In dry mining, beach washings laden with 40-70% Heavy Minerals (HM) are collected through front end loaders and bulldozers for further concentration to 90% HM at land-based concentrators. Dry mining is very simple and economic as well. However, it is facing opposition by local people on the ground that removal of sand causes sea erosion. Therefore, collection of beach washings has reduced significantly in recent past.

As an alternate approach, IREL has adoptped wet mining involving dredging and wet concentration (DWC) from inland areas away from the beach lines. In this mode, an artificial pond is created, the sand bed is cut and the slurry is pumped to spiral concentrator for removal of quartz. Manavalakurichi was the first plant to install a DWC (100 tph) followed by one (500 tph) at OSCOM and two (each 100 tph) at Chavara. The concentrate (90% HM) of beach washing plant from DWC is further upgraded to 97% HM grade at a Concentrate Upgradation Plant (CUP) before sending it to Mineral Separation Plant (MSP).

KMML collects seasonal accretions of heavy mineral sand from the beach front. The pit so formed gets filled by fresh accretions of heavy mineral sand. The mineral sand is collected using bulldozers and wheel loaders and transported in tippers to Mineral Separation Plant. In the Mineral Separation Unit Project of KMML, a new spiral concentrator was installed in 2008-09.

The mineral separation plants use variety of equipment such as gravity concentrators, high tension electrostatic separators and magnetic separators. Making use of difference in physical properties like electrical conductivity, magnetic susceptibility and difference in specific gravity, etc., individual minerals like ilmenite, rutile, zircon, sillimanite and garnet are separated. The mined beach sands are pre-concentrated and dried after sieving (30-mesh) to separate the heavies from rejects. The heavy minerals are passed through electrostatic separators where conducting minerals – ilmenite and rutile – are separated from other non-conducting minerals. Ilmenite and rutile are further subjected to low-intensity magnetic separators where magnetic fraction - ilmenite is separated from rutile. Similarly, non-conducting fractions are subjected to high-intensity magnetic separators where weakly magnetic fraction (monazite and garnet) is separated from non-magnetic fraction (zircon and sillimanite). The fractions are further processed on wind tables to separate garnet from monazite and sillimanite from zircon.

IREL carried out trial runs of expansion of capacity of ilmenite to 200,000 tonnes at Chavara plant in Kerala and has commissioned it successfully. The company has plans to expand MSP capacity at OSCOM to produce 5 lakh tonnes of ilmenite and associated minerals by the end of 2013. Trimex Group is understood to be gearing up to begin its 200,000 tpy ilmenite and 6,000 tpy rutile project in Srikakulam district, Andhra Pradesh.

Installed capacity and production of ilmenite, rutile and other associated heavy minerals by various separation plants are furnished in Table-6.

Table – 6 : Installed Capacity & Production of Ilmenite, Rutile and Other Heavy Minerals, 2008-09 to 2010-11

(In tonnes)

Company/ Location	Mineral	Specification	Installed capacity (tpy)	Production		
				2008-09	2009-10	2010-11
Indian Rare Earths Ltd						
Manavalakurichi,	Ilmenite	55% TiO_2 (min)	90000	69681	55542	43222
Kanyakumari dist.,	Rutile	94% TiO_2 (min)	4000	2368	1833	1628
Tamil Nadu.	Zircon	65% ZrO_2+HfO_2 (min)	10000	5813	4527	3542
	Sillimanite	58% Al_2O_3	–	270	67	150
	Monazite	96% pure	6000	–	–	–
	Garnet	97% pure (min)	8500	14527	13358	14909
Chavara,	Ilmenite	59% TiO_2 (min)	154000+	86403	89532	74320
Kollam dist.,	Rutile	95% TiO_2 (min)	10000	3859	3273	3556
Kerala.	Zircon	65% ZrO_2+HfO_2 (min)	12000	7772	8124	7500
	Rare Earths	–	4500*	22**	16**	NA
	Sillimanite	58% Al_2O_3 (min)	10000	10443	7935	8243
	Leucoxene	–	–	198	198	110
	Zirflor	-200 mesh -300 mesh	6000	1686	1444	918
	Microzir	1-3 micron	500	–	–	1627
Orissa Sands Complex,	Ilmenite	50.25% TiO_2 (min)	220000	200256	208781	206138
Ganjam dist., Odisha.	Rutile	94.25% TiO_2 (min)	10000	7629	8034	8044
	Zircon	64.25% ZrO_2+HfO_2 (min)	5000	5807	5906	5979
	Sillimanite	56.5% Al_2O_3 (min)	10000	13878	14117	17889
	Garnet	93.5% garnet (min)	24000	11455	11080	18474
Kerala Minerals & Metals Ltd						
Chavara,	Ilmenite	59.88% TiO_2	51600	42510	44300	38920
Kollam dist.,	Rutile	93.20% TiO_2	3400	2690	3335	2413
Kerala.	Zircon	64.81% ZrO_2	2500	2445	2592	2838
	Leucoxene	NA	300	–	–	–
	Monazite	NA	240	–	–	–
V.V. Mineral						
Thoothukudi,	Ilmenite	51.0-52.5% TiO_2	520000	215221	316200	372000
Tamil Nadu.	Rutile	95% TiO_2 (min)	(Total Heavy	2952	2100	6750
	Zircon	66% ZrO_2+HfO_2 (min)	Minerals)	7321	6900	13350
	Zircon-sillimanite	NA		-	7900	8200
	Garnet	NA	NA	-	NA	NA
Beach Minerals Co. Pvt. Ltd						
Kuttam, Tirunelveli dist., Tamil Nadu.	Ilmenite	KU grade 49-51% TiO_2	150000	61932	53000	34000

Source: *Department of Atomic Energy, Mumbai and IREL.*
** In terms of rare earths chloride.*
*** Mainly Rare Earths Fluoride, Cerium Oxide and Cerium Hydrate from conversion of Rare Earths Chloride.*
@ Besides, 7,900 tonnes production of zircon-sillimanite is also reported.
+ Expansion of capacity to 200,000 tonnes under trial runs was commissioned successfully.

INDUSTRY

For manufacture of titanium dioxide pigment, ilmenite is first treated chemically to obtain upgraded ilmenite, commonly called as synthetic rutile. There are two major pigment production processes namely chloride process and sulphate process depending on different operating characteristics and feedstock requirements. Plants employing chloride process consume high TiO_2 content feedstocks like synthetic rutile and chloride slag. On the other hand, plants employing the sulphate process use lower grade ilmenite and sulphate slags.

Ilmenite obtained from Mineral Separation Plant (MSP) is chemically treated to remove impurities such as iron to obtain synthetic rutile (90% TiO_2) in Synthetic Rutile Plant (SRP). Indian Synthetic Rutile Plants are based on reduction roasting followed by acid leaching with or without generation of hydrochloric acid. Plants of IREL (OSCOM) and KMML depend on acid regeneration from the leach liquor while those of Cochin Minerals & Rutile Ltd (CMRL) and DCW use fresh acid and recover ferric chloride from the leach liquor for its use in water purification.

At OSCOM plant of IREL, reduction-roasting of ilmenite with coal is followed by leaching with HCl to separate iron as soluble ferrous chloride. The leached ilmenite is calcined to yield synthetic rutile and the acidic leach liquor is treated in an acid regeneration plant to recover HCl for recycling with iron oxide as waste. The unit stopped production in 1997 as it was not viable economically.

The KMML is manufacturing rutile grade titanium dioxide pigment by chloride route at its Sankaramangalam plant near Chavara in Kerala. The project for the production of one lakh tonnes of TiO_2 in a phased manner is under implementation. The company also has plans to enhance pigment capacity to 60,000 tpy for which detailed project report is under preparation. In 2009, the company had developed Nano Titanium Dioxide particles on laboratory scale and in July 2011, India's first comercial plant for synthesis of nano-titanium dioxide was commissioned.

The DCW Ltd procures ilmenite from Manavalakurichi which is then roasted with coke fines to convert Fe_2O_3 into FeO. The reduced ore is leached with concentrated hydrochloric acid to remove oxides of iron and other metals. The leached ore is washed and calcined to get upgraded ilmenite which contains more than 95% TiO_2. The upgraded ilmenite is micronised to 2 microns by using high-pressure steam. This is marketed as Titox. The liquor from ilmenite leaching process contains fine TiO_2 particles and chlorides. The TiO_2 recovered by filtration & washing in filter presses is marketed as Utox. The company has plans to increase the capacity of plant to 36,000 tpy and also to install facilities for the manufacture of ferrite grade iron oxide from the effluent of the ilmenite plant.

Cochin Minerals and Rutile Ltd (CMRL), which began production at its 10,000 tpy synthetic rutile plant in Kerala in 1990 as a 100% EOU, has gradually raised the production capacity to around 45,000 tpy since 2008-09 for exports. It also has ferric chloride & ferrous chloride plants having capacities 24,000 tpy & 72,000 tpy, respectively.

The Travancore Titanium Products Ltd (TTPL), a Kerala State Govt. Undertaking, manufactures titanium dioxide pigment by sulphate process at its plant at Kochuveli, Thiruvananthapuram. Ilmenite is reacted with sulphuric acid in digesters and a porous cake is formed. The mass in the solid form is dissolved in dilute sulphuric acid to get titanium in solution as titanium oxysulphate along with other metallic ingredients in ilmenite as their sulphate. The liquor is reduced using scrap iron, when ferric iron gets completly reduced to the ferrous state. The liquor is clarified, concentrated and boiled to precipitate the titanium content as hydrated titania which is then filtered by vacuum filters and calcined. Sulphuric acid required for captive consumption is produced at site using elemental sulphur. Till recently TTPL was the only unit producing anatase grade titanium dioxide pigment in India. TTPL has proposals to expand its capacity to 27,000 tpy, modernise and diversify in stages to produce both anatase and rutile grades titanium dioxide pigment.

DCW Ltd has plans to expand the synthetic rutile capacity to 70,000 tpy after installation of Iron Oxide Plant. Iron oxide pigment will be a value-added product from waste leach liquor.

Tata Steel has proposed a project to produce 1,00,000 tonnes per year titanium dioxide from ilmenite mined from beach sands of Tirunelveli and Thoothukudi districts in southern Tamil Nadu.

The NMDC has signed an MoU with KSIDC and IREL for setting up a synthetic rutile plant in Kerala. The company has applied for prospecting licences in various areas in Odisha, Kerala and Tamil Nadu and sought Swedish technology for mineral separation plant. The Beach Minerals Co. Pvt. Ltd also has plans for production of synthetic rutile from ilmenite. Presently, it only has facility of pilot plant. M/s V. V. Mineral has plans to set up a 5 lakh tpy titanium pigment plant. The project is at approval stage.

Present domestic titanium metal production is negligible. KMML has set up a 500 tpy titanium sponge plant with Defence Metallurgical Research Laboratory (DMRL) technology and first batch of titanium was delivered in September 2011. The plant will be further expanded to 1,000 tpy. IREL is to set up a 10,000 tpy titanium sponge plant at OSCOM for which proposals have been invited on build, operate and own basis. IREL intends to set up titanium slag plant based on ilmenite from OSCOM, Odisha and has signed an MoU with NALCO for this purpose. Depending upon feasibility, further value addition to TiO_2 pigment and titanium sponge will be taken up subsequently. Titanium sponge is imported by Midhani for further processing in the country.

The available data on plantwise capacities & production of synthetic rutile and TiO_2 pigement from 2008-09 to 2010-11are given in Table-7. However, domestic production of synthetic rutile and TiO_2 pigment is estimated at 100,000 tpy and 60,000 tpy, respectively.

Table –7 : Installed Capacity and Production of Synthetic Rutile/Titanium Dioxide Pigement, 2008-09 to 2010-11

(In tonnes)

Plant	Location	Specification	Installed capacity (tpy)	Production		
				2008-09	2009-10	2010-11
Total			**243000** (Synthetic rutile)	**62169**	**70584**	**80936**
			75300 (TiO_2 Pigment)	**54145**	**61498**	**49586#**
IREL	Orissa Sands Complex, Dist. Ganjam, Odisha.	90.5% TiO_2 (min)	100000 (Synthetic rutile)	-	–	–
KMML	Chavara, Dist. Kollam, Kerala.	92%-93% TiO_2	50000 (Synthetic rutile)	NA	NA	NA
			40000@ (TiO_2-Chloride Process)	35486	35908	36879
DCW Ltd	Sahupuram, Dist. Thoothukudi, Tamil Nadu.	95% TiO_2	48000 (Synthetic rutile)	27566	36384	44761
CMRL	Edayar, Dist. Ernakulam, Kerala.	96.5% TiO_2	45000 (Synthetic rutile)	34603	34200	36175
TTPL	Kochuveli, Dist. Thiruvananthapuram, Kerala.	97.5% TiO_2	17500 (TiO_2-Sulphate Process)	7731	12686	12383
VVTi Pigments Pvt. Ltd* (formerly Kilburn Chemicals)	Thoothukudi, Tamil Nadu.	98% TiO_2 (min)	13000 (TiO_2-Sulphate Process)	10928	12460	NA
Kolmak Chemicals Ltd	Kalyani, Dist. Nadia, West Bengal.	NA	4800 (TiO_2-Sulphate Process)	Nil	444	324

Source: Department of Atomic Energy, Mumbai and individual companies.
Note: *KMML captively consumes synthetic rutile while CMRL and DCW export synthetic rutile.*
** Data relates to calendar year. @ Under expansion to 60,000 tpy capacity.*
 # Excluding Kilburn Chemicals.

USES

Ilmenite is used mainly for the manufacture of ferro-titanium and synthetic rutile; i.e., titanium dioxide, a white pigment. Because of a unique combination of its superior properties of high refractive index, low specific gravity, high hiding power and opacity and non-toxicity, titanium dioxide finds application for the manufacture of all types of white and pastle shades of paints, white-walled tyres, glazed papers, plastics, printed fabrics, flooring materials like linoleum, pharmaceuticals, soaps, face powders and other cosmetic products, etc. Because of its non-toxic nature, it is used in cosmetics, pharmaceuticals, and even added to foodstuffs as well as in toothpastes to improve their brightness. Titanium dioxide is used in the manufacture of many sunscreen lotions and creams because of its non-toxicity and ultra violet absorption properties. Synthetic rutile is used for coating welding electrodes as flux component and for manufacture of titanium tetrachloride which in turn is used in making titanium sponge. Synthetic rutile is also used as ingredient of special abrasives. Titanium metal is a versatile material with exceptional characteristics. The lightness, strength and durability of the metal make it an essential metal for the aerospace industry. It is also used in desalination and power generation plants and corrosive chemical industries because of its inertness and resistance to corrosion and high thermal conductivity. Its non-reactive property makes titanium metal one of the few materials that can be used in the human body for orthopaedic use and in pacemakers.

CONSUMPTION

The reported ilmenite consumption decreased to 189,900 tonnes in 2010-11 as compared to 208,900 tonnes in 2009-10. Bulk ilmenite was consumed for manufacturing synthetic rutile (99.7%), followed by ferro-alloys and welding electrode industry. The reported consumption of rutile in 2010-11 was 18,700 tonnes compared to 18,600 tonnes in 2009-10. Bulk consumption was in paint industry followed by electrode industry. In 2010-11, the reported consumption of ferro-titanium was 1,250 tonnes. About 82% consumption was in iron and steel industry and 18% in alloy steel and foundry industries (Table - 8).

Table – 8 : Consumption of Ilmenite, Rutile and Ferro-Titanium, 2008-09 to 2010-11 (By Industries)

(In tonnes)

Industry	2008-09	2009-10(R)	2010-11(P)
ILMENITE			
All Industries	**116300**	**208900**	**189900**
Electrode	300(5)	300(5)	300(5)
Ferro-alloys	300(3)	300(4)	300(4)
Iron & Steel	800(1)	–(1)	–(1)
Paint	++(2)	++(2)	++(2)
Refractory	++(1)	++(1)	++(1)
Synthetic rutile (Chemical)	114900(4)	208300(5)	189300(5)
RUTILE			
All Industries	**18300**	**18600**	**18700**
Electrode	1700(12)	1700(12)	1700(12)
Paint	16100(10)	16300(10)	16400(11)
Paper	300(3)	300(3)	300(3)
Others (Cosmetic, electrical, rubber)	200(13)	300(13)	300(13)
FERRO-TITANIUM			
All Industries	**1284**	**1117**	**1250**
Alloy steel & foundry	244(7)	154(7)	220(7)
Iron & steel	1040(8)	963(9)	1030(9)

Figures rounded off. Data collected on non-statutory basis. Figures in parentheses denote the number of units in organised sector reporting consumption. (*Includes actual reported consumption and/or estimates made wherever required).*

POLICY

The Government of India had notified in October 1998, a policy on exploitation of beach sand minerals in the country, which inter alia allows participation of private sector with or without foreign companies subject to conditions stipulated. This will encourage further exploitation of mineral deposits through a judicious mix of public & private sector participation including foreign collaboration. The ceiling on FDI on mining of titanium minerals has been raised to 100 percent.

Joint ventures with foreign participation were being pursued by IREL for production of value-added products, keeping in view the Beach Sand Mineral Policy of the Government.

The minerals ilmenite and rutile were grouped as 'prescribed substances' as per notifications issued under the Atomic Energy Act, 1962. However, as per the revised list of Prescribed Substances, Prescribed Equipment and Technology notified by Department of Atomic Energy vide S.O.No.61(E), dated 20.1.2006, the titanium ore minerals like ilmenite, rutile and leucoxene have been delisted as prescribed substances by the Department of Atomic Energy subject to the note as below:

"These minerals shall remain prescribed substances only till such time the policy on Exploration of Beach Sand Minerals notified vide Resolution No.8/1(1)/97-PSU/1422, dated 6.10.1998, is adopted/revised/modified by the Ministry of Mines or till 1.1.2007, whichever occurs earlier and shall cease to be so thereafter".

As per the Foreign Trade Policy, 2009-2014 and the policy on export and import, titanium ores and concentrates under heading 2614 (comprising ilmenite unprocessed and upgraded; i.e., beneficiated ilmenite including ground ilmenite) and rutile sand can be imported/exported freely.

SUBSTITUTES

There are no cost-effective substitutes for titanium dioxide pigments. Synthetic rutile made from ilmenite can be substituted for natural rutile. Nickel steels, stainless steels and some non-ferrous metal alloys can sometimes replace titanium alloys in industrial uses although at the expense of performance or economics. Tungsten carbide competes with titanium carbide for surface cutting machine tools. Titanium slag competes with ilmenite and rutile.

Environmental awareness indicates that titanium dioxide plants are likely to use chloride technology in future as it produces much less quantity of waste products. Synthetic rutile or slag (made from ilmenite) is likely to be used as feed in increasing amount. There is also a strong pressure to reduce the radioactive content of feed stocks because it affects the marketability of beach sand ilmenite. Titanium alloys may be replaced in aerospace applications by lithium-aluminium alloys or carbon-epoxy composites.

WORLD REVIEW

World resources of anatase, ilmenite and rutile are more than 2 billion tonnes. World reserves of ilmenite are estimated at 650 million tonnes in terms of TiO_2 content. Major reserves are in China (31%), Australia (15%), India (13%), South Africa (10%), Brazil (7%), Madagascar and Norway (6% each) and Mozambique (2%). The world reserves of rutile are 42 million tonnes in terms of TiO_2 content. Major rutile reserves are located in Australia (43%), followed by South Africa (20%), India (18%), Siera Leone (9%) and Ukraine (6%).

World production of ilmenite and rutile concentrates was 10.3 million and 0.8 million tonnes, respectively, in 2010. Canada contributed 23% of ilmenite production, followed by Australia (13%) and South Africa (12%) . Australia produced 54% of world rutile output, followed by South Africa with 17% and Ukraine 13%. World reserves and production of titanium minerals; viz, ilmenite and rutile, are furnished in Tables - 9 to 11, respectively.

Table – 9 : World Reserves of Ilmenite and Rutile (By Principal Countries)

(In '000 tonnes of contained TiO_2)

Country	Reserves	
	Ilmenite	Rutile
World: Total (Ilmenite+Rutile) : 690000		
World : Total (Rounded)	**650000**	**42000**
Australia	100000	18000
Brazil	43000	1200
Canada	31000	–
China	200000	–
India*	85000	7400
Madagascar	40000	–
Mozambique	16000	480
Siera Leone	–	3800
Norway	37000	–
South Africa	63000	8300
Ukraine	5900	2500
USA	2000	@
Vietnam	1600	–
Other countries	26000	400

***Source**: Mineral Commodity Summaries, 2012*

@ *Included with ilmenite..*

* *As per the NMI Unit,IBM, the total resources of titanium minerals in India are estimated at about 394 million tonnes.*

Table – 10 : World Production of Ilmenite (By Principal Countries)

(In '000 tonnes)

Country	2008	2009	2010
World: Total (wt. of concs)	**11100**	**10000**	**10300**
All form of TiO_2(e)	**5900**	**5400**	**5700**
Australia Ilmenite	2060	1626	1313
Leucoxene	126	137	160
Canada e#@	2600	2000	2400
China(e)	1080	900	1000
India*	676	680	680
Mozambique	329	471	678
Norway	915	671	864
South Africa	1360	1445	1200e
Ukraine(e)	600	600	600
USA(e)	200	200	200
Other countries	1154	1270	1205

***Source**: World Mineral Production, 2006-2010.*

***Note**: Some ilmenite is converted to synthetic rutile in Australia, India, Japan, Taiwan and USA.*

@ *Canada produces some ilmenite which is sold as such and not processed into slag; but tonnages are small.*

* *India's production of ilmenite in 2008-09, 2009-10 and 2010-11 was 588,127 tonnes, 713,605 tonnes and 663,217 tonnes, respectively.*

Table – 11 : World Production of Rutile (By Principal Countries)

(In '000 tonnes)

Country	2008	2009	2010
World: Total (wt. of concs)	**700**	**634**	**800**
Australia	318	302	430
India*	19	20e	20e
South Africa(e)	132	134	135
Sierra Leone	79	64	68
Ukraine(e)	100	100	100
Other countries	52	14	47

***Source**: World Mineral Production, 2006-2010.*

* *India's production of rutile in 2008-09, 2009-10 and 2010-11 was 19,098 tonnes, 18,573 tonnes, and 26,593 tonnes, respectively.*

World production of TiO_2 contained in titanium mineral concentrates increased by 13% compared with that of 2009. The leading sources of world imports of titanium mineral concentrates were Australia, Canada, and South Africa.

Metal

Commercial production of titanium metal involves the chlorination of titanium-containing mineral concentrates to produce titanium tetrachloride ($TiCl_4$), which is reduced with magnesium (Kroll process) or sodium (Hunter process) to form a commercially pure form of titanium metal. As the metal is formed, it has a porous appearance and is referred to as sponge. Titanium ingot and slab are produced by melting titanium sponge or scrap or a combination of both, usually with various other alloying elements.

Pigment

Global TiO_2 pigment production capacity was estimated to be 5.7 million tonnes per year. TiO_2 pigment produced by either process is categorised by crystal form as either anatase or rutile. Rutile pigment is less reactive with the binders in paint when exposed to sunlight than is the anatase pigment and is preferred to use in outdoor paints. Anatase pigment has a bluer tone than rutile, is somewhat softer, and is used mainly in indoor paints and in paper manufacturing. Depending on the manner in which it is produced and subsequently finished, TiO_2 pigment can exhibit a wide range of functional properties, including dispersion, durability, opacity, and tinting.

Australia

Matilda Zircon Ltd continued development of heavy-minerals deposits in the Northern Territory and Western Australia. Matilda Zircon will supply Tricoastal Minerals Co. of China all heavy-mineral concentrate in exchange of assistance in development of the Lethbridge Mine, which began production in 2010. Mining at Keysbrook was expected to begin by 2010-end after approval from Western Australian Environment Ministry. Tiwest Pty Ltd commissioned a 40,000 tpy expansion project at its Kwinana TiO_2 pigment plant in Western Australia, raising production capacity to 150,000 tpy.

Gunson Resources Ltd completed a feasibility study for its Coburn heavy minerals project in Western Australia. Diatreme Resources Ltd was conducting exploration and prefeasibility studies of its heavy mineral deposits in the Eucla Basin, also in Western Australia. Astron Ltd's Donald mining project was approved by the Industries Department of Victoria, and mine and plant designs were completed during the year.

Canada

Titanium Corp. commissioned a demonstration pilot plant at Canmet testing facilities of the Canadian Government in Devon, Alberta. Pilot studies were conducted during 2010. Additional studies are planned for 2011. Argex Mining Inc. was proceeding with exploration and development of its La Blahe titaniferous magnetite project near Bai-Comeau in Quebec.

Chile

White Mountain Titanium Corp. (WMT) conducted drilling and pilot plant feasibility studies at its Cerro Blanco rutile deposit in 2010. In 2011, WMT was to conduct a final engineering feasibility study for a 5 to 6 million tpy mining operation.

China

As per the Chinese Titanium Association, the top 14 titanium sponge producers increased production capacity to 103,500 tpy in 2010 and produced 57,800 tonnes sponge, 42% more than that in 2009. China's ingot and mill products production capacity also increased. Increased consumption of titanium concentrates was supplemented by increased imports of titanium concentrates. In 2010, China's imports of titanium concentrates rose to 2.04 million tonnes from 1.07 million tonnes in 2009.

Chinese authorities approved Panzhihua Group's plans to develop vanadium and titanium deposits in Sichuan Province. Panzhihua planned to increase production capacity of titanium mineral concentrates to 500,000 tpy, TiO_2 pigment to 200,000 tpy and titanium sponge to 15,000 tpy.

Japan

Toho Titanium Co. Ltd expanded its titanium sponge production capacity to 25,200 tpy and completed construction of a new 12,000 tpy plant at Wakamatsu in Fukuoka. OSAKA Titanium technologies Co. Ltd restarted plans to increase capacity at its Amagasaki titanium sponge plant to 38,000 tpy.

Kazakhstan

Ust-Kamenogorsk Titanium-Magnesium Plant (UKTMP) is the sole producer of titanium sponge in Kazakhstan. It commissioned a new 16,000 tpy capacity VAR ingot production plant producing commercially pure and alloy ingot in 2010 in eastern Kazakhstan.

Madagascar

QIT Madagascar Minerals SA (QMM) was ramping up its 700,000 tpy capacity mineral sands project near Mutamba. In 2010, QMM produced 287,000 tonnes ilmenite and planned to produce 473,000 tonnes in 2011.

Mozambique

Kenmare Resources plc was increasing heavy minerals production at its Moma operation to capacity. At 2010-end, Kenmare was proceeding with another expansion plan to increase production capacity by about 50%.

Norway

Nordic Mining ASA was developing a rutile-bearing eclogite deposit at Engebøfjellet in Sogn and Fjordane County.

Russia

ARZM Uranium Holding Co. continued development of the Lukoyanovskoye heavy minerals sands deposit near Nizhny Novgorod. By 2014, the company planned to begin producing up to 35,000 tpy ilmenite and 5,000 tpy rutile. VSMPO-AVISMA Corp. has resumed plans to increase titanium sponge production capacity to 44,000 tpy by 2015.

Senegal

A feasibility study of Mineral Deposits Ltd's Grande Cote heavy minerals deposit was completed in 2010. Construction of the mine and separation plants was expected to begin in 2011 and initial production was scheduled for 2013. On commissioning, the company expected to produce an average of 575,000 tpy ilmenite, 80,000 tpy zircon, 11,000 tpy leucoxene and 6,000 tpy rutile.

Sierra Leone

Titanium Resources Group Ltd (TRG) (now renamed Sierra Rutile Ltd) had plans to expand its production. The expansion was expected to be completed in 2011 followed by a significant increase in production in 2012 as a result of the completion of process improvements.

South Africa

Rio Tinto's tailings treatment facility at Richards Bay Minerals heavy minerals operation was nearing completion in 2010-end and was scheduled to begin production in early-2011. The facility will recover heavy mineral concentrates, including ilmenite and rutile from about 30 years' accumulation of mine tailings.

Ukraine

Velta LLC plans to begin production at the Birzulvovske mining operation near Korobchino, Kirovograd Oblast in 2012 with initial capacity of 180,000 tpy ilmenite.

FOREIGN TRADE

Exports

As per the data from DGCI&S, exports of titanium ores & conc. rose to 1.89 million tonnes in 2010-11 as compared to 0.46 million tonnes in the preceding year. Exports in 2010-11 comprised almost entirely ilmenite. Besides, rutile (3,688 tonnes) and other titanium ores (3,564 tonnes) were also exported. Main destinations were China (67%), Japan (17%) and Netherlands (6%).

Exports of titanium and alloys (including waste & scrap) were 216 tonnes in 2010-11 as compared to 90 tonnes in the previous year. Exports were mainly to USA and UK. Exports of tiatinum oxide and dioxide (total) increased to 57,999 tonnes in 2010-11 from 28,142 tonnes in 2009-10. Out of total exports in 2010-11, those of titanium dioxide were 6,868 tonnes and other titanium oxides were 51,131 tonnes . Exports were mainly to Japan (34%), Singapore (33%) and China (15%) (Tables-12 to 19).

Imports

As per the data from DGCI&S, imports of titanium ores & conc. rose sharply to 66,759 tonnes in 2010-11 as compared to 32,104 tonnes in the preceding year. Out of total imports of titanium ores & conc. in 2010-11, those of ilmenite were 48,747 tonnes, rutile 13,390 tonnes and other titanium ores were 4,622 tonnes. Main suppliers were Mozambique (67%) and Australia (17%).

Imports of titanium and alloys (including waste & scrap) were 822 tonnes in 2010-11 as compared to 1,745 tonnes in the previous year. Imports were mainly from Japan, China, USA and Russia. Imports of titatinum oxide and dioxide (total) were 18,694 tonnes in 2010-11 as compared to 15,453 tonnes in the preceding year. Bulk of these imports were of titanium dioxide (18,295 tonnes) and those of other oxides were 399 tonnes in 2010-11. Imports were mainly from China (24%), USA (18%), Germany (13%), Rep. of Korea (11%) and Czech Republic (6%) (Tables - 20 to 27).

Table – 12 : Exports of Titanium Ores & Conc. : Total (U)

(By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹ '000)
All Countries	**464947**	**2526109**	**1893721**	**9678965**
China	249174	940461	1277686	6166717
Japan	56767	852670	326561	2045138
Netherlands	102424	407606	114049	519022
Malaysia	-	-	68258	318027
Korea, Rep. of	34980	121309	56380	208854
Poland	12500	57744	40240	194162
Singapore	4120	123037	2338	69896
Iran	26	786	1140	35900
Bangladesh	20	827	823	31477
Germany	4900	19849	4134	28694

Source: *DGCI & S, Kolkata.*
(U): Under Reference

Table – 13 : Exports of Titanium Ores & Conc. (Ilmenite) (U)

(By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**463625**	**2506478**	**1886469**	**9517746**
China	248156	932434	1274808	6148480
Japan	56725	851783	326558	2044512
Netherlands	102424	407606	113860	512555
Malaysia	-	-	68230	317044
Korea, Rep. of	34800	114018	56260	203452
Poland	12500	57744	40240	194162
Singapore	4120	123037	2338	69896
Germany	4900	19849	4032	24630
Nepal	-	-	14	2058
Chinese Taipei/ Taiwan	-	-	52	467
Other countries	++	7	77	490

Source: *DGCI & S, Kolkata.*
(U): Under Reference

Table – 14 : Exports of Titanium Ores & Conc. (Rutile) (U)

(By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**382**	**14399**	**3688**	**132424**
Iran	26	786	1140	35900
Bangladesh	20	827	814	31101
Ukraine	-	-	441	18037
Philippines	-	-	420	14998
Netherlands	-	-	189	6467
Saudi Arabia	3	137	196	6311
Korea, Rep. of	180	7291	120	5401
Germany	-	-	102	4064
Kenya	7	301	74	3069
UAE	2	60	85	2582
Other countries	144	4997	107	4494

Source: *DGCI & S, Kolkata.*
(U): Under Reference

Table–15 : Exports of Titanium Ores & Conc. (Others) (U) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**940**	**5232**	**3564**	**28795**
China	918	3930	2850	17202
Russia	-	-	140	6067
Thailand	-	-	480	2295
Ukraine	-	-	48	1900
Japan	++	107	3	626
Bangladesh	-	-	9	376
Brazil	-	-	24	263
Indonesia	-	-	10	65
Other countries	22	1195	++	1

Source: *DGCI & S, Kolkata.*
(U): Under Reference

Table–16 : Exports of Titanium & Alloys (Incl. Waste & Scrap) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**90**	**382639**	**216**	**185647**
Thailand	2	3438	15	43037
U S A	++	2500	95	32961
Norway	3	37677	2	20999
U K	1	6527	61	20812
Philippines	++	3594	1	15799
South Africa	++	371	29	7974
Brunei	++	927	++	6207
Saudi Arabia	14	107219	2	5662
Singapore	4	22024	2	5459
UAE	4	9526	3	4046
Other countries	62	188836	6	22691

Source: *DGCI & S, Kolkata.*

Table–17 : Exports of Titanium Oxide & Dioxide : Total (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**28142**	**1330398**	**57999**	**2426518**
Japan	8649	352356	19464	646630
Singapore	10700	317665	18876	561291
China	1281	39753	8480	254182
Turkey	78	4844	1573	195700
Italy	952	99069	1100	133415
USA	2245	157760	1529	121060
Chinese Taipei/ Taiwan	++	25	3157	115722
Spain	517	53012	640	84581
Germany	++	14	568	73569
UAE	175	22918	605	62727
Other countries	3545	282982	2007	177641

Source: *DGCI & S, Kolkata.*

Table–18 : Exports of Titanium Dioxide (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**5941**	**579449**	**6868**	**809501**
Turkey	17	1097	1420	186741
Italy	844	87174	974	117802
Japan	1058	103341	781	86294
Spain	517	53012	620	83905
Germany	-	-	568	73508
UAE	169	22530	575	59874
U S A	1243	92881	437	37558
Singapore	300	28831	344	30833
Iran	662	69876	224	24673
Portugal	-	-	120	15101
Other countries	1131	120707	805	93212

Source: *DGCI & S, Kolkata.*

Table–19 : Exports of Titanium Oxides (Other than Titanium Dioxide) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**22201**	**750949**	**51131**	**1617017**
Japan	7591	249015	18683	560336
Singapore	10400	288834	18532	530458
China	1241	35468	8460	251606
Chinese Taipei/Taiwan	-	-	3157	115722
USA	1002	64879	1092	83502
Malaysia	624	36140	520	32351
Italy	108	11896	126	15612
Nigeria	142	4185	204	9680
Turkey	61	3745	153	8960
Brazil	-	-	120	4015
Other countries	1032	56787	84	4775

Source: *DGCI & S, Kolkata.*

Table–20 : Imports of Titanium Ores & Conc. : Total (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**32104**	**747639**	**66759**	**861652**
Australia	9918	331457	11550	358684
Mozambique	8505	44581	44578	266494
Sri Lanka	4999	81946	3818	62253
South Africa	1166	39217	1721	60318
Ukraine	3564	131377	1616	57617
Malaysia	488	10804	1998	13118
Vietnam	970	27959	450	11811
China	-	-	309	10799
Sierra Leone	558	20811	248	8324
Saudi Arabia	-	-	125	4273
Other countries	1936	59487	346	7961

Source: *DGCI & S, Kolkata.*

Table–21 : Imports of Titanium Ores & Conc. (Ilmenite) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**11137**	**68649**	**48747**	**287449**
Mozambique	8505	44581	44578	266494
Malaysia	42	1009	1950	12039
Sri Lanka	2080	7560	2219	8916
Other countries	510	15499	-	-

Source: *DGCI & S, Kolkata.*

Table–22 : Imports of Titanium Ores & Conc. (Rutile) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**15239**	**527866**	**13390**	**432741**
Australia	7747	264707	9266	289832
Sri Lanka	1436	52157	1425	47608
South Africa	828	28852	1229	44417
Ukraine	3160	117681	595	25054
Sierra Leone	558	20811	248	8324
Vietnam	645	18811	250	6527
China	-	-	154	5179
Saudi Arabia	-	-	125	4273
Malaysia	374	8657	48	1079
Germany	-	-	50	419
Other countries	491	16190	++	29

Source: *DGCI & S, Kolkata.*

Table–23 : Imports of Titanium Ores & Conc. (Others) (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**5728**	**151124**	**4622**	**141462**
Australia	2009	62133	2284	68852
Ukraine	404	13696	1021	32563
South Africa	314	9575	492	15901
Sri Lanka	1483	22230	174	5728
China	-	-	155	5620
Vietnam	325	9148	200	5284
Thailand	1046	31031	141	2892
UAE	75	2173	50	1216
Canada	-	-	26	873
Unspecified	-	-	56	1837
Other countries	72	1138	23	696

Source: *DGCI & S, Kolkata.*

Table–24 : Imports of Titanium & Alloys (Incl. Waste & Scrap) (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**1745**	**3069414**	**822**	**1135500**
China	158	195326	224	226013
USA	473	524724	78	204967
Japan	665	1385706	254	194795
Ukraine	6	13162	35	155480
Russia	118	167780	64	86906
Belgium	3	2373	17	58999
France	209	509963	12	37497
UK	35	74549	16	32201
Italy	30	96013	32	29434
Germany	12	25557	13	22058
Other countries	36	74261	77	87150

Source: *DGCI & S, Kolkata.*

Table–25 : Imports of Titanium Oxide & Dioxide: (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**15453**	**1691888**	**18694**	**2148503**
USA	2812	323938	3416	432564
China	1918	147842	4344	392807
Germany	2361	335215	2510	337573
Korea, Rep. of	2237	222724	1984	204507
Japan	600	90157	871	134008
Czech Republic	1339	143129	1163	123491
Australia	645	70849	773	93013
Chinese Taipei/Taiwan	522	58000	566	71122
Malaysia	642	66809	506	61048
Singapore	501	56049	435	52326
Other countries	1876	177176	2126	246044

Source : *DGCI & S, Kolkata.*

Table–26 : Imports of Titanium Dioxide (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**15174**	**1656308**	**18295**	**2093764**
USA	2771	318532	3356	424521
China	1917	143888	4343	389550
Germany	2289	323630	2426	324789
Korea, Rep. of	2237	222647	1964	202791
Japan	596	85506	868	132145
Czech Republic	1339	143129	1163	123491
Australia	645	70849	763	91709
Chinese Taipei/Taiwan	522	58000	546	68404
Malaysia	642	66809	506	61048
Singapore	500	54770	435	52320
Other countries	1716	168548	1925	222996

Source: *DGCI & S, Kolkata.*

Table–27 : Imports of Titanium Oxides (Other than Titanium Dioxides) (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**279**	**35580**	**399**	**54739**
France	-	-	111	19627
Germany	72	11585	84	12784
USA	41	5405	60	8043
China	1	3954	1	3257
Italy	120	4918	88	3066
Chinese Taipei/Taiwan	-	-	20	2718
Japan	4	4651	3	1863
Korea, Rep. of	++	77	20	1715
Australia	-	-	10	1304
UK	++	37	1	185
Other countries	41	4953	1	177

Source: *DGCI & S, Kolkata.*

FUTURE OUTLOOK

The major chunk of consumption of ilmenite is for the manufacture of synthetic rutile. The future demand of ilmenite during the 12th Plan Period at the GDP growth rate of 8%, 9% and 10% is estimated at 3.19 lakh, 3.27 lakh and 3.35 lakh tonnes, respectively, as per the Report of Working Group on Mineral Exploration and Development (other than coal & lignite) for the 12th Five Year Plan (2012 - 17); Planning Commission of India.

Demand for rutile for next five years is projected at 44,000 tpy to 45,000 tpy as per the GDP growth rate of 8%, 9% and 10%. The production projected is 30,000 tpy as per the Working Group.

The Working Group has observed that no substantial progress in exploration activities for Beach Minerals was witnessed during the 11th Plan and has stressed on the need to take substantive steps to develop beach sand reserves of the country to its full potential by adopting suitable exploration strategy with modern techniques.

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

IRON & STEEL AND SCRAP

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

48 Iron & Steel and Scrap

Steel is decidedly the vital component of a country's economy and is considered as the crux of modernisation. The level of per capita consumption of steel is treated as one of the important indicators of socio-economic development and living standards in any country. Steel continues to be the foremost engineering material, environment-friendly and is recyclable.

The finished steel production in India has grown from a mere 1.1 million tonnes in 1951 to 66.01 million tonnes in 2010-11. The growth in the steel sector in the early decades after independence was mainly in the public sector units. However, following the adoption of new economic policy and subsequent deregulation and decontrol of Indian Iron & Steel Sector, the 1990's witnessed accelerated growth in the private sector, catapulting its share of finished steel from 45% in 1992-93 to 80.1% in 2010-11.

Steel exports from India began in 1964. Exports in the first five years were mainly as a result of recession in the domestic Iron and Steel market. Exports subsequently declined due to revival of domestic demand. India once again started exporting steel in 1975 only to witness slump in exports again due to rising domestic demand. Post liberalisation, a rejuvenation in the steel sector, resulted in large-scale exports of iron and steel. In 1991-92, the main producers exported 3.87 lakh tonnes iron & steel as against 10.17 million tonnes in 2010-11 including finished steel exports of 5.1 million tonnes. Though the country's production of iron & steel is sufficient to meet the domestic demand, it imports mainly finished/semi- finished steel and iron & steel (scrap) to meet requirements of supply of essential grades.

Liberalisation of the Indian Steel Sector

The Government's new economic policies have opened up opportunities for expansion of the Steel Industry. With a view to accelerating growth in the steel sector, the Government since 1991 has been initiating and implementing a number of policy measures. These measures have impacted the Indian steel sector to achieve a positive growth.

NATIONAL STEEL POLICY-2005

The National Steel Policy (NSP) was announced in 2005. The salient features of the NSP 2005 are as under:

1. The NSP has set a target of 110 million tonnes of domestic steel production by 2019-20. This would require about 190 million tonnes iron ore. To meet the additional iron ore requirement, the Government plans to take the following steps:

   (a) Create additional mining capacity of 200 million tonnes iron ore.

   (b) Encourage investments totalling to about ₹ 20,000 crore.

   (c) Ensure that clearances from authorities of Environment & Forest be obtained within a specified time frame.

   (d) To make investment plans for large number of iron ore leases which are idle.

   (e) Renewal of existing leases only against credible mining investment plans.

   (f) Grant of fresh leases only against new norms and stringent assessment of technical and financial capabilities of the applicants.

   (g) Restrictions on long-term exports of iron ore to a maximum of 5-year contract.

   (h) Encourage sintering and pelletisation so as to use fines which make up about 90% of the present exports.

2. Projections for requirement of coking coal and non-coking coal were fixed at 70 million tonnes and 20 million tonnes, respectively, to achieve the target steel production. The NSP has recommended first priority to the Steel and Sponge Iron Industry in allocation of higher grade (below 12% ash content) non-coking coal. The policy makes it clear that 85% of the requirement of coking coal will have to be imported. Further, reduced rate of production of non-coking coal would necessitate import of non-coking coal as well for utilisation in the steel sector. The coal shortages have prompted the NSP to call for a constant review of allocation and pricing of natural gas as a suitable alternative.

3. The NSP assumes that 60% of the new steel capacity would come up through blast furnace route, 33% through sponge iron & EAF route and 7% through other routes. Sponge iron units are expected to increase capacity from 13 million tonnes at present to 38 million tonnes by 2020, especially in Jharkhand and Odisha. The NSP envisages a judicious blend of exports and domestic supply of steel.

4. The NSP also seeks the upgradation and modernisation of the refractory industry.

5. The NSP seeks to examine and formulate corrective measures to obtain fiscal incentives which are usually available to other infrastructure projects as also the rationalisation of customs and excise duty structure for reducing the fiscal and revenue deficits.

6. NSP 2005 is presently under review and Ministry of Steel has formulated a Committee in May, 2012 to review the existing National Steel Policy 2005.

STRUCTURE AND ROLE OF INDIAN STEEL INDUSTRY

India has risen to the 4th position as largest crude steel producing country in the world in 2010-11. The Indian Steel Industry comprises integrated steel plants in the primary sector using BF-BOF route of iron & steel production. In the primary sector, there are 13 integrated steel plants in the public and private sectors.

The secondary sector constitutes Electric Arc Furnace/Induction Furnace, pig iron/sponge iron units, re-rolling units, HR units, CR units, galvanised/colour coated units, tin plate units, wire-drawing units, etc. for producing either semi-finished or finished steel.

Traditionally, Indian steel industry was classified into Main Producers (SAIL plants, Tata Steel and Vizag Steel of RINL) and Secondary Producers. However, with the coming up of larger capacity steel making units of different process routes, the classification has been characterised as Main Producers & Other Producers. Other Producers comprise Major Producers, namely, Essar Steel, JSW Steel and Ispat Industries as well as large number of Mini Steel Plants based on Electric Furnaces & Energy Optimising Furnaces (EOF). Besides, the steel producing units, there are a large number of Sponge Iron Plants, Mini Blast Furnace units, Hot & Cold Rolling Mills & Galvanising/Colour Coating units which are spread across the country.

The structure of the Indian Steel Industry in 2010-11 is given in Table-1. Production of iron & steel by main producers and others during 2006-07 to 2010-11 is furnished in Table-2 and by public/private sector in Table-3. The details on plantwise capacity and production of hot metal and crude/liquid steel are given in Table-4. Table-5 elucidates the production of crude/liquid steel by BOF and EAF/IF routes. Prices of steel are provided in Table-6.

Table – 1 : Structure of the Indian Steel Industry, 2010-11

(In million tonnes)

Sector	Type of units	Working		Non-working		Total		Production	
		No. of units	Annual capacity	No. of units	Annual capacity	No. of units	Annual capacity	2009-10	2010-11(P)
Primary (Crude/Liquid/Steel)	Integrated plants (Oxygen route)	13	35.55	–	–	13	35.55	29.83	31.05
Secondary	Electric Arc Furnace (EAF)	38	17.99	1	0.05	39	18.04	16.18	16.46
	Induction Furnace (IF)	1114	24.40	–	–	1114	24.40	19.83	22.07
	Pig iron	>19	+4.83	–	–	>19	+4.83	5.88	5.54
	Sponge iron	324	30.09	NA	NA	324	30.9	24.32	26.71
	HR (sheets/strips/plates rerolling units)	1720	30.98	568	4.21	2288	35.19	NA	NA
	HR steel (sheets, strips, plates units)	12	14.39	–	–	12	14.39	16.03	NA
	CR Mills (sheets & strips)	65	9.55	–	–	65	9.55	5.91	5.76
	Steel wire drawing units	35	0.71	65	0.73	100	1.44	NA	NA
	GP/GC/PVC - coated sheets/strips	20	5.06	–	–	20	5.06	5.62	5.60
	Tin plate	1	0.10	2	0.11	3	0.21	0.24	0.23

Source: *Annual Report of Ministry of Steel, 2011-12.*

Table – 2 : Production of Iron and Steel, 2006-07 to 2010-11

(In '000 tonnes)

Item/producers	2006-07	2007-08	2008-09	2009-10	2010-11(P)
I. Pig Iron : Total	**4993**	**5314**	**6207**	**5884**	**5541**
Main Producers	860	936	589	731	579
Other Producers	4133	4378	5618	5153	4962
II. Sponge Iron : Total	**18345**	**20376**	**21091**	**24326**	**26709**
Gas Based	5265	5845	5516	6148	5794
Coal Based	13080	14531	15575	18178	20915
III. Crude Steel : Total	**50817**	**53857**	**58437**	**65839**	**69575**
Main Producers	21868	21789	21755	22969	23544
ASP + VISL	309	315	263	308	308
Other Producers					
EAF Units (Including Corex & MBF/EOF)	13250	14820	18365	22738	23655
Induction Furnaces	15390	16933	18054	19824	22068
IV. Finished Steel for Sale (Alloy/Non-alloy) : Total	**52529**	**56075**	**57164**	**60624**	**66013**
Main Producers	17614	18020	17216	18038	18280
Other Producers	40047	43332	46229	51093	57461
Less: Inter Plant Transfer/Own Consumption	5132	5277	6281	8507	9728

Figures rounded off.
Source: *Ministry of Steel, Annual Report, 2010-11 and 2011-12.*
EAF: Electric Arc Furnace, MBF: Mini Blast Furnace, EOF: Energy Optimising Furnace.

Table – 3 : Production of Iron and Steel, 2006-07 to 2010-11
(By Sectors)

(In '000 tonnes)

Item/producers	2006-07	2007-08	2008-09	2009-10	2010-11(P)
I. Pig Iron : Total	**4993**	**5314**	**6207**	**5884**	**5541**
Public Sector	860	936	589	731	579
	(17.2%)	(17.6%)	(9.5%)	(12.4%)	(10.4%)
Private Sector	4133	4378	5618	5153	4962
	(82.8%)	(82.4%)	(90.5%)	(87.6%)	(89.6%)
II. Crude/Liquid Steel : Total	**50817**	**53857**	**58437**	**65839**	**69575**
Public Sector	17003	17091	16372	16714	16996
	(33.5%)	(31.7%)	(28.01%)	(25.4%)	(24.41%)
Private Sector	33814	36766	42065	49125	52579
	(66.5%)	(68.3%)	(71.98%)	(74.6%)	(75.6%)
III. Finished Steel for Sale (Alloy/Non-alloy) : Total	**52529**	**56075**	**57164**	**60624**	**66013**
Public Sector	13176	13521	12673	13018	13123
	(25.1%)	(24.1%)	(22.2%)	(21.5%)	(19.9)
Private Sector	39353	42554	44491	47605	52890
	(74.9%)	(75.9%)	(77.8%)	(78.5%)	(80.1%)

Figures rounded off.
Source: *Ministry of Steel, Annual Report, 2010-11 and 2011-12.*

Table – 4 : Capacity and Production of Hot Metal and Crude/Liquid Steel, 2009-10 and 2010-11
(By Principal Producers)

(In '000 tonnes)

Unit	Annual installed capacity		Production			
	Hot metal	Crude/Liquid steel	Hot metal		Crude/Liquid steel	
			2009-10	2010-11(P)	2009-10	2010-11(P)
Public Sector						
Bokaro Steel Plant (Jharkhand)	4585	4360	4066	4108	3599	3592
Bhilai Steel Plant (Chhattisgarh)	4700	3925	5370	5708	5108	5329
Rourkela Steel Plant (Odisha)	2120	1900	2258	2303	2128	2160
Durgapur Steel Plant (West Bengal)	2088	1802	2174	2143	1966	1961
IISCO Steel Plant, Burnpur (West Bengal)	550	500	502	495	400	411
Visvesvaraya Iron Steel Plant (Karnataka)	205	118	126	131	103	108
Salem Steel Plant (Tamil Nadu)	–	320	–	-	NA	NA
Alloy Steel Plant, Durgapur (West Bengal)	–	264	–	-	205	200
Visakhapatnam Steel Plant (Andhra Pradesh)	3400	3000	3900	3830	3205	3235
IDCOL Kalinga Iron Works Ltd	170	–	NA	-	–	-
Private Sector						
JSW Steel Ltd (Karnataka)	NA	6800	NA	NA	6254	6864
Tata Steel Ltd (Jharkhand)	NA	6800	7232	7501	6563	6856
Ispat Industries Ltd (Maharashtra)	2000	3000	NA	NA	2689	2377
Essar Steel Ltd (Gujarat)	NA	4600	NA	NA	3474	3367
Jindal Steel & Power Ltd (Chhattisgarh)	1670	3000	NA	NA	1961	2273
Lloyds Steel Industries Ltd (Maharashtra)	–	850	–	-	505	553
Jindal Stainless Ltd	–	NA	–	-	517	703

Figures rounded off.
Source: *Annual Report of Ministry of Steel, 2010-11, 2011-12 and individual plants.*

Table – 5 : Production of Crude/Liquid Steel, 2006-07 to 2010-11 (By Route)

(In '000 tonnes)

Route/plant	2006-07	2007-08	2008-09	2009-10	2010-11(P)
All Routes : (A+B) Total	**50817**	**53857**	**58437**	**65839**	**69575**
A. Oxygen Route : Total	**25394**	**25966**	**26063**	**29832**	**31047**
Bhilai Steel Plant (Chhattisgarh)	4799	5055	5183	5108	5329
Durgapur Steel Plant (West Bengal)	1869	1914	1886	1966	1961
Rourkela Steel Plant (Odisha)	1990	2093	2083	2128	2160
Bokaro Steel Plant (Jharkhand)	4067	4127	3577	3599	3592
IISCO Steel Plant (West Bengal)	472	458	417	400	411
Visvesvaraya Iron Steel Ltd (Karnataka)	159	158	95	103	108
Visakhapatnam Steel Plant (Andhra Pradesh)	3606	3322	3145	3205	3235
Tata Steel Ltd (Jharkhand)	5174	5013	5646	6563	6856
JSW Steel Ltd (Karnataka)	2643	3147	3218	6254	6864
Other Oxygen Route	724	872	995	506	531
B. Electric Route : Total	**25423**	**27891**	**32374**	**36007**	**38528**
Electric Arc Furnace	**10033**	**10958**	**14320**	**16180**	**16457**
Alloy Steel Plant, Durgapur (West Bengal)	150	157	168	205	200
Essar Steel Ltd (Gujarat)	3006	3564	3342	3474	3367
Ispat Industries Ltd (Maharashtra)	2761	2827	2201	2689	2377
Jindal Steel & Power Ltd (Chhattisgarh)	803	1219	1457	1961	2273
Lloyds Steel Ltd (Maharashtra)	537	463	460	505	553
Jindal Stainless Ltd (Haryana)	585	585	470	679	703
Other Electric Arc Furnace Route	2191	2143	6222	6667	6984
Electric Induction Furnace	**15390**	**16933**	**18054**	**19824**	**22071**

Figures rounded off.
Source: *Ministry of Steel, Annual Report, 2010-11 and 2011-12.*

Table – 6 : Prices of Iron & Steel, 2008-09 to 2010-2011 (Domestic Markets)

(In ₹ per tonne)

Grade	Market	2008-09	2009-10	2011-12 (P)
CTD Bars (ISI, 8mm)	Delhi	38114	31600	32738
Joists (150 x 7.5mm)	''	34986	29367	30312
Channels (75 x 40mm)	''	35590	29437	30713
MS Squares (8mm)	''	37657	30796	31755
MS Angles (25 x 3mm)	''	26100	29965	31358
Melting Scrap	''	25875	19333	22704
Blooms (SAIL, 150mm)	Mandi Gobindgarh	44329	40583	40860
Heavy Slab (Bokaro)	''	34850	26560	28971
Melting Scrap (rolling)	''	26631	20815	24355
MS Rounds (10mm)	''	35631	28127	31196
CTD Bars (ISI 8mm)	''	41581	34446	36827
MS Squares (8mm)	''	34796	27742	30637
MS Angles (25x 3mm)	''	37113	30965	33758
Joists (150 x 75mm)	''	34077	28473	27957
Induction ingots (round)	''	32227	25190	29588
Old Ship Breaking Scrap	''	30433	22962	26917

(Contd.)

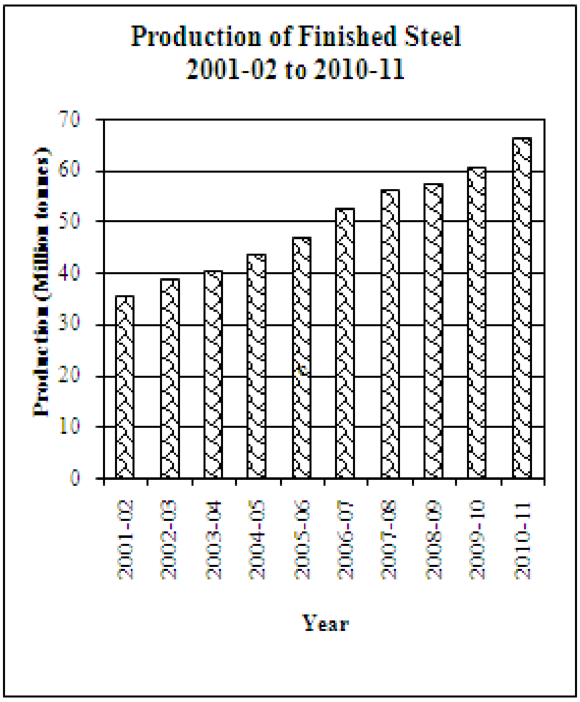
Table - 6 (Concld.)

Grade	Market	2008-09	2009-10(R)	2010-11(P)
Joists (150 x 75mm)	Mumbai	34618	28587	28173
MS Angles(40 x 6mm)	"	35514	29046	30358
Induction ingots	"	29959	23244	26515
Melting Scrap	"	24584	18121	22371
CTD Bars (local 8mm)	"	37551	30985	30735
MS Rounds (8mm)	"	35657	28792	30075
CTD Bars (ISI, 8mm)	Kolkata	32141	25727	26348
MS Squares (8mm)	"	32892	25881	25922
MS Angles (25 x 3mm)	"	31724	25227	30819
Channels (75 x 40mm)	"	33196	26446	26935
Joists (150 x 75mm)	"	31635	22606	23131
Induction Ingots	"	24259	18729	19689
Melting Scrap	"	19573	15204	18380
Arc Ingots	"	24460	19131	20057
Concast Billet Ingots	"	24737	19223	20647

Source : *Minerals & Metals Review, April 2012.*

Finished Steel

The Indian Steel Industry continued to record increased production of finished steel from 52.53 million tonnes in 2006-07 to 66.01 million tonnes in 2010-11. Finished steel produced by the steel plants of SAIL in 2010-11 was 10.2 million tonnes. In 2010-11, Visakhapatnam Steel Plant of Rashtriya Ispat Nigam Ltd produced 2.93 million tonnes and Tata Steel produced 5.16 million tonnes. JSW Steel (Vijaynagar) is the largest finished steel producer among private sector integrated steel plants. It produced 5.77 million tonnes saleable steel (comprising 5.04 million tonnes flat products and 0.73 million tonnes long products). Various finished steel products produced by principal steel plants are furnished in Table-7.



Electric Arc Furnace (EAF)

Steel produced in the Secondary Sector is mostly by recycling of steel scrap using Electric

Table – 7 : Various Finished Steel Products Produced by Principal Steel Plants

Plant	Products
Bokaro Steel Plant (Jharkhand)	Plates, HR coils, HR sheets, CR coils, CR sheets, GP/GC sheets, TMBP.
Durgapur Steel Plant (West Bengal)	Bars & rods, rails & railway materials, wheels and axles, fish plates, sleeper structurals, bars, rods, TMT bars, skelp, bloom, billets, slabs.
Rourkela Steel Plant (Odisha)	Flat products, bars and rods, plate, HR coil, CR coil, CR sheets, GP/GC sheets, electrical sheets, electrolytic tin plates, spirally welded large dimension pipes.
Bhilai Steel Plant (Chhattisgarh)	Billets, slabs, rails & railway materials, heavy structurals and squares, plates, merchant products, wire rods, plates and blooms.
IISCO Steel Plant (West Bengal)	Bars & rods, rail & railway materials, foundry & pipes and structural steel.
Visvesvaraya Iron Steel Ltd (Karnataka)	Stainless steel, tool steel, other alloys & steel, bearing steel, spring steel, free cutting steel, constructional steel (a) carbon steel, (b) case hardening steel & (c) heat treatable steel.
Visakhapatnam Steel Plant (Andhra Pradesh)	Steel products in long categories, finished steel (round & square), wire rods, re-bars, angles (equal & unequal), sections, channels, beams, saleable billets, flat products, light & medium merchant products (bars), medium merchant products (structural).
Tata Steel Ltd (Jharkhand)	Bars & rods, HR sheets and strips, CR coils, rolled/forged bars & structurals, plates, GP/GC sheets.
JSW Steel Ltd (Karnataka)	Plates, HR sheets, HR coils, CR coils/sheets, GP/GC sheets.
Ispat Industries Ltd (Maharashtra)	HR coils, CR coils/sheets, GP/GC sheets.
Essar Steel Ltd (Gujarat)	Plates, HR sheets, HR coils, CR coils/sheets, GP/GC sheets.
Jindal Steel & Power Ltd (Chhattisgarh)	Plates, structurals, HR coils, rails & railway materials.

Source: *Annual Report of Ministry of Steel and information from individual plants.*

Arc Furnace (EAF). Presently, there are 39 EAF based steel plants in operation in the country, with an aggregate capacity of 18.04 million tonnes per annum. One unit with a capacity of 0.05 million tonnes is reportedly closed. The production of steel ingots/ concast billets by EAF units reporting production in 2010-11 was estimated at 16.46 million tonnes as against 16.18 million tonnes in 2009-10 (Table-5).

The recent developments in EAF technology, viz, to increase oxygen consumption, to reduce power consumption and to reduce tap time have led to increase in metal production. The development of thin slab casting has made EAF route more productive. This route enables slab strips rolling at lesser cost, facilitating production of cheaper strips/sheets than those that can be achieved through BF/BOF route.

Induction Furnace (IF)

Presently, in India, EAF based industries are yet to switch over to induction furnace route. An induction furnace is an electrical furnace in which heat is generated through electromagnetic induction in an electrically conductive medium. Induction furnaces use steel melting scraps, sponge iron and pig iron/cast iron. On an average the proportion of these items is 40% sponge iron + 10% cast iron or pig iron and the remaining is steel melting scraps. Induction furnace has capability to operate on a charge up to 85% DRI (sponge iron). There are 1,114 induction furnaces with an aggregate capacity of 24.40 million tonnes. These units reportedly produced about 22.07 million tonnes steel in 2010-11 as against production of 19.83 million tonnes in 2009-10.

Pig Iron

Pig iron is one of the basic raw materials required by the foundry & casting industry for manufacturing various types of castings for the engineering section. The main sources of pig iron have traditionally been the integrated steel plants of SAIL besides plants of Tata Steel Ltd and Rashtriya Ispat Nigam Ltd. Domestic production of pig iron lags and is not in tandem with the demand. Efforts were, therefore, made to increase pig iron manufacturing facilities in the secondary sector.

As a result of various policy initiatives taken by the Government, private sector showed considerable interest in setting up new pig iron units especially in the post-liberalised period. This has resulted in drastic change, in the contribution of private/secondary sector units from merely 8% in 1991-92 to about 89.6% by 2010-11. In 2010-11, about 5.54 million tonnes pig iron was produced. The production of pig iron by public and private sector plants is furnished in Table-3. The share of private/ secondary producers in the years 2009-10 and 2010-11 was around 87.6% and 89.6%, respectively, in spite of the unprecedented increase in the price of imported metallurgical coke that the industry was constrained with. Location and capacity of principal pig iron units in private sector are furnished in Table - 8.

Table – 8 : Location and Capacity of Principal Pig Iron Units

(In lakh tonnes)

Sl.No.	Unit	Location	Capacity
1.	Lanco Industries Ltd	Chittoor, Andhra Pradesh	1.65
2.	Sathavahana Ispat Ltd	Anantapur, Andhra Pradesh	1.20
3.	Jayaswal NECO Industries Ltd	Raipur, Chhattisgarh	7.50
4.	Sesa Goa Ltd	Bicholim, Goa	1.80
5.	Usha Martin Industries	Jamshedpur, Jharkhand	1.10
6.	JSW Steel Ltd	Bellary, Karnataka	7.20
7.	Kalyani Ferrous Industries Ltd	Koppal, Karnataka	1.20
8.	Kirloskar Ferrous Industries Ltd	Koppal, Karnataka	2.40
9.	KIOCL Ltd	Mangalore, Karnataka	2.27
10.	Usha Ispat Ltd	Redi, Maharashtra	3.00
11.	Ispat Metallics India Ltd	Dolvi, Raigad, Maharashtra	20.00
12.	Kalinga Iron Works	Barbil, Keonjhar, Odisha	1.70
13.	Kajaria Iron Castings Ltd	Durgapur, West Bengal	1.10
14.	Electrosteel Castings Ltd	Khardah, West Bengal	1.10
15.	Tata Metaliks Ltd	Kharagpur, West Bengal	0.90

Source: *Development Commissioner for Iron & Steel, Ministry of Steel, Kolkata, and individual plants.*

Sponge Iron

India is the largest producer of sponge iron in the world. Sponge is produced from iron ore by using non-coking coal. Direct reduced iron (DRI), called as sponge iron, is a metallic material formed by reduction of iron oxide at temperatures below the fusion point of iron. Hot briquetted iron (HBI) is a product obtained after densification process where the DRI feed material is at temperature more than 650^0C at the time of moulding (hot briquetting) with density more than 5.0 g/cm^3.

During the early 1990s, sponge iron industry was specially promoted to provide an alternative to steel melting scrap which was increasingly becoming scarce. The production of sponge iron during the last five years is given in Table-2. The installed capacity of sponge iron has also increased over the years from 1.52 million tonnes in 1990-91 to currently at 34.9 million tonnes which includes 3 gas-based units having 9.3 million tpy capacity. The production has risen from 0.9 million tonnes in 1991-92 to about 26.71 million tonnes in 2010-11. Over the years, the coal based route has emerged as a key contributor to overall production; its share has increased from 63% in 2004-05 to 78.3% in 2010-11. About 80% coal-based sponge iron produced in the world comes from India. However, the constraints faced by sponge iron industry include non-availability of right grade of iron ore and non-coking coal at affordable prices.

Production of the sponge iron in the country has also resulted in providing an alternative feed material to steel melting scrap which was hitherto imported in large quantities by the Electric Arc Furnace units and the Induction Furnace units for steel making. This has resulted in a considerable saving in foreign exchange. The available data on annual installed capacity of principal sponge iron units are given in Table-9.

Table – 9 : Capacities of Principal Sponge Iron (DRI) Plants

(In lakh tonnes)

Unit	Location	Capacity
Gas-based		
Essar Steel Ltd	Hazira, Gujarat	68.00
Welspun Maxsteel Ltd,	Salav, Raigad, Maharashtra	9.00
(formerly, Vikram Ispat)		
Ispat Industries Ltd		
(formerly, JSW Ispat Ltd)	Geetapuram, Dolvi, Raigad, Maharashtra	16.00
Coal-based		
Action Ispat & Power Pvt. Ltd	Marakuta & Pandaripathar, Jharsuguda, Odisha	2.50
Adhunik Metaliks Ltd	Chandrihariharpur, Sundergarh, Odisha	1.80
Alliance Integrated Metallics Ltd	Bemta, Raipur, Chhattisgarh	5.00
Anjani Steel Ltd	Ujalpur, Raigarh, Chhattisgarh	1.02
API Ispat Powertech Pvt. Ltd	IGC Siltara, Raipur, Chhattisgarh	1.05
Beekay Steel & Power Ltd	Uliburu, Barbil, Odisha	1.05
Bhushan Steel & Strips Ltd	Meramandali, Dhenkanal, Odisha	3.00
Bihar Sponge Iron Ltd	Chandil, Singhbhum, Jharkhand	2.10
Crest Steel & Power Pvt. Ltd	IGC Borai, Durg, Chhattisgarh	1.15
Deepak Steel & Power Ltd	Topadihi, Keonjhar, Odisha	1.44
Gallant Metal Ltd	Samakhilai, Kachchh, Gujarat	1.70
Global Hi-tech Industries Ltd	Gandhidham, Gujarat	1.05

(Contd.)

Table - 9 (Concld.)

Unit	Location	Capacity
Goa Sponge Iron & Power Ltd	Santona, Sanguem, Goa	1.00
Godawari Power & Ispat Ltd	IGC Siltara, Raipur, Chhattisgarh	4.95
Goldstar Steel & Alloys Ltd	Srirampuram, Vizianagaram, Andhra Pradesh	2.20
Ind Synergy Ltd	Kotmar, Raigarh, Chhattisgarh	3.00
Jai Balaji Sponge Ltd	Baktarnagar, Raniganj, West Bengal	1.05
Jai Shri Balaji Steel Pvt. Ltd (HEG Ltd)	Borai, Durg, Chhattisgarh	1.20
Jayaswal Neco Ltd	IGC Siltara, Raipur, Chhattisgarh	2.55
Janki Corporation Ltd	Sidiginamola, Bellary, Karnataka	1.80
Jindal Steel & Power Ltd	Kharsia Road, Raigarh, Chhattisgarh	13.70
Lloyds Metals & Engineering Ltd	Ghuggus, Chandrapur, Maharashtra	2.70
Mastek Steels Pvt. Ltd	Holakundi, Bellary, Karnataka	1.05
MGM Steels Ltd	Chintapokhri, Dhenkanal, Odisha	1.00
Monnet Ispat Energy Ltd	Chandkhuri Marg, Hasaud, Raipur, Chhattisgarh	3.00
Monnet Ispat & Energy Ltd	Naharpalli, Raigarh, Chhattisgarh	5.00
MSP Steel & Power Ltd	Jamgaon, Raigarh, Chhattisgarh	1.92
Nalwa Steel & Power Ltd	Taraimal, Raipur, Chhattisgarh	1.98
Nova Iron & Steel Ltd	Dagori, Bilaspur, Chhattisgarh	1.50
OCL Iron & Steel Ltd	Lamloi, Sundergarh, Odisha	1.20
Orissa Sponge Iron Ltd	Palaspanga, Keonjhar, Odisha	2.50
Prakash Industries Ltd	Champa, Jangir Champa, Chhattisgarh	4.50
Rungta Mines Ltd	Karakola and Kamando, Sundergarh, Odisha	3.30
Sarda Energy & Minerals Ltd	IGC Siltara, Raipur, Chhattisgarh	2.10
Scaw Industries Pvt. Ltd	Gundichapara, Dhenkanal, Odisha	1.00
Shivshakti Steel Ltd	Chakradharpur, Raigarh, Chhattisgarh	1.00
Shri Bajrang Power & Ispat Ltd	Urla, Raipur, Chhattisgarh	2.10
Shraddha Ispat Pvt. Ltd	Santona, Sanguem, Goa	1.28
Shyam Sel Ltd	Dewabdighi, Burdwan, West Bengal	1.00
Singhal Enterprises Pvt. Ltd	Taraimal, Bilaspur, Chhattisgarh	1.94
Sree Metaliks Ltd	Loidapada, Keonjhar, Odisha	1.74
S.K.S. Ispat & Power Ltd	Raipur, Chhattisgarh	2.70
Sunflag Iron & Steel Co Ltd	Bhandara, Maharashtra	1.50
Sunil Ispat & Power Ltd	IGC Siltara, Raipur, Chhattisgarh	1.15
Sunil Sponge Iron Ltd	Chiraipani, Raigarh, Chhattisgarh	1.05
Tata Sponge Iron (Ipitata Sponge)	Joda, Keonjhar, Odisha	3.90
Topworth Steel Pvt. Ltd	IGC Borai, Durg, Chhattisgarh	1.65
Vandana Global Ltd	IGC Siltara, Raipur, Chhattisgarh	2.16
Vallabh Steels Ltd	Sahnewal, Ludhiana, Punjab	1.20
Visa Steels Ltd	KIC, Jajpur Road, Odisha	3.00
Zoom Vallabh Steels Ltd	Dughda, Saraikela-Kharswan, Jharkhand	1.20

I.G.C.: Industrial Growth Centre.

Source: *Sponge Iron Manufacturers' Association (SIMA) and individual plants.*

Apparent Consumption of Steel

India's per capita steel consumption increased from 38 kg in 2005-06 to 55 kg in 2010-11 and it is far below the level of other developed and developing countries. The world average of per capita steel consumption stands at 150 kg and that of developed country stands at 400 kg.

Apparent consumption of steel is calculated by taking into consideration export of steel, total domestic production and import of steel in the country. Sometimes change in stock is adjusted to arrive at the consumption figures. It is also treated as the actual domestic demand of steel in the country. The apparent consumption of finished steel since 2001-02 is given in Table-10.

Table – 10 : Domestic Consumption of Finished Steel

(In million tonnes)

Year	Consumption
2001-02	27.44 (3.43%.)
2002-03	30.68 (11.81%)
2003-04	33.12 (7.95%)
2004-05	36.38 (9.84%)
2005-06	41.43 (13.88%)
2006-07	46.78 (12.91%)
2007-08	52.13 (11.41%)
2008-09	52.35 (0.42%)
2009-10	59.34 (13.35%)
2010-11	65.61 (10.57%)

Source: *Annual Report, Ministry of Steel, 2008-09 to 2011-12.*
Figures in parentheses indicate the percentage increase over the previous year.

The normal demand of steel for infrastructure is 23%, construction 22%, manufacturing 18%, automobiles 12%, consumer durables 6% and other sectors 19%. With the ongoing economic liberalisation resulting in faster economic growth, the steel consumption is expected to increase rapidly.

With the expansion of capacities in the integrated plants and installation of new plants, additional supply of steel in Indian markets has increased considerably. This has created an intense competition in the domestic market in the short run.

MODERNISATION & EXPANSION

Modernisation and expansion works undertaken by different plants are as follows:

SAIL

SAIL is in the process of modernising and expanding its production units. The objective is to achieve a production capacity of 26.2 million tonnes/annum of hot metal. The expansion plans would increase the capacity of SAIL from 14.61 million tonnes (in 2006-07) per annum hot metal production to 26.18 million tonnes by 2012-13 is given below:

Plant	Hot metal capacity by 2012-13 (Million tonnes)
Bokaro Plant	7.44
Bhilai Plant	7.50
Rourkela Plant	4.50
Durgapur Plant	3.50
IISCO Plant	2.91
VISL	0.33
Total	26.18

Order for all major packages of ISP & SSP and part packages for expansion of Bokaro, Bhilai, Rourkela and Durgapur Steel Plants have been placed and they are in various stages of implementation. Objectives of expansion plan are:

* 100% production of steel through Basic Oxygen Furnance (BOF) route.
* 100% processing of steel through continuous casting.
* Value addition by reduction of semi-finished steel.
* Auxilliary fuel injection system in all the Blast furnaces.
* State-of-the-art process control computerisation/ automation.
* State-of-the-art online testing and quality control.

* Energy saving schemes.
* Secondary refining and
* Adherence to environment norms.

Bhilai Steel Plant

The Board of SAIL has given permission to the proposal in principle, for modernisation and capacity expansion of Bhilai Steel Plant to 7.5 million tonnes of hot metal and 7 million tonnes of crude steel per annum at an indicative cost of ₹11,267 crore. The proposal includes: a) Installation of a new blast furnace, b) A new 7 metre tall coke oven battery and a new sinter machine, c) Phasing out of ingot route with 100% continuous casting by adding a new steel melting shop of 4 million tpy capacity, d) Installation of a universal beam mill of 1 million tpy capacity, e) Addition of a new bar & roll mill of 0.9 million tpy capacity, f) Installation of a new universal rail mill of 1.2 million tpy capacity and g) capacity expansion of plate mill to 1.42 million tpy.

Bokaro Steel Plant

The hot metal production capacity at Bokaro is likely to touch 7.44 million tpy by 2012-13 from 4.59 million tpy in 2006-07. The facilities as planned for expansion include a) new Steel Melting Shop Complex (SMS III) with an installed annual capacity of 3.8 million tonnes crude steel, b) Cold Rolling Mills Complex of 1.2 million tpy capacity and c) Rebuilding of three coke oven batteries.

Rourkela Steel Plant

The hot metal production from RSP is to reach to 4.50 million tonnes by 2012-13 from 2.12 million tonnes. The progress at RSP includes a) New half coke oven battery (0.23 million tpy), b) New Sinter plant (3.9 million tpy), c) New blast furnace (1.6 million tpy), d) Third BOF converter (150 tonnes), e) Third slab caster in SMS II, f) Upgradation of Hot Strip Mill and Plate Mill, g) New CRNO Line (0.1 million tpy) and h) New Pipe Coating Plant (0.06 million tpy).

Durgapur Steel Plant

DSP's hot metal production is projected to touch 3.50 million tonnes by 2012-13 from 2.06 million tonnes in 2006-07. The new facilities as planned are a) New Sinter Plant b) Bloom-cum-Round Caster, c) Medium Structural Mill, d) Additional finishing Mill and e) New Bar and Rod Mill (0.6 million tpy).

IISCO Steel Plant

The plant is set to undergo modernisation cum expansion through which its hot metal production capacity will be raised to 2.91 million tpy by 2012-13.

Salem Steel Plant

Expansion and modernisation of the Salem Steel Plant, envisages installing Steel Melting and Continuous Casting facilities to produce 180,000 tpy slabs along with expansion of Cold Rolling Mill complex for Stainless Steel products from 60,000 tpy to 146,000 tpy and an additional Roll Grinding Machine for Hot Rolling Mill for enhancing the production to 364,000 tpy.

Rashtriya Ispat Nigam Ltd (RINL)

Visakhapatnam Steel Plant (VSP) of RINL is the first shore-based integrated steel plant located at Visakhaptnam in Andhra Pradesh. The plant was commissioned in 1992 with a capacity to produce around 3 million tonnes of liquid steel per annum. The plant has been built to match international standards in design and engineering with state-of-the-art technology, incorporating extensive energy saving and pollution control measures. Visakhapatnam has excellent layout which allows expansion of the plant capacity. VSP is in the midst of implementing an expansion plan to double its annual liquid steel making capacity from the present level of 3 million tpy to 6.3 million tpy. The new units are set to come on stream progressively from 2011-12.

Tata Steel Ltd (formerly TISCO)

The company has been rechristened as Tata Steel Ltd (TSL). The company has an integrated steel plant located at Jamshedpur, Jharkhand, with annual crude steel making capacity of 6.8 million tonnes which was slated to increase to 9.7 million tonnes by 2011-12. The 2.9 million tpy expansion inter alia comprises a 2.9 million tpy blast furnace, 6 million tpy pellet plant, 2.4 million tpy Linz -

Donawit (LD) basic oxygen converter, etc. TSL has achieved a production of 5.02 million tonnes and 5.16 million tonnes of finished steel and 5.56 million tonnes and 6.86 million tonnes of crude steel in 2009-10 and 2010-11, respectively.

Setting up of a new integrated steel plant with 12.5 million tonnes capacity in Kalinganagar, Jajpur, Odisha by TSL is currently underway, which the company plans to complete in phases. Government of Odisha has allotted 2000 acres of land for the plant at Kalinganagar. The company has further plans to set up a 7.0 million tpy per year capacity integrated steel plant at Jagdalpur in Bastar region of Chhattisgarh. In the first phase, installation of a 2 million tpy per year capacity plant is likely to be taken up; and it is expected to be completed in 3.5 to 5 years. Capacity expansion to 5 million tpy per year will be undertaken subsequently. The process of acquiring of land is under progress. The company also signed an MoU with the Government of Jharkhand for setting up of a 12 million tonnes per year integrated steel plant at Saraikela in phases. The above projects are, however, subject to raw material linkages and receipt of requisite approvals.

JSW Steel Ltd

JSW Steel Ltd has an installed crude steel capacity of 6.8 million tpy with value added products constituting 1.8 million tpy spread across four locations; Toranagallu (Vijaynagar Works), Salem (Salem Works), Vasind, and Tarapur (downstream units). Vijaynagar works existing operations produce flat and long steel products, Salem Works focus only in long products and the downstream units produce CR/Galvanised, colour coated, value added flat products. All the existing operating facilities have been accredited with OHSAS-18001, ISO-9001: 2000 and ISO - 14001. Vijaynagar works has integrated operations from beneficiation plant to 1 million tpy Cold Rolling Mill Complex. The Salem works has an integrated manufacturing facility with an overall crude steel capacity of 1 million tpy, comprising sinter plant, blast furnace, EOF, billet caster, bloom caster and rolling with associated facilities such as coke oven, power plant, oxygen plant, etc. The slabs and HR coil produced at Vijaynagar works are further processed in downstream units at Vasind and Tarapur into value added HR plates, CR, galvanised, galvalume and colour coated products.

The Company is enhancing the total capacity to 9.6 million tpy at Vijaynagar works. Two subsidiaries of the company - M/s JSW Bengal Steel Ltd and M/s JSW Jharkhand Steel Ltd are incorporated to set up greenfield steel plants with 10 million tpy capacity each in West Bengal and Jharkhand, respectively. The company is in possession of required land in West Bengal while in Jharkhand it has obtained a mining lease for iron ore.

Jindal Steel & Power Ltd (JSPL)

JSPL has set up a rail & universal beam plant with capabilities to produce 120 m long finished rails, the longest in the world, for the first time in India. The company has captive coal mines at Dongamahua in Raigarh district, Chhattisgarh and coal washing unit with capacity of 6 million tonnes per year to wash 47-48% coal ash to 26%. The sponge iron plant at Raigarh, Chhattisgarh has capacity of 1.37 million tpy. Facilities at Raigarh also include following capacities – steel 3 million tonnes (Rail and structurals 0.75 million tonnes, plates 1.00 million tonnes and slabs, rounds, blooms and billets 1.25 million tonnes), hot metal 1.67 million tonnes and captive powerplant 623 MW.

As expansion projects, JSPL is setting up a 6 million tpy integrated steel plant at Angul in Odisha. Other plants being set up are : 6 million tpy integrated steel plant at Patratu, Jharkhand and 7 million tpy steel plant at Raigarh, Chhattisgarh. It is planned to implement these projects in phases. The present plant at Raigarh is also under expansion to 7 million tpy (3 million tpy through EF route and 4 million tpy through BOF route) comprising 3 million tpy flat products and 4 million tpy long products. It will also have 6 million tpy gas-based DRI plant with matching coal gasification unit and 4 million tpy hot metal capacity.

Essar Steel Limited (ESL)

A state-of-the-art hot rolled coil steel plant was set up at Hazira, Gujarat. This plant was set up with 4.6 million tpy capacity and is expanded to 10 million tonnes per annum. It is the largest fully-integrated manufacturer of high quality flat steel products in western India. Company's operations include 8 million tpy and 12 million tpy beneficiation plants at Bailadila in Chhattisgarh and Dabuna in Odisha. Essar has the world's second largest slurry pipeline of 267 km and also 253 km to transport beneficiated iron ore slurry to the pellet plants namely 8 million tpy pellet complex at Visakhapatnam, Andhra Pradesh and 6 million tpy at Paradip at Odisha. The Essar Steel Complex at Hazira in Surat district, Gujarat houses the world's largest gas-based single location sponge iron plant with a capacity of 6.8 million tpy. The complex also house 1.4 million tpy cold rolling complex, 4.6 million tpy electric arc furnace, 4.6 million tpy continuous caster and 3.6 million tpy hot strip mill. Outstanding performance has been observed in the 3 DRI-HBI modules of the company.

The company has plans to set up a steel plant of 6 million tonnes per annum capacity at Paradip, Odisha. The scheme also includes installation of pellet plant and iron ore beneficiation plant. The company has plans to set up a steel plant of 3.2 million tonnes per annum capacity at Bastar, Chhattisgarh, (In first phase, a 1.6 million tpy steel plant with a captive power plant is to be set up), 3 million tonnes per annum in Jharkhand and 6 million tonnes per annum in Karnataka.

Ispat Industries Ltd (formerly, JSW Ispat Steel Ltd)

JSW Steel has aquired a 45.53% majority stake in Ispat Industries w.e.f. 21.12.2010. Ispat Industries Ltd, with its associated companies, had set up one of the largest integrated steel plants in the private sector in India at Dolvi in Raigad district, Maharashtra. The plant has a capacity to produce 3 million tpy of hot rolled coils (HRC). The company also manufactures sponge iron and pig iron at their Dolvi complex. The company has a gas-based DRI plant of 1.6 million tpy capacity and an ultra-modern blast furnace of 2 million tpy capacity to produce hot metal/pig iron. It also has a 2.24 million tpy sinter plant at Dolvi. The integrated steel plant functions on the Converter-cum-Electric Arc Furnace route (CONARC process) to produce steel through modern Twin Shell Electric Arc Furnace.

IIL has plans to expand its HR coils capacity at Dolvi to 3.6 million tonnes per year. A new 2 million tonnes sinter plant, a 1,260 tonnes/day oxygen plant and a new electric arc furnace have also been commissioned at IIL Dolvi. The capacity is considering to scale up the plant to 5 million tpy capacity and also company has plans to set up 5.0 million tpy integrated steel plant at Paradip, Odisha.

Neelachal Ispat Nigam Limited (NINL)

NINL has a 1.1 million tonnes per annum capacity iron & steel plant located at Duburi, Jajpur district, Odisha. The NINL and Odisha Government will be setting one million tonne steel plant at Kalinganagar, Jajpur, Odisha. The other product of the company that is sold in the domestic market is granulated slag which is consumed by several cement plants.

NEW STEEL PROJECTS

In the context of long-term demand projection of steel, the Government adopted a two-pronged strategy for increasing steel production in the country. Firstly, through modernisation and expansion of existing public sector steel plants in the country and secondly, by offering initiatives to private sector to install new steel capacities. After the announcement of the Industrial Policy in 1991 and encouraged by the various other policy initiatives of the Government, substantial interest by several entrepreneurs to set up new steel plants has been witnessed. Besides the steel PSUs, massive capacity addition is in the pipeline by private steel producers including foreign direct investors. As per the latest information available, 301 MoUs have been signed in various states with intended capacity of around 488.56 million tonnes with an investment of over ₹ 5-10 lakh crore by 2020. Some projects were at various stages of implementation. POSCO has planned to set up 12 million tpy capacity steel plant in Odisha by using "Finex" process with direct utilisation of sinter feed iron ore (-8 mm) besides utilising the advantages of "Corex" technology. Similar expansion is also coming up in secondary steel sector consisting of sponge iron, EAF, induction furnace, rolling mill, etc. With these new steel plants, contribution of private sector units is gradually increasing and this trend is expected to continue.

National Mineral Development Corporation Ltd

NMDC is now directing its resources to diversifying into steel making. An integrated steel plant with a capacity of three million tonnes will be set up in Chhattisgarh near Nagarnar, Bastar district. NMDC is in the process of expanding its business through forward integration in both greenfield and brownfield projects by setting up (a) 2.0 million tpy pellet plant in Chhattisgarh (b) 1.2 million tpy pellet plant at Donimalai in Karnataka (c) 0.36 million tpy BHJ ore beneficiation plant at Donimalai.

KIOCL Ltd

The company is operating 350 cu m capacity blast furnace at Panambur, New Mangalore Port for production of pig iron with 2.27 lakh tpy capacity and a Ductile Iron Spun Pipe (DISP) plant of 100,000 tonnes per year capacity. The hot metal from blast furnace will be the main feed stock for the DISP plant. The company was also in the process of selecting a joint venture equity partner for an integrated steel plant to be set up in Karnataka. The company also operates a 3.5 million tpy pellets plant at Mangalore with hematite ore purchased from NMDC. It has signed an MOU with Kerala State Industrial Development Corporation Ltd. (KSIDL) for setting up of iron ore mining, beneficiation and pelletisation plant in Kerala.

VISA Steel Ltd

The Kolkata based VISA Group was in the process of implementing a 500,000 tpy integrated special and stainless steel plant along with a 400,000 tpy coke oven plant. Its first blast furnace with 225,000 tonnes of pig iron per annum capacity was commissioned in 2005 at Kalinganagar Industrial Complex, Odisha. The 250 cu m blast furnace will have carbon hearth refractories, stoves & blowers and twin pig casting machines.

IRON & STEEL SCRAP

Iron & Steel Scrap is one of the essential requirements for manufacture of steel in mini-steel industry. It is also consumed by some major steel plants. Scrap–especially that from the ship breaking industry supplies substantial quantity of re-rollable steel and steel scrap for the iron & steel industry. Iron scrap is available in the country in the form of pressed bundles, a mixture of used steel components (called as a commercial scrap), turnings and borings and heavy melting scrap. These are generated by industries of all sectors like automobiles, railways and engineering workshops.

The collection and processing of scrap in an organised manner is undertaken by a few units in the country. In the local market, scrap is supplied by dealers who in turn arrange to have scrap collected manually or through sub-dealers.

The consumption of scrap is mainly reported by Induction Furnace and Electric Arc Furnace units, integrated steel plants and alloy steel & foundry industries. Scraps are used in the steel sector after recycling. Recycling scrap helps in conservation of energy as remelting of scrap requires much less energy than production of iron or steel from iron ore. Also, the consumption of iron and scrap by remelting reduces the burden on land fill disposal facilities and prevents the accumulation of abandoned steel products in the environment. It increases the availability of semi-finished material which otherwise would have to be produced using the ore. Thus, it helps in conservation of natural resources.

Ship breaking

Ship breaking has been a major source of scrap generation. Ship breaking activities are carried out at various places on the Indian Coast, the largest concentration is on the West Coast. Private entrepreneurs handle the task of ship breaking in India. It is a labour intensive job and in India, it is cost efficient activity. Location of present ship breaking activities are:

i) Alang and Sosiya yards in Bhavnagar district, Gujarat,

(ii) Sachana in Gujarat

(iii) Mumbai and

(iv) Kolkata.

Alang & Sosiya yards account for 90% concentration of the ship breaking industry in India. During 2008-09, 2009-10 and 2010-11, a total of 267, 379 and 357 ships were beached by the industry accounting for 2.0 million tonnes, 3.1 million tonnes and 2.8 million tonnes, respectively, in terms of LDT (Light Displacement Tonnage, viz, physical weight of a ship). Today, Alang possibly represents the single largest concentration of ship breaking industry in the world. The life of an average ocean-going ship is about 20 years. About 40% of the ships broken are dry cargo ships, while remaining 40% of the ships broken are wet cargo, tanker and specialised ships. These recyclable steels mainly as steel scrap provide feed to steel and foundry industry in India. The steel generated from ship recycling contributes to around 1% to 2% of the domestic steel demand.

The recommendations of a committee of Technical Experts on Ship Breaking set up by the Government of India on the directions of the Hon'ble Supreme Court have been accepted by the Hon'ble Supreme Court on 6.9.2007 on the issue of handling & management of the hazardous industrial waste generated during ship breaking. The Court has also directed the Government to formulate a comprehensive Code incorporating the recommendations which are operative till the statutes are amended. The Code is under formulation in the Ministry of Steel.

MSTC Ltd

(Formerly Metal Scrap Trade Corp. Ltd)

Presently, the company undertakes trading activities, e-commerce, disposal of ferrous and non-ferrous scrap, surplus stores and other secondary arising generated mostly from Public Sector Undertakings and Government Departments, including Ministry of Defence. The Company also undertakes import of raw materials in bulk required by large industrial houses on back-to-back basis. The items of import include petroleum products, LAM Coke, Coking Coal, DR Pellets, HR Coils and Melting Scrap, etc. It also undertakes trading in items within the country in competition with any other private trader.

Ferro Scrap Nigam Ltd (FSNL)

FSNL has become a fully-owned subsidiary of MSTC Ltd under the Ministry of Steel. The company undertakes the recovery and processing of scrap, slag and refuse dumps, in the nine steel plants at Bhilai, Bokaro, Burnpur, Durgapur, Rourkela, Visakhapatnam, Dolvi, Duburi and Raigarh. The scrap so recovered is returned to the steel plants for recycling or disposal and the company is paid processing charges on the quantity recovered at varying rates depending on the category of scrap. Scrap is generted during iron & steel making and also in the Rolling Mills. In addition, the company provides steel mill services, such as scarfing of slabs and handling of BOF slag, etc.

The recovery of scrap by FSNL in 2010-11 was 2.65 million tonnes in comparison to 2.37 million tonnes in 2009-10.

TRADE POLICY

As per the modified Export-Import Policy incorporated under the Foreign Trade Policy (FTP) for 2009-14, the imports of primary forms of pig iron, spiegeleisen, sponge iron, ferro-alloys, stainless steel, remelting scrap, as also the semi-finished products of iron, non-alloy steel or stainless steel (such as flat-rolled products, bars, rods, coils and wires), primary and semi-finished forms of other alloy-steels, etc. are unrestricted. Similarly, the exports are also allowed freely. In order to preserve iron ore resources for domestic use on cheaper rates, export duty on iron ore has been increased w.e.f. 30/12/2011 to 30% ad valorem on all varieties of iron ore (except pellets).

WORLD REVIEW

The world production of pig iron in 2010 was about 1,085 million tonnes as against 978 million tonnes in 2009. China, Japan, India, Russia, Rep. of Korea, Brazil, Ukraine, Germany and USA were the principal producers (Table-11).

World crude steel production in 2010 increased to 1,418 million tonnes from 1,231 million tonnes in 2009. China was the top producer accounting for 44% of world's crude steel production, followed by Japan (8%), USA (6%) and India (5%). Other important producers were Russia, Republic of Korea, Germany, Ukraine, Brazil, Turkey and Italy (Table-12).

Table – 11 : World Production of Pig Iron
(By Principal Countries)

(In '000 tonnes)

Country	2008	2009	2010
World : Total	1006000	978000	1085000
Brazil	34871	25135	30898
China	478244	552835	590218
France	11372	8104	10137
Germany	29105	20104	28560
India	58229	61677	64987
Japan	86171	66943	82283
Korea, Rep. of	31043	27475	31228
Russia	48300	43900	48200
Ukraine	30991	25683	27366
USA	33729	19018	26834
Other countries	163945	127126	144289

Source: *World Mineral Production, 2006-2010.*

Table – 12 : World Production of Crude Steel
(By Principal Countries)

(In '000 tonnes)

Country	2008	2009	2010
World : Total	**1334000**	**1231000**	**1418000**
Brazil	33716	26506	32928
Canada	14845	9286	13013
China	503057	572182	626959
France	17879	12840	15413
Germany	45832	32670	43830
India	57791	63527	68321
Italy	30590	19848	25750
Japan	118739	87534	109598
Korea, Rep. of	53322	48572	58912
Mexico	17209	14132	16710
Russia	68700	59200	66300
Spain	18640	14358	16343
Taiwan	19882	15873	19755
Turkey	26809	25304	29030
Ukraine	38136	30302	33345
United Kingdom	13520	10074	9708
USA	91350	58196	80495
Other countries	163983	130596	151590

Source: *World Mineral Prouduction, 2006-2010.*

FOREIGN TRADE

Exports

Exports of iron and steel (total) increased sharply by 66% in 2010-11 to 10.17 million tonnes from 6.12 million tonnes in the previous year. Steel exports in 2010-11 comprised of finished steel (including cold rolled sheets) 5.1 million tonnes (50%) and semi-finished steel (including steel ingots) 3.51 million tonnes (34%). Other items together accounted for remaining 16% exports. Exports in 2010-11 were mainly to Belgium (14%), USA (11%) and Saudi Arabia, UAE, Iran and Kuwait (6% each). Exports of pig and cast iron including spiegeleisen increased to 15 lakh tonnes in 2010-11 from 6.2 lakh tonnes in the previous year. Exports were mainly to Thailand (56%), China (27%), Rep. of Korea (5%) and Japan (4%) (Tables - 13 to 22).

Imports

Imports of iron and steel (total) in 2010-11 decreased slighly to 14.40 million tonnes from 14.44 million tonnes in the previous year. Imports in 2010-11 comprised of semi-finished steel including ingots 5.9 million tonnes (41%) iron and steel scrap 4.6 million tonnes (32%) and finished steel including cold rolled sheets 3 million tonnes (21%). Imports in

2010-11 were mainly from China (19%), Republic of Korea (10%), USA (8%), Japan (7%), UK (6%), and UAE, Russia, Ukrain (5% each). The imports of pig and cast iron (including spigeleisen) increased marginally to 48 thousand tonnes in 2010-11 from 39 thousand tonnes in the previsous year. Imports were mainly from South Africa (22%), Sweden (14%) and China (11%) (Tables-23 to 32).

Table -13 : Exports of Iron & Steel (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**6115076**	**342946993**	**10169643**	**599195646**
USA	625418	45470395	1163485	95493962
Belgium	148509	7860487	1473544	53684532
Saudi Arabia	115431	6297940	640649	51669840
UAE	505955	29660634	637765	39773305
Iran	310489	15234241	656607	34502759
Kuwait	63051	3529336	597552	28587375
Germany	131478	13783350	176129	22820447
UK	129477	8821588	372262	19303936
Italy	212061	13066371	190170	15904276
Iraq	51586	4752279	272549	14555677
Other countries	3821621	194470372	3988931	222899537

Table – 14 : Exports of Iron & Steel (Finished Steel Inc. Cr Sheet) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**3143360**	**157564745**	**5075390**	**303282605**
USA	353846	22478739	861818	64854810
Saudi Arabia	41721	2127197	431898	37162069
Iran	156399	7529703	543495	29526910
Kuwait	28751	1634483	569306	27000750
UAE	308346	15119784	320001	22038459
Iraq	43829	3874811	262023	13946356
Italy	165948	7210584	123918	6859329
Belgium	86437	3719963	112613	6103702
Oman	93421	5314374	107402	5720015
Kenya	51689	2033212	106044	5207661
Other countries	1812973	86521895	1636872	84862544

Table – 15 : Exports of Iron & Steel (Steel Wire) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**72363**	**7800739**	**98853**	**13282268**
USA	13139	1492621	16157	2336875
Germany	5240	769074	8868	1699792
France	3060	376897	5817	895504
Italy	2913	396421	5274	873380
Belgium	4332	568931	4576	798705
UK	3224	384488	3772	662589
Brazil	1544	247099	2518	477716
Turkey	1878	227254	2668	416896
UAE	4936	272048	7077	376218
Nepal	6848	226889	10121	362906
Other countries	25249	2839017	32005	4381687

Table – 16 : Exports of Iron & Steel (Other Finished Steel, NES) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**1111682**	**106184292**	**1402970**	**135299929**
USA	165478	16351074	216509	23068047
Germany	92179	8789392	110057	12810253
UK	61505	5455736	176112	11452966
UAE	109650	11070456	129336	10816895
Italy	20896	3112428	26628	3816571
Saudi Arabia	46911	3206006	55187	3738414
South Africa	22595	1515366	48536	3265959
Benin	14343	2810349	14597	2922173
Belgium	21022	2042728	21137	2623328
Canada	22793	1954105	30008	2468157
Other countries	534310	49876652	574863	58317166

Table–17: Exports of Iron & Steel (Semi-Finished Steel Including Steel Ingots) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**1710812**	**69818464**	**3507643**	**145307883**
Belgium	36677	1524800	1335206	44157743
Saudi Arabia	26343	926874	152719	10730231
UAE	82584	3191922	180176	6520924
Germany	23775	3195575	38940	6028064
USA	92714	5126760	68866	5222190
Nepal	153246	5008962	125873	4787834
UK	10310	478603	147615	4712649
Chinese Taipei/ Taiwan	8940	349578	160064	4697978
Italy	22291	2346249	34345	4354581
Nigeria	64088	2709791	102005	4140350
Other countries	1189844	44959350	1161834	49955339

Table – 18 : Exports of Iron & Steel: Alloy Steel (Granules) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**155**	**19314**	**729**	**103620**
Nepal	5	319	663	100136
Iran	2	123	26	2109
USA	47	11422	1	264
Sri Lanka	1	77	9	218
Saudi Arabia	20	813	4	201
UAE	2	251	4	145
Croatia	_	_	2	97
Romania	_	_	3	93
Singapore	++	66	1	85
Australia	_	_	1	85
Other countries	76	6243	15	187

Table – 19 : Exports of Iron & Steel: Alloy Steel (Powder) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**571**	**26620**	**58**	**4685**
UK	5	312	7	1703
Canada	-	-	6	808
South Africa	19	477	32	564
Turkey	5	300	8	410
Saudi Arabia	++	193	++	386
Australia	-	-	1	301
Spain	5	433	0	124
UAE	12	788	1	112
Poland	-	-	1	71
USA	18	951	++	62
Other countries	507	23166	2	144

Table – 20 : Exports of Iron & Steel (Scrap) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**23849**	**341729**	**7343**	**477649**
Sweden	1602	179522	1837	335221
China	18712	47703	3111	37147
Germany	193	28985	163	22621
Oman	1428	24677	1093	20096
Netherlands	860	33333	130	13203
Chinese Taipei/ Taiwan	++	1	82	9089
UK	7	375	158	8313
USA	118	4640	49	3867
UAE	406	4788	170	3476
Bhutan	_	_	104	3220
Other countries	523	17705	446	21396

Table – 21 : Exports of Iron & Steel (Sponge Iron) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**52284**	**1191090**	**76657**	**1437007**
Malaysia	19785	317201	44767	832351
Bangladesh	23265	745541	7306	187046
Nepal	426	8397	9936	165111
Bhutan	4757	54187	3675	46581
Mauritious	1512	24712	2430	45200
Ethiopia	–	–	1114	22415
Chile	–	–	1300	21969
Djibouti	–	–	1041	20943
Kuwait	400	5554	1000	18908
UAE	19	598	1000	17075
Other countries	2120	34900	3088	59408

Table – 22 : Exports of Pig & Cost Iron (Incl. Spiegeleisen) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**620990**	**10870770**	**1509984**	**31803705**
Thailand	69269	1511334	851707	19139492
China	26319	405202	402744	6676349
Korea, Dem. Peoples's Rep. of	62500	955024	69850	1410138
Japan	82644	1326766	57590	1107196
Chinese Taipei/ Taiwan	11157	204903	28900	921373
Korea, Rep. of	54016	847430	31703	638729
Malaysia	123294	2094815	20368	398871
Saudi Arabia	318	10050	9185	217640
Sweden	887	98145	1105	152582
Unspecified	81	1502	19008	437169
Other countries	190505	3415601	17824	704166

Table - 23 : Imports of Iron & Steel (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**14442652**	**511365616**	**14401512**	**616497590**
China	1500292	69945286	2787471	131656321
Korea, Rep. of	1331050	58052913	1436746	71703116
Japan	748045	42160223	975544	57213855
USA	1595957	40997605	1189478	35281101
Germany	596458	32274516	446603	28646270
UK	1148203	27543728	855569	22649941
Russia	772319	21591214	698188	22451680
Ukraine	967060	23410413	681388	19693753
UAE	620166	11889115	750588	19002979
Malaysia	163843	5805239	212456	15489030
Other countries	4999259	177695364	4367481	192709544

Table – 24 : Imports of Iron & Steel (Finished Steel Including CR Sheet) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**2986180**	**171605291**	**2981662**	**200100488**
China	669220	32268528	821118	50746614
Japan	328870	23458423	419525	29890664
Korea, Rep. of	377590	19940751	397749	24925596
Germany	113065	10051803	132401	11844223
USA	152040	12237733	159878	11512603
Italy	64804	7680259	83975	7713635
Belgium	87912	4443164	112018	5603634
Russia	127238	5887627	101277	5415477
France	40072	8189732	63357	5401769
Spain	28902	2344868	45789	4831133
Other countries	996467	45102403	644575	42215140

Table – 25 : Imports of Iron & Steel (Steel Wire) (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**126531**	**7783851**	**163060**	**11174142**
China	54171	2388454	70749	3951062
Japan	6607	872266	3948	1111636
Malaysia	15342	725379	20214	1053580
Nepal	13281	694215	16904	880091
Korea, Rep of	7783	580289	11013	873258
Sweden	1220	802630	1012	639068
Germany	1462	254426	1082	299954
Thailand	2976	136613	5068	273453
Brazil	1179	89510	3678	253884
Italy	3838	268413	2915	251767
Other countries	18672	971656	26477	1586389

Table – 26 : Imports of Iron & Steel (Other Finished Steel, NES) (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**374787**	**70723437**	**788681**	**94967205**
China	154692	16934133	189051	21677531
Indonesia	1344	330129	20077	8526563
Germany	26012	7306221	76195	7938977
Malaysia	6326	935091	35987	7540822
Japan	26343	4345346	54353	7148914
Korea, Rep of	33944	5459791	71917	6965805
USA	19325	5044601	202406	6046283
Italy	22177	9079993	15678	3723229
Thailand	11998	2274317	17863	3362546
Singapore	5462	1222651	12412	3057504
Other countries	67164	17791164	92742	18979031

Table – 27 : Imports of Iron & Steel (Semi-Finished Steel including Steel Ingots) (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**5529733**	**162605997**	**5853171**	**199872343**
China	615767	18055892	1692996	54893008
Korea, Rep of	897395	31285032	915142	35109601
Japan	368425	13089298	490717	18869671
Ukraine	612029	14780389	653721	18793115
Russia	607862	14802911	547286	15841704
Brazil	404024	10110914	259593	7403852
Germany	259617	11006337	143758	6291175
Saudi Arabia	112312	2528777	115332	3474416
Belgium	122852	4341761	84495	2985246
Sweden	34629	1588268	17337	2818739
Other countries	1494821	41016418	932794	33391816

Table – 28 : Imports of Iron & Steel : Alloy Steel (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**12776**	**531453**	**13866**	**567809**
Spain	4742	192440	4727	197434
China	1220	45984	1893	70707
France	2381	108051	1779	69559
Italy	1536	65556	1613	68372
South Africa	830	29760	1166	43916
Thailand	936	37977	605	24701
Chinese Taipei/ Taiwan	147	7785	527	20108
Ukraine	54	1796	580	19912
Germany	121	6654	329	18552
USA	196	8988	165	9208
Other countries	613	26462	482	25340

Table – 29 : Imports of Iron & Steel: Alloy Steel (Powder)
(By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**956**	**232944**	**2068**	**396792**
USA	244	40085	645	105030
Sweden	165	26266	696	98495
UK	115	64307	133	68121
China	109	32841	145	41091
Canada	71	7223	373	39087
Belgium	21	11184	44	23490
Japan	12	15604	22	14906
Italy	_	_	2	3117
Germany	45	7458	4	1551
Hong Kong	_	_	2	750
Other countries	174	27976	2	1154

Table – 30 : Imports of Iron & Steel (Scrap)
(By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**5286225**	**96084087**	**4557022**	**108688994**
USA	1324872	20690845	777008	16007120
UK	1057434	20271202	773632	15670411
UAE	557778	9619404	663714	14120429
Netherlands	161320	6976893	138417	10071507
South Africa	245650	4037670	394668	7956590
Malaysia	101494	2377807	95103	3949944
Korea, Rep of	14336	787017	40910	3828559
Singapore	83507	1669284	85094	2972743
Germany	196136	3641616	92791	2247929
Kuwait	99214	1616278	111481	2237130
Other countries	1444484	24396071	1384204	29626632

Table – 31 : Imports of Iron & Steel (Sponge Iron)
(By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**125464**	**1798556**	**41982**	**729817**
Qatar	103886	1503785	37775	650050
Russia	1980	24960	3256	48822
Sweden	319	4315	229	9743
Saudi Arabia	10177	140520	508	7820
Japan	_	_	15	5044
USA	208	2800	156	4083
Germany	_	_	43	3909
UK	2	1512	++	171
Belgium	_	_	++	169
China	_	_	++	6
Other countries	8892	120664	_	_

Table – 32 : Imports of Pig & Cost Iron (Incl. Spiegeleisen)
(By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**39013**	**1700708**	**48291**	**2316267**
Sweden	4739	208996	6669	366669
South Africa	11041	258753	10464	294281
China	3234	141086	5288	238398
Germany	586	187350	724	205999
Spain	2927	118005	4596	187910
Brazil	2372	70405	4434	172390
Italy	4533	197168	3532	172208
USA	976	67435	1893	120152
France	1516	85801	1823	105789
Japan	199	56902	222	69090
Other countries	6890	308807	8646	383381

FUTURE OUTLOOK

India ranked fourth as a largest producer of crude steel in the world and is expected to become the 2nd largest producer by 2015-16, provided all requirements for fresh capacity creation are met. The Steel Industry in general is on the upswing due to strong growth in demand propelled by the strong domestic demand for steel particularly from the construction, manufacturing and automotive sectors. India is the largest producer of sponge iron in the world with production over 26.7 million tonnes. The economic reforms and the consequent liberalisation of the Iron & Steel sector brought a sea change in the industry, particularly in the field of greenfield steel plants in the private sector.

The Steel Industry has now exalted itself and is in a position of self-reliance and also to compete globally in terms of product range, quality and price. The growth of the steel sector is linked intricately with the growth of the Indian economy, especially with growth of the steel consuming sectors. India has become self-sufficient in iron & steel materials in the last five years. This position needs to be consolidated further and issues affecting production and consumption need to be resolved expeditiously. At the same time, measures to match the productivity of our steel plants to that of international quality standards must be taken up on top priority. India has established herself as a key destination market for global steel and as emerging market in the field of mergers & acquisitions and is also reckoned as one of the major producers of steel of low manufacturing cost. The National Steel Policy, 2005 envisages to achieve global competitiveness not only in terms of cost, quality and product mix but also in terms of global benchmarks of efficiency and productivity in the Indian Steel Sector and is presently under review.

As per the report of Working Group on Mineral Exploration and Development (other than coal & lignite) for XII Five Year Plan (2012-17) of the Planning Commission, technologies for agglomeration, pelletisation and direct use of fines to produce steel must be identified and taken up in Mission Mode to achieve the national goal to produce 200 million tonnes per annum of steel by 2020.

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

IRON ORE

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

47 Iron Ore

Iron & steel is the driving force behind industrial development in a country. The vitality of the iron & steel industry largely influences its economic status. The mining of iron ore, an essential raw material for Iron & Steel Industry is arguably of prime importance among all mining activities undertaken by any country. With the total resources of over 28.52 billion tonnes of hematite (Fe_2O_3) and magnetite (Fe_3O_4), India is among the leading producers as well as exporters of iron ore in the world.

RESOURCES

Hematite and magnetite are the most important iron ores in India. About 59% hematite ore deposits are found in the Eastern Sector. About 92% magnetite ore deposits occur in Southern Sector, especially in Karnataka. Of these, hematite is considered to be superior because of its higher grade. Indian deposits of hematite belong to the Precambrian Iron Ore Series and the ore is within banded iron ore formations occurring as massive, laminated, friable and also in powdery form.

As per UNFC system, the total resources of hematite as on 1.4.2010 are estimated at 17,882 million tonnes of which 8,093 million tonnes (45%) are under 'reserves' category and the balance 9,789 million tonnes (55%) are under 'remaining resources' category. By grades, lumps constitute about 56% followed by fines (21%), lumps with fines (13%) and the remaining 10% are black iron ore, not-known and other grades. Major resources of hematite are located in Odisha - 5,930 million tonnes (33%), Jharkhand - 4,597 million tonnes (26%), Chhattisgarh - 3,292 million tonnes (18%), Karnataka - 2,159 million tonnes (12%) and Goa - 927 million tonnes (5%). The balance resources of hematite are spread in Andhra Pradesh, Assam, Bihar, Maharashtra, Madhya Pradesh, Meghalaya, Rajasthan and Uttar Pradesh (Table -1).

Magnetite is another principal iron ore that also occurs in the form of oxide, either in igneous or metamorphosed banded magnetite-silica formation, possibly of sedimentary origin. As per UNFC system. the total resources of magnetite as on 1-4-2010 are estimated at 10,644 million tonnes of which 'reserves' constitute a mere 22 million tonnes while 10,622 million tonnes are placed under 'remaining resources'. Classification on the basis of grades show 21% resources of metallurgical grade while 79 resources belong to unclassified, not-known and other grades. The resources of coal washery and foundry grades constitute meagre proportions. India's 97% magnetite resources are located in four states, namely, Karnataka - 7,802 million tonnes (73%) followed by Andhra Pradesh - 1,464 million tonnes (14%), Rajasthan - 527 million tonnes and Tamil Nadu - 507 million tonnes (5% each). Assam, Bihar, Goa, Jharkhand, Kerala, Maharashtra, Meghalaya and Nagaland together account for the remaining 3% resources (Table-2).

EXPLORATION & DEVELOPMENT

In 2010-11, GSI, State Directorates of Chhattisgarh, Karnataka, Jharkhand and West Bengal, NMDC, SAIL, Mysore Minerals Ltd, OMC, M/s Chowgule & Co. Pvt. Ltd and M/s V.M. Salgaocar & Bro. Pvt. Ltd conducted exploration for iron ore. Details of exploration activities carried out by various agencies in 2010-11 are furnished in Table-3.

PRODUCTION, STOCKS & PRICES

The production of iron ore constituting lumps, fines and concentrates was at 208 million tonnes in the year 2010-11, showing a decline of about 5% as compared to the preceding year.

There were 316 reporting mines in 2010-11 as against 320 in the previous year. Among them, 33 mines were in the public sector and 283 in private sector. Besides production of iron ore was reported as an associated mineral by 17 mines in 2010-11. The contribution of public sector to the total production was about 28% as against 27% in the preceding year. The remaining 72% production in 2010-11 was from private sector. Among

33 public sector mines, 15 mines (5 in Chhattisgarh, 4 in Odisha, 3 in Jharkhand and 3 in Karnataka) each producing more than one million tonnes annually accounted for 96% of the output in public sector and 27% of the total production in the country during 2010-11. Out of 283 iron ore mines and 17 associated mines in private sector, 40 iron ore mines and 2 associated mines (21 in Odisha, 9 in Goa, 8 in Karnataka, and 4 in Jharkhand) each producing more than one million tonnes annually accounted for about 66.5% of the output of private sector and about 47.9% of the total iron ore production. Thus, 55 iron ore mines and 2 associated mines, each producing more than one million tonnes of iron ore annually, contributed about 74.9% of the total output in 2010-11. Out of 27 captive mines in the country, 14 were in the public sector and the remaining 13 in private sector. The production of captive mines in the public sector was 24.3 million tonnes or 41.6% of the sectoral output in 2010-11. On the other hand, production of captive mines in private sector was 21.6 million tonnes or 14.4% of the output in private sector.

Gradewise analysis of the current year's output reveals, that out of total output of 208 million tonnes, iron ore lumps constituted 82.2 million tonnes or about 39.5%, fines 125.1 million tonnes or about 60.2% and concentrates 0.7 million tonnes or about 0.3% of the total output of iron ore lumps. About 23.8 million tonnes or 29.1% was of grade 65% Fe and above, about 30 million tonnes or 36.5% of grade 62% to below 65% Fe, 11.5 million tonnes or 14% was of grade 60% to below 62% Fe and the rest 16.9 million tonnes or about 20.5% of the production was of grade below 60% Fe. In the case of iron ore fines, 17.2 million tonnes or 13.8% of the production was of grade 65% Fe and above, 53.9 million tonnes or 43.1% of grade 62% to below 65% Fe and balance 53.9 million tonnes or about 43.1% of grade below 62% Fe.

Among the states, Odisha recorded the highest production of 76.3 million tonnes or about 36.7% of the country's production in 2010-11. Karnataka was at the second place with a production of 37.9 million tonnes or 18.2% of the total production followed by Goa 36.7 million tonnes or 17.7%, Chhattisgarh 29.1 million tonnes or about 14% and Jharkhand 23.1 million tonnes or 11.1%. The remaining 2.3% production was reported from Andhra Pradesh, Madhya Pradesh, Maharashtra and Rajasthan.

The mine-head stocks of iron ore at the end of 2010-11 were 117.1 million tonnes as compared to 90.8 million tonnes at the beginning of the year. The stocks relate to iron ore lumps, fines and concentrates in all the states.

The average daily employment of labour strength was 42,591 during 2010-11 as against 43,557 in the preceding year. The prices of iron ore are furnished in the General Review on 'Prices'.

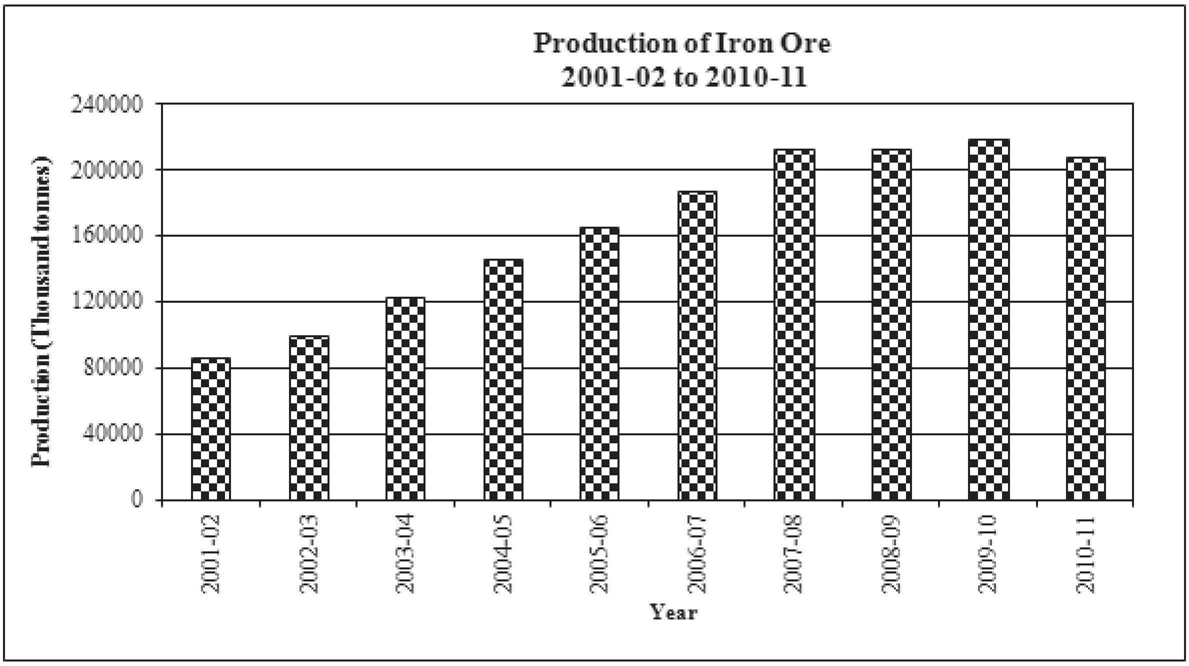


Table – 1 : Reserves/Resources of Iron Ore (Hematite) as on 1.4.2010
(By Grades/States)

(In '000 tonnes)

Grade/State	Reserves				Remaining resources								Total resources (A+B)
	Proved STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
		STD121	STD122			STD221	STD222						
All India	**5982042**	**1173324**	**938180**	**8093546**	**515353**	**756190**	**494738**	**540188**	**1197539**	**3942673**	**2341870**	**9788551**	**17882097**
By Grades													
Lump, High-grade	704874	89475	229589	1023938	85053	67668	11746	53586	32222	188840	35687	474802	1498740
Lump, Medium-grade	3411208	643575	272908	4327691	90878	203315	135930	156886	560175	903906	42533	2093623	6421314
Lump, Low-grade	154561	29684	61602	245847	84583	36168	95031	11653	91346	823326	238032	1380139	1625986
Lump, Unclassified	29097	114	40022	69233	54870	183	7882	52768	32934	151983	22800	323420	392653
Fines, High-grade	167700	4294	56498	228492	8215	6132	5675	54480	8451	46459	880	130292	358784
Fines, Medium-grade	421188	233772	56194	711154	38963	155282	54799	173318	279600	675621	18222	1395805	2106959
Fines, Low-grade	330476	48717	49103	428296	89848	57270	85045	9794	76746	416943	28977	764623	1192919
Fines, Unclassified	735	-	320	1055	-	-	-	8452	12908	118738	15200	155298	156353
Lumps & Fines, High-grade	256525	61689	26026	344240	24990	419	59151	8378	7981	6698	112375	219992	564232
Lumps & Fines, Medium-grade	207919	38185	59596	305700	3320	20531	15525	9495	19461	48741	238214	355287	660987
Lumps & Fines, Low-grade	183839	20463	31219	235521	29694	13310	11174	745	73912	274859	100498	504192	739713
Lumps & Fines Unclassified	97236	10	51198	148444	2103	175147	10045	633	725	31256	3602	223511	371955
Black Iron Ore	3150	-	1370	1464	4936	2716	-	1059	8294	-	-	17005	18469
Others	11888	2501	2536	16925	6	13591	17	-	-	25154	-	38768	55693
Unclassified	-	-	-	-	1314	389	-	-	-	389	-	2092	2092
Not-known	1648	846	-	2494	51	1850	-	-	18	161188	1484850	1647957	1650451
By States													
Andhra Pradesh	60038	58011	34167	152216	551	20988	32475	377	4624	169955	291	229261	381477
Assam	-	-	-	-	-	-	-	-	8600	4000	-	12600	12600
Bihar	-	-	-	-	-	-	-	-	-	55	-	55	55
Chhattisgarh	636460	-	263650	900110	114382	5080	15610	107625	527563	872739	748715	2391714	3291824
Goa	367378	44907	57559	469844	88723	63145	117393	7539	10050	141984	28493	457327	927171
Jharkhand	1840594	391052	72496	2304142	89372	14339	113334	45282	199455	594716	1235981	2292479	4596621
Karnataka	602685	95458	178723	876866	73194	171202	59231	245454	42843	501669	188218	1281811	2158677
Madhya Pradesh	40534	7099	9181	56814	9978	587	10170	4710	4014	145162	10	174631	231445
Maharashtra	6937	6460	17	13414	7544	6093	7659	79793	71806	64714	32185	269794	283208
Meghalaya	-	-	-	-	-	-	-	-	-	225	-	225	225
Odisha	2422247	569186	321568	3313001	128440	471517	138365	49408	317074	1404450	107978	2617232	5930233
Rajasthan	5169	1152	819	7140	3168	3239	500	-	11510	5004	-	23421	30561
Uttar Pradesh	-	-	-	-	-	-	-	-	-	38000	-	38000	38000

Figures Rounded off.

Table – 2 : Reserves/Resources of Iron Ore (Magnetite) as on 1.4.2010 (By Grades/States)

(In '000 tonnes)

Grade/State	Reserves				Remaining resources								
	Proved STD111	Probable STD121	Probable STD122	Total (A)	Feasibility STD211	Pre-feasibility STD221	Pre-feasibility STD222	Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	Total resources (A+B)
All India : Total	**15973**	**3672**	**2111**	**21756**	**189478**	**1714**	**50816**	**1513168**	**1984566**	**6313583**	**568980**	**10622305**	**10644061**
By Grades :													
Metallurgical	2149	3047	369	5565	163205	102	18435	690596	342792	966726	255	2182111	2187676
Coal washery	-	346	510	856	-	518	1981	411	318	4491	-	7719	8575
Foundry	330	125	-	455	-	-	-	-	-	303	-	303	758
Others	2074	139	-	2213	62	-	-	-	-	231	-	293	2506
Unclassified	11049	14	978	12041	26211	1094	30400	822161	1641456	5061583	568677	8151582	8163623
Not-known	372	-	254	626	-	-	-	-	-	280249	48	280297	280923
By States													
Andhra Pradesh	-	-	-	-	43034	-	-	13800	1266666	140027	14	1463541	1463541
Assam	-	-	-	-	-	-	-	-	-	15380	-	15380	15380
Bihar	-	-	-	-	-	-	-	-	-	2659	-	2659	2659
Goa	12489	3186	-	15675	26211	1094	30400	-	-	147296	1997	206998	222673
Jharkhand	-	361	551	912	-	518	1981	411	3948	2724	48	9630	10542
Karnataka	-	-	-	-	120022	-	18375	1498957	479372	5345018	340000	7801744	7801744
Kerala	-	-	-	-	-	-	-	-	59912	23523	-	83435	83435
Maharashtra	559	-	315	874	211	-	60	-	-	215	-	486	1360
Meghalaya	-	-	-	-	-	-	-	-	-	3380	-	3380	3380
Nagaland	-	-	-	-	-	-	-	-	5280	-	-	5280	5280
Odisha	-	-	54	54	-	102	-	-	-	43	-	145	199
Rajasthan	2924	125	1191	4240	-	-	-	-	-	522590	-	522590	526830
Tamil Nadu	-	-	-	-	-	-	-	-	169388	110728	226921	507037	507037

Figures rounded off.

Table-3 : Details of Exploration Activity for Iron ore, 2010-11

Agency/ State/ District	Location/ Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources Estimated
		Scale	Area (sq km)	No. of Boreholes	Meter -age		
GSI							
Chhattisgarh Kanker	Aridongri area	-	-	-	-	-	Prospecting stage (G-3) investigatio initiated during the FS 2007-08 fo assessment of iron in this area sponsored by the Chhattisgar Mineral Development Corporatio Ltd. was completed after gettin necessary forest clearance for drillin in December 2010. BIF bands ar present within a sequence c amphibolite, metapelite and quartzite The mapping revealed three iron or bands in BIF of strike lengths 1383 r (northern), 130 m (Central) and 88 m (Southern), respectively. A tota inferred resource (333) of 10.0 million tonnes with a grade c 62.28% Fe has been estimated
Jharkhand Singhbhum (West)	Around Siulpunji-Kantoria Block.	-	-	-	-	-	In this area, Reconnaissance stag (G-4) investigation was take up during FS 2010-12 in Iro Ore Supergroup at the request c DMG, Jharkhand as a collaborativ programme to assess the iron an manganese ore potentialities in an falls within the Upper Shale Forma ion in Jamda-Koira synformal bel Lithounits include intraformationa conglomerate, BIF, quartzite, shal and ferruginous brecciated chert. Iro ore bodies with dimension varyin from 85 m to 1000 m in length an width from 2.5 m to 4 m wer delineated in the area to the west c Kantoria. Iron ore bodies were als identified in Mereralgara area. A fe lenses of manganese ore occurred t the north of Diriburu and west c Ä521 hillock. The work is i progress.
Karnataka, Chitradurga	Kenkeri, Melanahalli, Guruvapura, Kempana halli,Dasudi, Kandikere Blocks	-	-	-	-	-	Reconnaissance stage investigatio (G-4) was initiated during F 2010-12 in selected freehold areas fo preliminary assessment of the iro ore occurrences in parts c Chitradurga Schist Belt as a follo up of decisions taken in SGPB c Karnataka and CGPB meeting Large scale mapping in Melanahal and Guruvapura Blocks has brough out three bands of BIF. Th analytical results of four sample collected from trench nos. T3/CSI and T5/CSB in Guruvapura Bloc analysed 33.23 to 34.01 wt% Fe. . higher value of 55.01% Fe wa obtained near a fold closur indicating a structural control for th ore concentration. Bed rock sample have given value range of 20.1 wt% to 46.91 wt% Fe. Th investigation is in progress. I Devadaribetta Range (NMDC block Bellary district, which was explore during FS 2005-08, a Reconnaissanc resource (334) of 8.20 million tonne of iron ore (Hematite) with 57.37 Fe has been estimated

Contd

Table-3 (Contd.)

Agency/ State/ District	Location/ Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources Estimated
		Scale	Area (sq km)	No. of Boreholes	Meter -age		
Odisha Keonjhar	Damurda-Champua-sahi	-	-	-	-	-	Prospecting stage investigation (G-3) in Bonai-Kendujhar belt was taken up during FS 2010-12. to assess the potential of low grade iron ore associated with BHJ and ferruginous laterites in the area. The iron ore is hematite and occured as lenses and narrow bands within ferruginous shale and BHJ. It is mainly powdery, soft and hard laminated type. The trend of ore bodies in Damurda-Lasarda ridge is NE-SW and extends over a strike length of 2.5 km with surface width varying from 50 m to 300 m. The iron content ranges from 35 to 65%. Two boreholes CBH-1 and 2 were drilled at a strike interval of 200 m. The first borehole CBH-1, planned to intersect the ore body at 50 m depth, intersected the BHJ between 41.55 m and 67.55 m with occasional shale parting and iron ore bands. The iron ore band (hematite) was intersected from 51.50 m to 53.60 m depth. The work is in progress.
Sundergarh	Sagasahi East Block	-	-	-	-	-	Prospecting stage (G-3) investigation in Bonai-Kendujhar belt was taken up during FS 2010-12 to assess iron ore potential in the northern contiguous area of Ghoraburhani block. The iron ore bodies contains hematite and occured as bands, lenses and pockets with varying dimensions and are covered by laterite. The strike length of iron ore bands is 600 m with width of about 200 m. All the boreholes intersected iron ore varying in thickness.
Rajasthan Bhilwara	Aravalli Fold Belt	-	-	-	-	-	Reconnaissance stage investigation (G-4) for ferrous and associated metallic minerals was initiated during FS 2010-12 to evaluate and delineate the iron ore occurrences in parts of south Rajasthan. Two moderately dipping BIF bands trending NE-SW have been delineated within Banded Gneissic Complex. The BGC comprises granite gneiss, leuco-granite and migmatite. The eastern BIF band is prominent with strike length of about 4.5 km and width varying from 200 m to 500 m. The western BIF band occurring in northwestern part is about 1.5 km in length and 25 m to 150 m in width. The BIF is reddish brown in colour and shows well developed compositional banding. The BIF bands in association with banded amphibolite are also reported from west of Ghatol in south Rajasthan. The BIF bands have been sampled and submitted for chemical analysis. The results are awaited. The work is in progress.

Contd

Table-3 (Contd.)

Agency/ State/ District	Location/ Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources Estimated
		Scale	Area (sq km)	No. of Boreholes	Meter -age		
DGM Chhattisgarh Kanker	Raoghat	1:50,000	514.0	-	-	54	Out crops of BHQ & BMQ were spread over an area of 2 km x 0.2 km with thickness of 5 m. So far 41.17 million tonnes were estimated, out of which 11 million tonnes were estimated during the year
Dte. of Geology Jharkhand Singhbhum (West)	Silpunji - Kantoria, Noamundi	1:12,500	58.0	-	-	70	Occurrences of discontinuous lentoid residual deposits of iron ore were noticed in this area. The iron ore particularly in this area occurred within lateritic pockets developed over BHJ, small iron ore bodies were also noticed in the form of capping which are mostly confined to shale formation. At some places iron ore is being mined from BHJ. Resources of iron ore were not estimated.
DMG Karnataka Bagalkot	N/V Ameengarh	1:50,000	85.0	-	-	-	The area comprises peninsular gneissic complex tonalite/ magmatite) followed by metamorphic horizon of Kaladgi group of rocks and younger intrusions such as dolerite & quartz veins with laterite capings. The banded iron formation is of BHQ and BMQs with occasional intermittent beds of BHJ. Fe ranges 42.05-58.75%. Resources were not estimated.
DMM West Bengal Purulia	N/V Chirugora	1:500	10,720	-	-	43	Quartz-Apatite-Magnetite bearing rock was present within phyllitic country. At places ore body was found highly weathered. Strike of the ore body was found roughly WNW-ESE dipping 40°-65° towards south. Rocks were mainly massive and at some places schistosity & compositional layering were also noticed. Quartz-apatite-magnetite rocks were also jointed. Strike extension of the deposit was about 200 m. Resource will be estimated after completion of drilling.
NMDC Ltd Chhattisgarh Dantewara	Bailadila Iron Ore mine-Kirandul Deposits 14 & 11C	-	-	50	6320.50	-	Exploratory drilling is under progress. Resources will be calculated after completion of the drilling.
	Bailadila Iron Ore mine-Bacheli Deposit 5	-	-	12	997.0	-	Reserves were not estimated.

Contd.

Table - 3 (Contd.)

Agency/ State/ District	Location/ Area/ Block	Mapping		Drilling		Sampling (No.)	Remark Reserves/ Resources Estimated
		Scale	Area (sq km)	No. of Boreholes	Meterage		
Karnataka Bellary	Donimalai	-	-	08	717.50	320	Donimalai iron ore deposit is located in these portion of Sandur Schist Belt. The trend is NNW-SSE & dipping between 70°-80° ENE. Hematite is the main ore constituent whereas BHJ/BHQ & Shale are the main waste constituents. Iron ore have been originated from BHJ by leaching of silica and enrichment of iron oxide by meteoric agencies. Resources are yet to be estimated.
SAIL **Chhattisgarh**							
Durg	Mahamaya	1:2,000	1522.67 (ha)	-	-	-	About 3.27 million tonnes iron resources were estimated. The iron ore deposit is associated with banded ferruginous formation of Iron ore series of Dharwarian system. The total strike length of the deposit was found to be 2500 m & strike direction was N-S. Average depth of the ore body is 37 m. Dip varied from 50°–80°.
	Jharandalli	1:2,000	201.45	-	-	-	The iron ore deposit is associated with banded ferruginous formation of Iron ore series of Dharwarian system. The total strike length is 2060 m & average depth of the deposit 32.53 m (2.14 m – 64.0 m). As on 1.4.2011, the total iron ore resources were estimated at 5.69 million tonnes. (Fe – 61.94%, SiO_2 – 5.12%, Al_2O_3 – 2.08% & P – 0.086
	Dalli Rajhara	1:2,000	220.42 (ha)	-	-	-	The iron ore deposits are associated with the BIF (Banded Iron Formations). The general rock types in the area are BHQ, shale, laterite & iron ore. Average width of the ore body is 200 m & average thickness of balance ore body is 40 m. About 33.91 million tonnes of iron ore were estimated of grade Fe– 65.37%, SiO_2 – 3.45% & Al_2O_3 – 1.53%.
	Dalli (Mech. Mine)	1:2,000	333.50 (ha)	-	-	-	The iron ore bearing formation belongs to meta-sedimentary sequence of Dharwarian system of Archaeozoic age. Average width of the ore body was found to about 253 m & average thickness of balance ore body is 20.08 m. The general rock types occurring in the area are BHQ, shale, laterites & hematite. About 24.5 million tonnes iron ore resources were estimated of grade Fe– 63.07%, SiO_2–5.3% & Al_2O_3–2.54%.

Contd.

Table - 3 (Contd.)

Agency/ State/ District	Location/ Area/ Block	Mapping		Drilling		Sampling (No.)	Remark Reserves/ Resources Estimated
		Scale	Area (sq km)	No. of Boreholes	Meterage		
SAIL **Chhattisgarh** Durg	Dalli	1:2,000	100.00 (ha)	-	-	-	The iron ore bearing formation belongs to meta-sedimentary sequence of Dharwarian system of Archaeozoic age. The deposit has a strike length of 1530 m. The ore body along with its surrounding rocks dipped towards north at 40^o–60^o. Widespread laterisation has been noticed in the area. The iron ore bearing rocks of this deposit occurred along southern fringe of Chhattisgarh quadrangle. The ore body occurred as cap over the country rock of the ferruginous shale. The BHQ conti-nued at depth for considerable thickness. About 1.30 million tonnes iron ore resources were estimated with grade Fe-61.25%, SiO_2-5.80% and Al_2O_3-2.32%.
Jharkhand Singhbhum (West)	Kiriburu	1:2,000	27.60(ha)	14	1017.00	-	The rock exposed in this region consists of a series of Precombrian Formations of iron ore. Geological structure of the area consists of inter layer of shales & BHQ/BHJ and irregularly overlying shales float ore & laterite sediments of recent formation. Strike extension of the deposit was found about 2000 m & depth – 138 m. About 24.62 million tonnes with an average grade of 62.70% Fe were estimated.
	Meghataburu	-	-	-	-	750	The deposit here belong to Precambrian formation, structurally controlled by folds, faults & joints. Continuity of the ore types are not homogeneous, rather occurred in patches. As on 1.4.2011, total iron ore resources were estimated at 51.42 million tonnes.
Odisha Keonjhar	Bolani iron ore mine	1:2,000	1321.45 (ha)	-	-	-	Friable, banded & massive type iron ore has been noticed. Strike was NNE-SSW. Resources were not estimated.
OMC **Odisha** Keonjhar	Seremda-Bhadrasahi	1:500	12(ha)	-	-	-	So far about 12.13 million tonnes iron ore (+58% Fe) resources were estimated.
	Khandbandh	1:500 1:1000	12.25 (ha) 18.25 (ha)	07	339.20	255	About 5.75 lakh tonnes resources were estimated.
OMC Keonjhar	Balda-Palsa, Jajang	1:1,000 1:5,00	22.75 (ha) 7.0 (ha)	30	941.6	419	About 11.38 lakh tonnes resources were estimated.
	Daitari	1:2,000	1812.99 (ha)	10	1282	528	The principal ore mineral is hematite. It is soft, laminated, biscuty ore. Strike length of the ore body was found to be about 1400 m and average width & depth was about 300 m x 100 m. About 14 million tonnes of iron ore with +45% Fe were estimated.

Contd.

Table - 3 (Contd.)

Agency/ State/ District	Location/ Area/ Block	Mapping		Drilling		Sampling (No.)	Remark Reserves/ Resources Estimated
		Scale	Area (sq km)	No. of Boreholes	Meterage		
	Unchaballi	-	-	77	3289.35	1281	About 52.60 lakh tonnes resources were estimated. At the end of the year, 92 lakh tonnes resources were estimated. Out of which 22 lakh tonnes were under (111), 60.00 lakh tonnes were under (121) and 10.0 lakh tones were under (333) categories.
Sundergarh	Kumritarl Barsuan, Bane	1:500	11 (ha)	1	2485.20	633	So far a total of 105 million tonnes resources were estimated, out of which 29 million tonnes (58-65% Fe) were placed under 111 category, 40 million tonnes (58-65% Fe) under 122 and 36 million tonnes (45-58% Fe) under 331 category.
	Kasira Koira Banel	1:500	4.5	-	-	-	About 2.10 million tonnes resources (58-65% Fe) were estimated under 222 category.
	Rantha – Barsuan Banel	1:500	5	10	295.40	174	Iron ore occurred in the form of LIO, HMO, HLO, SLO & blue dust. So far about 4.25 million tonnes (58-65% Fe) were estimated under 111 category, 21 million tonnes (+45% Fe) under 222 and 10.37 million tonnes resources were estimated under 334 category.
MML **Karnataka** Bellary	N/V Krishnanagar (Thimmappa-nagudi mine)	-	-	37	2768	2585	The iron ore deposit occurred in the area in the form of reef with banded iron formations-BHQ, BHJ and BHC. The other litho units occurring in the mine area are laterite, Metavolcanic /Shale. Ore body has been exposed over a strike length of 800 m and the dip varied between 65° to 70° towards north east. The ore body is banded and powdery in nature, reddish brown in colour and band hard metallic luster. Quality of ore is good but it varies in grade and range from 50%-60% Fe content. The area is structurally disturbed with folds and fault. A total of 17.1 million tonnes resources were estimated out of which 3.5 million tonnes are placed under 111 category, 9.5 million tonnes under 121 & 122 category and remaining 4.1 million tonnes resources are placed under 333 category.
	Ubbalagundi	-	-	23	756	-	The iron ore formations observed are mostly of hematite and confined to the Banded Hematite Quartzite and phyllite striking N15°W to S15°E and dipping westernly at an angle of 80°. The ore body formed lenticular masses and bands intercalated with the quartzite and schist are disposed along the same trend of these rock. The ore observed in this area has been formed by a processes of replacement and subsequent enrichment of clayee schist & phyllite associated closely with Banded Hematite Quartzite.

Contd.

Table - 3 (Contd.)

Agency/ State/ District	Location/ Area/ Block	Mapping		Drilling		Sampling (No.)	Remark Reserves/ Resources Estimated
		Scale	Area (sq km)	No. of Boreholes	Meterage		
MML							
Karnataka Bellery	Ubbalagundi (Concld.)						The width of the ore body in the main working varied from 25-30 m with a strike length of 1000 m and the same has been considered for reserves/resource estimation. The maximum width was noticed at the northern side and the ore body thinning towards southern side. It was also noticed that flaky type of hematite are intercalated with BHQ on the top and western slope of the lease area has been observed as parallel bands. As the depth increases, the ore became friable, towards the valley side 65°-70° the ore become fines. Total 8.74 million tonnes hematite resources were estimated out of which about 4.63 million tonnes were placed under 111 category and 4.11 million tonnes under 333 category.
Chowgule & Co. Pvt. Ltd							
Goa North Goa	Sirigao	-	-	-	-	-	General strike is N60°W/S60°E dipping due NE at 35°-45° and due SW at 65°-85° considered as north-westerly plunging overturned anticline.
	Pale	-	-	09	341.9	209	General strike of the ore body is found to be N30° W/ S30° E dipping due NE at 40°-45° and due SW at 30°-35°. Considered as double anticline separated by a minor syncline, with SE plunge. The iron ore resources were estimated at 0.40 million tonnes.
	Onda	-	-	04	152.6	64	General strike of the ore body is found to be N 25°-30° W/S 25°-30° E, extending over a strike length of 650 m. Ore body dipped on either side at moderate angles and is folded. The iron ore resources were estimated at 0.10 million tonnes.
	Vaguriem	-	-	-	-	-	General strike of the ore body is found to be N35°W/S35°E. Asymm-etrical anticline with south-western limb steeply dipping & NW limb dipping gently. Deposit extended over a strike length of 1200 m.
South Goa	Tudou	-	-	-	-	-	General strike of the ore body is found to be N 50°–60°W to S 50°–60°E extending over a strike length of 1400 m. Ore body dipped on either sides at moderate angles and is folded.

Contd.

Table - 3 (Concld.)

Agency/ State/ District	Location/ Area/ Block	Mapping		Drilling		Sampling (No.)	Remark Reserves/ Resources Estimated
		Scale	Area (sq km)	No. of Boreholes	Meterage		
V.M. Salgaocar & Bro. Pvt. Ltd							
Goa							
North Goa	Velguem/ Surla	-	-	12	797.0	-	The entire area was covered with thick cap of laterite. Lower portions of the slope were covered with clay and formed from weathering of phyllite & laterite. In general, strike of the ore deposit is N30°W-S30°E and generally dips in north-easterly direction. Amount of dip varied from 20°–70°. A few places opposite dips are also seen indicating the cross folds as antiforms & synforms. This deposit extends over a strike length of 2.8 km and spread over mining l eases. Iron ore resources were estimated at 11.62 million tonnes out of which 9.42 million tonnes were placed under category (111) and 2.20 million tonnes were placed under category (121 & 122).
North Goa	Sancordem-Malpona	-	-	-	-	-	The ore body is associated with phyllitic & limonitic clays with occasional bands of manganiferous clays & friable ferruginous quartzites on the hanging wall side. Friable silica & siliceous mangniferous clays form the footwall. The strike of the ore body was NW-SE. A total of 10.37 million tonnes iron ore resources were estimated out of which 8.81 million tonnes resources were placed under '111' category & 1.60 million tonnes under 121 & 122 category.
SouthGoa	Sigao Iron ore	-	-	27	1672.00	-	The ore body is associated with manganiferous & phyllitic clays on the hanging wall side and friable ferrugi-nous siliceous formation/ siliceous manganiferous clay on the footwall side. The general strike of the ore body is N85°W – S85°E and dipped 25°– 60° northerly. Thickness of the ore body varied from 10 m – 15 m. The ore body consists of medium to hard lumpy ore nearer to the surface and becomes friable and powdery ore at depth. In general, the ore body consists of fines with intercalations of hard ore. Mineralogically, the ore body consists mainly of hematite, martite, goethite & limonite. Chemically, the ore varied from 58% Fe in the case of earthy hematite to +62% Fe in the case of hematite–martite-specularite combinations.

Table – 4 : Principal Producers of Iron ore 2009-10

Name & address of producer	Location of mine	
	State	District
National Mineral Development Corporation Ltd, 10-3-311/A, Khanij Bhavan, Masab Tank, Hyderabad –500 028. Andhra Pradesh.	Karnataka Chhattisgarh	Bellary Dantewada
Steel Authority of India Ltd, Ispat Bhavan, Lodhi Road, New Delhi – 110 003.	Jharkhand Chhattisgarh Odisha	Singhbhum (West) Durg Keonjhar Sundergarh
Tata Steel Ltd. 24, Homi Mody Street, Fort, Mumbai –400 002, Maharashtra.	Jharkhand Odisha	Singhbhum (West) Keonjhar
Sesa Goa Ltd, Altinho, Panjim, Goa – 403 001.	Goa Karnataka	North Goa South Goa Chitradurga
Rungta Mines Pvt. Ltd, 206, A.C.J. Bose Road, Kolkata – 700 017West Bengal.	Jharkhand Odisha	Singhbhum (West) Keonjhar
Sarda Mines Private Limited, Thakurani Iron Ore Mines, Post Box No. 85, P.O. Barbil-758 035, Keonjhar, Odisha.	Odisha	Keonjhar
The Odisha Mining Corporation Ltd.P. B. No. 34, Bhubaneswar-751 001, Odisha.	Odisha	Keonjhar Sundergarh
Kamaljeet Singh Ahluwalia, P.B.No. 3, Barbil-758 035, Dist. Keonjhar, Odisha.	Odisha	Keonjhar
Ramesh Prasad Sao, Near Gandhi Park, Chaibasa, Dist. Singhbhum (West), Jharkhand.	Odisha	Keonjhar
Essel Mining & Industries Ltd, 10, Camac Street, Kolkata-700 017, West Bengal.	Odisha	Keonjhar Sundergarh

Contd.

Name & address of producer	Location of mine	
	State	District
Mysore Minerals Ltd, 39, M.G. Road, Bengaluru – 560 001, Karnataka	Karnataka	Bellary
Bonai Industrial Co. Ltd, Barbil P.O., Barbil-758 035, Dist. Keonjhar, Odisha	Odisha	Sundergarh
Smt. Indrani Patnaik, Bonaikela, P.O. Joda-758 035, Dist. Keonjhar, Odisha	Odisha	Keonjhar
Rungta Sons (P) Ltd, Rungta House, Chaibasa-833 201, Jharkhand	Odisha	Sundergarh
Cosme Costa & Sons, Altino Mapusa, Goa.	Goa	North Goa
Jindal Steel & Power Ltd, P.B. No. 6, Delhi Road, Hissar- 125 005, Haryana.	Odisha	Sundergarh
Usha Martin Ltd, Mangal Kalash, 2A Shekeshpeer Sarani, Kolkata-700 071, West Bengal	Jharkhand	Singhbhum (West)
V.M. Salgaocar & Bros. Pvt. Ltd, Salgaocar House, P.B.No.14, Vasco-da-gama, Goa-403 803	Goa	North Goa South Goa
Veerabhadrappa Sangappa & Co., No. 2/138, Bellary Road, Sandur-583 119, Karnataka	Karnataka	Bellary
Chowgule & Co. Ltd, Chowgule House, Marmugao Harbou-403 803, Goa.	Goa	North Goa
Kaypee Enterprises, Post Box No.3, P.O. Barbil -758 035, Keonjhar, Odisha.	Odisha	Keonjhar
Sesa Mining Corporation Ltd, Jeevan Vishwas, LIC Building, 2 EDC Complex, Panaji-403 001, Goa.	Goa	North Goa

Contd.

(Table-4 Contd.)

Name & address of producer	Location of mine	
	State	District
B. Kumar Gowda, (Legal heir B. Rudra Gouda) 125/B, L. B. Colony, Dist: Bellary Sandur -583 119, Karnataka.	Karnataka	Bellary
V.S. Lad & Sons, Prasanth Nivas, Krishna Nagar, Sandur – 583 119, Karnataka.	Karnataka	Bellary
Serajuddin & Co., P-16, Bentinck Street, Kolkata-700 001 West Bengal.	Odisha	Keonjhar
Padam Kumar Jain, Chaibasa-833 201, Dist. Singhbhum (West) Jharkhand.	Jharkhand	Singhbhum (West)
Khatau Narbheram & Co., N.V.Ram Complex, At- Barbil-758 035, Dist. Keonjhar, Odisha.	Odisha	Keonjhar
Feegrade & Co. (P) Ltd, P.O. Barbil-758 035, Dist. Sundergarh, Odisha	Odisha	Sundergarh

(Contd.)

(Table-4 Concld.)

Name & address of producer	Location of mine	
	State	District
Mideast Integrated Steels Ltd, Mesco Tower, 3915, Lewis Road, Bhubaneswar-751 016, Odisha.	Keonjhar	Odisha
Sociedade Timblo Irmaos Ltd, P.O. Margao, Kadar Manzil, Margao-403 601, Dist. South Goa , Goa	Goa	South Goa
Sandur Manganese & Iron Ores Ltd, At & P.O. Deogiri, Via- Sandur-583 112, Dist. Bellary, Karnataka	Karnataka	Bellary
Aryan Mining & Trading Corp. (P) Ltd.61, Strand Street, Kolkata-700 006, West Bengal.	Odisha	Sundergarh
Panduranga Timblo Industries, Subhash Timblo Bhavan, P.B.No 242, Margao-403 601, Goa.	Goa	South Goa
R.S.Gharse, P.B.No 204, Kadar Manzil, Near Municipalty Office, Margao-403 601, Goa.	Goa	South Goa

Table – 5 : Production of Iron Ore, 2008-09 to 2010-11 (By States)

(Quantity in '000 tonnes; value in ₹ '000)

States		2008-09		2009-10		2010-11(P)	
		Quantity	Value	Quantity	Value	Quantity	Value
India	**Total**	**212960**	**285444020**	**218553**	**264620052**	**207998**	**375343429**
	Lumps	92400	148365130	90262	126412246	82156	169757545
	Fines	120054	136655553	127720	137815781	125128	205002575
	Concentrates	506	423337	571	392025	714	583309
Andhra Pradesh	**Total**	10112	15211659	6246	8101303	1435	422293
	Lumps	4874	6381572	3249	4684328	984	329346
	Fines	5238	8830087	2997	3416975	451	92947

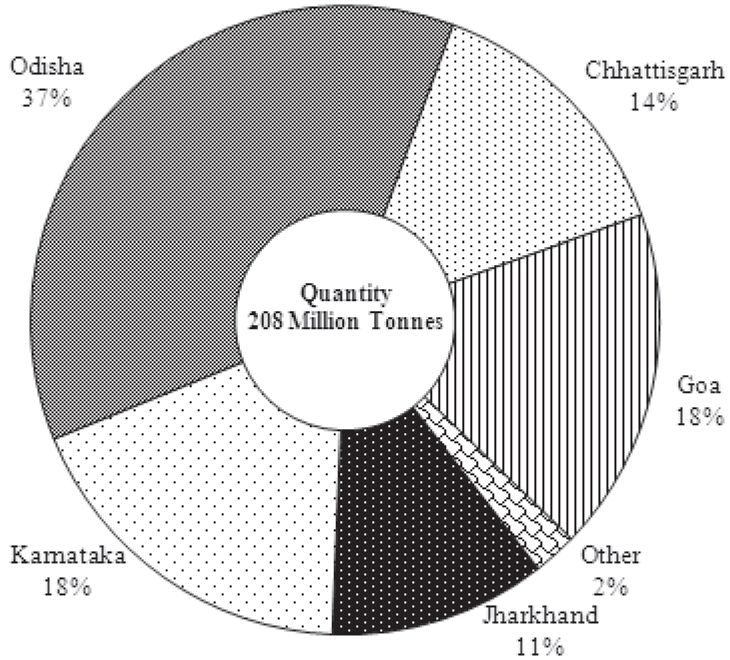
Contd.

Table-5 (Concld.)

(Quantity in '000 tonnes; value in ₹ '000)

States		2008-09		2009-10		2010-11(P)	
		Quantity	Value	Quantity	Value	Quantity	Value
Chhattisgarh	**Total**	**29997**	**59064269**	**26211**	**44227248**	**29146**	**82675755**
	Lumps	11072	32447619	11191	23572505	11862	39542517
	Fines	18925	26616650	15020	20654743	17284	43133238
Goa	**Total**	**31195**	**48609019**	**38136**	**55846319**	**36723**	**74085391**
	Lumps	5525	9463464	8267	11145773	8159	13652580
	Fines	25164	38722218	29298	44308521	27855	59852502
	Concentrates	506	423337	571	392025	709	580309
Jharkhand	**Total**	**21329**	**9246556**	**22547**	**11242048**	**23174**	**16393379**
	Lumps	9858	5026145	10249	5766639	10716	8437483
	Fines	11471	4220411	12298	5475409	12458	7955896
Karnataka	**Total**	**46971**	**57305574**	**43163**	**48811665**	**37878**	**62114924**
	Lumps	18661	24726260	16337	19013755	13729	23851070
	Fines	28310	32579314	26826	29797910	24144	38260854
	Concentrates	-	-	-	-	5	3000
Madhya Pradesh	**Total**	**412**	**101332**	**1058**	**359750**	**1745**	**789840**
	Lumps	87	19612	117	46591	114	46976
	Fines	325	81720	941	313159	1631	742864
Maharashtra	**Total**	**294**	**236085**	**283**	**221777**	**1520**	**1231774**
	Lumps	175	137433	190	149047	1030	717993
	Fines	119	98652	93	72730	490	513781
Odisha	**Total**	**72627**	**95665250**	**80896**	**95807348**	**76350**	**137623681**
	Lumps	42125	70158749	40649	62031014	35535	83173188
	Fines	30502	25506501	40247	33776334	40815	54450493
Rajasthan	**Total**	**23**	**4276**	**13**	**2594**	**27**	**6392**
	Lumps	23	4276	13	2594	27	6392

Quantity and Value of Iron Ore Production in
Different States, 2010-11



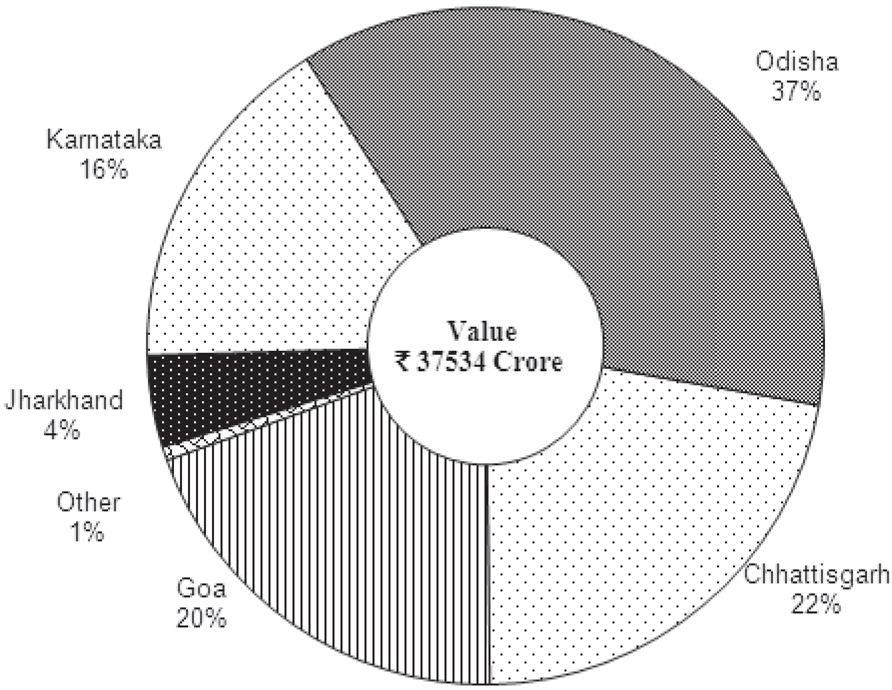


Table – 6 (A) : Production of Iron Ore, 2009-10
(By Sectors/States/Districts/Grades)

(Quantity in ’000 tonnes; value in ₹ ’000)

Sector/State/ District	No. of mines	Lumps: Below 60% Fe	Lumps: 60%-62% Fe	Lumps: 62%-65% Fe	Lumps: 65% Fe & above	Lumps: Total Qty	Lumps: Total Value	Fines: Below 62% Fe	Fines: 62%-65% Fe	Fines: 65% Fe & abvoe	Fines: Total Qty	Fines: Total Value	Concentrates Qty	Concentrates Value	Total Qty	Total Value
India	**320(18)**	**13440**	**6905**	**41249**	**28668**	**90262**	**126412246**	**46121**	**63399**	**18200**	**127720**	**137815781**	**571**	**392025**	**218553**	**264620052**
Public sector	32	359	1577	13759	9868	25563	42657196	9167	19088	4803	33058	34438160	-	-	58621	77095356
Private sector	288(18)	13081	5328	27490	18800	64699	83755050	36954	44311	13397	94662	103377621	571	392025	159932	187524696
Andhra Pradesh	**35(2)**	**871**	**2**	**2058**	**318**	**3249**	**4684328**	**747**	**2250**	**-**	**2997**	**3416975**	**-**	**-**	**6246**	**8101303**
Anantapur	6	149	-	2058	318	2525	4483272	327	2250	-	2577	3334445	-	-	5102	7817717
Cuddapah	9	394	-	-	-	394	120276	357	-	-	357	71045	-	-	751	191321
Karimnagar	2	15	-	-	-	15	5320	5	-	-	5	1440	-	-	20	6760
Krishna	1	1	-	-	-	1	285	-	-	-	-	-	-	-	1	285
Kurnool	16(2)	312	2	-	-	314	75143	58	-	-	58	10045	-	-	372	85188
Prakasam	1	++	-	-	-	++	32	-	-	-	-	-	-	-	++	32
Chhattisgarh	**10**	**70**	**79**	**3393**	**7649**	**11191**	**23572505**	**2478**	**7739**	**4803**	**15020**	**20654743**	**-**	**-**	**26211**	**44227248**
Dantewada	3	-	-	1220	6113	7333	22294142	270	5626	4803	10699	19293938	-	-	18032	41588080
Durg	5	-	-	2071	1351	3422	1028200	2076	2113	-	4189	1284984	-	-	7611	2313184
Kanker	1	70	79	102	185	436	250163	132	-	-	132	75821	-	-	568	325984
Rajnandgaon	1*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Goa	**71(1)**	**6970**	**1150**	**147**	**-**	**8267**	**11145773**	**25914**	**3360**	**24**	**29298**	**44308521**	**571**	**392025**	**38136**	**55846319**
North Goa	28	3580	381	58	-	4019	5589862	12747	2101	-	14848	22675258	-	-	18867	28265120
South Goa	43(1)	3390	769	89	-	4248	5555911	13167	1259	24	14450	21633263	571	392025	19269	27581199

Contd.

Table-6 (A) (Concld.)

Sector/State/ District	No. of mines	Lumps: Below 60% Fe	Lumps: 60%-62% Fe	Lumps: 62%-65% Fe	Lumps: 65% Fe & above	Lumps: Total Qty	Lumps: Total Value	Fines: Below 62% Fe	Fines: 62%-65% Fe	Fines: 65% Fe & abvoe	Fines: Total Qty	Fines: Total Value	Concentrates Qty	Concentrates Value	Total Qty	Total Value
Jharkhand	**19(1)**	**1053**	**2234**	**4734**	**2228**	**10249**	**5766639**	**778**	**8286**	**3234**	**12298**	**5475409**	**-**	**-**	**22547**	**11242048**
Singhbhum West	19(1)	1053	2234	4734	2228	10249	5766639	778	8286	3234	12298	5475409	-	-	22547	11242048
Karnataka	**93(6)**	**3287**	**2472**	**7955**	**2623**	**16337**	**19013755**	**10828**	**15276**	**722**	**26826**	**29797910**	**-**	**-**	**43163**	**48811665**
Bagalkot	2	180	-	-	-	180	105302	188	-	-	188	63852	-	-	368	169154
Bellary	73(5)	2499	1855	7657	1834	13845	16773258	8724	11083	722	20529	23426065	-	-	34374	40199323
Chitradurga	7	274	252	266	789	1581	1770358	1015	4117	-	5132	5135954	-	-	6713	6906312
Tumkur	11(1)	334	365	32	-	731	364837	901	76	-	977	1172039	-	-	1708	1536876
Madhya Pradesh	**5(2)**	**117**	**-**	**-**	**-**	**117**	**46591**	**941**	**-**	**-**	**941**	**313159**	**-**	**-**	**1058**	**359750**
Jabalpur	4(2)	94	-	-	-	94	37510	941	-	-	941	313159	-	-	1035	350669
Sagar	1	23	-	-	-	23	9081	-	-	-	-	-	-	-	23	9081
Maharashtra	**12**	**190**	**-**	**-**	**-**	**190**	**149047**	**93**	**-**	**-**	**93**	**72730**	**-**	**-**	**283**	**221777**
Chandrapur	3	92	-	-	-	92	67734	2	-	-	2	1504	-	-	94	69238
Gadchiroli	3	17	-	-	-	17	12847	-	-	-	-	-	-	-	17	12847
Gondia	3	7	-	-	-	7	4673	-	-	-	-	-	-	-	7	4673
Sindhudurga	3	74	-	-	-	74	63793	91	-	-	91	71226	-	-	165	135019
Odisha	**74(6)**	**869**	**968**	**22962**	**15850**	**40649**	**62031014**	**4342**	**26488**	**9417**	**40247**	**33776334**	**-**	**-**	**80896**	**95807348**
Keonjhar	46(3)	859	445	14575	14448	30327	46640551	1978	18799	8496	29273	24712771	-	-	59600	71353322
Mayurbhanj	5	10	11	183	95	299	400476	-	85	-	85	81621	-	-	384	482097
Sundergarh	23(3)	-	512	8204	1307	10023	14989987	2364	7604	921	10889	8981942	-	-	20912	23971929
Rajasthan	**1**	**13**	**-**	**-**	**-**	**13**	**2594**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**13**	**2594**
Jaipur	1	13	-	-	-	13	2594	-	-	-	-	-	-	-	13	2594

**Reporting labour employment only.*

Table – 6 (B) : Production of Iron Ore, 2010-11 (P)
(By Sectors/States/Districts/Grades)

(Quantity in ’000 tonnes; value in ₹ ’000)

Sector/State/ District	No. of mines	Lumps						Fines					Concentrates		Total	
		Below 60% Fe	60%- 62% Fe	62%- 65% Fe	65% Fe & above	Total		Below 62% Fe	62%- 65% Fe	65% Fe & abvoe	Total					
						Qty	Value				Qty	Value	Qty	Value	Qty	Value
India	**316(17)**	**16851**	**11470**	**29968**	**23867**	**82156**	**169757544**	**53967**	**53941**	**17220**	**125128**	**205002576**	**714**	**583309**	**207998**	**375343429**
Public sector	33	961	2237	12119	8979	24296	65676317	9771	17176	7068	34015	63310770	-	-	58311	128987087
Private sector	283(17)	15890	9233	17849	14888	57860	104081227	44196	36765	10152	91113	141691806	714	583309	149687	246356342
Andhra Pradesh	**29(3)**	**984**	**-**	**-**	**-**	**984**	**329346**	**451**	**-**	**-**	**451**	**92947**	**-**	**-**	**1435**	**422293**
Anantapur	1	-	-	-	-	-	18	-	-	-	-	-	-	-	-	18
Cuddapah	9	374	-	-	-	374	127488	332	-	-	332	69750	-	-	706	197238
Krimnagar	2	25	-	-	-	25	8594	18	-	-	18	5340	-	-	43	13934
Krishna	1	-	-	-	-	-	227	-	-	-	-	-	-	-	-	227
Kurnool	15(3)	585	-	-	-	585	193000	101	-	-	101	17857	-	-	686	210857
Prakasam	1	-	-	-	-	-	19	-	-	-	-	-	-	-	-	19
Chhattisgarh	**10**	**50**	**2155**	**1649**	**8008**	**11862**	**39542517**	**5054**	**5468**	**6762**	**17284**	**43133238**	**-**	**-**	**29146**	**82675755**
Dantewada	3	-	4	184	7834	8022	36463086	759	5468	6762	12989	40704505	-	-	21011	77167591
Durg	5	-	2115	1411	-	3526	2922487	4224	-	-	4224	2400202	-	-	7750	5322689
Kanker	1	50	36	54	174	314	156944	70	-	-	70	28132	-	-	384	185076
Rajnandgaon	1	-	-	-	-	-	-	1	-	-	1	399	-	-	1	399
Goa	**70(2)**	**7196**	**943**	**13**	**7**	**8159**	**13652580**	**26138**	**1716**	**1**	**27855**	**59852502**	**709**	**580309**	**36723**	**74085391**
North Goa	28	3589	261	8	7	3865	6773977	12251	1094	-	13345	28363924	3	1998	17213	35139899
South Goa	42(2)	3607	682	5	-	4294	6878603	13887	622	1	14510	31488578	706	578311	19510	38945492

Contd.

Table-6 (B) (Concld.)

Sector/State/ District	No. of mines	Lumps						Fines					Concentrates		Total	
		Below 60% Fe	60%-62% Fe	62%-65% Fe	65% Fe & above	Total		Below 62% Fe	62%-65% Fe	65% Fe & abvoe	Total					
						Qty	Value				Qty	Value	Qty	Value	Qty	Value
Jharkhand	**20**	**2343**	**1930**	**4538**	**1905**	**10716**	**8437483**	**1967**	**7708**	**2783**	**12458**	**7955896**	**-**	**-**	**23174**	**16393379**
Singhbhum (West)	20	2343	1930	4538	1905	10716	8437483	1967	7708	2783	12458	7955896	-	-	23174	16393379
Karnataka	**94(8)**	**2825**	**3418**	**6064**	**1422**	**13729**	**23851070**	**12113**	**11415**	**616**	**24144**	**38260854**	**5**	**3000**	**37878**	**62114924**
Bagalkote	1	236	-	-	-	236	204672	183	-	-	183	84370	-	-	419	289042
Bellary	73(5)	1743	3146	5467	1198	11554	20243680	7896	10040	616	18552	29107176	5	3000	30111	49353856
Chitradurg	9(2)	442	82	546	224	1294	2919816	3290	1311	-	4601	7716479	-	-	5895	10636295
Tumkur	11(1)	404	190	51	-	645	482902	744	64	-	808	1352829	-	-	1453	1835731
Madhya Pradesh	**6(2)**	**114**	**-**	**-**	**-**	**114**	**46976**	**1631**	**-**	**-**	**1631**	**742864**	**-**	**-**	**1745**	**789840**
Jabalpur	5(2)	86	-	-	-	86	26786	1623	-	-	1623	734685	-	-	1709	761471
Sagar	1	28	-	-	-	28	20190	8	-	-	8	8179	-	-	36	28369
Maharashtra	**15**	**1028**	**1**	**1**	**-**	**1030**	**717993**	**490**	**-**	**-**	**490**	**513781**	**-**	**-**	**1520**	**1231774**
Chandrapur	3	36	1	-	-	37	25906	34	-	-	34	22852	-	-	71	48758
Gadchiroli	2	8	-	1	-	9	9342	-	-	-	-	-	-	-	9	9342
Gondiya	4	9	-	-	-	9	5715	1	-	-	1	351	-	-	10	6066
Sindhudurga	6	975	-	-	-	975	677030	455	-	-	455	490578	-	-	1430	1167608
Odisha	**71(2)**	**2284**	**3023**	**17703**	**12525**	**35535**	**83173188**	**6123**	**27634**	**7058**	**40815**	**54450493**	**-**	**-**	**76350**	**137623681**
Keonjhar	43(1)	1855	992	11386	11370	25603	58425975	2489	21269	5432	29190	38000208	-	-	54793	96426183
Mayurbhanj	3	192	323	58	146	719	1623486	151	21	-	172	155295	-	-	891	1778781
Sundergarh	25(1)	237	1708	6259	1009	9213	23123727	3483	6344	1626	11453	16294990	-	-	20666	39418717
Rajasthan	**1**	**27**	**-**	**-**	**-**	**27**	**6392**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**27**	**6392**
Jaipur	1	27	-	-	-	27	6392	-	-	-	-	-	-	-	27	6392

Table – 7 : Production of Iron Ore, 2008-09 and 2009-10(P) (By Frequency Groups)

Production Group (in tonnes)	No. of mines		Production for the Group (in '000 tonnes)		Percentage in total production		Cumulative percentage	
	2009-10	2010-11	2009-10	2010-11	2009-10	2010-11	2009-10	2010-11
Total	**320(18)**	**316(17)**	**218553**	**207998**	**100.00**	**100.00**	**-**	**-**
Up to 50,000	85(13)	102(5)	1689	1657	0.77	0.79	0.77	0.79
50,001 - 100,000	45(2)	33(6)	3722	2775	1.70	1.33	2.47	2.12
100,001 - 500,000	94(2)	94(4)	26778	24829	12.25	11.94	14.72	14.06
500,001 - 1,000,000	38(1)	32	27586	22984	12.62	11.05	27.34	25.11
1,000,001 – 1,500,000	14	16(2)	16729	22329	7.66	10.74	35.00	35.85
1,500,001 – 2,000,000	16	13	28902	22936	13.23	11.03	48.23	46.88
2,000,001 and Above	28	26	113147	110488	51.77	53.12	100.00	100.00

Table – 8 (A) : Mine-head stocks of Iron ore at the beginning of the Year, 2010-11 (By States/Grades)

(In '000 tonnes)

State	Lumps					Fines				Concen-trates Total	Total Lumps, Fines & Concen-trates
	Below 60% Fe	60%-62% Fe	62%-65% Fe	65% Fe & above	Total	Below 62% Fe	62%-65% Fe	65% Fe & above	Total		
India	**8961**	**2915**	**14223**	**2870**	**28969**	**25887**	**29288**	**6599**	**61774**	**24**	**90767**
Andhra Pradesh	323	3	273	44	643	178	104	-	282	-	925
Chhattisgarh	32	32	244	369	677	1081	4693	2121	7895	-	8572
Goa	1138	199	11	-	1348	2333	411	-	2744	24	4116
Jharkhand	383	69	579	-	1031	394	856	++	1250	-	2281
Karnataka	3634	1857	7218	783	13492	13839	3470	370	17679	-	31171
Madhya Pradesh	317	-	-	-	317	35	-	-	35	-	352
Maharashtra	41	1	7	-	49	14	8	-	22	-	71
Odisha	3092	754	5891	1674	11411	8013	19746	4108	31867	-	43278
Rajasthan	1	-	-	-	1	-	-	-	-	-	1

Table – 8 (B) : Mine-head stocks of Iron ore at the end of the Year, 2010-11 (By States/Grades)

(In '000 tonnes)

State	Lumps					Fines				Concen-trates Total	Total Lumps, Fines & Concen-trates
	Below 60% Fe	60%-62% Fe	62%-65% Fe	65% Fe & above	Total	Below 62% Fe	62%-65% Fe	65% Fe & above	Total		
India	**14956**	**3043**	**7358**	**2858**	**28215**	**66211**	**17224**	**5388**	**88823**	**46**	**117084**
Andhra Pradesh	397	2	168	-	567	231	114	-	345	-	912
Chhattisgarh	14	94	75	227	410	630	635	265	1530	-	1940
Goa	892	6	6	-	904	2203	290	-	2493	20	3417
Jharkhand	366	92	785	-	1243	20283	1952	-	22235	16	23494
Karnataka	4266	2300	1842	620	9028	17917	3665	522	22104	10	31142
Madhya Pradesh	10	-	-	-	10	519	-	-	519	-	529
Maharashtra	208	1	7	-	216	21	8	-	29	-	245
Odisha	8803	548	4475	2011	15837	24407	10560	4601	39568	-	55405
Rajasthan	++	-	-	-	++	-	-	-	-	-	++

MINING, MARKETING & TRANSPORT

Iron ore mining is carried out by opencast method by manual, semi-mechanised and mechanised operations.

The charecteristics of iron ore vary as per the geological set up. Some ores are found in BHQ which exists as hard massive reef type of deposit, while in other places they occur as friable or powdery form as well as in combinations of both hard massive and powdery form. Hence, the method of mining and deployment of machinery vary from place to place. Large mechanised mines are mostly in the public sector. Manual and semi-mechanised mines are mainly in private sector. Some mechanised mines in Goa, Jharkhand and Odisha are also operated by the private sector.

Manual Mines

Generally, these mines are confined to float ores where mining is done by digging the ore with pickaxes, crowbars, chisels and spades. The mined material is screened manually to separate +10 mm float ore which is then stacked separately. The waste is backfilled into the pits. In some reef workings, 35-40 mm diameter holes are drilled to 0.6 m depth by hand-held jackhammers at a spacing of about 0.6 m and each hole is charged with 150-200 grams gunpowder or special gelatine cartridges. Blasted tonnage per kg gunpowder is usually 2.5-3 tonnes. Blasted ore is manually loaded into trucks for transport to either railway sidings or to buyer's destination directly. Output per manshift (OMS) is normally between 1.5 and 2 tonnes.

Mechanised Mines

Most mechanised mines are captive ones of different steel plants and have been developed to meet their requirements. Mining is done by formation of systematic benches in overburden and ore. The height of the benches normally varies from 10 to 12 m and width up to 20 m in the ore. Drilling holes of 300 mm diameter and till 12 m depth by crawler drills and use of explosives, such as ANFO, SMS and emulsion explosives for blasting are in practice. Loading is done by earth-moving machinery powered by diesel or electric engines, such as hydraulic excavators in the range from 1.9 cu m to 10 cu m. Ripper dozers and motor graders are also deployed for excavation and levelling purposes. Dumpers/trucks/tippers up to 120-tonne capacity were deployed in mines like Kudremukh (now closed) for transportation.

In some Goan mines, where ore is predominantly in powdery form, hydraulic shovels with boom height of 9 m are used for excavation and loading. Heavy-duty Ripper-Dozers are preferred for mining as Goan ores are soft. Height of the benches is restricted to 7 m for safe and efficient operations. Widths of working benches are maintained at more than 15 m and bench slope is maintained at about 80^{o}. The ore produced is transported to short distances by dumpers of up to 40-tonne capacity. For longer distances and barge loading, dumpers up to 10-tonne capacity are used. The barges carry the ore to harbours. The ore from the barges is loaded to ships either through berth or through transshippers.

Almost all the public sector mines including Kiriburu, Barsua, Gua, Bailadila, Donimalai, Daitari and Dalli-Rajhara operated by SAIL, NMDC and OMC are fully mechanised. Kudremukh iron ore mine of KIOCL closed since December 2005 was also mechanised. In private sector, mines operated in Goa region and Tata Steel's captive mines are mechanised. Approximately, 90% iron ore production comes from mechanised mines. In order to achieve 50 million tpy capacity of production by 2014-15, NMDC has undertaken expansion of deposit 11B mine to 7 million tpy ROM on priority. In view of depleting reserves at Donimalai mine, construction of Kumarswami mine with 7 million tpy capacity is envisaged. The entire project will be executed in 6 packages. NMDC has formed a joint venture company, namely, NMDC-CMDC Ltd. to develop Deposit 13 and Deposit 4 as stand alone projects. Deposit 13 is proposed to have a 10 million tpy capacity, while Deposit 4 will supply raw material to the proposed 3 million tpy integrated steel plant at Nagarnar, Jagdalpur.

The processing of iron ore in the country involves crushing, screening, washing and in some cases beneficiation and agglomeration. Crushing and screening are adopted mainly for sizing the ore and also for removing the adherent gangue minerals. Dry and wet grinding is also resorted to in some cases.

The lumps and fines of iron ore are marketed after washing, screening and beneficiation. Fines are converted into sinters for use in steel plants while pellets made from oncentrates/fines are predominantly exported and also are utilised for internal consumption in sponge iron units.

ENVIRONMENTAL FACTORS

Afforestation, waste dump management, top soil management, management of subgrade minerals, mechanical beneficiation, dust suppression, monitoring of water and air quality, vibration survey, publicity and propaganda are some common environmental restoration efforts pursued by all mechanised and semi-mechanised iron ore mines. Mining and beneficiation of ores carried out on large-scale cause environmental problems. A specific problem to iron ore mining is the disposal of tailings and other deleterious silica minerals and phosphorus. To safeguard the environment and prevent ecological degradation, thrust has been laid on green belt development, solid waste management, monitoring of liquid and air effluents and other crucial environmental parameters.

Goa region is prone to siltation of agricultural fields, nallahs, riverbeds and creeks due to wash off from iron ore dumps in rainy season. Loss of crop yield and reduction in fish population in streams and navigation difficulties are the problems due to silting. To overcome the problems, check dams and water filter beds at higher contours have been constructed. Tailing ponds are also being maintained at some mines. Afforestation is the mainstay in reclaiming the mined out areas in Goa. In a few cases, pits are used as water reservoir for pisciculture.

In Bellary-Hospet area, Karnataka, dust concentration (suspended particulate matter) is the main environmental problem. Environmental concerns had led to closing down of mining operations at Kudremukh iron ore mine of KIOCL in December 2005 in compliance with the order passed by the Hon'ble Supreme Court in this regard. In Bailadila sector, Chhattisgarh, forest is fairly widespread and dense, supported by good rainfall and rich flora and fauna. The deforestation taking place due to mining and waste dumping needs to be compensated continuously by afforestation at suitable slopes and in township areas. In Jharkhand, afforestation of land is the main recourse adopted for reclamation of degraded lands or improvement in land uses.

INDUSTRY

Iron ore is the basic raw material used for making pig iron, sponge iron and finished steel. The iron ore is used mainly in blast furnaces, mini-blast furnaces (MBF), DRI and sintering and pelletisation plants.

Pelletisation

In general, the pelletisation process involves mixing of iron ore and required limestone with water which later is ground in ball mills to the desired size. The discharged slurry from ball mills is filtered in pressure filters. The filter cake from filters is then mixed with dry-ground coke fines to which bentonite is mixed in suitable proportion to form green pellets in pelletising discs. The coke fines and bentonite are ground separately. The green pellets are then dried, heated and fired in indurating machine to produce iron ore pellets. There is an increasing trend for utilisation of pellets or sinters in the recent years. The use of pellets as feed in the blast furnace has several advantages because of their uniform size, known composition and strength.

The seven pelletisation plants in the country about which information is available have a total capacity of 23.35 million tonnes per annum. The pellet plant of JSW Steel Ltd (formerly Jindal Vijayanagar Steel Ltd) at Vijaynagar, Bellary district, Karnataka, has annual capacity of 4.2 million tonnes. This pellet plant reportedly supplies 1.5 million tonnes pellets to its Corex Plant and exports around 2 million tonnes. The pellet plant uses coal fines and also off-gases from the power plant to reduce production cost. Second pellet plant of JSW Steel Ltd. with 4.2 million typ capacity was expected to commence by June 2011 at Toranagallu in Karnataka. Jindal Steel & Power Ltd is setting up a 10 million tpy pellet plant at Barbil, Odisha that will utilise the huge stocks of iron ore fines lying with various iron ore mines in Odisha. The first module of 5 million tpy was put through trial run since January 2010. It produced 2.8 million tonnes pellets by the end of 2010-11 against present installed capacity of 4.5 million tpy. The project will conserve precious resources by converting unused fines into pellets for usage in DRI production.

Essar Steel Pelletisation plant at Visakhapatnam has installed capacity of 8 million tonnes per annum. After meeting its own requirement at its hot briquetted iron (HBI) plant in Hazira, Gujarat, Essar supplies pellets to both domestic and international markets. The plant has an assured supply of high quality iron ore from the captive 8 million tpy beneficiation plant at Bailadila, Chhattisgarh. The iron ore slurry is pumped through a 267 km pipeline, the second largest in the world, to the pellet plant at Visakhapatnam. A 12 million tpy integrated pelletisation facility of Essar Steel is coming up at Paradip, Odisha, in two phases.

In the first phase, 6 million tpy pellet plant was commissioned in April, 2012. Also comprising the first phase, 8 million tpy beneficiation plant and 253 km under ground slurry pipeline to transport concentrate to pellet plant will be set up. During second phase, the capacity will be scaled up to 12 million tpy by October, 2012.

Owing to environmental concerns and consequent to the Hon'ble Supreme Court's order thereupon effective 31st December, 2005, mining activity at Kudremukh was halted by KIOCL. Alternatively, the Government's decision to allot iron ore from Donimalai deposits to KIOCL's Mangalore Pellet Plant which has a capacity 3.5 million tonnes pellets per annum, has furthered the prospects for pellet production. An arrangement has also been made to transport fine ore by train from Bellary-Hospet region to the Pellet Plant at Mangalore. On 22.9.2011, KIOCL signed MoU with Kerala State Industrial Develoment Corporation Ltd for mining and setting up beneficiation and pelletisation plant in Kasargod, Kozhikode district.

NMDC was in the process of setting up two plants one at Bacheli with 2 million tpy capacity and the other at Donimalai with 1.2 million tpy capacity. The Donimalai pellet plant is scheduled to be completed by March 2013. The pellet plant at Bacheli is now on hold and is being relocated from Bacheli, Dantewada to Nagarnar, Jagdalpur, adjacent to the proposed 3 million tpy integrated steel plant.

The Orissa Minerals Development Co. Ltd (OMDCL) is planning to set up a 2 million tpy pellet plant along with a beneficiation plant at Barbil, Odisha. Bhushan Power & Steel Ltd is also setting up a pellet plant. The pelletisation plants of Tata Steel at Noamundi and Chowgule & Co. Pvt. Ltd at Pale, Goa are not in operation.

Sintering

The sintering plants in the country have annual capacity of 39.56 million tonnes. All integrated steel plants except IISCO Steel Plant (ISP) have their own sintering plants. These plants receive raw material mostly from their captive mines. Two sintering plants have recently come on stream, namely, Neelachal Ispat Nigam Ltd, Odisha (1,711 thousand tonnes) and SISCO, Mettur, Tamil Nadu (127.5 thousand tonnes). Erstwhile Ispat Metallics Ltd, a Group Company of Ispat Industries Ltd, (now JSW Ispat Ltd) had commissioned a 2.24 million tpy capacity sinter plant at the Dolvi Steel Complex in Raigarh district, Maharashtra. JSW Ispat Ltd has proposed to set up a second 4 million tpy capacity sinter plant at the Dolvi complex. Sesa Goa Ltd is also setting up sinter plant as part of its expansion project.

Pellets along with sinters have resulted in growth in utilisation of iron ore fines and blue dust. Information on capacity and production of pellets and sintering plants is given in Table-9.

Pig Iron

Pig iron is one of the basic raw materials required by foundry and casting industry for manufacturing various types of castings for the engineering secton. The post-liberalisation regime has witnessed expression of interest from a large number of entrepreneurs for setting up mini-blast furnaces for production of hot metal/pig iron. Commissioned pig iron units are mostly of stand-alone-type. Three units, namely, M/s Usha Martin Industries Ltd, M/s Jindal Steel & Power Ltd and Ispat Industries Ltd have integrated the mini-blast furnaces (MBF) and are using the hot metal in the charge-mix directly for manufacturing steel through electric arc furnace (EAF). Two units, in Karnataka (M/s Hospet Steel, a joint venture of Kalyani & Mukand) and in Tamil Nadu (M/s Southern Iron & Steel Company Ltd) have integrated their MBF with energy optimising furnace (EOF) for manufacturing steel. The excess hot metal produced by them supplements the pig iron production. Tata Metalliks Ltd, a subsidiary of Tata Steel, has been manufacturing pig iron at its plants located at Kharagpur in West Bengal and Redi in Maharashtra and has been catering to the domestic demand.

At JSW Steel Ltd in Karnataka, besides MBF, a Corex Plant (alternative to conventional MBF/BF) supplements the production of pig iron along with downstream steel making facilities. Erstwhile Ispat Industries Ltd's subsidiary Ispat Metallics (India) Ltd had set up a large blast furnace to produce 2 million tonnes per annum hot metal/pig iron at Dolvi, Raigad in Maharashtra. The excess hot metal, after meeting the requirements of the new parent company, viz, JSW Ispat Ltd, for manufacturing steel is made available as pig iron for sale. M/s Neelachal Ispat Nigam Ltd had commissioned a blast furnance with 1.1 million tpy hot metal capacity and started production of pig iron at Duburi in Jajpur district of Odisha. Visa Steel Ltd commissioned a pig iron plant in March , 2005, having

Table – 9 : Installed Capacity & Production of Pellets/Sinters, 2010-11 (By Plants)

(In '000 tonnes)

Name & location of plant	Annual installed capacity	Production		Iron ore fines consumed		General specification of concentrates/fines used
		2009-10	2010-11	2009-10	2010-11	
A) Pellet Plants :						
i) KIOCL Ltd, Panambur, Mangalore, Karnataka.	3500	1272	2124	1275	2119	Fe 64% , SiO_{+} + Al_2O_3 6% (max), S 0.05%, P 0.08% (max), Size - 10 mm.
ii) Mandovi Pellets Ltd, Near Borim Bridge, Shiroda, Goa – 403 103.	1800	297	NA	308	NA	Fe 62%, SiO_2 2 to 3.5%, Al_2O_3 1.35 to 2%, Size -10 mm.
ii) JSW Steel Ltd, Bellary, Karnataka.	4200	NA	NA	NA	NA	Fe 62%, Size -10 mm
iv) Tata Steel Ltd, Noamndi, Jharkhand.	800	Nil	Nil	Nil	Nil	(Lying closed)
v) Chowgule & Co. Ltd. Pale, Goa.	550	Nil	Nil	Nil	Nil	(Lying closed)
vi) Essar Steel Ltd, Visakhapatnam, Andhra Pradesh.	8000	NA	NA	NA	NA	NA
vii) Jindal Steel & Power Ltd	4500	227	2787	NA	NA	NA
B) Sintering Plants :						
i) Bokaro Steel Plant, Jharkhand.	6200	4545	4190	4014	3898	Fe 63.88% (max), SiO_2 -5.19% max., Al_2O_3 2.69% (Av), Size -3 mm.
ii) Bhilai Steel Plant, Bhilai, Chhattisgarh.	6334	7459	7834	5390	5603	Fe 62.6% (min), Size -0-10 mm or <10% & 1 mm or >75%.
iii) Durgapur Steel Plant, West Bengal.	3009	NA	NA	2353	2250	Fe >63%, SiO_2 2.17 to 4.54%, Al_2O_3 2.57 to 3.03%, Size +10 mm <10% & 1 mm >75%.
iv) Rourkela Steel Plant, Odisha	3070	3391	3361	2216	2647	Fe 62.80%, SiO_2 2.28%, Al_2O_3 3.04%, Size -10 mm.
v) Visakhapatnam Steel Plant, Andhra Pradesh.	5256	5310	5126	3952	3800	Fe 64.50% (min), Al_2O_3 3.0% (max), SiO_2 3%, (max), Size (-) 10 mm.
vi) Tata Steel Ltd, Jamshedpur, Jharkhand.	7500	7662	7444	7223	7154	Fe 66.63, Size +10 mm
vii) IDCOL, Kalinga, Keonjhar, Odisha	8	NA	NA	6	4	Fe 62% min., Al_2O_3 + SiO_2 8% max., Moisture 4%, SiO_2 1.5-5%.

Contd.

Table - 9 (Concld.)

(In '000 tonnes)

Name & location of plant	Annual installed capacity	Production		Iron ore fines consumed		General specification of concentrates/fines used
		2009-10	2010-11	2009-10	2010-11	
viii) JSW Ispat Steel Ltd, Dolvi, Raigad, Maharashtra.	2240	NA	NA	NA	NA	NA
ix) Neelachal lspat Nigam Ltd, Kalinga Nagar, Industrial Complex, Duburi-755 026, Dist. Jajpur, Odisha	1711	859	1000	715	817	Fe 63% (min.), Size + 10 mm 7% max.
x) SISCO, Mettur, Tamil Nadu.	127.5	NA	NA	NA	NA	NA
xi) Jindal Steel & Power Ltd, Raigarh, Chhattisgarh.	2300	NA	NA	NA	NA	NA
xii) Jayaswal Necco Industries Ltd, Sitara Growth Centre, Raipur-493 221, Chhattisgarh.	800	736	638	621	514	Fe 56.5 %, Cao 9.0%, MgO 2.25%.
xiii) Bhushan Power & Steel Ltd Sambalpur, Odisha	1000	NA	NA	NA	NA	NA

a capacity of 2.25 lakh tonnes per annum at Kalinganagar in Odisha. Sesa Goa Ltd, a Vedanta Group Company, is expanding its pig iron capacity from 0.25 million to 0.625 million tpy, along with expansion of metallurgical coke plant and a new sinter plant.

The gross pig iron manufacturing capacity in the country was about 4.833 million tonnes. Total production of pig iron in the country in 2010-11 was 5.15 million tonnes. The contribution of private sector units in the overall production of pig iron in the country continued to increase and accounted for more than 89% production in 2010-11.

Sponge Iron

India is the largest producer of sponge iron in the world. The growth of sponge iron industry during the last few years in terms of capacity and production has been substantial. The installed capacity of sponge iron increased from 1.52 million tonnes per annum in 1990-91 to around 35 million tonnes in 2010-11. Production has increased from 0.9 million tonnes in 1990-91 to 26.71 million tonnes in 2010-11. There were 324 sponge iron units in the country. Out of these, 3 gas-based units had a capacity of about 8 million tonnes per annum and the rest were coal-based units. JSPL, Raigarh, Chhattisgarh was setting up a 2 million tpy gas-based unit. The DRI plant was completed in 2011. The plant uses gas produced by coal gasification.

Sponge iron is a good substitute for scrap which is required by the electric arc furnaces and induction furnaces or mini-steel plants in the country. The availability of indigenous metal scrap is scarce, and therefore, to meet the domestic demand scrap is usually imported. Sponge iron is a viable alternative for scrap and is produced by direct reduction of high-grade iron ore or pellets to metallic iron ore in solid state by using coal or natural gas as reductant. It is also known as Direct Reduced Iron (DRI) or Hot Briquetted Iron (HBI).

Iron & Steel

The details of the Iron & Steel Industry are provided in the Review on "Iron & Steel and Scrap".

Ferro-alloys

Iron is an important constituent of ferro-alloys, like ferro-manganese (high carbon, medium carbon and low carbon), ferro-silicon, ferro-chrome (high carbon and low carbon)/charge-chrome, ferro-molybdenum, ferro-vanadium, ferro-tungsten, ferro- silicon-magnesium, ferro-aluminium, ferro-silicon-zirconium, ferro-titanium, etc. Ferro-alloys in turn are either used in steel industries to impart some special qualities or are exported. Ferro-alloys Industry has an annual capacity of producing over 4.65 million tonnes. The production was almost 2.49 million tonnes and 2.89 million tonnes in 2009-10 and 2010-11, respectively. The details about the ferro-alloys industry are provided in the Review on 'Ferro-Alloys'.

Cement

Iron ore lumps and powder containing +58% Fe are normally used in the Cement Industry as they improve burning properties, impart colour and balance the composition of the mix. Further details about the Cement Industry are provided in the Review on 'Cement'.

Coal Washeries

Magnetite ore is used as heavy media in coal washeries. There are 19 washeries for coking coal and 35 washeries for non-coking coal with 32.80 million tpy and 111.61 million tpy raw coal capacity, respectively, during 2010-11. Details on the coal washeries are provided in the Review on 'Coal & Lignite'.

USES & SPECIFICATIONS

Iron ore is used mainly for manufacturing of pig iron, sponge iron and steel. It is also used in cement, coal washeries, ferro-alloys, foundry, vanaspati and glass industries. The specifications of iron ore consumed by major sponge iron plants are furnished in Table - 10 and by major steel plants in Tables - 11.

CONSUMPTION

In 2010-11, about 104.05 million tonnes iron ore was consumed in various industries like iron & steel, sponge iron, ferro-alloys, alloy steel, coal washery and cement. Iron & steel including sponge iron were major consumer of iron ore and accounted for over 98% of its consumption. Plantwise consumption of iron ore in steel plants is furnished in Table-11. Industrywise consumption of iron ore from 2008-09 to 2010-11 is given in Table-12.

Table – 10 : Specifications of Iron Ore Consumed by Major Sponge Iron Plants

Sl. No.	Name of the Plant	Size	Specifications			
			Fe	$Al_2O_3 + SiO_2$	P	S
1.	Orissa Sponge Iron Plant	5-18 mm	65% min	4.5% max	0.03% max	N. A.
2.	Vikram Ispat	9-16 mm	66%	2.6% max	0.05%	0.01%
3.	HEG Ltd	5-18 mm	65% min	5% max	0.05%	0.03%
4.	Sunflag Iron & Steel Ltd	5-20 mm	67.5%	–	–	–
5.	Sponge Iron India Ltd	6-20 mm	55-58% & 64-66%	–	–	–
6.	Essar Steel Ltd	10-40 mm	67%	2.60% max	0.05%	0.01%
7.	Jindal Steel & Power Ltd	10-30 mm	65% min	3% max (SiO_2)	0.05%	–
8.	Tata Sponge Iron Ltd	5-18 mm	65% min	5% max	–	–
9.	GSAL India Ltd	10-40 mm	62%	–	–	–
10.	Raipur Alloys & Steel Ltd	5-18 mm	65-66%	–	–	–
11.	OCL India Ltd	Sized	62% min	–	–	–
12.	Nalwa Steel & Power Ltd	5-20 mm	63% min	–	–	–
13.	Shri Bajrang Power & Ispat Ltd	5-18 mm	64% min	–	–	–
14.	Jai Balaji Industries Ltd	5-18 mm	65%	5%	0.05%	0.03%
		10-30 mm	–	–	–	–
		10-150 mm	–	–	–	–

Table – 11 : Consumption and Specifications of Iron Ore, 2009-10 and 2010-11
(By Steel Plants)

(In '000 tonnes)

Steel plant	Iron ore consumption						Specifications
	Blast furnace (BF)				Steel melting shop (SMS)		
	2009-10		2010-11		2009-10	2010-11	
	Lumps	Fines (in sinters/ pellets)	Lumps	Fines (in sinters/ pellets)			
Bokaro Steel Plant, Bokaro, Jharkhand.	2363	3985	2524	3898	–	–	Lumps : Fe 63.40%, SiO_2 2.25%, Al_2O_3 2.39%, Size-10- 40 mm. Fines : Fe 62.24%, SiO_2 3.36%, Al_2O_3 3.45%
Bhilai Steel Plant, Bhilai, Chhattisgarh.	2992	5390	3160	5603	40	50	BF : Fe-64% (min), Size-10 - 40 mm. SMS : Fe 66%, (min), Size- 40 - 100 mm. Sinters: Fe 62.6% (min), Size - 0-10 mm.
Rourkela Steel Plant Rourkela, Odisha.	1600	2216	1547	2647	104	5	Lumps : Fe 63.54%, $SiO_2$1.78%, Al_2O_3 2.48%, Size- 10 to 50 mm, Fines:Fe 62.21%, SiO_2 2.96%, Al_2O_3 3.01%, Size -10 mm
Durgapur Steel Plant, Durgapur, West Bengal.	1203	2353	1144	2250	15	NA	Lumps : Fe 62.48%, Al_2O_3 2.42%, Size- 10 - 50 mm. Fines : Fe 62.8%, SiO_2 2.28%, Size -10 mm.
IISCO Steel Plant, Burnpur, West Bengal.	960	NA	1021	NA	18	NA	Lumps : Fe 62.86%, SiO_2 2.56%, Al_2O_3 2.56% (max.), Size - 10-40 mm.
Visvesvaraya Iron & Steel Ltd., Bhadravati, Karnataka.	222	NA	231	NA	19	126	Fe 62.97%, SiO_2 2.85%, Al_2O_3 2.43%, Size- 10-40mm.
Visakhapatnam Steel Plant, Visakhapatnam, Andhra Pradesh.	1156	3952	1437	3800	4691	4574	Lumps: Fe 65.5% min, Al_2O_3 1.60% max, SiO_2 2.25% max, Size 10-150 mm for BF, Fines : Fe 64.5% min, Al_2O_3 3.0%, SiO_2 3.00% max, Size - 10 mm.
Tata Steel Ltd, Jamshedpur, Jharkhand.	3555	7223	4101	7154	339	340	Fe 66.63, Size + 10 mm

Contd.

Table - 11 (Concld.) (In '000 tonnes)

Steel plant	Iron ore consumption						Specifications
	Blast furnace (BF)				Steel melting shop (SMS)		
	2009-10		2010-11		2009-10	20010-11	
	Lumps	Fines (in sinters/ pellets)	Lumps	Fines (in sinters/ pellets)			
IDCOL, Kalinga Iron Works, P.O. Matkarmbeda –758 036, Barbil, Dist. Keonjhar, Odisha.	NA	NA	NA	NA	NA	NA	Fe 65%, SiO_2 + Al_2O_3 5% max, Size - 10 to 30 mm.
Visa Steel Ltd, Kalinga Nagar, Industrial Complex, At & Post Jakhapura Jajpur, Odisha	307	–	73	–	–	–	Fe - 62%-64%, Size- 10 - 40 mm in BF Fe -62% -64%, Size in DRI : 5-18mm, 10-40 mm & 10-180 mm.
Neelachal Ispat Nigam Ltd, Kalinga Nagar, Industrial Complex, Duburi –755 026, Jajpur, Odisha.	427	715	233	817	–	–	Lumps : Fe 65% (min) Size + 40 mm, Fe 63% (min), Size +10 mm.

Table – 12 : Reported Consumption of Iron Ore* 2008-09 to 2010-11 (By Industries)

(In tonnes)

Industry	2008-09	2009-10(R)	2010-11(P)
All Industries	**86816000**	**96955300**	**104053900**
Alloy steel	290900 (3)	290900 (3)	290900 (3)
Cement	1074100 (53)	1294600 (58)	1130000 (60)
Coal washery **	33900 (15)	33900 (15)	33900 (15)
Ferro-alloys	7800 (3)	3300 (4)	3700 (4)
Iron & steel	51662400 (15)	56417600 (17)	59856500 (17)
Sponge iron	33744000 (e)	38912000 (e)	42736000 (e)
Others (chemical, foundry, glass, refractory)	2900 (7)	3000 (8)	2900 (8)

Figures rounded off. Data collected on non-statutory basis.
Figures in parentheses denote the number of units in organised sector reporting consumption.*
*(*Includes actual reported consumption and/or estimates made wherever required).*
** Does not include consumption of pellets & sinters; includes consumption of iron ore(fines) consumed in the production of pellets & sinters.*
*** Magnetite.*

TRADE POLICY

As per the Foreign Trade Policy (FTP) for 2009-2014 and the amended Export and Import Policy incorporated in the FTP, the present export policy for iron ore is furnished below in brief. The imports of iron ore lumps, fines, concentrates and agglomerated pellets are freely allowed.

HS Code	Item	Export Policy	Nature of restrictions
26011100	Iron ore other than those specified under Free category	STE	Export through MMTC
26011100	Iron ore of Goa origin when exported to China, Europe, Japan, South Korea and Taiwan, irrespective of the Fe content	Free	
26011100	Iron ore of Redi origin supplied to all markets, irrespective of the Fe content	Free	
26011100	All iron ores of Fe content up to 64%	Free	
26011150	Iron ore concentrate prepared by beneficiation and/or concentration of low-grade ore containing 40% or less iron produced by KIOCL Ltd	STE	Export through KIOCL Ltd, Bengaluru
26011210	Iron ore pellets manufactured by KIOCL Ltd	STE	Export through KIOCL Ltd, Bengaluru
26011290	Rejects of iron ore chips and like generated from the manufacturing process after using imported raw material	Free	(i) The quantity of export of such rejects shall not be more than 10% of the imported raw materials (ii) The size of the rejected pellets chips (fines) shall be less than 6 mm.

***Source**: Export-Import Policy, 2009-2014.*

STE: State Trading Enterprise

WORLD REVIEW

The world reserves of crude iron ore are estimated to be around 170 billion tonnes. The iron content in the iron ore reserves is estimated to be around 80 billion tonnes. The world reserves of crude iron ore and iron content by principal countries is given in Table - 13.

In 2010, the world production of iron ore was 2,611 million tonnes as against 2,277 million tonnes in the previous year. China, Australia, Brazil, India and Russia were the principal producers. The world production of iron ore is given in Table-14.

Australia

The imposition of Federal super-profits tax has reportedly threatened development of iron ore and other mineral reserves. Several companies have indicated that such a tax increase would force them to cancel projects or move investments elsewhere. Australian projects have been placed on hold to evaluate the effects of the new taxes on project economics.

BHP Billiton continued work on its Rapid Growth Project 5 (RGP5). With the completion of 89% construction by 2010-end, it was expected to add 50 million tpy capacity by mid-2011. Rio Tinto's Pilbara region reported higher iron ore production as a result of commencement of the Mesa A/Warramboo Mine in 2010. Rio Tinto has approved the expansion of its iron ore operations in Western Australia. The plan included the expansion of the mines in the Pilbara and development of additional port capacity at Dampier and Cape Lambert for expanding iron ore capacity to 330 million tpy by 2016.

China's Sinosteel Midwest Corp. agreed to share infrastructure facilities and mine services between Ansteel-Gindalbie's Karara iron ore project and

Sinosteel's Koolanooka/Blue Hills project in Western Australia. Sinosteel expected to begin operation of 1.5-million tpy hematite mine by early-2010. The Ansteel-Gindalbie joint venture was expected to begin production at Karara in 2011.

Brazil

MMX Mineracao e Metalicos S.A. announced plans to increase iron ore production at its Serra Azul and Bom Sucesso Mines in southeastern Minas Gerais State.

Canada

IOC approved to increase annual iron ore concentrate capacity to 22 million tonnes from 18 million tonnes. Labrador Iron Mines (LIM) Holdings Ltd's construction on the James iron ore mine in the Province of Quebec was nearly complete. Mine production was scheduled to begin in April 2011.

Guinea

Rio Tinto signed an agreement with Aluminium Corporation of China Ltd (China Co) for a joint venture to develop and operate the Simandou iron ore project. The mine was expected to begin operation within 5 years and was expected to produce 95 million tpy at full capacity.

Vale planned to establish a 50-million tpy iron ore mine at Simandou by 2014, with production slated to begin in 2012 with 10 to 15-million tpy capacity.

Liberia

Arcelor Mittal planned to restart the Nimba iron ore mine which had been stalled since 2009. Construction and development work started during 2010 and the company planned to start production in 2011.

Oman

Vale Oman Pelletizing Company LLC (VOPC)'s pelletising plant was scheduled to begin production in 2011 with a production capacity of 9 million tpy of direct reduction pellets.

Sweden

Luossavaara-Kiirunavaara Aktiebolag's (LKAB) announced plans for three new open pit mines in the Svappavaara area to increase mine production to 37 million tpy within 5 years.

Table – 13 : World Reserves of Iron Ore (By Principal Countries)

(In million tonnes)

Country	Reserves	
	Crude ore	Iron content
World : Total (rounded)	**170000**	**80000**
Australia	35000	17000
Brazil	29000	16000
Canada	6300	2300
China	23000	7200
India*	7000	4500
Iran	2500	1400
Kazakhstan	3000	1000
Mauritania	1100	700
Mexico	700	400
Russia	25000	14000
South Africa	1000	650
Sweden	3500	2200
Ukraine	6000	2100
USA	6900	2100
Venezuela	4000	2400
Other countries	12000	6000

Source: *Mineral Commodity Summaries, 2012.*

* *India's resources of iron ore as per UNFC system as on 1.4.2010 (P) are estimated at 28.52 billion tonnes of ore.*

Table – 14 : World Production of Iron ore (By Principal Countries)

(In million tonnes)

Country	2008	2009	2010
World : Total	**2213**	**2277**	**2611**
Australia	342	394	433
Brazil	351	331	372
Canada *	32	32	37
China	824	880	1071
India **	213	219	208
Iran	38[e]	34	34[e]
Kazakhstan	21	46	50
Russia	100	92	95
South Africa @	49	55	59
Sweden	24	18	25
Ukraine	73	66	78
USA	54	27[e]	49
Venezuela	19	14	14
Other countries	73	69	86

Source*: World Mineral Production, 2006-2010*

@ Including by-product magnetite

**including by-product iron ore*

*** India's production of iron ore in 2008-09, 2009-10 and 2010-11 was 212.96 million tonnes, 218.55 million tonnes and 208.00 million tonnes, respectively.*

FOREIGN TRADE

Exports

Exports of iron ore decreased to 46.88 million tonnes in 2010-11 from 101.53 million tonnes in the previous year. In terms of value too, the iron ore exports rose to ₹ 21,416 crore in 2010-11 from, ₹ 28,366 crore in 2009-10. The exports in 2010-11 in terms of volume comprised iron ore fines (92%), iron ore lumps (7%), and iron ore concentrates & iron ore pellets (1%). Exports were mainly to China (91%) and Japan and UAE (3% each) (Tables - 15 to 20).

Imports

Imports of iron ore were 1,867 thousand tonnes in 2010-11 as compared to 897 thousand tonnes in the previous year. The imports in 2010-11 comprised iron ore pellets (60%), fines and non-agglomerated concentrates, etc. The iron was imported from Bahrain, Mali, Brazil and Ukraine (Tables - 21 to 25).

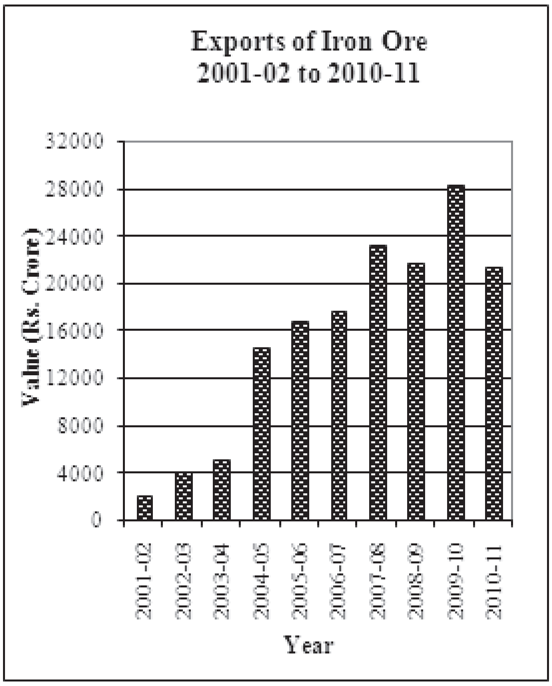


Table – 15 : Exports of Iron ore : Total (U)
(By Countries)

Country	2009-10 Qty (000' t)	2009-10 Value (₹ '000)	2010-11 Qty (000' t)	2010-11 Value (₹ '000)
All Countries	**101531**	**283661742**	**46881**	**214159541**
China	87024	242638493	42669	198864810
Japan	4989	14844264	1273	5329960
Korea, Rep. of	1101	2993033	857	4058270
UAE	131	230730	1603	3940637
Netherlands	140	411721	160	629342
Luxembourg	-	-	145	507304
Thailand	-	-	61	269827
Philippines	133	573243	44	212520
Oman	-	-	30	193959
Nepal	++	69	37	137129
Other countries	8013	21970189	2	15783

(U) : Under reference

Table – 16 : Exports of Iron ore : Lumps
(By Countries)

Country	2009-10 Qty (000' t)	2009-10 Value (₹ '000)	2010-11 Qty (000' t)	2010-11 Value (₹ '000)
All Countries	**9701**	**26092192**	**3299**	**12366740**
Australia	130	422338	-	-
Bhutan	-	-	++	320
China	7824	20537840	2757	10210839
Germany	++	2	-	-
Hong Kong	341	680420	-	-
Japan	1263	4042521	281	1222486
Korea, Rep. of	34	84985	68	389518
Singapore	58	187104	-	-
UAE	51	136980	193	543576
USA	-	-	-	-
Other countries	++	2	++	1

Table – 17 : Exports of Iron ore : Fines (By Countries)

Country	2009-10 Qty (000' t)	2009-10 Value (₹ '000)	2010-11 Qty (000' t)	2010-11 Value (₹ '000)
All Countries	**91045**	**255552349**	**43353**	**200653480**
Australia	529	1571261	1	6772
China	78434	220135821	39757	187923598
Hong Kong	4418	12038925	-	-
Japan	3726	10801742	992	4107473
Korea, Rep.of	1048	2857043	789	3668752
Macao	429	1197430	-	-
Netherlands	140	411721	160	629342
Singapore	665	2032368	++	552
Switzerland	641	1960025	-	-
UAE	80	93483	1410	3397062
Other countries	935	2452530	244	919929

Table – 18 : Exports of Iron ore: Concentrates Non-Agglomerated (By Countries)

Country	2009-10 Qty (000' t)	2009-10 Value (₹ '000)	2010-11 Qty (000' t)	2010-11 Value (₹ '000)
All Countries	**498**	**1276716**	**142**	**563698**
China	479	1225160	98	349496
Philippines	-	-	44	212520
Nepal	++	69	++	1500
Bangladesh	-	-	++	100
Malaysia	++	136	++	74
USA	++	7	++	5
Germany	-	-	++	3
Other countries	19	51344	-	-

Table – 19 : Exports of Iron ore: Pellets (By Countries)

Country	2009-10 Qty (000' t)	2009-10 Value (₹ '000)	2010-11 Qty (000' t)	2010-11 Value (₹ '000)
All Countries	**287**	**739673**	**87**	**574835**
China	287	739673	57	380876
Oman	-	-	30	193959

Table – 20 : Exports of Iron ore : Pyrites (By Countries)

Country	2009-10 Qty (000' t)	2009-10 Value (₹ '000)	2010-11 Qty (000' t)	2010-11 Value (₹ '000)
All Countries	**++**	**812**	**++**	**788**
Australia	++	177	-	-
Bangladesh	++	62	-	-
Greece	-	-	++	106
Iran	-	-	++	432
Malawi	++	57	-	-
Nepal	-	-	++	16
South Africa	++	474	-	-
Sri Lanka	-	-	++	62
UAE	++	41	-	-
Vietnam	-	-	++	172
Other countries	++	1	-	-

Table – 21 : Exports of Iron ore: Total (By Countries)

Country	2009-10 Qty (000' t)	2009-10 Value (₹ '000)	2010-11 Qty (000' t)	2010-11 Value (₹ '000)
All Countries	**897**	**4681128**	**1867**	**10284802**
Bahrain	270	1575032	682	6310170
Brazil	36	197152	168	1598981
Ukraine	226	1128411	117	960947
Russia	99	527663	45	346466
Indonesia	-	-	21	190054
Philippines	-	-	55	179933
South Africa	-	-	9	67688
Mali	-	-	678	18869
Finland	91	466164	1	9662
Unspecified	-	-	73	595814
Other countries	175	786706	18	6218

Table – 22 : Exports of Iron ore: Fines (By Countries)

Country	2009-10 Qty (000' t)	2009-10 Value (₹ '000)	2010-11 Qty (000' t)	2010-11 Value (₹ '000)
All Countries	**152**	**779767**	**55**	**179933**
Philippines	-	-	55	**179933**
Other countries	152	**779767**	-	-

Table – 23 : Imports of Iron Ore Concentrates: Non-Agglomerated (By Countries)

Country	2009-10		2010-11	
	Qty (000' t)	Value (₹ '000)	Qty (000' t)	Value (₹ '000)
All Countries	**10**	**1601**	**5**	**79**
Bolivia	-	-	5	79
Other countries	10	1601	-	-

Table – 24 : Imports of Iron Ore : Pelletes (By Countries)

Country	2009-10		2010-11	
	Qty (000' t)	Value (₹ '000)	Qty (000' t)	Value (₹ '000)
All Countries	**721**	**3889791**	**1115**	**10070122**
Bahrain	270	1575032	682	6310170
Brazil	36	197152	168	1598981
Ukraine	226	1128411	117	960947
Russia	99	527663	45	346466
Indonesia	-	-	21	190054
South Africa	-	-	9	67688
Unspecified	-	-	73	595814
Other countries	90	461533	++	2

FUTURE OUTLOOK

India is the leading producer of iron ore in the world. Indian production of iron ore constitutes around 10% of the world iron ore output.

Domestic consumption of iron ore in iron & steel and sponge iron industries account for about 98%. Cement industry is the second major consumer of iron ore.

The Working Group for 12th Plan, Planning Commission of India has estimated that the production

Table – 25 : Imports of Iron Ore : Pyrites (By Countries)

Country	2009-10		2010-11	
	Qty (000' t)	Value (₹ '000)	Qty (000' t)	Value (₹ '000)
All Countries	**14**	**9969**	**14**	**15799**
Finland	1	4631	1	9662
China	13	2487	13	2961
Austria	++	2576	++	1530
France	-	-	++	438
Portugal	-	-	++	323
Thailand	-	-	++	271
Germany	++	255	++	186
Japan	-	-	++	185
Australia	-	-	++	182
U S A	++	18	++	59
Other countries	++	2	++	2

of iron ore would be about 374 million tonnes by 2016-17 at 8% growth rate. The apparent consumption is estimated at 218 million tonnes by 2016-17 at 8% growth rate.

The Working Group has pointed out that to promote the domestic steel industry assured iron ore linkages need to be promoted. It has futher recommended that fiscal and non-fiscal incentives will be needed to be provided through joint effort of the Ministry of Mines and Minstry of Steel. In particular, technologies for agglomeration, pelletisation and direct use of fines to produce steel must be identified and taken up in Mission mode to achieve the national goal to produce 200 million tonnes of steel per annum by 2020. Acquisition of technology assets abroad pertaining to application of low grade iron ore and other technology for pig iron, sponge iron and pelletisation has also been underlined by the Working Group in its Report.

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

KAOLIN, BALL CLAY, OTHER CLAYS AND SHALE

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

49 Kaolin, Ball Clay, Other Clays and Shale

1. Kaolin (China Clay)

Kaolin, also known as china clay, is a natural clay formed by weathering of felspars. It is relatively pure clay predominantly consisting of kaolinite (Al_2O_3. $2SiO_2$. $2H_2O$), associated with other clay minerals like dickite, halloysite, nacrite and anauxite. Kaolin is commercially valued for its whiteness and fine particle size which distinguish it from other clays, such as, ball clay and fireclay. Other physical characteristics that influence commercial utility include brightness, glossiness, abrasiveness and viscosity. It often contains small amounts of impurities in the form of rock fragments, hydrous oxides and colloidal materials. Kaolin is produced and consumed in the country in crude & processed forms. The major use of crude china clay in the country is in Cement Industry and of processed china clay is in Ceramic Industry. India has extensive deposits of china clay distributed almost in every state and is in a reasonable position to cater to the needs of both domestic and export markets. The clay formed in situ in India is often soft and easily extracted with no blasting required.

RESOURCES

China clay resources in the country as per UNFC system as on 1.4.2010 have been placed at 2,705.21 million tonnes. The reserves constitute only about 7% of the resources at 177.16 million tonnes. Out of the total reserves, 70% (about 124 million tonnes) reserves are under proved category whereas 30% (about 53 million tonnes) reserves fall under probable category.

The resources are spread over in a number of states of which Kerala holds about 25%, followed by West Bengal and Rajasthan (16% each) and Odisha and Karnataka (10% each).

Out of total resources, about 22% or 608 million tonnes fall under ceramic/pottery grade, 4% are classified under chemical, paper filler and cement grades and about 73% or 1,980 million tonnes resources fall under mixed grade, others, unclassified & not-known categories. The details of reserves/ resources are given in Table - 1.

EXPLORATION & DEVELOPMENT

Details of exploration carried out by different exploration agencies during 2010-11 are given in Table-2.

PRODUCTION, STOCKS & PRICES

The production of kaolin at 2.52 million tonnes in 2010-11 decreased by 10% as compared to previous year due to temporary discontinuance of some mines.

There were 74 reporting mines during 2010-11 as against 92 mines in the previous year. Besides, the production of kaolin was also reported as an associated mineral by two mines in both the years.

Ten principal producers accounted for about 82% of the total output of kaolin in 2010-11. The private sector mines reported 99% of the total production and the remaining 1% was reported by 6 public sector mines. During 2010-11, twenty seven mines each producing more than 10,000 tonnes annually accounted for 96% of the total production of kaolin (natural) while 10 mines including one associtated mine each in the annual production range of 5,000 to 10,000 tonnes accounted for 3% and the remaining 1% of the production of kaolin (natural) was shared by 20 small mines, each producing up to 5,000 tonnes annually.

Contribution of seven mines producing more than 5,000 tonnes of kaolin (processed) was about 65% and remaining 35% production of kaolin (processed) was shared by 11 small mines along with one associated mine.

The contribution of natural and processed kaolin in 2010-11 was 97% and 3% respectively, same as in the preceding year.

Gujarat was the leading producing state of kaolin accounting for 49% production in 2010-11 followed by Kerala 27%, Rajasthan 16%, Jharkhand 4% and West Bengal 3%. The remaining 1% was shared by Andhra Pradesh, Karnataka, Madhya Pradesh and Odisha (Tables - 3 to 7).

Mine-head stocks of kaolin at the end of 2010-11 were 382 thousand tonnes as against 412 thousand tonnes at the beginning of the year (Table-8).

The average daily employment of labour strength during 2010-11 was 1,510 as against 2,226 in the preceding year. Prices of kaolin are furnished in the General Review on 'Prices'.

Table –1 : Reserves/Resources of China Clay as on 1.4.2010
(By Grades/States)

(In '000 tonnes)

Grade / State	Reserves				Remaining resources								Total resources (A+B)
	Proved STD111	Probable STD121	Probable STD122	Total (A)	Feasibility STD211	Pre-feasibility STD221	Pre-feasibility STD222	Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
All India : Total	**124118**	**11034**	**42006**	**177158**	**24543**	**22980**	**71270**	**284781**	**412852**	**1651286**	**60338**	**2528050**	**2705208**
By Grades													
Chemical	-	-	-	-	-	600	-	-	-	33945	-	34545	34545
Ceramic/Pottery	48028	2948	19564	70540	5957	10837	34695	100846	21283	337834	25788	537240	607780
Mixed Grade	7926	525	1330	9781	256	1784	2725	884	607	199355	18373	223984	233765
Filler	5793	181	2892	8866	2699	992	3671	11	665	30035	2804	40877	49743
Cement	14275	4324	2981	21580	1211	321	4637	730	1286	2565	409	11159	32739
Others	17796	1563	10234	29593	9464	6606	13651	180195	2758	41709	676	255059	284652
Unclassified	22924	506	1801	25231	3888	1161	3820	850	68338	30644	1289	109990	135221
Not-known	7376	987	3205	11568	1068	677	8071	1264	317915	975199	11000	1315194	1326762
By States													
Andhra Pradesh	2524	339	2205	5068	683	1490	1147	126	691	61883	3088	69108	74176
Assam	-	-	-	-	-	131	-	392	-	3520	-	4043	4043
Bihar	-	-	-	-	-	-	-	104	39	1296	-	1439	1439
Chhattisgarh	834	-	344	1178	480	765	1076	-	-	11512	-	13833	15011
Delhi	-	-	-	-	-	-	-	857	630	3802	-	5289	5289
Goa	-	-	-	-	-	-	16	-	-	-	-	16	16
Gujarat	34290	240	6232	40762	4654	856	24135	-	878	40904	-	71427	112189
Haryana	-	-	-	-	2367	789	3377	13	34	5485	-	12065	12065
Jammu & Kashmir	-	-	-	-	-	-	-	-	-	28122	-	28122	28122
Jharkhand	8554	325	8731	17610	209	2031	1565	1936	7363	149957	18019	181080	198690
Karnataka	943	835	280	2058	819	738	3390	220360	443	24685	6030	256465	258523
Kerala	3352	792	-	4144	2447	463	2985	43930	20439	569226	20200	659690	663834
Madhya Pradesh	-	-	-	-	942	-	61	-	415	11741	-	13159	13159
Maharashtra	-	-	-	-	418	256	856	11	184	5523	-	7248	7248
Manipur	-	-	-	-	-	-	-	2520	-	-	-	2520	2520
Meghalaya	-	-	-	-	-	-	-	1410	6266	76032	5167	88875	88875
Odisha	2376	715	811	3902	-	1252	2476	223	35393	236421	1259	277024	280926
Puduchery	-	-	-	-	-	-	-	-	-	2940	-	2940	2940
Rajasthan	70012	7603	22497	100112	11524	14008	29483	1260	4067	271314	749	332405	432517
Tamil Nadu	-	-	-	-	-	-	-	-	327	56570	-	56897	56897
Uttar Pradesh	-	-	-	-	-	-	-	11600	3447	10018	-	25065	25065
West Bengal	1232	185	906	2323	-	202	703	38	332236	80335	5826	419340	421663

Figures rounded off.

Table- 2 : Details of Exploration Activities for Kaolin and other Clays, 2010-11

Agency/ State/ District	Location/ Area/ Block	Mapping		Drilling		Sampling (No)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of bore-holes	Meterage		
China Clay							
DMG **Kerala** Kollam	Kanjiram Kodeare	-	-	07	340	-	The average thickness of clay horizon was 8 m. with 4 - 4.5 m thick overburden .About 0.33 million tonnes resources were estimated over an area of 2.5 hect. Investigation is continued.
Kannur	Pazhangadi	-	-	04	83.5		The average thickness of china clay horizon encountered is 2 m. The clay is pale white in colour.
Kannur	Pointhatta	-	-	11	244.3		The average thickness of clay horizon encountered is 6 m.
Clay **DMG** Rajasthan Bikaner	N/v Nokhra Udat & Tonkla	1:50,000 1:10,000 1:2,000	250 10 2			02	Thickness of clay varies from 1 - 18 m exposed below overburden of 4 - 31 m. Extension of new 31 m occurrences were noted of horizontal extention below O.B. at Navagaon & 4 m O.B. at Kalamagra having thickness 18 m x 1 m respectively. Resources were not estimated.
Bikaner	N/v Kodam Desar, Chandi, Golari Modia etc.	1:50,000 1:10,000 1:2,000	200 10 2			08	New occurrences of clay & bajri were located & mapped.
Karauli	N/v Khaoda & Gajjupura	1:50,000 1:10,000 1:2,000	55 11 1	-	-	16	About 1.01 million tonnes resources of clay were estimated out of which 0.07 million tonnes ore n/v Khaoda & 0.94 million tonnes ore n/v Gajjupura. The clay area observed near two villages has following dimensions: 700 m x 30 m x 3 m.
China clay **DMM** **West Bengal** Bankura	Siarbada	1.5		-	-	-	Clay beds range from 1.2 m to 1.3 m thickness, up to a maximum depth of about 5.7 m from the surface. Resources were not estimated.

Table – 3 : Principal Producers of Kaolin, 2010-11

Name & address of producer	Location of mine	
	State	District
Shri Ram Mine Chem International, Near Kutch Dairy, G.I.D.C. Area, Madhapur-370 020, Dist. Kachchh, Gujarat.	Gujarat	Kachchh
English Indian Clays Ltd, KP 111/428, Veli. Thiruvananthapuram-695 021, Kerala.	Kerala	Thiruvananthapuram
H.D. Enterprises Pvt. Ltd, Silver Point H.D. House, Pooja 'A', Above ICICI Bank Ltd., P.O. Bhuj-370 001, Dist. Kachchh, Gujarat.	Gujarat	Kachchh
Manoj P. Solanki, At-Madhapar, P.O. Bhuj, Dist. Kachchh Gujarat.	Gujarat	Kachchh
Mohd. Sherkhan Pathan P. O. Sawa-312 613, Dist. Chittorgarh, Rajasthan.	Rajasthan	Chittorgarh

Contd.

(Table - 3 Concld.)

Name & address of producer	Location of mine	
	State	District
Shri Modi Levigated Kaolin (P) Ltd, Opp. Railway Station, Neem-ka-Thana -332 713, Dist. Sikar, Rajasthan.	Rajasthan	Jaipur
Patel Nagar Minerals & Industries Pvt. Ltd, P. O. Md. Bazar-731 132, Dist. Birbhum, West Bengal.	West Bengal	Birbhum
Deedwania & Sons, D-4, Nagori Garden, Bhilwara-311 001 Rajasthan.	Rajasthan	Bhilwara
J.K. White Cement Works 70, Sector–7 Extn. Indra Vihar Street, New Power House Road, Jodhpur, Rajasthan.	Rajsthan	Chittorgarh
D.B.H. International (P) Ltd, N-75, Connaught Circus, New Delhi-110 001.	Kerala	Thiruvananthapuram

Table - 4 : Production of Kaolin (Total) 2008-09 to 2010-11
(By States)

(Qty in tonnes; value in ₹ '000)

State	2008-09		2009-10		2010-11 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**2083731**	**641747**	**2798340**	**676728**	**2522181**	**627559**
Andhra Pradesh	47678	4730	108395	9937	11772	1629
Gujarat	968928	201117	1306539	207944	1228759	221385
Jharkhand	168922	92050	106828	102218	92029	90212
Karnataka	6164	6110	19543	12015	9785	8347
Kerala	587222	258656	698915	214303	672438	182660
Madhya Pradesh	8400	762	17350	1209	5806	460
Odisha	3453	1771	4558	2165	2809	2261
Rajasthan	202189	36027	436773	83958	408940	81177
West Bengal	90775	40524	99439	42979	89843	39428

Table - 5 : Production of Kaolin, 2009-10 and 2010-11

(By Sectors/States/Districts/Grades)

(Qty. in tonnes, value in ₹ '000)

State/District	2009-10							2010-11(P)						
	No. of mines	Natural		Processed		Total		No. of mines	Natural		Processed		Total	
		Qty	Value	Qty	Value	Qty	Value		Qty	Value	Qty	Value	Qty	Value
India	**92(2)**	**2718377**	**524683**	**79963**	**152045**	**2798340**	**676728**	**74(2)**	**2447439**	**503740**	**74742**	**123819**	**2522181**	**627559**
Public sector	6	19928	5824	12406	37337	32334	43161	6	25578	4887	12205	23860	37783	28747
Private sector	86(2)	2698449	518859	67557	114708	2766006	633567	68(2)	2421861	498853	62537	99959	2484398	598812
Andhra Pradesh	**10**	**108395**	**9937**	**-**	**-**	**108395**	**9937**	**8**	**11772**	**1629**	**-**	**-**	**11772**	**1629**
Adilabad	1	4737	474	-	-	4737	474	1	1807	181	-	-	1807	181
Cuddapah	2	68251	6955	-	-	68251	6955	1	1772	266	-	-	1772	266
East Godavari	4	4829	952	-	-	4829	952	4	4973	994	-	-	4973	994
Visakhapatnam	2	30178	1479	-	-	30178	1479	1	3000	144	-	-	3000	144
West Godavari	1	400	77	-	-	400	77	1	220	44	-	-	220	44
Gujarat	**28**	**1274099**	**165465**	**32440**	**42479**	**1306539**	**207944**	**20**	**1199307**	**185757**	**29452**	**35628**	**1228759**	**221385**
Kachchh	18	1062825	144031	-	-	1062825	144031	12	1189737	184758	-	-	1189737	184758
Mahesana	2	-	-	9280	9744	9280	9744	2	-	-	8910	9356	8910	9356
Patan	3	206894	20689	-	-	206894	20689	1	8970	897	-	-	8970	897
Sabarkantha	5	4380	745	23160	32735	27540	33480	5	600	102	20542	26272	21142	26374
Jharkhand	**13(1)**	**78395**	**36933**	**28433**	**65285**	**106828**	**102218**	**8(1)**	**66960**	**33871**	**25069**	**56341**	**92029**	**90212**
Sahebganj	4(1)	24893	3004	14148	39827	39041	42831	4(1)	25515	2505	12942	35536	38457	38041
Singhbhum (West)	9	53502	33929	14285	25458	67787	59387	4	41445	31366	12127	20805	53572	52171

(Contd.)

Table - 5 : (Concld.)

(Qty. in tonnes, value in ₹ '000)

State/District	2009-10							2010-11(P)						
	No. of mines	Natural		Processed		Total		No. of mines	Natural		Processed		Total	
		Quantity	Value	Quantity	Value	Quantity	Value		Quantity	Value	Quantity	Value	Quantity	Value
Karnataka	**3**	**15950**	**5522**	**3593**	**6493**	**19543**	**12015**	**3**	**6500**	**1920**	**3285**	**6427**	**9785**	**8347**
Hassan	1	-	-	3593	6493	3593	6493	1	-	-	3285	6427	3285	6427
Kolar	1	2450	662	-	-	2450	662	1	1500	120	-	-	1500	120
Shimoga	1	13500	4860	-	-	13500	4860	1	5000	1800	-	-	5000	1800
Kerala	**15**	**690102**	**183458**	**8813**	**30845**	**698915**	**214303**	**15**	**663518**	**165226**	**8920**	**17434**	**672438**	**182660**
Kannur	2	-	-	7523	26078	7523	26078	2	-	-	8098	15790	8098	15790
Kasaragod	1	-	-	1290	4767	1290	4767	1	-	-	822	1644	822	1644
Kollam	2	14078	2494	-	-	14078	2494	2	28650	4701	-	-	28650	4701
Thiruvananthapuram	10	676024	180964	-	-	676024	180964	10	634868	160525	-	-	634868	160525
Madhya Pradesh	**3**	**17350**	**1209**	-	-	**17350**	**1209**	**2**	**5806**	**460**	-	-	**5806**	**460**
Katni	2	15550	939	-	-	15550	939	1	5706	445	-	-	5706	445
Satna	1	1800	270	-	-	1800	270	1	100	15	-	-	100	15
Odisha	**3**	**3170**	**1048**	**1388**	**1117**	**4558**	**2168**	**1**	-	-	**2809**	**2261**	**2809**	**2261**
Bargarh	1	3100	1023	-	-	3100	1023	-	-	-	-	-	-	-
Mayurbhanj	2	70	25	1388	1117	1458	1142	1	-	-	2809	2261	2809	2261
Rajasthan	**14(1)**	**436773**	**83958**	-	-	**436773**	**83958**	**14(1)**	**408940**	**81177**	-	-	**408940**	**81177**
Bhilwara	6	120668	16863	-	-	120668	16863	4	102310	16901	-	-	102310	16901
Chittorgarh	6(1)	264655	58016	-	-	264655	58016	6	204360	47790	-	-	204360	47790
Jaipur	1	48450	8479	-	-	48450	8479	1	84155	14727	-	-	84155	14727
Pali	1	3000	600	-	-	3000	600	1	55	14	-	-	55	14
Sikar	-	-	-	-	-	-	-	1#	-	-	-	-	-	-
Udaipur	-	-	-	-	-	-	-	1(1)	18060	1745	-	-	18060	1745
West Bengal	**3**	**94143**	**37153**	**5296**	**5826**	**99439**	**42979**	**3**	**84636**	**33700**	**5207**	**5728**	**89843**	**39428**
Birbhum	3	94143	37153	5296	5826	99439	42979	3	84636	33700	5207	5728	89843	39428

Figures in parentheses indicate number of associated mines.
 # Mine reporting production of dolomite only.

Table – 6 : Production of Kaolin (Natural), 2009-10 and 2010-11 (P)
(By Frequency Groups)

(In tonnes)

Production Group	No. of mines		Production for the Group		Percentage in total production		Cumulative percentage	
	2009-10	2010-11	2009-10	2010-11	2009-10	2010-11	2009-10	2010-11
All Groups	**77(1)**	**57(1)**	**2718377**	**2447439**	**100.0**	**100.0**	**-**	**-**
Up to 500	10	6	1350	1025	++	++	++	++
501-1000	3	3	2165	1875	0.1	0.1	0.1	0.1
1001-2000	4	3	6601	5079	0.2	0.2	0.3	0.3
2001-3000	6	5	15105	12502	0.6	0.5	0.9	0.8
3001-4000	2	-	6200	-	0.2	-	1.1	0.8
4001-5000	5	4	22042	17979	0.8	0.7	1.9	1.5
5001-10000	10	9(1)	73133	71064	2.7	2.9	4.6	4.4
10001-15000	6(1)	5	89137	65131	3.3	2.7	7.9	7.1
15001 & Above	31	22	2502644	2272784	92.1	92.9	100.0	100.0

Figures in parentheses indicate the number of associated mines.

Table – 7 : Production of Kaolin (Processed), 2009-10 and 2010-11 (P)
(By Frequency Groups)

(In tonnes)

Production Group	No. of mines		Production for the Group		Percentage in total production		Cumulative percentage	
	2009-10	2010-11	2009-10	2010-11	2009-10	2010-11	2009-10	2010-11
All Groups'	**20(1)**	**18(1)**	**79963**	**74742**	**100.0**	**100.0**	**-**	**-**
Up to 500	2	2	649	159	0.8	0.2	0.8	0.2
501-1000	1	2	740	1468	0.9	2.0	1.7	2.2
1001-2000	6	1	8252	1006	10.3	1.3	12.0	3.5
2001-3000	-	4	-	10444	-	14.0	12.0	17.5
3001-4000	3	1	9849	3285	12.3	4.4	24.3	21.9
4001-5000	1(1)	1(1)	9422	9484	11.8	12.7	36.1	34.6
5001-10000	6	6	38598	37082	48.3	49.6	84.4	84.2
10001 & Above	1	1	12453	11814	15.6	15.8	100.0	100.0

Figures in parentheses indicate the number of associated mines.

Table – 8 : Mine-head Stocks of Kaolin (Total), 2010-11 (P)
(By States)

(In tonnes)

State	At the beginning of the year	At the end of the year
India	**412088**	**382105**
Andhra Pradesh	57813	25595
Gujarat	104874	111555
Jharkhand	22330	14424
Karnataka	14979	15914
Kerala	18022	29466
Madhya Pradesh	30572	14574
Odisha	4566	2658
Rajasthan	144483	147977
West Bengal	14449	19942

MINING, PROCESSING & MARKETING

China clay deposits worked in India are mostly of pocket-type. Opencast manual mining is followed in most kaolin mines. The most common practice is to dig trial pits for locating clay pockets or beds which are gradually enlarged into pits of various dimensions. China clay is often soft and easily extracted with no blasting required. Clay and overburden are quarried in benches. In few mines, bulldozers and excavators are used to remove the overburden which is then transported through trucks/tractors/trailers.

Crude china clay is normally processed outside the leasehold area. Almost all the china clay user industries except cement, insecticide and refractory units consume processed china clay. The natural china clay is processed in the country mostly by conventional method of levigation/washing. In addition, hi-tech processes, such as, Mozeley hydrocyclone separator, high-intensity magnetic separator, bleaching (chemical decolourisation), spray drying and calcination are in practice. There is a need to use more sophisticated processing techniques like ultra froth-flotation, cryo-filter, etc.

The recovery percentage of processed china clay from raw china clay ranges from as low as 14% to as high as 56%, depending upon the quality of china clay available in different states. Large number of levigation plants are installed in the country mostly in Kerala, Gujarat, Jharkhand, West Bengal and Rajasthan. Kerala has become a hub for India's processed kaolin production. The important plants in the country are English Indian Clays Ltd (EICL) (220,000 tpy capacity), Veli, Thiruvananthapuram, Kerala; Kerala Clays and Ceramic Products Ltd, (10,000 tpy capacity) Payangadi, Kannur district, Kerala; 20 Microns Ltd, Mamuara, Bhuj district, Gujarat (80,500 tpy capacity; a new plant of 33,600 tpy is also installed); Amrapali China Clay Washing Plant, Nadapa, Bhuj district, Gujarat; Mokdumnagar China Clay Processing Plant of West Bengal Projects Ltd, Mohammad Bazar, Birbhum district, West Bengal and Hindalco's Beneficiation Plant at Bagru Plateau in Lohardaga district, Jharkhand. EICL has capacity to produce 180,000 tpy paper coating and filler grades of processed china clay (hydrous), besides 30,000 tpy of calcined clays. It is in the process of increasing capacity of calcined clay to 60,000 tpy. Popular Minerals is reported to be developing its mine and plant in Chittorgarh, Rajasthan. Ashapura is also establishing new production unit in Kerala with a 200,000 tpy kaolin capacity of various grades - air floated, lumps, hydrous and hydrous calcined.

Processed kaolin is presently marketed under various trade names mostly in levigated and spray dried forms. A small quantity of crude kaolin is also marketed. The various trade names under which the levigated kaolin is marketed are Hibrite, Cerefel - K.C.G. Spray dried, K.C.G. Lumps, B.C.K. Spray dried, etc. Grading is based primarily on white colouration and grit content. Improved processing techniques could further the prospects of Indian kaolin in the international markets.

USES AND SPECIFICATIONS

China clay (kaolin) is used in a number of industries in both crude and processed forms. The major use for crude china clay in India is in the Cement Industry, whereas Ceramic Industry accounts for consumption of a major share of processed form of china clay. Besides ceramics, processed china clay finds use in other industries in the country, such as sealants, paper coatings, as extender in fibre glass, paint and as a filler for paper, rubber, plastic, cosmetics, pharmaceuticals and textiles. Crude china clay also finds use in Insecticide and Refractory Industries. Other uses of china clay are in ink, ultramarine, synthetic zeolite, catalyst, water filter candles, soaps & detergents and explosives & pyrotechnic industries. Some of the areas where use of china clay is gaining importance are in the manufacture of plastic film, video and audio tapes where clays are used as anti-blocking agents, and in the field of biotechnology, where ceramics are widely in use for its light weight & high strength properties.

The Bureau of Indian Standards (BIS) has prescribed specifications for china clay to be used in different industries. They are IS:505-1995 (Third Revision, Reaffirmed 2011) for paper coating and filler for paper, rubber, textile industries, IS:1463-1983 (Third Revision, Reaffirmed 2000) for cosmetics and IS:7589-1974 (Reaffirmed 2011) for Explosive & Pyrotechnic Industry. BIS has revised the specifications for china clay for Ceramic Industry to IS:2840-2002 (Second Revision, Reaffirmed 2008) and for paint industry to IS:68-2006. The whiteness, particle size, plasticity, contents of alumina, iron and titanium are some important factors which control the specifications of china clay for different end-uses. China clay for ceramic and refractory applications is analysed for grit, brightness, green and dry strength, fixed colour, iron and alumina contents. For filler and extender applications, it must meet very rigid specifications, such as, particle size, colour, brightness and viscosity (Table - 9).

CONSUMPTION

The main consuming industry for raw china clay is the china clay processing/refining plants. The china clay processed by these plants in turn is consumed by various industries except cement, refractory and pesticide industries. The data on raw china clay consumption by various china clay processing plants are not readily available. However, the consumption of china clay by various industries is given in Table-10.

Consumption of china clay increased to 1,477 thousand tonnes in 2010-11, from 1,485 thousand tonnes in 2009-10. Cement Industry accounted for 45% consumption followed by ceramic (42%), the major consumer of raw china clay. Pesticide, paint, refractory, paper, cosmetic, rubber, abrasive, asbestos products, chemical, dry cell batteries, textile, electrical, electrode and glass industries together accounted for the remaining 13%.

Table -10: Reported Consumption of Kaolin (China clay), 2008-09 to 2010-11 (By Industries)

(In tonnes)

Industry	2008-09	2009-10(R)	2010-11(P)
All Industries	**1088100**	**1484600**	**1476600**
Cement 1/	339300(8)	642100(6)	662700(6)
Ceramic 2/	480700(236)^e	645000(237)^e	624800(237)^e
Cosmetic	2200(5)	2300(5)	2200(5)
Glass	2300(3)	700(3)	700(3)
Paint	110900(25)	111000(25)	111000(25)
Paper	21100(23)	21700(23)	21700(23)
Pesticide	24800(21)	24800(21)	24800(21)
Refractory	27900(28)	33000(28)	24700(27)
Rubber	2400(31)	2400(31)	2400(31)
Others (abrasives, asbestos-products, chemical, dry cell battery, electrical, electrode and textile).	76500(41)	1600(36)	1600(36)

Figures rounded off. Data collected on non-statutory basis. Figures in parentheses denote the number of units in organised sector reporting consumption.*

*(*Includes actual reported consumption and/or estimates made wherever required).*

1/ Relates to raw/unprocessed china clay.
2/ Includes 2 units which processed crude china clay to the tune of about 74,900 tonnes, 65,300 tonnes & 65,300 tonnes during 2008-09, 2009-10 & 2010-11, respectively.

Table – 9 : Specifications of China Clay Required in Different Industries

Sl. No.	Characteristics	Paper coating Grade I	Filler in paper, rubber, textile Grade II	Cosmetics	Explosives
1.	Bureau of Indian Standard Specification No.	505 (1995)	505 (1995)	1463 (1983)	7589 (1974)
2.	Fineness (by weight % material retained on:)				
	45 micron sieve	–	–	2.0	–
	53 micron sieve	0.8	1.0	–	–
	63 micron sieve	–	–	–	1.0
	90 micron sieve	–	–	0.1	–
3.	Larger than 10 microns in diameter (% by mass, max)	5.0	15.0	–	–
4.	Smaller than 10 microns in diameter (% by mass, min)	75.0	60.0	–	–
5.	Grit (% by mass, max)	–	–	–	0.001
6.	Loss on drying (% max)	2.0	2.0	1.5	1.5
7.	Loss on ignition (% max)	14-15.5	14-15.5	15	14.0
8.	Water Plasticity (%)	14.0	–	–	–
9.	Shrinkage linear				
	a) Dry shrinking	–	–	–	–
	b) Fired shrinking	–	–	–	–
10.	Relative/Bulk density	2.5-2.9	2.5-2.9	*0.65-0.90(BD)	
11.	Colour reflectance to blue light (%)	80-85	*	–	–
12.	Chemical (% by mass, max)	–	–	@	–
	Fe_2O_3	0.6	0.75	0.5	–
	Matter soluble in HCl	0.5-1	1.5-2.5	2.0	1.5
	CuO	–	0.007	–	–
	MnO	–	0.013	–	–
	Heavy metals (as Pb)	–	–	5 ppm	–
	As_2O_3	–	10 ppm	2 ppm	–
	pH value of aqueous extract	4.5-7.5	4.5-7.5	7.5	6.0-7.5
13.	Oil absorption (ml/100 g)	–	50 (min)	–	35-45
14.	Water soluble matter (%, max)	–	0.5	–	0.5

** As agreed.*
@ To pass test for iron and carbonate as well.

TRADE POLICY

As per the Foreign Trade Policy (FTP) 2009-2014, there are no restrictions on exports and imports of china clay (kaolin).

WORLD REVIEW

The world production of kaolin at 26.2 million tonnes in 2010 showed 6% increase over the previous year. Six countries, namely, USA, Germany, China, Brazil, UK and Iran accounted for about 67% world production. The share of USA in total world production was about 22%, followed by Germany (17%), China (11%), Brazil (9%) and Iran Republic of Korea and UK (4% each) (Table-11).

Table – 11 : World Production of Kaolin (By Principal Countries)

(In '000 tonnes)

Country	2008	2009	2010
World : Total	**28000**	**24700**	**26200**
Brazil	2667	1987	2400
China	3000	3000	3000
Czech Republic	664	488	636
France	355	350	350
Germany	3622	4513	4578
Iran	1274	907	1000[(e)]
Korea, Rep. of	1182	890	962
Malaysia	506	488	530
Mexico	690	406	517
Spain	356	270	251
Turkey	233	235	711
UK	1355	1060	1000[(e)]
USA	6750	5290	5700[(e)]
Vietnam	650	650	650
Other countries	4696	4166	3915

Source: *World Mineral Production, 2006-2010*

USA

New project I Minerals made progress with its Bovill kaolin deposit in Idaho. The deposit has inferred resources of 38.4 million tonnes of primary clay with 8.9 million tonnes in the main area of focus. I-Minerals has estimated a production rate of 900 tpd and a minimum mine life of over 50 years.

Australia

W.A. Kaolin was in the planning stages for a capacity expansion of 350,000 tpy. The initial installed capacity would be 150,000 tpy for its mine near Wickepin, Western Australia. The company was developing a new mine where overburden is very little and over 100 million tonnes proved reserves have been identified.

FOREIGN TRADE

Exports

Exports of kaolin decreased to 110,117 tonnes in 2010-11 from 160,935 tonnes in 2009-10. UAE (58%) and Bangladesh (20%) were the major importing countries in 2010-11 (Table - 12).

Imports

Imports of kaolin increased marginally to 52,663 tonnes in 2010-11 from 46,708 tonnes in 2009-10. Major suppliers were USA (48%), Ukraine (17%) and China (15%) (Table - 13).

Table - 12: Exports of Kaolin (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**160935**	**490785**	**110117**	**408198**
UAE	108934	136641	64148	85365
Bangladesh	25047	82080	21870	61510
Germany	4627	49808	4621	58512
Malaysia	2768	29443	2736	28933
Angola	3643	25290	2550	16376
Egypt	1896	28063	1984	13171
Sri Lanka	1207	10957	1116	12407
Philippines	527	8073	560	11194
Nepal	1038	4427	1554	9296
Mauritius	775	8376	558	8466
Other countries	10473	107627	8420	102968

Table - 13: Imports of Kaolin

(By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**46708**	**563887**	**52663**	**636698**
USA	24842	327863	25350	330473
China	9577	98991	7737	90486
UK	2518	44968	3335	61726
Ukraine	5376	28208	8783	50658
New Zealand	588	15858	1006	26485
Thailand	460	3851	2094	17581
Spain	900	12974	1017	12834
Germany	302	3489	888	12252
France	572	11512	700	9343
Chinese Taipei/Taiwan	324	3577	415	5345
Other countries	1249	12596	1338	19515

FUTURE OUTLOOK

India has abundant resources of kaolin which can easily meet both the internal and the external demands. The future requirement of processed kaolin in the domestic market is expected to grow substantially. The processing of kaolin in the country is done mostly by conventional methods like levigation and washing.

New capacities for High-tech processing have to be established and existing capacities in the country have to be augmented to meet the demand of processed kaolin in the future. Efforts to foray into the potential markets like Egypt, Zimbabwe, Iran, Malaysia, Jordan and Pakistan need to be prioritised, besides expansion in exports to the traditional and neighbouring markets like Bangladesh, Sri Lanka and Nepal as also other prospective markets such as, Kenya, UAE, Saudi Arabia and Bahrain must be high in the line of focus.

In the Indian kaolin market, good growth is expected both for hydrous and calcined clay particularly in paint, cables, plastics, rubber and ceramics. The apparent demand of china clay is estimated at 2.99 million tonnes by 2011-12 and at 4.61 million tonnes by 2016-17 and that of ball clay at 1.18 million tonnes by 2011-12 and 1.82 million tonnes by 2016-17 at 9% growth rate by Planning Commission of India.

2. Ball Clay

Ball clay and china clay are used for similar purposes in ceramic and pottery. Ball clay and china clay differ only in the degree of plasticity. China clay is less plastic than ball clay. Ball clay is a highly plastic variety of kaolin having high binding power, tensile strength and shrinkage. It is utilised generally after mixing with non-plastic clay to impart the desired plasticity in pottery, porcelain and refractory materials. It also helps in the preparation of glaze, enamels and for imparting a dense vitrified body.

RESOURCES

The total resources of ball clay as on 1.4.2010 in the country are placed at 83.39 million tonnes. Out of these resources, the reserves are about 16.78 million tonnes and the remaining resources are 66.61 million tonnes. More than 62% resources are in Andhra Pradesh, followed by Rajasthan with 38%. Resources in Gujarat are nominal. Out of the total resources, ceramic/pottery grade constitutes 89%. All India reserves/resources of ball clay are given in Table-14.on of India.

PRODUCTION, STOCKS & PRICES

The production of ball clay at 958 thousand tonnes in 2010-11 increased by 3% as compared to that in the previous year.

During the year under review, there were 36 reporting mines as against 39 in 2009-10. Besides, production of ball clay was also reported as an associated mineral by two mines during 2010-11. Six principal producers accounted for about 66% of total production. The share of public sector mines in the total production was 12% as compared to about 8% in the preceding year.

Rajasthan continued to be the major producing state accounting for 69% of the total production followed by Andhra Pradesh with 27%. The remaining 4% production was from Gujarat and Tamil Nadu (Tables - 15 to 17).

Mine-head stocks of ball clay at the end of 2010-11 were 457 thousand tonnes as against 365 thousand tonnes at the beginning of the year (Table -18).

The average daily employment of labour strength in 2010-11 was 360 as against 363 in the previous year. Domestic prices of ball clay are furnished in the General Review on Prices.

Table – 14 : Reserves/Resources of Ball Clay as on 1.4.2010
(By Grades/States)

(In tonnes)

Grade/State	Reserves				Remaining resources							Total resources (A+B)
	Proved STD111	Probable		Total (A)	Feasibilty STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Total (B)	
		STD121	STD122			STD221	STD222					
All India : Total	**12292820**	**350832**	**4134190**	**16777842**	**6122450**	**3906958**	**12387575**	**268486**	**2279330**	**41650863**	**66615662**	**83393504**
By Grades												
Ceramic Pottery	12252380	350832	4059390	16662602	3225279	3818040	11158607	268486	2279330	36989941	57739683	74402285
Others	40440	-	74800	115240	-	46134	67320	-	-	107800	221254	336494
Unclassified	-	-	-	-	2897171	42784	1161648	-	-	4553122	8654725	8654725
By States												
Andhra Pradesh	6017412	-	1288720	7306132	1821233	2806267	9512513	-	2279330	27555824	43975167	51281299
Gujarat	-	-	-	-	-	-	-	249810	-	49670	299480	299480
Rajasthan	6275408	350832	2845470	9471710	4301217	1100691	2875062	18676	-	14045369	22341015	31812725

Figures rounded off.

Table – 15 : Principal Producers of Ball clay, 2010-11

Name & address of producer	Location of mine	
	State	District
Tahlaram & Sons, Ramnath Sadan, Rathkhana Colony, Bikaner-334 001, Rajasthan	Rajasthan	Bikaner
Jaichandlal Daga, Bagree Mohalla, Bikaner-334 001, Rajasthan	Rajasthan	Bikaner
Harish Clays, P.B.No. 57, Harasar House, Near M. N. Hospital, Bikaner, Rajasthan	Rajasthan	Bikaner

Contd.

(Table - 15 Concld.)

Name & address of producer	Location of mine	
	State	District
Andhra Pradesh Mineral Dev. Corpn. Ltd , House No. 8-3-945, Pancom Business Center Ameerpet, Hyderabad –500 016	Andhra Pradesh	West Godavari
Sunder Lal Daga, Bagree Mohalla, Bikaner - 334 001, Distt.: Bikaner, Rajasthan	Rajasthan	Bikaner
Sri Satya Sai Mines & Minerals, R.S. No. 65/2, Dwarka Tirumala-534 426, Dist.: Godavari West, Andhra Pradesh.	Andhra Pradesh	West Godavari

Table - 16 : Production of Ball clay, 2008-09 to 2010-11 (By States)

(Qty in tonnes; value in ₹ '000)

State	2008-09		2009-10		2010-11 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**997676**	**200778**	**932993**	**218174**	**958454**	**202616**
Andhra Pradesh	262342	35221	202796	26700	256986	33740
Gujarat	11539	579	31053	1477	20024	1082
Rajasthan	698795	159328	676559	184938	665925	164318
Tamil Nadu	25000	5650	22585	5059	15519	3476

Table - 17 : Production of Ball clay, 2009-10 and 2010-11 (By Sectors/States/Districts)

(Qty. in tonnes; value in ₹'000)

State/District	2009-10			2010-11 (P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India	**39(1)**	**932993**	**218174**	**36(2)**	**958454**	**202616**
Public sector	2(1)	71396	6731	2(1)	115500	7433
Private sector	37	861597	211443	34(1)	842954	195183
Andhra Pradesh	**12**	**202796**	**26700**	**12**	**256986**	**33740**
Chittoor	1	1035	49	1	792	40
West Godavari	11	201761	26651	11	256194	33700
Gujarat	**2(1)**	**31053**	**1477**	**1(1)**	**20024**	**1082**
Bharuch	(1)	20983	420	(1)	11764	235
Kachchh	1	30	3	-	-	-
Patan	1	10040	1054	1	8260	847
Rajasthan	**24**	**676559**	**184938**	**22(1)**	**665925**	**164318**
Bikaner	24	676559	184938	22(1)	665925	164318
Tamil Nadu	**1**	**22585**	**5059**	**1**	**15519**	**3476**
Cuddalore	1	22585	5059	1	15519	3476

Figures in parentheses indicate associated mines of ball clay with silica sand & fireclay.

Table – 18 : Mine-head Stocks of Ball Clay 2010-11(P) (By States)

(In tonnes)

State	At the beginning of the year	At the end of the year
India	**364821**	**456814**
Andhra Pradesh	114672	123331
Gujarat	275	532
Rajasthan	235137	314914
Tamil Nadu	14737	18037

SPECIFICATIONS

The specifications for plastic clay and washed plastic clay for use in Ceramic Industry are prescribed vide IS:4589-2002 (Third Revision, reaffirmed 2008).

CONSUMPTION

Consumption of ball clay increased from 561,200 tonnes in 2009-10 to 596,100 tonnes in 2010-11. About 98% consumption was accounted for by the Ceramic Industry. The remaining consumption was reported by the Refractory and Abrasive industries (Table - 19).

Table – 19 : Reported Consumption of Ball clay 2008-09 to 2010-11(P) (By Industries)

(In tonnes)

Industry	2008-09	2009-10 (R)	2010-11(P)
All Industries	**546600**	**561200**	**596100**
Abrasive	100(2)	100(2)	100(2)
Ceramic[(e)]	534100(221)	547600(222)	582600(222)
Refractory	12400(22)	13500(22)	13400(22)

Figures rounded off. Data collected on non-statutory basis. Figures in parentheses denote the number of units in the organised sector reporting consumption.*
(Includes actual reported consumption and/or estimates made wherever required).*

FOREIGN TRADE

Exports

Exports of ball clay decreased to 19,477 tonnes in 2010-11 from 32,132 tonnes in 2009-10. Exports were mainly to Bangladesh (83%) (Table - 20).

Imports

Imports of ball clay were 126,665 tonnes in 2010-11 as compared to 123,073 tonnes in the previous year. Imports were mainly from Ukraine (48%), Indonesia (23%), UK (12%) and USA (9%) (Table -21).

Table - 20 : Exports of Ball Clay (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**32132**	**104567**	**19477**	**62920**
Bangladesh	30783	101090	16178	52365
UAE	717	2026	2711	8767
Iran	-	++	312	775
Oman	330	542	112	543
Jordan	-	-	49	125
Egypt	-	-	28	118
Nepal	51	194	15	18
South Africa	8	63	9	9
Sri Lanka	-	-	1	7
Unspecified	-	-	48	188
Other countries	243	652	14	5

Table – 21 : Imports of Ball Clay (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**123073**	**667661**	**126665**	**637682**
Ukraine	68961	372948	61296	315930
U K	21247	184931	15379	141200
Indonesia	27594	62964	28650	65131
USA	694	11469	11184	61955
China	3095	20784	2229	16101
Malaysia	426	1312	6575	15283
Japan	100	2263	480	11889
Spain	112	1410	245	3919
Germany	139	2329	154	2062
Portugal	456	3936	168	1319
Other countries	249	3315	305	2893

3. Clay(others)

Clay under this category includes aluminous, ferruginous and tile & brick making clays.

PRODUCTION, STOCKS & PRICES

The production of clay (others) at 591 thousand tonnes in 2010-11 decreased by about 44% as compared to that in the previous year due to less demand.

There were 11 mines reporting production in 2010-11 as against 18 mines in the previous year. Besides, production of clay (others) was reported by 9 mines as associated mineral. About, 62% production of clay (others) was reported as an associated mineral. Entire production of clay (others) was in private sector.

Madhya Pradesh, the major producing state, accounted for about 55% production during the period under review, followed by Gujarat 31%, Andhra Pradesh 13% and Rajasthan 1%.

About 92 % of the total production was contributed by six principal producers. Six mines including 4 associated mines having annual production more than 10,000 tonnes contributed about 92% of the total production (Tables -22 to 25).

Mine-head stocks of clay (others) was 49 thousand tonnes at the end of 2010-11 as against 162 thousand tonnes at the beginning of the year (Table-26).

The average daily employment of labour was 89 during 2010-11 as against 179 in the previous year. Domestic prices of clay (others) are furnished in the General Review on Prices.

Table–22 : Principal Producers of Clay (others), 2010-11

Name and address of producer	Location of mine: State	Location of mine: District
The ACC Ltd, 'Cement House', 121, Maharshi Karve Road, Mumbai – 400 020 Maharashtra	Madhya Pradesh	Katni
Sanghi Industries Ltd, P.O. Bermoti, Tal: Abdasa Distt. Kachchh - 370 655 Gujarat.	Gujarat	Kachchh
Narmada Cement Ltd, P.B. No. 10, Post: Jafarabad-365 540 Dist.: Amreli, Gujarat .	Gujarat	Amreli
**India Cement Ltd, Dhum Building, 827, Anna Salai, Chennai, Tamil Nadu	Andhra Pradesh	Ranga Reddy
**Hemadri Cement Ltd, 8-3960/11, Near SBI, Hyderabad-500 073, Andhra Pradesh.	Andhra Pradesh	Krishna
G.N. Vijay, 4/2/7/21, Nehru Nagar, PO: Dhone-518 222, Dist: Kurnool, Andhra Pradesh	Andhra Pradesh	Kurnool

***Producing clay (others) with limestone.*

Table – 23 : Production of Clay (Others), 2008-09 to 2010-11
(By States)

(Qty in tonnes; value in ₹'000)

State	2008-09		2009-10		2010-11 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**1220783**	**80499**	**1056273**	**71294**	**590702**	**44508**
Andhra Pradesh	150265	10863	237220	26240	74843	7692
Chattisgarh	400	100	-	-	-	-
Gujarat	369232	11000	420598	7040	185388	3490
Madhya Pradesh	556030	42586	235027	20453	322607	32186
Rajasthan	144669	15931	163428	17561	7864	1140
West Bengal	187	19	-	-	-	-

Table - 24: Production of Clay (Others), 2009-10 and 2010-11(P)
(By Sector/States/Districts)

(Qty in tonnes; value in ₹ '000)

State/District	2009-10			2010-11(P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India	**18(11)**	**1056273**	**71294**	**11(9)**	**590702**	**44508**
Private sector	18(11)	1056273	71294	11(9)	590702	44508
Andhra Pradesh	**10(8)**	**237220**	**26240**	**6(6)**	**74843**	**7692**
Adilabad	1	5109	480	1	2128	228
Anantapur	(4)	9956	745	(2)	5680	815
Godavari (East)	1	30875	5249	-	-	-
Godavari (West)	1	36900	3469	-	-	-
Krishna	(1)	12900	1458	(1)	11400	1216
Kurnool	7(2)	49868	3847	5(2)	30635	2433
Ranga Reddy	(1)	91612	10992	(1)	25000	3000
Gujarat	**3**	**420598**	**7040**	**2**	**185388**	**3490**
Amreli	1	49827	2591	1	31646	1646
Kachchh	2	370771	4449	1	153742	1844
Madhya Pradesh	**(3)**	**235027**	**20453**	**(3)**	**322607**	**32186**
Katni	(2)	234907	20446	(2)	320607	32066
Jabalpur	(1)	120	7	-	-	-
Satana	-	-	-	(1)	2000	120
Rajasthan	**5**	**163428**	**17561**	**3**	**7864**	**1140**
Bikaner	5	163428	17561	3	7864	1140

Figures in parentheses indicates number of associated mines of clay (others) with laterite, lime stone, steatite & ochre.

Table – 25 : Production of Clay (Others), 2009-10 and 2010-11 (By Frequency Group)

(Qty in tonnes)

Production/ group	No. of mines		Production for the group		Percentage in total production		Cumulative percentage	
	2009-10	2010-11	2009-10	2010-11	2009-10	2010-11	2009-10	2010-11
All Groups	**18(11)**	**11(9)**	**1056273**	**590702**	**100.00**	**100.00**	-	-
Upto 5000	5(7)	4(5)	19773	12863	1.87	2.18	1.87	2.18
5001 to 10000	5	5	31856	35444	3.02	6.00	4.89	8.18
10001 to 20000	(1)	(1)	12900	11400	1.22	1.93	6.11	10.11
20001 to 30000	2	(1)	45825	25000	4.34	4.23	10.45	14.34
30001 & above	6(3)	2(2)	945919	505995	89.55	85.66	100.00	100.00

Table – 26: Mine-head Stocks of Clay (Others), 2010-11 (P) (By States)

(In tonnes)

State	At the beginning of the year	At the end of the year
India	**162181**	**48730**
Andhra Pradesh	67636	39816
Karnataka	333	333
Madhya Pradesh	1833	1933
West Bengal	1633	-
Rajasthan	90746	6648

FOREIGN TRADE

Exports

Exports of clay (others) decreased sharply to 50 thousand tonnes in 2010-11 from 93 thousand tonnes in 2009-10. Exports were mainly to Malaysia (54%), Bangladesh (13%), Saudi Arabia (8%) Syria (7%) & UAE (4%) (Table- 27).

Imports

Imports of clay (others) more than tripled to 11,610 tonnes in 2010-11 from 3200 tonnes in 2009-10. Ukraine (82%), USA (8%), and China (4%) were the main suppliers (Table - 28).

Table – 27: Exports of Clay (Others) By Countries

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**93381**	**273221**	**50121**	**199490**
Malaysia	73750	156441	27009	49642
Syria	-	-	3390	43828
Saudi Arabia	5302	25497	4218	22474
Bangladesh	2857	8431	6635	21006
UAE	2541	15871	2155	14063
Sri Lanka	1350	8337	1056	8580
Kenya	821	7189	1004	7727
Nepal	1876	8237	1432	6779
Chinese Taipei/Taiwan	461	5125	331	3386
Philippines	399	4234	375	3370
Other countries	4024	33859	2516	18634

Table – 28 : Imports of Clay (Others) By Countries

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**3200**	**59861**	**11610**	**103765**
Ukraine	501	4953	9547	49592
U S A	1361	37061	874	29222
Germany	191	4092	308	6826
China	924	8285	498	6409
France	66	1579	147	4509
U K	6	349	58	1759
Japan	75	2066	4	1360
Thailand	2	327	50	1303
Italy	24	358	61	1066
UAE	-	-	48	971
Other countries	50	791	15	748

4. Shale

Shale which occurs with limestones as parting is rich in alumina content. Hitherto, shale was considered as implacable substance that reduced the quality of limestone due to presence of clay minerals, which reportedly encumbered the stages at the captive mines of cement companies. Now, with advancements and better knowledge, it is utilised as a source of alumina in cement making.

RESOURCES

The resources of shale were placed at 15.9 million tonnes as on 1.4.2010, comprising 15.3 million tonnes reserves and 0.6 million tonnes remaining resources. All the estimated resources are located in Andhra Pradesh (Table - 29).

PRODUCTION & STOCKS

Production of shale primarily used in manufacture of cement at 3019 thousand tonnes in 2010-11 decreased marginally over the previous year. There were 2 reporting mines in 2010-11as compared to 3 reporting mines in 2009-10. About 97% of total production of shale was reported as an associated mineral by 16 limestone mines in 2010-11. About 98% of total production was reported by captive mines of cement plant in both the years. The share of public sector was 1% as against 2% in the previous year.

As regards of state-wise production, Himachal Pradesh contributed 47% of the total production of shale followed by Madhya Pradesh (20%), Karnataka (19%), Maharashtra (10%) and Andhra Pradesh(4%) (Table -30 to 32).

Mine-head stock at the end of 2010-11 was 66 thousand tonnes as against 89 thousand tonnes in the previous year. The average daily employment of labour employed in shale mines in 2010-11 was 5 as against 13 in the previous year.

Table – 29 : Reserves/Resources of Shale as on 1.4.2010
(By Grades/States)

(In '000 tonnes)

Grade / state	Reserves				Remaining resources								Total resources (A+B)
	Proved STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
		STD121	STD122			STD221	STD222						
All India : Total	**14,992**	**76**	**263**	**15,331**	**-**	**-**	**245**	**-**	**-**	**252**	**83**	**580**	**15,911**
By Grade													
All grades	14,992	76	263	15,331	-	-	245	-	-	252	83	580	15,911
By State													
Andhra Pradesh	14,992	76	263	15,331	-	-	245	-	-	252	83	580	15,911

Figures rounded off

Table - 30 : Producers of Shale, 2010-11

Name & address of producer	Location of mines	
	State	District
*The ACC Ltd Cement House 121, Maharshi Karve Road, Churchgate, Mumbai – 400 020.	Karnataka Himachal Pradesh Maharashtra	Gulbarga Bilaspur Yavatmal
*Jaiprakash Associates Ltd Sector-128, Noida-201304 Uttar Pradesh.	Madhya Pradesh	Rewa
*Ambuja Cements Ltd Ambuja Nagar Taluka-Kodinar, Dist-Junagarh, Gujarat 362 715	Himachal Pradesh	Solan
* Jaypee Himachal Cement Plant Sector-128, Noida-201 304 Uttar Pradesh.	Himachal Pradesh	Solan
*Ultratech Cement Ltd, 'A' Wing, Ahura Centre, 1st Floor, Mahakali Caves Road, Andheri (E), Mumbai – 400 093.	Maharashtra	Chandrapur

** Producing on an associated mineral with lime stone*

Table – 31 : Production of Shale, 2008-09 to 2010-11

(By States)

(Qty in tonnes; value in ₹ ' 000)

State	2008-09		2009-10		2010-11(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**3047063**	**90260**	**3033948**	**89288**	**3018540**	**81458**
Andhra Pradesh	195676	10062	130425	7092	111030	5659
Himachal Pradesh	674840	7573	924714	24700	1441517	36219
Karnataka	1152357	43820	936636	34304	559356	24499
Madhya Pradesh	589620	5307	637088	5734	598220	5384
Maharashtra	434570	23498	405085	17458	308417	9697

Table - 32 : Production of Shale, 2009-10 and 2010-11
(By Sectors/States/Districts)

(Qty in tonnes; value ₹ '000)

State/District	2009-10 No. of Mines	2009-10 Quantity	2009-10 Value	2010-11(P) No. of Mines	2010-11(P) Quantity	2010-11(P) Value
India	**3(16)**	**3033948**	**89288**	**2(16)**	**3018540**	**81458**
Public sector	1	62495	3687	1	28800	1679
Private sector	2(16)	2971453	85601	1(16)	2989740	79779
Andhra Pradesh	**3(4)**	**130425**	**7092**	**2(4)**	**111030**	**5659**
Anantapur	1(1)	490	69	(1)	410	58
Kurnool	(2)	23347	1536	(2)	13634	967
Nalgonda	1(1)	44093	1800	1(1)	68186	2955
Ranga Reddy	1	62495	3687	1	28800	1679
Himachal Pradesh	**(3)**	**924714**	**24700**	**(3)**	**1441517**	**36219**
Bilaspur	(1)	285800	5144	(1)	328200	12892
Solan	(2)	638914	19556	(2)	1113317	23327
Karnataka	**(2)**	**936636**	**34304**	**(2)**	**559356**	**24499**
Gulbarga	(2)	936636	34304	(2)	559356	24499
Madhya Pradesh	**(5)**	**637088**	**5734**	**(5)**	**598220**	**5384**
Rewa	(5)	637088	5734	(5)	598220	5384
Maharashtra	**(2)**	**405085**	**17458**	**(2)**	**308417**	**9697**
Chandrapur	(1)	264994	2843	(1)	228859	2455
Yavatmal	(1)	140091	14615	(1)	79558	7242

Figures in parentheses indicate associated mines with limestone.

Table - 33 : Mine-head Stocks of Shale, 2010-11(P)
(By States)

(In tonnes)

State	At the beginning of the year	At the end of the year
India	**88664**	**65884**
Andhra Pradesh	36389	40216
Karnataka	52275	25668

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

KYANITE, SILLIMANITE AND ANDALUSITE

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

50 Kyanite, Sillimanite and Andalusite

Kyanite, sillimanite and andalusite are three aluminium silicate minerals having the same chemical composition ($Al_2O_3.SiO_2$) but differing in physical properties. These minerals are also known as 'super-refractories' in view of their special refractory properties. These minerals have special property of undergoing conversion into mullite ($3Al_2O_3.2SiO_2$) and vitreous silica (cristobalite) on heating between $1,350^0$ and $1,500^0$ C. The conversion takes place with about 20% increase in volume and hence it is necessary to calcine these minerals before use. Mullite (artificial) is the most important constituent of refractory products as it shows little or no softening below its melting point ($1,810^0$C). After calcination of these minerals the mullite obtained is characterised by good high temperature insulation of electricity, increase in firing range and temperature, high mechanical strength, low thermal expansion, good resistance to thermal shock of cooling and heating, and good resistance to corrosion. It also does not spall. It is not a plastic mineral and is mixed with clay to make refractory products for electrical insulators and spark plugs, glass furnaces, tanks and pots, furnaces for high melting point alloys and pottery kiln linings, saggers and laboratorywares.

RESOURCES

Kyanite

The total resources of kyanite as per UNFC system in the country as on 1.4.2010 are placed at 103.24 million tonnes. Out of these resources, only 1.57 million tonnes are the reserves and 101.67 million tonnes are the remaining resources. Out of total resources, high and medium-grade resources together are merely 1.5%, low grade 7.6%, mixed grade 0.8%, quartz kyanite gneiss and kyanite schist rock 88.6% and granular, others and not- known grades 1.6%. Statewise, the share of Andhra Pradesh alone is more than 78% of total resources followed by Karnataka 13% and Jharkhand 6%. Remaining 3% resources are in Kerala, Maharashtra, Rajasthan, Tamil Nadu and West Bengal (Table - 1).

Sillimanite

The total resources of sillimanite as per UNFC system in the country as on 1.4.2010 are placed at 66.98 million tonnes. Out of these resources, the reserves are only 4.08 million tonnes, while about 62.90 million tonnes are the remaining resources. Out of total resources, more than 72.1% are granular high-grade, while quartz sillimanite rocks and sillimanite bearing rocks are about 22.7%. Resources of massive sillimanite of all grades are about 5.0%. The resources are located mainly in Tamil Nadu (27%), Odisha (20%), Uttar Pradesh (17%), Andhra Pradesh (14.%), Kerala (11%) and Assam (7%). Remaining 4% resources are in Jharkhand, Karnataka, Madhya Pradesh, Maharashtra, Meghalaya, Rajasthan and West Bengal (Table-2).

Andalusite

The total resources of andalusite in the country as on 1.4.2010 as per UNFC system are placed at 18.5 million tonnes. There are no reserves. The resources are of inferred category located in Uttar Pradesh and Jharkhand (Table-3).

EXPLORATION & DEVELOPMENT

In 2010-11, DGM, Maharashtra carried out geological mapping and drilling for pyrophyllite and sillimanite in Walni-Khatgaon village, Chandrapur district. About 1.29 million tonnes of pyrophyllite/sillimanite resources have been estimated in the area by DGM. The exploration was also carried out by Directorate of Geology, Odisha for heavy minerals like ilmenite, rutile, sillimanite, garnet, zircon, etc. Details of exploration are furnished in Table-4.

Table – 1 : Reserves/Resources of Kyanite as on 1.4.2010
(By Grades/States)

(In tonnes)

Grade/State	Reserves				Remaining resources								Total resources (A+B)
	Proved STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
		STD121	STD122			STD221	STD222						
All India : Total	**551529**	**524485**	**498839**	**1574853**	**322622**	**25917**	**1238407**	**578607**	**3590902**	**95914312**	**-**	**101670767**	**103245620**
By Grades													
High grade	-	-	-	-	-	4317	21867	-	297827	114689	-	438700	438700
Medium grade	266698	-	83851	350549	33295	-	252334	-	34410	430511	-	750550	1101099
Low grade	17609	-	12663	30272	276230	21600	953600	386247	2228400	3948492	-	7814569	7844841
High & medium mixed	-	100550	53103	153653	-	-	-	-	93640	106928	-	200568	354221
Medium & low mixed	-	-	-	-	-	-	-	-	-	48000	-	48000	48000
High, medium & low mixed	-	89650	-	89650	13097	-	10606	-	45000	210025	-	278728	368378
Granular	-	-	-	-	-	-	-	-	167000	81359	-	248359	248359
Quartz kyanite rock	-	-	-	-	-	-	-	-	-	81105358	-	81105358	81105358
Kyanite gneiss rock	-	-	-	-	-	-	-	-	-	5370800	-	5370800	5370800
Kyanite schist	-	-	-	-	-	-	-	-	724625	4250000	-	4974625	4974625
Others	-	-	-	-	-	-	-	-	-	12530	-	12530	12530
Not-known	267222	334285	349222	950729	-	-	-	192360	-	235620	-	427980	1378709
By States													
Andhra Pradesh	-	-	-	-	-	-	399	-	-	80353829	-	80354228	80354228
Jharkhand	267222	524485	402325	1194032	-	-	41384	-	1754900	3040283	-	4836567	6030599
Karnataka	-	-	-	-	309525	21600	18843	386247	1610502	10688721	-	13035438	13035438
Kerala	-	-	-	-	-	-	-	192360	-	10000	-	202360	202360
Maharashtra	284307	-	96514	380821	-	4317	1167175	-	58500	1713600	-	2943592	3324413
Rajasthan	-	-	-	-	13097	-	10606	-	-	-	-	23703	23703
Tamil Nadu	-	-	-	-	-	-	-	-	167000	81359	-	248359	248359
West Bengal	-	-	-	-	-	-	-	-	-	26520	-	26520	26520

Figures rounded off.

Table – 2: Reserves/Resources of Sillimanite as on 1.4.2010
(By Grades/States)

(In tonnes)

Grade/States	Reserves				Remaining resources								Total resources (A+B)
	Proved STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
		STD121	STD122			STD221	STD222						
All India : Total	**1693000**	**1602228**	**789824**	**4085052**	**317869**	**124000**	**20082855**	**4579816**	**17795772**	**16152473**	**3849600**	**62902385**	**66987437**
By Grades													
Massive high grade	-	-	-	-	-	-	-	-	-	11903	-	11903	11903
Massive medium grade	-	-	-	-	-	4000	-	-	-	29705	-	33705	33705
Massive low grade	5139	-	2056	7195	300	-	519	-	850000	2259814	-	3110633	3117828
Massive high & medium	-	-	-	-	-	-	-	-	-	19800	-	19800	19800
Massive medium & low	140005	-	56002	196007	-	-	-	-	-	1120	-	1120	197127
Massive high, medium & low	-	-	-	-	-	-	-	-	-	38	-	38	38
Granular high	1547856	1602228	731766	3881850	317569	120000	20082336	2479816	7595708	13829577	-	44425006	48306856
Quartz sillimanite rock	-	-	-	-	-	-	-	-	-	-	3748000	3748000	3748000
Sillimanite bearing rock	-	-	-	-	-	-	-	2100000	9350000	-	-	11450000	11450000
Not-known	-	-	-	-	-	-	-	-	64	516	101600	102180	102180
By States													
Andhra Pradesh	518000	-	170000	688000	-	-	-	-	7430300	1526200	-	8956500	9644500
Assam	-	-	-	-	-	-	-	-	850000	6700	3748000	4604700	4604700
Jharkhand	-	-	-	-	-	-	-	-	-	83000	-	83000	83000
Karnataka	-	-	-	-	-	-	-	-	-	982725	-	982725	982725
Kerala	698056	-	-	698056	317569	120000	-	2479816	165408	3369200	-	6451993	7150049
Madhya Pradesh	-	-	-	-	-	-	-	-	-	-	101600	101600	101600
Maharashtra	145144	-	58058	203202	-	-	-	-	64	2664	-	2728	205930
Meghalaya	-	-	-	-	-	-	-	-	-	55807	-	55807	55807
Odisha	-	1602228	-	1602228	-	-	6557013	-	-	4943600	-	11500613	13102841
Rajasthan	-	-	-	-	300	-	519	-	-	-	-	819	819
Tamil Nadu	331800	-	561766	893566	-	4000	13525323	-	-	3529577	-	17058900	17952466
Uttar Pradesh	-	-	-	-	-	-	-	2100000	9350000	-	-	11450000	11450000
West Bengal	-	-	-	-	-	-	-	-	-	1653000	-	1653000	1653000

Figures rounded off.

Table – 3 : Reserves/ Resources of Andalusite as on 1.4.2010

(In '000 tonnes)

State	Total reserves (A)	Remaining resources Inferred STD333	Remaining resources Total (B)	Total resources (A+B)
All India : Total	–	**18450**	**18450**	**18450**
By States				
Jharkhand	–	4000	4000	4000
Uttar Pradesh	–	14450	14450	14450

Table - 4: Details of Exploration Activities for Kyanite, Sillimanite and Andalusite, 2010-11

Agency/ District	Location/ Area/ Block	Mapping Scale	Mapping Area (sq km)	Drilling No. of bore-holes	Drilling Meterage	Sampling (Nos.)	Remarks Reserves/ Resources estimated.
Dte of Geology Odisha Puri	ESE of Hunda Village Krishnap-rasad block	1:2000	1.04	NA	2060 m	2060	The beach placer deposit comprise of fine to coarse sand and runs continuously parallel to coast in the form of front-rear-intermediate dunes. It continues beyond 10 m depth.
-do-	Along coastal track of Jagatsing-hpur dist. (Balikudo block)	39 line km		NA	1229 m	659	The area occupied by alluvium sand in the form of beach, beam and dunes in coastal zone. The coastal province comprises of deltaic alluvium of Mahanadi river system along with littoral beach sand and wind blown sand of fine to medium grained sand. Heavy mineral is distributed throughout the area in varying proportions.
DGM Maharashtra Chandrapur	Walni-Khatgaon		-	NA	538.95 m	Nil	Presence of pyrophylite – sillimanite rock has been noticed in the area.About 1.29 million tonnes of resources of pyrophyllite-sillimanite have been estimated.

PRODUCTION, STOCKS & PRICES

Kyanite

The production of kyanite at 5,569 tonnes in 2010-11, increased by 1% as compared to the previous year. There were 3 reporting mines during the year under review as against 4 mines in the previous year. The share of public sector was about 69% during 2010-11 as compared to 85% in the preceding year.

In 2010-11 about 33% of the total production of kyanite was of grade above 40% Al_2O_3 and the rest 67% was of below 40% Al_2O_3 grade .

Jharkhand State Mineral Development Corp Ltd alone accounted for about 64% of the total production during the year under review. Remaining 36% was the contribution of one public sector mine and one private sector mine in Maharashtra (Table- 7).

Mine-head stocks at the end of 2010-11 were 1,771 tonnes as against 2,341 tonnes at the beginning of the year (Table - 8).

The average daily employment of labour was 76 in 2010-11 as against 115 in the preceding year. Prices of kyanite are furnished in the General Review on Prices.

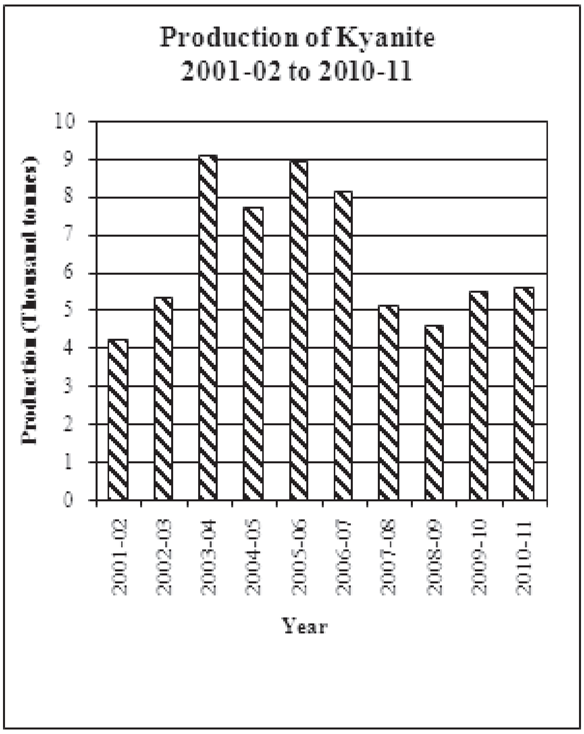


Table – 5 : Producers of Kyanite, 2010-11

Name & address of producer	Location of mine	
	State	District
Jharkhand State Mineral Development Corp. Ltd, Khanij Nigam Bhawan, Nepal House Area, P.O. Doranda, Ranchi - 834 002, Jharkhand.	Jharkhand	Singhbhum (East)
H.M.Pavri, Salpekar Building, Rani Jhansi Square, P.O. Sitabuldi - 440 012, Nagpur, Maharashtra.	Maharashtra	Bhandara
Maharashtra State Mining Corporation Ltd, Plot No. 7, Ajni Chowk, Wardha Road, Nagpur - 440 015, Maharashtra.	Maharashtra	Bhandara

Table – 6 : Production of Kyanite, 2008-09 to 2010-11 (By States)

(Qty in tonnes; value in ₹'000)

State	2008-09		2009-10		2010-11 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**4620**	**5184**	**5495**	**5812**	**5569**	**5916**
Jharkhand	3615	4407	4420	4862	3547	4156
Maharashtra	1005	777	1075	950	2022	1760

Table – 7 : Production of Kyanite, 2009-10 and 2010-11 (By Sectors/States/Districts/Grades)

(Qty in tonnes; value in ₹ '000)

State/District	2009-10					2010-11 (P)				
	No. of mines	Quantity			Value	No. of mines	Quantity			Value
		Above 40% Al_2O_3	Below 40% Al_2O_3	Total			Above 40% Al_2O_3	Below 40% Al_2O_3	Total	
India	**4**	**923**	**4572**	**5495**	**5812**	**3**	**1859`**	**3710**	**5569**	**5916**
Public sector	2	88	4572	4660	5060	2	121	3710	3831	4352
Private sector	2	835	-	835	752	1	1738	-	1738	1564
Jharkhand	**1**	**–**	**4420**	**4420**	**4862**	**1**	**-**	**3547**	**3547**	**4156**
Singhbhum (East)	1	–	4420	4420	4862	1	-	3547	3547	4156
Maharashtra	**3**	**923**	**152**	**1075**	**950**	**2**	**1859**	**163**	**2022**	**1760**
Bhandara	3	923	152	1075	950	2	1859	163	2022	1760

Table – 8 : Mine-head Stocks of Kyanite, 2010-11 (P)

(By States/Grades)

(In tonnes)

State	At the beginning of the year			At the end of the year		
	Above 40% Al_2O_3	Below 40% Al_2O_3	Total	Above 40% Al_2O_3	Below 40% Al_2O_3	Total
India	**261**	**2080**	**2341**	**85**	**1686**	**1771**
Jharkhand	–	1327	1327	–	1327	1327
Maharashtra	261	753	1014	85	359	444

Sillimanite

The production of sillimanite at 47,671 tonnes in 2010-11 reported an increase of 42% as compared to that in the previous year. There were 4 reporting mines in both the years. Besides, two mines reported production of sillimanite as an associated mineral with kyanite and garnet during 2010-11.

Four principal producers contributed the entire production. About 57% production of sillimanite was reported by the public sector, while the remaining 43% production was reported by the private sector. Odisha, the main producing state contributed as much as 38% of the total output of sillimanite in 2010-11 followed by Andhra Pradesh 37%, Kerala 17% and Maharashtra 8% (Tables - 9 to 11).

Mine-head stocks at the end of the year 2010-11 were 8,463 tonnes as against 2,201 tonnes at the beginning of the year (Table - 12).

The average daily employment of labour during 2010-11 was 1,674 as against 2,066 in the previous year. Domestic prices of sillimanite are furnished in the General Review on Prices.

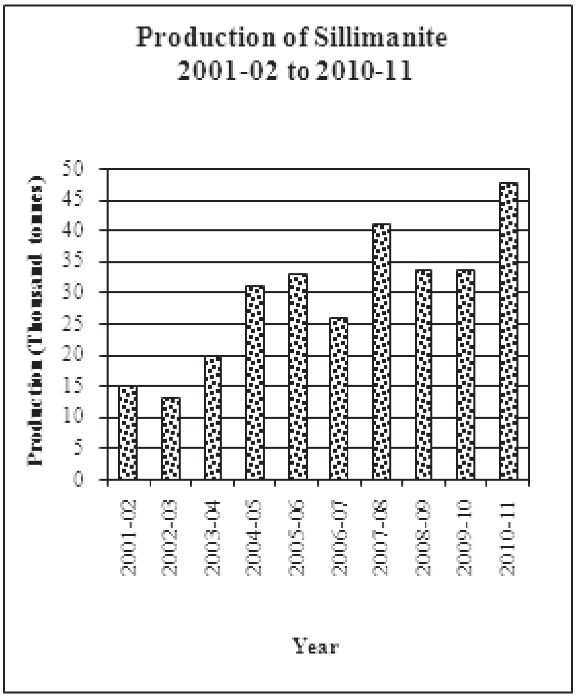


Table – 9 : Producers of Sillimanite, 2010-11

Name & address of producer	Location of mine	
	State	District
Indian Rare Earths Ltd, Plot No. 1207, Veer Sawarkar Marg, Near Siddhi Vinayak temple, Prabhadevi, Mumbai-400 028, Maharashtra.	Odisha Kerala	Ganjam Kollam
#Trimex Sands Private Limited, 3rd Floor, Serene Tower, Banjara Hills, Hyderabad.	Andhra Pradesh	Srikakulam
* H. M. Pavri, Salpekar Building, Rani Jhansi Square, P.O. Sitabuldi. Nagpur-440 012, Maharashtra.	Maharashtra	Bhandara
Maharashtra State Mining Corp. Ltd, Plot No.7, Ajni Chowk, Nagpur - 440 015. Maharashtra.	Maharashtra	Bhandara

Producing as an associated mineral with garnet.
**Producing as an associated mineral with kyanite.*

Table – 10 : Production of Sillimanite, 2008-09 to 2010-11 (By States)

(Qty.in tonnes; value in ₹000)

State	2008-09		2009-10 (R)		2010-11(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**33702**	**236871**	**33687**	**258779**	**47671**	**424964**
Andhra Pradesh	-	-	2025	12454	17848	137711
Kerala	10423	91504	7939	75460	8315	89989
Maharashtra	9130	7628	9539	7093	3618	3419
Odisha	13878	136879	14117	163009	17890	193845
Tamil Nadu	271	860	67	763	-	-

Table – 11 : Production of Sillimanite, 2009-10 and 2010-11
(By Sectors/States/Districts)

(Qty in tonnes; value in ₹'000)

State/District	2009-10			2010-11(P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India	**4(4)**	**33687**	**258779**	**4(2)**	**47671**	**424964**
Public sector	4(1)	23057	240302	4	27006	285281
Private sector	(3)	10630	18477	(2)	20665	139683
Andhra Pradesh	**(1)**	**2025**	**12454**	**(1)**	**17848**	**137711**
Srikakulam	(1)	2025	12454	(1)	17848	137711
Kerala	**1**	**7939**	**75460**	**1**	**8315**	**89989**
Kollam	1	7939	75460	1	8315	89989
Maharashtra	**2(2)**	**9539**	**7093**	**2(1)**	**3618**	**3419**
Bhandara	2(2)	9539	7093	2(1)	3618	3419
Odisha	**1**	**14117**	**163009**	**1**	**17890**	**193845**
Ganjam	1	14117	163009	1	17890	193845
Tamil Nadu	**(1)**	**67**	**763**	-	-	-
Kanyakumari	(1)	67	763	-	-	-

Figures in parentheses indicate the number of associated mines.

Table – 12 : Mine-head Stocks of Sillimanite 2010-11(P)
(By States)

(In tonnes)

State	At the beginning of the year	At the end of the year
India	**2201**	8463
Andhra Pradesh	1290	926
Kerala	61	1180
Maharashtra	750	212
Odisha	48	6145
Tamil Nadu	52	–

Andalusite

There was no production of andalusite in the country since 1988.

MINING & MARKETING

Kyanite

Kyanite mines are worked by opencast method. Generally, the mineral is marketed under three grades: above 60% Al_2O_3, 50-60% Al_2O_3 and less than 50% Al_2O_3. These three grades are used in the manufacture of refractories.

Sillimanite

Sillimanite mines are also worked by opencast method. Pohra mine of Maharashtra State Mining Corporation Ltd is semi-mechanised.

Granular sillimanite is obtained from beach sands in Kerala, Odisha and Tamil Nadu, as a by-product, along with ilmenite, rutile, zircon, garnet, etc. while recovering monazite. The Odisha Sands Complex of IREL in the coastal region of Chatrapur in Ganjam district, Odisha, has the capacity to recover 10,000 tpy granular sillimanite at present. At Chatrapur, mining is carried out by suction dredging with gravel pump. IREL's Chavara plant in Kollam district, Kerala, presently has an installed capacity of 10,000 tpy granular sillimanite, whereas that at Manavalakurichi in Tamil Nadu presently has not reported installed capacity to recover sillimanite.

At Chavara in Kerala, beach sand mining operations are carried out by IREL in two stages: (i) by means of bulldozers and wheel loaders, and subsequently loading by front-end loaders, wheel loaders and belt conveyors; and (ii) upgrading it to around 93% heavy minerals at Dredge and Wet Concentration Plant and concentrate upgrading unit. The Mineral Recovery Plant (MRP) essentially consists of a dredging system to mine the deposit and a pre-concentration system to separate the valuable minerals and dispose of the waste at the same place from where it was mined. The two systems are mounted on a combined floating platform which keeps moving with the progress of mining. For details regarding mining and processing, etc. of beach sand minerals, review on 'Ilmenite and Rutile' may be referred.

USES

Kyanite, sillimanite and andalusite are mainly used in refractories because of their ability to form mullite phase at high temperture. Sillimanite refractory bricks are extensively used in steel and glass industries and also in ceramics, cement kilns, heat treatment furnaces and petrochemical industries.

SPECIFICATIONS

BIS has prescribed IS:14301-1995 (reaffirmed in 2010) for kyanite used in refractory industry. There are two grades i.e. Grade-1 and Grade-2. Composition of kyanite under this specification is Al_2O_3 58% min for Grade-1 and 54% min for Grade-2; Fe_2O_3 1.50% max, K_2O + Na_2O 1% max; other constituents as agreed between the supplier and purchaser and PCE not less than 36 (for Grade-1) and 35 (for Grade-2). Size of the material is 50 to 150 mm or 10 to 50 mm.

BIS has laid down IS:14302-1995 (reaffirmed in 2010) in respect of beach sand sillimanite for use in refractory industry while IS:2045-1962 in respect of natural sillimanite blocks for glass melting tanks furnaces has been withdrawn.

CONSUMPTION

Kyanite

Reported consumption of kyanite estimated at 4,500 tonnes in 2010-11 increased slightly as compared to that in the previous year. Entire consumption of kynite was accounted for by the refractory industry.

Sillimanite

Reported consumption of sillimanite estimated at 15,300 tonnes in 2010-11 increased by 6% over the previous year. Refractory industry alone accounted for about 97% consumption (Table-13).

Table – 13 : Reported Consumption of Kyanite and Sillimanite 2008-09 to 2010-11 (By Industries)

(In tonnes)

Industry	2008-09	2009-2010(R)	2010-11(P)
Kyanite			
All Industries	**3800**	**4400**	**4500**
Iron & steel	0(1)	0(1)	0(1)
Refractory	3800(21)	4400(23)	4500(23)
Sillimanite			
All Industries	**13700**	**14400**	**15300**
Ceramic	300(4)	200(3)	300(3)
Chemical	200(1)	200(1)	200(1)
Foundry	++(1)	++(1)	++(1)
Refractory	13200(23)	14000(23)	14800(23)

Figures rounded off.
Data collected on non-statutory basis. Figures in parentheses denote the number of units in organised sector reporting consumption.*
(includes actual reported consumption and/or estimates made wherever required).*

WORLD REVIEW

World reserve of kyanite and related minerals is large in USA. Andalusite is limited to only a few countries. The main producer of andalusite is South Africa. The USA and India are the main producers of kyanite. Kyanite Mining Corp. in USA is, by far, the largest producer of kyanite, with an estimated production of about 93,000 tpy. India is the leading producer of sillimanite. World production of kyanite and related minerals is given in Table-14.

Table – 14 : World Production of Kyanite and Related Minerals (By Principal Countries)

(In tonnes)

Country	2008	2009	2010
Brazil			
Kyanite[(e)(b)]	200	200	200
France			
Andalusite[(e)]	65000	65000	65000
India*			
Kyanite	4620	5553	5650[(e)]
Sillimanite	33702	30690	30000[(e)]
Nepal	15	10	10
South Africa			
Andalusite	216667	245000[(e)]	245000[(e)]
USA			
Kyanite[(a)]	97200	71000	93000

Source: *World Mineral Production, 2006-2010.*
(a). Including related minerals.
(b). Including beneficiated & directly shipped material.
** India's production of kyanite during 2008-09, 2009-10 and 2010-11 was 4,620 tonnes, 5,495 tonnes and 5,569 tonnes, respectively, while that of sillimanite was 33,702 tonnes, 33,687 tonnes and 47,671 tonnes, respectively.*

FOREIGN TRADE

Exports

In 2010-11, 28 tonnes kyanite was exported mainly to Greece. Exports of sillimanite decreased to 2,325 tonnes in 2010-11 from 6,708 tonnes in the previous year. Sillimanite was exported mainly to China, Singapore, Tanzania and Japan. In 2010-11, 40 tonnes of andalusite was exported to Nepal (Tables - 15 to 17).

Imports

In 2010-11, imports of kyanite were 504 tonnes as against 292 tonnes in the previous year. Imports of sillimanite were 1,363 tonnes in 2010-11 as compared to 1,148 tonnes in the previous year. Imports of andalusite decreased to 5,515 tonnes in 2010-11 from 5,930 tonnes in the previous year. USA was the main supplier of kyanite and Ukrain that of sillimanite while South Africa was the main supplier of andalusite in 2010-11 (Tables - 18 to 20).

Table – 15 : Exports of Kyanite (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**130**	**2315**	**28**	**381**
Greece	-	-	25	339
Saudi Arabia	-	-	1	27
Sri lanka	-	-	1	12
Nepal	20	120	1	3
Other countries	110	2195	-	-

Table – 16 :Exports of Sillimanite (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**6708**	**21409**	**2325**	**26451**
China	135	2127	1220	11445
Iran	119	4139	171	5369
Japan	122	2463	208	3984
Tanzania	-	-	219	1861
Singapore	100	456	242	1785
Thailand	24	412	52	900
Nepal	8	16	46	382
UAE	++	12	8	162
Kuwait	-	-	20	141
Mauritius	-	-	13	98
Other countries	6200	11784	126	324

Table – 17 : Exports of Andalusite (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**-**	**-**	**40**	**96**
Nepal	-	-	40	96

Table – 18 : Imports of Kyanite (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**292**	**8171**	**504**	**11318**
USA	279	5143	440	8567
Nepal	13	3028	19	2116
China	-	-	20	385
Ukraine	-	-	25	250

Table – 19 : Imports of Sillimanite (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**1148**	**12589**	**1363**	**15992**
Ukraine	1122	11757	1316	13234
Nepal	6	490	28	2312
USA	20	341	19	446
Other countries	++	1	-	-

Table – 20 : Imports of Andalusite (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**5930**	**127949**	**5515**	**104883**
South Africa	5559	119417	4675	87945
France	371	8532	703	14349
Peru	-	-	97	2174
USA	-	-	40	415

FUTURE OUTLOOK

As per the Report of the Working Group for 12th Plan (2012-17), the current demand of sillimanite is 32,000 tpy. Projected demand for next five years is 35,000 to 40,000 tpy at GDP growth rate of 8%, 9% and 10%. The production of sillimanite is likely to double in next couple of years and the projected demand is met adequately.

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

LATERITE

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

51 Laterite

Laterite is a residual ferruginous rock commonly found in tropical regions and has close genetic association with bauxite. The term 'laterite' was originally used for highly ferruginous deposits first observed in Malabar Region of coastal Kerala and Dakshin Kannad & other parts of Karnataka. It is a highly weathered material, rich in secondary oxides of iron, aluminium or both. It is either hard or capable of hardening on exposure to moisture and drying.

Laterite and bauxite show a tendency to occur together. Aluminous laterites and ferruginous bauxites are quite common. The most common impurity in both is silica. Laterite gradually passes into bauxite with decrease in iron oxide and increase in aluminium oxide. The laterite deposits may be described on the basis of the dominant extractable minerals in it: (i) aluminous laterite (bauxite), (ii) ferruginous laterite (iron ore), (iii) manganiferous laterite (manganese ore), (iv) nickeliferous laterite (nickel ore) and (v) chromiferous laterite (chrome ore). Laterite with Fe_2O_3:Al_2O_3 ratio more than one, and SiO_2:Fe_2O_3 ratio less than 1.33 is termed as ferruginous laterite, while that having Fe_2O_3:Al_2O_3 ratio less than one and SiO_2:Al_2O_3 ratio less than 1.33 is termed as aluminous laterite.

Laterite can be considered as polymetallic ore as it is not only the essential repository for aluminium, but also a source of iron, manganese, nickel and chromium. Furthermore, it is the home for several trace elements like gallium and vanadium which can be extracted as by-products.

RESOURCES

In the peninsular India, laterite deposits are the most important Pleistocene Formations. Laterite generally occurs as capping on the hills and plateaus of Madhya Pradesh and in some states of the Deccan peninsula at altitudes ranging from coastal to 2,000 m with thickness varying between 20 m and 60 m.

Laterite occurrences are reported from all over the country. Almost all Indian bauxite deposits are associated with laterite, except those in Jammu & Kashmir. So far, systematic resource estimation has not been carried out for laterite. Some important laterite deposits are discussed below:

In Andhra Pradesh, occurrences of aluminous laterite have been reported from Dumkonda hill in the East Godavari district and Galikonda, Raktakonda, Katuki, Chittamgundi and Kottavalasa areas in Visakhapatnam district. Deposits also occur in Khammam and Ranga Reddy districts.

In Bihar, occurrences of aluminous laterite have been reported from Mahol and Bhaganda, areas in Rohtas district. These laterites have analysed Al_2O_3-46.49%, Fe_2O_3-4.61% and TiO_2-10.30%.

In Chhattisgarh, laterite has been reported from Bastar, Bilaspur and Surguja districts.

In Goa, GSI has reported aluminous laterite in areas near Morgim, Consua, Calangute, Camorlin, etc.

In Gujarat, laterite is found in Jamnagar, Bhavnagar, Kachchh, Sabarkantha, Kheda, Bharuch, Ahmedabad, Porbandar and Surat districts. The laterite belt in Kachchh and Jamnagar districts runs to about 250 km with width varying from a hundred metres to as much as 3 km and thickness ranging from 2 m to 5 m.

In Jharkhand, laterite occurrences have been reported in Bagru, Manduapat, Pakharpat, Maidanpat, Birhnipat and Serandag plateaus in Ranchi district and Netrahat plateau areas near Jamirapat in Palamau district. Deposits also occur in Gumla and Lohardaga districts.

In Karnataka, the principal deposits of bauxite associated with laterite rocks capping the Deccan lava flows were reported from Sidh Pahar, Jamboti and Betne areas and in Mogalgad Plateau, Kasar Sada range of hills, Kalanandigarh area and Boknur Navge ridge in Belgaum district. In Sidh Pahar, the massive aluminous laterite and bauxite covered an area of 90,000 sq m with thickness varying from 1.6 m to 5 m. GSI has located aluminous laterite and bauxite at Mudupina Padavu, Pajir Perna Kuddarka, Kalamanadkuru, Shedde Padaru, Badaga Mijir, Mudabidri, Sampayee, Belmana, Manipal, Baindur, Kellingagudda and other localities in Dakshin Kannad district and near Apsarkond, Honnavar Plateau, Haldipur-Hebbadkeri, Tadri-Gokarn, Swarnagadde, etc. in Uttar Kannad district. In Kerala, thick beds of laterite rocks are found in the coastal areas.

In Madhya Pradesh, aluminous and ferruginous laterites are found in the Amarkantak area which was the largest deposit of bauxite in the State, extending from Mandla and Shahdol districts in Madhya Pradesh to Bilaspur district in Chhattisgarh. Here, bauxite and laterite occur as tabular & lenticular bodies and in pockets. Similar occurrences are also found in Katni, Jabalpur, Rewa and Satna districts.

In Maharashtra, laterite occurrences are reported from Kolhapur, Satara, Ratnagiri, Raigad, Sindhudurg and Chandrapur districts.

In Odisha, GSI has reported extensive deposits of aluminous laterite, ferruginous laterite and bauxite in Kalahandi and Koraput districts. The thickness of laterite varies from 1 m to 5 m. Thick cappings of laterite over 40 sq km are observed in Cuttack and Dhenkanal districts, Odisha. Systematic sampling of the laterite in these districts shows fairly high concentration of nickel in sporadic patches.

In Rajasthan, laterite is reported associated with ochre deposits.

In Tamil Nadu, laterite is reported from the eastern part of the Nilgiri Hills, Ootakamand; plateau portion of the Palani Hills around Kodaikanal in Madurai district; Shevroy Hills near Yercaud and in parts of the Kollaimalai Hills in Salem district.

In Uttar Pradesh, laterite containing pockets of bauxite has been reported from Mirzapur, Banda and Varanasi districts. Exploratory work in Barela area, Mirzapur district, has shown laterite analysing 20.23 to 39.61% Al_2O_3 12.8 to 33.2% Fe_2O_3, 7.56 to 37.03% SiO_2 and 2.01 to 9.3% TiO_2.

Nickeliferous laterite is reported from Odisha, Manipur, Tamil Nadu and Andaman Group of Islands.

EXPLORATION & DEVELOPMENT

In 2010-11, GMDC, Gujarat, conducted geological mapping & sampling for 6 bauxite deposits in Kachchh district. In this area, sometimes laterite has also been encountered as an overburden. DGM, Maharashtra, carried out exploratory work for bauxite in Ratnagiri district of Maharashtra. The area wholly comprises basalt which is overlain by laterite.

In 2010-11, GSI carried out investigation (G-4) in Ratnagiri and Sindhudurg districts of Maharashtra for bauxite. The 8 m vertical section of the Nanarwadi laterite quarry exposes 1-1.5 m thick hard & compact limonitised laterite in the top followed by 4 cm-5 cm thick reddish soil with rare lenses & pockets of white aluminous laterite. The area comprises laterite on the surface which exhibits altered vermicular features. Bauxite occurs as tabular body within thick laterite cappings in Tantar & Tainchi Blocks, Dindori district, Madhya Pradesh.

PRODUCTION, STOCKS AND PRICES

The production of laterite at 1.16 million tonnes in 2010-11 decreased by 11 % as compared to that of the previous year owing to less market demand.

There were 20 reporting mines during 2010-11 as against 23 in the previous year. Besides, the production of laterite was reported as associated mineral by 11 mines in 2010-11. Seven principal producers accounted for about 84% of the total production. Fifteen mines, which include 13 mines of laterite and 2 associate mines each producing more than 10,000 tonnes annually, accounted for 97% of the total production during the period under review. About 21% of the total production was reported from captive mines in 2010-11 as against 15% in the preceding year.

Andhra Pradesh was the leading state in laterite production contributing 54% of the total production, followed by Gujarat (20%), Karnataka (11%) and Kerala (8%). The remaining 7% production was from Jharkhand & Madhya Pradesh.

Gradewise analysis of production in 2010-11 revealed that the bulk of production was of cement grade, accounting for 95% of the total production. Four percent production in below 40% Al_2O_3 grade was reported from Kerala, Karnataka and Jharkhand. Nomial production of other grades have been reported from some states (Tables 1 to 4).

Mine-head stocks of laterite at the end of 2010-11 were 168 thousand tonnes as against 102 thousand tonnes in the beginning of the year (Tables 5 (A) & 5 (B).

The average daily employment of labour in laterite mines was 230 in 2010-11 as against 379 in the previous year. Domestic prices of laterite are furnished in the General Review on 'Prices'.

Table-1: Principal Producers of Laterite, 2010-1

Name and address of producer	Location of mine	
	State	Distri
S.Lakshmana Reddy Chinthaluru East Godawari Andhra Pradesh	Andhra Pradesh	East Goda
Sanghi Industries Ltd, P.O. Motiber - 370 655 Taluka – Abdasa Dist. Kachchh, Gujarat.	Gujarat	Kachchh
S.Soban Babu, D.No 23-16-25/A, Lalitha Nagar, Rajamundry, East Godavari, Andhra Pradesh.	Andhra Pradesh	East God
Kerala Clays & Ceramic Products Ltd, Pappinisseri, Kannur-670 561 Kerala.	Kerala	Kasargod

(Contd.)

Table-1 (Concld)

Name and address of producer	Location of mine	
	State	District
K. Surya Kumari # 91, Ganesh Krupa, Vinayak Nagar, Hinidalga Road, Belgaum- 591 108, Karnataka.	Karnataka	Belgaum
N. Abdul Aleem, H. No. 2-1-50 Tandur – 501 141, Ranga Reddy, Andhra Pradesh.	Andhra Pradesh	Ranga Reddy
Syed Salaluddin, C/o N. Md. Zaheer, H. No 2-1-50, Opp. Willam Moon School, Hyderabad Road, Tandur-501 141, Andhra Pradesh.	Andhra Pradesh	Ranga Reddy

Table-2 : Production of Laterite, 2008-09 to 2010-11(P)
(By States)

(Quantity in tonnes; value in ₹ '000)

State	2008-09		2009-10		2010-11	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**1237393**	**162442**	**1300772**	**177376**	**1158192**	**120886**
Andhra Pradesh	528692	52571	596318	60449	630702	63144
Gujarat	259767	21104	184840	8343	234547	7284
Jharkhand	4869	752	5084	667	1220	183
Karnataka	108628	36527	203378	69711	130300	17108
Kerala	77327	21410	69171	15322	89665	28466
Madhya Pradesh	94779	6659	133080	7269	71758	4701
Maharashtra	163331	23419	108901	15615	-	-

Table- 3(A) : Gradewise Production of Laterite, 2009-10
(By Sectors, States and Districts)

(Quantity in tonnes; value in ₹'000)

State / District	No. of mines	For use in alumina & aluminium extraction, Production by Grades : Al_2O_3 Content		For use in other than alumina & aluminium extraction				Total	
		Below 40%	40-45%	Cement	Chemical	Refractory	Others	Quantity	Value
India	**23(14)**	**43853**	**51500**	**1179419**	**700**	**200**	**25100**	**1300772**	**177376**
Public Sector	2	-	-	52849	-	-	-	52849	12580
Private Sector	21(14)	43853	51500	1126570	700	200	25100	1247923	164796
Andhra Pradesh	**7(1)**	**-**	**-**	**596318**	**-**	**-**	**-**	**596318**	**60449**
East Godavari	2(1)	-	-	449771	-	-	-	449771	53054
Khammam	1	-	-	100	-	-	-	100	15
Ranga Reddy	4	-	-	146447	-	-	-	146447	7380
Gujarat	**2**	**-**	**-**	**184740**	**-**	**-**	**100**	**184840**	**8343**
Kachchh	1	-	-	184740	-	-	-	184740	8313
Porbandar	1	-	-	-	-	-	100	100	30
Jharkhand	**(2)**	**5084**	**-**	**-**	**-**	**-**	**-**	**5084**	**667**
Gumla	(1)	1063	-	-	-	-	-	1063	64
Lohardaga	(1)	4021	-	-	-	-	-	4021	603
Karnataka	**3**	**10778**	**51500**	**115200**	**700**	**200**	**25000**	**203378**	**69711**
Belgaum	3	10778	51500	115200	700	200	25000	203378	69711
Kerala	**4(1)**	**23800**	**-**	**45371**	**-**	**-**	**-**	**69171**	**15322**
Alapuzha	1	15650	-	-	-	-	-	15650	2942
Kannur	2	8150	-	992	-	-	-	9142	1372
Kasaragod	1	-	-	43447	-	-	-	43447	10775
Thiruvananthapuram	(1)	-	-	932	-	-	-	932	233
Madhya Pradesh	**4(10)**	**4191**	**-**	**128889**	**-**	**-**	**-**	**133080**	**7269**
Jabalpur	2	-	-	213	-	-	-	213	30
Katni	(1)	-	-	12897	-	-	-	12897	1032
Rewa	(1)	-	-	37800	-	-	-	37800	1512
Satna	2(8)	4191	-	77979	-	-	-	82170	4695
Maharashtra	**2**	**-**	**-**	**108901**	**-**	**-**	**-**	**108901**	**15615**
Chandrapur	2	-	-	108901	-	-	-	108901	15615
Rajasthan	**1**	-	-	-	-	-	-	-	-
Chittorgarh*	1	-	-	-	-	-	-	-	-

**Reported production of ochre only.*
Figures in parentheses indicate number of associated mines.

Table- 3(B) : Gradewise Production of Laterite 2010-11(P)
(By Sectors, States and Districts)

(Quantity in tonnes; value in ₹'000)

State/District	No. of mines	For use in alumina & aluminium extraction, by grades :Al_2O_3 content		For use in other than alumina & aluminium extraction				Total	
		Below 40%	40-45%	Cement	Chemical	Refractory	Others	Quantity	Value
India	**20(11)**	**49314**	**6200**	**1101310**	**1168**	**150**	**50**	**1158192**	**120886**
Public sector	2(1)	-	-	65036	-	-	-	65036	19691
Private sector	18(10)	49314	6200	1036274	1168	150	50	1093156	101195
Andhra Pradesh	**8(1)**	**-**	**-**	**630702**	**-**	**-**	**-**	**630702**	**63144**
East Godavari	2(1)	-	-	479240	-	-	-	479240	56318
Khammam	1	-	-	1853	-	-	-	1853	278
Ranga Reddy	5	-	-	149609	-	-	-	149609	6548
Gujarat	**2**	**-**	**-**	**234497**	**-**	**-**	**50**	**234547**	**7284**
Kachchh	1	-	-	234497	-	-	-	234497	7269
Porbandar	1	-	-	-	-	-	50	50	15
Jharkhand	**(1)**	**1220**	-	**-**	-	-	**-**	**1220**	**183**
Lohardaga	(1)	1220	-	-	-	-	-	1220	183
Karnataka	**3**	**15800**	**6200**	**107250**	**900**	**150**	-	**130300**	**17108**
Belgaum	3	15800	6200	107250	900	150	-	130300	17108
Kerala	**3(1)**	**32294**	**-**	**57103**	**268**	**-**	**-**	**89665**	**28466**
Alapuzha	1	22000	-	-	-	-	-	22000	7034
Kannur	1	10294	-	-	-	-	-	10294	3037
Kasargod	1	-	-	57082	-	-	-	57082	18324
Thiruvananthapuram	(1)	-	-	21	268	-	-	289	71
Madhya Pradesh	**3(8)**	**-**	**-**	**71758**	**-**	-	-	**71758**	**4701**
Jabalpur	1(1)	-	-	23680	-	-	-	23680	1184
Rewa	(1)	-	-	6200	-	-	-	6200	248
Satna	2(5)	-	-	41018	-	-	-	41018	3226
Shahdol	(1)	-	-	860	-	-	-	860	43
Rajasthan	**1**	-	-	-	-	-	-	-	-
Chittorgarh*	1	-	-	-	-	-	-	-	-

** Reported production of ochre only*
Figures in parenthesis indicate number of associated mines.

Table-4 : Production of Laterite, 2009-10 & 2010-11(P)
(By Frequency Groups)

(Qty in tonnes)

Production group	No. of mines		Production for the group		Percentage in total production		Cumulative Percentage	
	2009-10	2010-11	2009-10	2010-11	2009-10	2010-11	2009-10	2010-11
Total	**23(14)**	**20(11)**	**1300772**	**1158192**	**100.00**	**100.00**		
Up to 1000	6(3)	3(5)	3237	2834	0.25	0.24	0.25	0.24
1001-2000	(2)	1(2)	2141	4579	0.16	0.40	0.41	0.64
2001-5000	1(3)	1(1)	14732	6112	1.13	0.53	1.54	1.17
5001-10000	3(1)	2(1)	35078	23044	2.70	1.99	4.24	3.16
10001-50000	7(5)	8(2)	287017	247484	22.07	21.37	26.31	24.53
50001 & above	6	5	958567	874139	73.69	75.47	100.00	100.00

Figures in parentheses indicate number of associated mines.

Table- 5(A) : Mine-head Stocks of Laterite at the beginning of the year 2010-11
(By States/Grades)

(In tonnes)

State	For use in alumina & aluminium extraction Al_2O_3 Content		For use in other than alumina & aluminium metal extraction				Total
	Below 40%	40 – 45%	Chemical	Cement	Refractory	Others	
India	**5540**	**1387**	**633**	**83565**	**18**	**11008**	**102151**
Andhra Pradesh	-	-	-	4996	-	-	4996
Gujarat	-	-	-	-	-	11008	11008
Jharkhand	113	-	-	-	-	-	113
Karnataka	3780	1387	84	9647	18	-	14916
Kerala	427	-	-	1131	-	-	1558
Madhya Pradesh	1220	-	549	67460	-	-	69229
Maharashtra	-	-	-	246	-	-	246
Tamil Nadu	-	-	-	85	-	-	85

Table- 5(B) : Mine-head Stocks of Laterite at the end of the year 2010-11(P)
(By States / Grades)

(In tonnes)

State	For use in alumina & aluminium extraction: Al_2O_3 content		For use in other than alumina & aluminium metal extraction				Total
	Below -40%	40-45%	Chemical	Cement	Refractory	Abrasive	
India	**7427**	**665**	**84**	**155402**	**48**	**4030**	**167656**
Andhra Pradesh	-	-	-	56668	-	-	56668
Gujarat	-	-	-	1696	-	4030	5726
Jharkhand	19	-	-	117	-	-	136
Karnataka	4354	665	84	8092	48	-	13243
Kerala	1834	-	-	-	-	-	1834
Madhya Pradesh	1220	-	-	88744	-	-	89964
Tamil Nadu	-	-	-	85	-	-	85

USES & SPECIFICATIONS

The compact and ferruginous variety of laterite is used widely as a road metal and as a local stone for culverts and buildings. It cannot withstand heavy pressure and as such it is used for construction of light structures, partition walls, boundary walls, etc. Laterite as a building stone possesses one advantage that it is soft when quarried and can be easily cut and dressed into blocks and bricks which on exposure to air become hard.

The industrial use of laterite is in the cement industry. It is used as an additive for lowering the clinkerisation temperature and supplementing aluminous and iron contents required in the manufacture of cement. R&D on use of laterite for removal of fluoride from contaminated drinking water is being investigated. It is also reported that laterite is capable of removal of phosphorus from solutions and percolating columns of laterite remove cadmium, chromium and lead to very low concentrations. Specifications of laterite for cement industry are given in Table - 6

Table – 6: Specifications of Laterite Consumed in Different Cement Plants

(In Percentage)

Plant	Al_2O_3	Fe_2O_3	SiO_2
ACC Ltd, Wadi Cement Works, District Gulbarga, Karnataka.	36-45	–	–
Anjani Portland Cement Ltd, Anjanipuram, District Nalgonda, Andhra Pradesh.	20-40	–	–
Birla Cement Works, Chanderia, District Chittorgarh, Rajasthan.	17	50	18
Birla Corporation Ltd, P.O. Birla Vikas, District Satna, Madhya Pradesh.	26	37	17
Cement Corporation of India, Tandur, District Ranga Reddy, Andhra Pradesh.	> 22	> 40	–
The India Cements Ltd, Chilamkur, District Cuddapah, Andhra Pradesh.	22-37	22-36	21-30
The India Cements Ltd, Vishnupuram, Wadapally District Nalgonda, Andhra Pradesh.	12-18	45-50	12-18
The India Cements Ltd, Malkapur, District Ranga Reddy, Andhra Pradesh.	12-15	40-43	–
Heidelberg Cements (Diamond Cements) P.O. Narsingarh District Damoh Madhya Pradesh	5-8	42-47	–
Jaypee Rewa Cement, Jaypee Nagar, District Rewa, Madhya Pradesh.	15(min.)	30(min.)	10-12
J.K. Cement Works, Nimbahera and Mangrol, District Chittorgarh, Rajasthan.	10-15	40-55	12-27
Kakatiya Cement & Sugar Industries, District Krishna, Andhra Pradesh.	40-45	9	10
J.K.Cement Works, P.O. Gotan, Dist. Nagaur, Rajasthan	-	>50	-
Keerthi Industries Ltd, Mellacheruvu, District Nalgonda, Andhra Pradesh.	25.52	31.05	30.54
Kesoram Cement, P.O. Basantnagar, District Karimnagar, Andhra Pradesh.	35-38	–	–
The KCP Ltd, Macherla, District Guntur, Andhra Pradesh.	–	45-55	–
Madras Cements Ltd, Kumarasamy, Raja Nagar District Krishna, Andhra Pradesh.	–	–	12 (max.)
Maihar Cement,(Unit -2) P.O. Sarla Nagar, Maihar District Satna, Madhya Pradesh.	–	>45	< 18

(Contd.)

Table - 6 (Contd.)

Plant	Al_2O_3	Fe_2O_3	SiO_2
Malabar Cements Ltd. Walayar, District Palakkad, Kerala.	38	30	10
Manikgarh Cement, Gadchandur, District Chandrapur, Maharashtra.	>25	>30	–
Mancherial Cement Company (P) Ltd, Mancherial, District Adilabad, Andhra Pradesh.	–	32-40	16-22
Orient Cement, Devapur Cement Works, District Adilabad, Andhra Pradesh.	22-35	27-45	–
Panyam Cements & Mineral Industries Ltd, Cement Nagar, District Kurnool, Andhra Pradesh.	–	24-42	10-14
Penna Cement Ind. Ltd, Ganeshpahad, Dist. Nalgonda, Andhra Pradesh.	35	30	14
Penna Cement Ind. Ltd, Boyareddypalli District Anantapur Andhra Pradesh	–	38	–
Penna Cement Ind. Ltd, Vill. Talaricheruvu, Dist. Anantapur, Andhra Pradesh.	42	25	14
Rajashree Cements, Malkhed Road, District Gulbarga Karnataka.	20	44	19
Rain Commodities Ltd, District Nalgonda,Ramapuram, Andhra Pradesh.	–	35(min.)	–
Sanghi Cement Sanghipuram, Kachchh, Gujarat.	15-20	18-25	25-30

(Contd.)

Table - 6 (Concld.)

Plant	Al_2O_3	Fe_2O_3	SiO_2
Satna Cement Works, Ghurdang, District Satna, Madhya Pradesh.	26	37	17
Shree Cements, Beawar, District Ajmer, Rajasthan.	–	70-94	–
Shri Durga Cement Company Ltd, Hesla, Ramgarh Cantt; Ramgarh, Jharkhand.	36	34	6
Ultra Tech Cement Ltd. Adityanagar, Malkhed Road, Gulberga, Karnataka	21	42	19
Ultra Tech Cement Ltd. (Unit-Vikram Cement Works) Vill. Khor, Kheda Rathore, etc. Teh. Jewad, Neemuch, Madhra Pradesh	68	58	12-14
Sri Vishnu Cement Ltd, Dondapadu, District Nalgonda, Andhra Pradesh	36–42	–	18-22
Toshali Cements Pvt. Ltd, District Koraput, Ampavalli, Orissa.	10	8	10
Vasavadatta Cement, Sedam, District Gulbarga, Karnataka.	–	55	< 30
Vikram Cement, Vikram Nagar, Khor, District Neemuch, Madhya Pradesh.	–	58 (min)	12-14
Zuari Cement, Krishna Nagar District Cuddapah, Andhra Pradesh.	16-24	24-39	28-35
Zuari Cement Ltd, Sitapuram, P.O. Dondapadu District Nalgonda. Andhra Pradesh	35-42	–	20-22

***Source** - Individual plants*

CONSUMPTION

Laterite is used as an additive in cement industry. The estimated industrial end-use consumption of laterite in 2008-09, 2009-10 and 2010-11 was approximately 3.01 million tonnes, 3.61 million tonnes and 3.24 million tonnes, respectively. Other consuming sectors are building construction and road metal.

FUTURE OUTLOOK

Though vast resources of laterite are available in India, systematic exploration and estimation of resources need to be taken up. There seems to be no major change in the end-use pattern of laterite. The consumption of cement has increaseddue to its increased demand in the country. In future, laterite could be used as a source of metallic minerals like iron, aluminium, chromite and of trace elements like gallium and vanadium.

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

LEAD & ZINC

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

52 Lead & Zinc

Lead is a soft, heavy, toxic and highly malleable metal. It is bluish white when freshly cut, but tarnishes to dull grey when exposed. It is usually found in ore with zinc. Zinc is a silvery blue-grey metal with a relatively low melting and boiling point.

The largest single use of lead today is in the manufacture of lead acid storage batteries while the single largest use for the zinc is in galvanizing industry.

With the expansion in capacities by HZL the country enjoys self-sufficiency in respect of zinc. Production of zinc is more than its consumption. However, there is a shortage of lead in the country.

There is a thriving market of lead scrap recycling to meet the ever increasing demand from lead acid battery sector. Government of India has enacted Battery Management and Handling Rule (BMHR) 2002 which will further increase the availability of scrap from organised sector. It is estimated that worldwide more than 50% of refined lead produced is from recycled material. Producing lead through this route required around one third of the energy needed to extract it from its ores. Recovery of secondary zinc and lead is economically more attractive because of certain advantages. Besides lower energy consumption, it also entails low capital cost, less environmental hazards and high metal contents. However, in this review emphasis is given on the primary lead and zinc scenario.

HZL is the only producer of primary lead in the country as well as the only integrated producer of primary zinc from its mines situated in Rajasthan. Other producer of zinc namely Binani Zinc Ltd (BZL) produces zinc from imported concentrates. Indian Lead Ltd (ILL) is yet to start production. During the year 2010-11 there was an increase in production of lead and zinc ore by 5%, lead concentrate by about 8%, zinc concentrate by 1%. There was a decrease in production of primary lead by about 12%. However, production of zinc ingot increased by 21% over the previous year.

RESOURCES

The total resources of lead and zinc ores as on 1.4.2010 as per UNFC system, are estimated at 685.59 million tonnes. Of these, 108.98 million tonnes (16%) fall under 'reserves' (STD 111, STD 121, STD 122) while balance 576.61 million tonnes (84%) are classified as 'remaining resources' (STD 211, STD 221, STD 222, STD 331, STD 332, STD 333, and STD 334).

The resources of ore containing + 10% Pb & Zn were estimated at 139.85 million tonnes, ore containing 5 to 10% Pb & Zn were 252.30 million tonnes and ore containing less than 5% Pb & Zn were 293.44 million tonnes.

The total metal content in resources is 11.55 million tonnes lead and 36.66 million tonnes zinc. Besides, 118.45 thousand tonnes lead+zinc metal resources are available. In terms of reserves, 2.24 million tonnes of lead metal and 12.45 million tonnes of zinc metal are estimated. Rajasthan is endowed with the largest resources of lead-zinc ore amounting to 607.53 million tonnes (88.61%), followed by Andhra Pradesh 22.69 million tonnes (3.31%), Madhya Pradesh 14.84 million tonnes (2.16%), Bihar 11.43 million tonnes (1.67%) and Maharashtra 9.27 million tonnes (1.35%). Resources are also established in Gujarat, Meghalaya, Odisha, Sikkim, Tamil Nadu, Uttarakhand and West Bengal (Table-1).

EXPLORATION & DEVELOPMENT

GSI carried out exploration for lead and zinc during 2010-11 in the districts of Bhilwara and Jaipur in Rajasthan, besides Baramulla and Reasi districts of Jammu & Kashmir, and Betul and Chhindwara districts in Madhya Pradesh. MECL conducted exploration for lead and zinc in Ajmer district, Rajasthan. HZL carried out exploration in Rajsamand and Udaipur districts in their lease hold areas.

The details of exploratory activities are given in Table-2.

Table - 1 : Reserves/Resources of Lead & Zinc Ore as on 1.4.2010 (By Grades/States)

(In '000 tonnes)

Grade/State	Reserves				Remaining resources								Total resources (A+B)
	Proved STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
		STD121	STD122			STD221	STD222						
All India : Total													
Ore	**20215**	**87569**	**1196**	**108980**	**129**	**1077**	**3983**	**21433**	**221601**	**325051**	**3340**	**576614**	**685594**
By Grades													
Ore with (+)10% Pb & Zn	11055	64958	81	76094	-	-	-	-	24660	39095	-	63755	139849
Ore with 5-10 % Pb & Zn	9160	22611	1115	32886	-	961	3983	16827	59043	138602	-	219416	252302
Ore with (-)5% Pb & Zn	-	-	-	-	129	117	-	4606	137898	147354	3340	293444	293444
Metal													
Lead metal	398.42	1817.89	28.70	2245.01	-	34.32	50.95	472.37	2915.70	5831.04	-	9304.38	11549.39
Zinc metal	1938.37	10460.72	54.17	12453.26	5.20	4.71	86.91	1168.96	9607.12	13237.09	101.65	24211.64	36664.90
Lead & Zinc metals	-	-	-	-	-	-	-	-	-	118.45	-	118.45	118.45
By States													
Andhra Pradesh													
Ore	-	-	-	-	-	-	-	1000	4159	17530	-	22689	22689
Lead metal	-	-	-	-	-	-	-	28.70	119.53	688.65	-	836.88	836.88
Zinc metal	-	-	-	-	-	-	-	12.00	44.00	7.00	-	63.00	63.00
Bihar													
Ore	-	-	-	-	-	-	-	-	435	11000	-	11435	11435
Lead metal	-	-	-	-	-	-	-	-	-	24.00	-	24.00	24.00
Zinc metal	-	-	-	-	-	-	-	-	14.75	24.00	-	38.75	38.75
Gujarat													
Ore	-	4955	845	5800	-	-	-	129	-	200	-	329	6129
Lead metal	-	104.37	17.81	122.18	-	-	-	3.90	-	-	-	3.90	126.08
Zinc metal	-	224.04	39.37	263.41	-	-	-	1.10	-	-	-	1.10	264.51
Lead & Zinc metals	-	-	-	-	-	-	-	-	-	0.90	-	0.90	0.90
Madhya Pradesh													
Ore	-	-	-	-	129	117	-	1510	4006	5930	3150	14842	14842
Lead metal	-	-	-	-	-	-	-	26.12	5.13	5.04	-	36.29	36.29
Zinc metal	-	-	-	-	5.20	4.71	-	114.76	41.93	186.02	101.00	453.62	453.62
Maharashtra													
Ore	-	-	-	-	-	-	-	1967	6305	1000	-	9272	9272
Zinc metal	-	-	-	-	-	-	-	133.56	428.11	28.00	-	589.67	589.67

(Contd.)

Table - 1 (Concld.)

Grade/State	Reserves				Remaining resources								Total resources (A+B)
	Proved STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
		STD121	STD122			STD221	STD222						
Meghalaya													
Ore	-	-	-	-	-	-	-	-	880	-	-	880	880
Lead metal	-	-	-	-	-	-	-	-	16.50	-	-	16.50	16.50
Zinc metal	-	-	-	-	-	-	-	-	14.00	-	-	14.0	14.00
Odisha													
Ore	-	-	-	-	-	961	119	-	-	670	-	1750	1750
Lead metal	-	-	-	-	-	34.32	4.25	-	-	38.39	-	76.96	76.96
Rajasthan													
Ore	20215	82178	287	102680	-	-	3864	13157	200065	287576	190	504852	607532
Lead metal	398.42	1706.62	9.21	2114.25	-	-	46.70	272.54	2604.74	5055.46	-	7979.44	10093.69
Zinc metal	1938.37	10223.80	11.66	12173.83	-	-	86.91	741.17	8821.59	12950.20	0.53	22600.40	34774.23
Lead & Zinc metals	-	-	-	-	-	-	-	-	-	117.55	-	117.55	117.55
Sikkim													
Ore	-	436	64	500	-	-	-	300	-	150	-	450	950
Lead metal	-	6.90	1.68	8.58	-	-	-	-	-	-	-	-	8.58
Zinc metal	-	12.88	3.14	16.02	-	-	-	3.00	-	1.05	-	4.05	20.07
Tamil Nadu													
Ore	-	-	-	-	-	-	-	200	590	-	-	790	790
Lead metal	-	-	-	-	-	-	-	2.26	5.48	-	-	7.74	7.74
Zinc metal	-	-	-	-	-	-	-	11.76	24.76	-	-	36.52	36.52
Uttarakhand													
Ore	-	-	-	-	-	-	-	3170	1790	660	-	5620	5620
Lead metal	-	-	-	-	-	-	-	138.85	34.25	9.50	-	182.60	182.60
Zinc metal	-	-	-	-	-	-	-	151.21	87.99	27.63	-	266.83	266.83
West Bengal													
Ore	-	-	-	-	-	-	-	-	3371	335	-	3706	3706
Lead metal	-	-	-	-	-	-	-	-	130.07	10.00	-	140.07	140.07
Zinc metal	-	-	-	-	-	-	-	-	130.42	13.00	-	143.42	143.42

Figures rounded off.

Table – 2 : Details of Exploration for Lead & Zinc, 2010-11

Agency/ State/District	Location	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Metres		
GSI							
Jammu & Kashmir							
Baramulla	Buniyar area	G-4 Stage (Reconnaissance Stage)	-	-	-	-	To reassess the nature and extent of Pb-Zn and other associated mineralisation. The work is yet to be taken up.
Reasi	Bakkal-Sersandhu Khairikot area	G-4 Stage (Reconnaissance Stage)	-	-	-	-	To reassess the potentiality of Pb-Zn mineralisation and other associated metals. Surface indications of sulphide minerlisation are seen in the form of gossan, slag pieces, malachite staining in quartzite and old workings. The work is in progress.
Madhya Pradesh							
Betul	Biskhan Khairi Block	-	-	-	-	-	The area was explored during Field season 2006-09. An indicated reserve (332) of 1.91 million tonnes of zinc ore with Zn-1.14% has been estimated.
Rajasthan							
Bhilwara	Rampuriya and Gadariya-Khera villages (Pur-Banera Belt)	G-4 Stage (Reconnaissance Stage)	-	-	-	489 soil samples	To identify the target areas for base-metal and gold mineralisation by ground evaluation of airborne geophysical anomalies. Results of 119 samples indicated Pb values from >710 ppm to 460 ppm and Zn from 20 ppm to 100 ppm.
Jaipur	Dholpura area (North Delhi Fold Belt)	(Reconnaissance Stage) 1:25000		-	-	-	To assess the extent and potential basemetal and associated gold mineralisation in the Rialo group of rocks. The channel/bedrock samples indicated Cu values ranging from < 5 ppm to 686 ppm(max.).3 samples from old workings with malachite stains show 0.1% to 0.18% Cu. The Pb values range from < 25 ppm to 100 ppm (max) and Ag values are < 5 ppm.
MECL							
Rajasthan							
Ajmer	105 km from Ajmer	1:1000	0.20	8	1826	100	Three lodes have been intersected in boreholes. Thickness varies from 2 to 4 m with grade of TMC-3-4%. Few individual samples analysed Pb-from 15% to 30%.

(Contd.)

Table-2 (Concld.)

Agency/ State/District	Location	Mapping Scale	Mapping Area (sq km)	Drilling No. of boreholes	Drilling Metres	Sampling (No.)	Remarks Reserves/Resources estimated
HZL							
Rajasthan							
Rajsamand	Rajpura-Dariba Mine	1:200	1551.10 m (linear)	15	798	391	Total reserves and resources of lead and zinc ore (sphalerite & galena) to a tune of 49.37 million tonnes were established (7.37 million tonnes in 111 category with Zn 6.87% and Pb 1.80%; 6.47 million tonnes in 122 category with Zn 6.47% and Pb 1.65%; 7.87 million tonnes in 211 & 222 category with Zn 7.3% and Pb 2.21% and 32.47 million tonnes in 333 category with Zn 7.76% and Pb 2.13%).
Udaipur (Zawar Group of Mines- Mochia, Balaria, Zawarmala, Baroi)	Balaria Mine	1:200	1158 m	41	1231.85 1728.80	6913 for all mines	As on 1.4.2011 a total of 65.86 million tonnes of reserves were available in all mines at Zawar group of mines. (Mochia mine - 24.32 million tonnes; Balaria mine- 23.226 million tonnes; Zawarmala Mine- 6.085 million tonnes and Baroi Mine 65.86 million tonnes.
				14	11778.10 including Surface drilling)	2475 (Surface)	

In addition, Pebble Creek Mining Ltd (PCML) of Canada continued exploration in its Askot project in Uttarakhand. PCML owns 100% of the Askot project through a subsidiary Adi Gold Mining Private Ltd. The Askot project is a polymetallic deposit containing gold, silver, copper, lead and zinc. SRK Consulting estimated a compatible resource of 2 million tonnes containing 2.6% Cu, 5.7% Zn, 3.7% Pb, 0.5 g/t Au and 37 g/t Ag.

PRODUCTION AND STOCKS

Lead & Zinc Ores and Concentrates

The production of lead and zinc ore at 7.49 million tonnes in 2010-11 increased by about 5% as compared to that in the previous year.

The metal content of lead and zinc in the ore produced in 2010-11 worked out to 152,599 tonnes and 863,995 tonnes, respectively as against 145,213 tonnes and 732,930 tonnes, respectively, in the previous year. During 2010-11, 7.08 million tonnes of lead & zinc ore was treated as against 7.11 million tonnes in 2009-10.

The production of lead concentrates in 2010-11 at 145,043 tonnes increased by about 8% as compared to the previous year. Rajasthan continued to be the only producing state of lead concentrates accounting for the entire production.

The production of zinc concentrates increased from 1,279,880 tonnes in 2009-10 by 11% to 1,420,105 tonnes in 2010-11. The entire output of lead and zinc ores and concentrates in both the years was reported by mines from Rajasthan owned by Hindustan Zinc Ltd, a private sector unit.

Grade Analysis

All-India average metal content of ore treated in 2010-11 worked out to 13.75% (2.07% Pb and 11.68% Zn) as against 12.34% (1.82% Pb and 10.52% Zn) in 2009-10. The metal content of ore treated from Rampura-Agucha mine in Bhilwara district of Rajasthan was the highest at 15.19% (2.14% Pb and 13.05% Zn). The lead concentrates produced in Rajasthan in 2010-11 was of grade 57.46% Pb as against 61.70% Pb in 2009-10. Metal content of zinc concentrates produced in Rajasthan worked out to 51.16% Zn in 2010-11 as against 52.96% Zn in the previous year (Tables - 3 to 9).

Stocks

Mine-head stocks of lead concentrates at the end of the year were 41,431 tonnes as against 10,042 tonnes at the beginning of the year. The entire stocks at the end of the year were held in Rajasthan (Table-10).

Mine-head stocks of zinc concentrates at the end of year were 33,930 tonnes as against 52,946 tonnes at the beginning of the year. The entire stocks were held in Rajasthan (Table-11).

Employment

The average daily labour employed in lead and zinc mines during the year under review was 4,257 as against 3,859 in 2009-10.

Lead and Zinc Metals

The production of primary lead during 2010-11 decreased to 57,294 tonnes from 64,319 tonnes in the previous year. The entire output of primary lead was contributed by HZL from Chanderiya smelter. 'Nil' production of secondary lead from Indian Lead Ltd. was reported in both the years (Table-12).

The production of zinc ingot metal at 740,402 tonnes in 2010-11 increased by 21% as compared to that in the previous year (Table-13). HZL contributed 96% of the total output. Remaining production was from Binani Zinc Ltd. The entire production was reported from private sector (Tables - 14 & 15).

Annual average prices of lead and zinc metals are furnished in the General Review on 'Prices'.

Table – 3 : Producer of Lead & Zinc Ore, Concentrates and Metals, 2010-11

Name and address of the producer	Location	
	State	District
Hindustan Zinc Ltd Yashad Bhavan, Udaipur–313 004, Rajasthan.	Rajasthan	Bhilwara, Rajsamand Udaipur
Binani Zinc Ltd* (Binani Industries Ltd) Binanipuram-683 502 Kerala.	Kerala	Ernakulum

* *Produce Zinc metal from imported concentrates.*

Table – 4 : Production of Lead and Zinc Ore, 2009-10 & 2010-11 (By State)

(In tonnes)

State	2009-10			2010-11(P)		
	Ore produced	Metal content		Ore produced	Metal content	
		Lead	Zinc		Lead	Zinc
India/ Rajasthan	7101872	145213	732930	7489693	152599	863995

Table – 5 : Lead and Zinc Ore Treated, 2009-10 and 2010-11 (By State)

(In tonnes)

State	2009-10			2010-11(P)		
	Ore treated	Metal content		Ore treated	Metal content	
		Lead	Zinc		Lead	Zinc
India / Rajasthan	7108154	129432	747466	7081518	146265	827454

Table – 6 : Production of Lead Concentrates,2008-09 to 2010-11
(By State)

(Quantity in tonnes; value in ₹ '000)

State	2008-09		2009-10		2010-11(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India/ Rajasthan	133768	1362744	133921	1765874	145043	1961805

Table – 7 : Production of Lead Concentrates, 2009-10& 2010-11
(By Sector/State/Districts)

(Quantity in tonnes; value in ₹ '000)

State/District	2009-10				2010-11(P)			
	No. of mines	Production			No. of mines	Production		
		Quantity	Pb%	Value		Quantity	Pb%	Value
India	**7**	**133921**	**61.7**	**1765874**	**6**	**145043**	**57.46**	**1961805**
Private sector	7	133921	61.7	1765874	6	145043	57.46	1961805
Rajasthan	**7**	**133921**	**61.7**	**1765784**	**6**	**145043**	**57.46**	**1961805**
Bhilwara	1	89205	61.77	815315	1	117272	58.57	1368993
Rajsamand	2	20827	53.17	318454	2	24314	53.29	448456
Udaipur	4	23889	68.92	632105	3	3457	49.38	144356

Table – 8 : Production of Zinc Concentrates, 2008-09 to 2010-11
(By State)

(Quantity in tonnes; value in ₹ '000)

State	2008-09		2009-10		2010-11(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India/Rajasthan	1224077	9466647	1279880	13058419	1420105	17633867

Table – 9 : Production of Zinc Concentrates, 2009-10 & 2010-11
(By Sector/State/Districts)

(Quantity in tonnes; value in ₹ '000)

State/District	2009-10				2010-11(P)			
	No. of mines	Production			No. of mines	Production		
		Quantity	Zn%	Value		Quantity	Zn%	Value
India/Private sector	@	1279880	52.96	13058419	@	1420105	51.16	17633867
Rajasthan	@	1279880	52.96	13058419	@	1420105	51.16	17633867
Bhilwara	@	1155849	53.03	10564215	@	1319285	51.35	15400412
Rajsamand	@	74872	49.85	1222003	@	86198	47.90	1669648
Udaipur	@	49159	56.06	1272201	@	14622	52.93	563807

@ *Associated mines with lead concentrates.*

Table – 10 : Mine-head Stocks of Lead Concentrates, 2010-11 (By State)

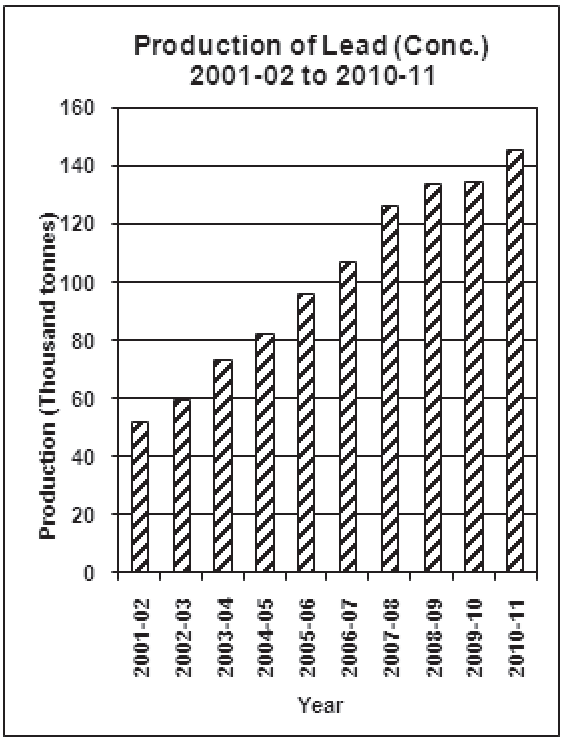
(In tonnes)

States	Stocks at the Beginning of the year	Stocks at the End of the year
India/		
Rajasthan	10042	41431

Table – 11 : Mine-head Stocks of Zinc Concentrates, 2010-11 (By State)

(In tonnes)

States	Stocks at the Beginning of the year	Stocks at the End of the year
India/		
Rajasthan	52946	33930



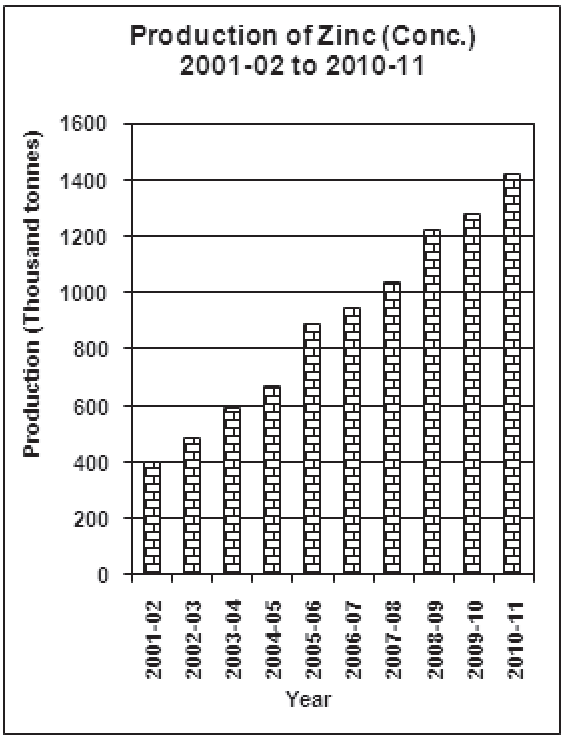


Table – 12 : Production of Lead Metal, 2008-09 to 2010-11

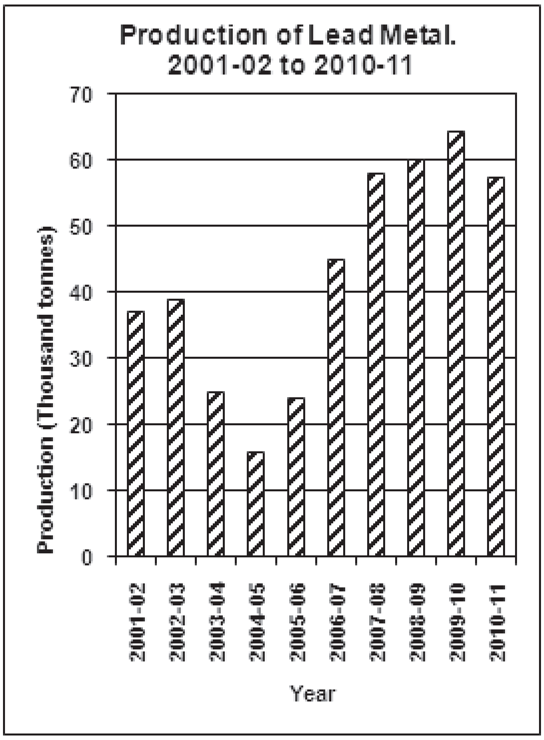
(Quantity in tonnes; value in ₹'000)

Year	Lead Primary	
	Quantity	Value
2008-09	60323	5418563
2009-10	64319	7260867
2010-11(P)	57294	6832535

Table – 13 : Production of Zinc Metal, 2008-09 to 2010-11

(Quantity in tonnes; Value in ₹'000)

Year	Zinc Ingots	
	Quantity	Value
2008-09	579091	47090795
2009-10	613964	67484136
2010-11(P)	740402	86758258



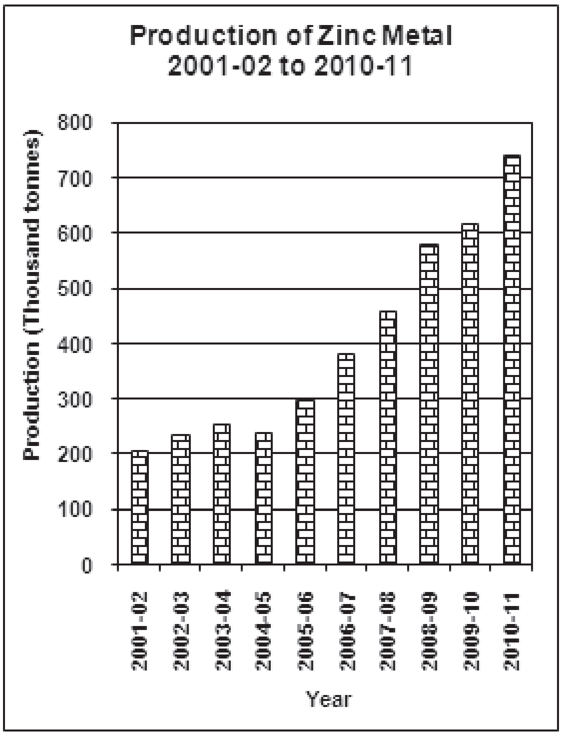


Table – 14 : Production of Lead (Primary), 2009-10 and 2010-11
(By State/Plant)

(Quantity in tonnes; value in ₹ '000)

State	Plant	2009-10		2010-11(P)	
		Quantity	Value	Quantity	Value
India/		**64319**	**7260867**	**57294**	**6832535**
Rajasthan	HZL Chanderia	64319	7260867	57294	6832535

Table – 15 : Production of Zinc (Ingots), 2009-10 and 2010-11
(By States/Plants)

(Quantity in tonnes; value in ₹ '000)

State	Plant	2009-10		2010-11(P)	
		Quantity	Value	Quantity	Value
India		**613964**	**67484136**	**740402**	**86758258**
Rajasthan	HZL Chanderia/ Debari	578412	63881436	712471	83427758
Kerala	Binani Zinc	35552	3602700	27931	3330500

MINING & MILLING

HZL is the only integrated lead and zinc producer in the country. Its operation can be classified into mining and smelting. It has seven mining operations and three smelting operations. All except one operation are located in Rajasthan. One smelting operation is located in Visakhapatnam, Andhra Pradesh. The company's mining operations are located in Rampura-Agucha (Bhilwara district), Rajpura-Dariba, Sindesar-Khurd (both in Rajsamand district) and Zawar (Udaipur district), Rajasthan. Rampura-Agucha is the largest opencast mine for zinc and lead, with a capacity of 6.15 million tpy lead zinc ore after a recent expansion. The other three mines viz, Sindesar-Khurd, Rajpura-Dariba, and Zawar are underground mines with an annual capacity of 1.5 million tonnes, 0.9 million tonnes and 1.2 million tonnes of lead & zinc ore capacity, respectively. The average grade of Rampura-Agucha mine is zinc 14.28% and Pb 1.96%, Sindesar-Khurd (Zn 4.93%, Pb 2.78%), Rajpura-Dariba mine (Zn 6.80%, Pb 1.77%) and Zawar mines (Zn 3.66% and Pb 2.03%). Sargipalli mine in Sundergarh district of Odisha, having a capacity of 500 tpd lead ore has not reported production for the last few years (Table-16).

Table – 16 : Ore Production Capacity of HZL Mines

Mine	Ore	Capacity* (million tpy)
Total		**9.75**
Zawar Mines, Dist. Udaipur, Rajasthan.	Zinc-Lead	1.20
Rajpura-Dariba, Dist. Rajsamand, Rajasthan.	Zinc-Lead	0.90
Sindesar-Khurd Mine, Dist. Rajsamand, Rajasthan.	Zinc-Lead	1.50
Rampura-Agucha, Dist. Bhilwara, Rajasthan.	Zinc-Lead	6.15
Sargipalli, Dist. Sundergarh, Odisha.	Lead	Closed

* ***Source :*** *HZL Annual Report 2011*

All the mines of Zawar Group are mechanised. The Group has underground mining complex consisting of four underground mines namely Mochia, Balaria, Zawarmala and Baroi and one concentrator for all mines. The mining operations at Mochia, Zawarmala, Baroi and partially in Balaria of Zawar mines have been suspended from 30.3.2010 as per order from DMG, Rajasthan.

The Rajpura-Dariba mine of HZL is an undergound mine with on-site concentrator and two vertical access shafts. Mining is done through vertical crater retreat and blast hole stoping. Ore is crushed underground before hoisting and stock piling for secondary and tertiary crushing.

Sindesar-Khurd mine, located near Rajpura-Dariba is an underground mine having access through a decline and service incline. Mining is done through Blast Hole Stoping method using 17 t LHD (Load Haul Dump) and 50 t Low Profile Dump Trucks(LPDT). Ore produced is hauled up to surface stock pile and crushed and then transported to RDM concentrator for secondary crushing.

Rampura-Agucha mine is the single largest open cast lead zinc mine in the world with one of the lowest cost operated zinc mine with modern efficient mining operation. Rampura-Agucha underground mine development and associated infrastructure work continued in conformity with the outcomes of the feasibility studies done by internationally reputed consultants. Underground mining is planned beyond the ultimate open pit depth of 372 metres from the surface. The process for carrying out detailed engineering work for shaft sinking (900 metres depth) has also begun. The Shotcreting machine (for the first time in the Indian mining industry), 17 tonnes loaders, 30 tonnes LPDT (Low Profile Dump Trucks), twin boom jumbo drill machines and other support equipment will be utilised for mining. In-stream analyser and computerised process control system were installed at Mochia and Dariba beneficiation plants. This system, already is in operation at Balaria plant, improved operational efficiency, such as higher grade concentrate, reduction in consumption of reagents and higher metal recovery.

INDUSTRY

After the commissionig of lead smelter of 1,00,000 tpy capacity at Rajpura Dariba Smelting Complex by HZL in 2012 the smelting capacity for lead (primary) in the country has risen to 1,85,000 tpy and for zinc (primary). It remained 917,000 tpy in 2010-11.

Primary lead was produced entirely by HZL which operated smelter at Chanderiya and Dariba having capacity of 85,000 tpy and 1,00,000 tpy of lead metal, respectively . The Vizag lead smelter having 22,000 tpy metal capacity was closed down on 24.1.2001 while Tundoo lead smelter was closed from May 2003 for economic reasons. For producing secondary lead, Indian Lead Ltd (ILL), a private sector company, has two units, one at Kolkata and other at Thane (Maharashtra), each having 12,000 tpy capacity. Both the units are based on imported concentrates/scrap. However, no production was reported by ILL. It is reported that Pondy Oxides & Chemicals also uses lead scrap along with concentrates as feedstock at its 17,000 tpy smelter and subsidiary company has capacity to refine metal to the tune of 12,000 tpy.

The smelting capacity of HZL for zinc is distributed between HZL smelters at Debari 88,000 tpy, Visakhapatnam 56,000 tpy and Chanderiya 525,000 tpy. HZL Dariba Smelting Complex-Hydrozinc Smelter has capacity of 210,000 tpy. BZL's plant at Binanipuram (Alwaye), Kerala having a capacity of 38,000 tpy produces zinc from imported concentrates. Besides lead & zinc capacities, HZL has capacities to produce 168 tpy of silver, 740 tonnes of cadmium and 1.34 million tonnes of sulphuric acid.

BZL does not have captive mines. The company produces zinc by procuring zinc concentrates from abroad/indigenously at its plant at Alwaye (Kerala). Companywise smelting capacity of lead and zinc smelters is furnished in Table - 17.

The Chanderia zinc smelter complex has three zinc smelters, namely, lead zinc smelter using Imperial Smelting Technology, UK, Hydrometallurgical zinc smelter, Hydro-I (100% EOU) and Hydro-II using Roast Leach Electrowinning Technology with conversion process and lead smelter using TSL Technology from Ausmelt, Australia and Cansol Technology for sulphur recovery. The total Pb-Zn metal production capacity is 6.1 lakh tpy and the silver production capacity is 168 tpy.

The Debari zinc smelter and Vizag zinc smelter are hydrometallurgical zinc smelters using Roast Leach Electrowinning Technology with conversion process. The product range of HZL constitutes two grades, namely, Special High Grade (SHG) zinc containing 99.995% Zn (min) and Prime Western (PW) containing 98.65% Zn (min). Both these products are available in the form of slabs weighing 25 kg, SHG Jumbo weighing 1,000 kg and PW Jumbo weighing 600 kg. Lead is available as HZL Grade containing 99.99% Pb (min) in the form of slab weighing 25 kg.

During 2011, HZL at silver-rich Sindesar Khurd mine commissioned 1.50 million tpy concentrator. A 100 thousand tpy lead smelter at Dariba has been commissioned in 2012 to reach the stated objective of over 1,064 thousand tonnes of lead and zinc metal production capacity.

Table – 17 : Companywise Capacity and Production of Primary Lead and Zinc

(In tonnes)

Company	Lead capacity tpy	Production 2009-10	Production 2010-11	Zinc capacity tpy	Production 2009-10	Production 2010-11
Hindustan Zinc Ltd	185000	64319	57294	879000	578412	712471
Binani Zinc Ltd	-	-	-	38000	35552	27931
Total	**185000**	**64319**	**57294**	**917000**	**613964**	**740402**

POLLUTION CONTROL & ENVIRONMENTAL MANAGEMENT EFFORTS

In order to regulate the reuse/reprocessing of recyclable waste in an environmentally sound manner, the Government had decided, with effect from 31 December 1999, to auction old/used lead-acid batteries and other non-ferrous metal waste to the actual users enlisted with Ministry of Environment & Forest (MoEF) and having facilities for environmentally sound management of waste processing.

Most of the mine overburden generated is utilised for secondary construction work including raising of tailing dam heights and mine backfilling. The slag generated from Pyro operations of Chanderiya is gainfully utilised for cement manufacturing. Likewise, fly ash is used in cement production, brick manufacturing and other secondary constructions.

The hazardous wastes generated are being disposed of in the secured landfills in environment-friendly manner, designed with state-of-the-art technologies and approved by statutory bodies. Extensive R&D has been undertaken for gainful utilisation of Jarosite (a waste from Hydro operations), in road construction and cement manufacturing. Premier research institutes and industries including National Council for Cement and Building Materials (NCCBM) and Cement industries and Tiles industries, have been associated for the same. HZL has obtained positive results and is hopeful on alternative gainful utilisation of Jarosite.

All the units of HZL have achieved certification by International Occupational Health and Safety Management System OHSAS 18001, ISO 9001 and ISO 14001. Debari and Vizag smelters have obtained SA 8000 certificate for the social accountability. In view of severe scarcity of water in Rajasthan, zero discharge of desliming hydrocyclones was introduced in the tailing circuit to increase the recovery of water from the tailings. This has resulted in reducing the fresh water consumption. The sewage treatment plants at Debari and Chanderiya smelters were operated continuously and the effluents were reutilised in the smelter and for plantation in the colony. Over the years, the company has been voluntarily filing Carbon Disclosure Project (CDP) responses as a proactive step towards reporting carbon foot-printing.

HZL has entered into a charter for Corporate Responsibility for Environmental Protection (CREP) with MoEF, Central Pollution Control Board (CPCB) and State Pollution Control Boards (SPCBs) for achieving a quantum jump in its environmental performance in the coming years.

RECYCLING OF LEAD & ZINC

Lead

Lead when used as metal in batteries, cable sheathing and sheathing for containing radiation is fully recyclable without loosing its properties. Therefore, there is a thriving industry of lead recycling in the country. However, due to the health risk involved in lead recycling the Central Pollution Control Board authorises licences to the lead-reprocessors with stringent environmental checks.

Government of India has enacted Battery Management and Handling Rules (BMHR) 2002 to organise the recycling of lead acid batteries and to make available raw material to the lead reproducers. As on 13.5.2010, there were 316 lead waste reprocessors in the country with their combined battery intake capacity of 1,097,900 tpy. In the recently published Market Survey on Lead & Zinc by IBM, the secondary lead productions have been estimated at 72,000 tonnes in 2009-10.

Zinc

Largest consumer of zinc is galvanising industry, the zinc once used for galvanising as well for brass making is not recoverable. Hence, the quantum of zinc recycling is comparatively small as compared to lead recycling.There were 170 units of zinc recycling with combined capacity of 402,500 tpy and 132 units of zinc with other metal recycling having a combined capacity of 517,500 tpy in the country as on 13.5.2010.

There is an estimated production of 61,000 tonnes of secondary zinc in 2009-10.

CONSUMPTION

Consumption of lead and zinc in various industries is not available readily. However, it is known that lead and zinc are consumed in the form of metals as well as in the form of compounds and oxides.

Lead

The battery industry consumes about 74% of lead followed by pigments and compounds 9%, rolled and extruded products 8%, alloys 3%, cable sheathing 2% and the balance 4% is consumed by other industries.

Zinc

Owing to its corrosion resistance in varying types of environment, zinc is used for protecting steel by way of galvanising. The galvanising industry alone consumes about 57% of zinc, followed by coatings 16%, die-casting alloys 14%, oxides & chemicals 7% and extruded products 6%.

SUBSTITUTES & TECHNICAL POSSIBILITIES

Lead

Battery replacements include batteries of nickel-zinc, zinc lithium chloride, sulphide or nickel lithium hydride. The large-scale commercial use of any of these four possible substitutes was so far precluded by cost and operating problems. Polyethylene and other materials work as substitute in some cable applications.

In construction applications, in place of galvanised sheets, copper and aluminium are alternatives. In corrosive chemical environment, stainless steel, titanium, plastics and cements are substitutes. Tin, glass, plastics and aluminium are alternatives in tubes and containers, iron & steel or bismuth in shots for ammunition, and tin in solder. In electronic industry, there has been a move towards lead-free solders with varying compositions of tin, bismuth, silver and copper.

Environmental concerns for lead are limiting the uses, particularly in gasoline, where its use as an anti-knock was phased out by the introduction of catalytic converters. Storage batteries for industrial load levelling, mains power management and electric vehicles have growing markets. The continued search for weight reduction is reducing the amount of lead per battery, and battery lives are being extended. Possible new developments include the use of lead as an antioxidant in asphalt, as a shielding material in nuclear waste, in protection of buildings against radon gases and as a sound buffer. Environmental legislation will inhibit the growth of new uses and possibly eliminate lead from many existing uses. The Organisation for Economic Cooperation & Development (OECD) is actively examining possible restrictions on uses of lead. New techniques to recover lead from concentrates and from scrap are developing and will become more important in future. Recycling of lead and zinc through environmentally safe processes needs to be encouraged as the growing use of lead and zinc in railway electrification as well as in road transport and agriculture sectors has created shortage in country.

Zinc

Aluminium, magnesium and plastic compete in some die-casting applications. Ceramic and plastic coatings, electroplated cadmium & aluminium and special steel compete in some galvanising applications. Aluminium, magnesium and titanium can replace zinc in chemicals and pigments. Zirconium is an alternative in ceramic and enamel applications. New alloys, e.g. superplastic alloys of zinc and aluminium could be developed. Many elements are substitutes for zinc in chemical, electronic and pigment uses.

WORLD REVIEW

Global refined lead metal production in 2011 was expected to increase by 7% (10.3 million tonnes), owing to production increases and new plants in Australia, China, Germany, India, the Republic of Korea, and Mexico.

The majority of new primary and secondary refined lead capacity added in 2011 was expected to be in China. Global consumption of refined lead in 2011 was forecast to be 10.2 million tonnes, a 6% increase from that of 2010, according to ILZSG.

The global increase in consumption was attributed to a 7% increase in use of refined lead in China owing to growth in the automotive, e-bike, and industrial battery sectors. Consumption in Europe, India, and the United States was expected to be greater in 2011 than in 2010. In North America, the BCI forecast that total shipments of SLI lead-acid batteries would increase slightly in 2011 from those in 2010.

Overall, ILZSG expected that production of refined lead would exceed consumption, and the lead market would remain in surplus of about 188,000 tonnes by year end 2011.

ILZSG forecast zinc consumption in 2011 to increase by 2% from that in 2010 to 12.85 million tonnes. China's apparent consumption was expected to increase a modest 2% as a result of a destocking of unreported inventories. Europe's consumption was forecast to increase by 3%. Notable increases in consumption were also expected in Brazil, India, and Turkey.

World mine production was expected to increase by 4% in 2011 to 12.8 million tonnes owing to increased production in China, India, Kazakhstan, Mexico, and Russia, despite declines predicted in Australia and Peru. Refined metal production was expected to increase by 3% to 13.2 million tonnes owing to increases in China, India, and the Republic of Korea. Overall, the zinc metal market in 2011 was forecast to remain in a substantial surplus of 317,000 tonnes followed by smaller surplus in 2012.

RESERVES

Lead

The world's reserves of lead were estimated at 85 million tonnes. Australia leads with 34% of world's reserves of lead, followed by China (16%), Russia (11%), Peru (9%), and USA & Mexico (about 7% each) (Table- 18).

Zinc

The world's reserves were estimated at 250 million tonnes. Australia accounts for 22% of world's zinc reserves, followed by China (17%), Peru (8%), Mexico (7%) and USA, India and Kazakhstan (5% each) (Table-19).

PRODUCTION

Lead

The world mine production of lead increased to 4.2 million tonnes in 2010 as compared to 3.9 million tonnes in 2009. China was the leading producer accounting for about 44% of world production, followed by Australia (17%), USA (9%), Peru (6%) and Mexico (5%) (Table-20).

Zinc

The world mine production of zinc increased to 12.3 million tonnes in 2010 from 11.6 million tonnes in 2009. China (30%), Peru and Australia (12% each) were the leading producers followed by USA and India (6% each) and Canada & Mexico (5% each) (Table - 21).

WORLD PRICES

Prices of lead and zinc are furnished in the General Review on 'Prices'.

Table – 18 : World Reserves of Lead (By Principal Countries)

(In '000 tonnes of lead content)

Country	Reserves
World: Total (rounded)	**85000**
Australia	29000
Bolivia	1600
Canada	450
China	14000
India	2600
Ireland	600
Mexico	5600
Peru	7900
Poland	1700
Russia	9200
South Africa	300
Sweden	1100
USA	6100
Other countries	5000

Source: *Mineral Commodity Summaries, 2012.*

Table – 19 : World Reserves of Zinc (By Principal Countries)

(In '000 tonnes of zinc content)

Country	Reserves
World: Total (rounded)	**250000**
Australia	56000
Bolivia	5000
Canada	4200
China	43000
India	12000
Ireland	1800
Kazakhstan	12000
Mexico	17000
Peru	19000
USA	12000
Other countries	68000

Source: *Mineral Commodity Summaries, 2012.*

Table - 20 : World Mine Production of Lead (By Principal Countries)

(In '000 tonnes of metal content)

Country	2008	2009	2010
World : Total	**3800**	**3900**	**4200**
Australia	650	566	712
Bolivia	82	84	73
Canada	100	69	65
China	1403	1604	1851
India*	81	84	84
Irish Republic	50	50	39
Kazakhstan	39	34	35
Mexico	141	144	192
Morocco	33	34	33
Macedonia	67	63	44
Poland	67	63	44
Peru	345	302	262
Russia	60	72	97
South Africa	46	49	51
Sweden	63	69	68
USA	410	406	369
Other countries	163	207	181

Source *: World Mineral Production,2006-2010.*

* *India's production of primary lead in 2008-09, 2009-10 and 2010-11 was 60.32 thousand tonnes, 64.32 thousand tonnes and 57.29 thousand tonnes, respectively.*

Table – 21 : World Mine Production of Zinc (By Principal Countries)

(In '000 tonnes of metal content)

Country	2008	2009	2010
World : Total	**12000**	**11600**	**12300**
Australia	1519	1290	1480
Canada	750	699	649
China	3343	3324	3700
India*	648	680	737
Irish Rep.	398	386	343
Kazakhstan	387	396	405
Mexico	454	490	570
Peru	1603	1513	1471
USA	778	736	748
Other countries	2120	2086	2197

Source: *World Mineral Production, 2006-2010.*
India's production of primary zinc in 2008-09, 2009-10 and 2010-11 was 579.0 thousand tonnes, 613.9 thousand tonnes and 740.4 thousand tonnes, respectively.

European Union

Recylex S.A. (Paris, France), a leading lead producer in Europe, reported that in 2010 its two facilities in France and subsidiary in Germany processed 149,000 tonnes of spent lead-acid batteries, a 14% increase compared with 131,000 tonnes in 2009. The lead-bearing materials produced by these plants were sent to the company's two smelters in Belgium and Germany.

Australia

Magellan Metals Pty. Ltd. [a wholly owned subsidiary of Ivernia Inc., (Toronto)] announced that it had restarted operations at its Magellan Mine in Western Australia. Mining operations at Magellan had been suspended in April 2007 owing to environmental concerns associated with the transport of lead concentrate from the mine. It again ceased all mining operations immediately upon receipt of the order from Ministry of Environment and remained closed during the first quarter of 2011 .

Canada

Xstrata plc's (Zug, Switzerland) Brunswick underground zinc-lead mine near Bathurst, New Brunswick, was the leading producer of lead in concentrate in Canada. The mine had production capacity to process 3.40 million tonnes of ore containing copper, lead, silver, and zinc on an annual basis. Xstrata increased reserves at Brunswick Mine to extend the mine life to 2013, beyond its previously anticipated closure in early 2010. In 2010, Selwyn Resources Ltd. (Vancouver, British Columbia) and joint-venture partner, Yunnan Chihong Zinc and Germanium Co. Ltd., In 2010, Selwyn Chihong completed an extensive diamond drilling programme in the XY Central and Don deposits to upgrade mineral resources to the measured and indicated category. It also undertook exploratory drilling in the XY West deposit to confirm the continuity and extent of the high-grade mineral resources. The Selwyn project was one of the largest undeveloped resources of lead and zinc in the world according to the company. The latest resource estimates for the project, as of February 2009, included 16.06 million tonnes of indicated high-grade mineral resources, grading 4.23% lead. Selwyn's development schedule provided for initial ore production to begin in 2014 at rates that would produce about 65,000 tpy of lead in concentrate.

Teck announced that, in 2010 refined lead production at its metallurgical complex at Trail was 71,500 tonnes, a slight decline from that of 2009 owing to operational issues at an oxygen plant that affected lead operations and planned maintenance activities during the fourth quarter of 2010. The required maintenance necessitated a 32-day shutdown of the lead smelter. By year end 2010, the lead smelter had returned to full production. Teck expected to produce 80,000 tonnes of refined lead at Trail in 2011.

China

China continued to be the leading global producer and consumer of lead in 2010. China was also the leading producer of lead-acid batteries in the world. Consumption of lead in China has increased by an average of 20% per year from 1999 to 2009 and was estimated to have increased by 7% to 4.21 million tonnes in 2010 from 3.93 million tonnes in 2009. Secondary lead production was expected to continue to increase and achieve 50% of total refined lead output by 2015. In 2010, the Chinese Government continued to eliminate smaller lead mines and smelters in an attempt to consolidate production. Lead was one of several nonferrous metals targeted by the Government for consolidation and modernisation, but a multitude of lead exposure and poisoning incidents from lead smelters and lead-acid battery plants during 2009–10 had increased pressure to clean up the lead industry and increase oversight of production. The Ministry of Industry and Information announced that 17 lead smelters with capacity to produce about 266,000 tpy of refined lead were targeted for elimination. The majority of these smelters were smaller operations with substantially less than 50,000 tpy of refined lead production capacity. These closures were part of the The National Development and Reform Commission's twelfth 5-year plan (2011–15), which proposed to limit lead smelting capacity in China to 5.5 million tonnesper year by 2015 and eliminate all outdated capacity.

Recycled production of lead was to account for more than 30% of annual refined lead production by 2015. The plan called for consolidation that would lead to the 10 leading producers to account for 70% of annual refined lead output by 2015. Despite the closures of smaller smelters, it was expected that new larger smelters scheduled to open would allow for continued increases in total lead metal production. In 2010, construction was ongoing at four new lead smelters that were expected to add about 360,000 tpy of refined lead capacity by 2011. More projects were planned for 2012 to 2013.

Mexico

In September, Goldcorp Inc. (Vancouver, British Columbia, Canada) announced that it had reached commercial production levels at its Penasquito gold-silver-lead-zinc project in the northeast corner of the State of Zacatecas. JCI's new secondary lead smelter in Monterrey commenced operations in November. The plant was ramping up output towards its design capacity of 132,000 tpy of refined lead. The smelter had the ability to expand to 176,000 tpy of refined lead capacity and was expected to recycle spent lead-acid batteries from Mexico and the Southwest United States. The new plant was the company's second lead recycling facility in the Monterrey area, with an existing 120,000 tpy refined lead capacity operation at Cienega de Flores.

Peru

In the second quarter of 2009, Doe Run Peru halted operations at its La Oroya metallurgical complex, 140 kilometers east of Lima, owing to environmental and financial problems that kept it from obtaining copper, lead, and zinc concentrates to process. La Oroya had the capacity to produce 120,000 tpy of refined primary lead.

FOREIGN TRADE

Lead

Exports

Exports of lead from the country are in the form of ore and concentrates, lead alloys and scrap, lead waste and scrap, lead unrefined, refined lead unwrought, pig lead, lead and alloys worked and others.

Exports of lead ores and concentrate increased sharply to 122,200 tonnes in 2010-11 as compared to 36,476 tonnes in the previous year. China was the single largest importer accounting for almost the entire quantity. Exports of lead and alloys & scrap also increased to 161,430 tonnes during 2010-11 as compared to 53,779 tonnes in the preceding year. Almost entire exports were of lead & alloys while those of scrap were nominal. China accounting for 71% of exports was followed by Rep. of Korea (14%) and Indonesia (6%) as the major destinations in 2010-11 (Tables - 22 to 29).

Imports

Imports of lead in India are in the form of lead ores and concentrates, lead and alloys including scrap, lead and alloys unwrought, pig lead, antimonial lead, worked lead and alloys (bars, rods, plates, etc.).

Imports of lead ores & concentrates increased to 9,722 tonnes in 2010-11 as compared to 6,944 tonnes in 2009-10. Imports were mainly from Malaysia (13%), Iran (12%) and Morocco (11%). Imports of lead and alloys & scrap during 2010-11 were 285,662 tonnes compared to 253,275 tonnes in 2009-10. Imports comprised mainly lead and alloys and the rest was scrap. UAE (15%), UK (14%), Australia (13%), Rep. of Korea (7%), & Belgium (6%) were the major suppliers during 2010-11 (Tables - 30 to 34).

Zinc

Exports

Exports of zinc from the country are in the form of ores and concentrates, zinc & alloys including scrap, zinc spelter, zinc and alloys in the forms of bars, rods and plates.

Exports of zinc ores and concentrates increased sharply to 439,265 tonnes in 2010-11 as compared to 191,960 tonnes in the previous year. China was the major importer and accounted for almost entire quantity.

Exports of zinc and alloys & scrap during 2010-11 were 307,288 tonnes as against 175,767 tonnes in the preceding year. Almost entire exports during 2010-11 were of zinc & alloys. Malaysia (23%), Rep. of Korea (22%), China (9%) and Nigeria & Chinese Taipei/Taiwan (8% each) were the main destinations (Tables-35 to 38).

Imports

Imports of zinc in the country are in the form of zinc ores and concentrates, zinc and alloys including scrap, zinc spelter, zinc and alloys in the forms of bars, rods, plates, mazak, etc. Imports of zinc ores and concentrates increased to 88,171 tonnes in 2010-11 from 59,857 tonnes in the preceding year. Imports were mainly from Peru (57%) and Australia (42%). Imports of zinc and alloys & scrap during 2010-11 were 112,228 tonnes compared to 153,920 tonnes in 2009-10. Kazakhstan (18%), Iran & UAE (10% each), Rep. of Korea (9%) and Australia (7%) were the major suppliers (Tables - 39 to 46).

Table – 22 : Exports of Lead Ores & Concentrates (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**36476**	**2434582**	**122200**	**10827976**
China	36450	2434324	121920	10826285
Indonesia	-	-	275	1680
Sri Lanka	4	13	5	10
UK	-	-	++	1
Other countries	22	245	-	-

Table – 23 : Exports of Lead and Alloys Including Scrap : Total (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**53779**	**5469186**	**161430**	**21580636**
China	898	99427	115274	16707080
Korea, Rep. of	18002	1950868	22367	2352700
Indonesia	12131	1217195	9715	969018
Saudi Arabia	1289	128412	5741	648612
Malaysia	3251	378655	1785	176138
Sri Lanka	1867	175585	1633	169165
Vietnam	650	69070	1162	108573
Thailand	1647	165782	566	52851
Bahrain	4	478	301	36417
Benin	34	5183	175	30377
Other countries	14006	1278531	2711	329705

Table – 24 : Exports of Lead & Alloys (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**53658**	**5458634**	**161320**	**21571691**
China	818	90935	115164	16698595
Chinese Taipei/ Taiwan	7162	538315	219	23908
Indonesia	12131	1217194	9715	969018
Korea, Rep. of	18002	1950868	22367	2352700
Malaysia	3251	378655	1785	176138
Saudi Arabia	1289	128413	5741	648151
Singapore	1434	173398	95	10582
Sri Lanka	1867	175585	1633	169165
Thailand	1647	165782	566	52851
Vietnam	650	69070	1162	108572
Other countries	5407	570419	2873	362011

Table – 25 : Exports of Lead & Waste & Scrap (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**121**	**10552**	**110**	**8945**
China	80	8493	110	8484
Egypt	2	110	-	-
Kenya	13	237	-	-
Maldives	++	10	-	-
Saudi Arabia	-	-	++	461
UAE	26	1596	-	-
USA	++	106	-	-
Other countries	-	-	-	-

Table - 26 : Exports of Refined Lead, Unwrought (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**26971**	**2441023**	**149057**	**20191846**
China	197	18011	114560	16643443
Korea, Rep. of	9580	973414	20565	2159796
Saudi Arabia	984	97668	4599	478443
Indonesia	7801	788076	4752	456425
Malaysia	73	6775	1648	158527
Sri Lanka	908	81017	1211	125537
Vietnam	249	24294	669	64328
Thailand	537	52097	294	24541
Chinese Taipei/ Taiwan	4941	261196	219	23866
Nepal	3	262	202	21462
Other countries	1698	138213	338	35478

Table – 27 : Exports of Lead & Alloys Unwrought, NES. (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**20123**	**2328945**	**4641**	**532675**
Korea, Rep. of	7968	934967	1084	110073
Saudi Arabia	209	12467	908	107729
Indonesia	853	89719	386	41582
Sri Lanka	879	85622	400	41530
Benin	34	5183	175	30377
Italy	126	13461	303	29299
Tanzania	51	6399	145	22693
Portugal	-	-	124	13679
Thailand	597	65247	144	13424
Bahrain	++	6	87	13004
Other countries	9406	1115874	885	109285

Table – 28 : Exports of Lead Unrefined, NES (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**301**	**30950**	**20**	**2621**
USA	-	-	20	2490
UAE	4	464	++	131
Other countries	297	30486	-	-

Table – 29 : Exports of Lead: Pig Lead (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**120**	**11407**	**-**	**-**
Korea, Rep. of	120	11407	-	-
Other countries	-	-	-	-

Table – 30 : Imports of Lead Ores & Conc. (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**6944**	**223284**	**9722**	**342050**
Morocco	864	38961	1093	71100
Malaysia	87	2850	1230	45346
Iran	-	-	1119	27253
Ghana	171	4853	794	27216
China	-	-	351	19005
Ethiopia	-	-	695	18789
Ivory Coast	1122	28973	509	14825
Senegal	28	716	406	14669
Spain	-	-	293	13397
Mozambique	-	-	312	11407
Other countries	4672	146931	2920	79043

Table – 31 : Imports of Lead and Alloys Including Scrap : Total (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**253275**	**21984498**	**285662**	**27568237**
UAE	22754	1936427	41441	3936905
Australia	44962	4219881	36809	3880606
UK	43394	3640569	40198	3795711
Korea, Rep. of	19390	1875236	20826	2462205
Belgium	14922	1333072	16536	1587344
Germany	26368	2635111	15421	156517
Saudi Arabia	2946	212656	11468	1037619
Pakistan	9433	756803	10126	932290
Algeria	3461	230299	6226	527194
Nigeria	6076	437509	5844	514644
Other countries	59569	4706935	80767	7357202

Table – 32 : Imports of Lead & Alloys (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**212890**	**18788265**	**227387**	**22411491**
Australia	44641	4192470	36140	3824638
UAE	20713	1774140	37674	3593873
Korea, Rep. of	19390	1875236	20826	2462205
Germany	25667	2583210	14311	1445105
Belgium	14576	1307434	14796	1442156
Saudi Arabia	2861	207129	11414	1032522
Pakistan	9214	737071	10102	930523
UK	13848	1226300	6550	753807
Algeria	3461	230299	6226	527194
Nigeria	6076	437509	5793	511122
Other countries	52443	4217467	63555	5888346

Table – 33 : Imports of Lead (Scrap) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**40385**	**3196233**	**58275**	**5156746**
UK	29546	2414269	33648	3041904
UAE	2041	162287	3767	343032
USA	1286	77991	2652	229818
Netherlands	818	53751	1880	152913
Belgium	346	25638	1740	145189
France	152	15077	1240	105010
Italy	356	22477	1140	96048
Germany	701	51901	1110	91412
Egypt	67	4542	962	82004
Bahrain	360	28042	834	77560
Other countries	4712	340258	9302	791855

Table – 34 : Imports of Lead (By Items)

Item	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Items	**253275**	**21984498**	**285662**	**27568237**
Lead & alloys: unwrought	210532	18408052	226303	22203677
Pig lead	1695	116783	3136	309565
Unrefined lead, NES	12307	883317	24260	2192764
Refined lead, unwrought	110200	10203561	92372	9366335
Antimonial lead	2895	229225	2052	202562
Lead & alloys unwrought, NES	83435	6975166	104483	10132453
Lead & alloys: worked (bars, rods, plates, etc.)	2358	380213	1084	207814
Lead scrap	40385	3196233	58275	5156746

Table – 35 : Exports of Zinc Ores & Concentrates (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**191960**	**6167984**	**439265**	**18270707**
China	171800	5564052	439264	18270689
USA	-	-	1	13
UK	-	-	++	5
Other countries	20160	603932	-	-

Table – 36 : Exports of Zinc & Alloys Including Scrap : Total (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**175767**	**19140301**	**307288**	**38344923**
Malaysia	24831	2986431	70124	8594723
Korea, Rep. of	26935	3012382	66404	8128012
China	18602	1795499	27851	3763209
Nigeria	9743	1004142	25688	3423650
Chinese Taipei/ Taiwan	24073	2559572	23539	3046798
UAE	8874	987184	15297	1816738
Indonesia	8645	963131	8991	1164698
Netherlands	48	3201	8632	1054000
Nepal	8375	844693	8846	880413
Bangladesh	10121	1146025	6547	816045
Other countries	35520	3838041	45369	5656637

Table – 37 : Exports of Zinc & Alloys (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**175746**	**19134250**	**307283**	**38343746**
Bangladesh	10121	1146024	6547	816045
China	18602	1795499	27851	3763209
Chinese Taipei/ Taiwan	24073	2559572	23539	3046798
Indonesia	8645	963131	8991	1164698
Korea, Rep. of	26935	3012382	66404	8128011
Malaysia	24831	2986432	70124	8594723
Nepal	8366	839245	8846	880414
Nigeria	9743	1004143	25688	3423650
Turkey	5682	594571	6389	748148
UAE	8864	986894	15297	1816739
Other countries	29884	3246357	47607	5961311

Table – 38 : Exports of Zinc (Scrap) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**21**	**6051**	**5**	**1177**
Austria	1	234	-	-
Bahrain	-	-	4	900
Nepal	9	5448	-	-
UAE	10	290	-	-
USA	1	78	1	277
Other countries	++	1	-	-

Table – 39 : Imports of Zinc Ores & Conc. (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**59857**	**1911107**	**88171**	**3415929**
Peru	12920	453081	50317	2121274
Australia	36395	1162123	37120	1266903
Congo	466	23888	346	17643
UAE	-	-	51	3022
Djibouti	-	-	147	2546
Morocco	-	-	46	1601
Iran	209	2374	48	1351
Ethiopia	199	2860	74	1263
Japan	-	-	22	326
Other countries	9668	266781	-	-

Table - 40 : Imports of Zinc and Alloys Including Scrap : Total (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**153920**	**13463420**	**112228**	11302210
Kazakhstan	27547	2747414	20008	2049080
Iran	19417	1742786	10725	1115003
UAE	10717	948135	10878	1046188
Korea, Rep. of	10706	1133266	9657	1029929
Australia	22342	1972751	7789	842900
China	3829	2264429	4530	520588
Germany	4913	355255	3658	394389
Malaysia	3159	286139	3590	390711
Namibia	2212	224083	3690	382154
Belgium	2514	192883	2390	261730
Other countries	46564	3596279	35313	3269538

Table – 41 : Imports of Zinc & Alloys :Worked (Bars, Rods, Plates, Etc) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**10657**	**995042**	**12944**	**1118618**
Malaysia	1487	176577	1628	198028
Germany	1041	100459	1245	168257
Iran	1671	156514	1215	129765
UAE	1642	178767	1164	106076
Bangladesh	991	44720	1768	86971
Australia	832	73864	431	59538
Korea, Rep. of	349	30973	510	55222
China	624	65980	455	55215
Belgium	167	17577	335	42414
Finland	520	61061	314	40101
Other countries	1333	88550	3879	177031

Table – 42: Imports of Zinc & Alloys (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**126684**	**11698545**	**82411**	**8635693**
Kazakhstan	27547	2747414	20008	2049080
Iran	19417	1742786	10725	1115003
Korea, Rep.of	10663	1131277	9444	1007843
Australia	21809	1938361	7244	800732
UAE	8268	771443	7463	770357
China	3737	259815	4421	508665
Namibia	2212	224083	3690	382154
Malaysia	2003	216366	2573	288379
Russia	2008	172735	2084	230814
Germany	1244	123034	1504	218780
Other countries	27776	2371231	13255	1263886

Table – 43 : Imports of Zinc & Alloys, NES (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**8932**	**753013**	**3613**	**537591**
China	1451	31934	721	115777
Australia	1687	150423	957	103333
Belgium	292	26702	557	69079
Germany	102	15363	136	40297
ChineseTaipei/ Taiwan	45	17519	78	39048
Japan	67	19191	95	27678
Italy	6	1177	80	20443
UK	64	15081	115	16894
UAE	347	30292	150	15573
Korea, Rep.of	181	13864	124	14155
Other countries	4690	431467	600	75314

Table – 44 : Imports of Zinc or Spelter (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**103474**	**9530567**	**61164**	**6462902**
Kazakhstan	27347	2733596	18530	2032992
Iran	17513	1555548	9385	973729
UAE	6279	562384	6149	648709
Australia	19116	1698905	5608	611653
Korea, Rep. of	7076	722331	4744	492224
Namibia	1967	202959	3617	374100
China	1662	161901	3245	337672
Russia	1827	160824	2084	230814
Singapore	1781	188090	2165	198439
Japan	3735	310514	1734	174455
Other countries	15171	1233515	3903	388115

Table – 45: Imports of Zinc (Scrap) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**27236**	**1764875**	**29817**	**2666517**
UAE	2449	176691	3415	275831
Saudi Arabia	1096	79270	2566	210702
USA	2626	167541	2014	187253
Mexico	966	64955	1597	178019
Germany	3669	232221	2154	175608
UK	2241	158821	1525	124311
Belgium	1498	95293	1116	105377
Malaysia	1156	69773	1017	102333
Italy	1020	59477	1085	102139
Thailand	833	45908	1132	89138
Other countries	9682	614925	12196	1115806

Table – 46: Imports of Zinc
(By Items)

Item	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Items	**153920**	**13463420**	**112228**	**11302210**
Zinc & alloys	126684	11698545	82411	8635693
Zinc or spelter	103474	9530567	61164	6462902
Mazak	3621	419923	4690	516582
Zinc & alloys, NES	8932	753013	3613	537591
Zinc & alloys: worked (bars, rods, plates, etc.)	10657	995042	12944	1118618
Zinc scrap	27236	1764875	29817	2666517

FUTURE OUTLOOK

It is noteworthy that from being a net importer, 8 years ago, India has become a net exporter of zinc. The demand of zinc is riding on the steel industry growth, mainly driven by the production of galvanised sheets. Similarly, with the growth in the automotive, information & communication technology and infrastructure sectors, the demand for lead is poised to increase and sustain in future. It is expected that down-stream industry development, improvement in standard of living and consumer awareness is set to further increase the demand of zinc and lead in the forthcoming years.

As per the Report of Sub- Group-II on Metals and Minerals for the XII Five Year Plan, the demand for zinc in India is expected to be 6,00,000 tonnes in 2012-13 and would increase to 8,80,000 tonnes in 2016-17, HZL is the lone producer of lead in India its current primary lead capacity is 1,85,000 tonnes per anum. Lead demand in 2012-13 would be 4,33,000 tonnes and is expected to be 5,68,000 tonnes by 2016-17.

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

LIMESTONE & OTHER CALCAREOUS MATERIALS

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

53 Limestone & Other Calcareous Materials

The term limestone is applied to any calcareous sedimentary rock consisting essentially of carbonates. The two most important constituents are calcite and dolomite. Limestone often contains magnesium carbonate, either as dolomite CaMg $(CO_3)_2$ or magnesite ($MgCO_3$) mixed with calcite. It is then termed 'dolomitic' or 'magnesian' limestone. Such limestone contains 10 to 40% $MgCO_3$. Limestones altered by dynamic or contact metamorphism become coarsely crystalline and are referred to as 'marbles' and 'crystalline limestones'. Other common varieties of limestones are 'marl', 'oolite' (oolitic limestone), shelly limestone, algal limestone, coral limestone, pisolitic limestone, crinoidal limestone, travertine, onyx, hydraulic limestone, lithographic limestone, etc. However, the limestone which is used by industries in bulk quantity is a bedded type sedimentary limestone. Other calcareous material used by industry is 'chalk', a white, extremely fine-grained, usually soft and friable variety of limestone, composed wholly or largely of microscopic small remains of foraminifera and broken shelly fragments; 'kankar', irregular nodules and concretions of impure calcium carbonate of all sizes found in the older surface alluvium or soils; and 'limeshell', the thick calcareous shells of molluscs deposited in the form of beds in present as well as ancient lakes and shallow seas. A limestone rock which separates well along the stratification into a few centimetres thick slabs is termed 'flagstone'. The dimensional limestone used for building and ornamental stone purposes is discussed in the Reviews on 'Marble' and 'Slate, Sandstone & Other Dimension Stones'.

RESOURCES

The total resources of limestone of all categories and grades as per UNFC system as on 1.4.2010 are estimated at 184,935 million tonnes, of which 14,926 million tonnes (8%) are under reserves category and 170,009 million tonnes (92%) are under remaining resources category. Karnataka is the leading state having 28% of the total resources followed by Andhra Pradesh (20%), Rajasthan (12%), Gujarat (11%) , Meghalaya (9%) and Chhattisgarh (5%). Gradewise, cement grade has leading share of about 69% followed by SMS & BF grades (12%) and chemical grade (3%). Remaining 16% are others, not-known and unclassified grades (Table-1(A)).

The total resources of chalk of all categories and grades as per UNFC system as on 1.4.2010 are estimated in Gujarat at 4.92 million tonnes of which 4.33 million tonnes (88%) are under reserves category and 0.59 million tonnes are under remaining resources category (Table-1(B)).

The total resources of marl of all categories and grades as per UNFC system as on 1.4.2010 are estimated in Gujarat State at 151.68 million tonnes of which 139.98 million tonnes (92%) are under reserves category and 11.70 million tonne are under remaining resources category (Table-1(C)).

EXPLORATION & DEVELOPMENT

GSI conducted exploration for limestone in Andhra Pradesh, Karnataka, Meghalaya and Rajasthan Directorates of Mining and Geology of Governments of Karnataka, Odisha and Rajasthan also carried out exploration for limestone. Mineral Exploration Corporation Ltd (MECL) also engaged in exploration of limestone. Details of work carried out by these organisations are given in Table-2.

PRODUCTION, STOCKS AND PRICES

Limestone

The production of limestone in 2010-11 at about 237.77 million tonnes increased by 2% as compared to that of the previous year. Owing to more demand in the market, some of the principal producers of limestone reported more production during the year.

Table – 1 : Reserves/Resources of Limestone as on 1.04.2010
(By Grades/States)

(In '000 tonnes)

Grade/State	Reserves				Remaining resources								Total resources (A+B)
	Proved STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measurred STD331	Indicated STD332	Interred STD333	Reconnsaissance STD334	Total (B)	
		STD121	STD122			STD221	STD222						
All India: Total	**8978583**	**3650574**	**2297234**	**14926392**	**1827583**	**3739470**	**6309489**	**6858999**	**22040640**	**124835558**	**4396981**	**170008720**	**184935112**
By Grades													
Chemical	189441	4094	42988	236522	40413	91817	569507	17074	1823217	2301101	-	4843129	5079652
S.M.S.(O.H.)	148323	864528	2284	1015135	1990	279167	729551	469116	454149	1825195	239223	3998392	5013527
S.M.S.(L.D.)	1619	98635	155	100409	810	9928	11364	1019	49894	123965	-	196979	297388
S.M.S.(O.H. & L.D. mixed)	22842	-	-	22842	-	-	-	-	2604	167182	-	169786	192628
B.F.	432522	455504	42720	930747	97375	26225	63246	467190	966030	11137050	13313	12770428	13701174
S.M.S. & B.F. mixed	4910	211614	2956	219480	24171	25138	36038	2000	122103	780680	240733	1230862	1450342
Cement (portland)	7475616	1638178	2102094	11215887	1564469	3192817	4799174	4884690	12802454	82928360	3516270	113688234	124904122
Cement (white)	1503	-	759	2263	4742	2066	1976	117000	-	2256	-	128039	130302
Cement (portland & white)	80266	5082	1110	86458	5103	13495	13119	338670	60000	506445	39000	975833	1062291
Cement (blendable/ benificiable)	232608	55367	27316	315290	30317	37274	2672	43047	43776	438833	-	595918	911208
B.F. & cement mixed	13149	14135	26468	53753	-	26608	6119	485	-	76843	-	110056	163809
S.M.S.,chemical & paper	1059	-	273	1331	25	2169	1303	-	-	1228617	-	1232114	1233446
Paper	28343	-	448	28791	466	56	131	120678	27073	748560	-	896964	925755
Others	83074	14450	9058	106582	11264	19016	22972	162376	515695	2876988	253007	3861317	3967899
Unclassified	115052	26687	38305	180044	46132	7325	44287	190717	5094328	18780431	74468	24237689	24417733
Not-known	148255	262301	300	410857	307	6366	8030	44938	79318	913053	20967	1072980	1483836
By States													
Andhra Pradesh	2483095	581935	983048	4048078	311682	64645	460685	215847	1075504	28112011	3147926	33388299	37436377
Arunachal Pradesh	-	-	-	-	-	-	-	-	49220	433575	-	482795	482795
Assam	183788	152562	-	336350	10902	9828	4257	154644	34200	897161	-	1110992	1447342
Bihar	7822	-	795	8617	-	6123	6689	86379	38210	709522	-	846923	855540
Chhattisgarh	856930	10962	30004	897896	46468	742220	80465	1331984	480812	5379600	-	8061550	8959446
Daman & Diu	-	-	-	-	-	-	-	-	-	128670	-	128670	128670
Gujarat	542498	72263	195715	810475	60640	88866	159549	18728	858265	18014634	-	19200681	20011157

(Contd.)

Table - 1 (Concld.)

Grade/State	Reserves				Remaining resources								Total resources
	Proved	Probable		Total	Feasibility	Pre-feasibility		Measurred	Indicated	Interred	Reconnsaissance	Total	
	STD111	STD121	STD122	(A)	STD211	STD221	STD222	STD331	STD332	STD333	STD334	(B)	(A+B)
Haryana	-	-	-	-	1425	15507	3382	-	2200	52163	-	74677	74677
Himachal Pradesh	541555	226170	209638	977363	48410	44097	21220	1525202	1891	2830449	433	4471702	5449064
Jammu & Kashmir	257480	5525	54100	317106	42116	21686	165199	43621	-	1001420	203	1274246	1591352
Jharkhand	144259	4105	54713	203077	8364	7704	9672	9534	12125	372131	11803	431333	634410
Karnataka	538927	486300	72518	1097745	171995	394671	453541	1573788	13919929	34579866	8240	51102029	52199775
Kerala	12959	-	-	12959	122659	77	1576	21161	2888	35228	-	183589	196548
Madhya Pradesh	460445	1166513	24865	1651823	287634	204089	88311	514783	560472	3971168	264247	5890703	7542526
Maharashtra	589789	176015	60794	826598	464232	176987	52152	28470	159309	1114112	-	1995262	2821860
Manipur	-	-	-	-	-	-	-	19953	2138	23962	-	46053	46053
Meghalaya	138207	94459	-	232666	36898	23400	-	460107	2811179	13941438	-	17273022	17505688
Nagaland	825	-	-	825	-	-	-	-	1010000	27000	-	1037000	1037825
Odisha	280588	466627	126717	873932	3225	49045	241871	133600	44562	386952	49800	909055	1782987
Puducherry	-	-	-	-	-	-	-	4433	4333	6966	-	15732	15732
Rajasthan	1740173	91434	428111	2259717	141539	1607076	4438479	467462	720874	11110360	914330	19400121	21659838
Sikkim	-	-	-	-	-	-	-	-	-	2380	-	2380	2380
Tamil Nadu	199243	115705	55165	370112	19229	55984	42014	69951	32169	460412	-	679759	1049871
Uttar Pradesh	-	-	-	-	45130	135590	21050	142763	40000	31200	-	415733	415733
Uttarakhand	-	-	1051	1051	5035	91872	59378	29486	164879	1191059	-	1541709	1542760
West Bengal	-	-	-	-	-	-	-	7104	15482	22120	-	44706	44706

Figures rounded off.

Table – 1 (B) : Reserves/Resources of Chalk as on 1.04.2010
(By Grades/States)

(In '000 tonnes)

Grade/State	Reserves				Remaining resources								Total resources
	Proved STD111	Probable STD121	Probable STD122	Total (A)	Feasibility STD211	Pre-feasibility STD221	Pre-feasibility STD222	Measurred STD331	Indicated STD332	Interred STD333	Reconnsaissance STD334	Total (B)	(A+B)
All India : Total	**3266**	**537**	**528**	**4332**	**184**	**5**	**127**	**-**	**-**	**269**	**-**	**585**	**4917**
By Grade													
Unclassified	3266	537	528	4332	184	5	127	-	-	269	-	585	4917
By State													
Gujarat	3266	537	528	4332	184	5	127	-	-	269	-	585	4917

Figures rounded off.

Table – 1 (C) : Reserves/Resources of Marl as on 1.04.2010
(By Grades/States)

(In tonnes)

Grade/State	Reserves				Remaining resources								Total resources
	Proved STD111	Probable STD121	Probable STD122	Total (A)	Feasibility STD211	Pre-feasibility STD221	Pre-feasibility STD222	Measurred STD331	Indicated STD332	Interred STD333	Reconnsaissance STD334	Total (B)	(A+B)
All India : Total	**133236150**	**4650000**	**2090000**	**139976150**	**11704870**	**-**	**-**	**-**	**-**	**-**	**-**	**11704870**	**151681020**
By Grade													
All grades	133236150	4650000	2090000	139976150	11704870	-	-	-	-	-	-	11704870	151681020
By State													
Gujarat	133236150	4650000	2090000	139976150	11704870	-	-	-	-	-	-	11704870	151681020

Figures rounded off.

Table – 2 : Details of Exploration Activities for Limestone, 2010-11

Agency/ State/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
GSI							
Andhra Pradesh Kurnool	West of Nandikotkur	1:12,000	107.0	-	-	280	Reconnaissance stage investigation (G-4) initiated during 2009-10 was continued in Cuddapah basin for limestone. Total 20 cu m of trench ing, 260 bed rock and 20 trench samples have been collected. The analytical results of eleven samples of Narji limestone show CaO con tent more than 43% which is ideal for cement industry. Two samples showed more than 50% of CaO which can be used in chemical in dustry. Two samples showed very less CaO content (Koilakuntla lime stone). Detailed classification and resource evaluation of limestone will be carried out after the receipt of complete chemical analysis results. The work is in progress.
Karnataka Bagalkot	Jalikatti, Lokapur and adjoining areas	-	-	-	-	-	Reconnaissance (G-4) stage investigation has been taken up during FS 2010-12 as per request of DMG, Karnataka in Kaladgi ba sin around this areas (DMG blocks: A and B) of Bagalkot districtto as sess SMS grade limestone for alkali content. Preliminary assessment indicates that the dark grey lime stone belonging to Yendigere For mation tentatively conforms to the specifications of flux and SMS grade limestone. The work is under progress to categorise the limestone based on chemical analysis results. Evidence of stromatolites have been noted in Petlur limestone near Venkatapur, Nagnapur (Jalikatti) of Muddapur Formation and Chitrabanukot dolomite (Varchagal) of Yargatti Formation.

(Contd.)

Table - 2 (Contd.)

Agency/ State/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
Meghalaya							
Jaintia Hills	Umphyrluh Block	-	-	-	-	-	Prospecting stage investigation (G-3) was taken up during FS 2010-12 in the area to explore lime stone resources in the peripheral area of the Litang Valley limestone deposit. The limestone is bedded type striking NNE-SSW with hori zontal to sub-horizontal dip of about 3^0 to 5^0 towards ESE. The work is in progress.
Rajasthan							
Jaisalmer	Jiraj ka Toba-AsuTar area	-	-	-	-	02	Prospecting stage of investigation (G-3) in this area was taken up in Tertiary limestone belt, Jaisalmer basin to locate low silica SMS (LD-grade) limestone in view of increas ing demand by steel plants. The bore hole JRA-2 has intersected hardand massive foossiliferous/limestone, moderately hard limestone, gritty limestone and fragmentary iron stone in the ascending order. The hard and massive limestone is simi lar to the Khuiala limestone inter sected in the Minyun ki Dhani. De crepitating test of 2 samples were carried out. The work is in progress.
DMG							
Karnataka							
Gulbarga	Malkhed Jewargi	-	-	05	588.0	-	The limestone are generally massive in nature, grey to light grey & pale blue in colour.
Tumkur	N/V Melanahalli	-	-	07	642.0	-	Principally area composed of Dharwar Group of metamorphosed schists with isolated batholiths of Archean complexes. The general strike trend is NNW-SSE which dipped on either side at angles ranging from 50o to almost vertical. The lithological units are highly folded and disturbed. They are also intruded by basic dykes besides quartz and pegmatite veins emplacing the host rock. The limestone occurred atlternately & elongated near bands.

(Contd.)

Table - 2 (Contd.)

Agency/ State/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
Directorate of Geology Odisha							
Bargarh	Around Jharabandh in the western part of Nuapada-Putka belt.	1:50,000	125.0	-	-	20	The area formed a part of the Chhattisgarh Group of rocks represented by quartzite, shale, limestone & dolomite intruded by granite & basic dykes. The limestone and dolomite horizon associated/ interbedded with shale are exposed on the eastern bank of Ong river to NE of Saraumsili. The bedding in shale varied from N 25^0-35^0 E to S 25^0- 35^0 W dipping 20^0- 30^0 SE. The trend of foliation in quartzite is N 40^0 E - S 40^0 W dipping 50^0-70^0 SE.
Nabarangpur	Around Mokia & Jamuguda of Papadahandi	1:25,000	110.0	-	-	75	The area under investigation ormed a part of north-eastern boundry of the Indravati basin. It exposes basement granite of Archaean age overlain by Indravati Group of rocks of proterozoic age represented by quartzite, shale, laterite with intrusion of vein quartz, gabbro and dolerite. Intromatolitic limestone deposit occurred as sub-horizontally bedded underlain & overlain by purple shale near Village Burubhusi. The strike of the bed is N 40oE-S40oW, dipping 25^0 south-easterly. The dimension of the deposit was found to be 400 m x 50 m. A small occurrence of secondary grade (9 Nos.), ore floats zone (250 m x 50 m) have been noticed for the length of 2 km east of Kohiagura.
Sundergarh	Around Mundagaon, Jarangloi & Lahandabad	1:50,000	122.0	-	-	25	The area represents a part of Gangpur Group of rocks comprising conglomerate quartzite, carbonaceous phyllite/shale, limestone/dolomite, staurolite and garnet-schist. Discontinuous dolomite occurrences reported earlier was traced up to a strike length of 4 km from Tumelbad to Tilaimalti and a width of 300 m was proved by pitting. The rocks are highly folded. Besides, surfacial crenulations & warping has also been noticed. At one place manganese occurrence & two quartz veins were also encountered.

(Contd.)

Table - 2 (Contd.)

Agency/ State/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
Sundergarh	Around Orangtoli, Udarama, Kultra & Kumarmunda	1:50,000	112.0	-	-	61	The area formed a part of the northern limb of Gangpur Group of rocks comprising conglomerate, quartzite, carbonaceous phyllite, limestone/ dolomite, quartz schist and quartz-mica-schist. Discontinuous dolomite bodies were exposed to the NW of Udarama over a length of 2.5 km. Exposures to the South of Oranagtoli and north-west of Udarama area were aligned in ENE-WSE direction with 40^0 - 65^0 dip due SE. The strike varied from N60^0 E-S60^0 W to N75^0E - S 75^0 W with dip 40^0- 65^0 SE.
DMG Rajasthan							
Ajmer	Dhanar, Kabra, Rajpura, etc.	1:50,000 1:10,000 1:2,000	100.0 10.0 1.00	-	-	13	Rock types exposed in this area are quartzite, mica schist, dolomitic limestone & pegmatite. General trend of the rock formation is NE-SW. Four intermittantly exposed bands of dolomitic limestone trending NE-SW were mapped in Dhanar in north to Raipur in south in about 3 km strike length. Width of the deposit varied from 20-60 m.
Baran	N/V Ladwara-Raipura Baldara	1:50,000 1:10,000 1:2,000	115.0 12.5 1.35	-	-	18	Geologically the area comprises rock formations of Bhander Group of Vindhyan Super Group. The limestone of marginal cement grade was observed along Kali Sindh river in 2200 m x 100 m x 5-8 m N/V Ladwara-Raipura, 100 m x 100 m x 5-8 m N/V Baldara & 500 m x 200 m x 4 m, 200 m x 100 m x 1.5 m area N/V Nagda. The resources of about 3.43 million tonnes N/V Dungarpur, 2.29 million tonnes N/V Rajpura-Ladwara, 1.56 million tonnes N/V Baldara & 1.12 million tonnes N/V Nagda were estimated.

(Contd.)

Table - 2 (Contd.)

Agency/ State/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
Jaipur	N/V Ajitpura, Mandha etc.	1:10,000 1:2,000	15.0 1.0	-	-	-	Geologically the area comprises quartzite, calc-silicate, limestone, The granite, pegmatite & vein quartz belong to the Delhi Super Group.
-do-	Bithloda, Mandha, Karoi, etc.	1:10,000 1:2,000	15.0 1.0	-	-	06	The general strike of limestone was found. N 55^{0}E–S 55^{0}W with sub-vertical dip. On the basis of tube well cuttings the limestone has been found spread over the villages Yadvon-ki-Dhani (800 m x 350 m), Sanwalon-ki-Dhani (600 m x 400 m) & Gujron-ki-Dhani (350 m x 50 m). Resources were not estimated.
Jhalawar	N/V Dungarpur, Salora Khurd & Bariya	1:50,000 1:10,000 1:2,000	55.0 11.0 1.0	-	-	18	Geologically the area comprises shale & limestone. Limestone of marginal cement grade was noticed in 2250 m x 500 – 1300 m x 1-2 m near Village Dungarpur and in 1750 m x 200 – 500 m x 1-2 m near Village Sarola Khurd & Bariya. A total of 9.88 million tonnes of resources of marginal cement grade limestone were estimated, out of which about 7.39 million tonnes were estimated N/V Dungarpur & 2.29 million tonnes N/V Sarola & Khurd & Bariya.
Nagaur	N/V Madpura	1:10,000 1:2,000	20.0 1.50	13	351.0	174	The area under investigation comprises carbonate lithofacies of Bilara Group. Siliciclastic lithofacies of Jodhpur Group, both belong to Marwar Super Group of Cambrian age. The main rock types of the investigated area are limestone (Chemical grade), dolomitic limestone. The limestone showed horizontal dips. High grade limestone bands N/V Shivpura (Madpura) were located in 8.96 sq km area besides high grade limestone were also located in 2.0 sq km area. Limestone resources were estimated at 26 million tonnes.

(Contd.)

Table - 2 (Concld.)

Agency/ State/ District	Location Area/ Block	Mapping Scale	Mapping Area (sq km)	Drilling No. of boreholes	Drilling Meterage	Sampling (No.)	Remarks Reserves/Resources estimated
Nagaur	N/VHarima & Pitasar	1:10,000 1:2,000	25.0 2.50	38	1193.0	796	The area mainly comprises of lithofacies of Gotan formation of Bilara Group of Marwar Super Group of Cambrian age. The main rock types of the investigated area are dolomitic limestone, high grade limestone. These limestone deposits are bedded in nature & showed horizontal disposition. The potential area which contained cement grade & chemical grade limestone were also found N/V Harima & Pitasar. About 129.60 million tonnes limestone resources were estimated.
Rajsamand	N/V Lassaria Dand & Biliyawas	1:10,000 1:2,000	20.0 2.0	03	137.0	104	In this area paralledl bands of crystalline limestone are exposed from village Dand in the SW to village Billyawas in the N-E for about 7 km width. Strike continuity width of limestone bands varied from 30-200 m. These bands are separated by calc-gneiss and siliceous biotite limestone. The limestone is fine grained, crystalline, buff, light grey and seems to be of cement grade. Resources were not estimated as a result of chemical analysis are awaited.
Sikar	N/V Kairpura, Kotari, Luharwas, etc.	1:10,000 1:2,000	20.0 1.0	-	-	-	The area is comprised of quartzite, limestone, calc-silicate, mica schist, amphibole gneisses, phyllite, etc. intruded by albetite, pegmatite, quartz, etc. The area was covered by several bands of impure limestone. Extension of these bands varied from 150-160 m in length and 15-60 m in width.
MECL **Meghalaya**							
Jaintia Hills	Jaintia Hills	1:5,000	0.50	8	1148.50	488	Boreholes have intersected high grade limestone bands with thickness 30-160 m with grade CaO 51.26%. MgO 1.82%, SiO_2 1.96%.

There were 553 reporting mines in 2010-11 as against 565 during the previous year. Eighteen mines, each producing more than 3 million tonnes per annum contributed about 36% of the total production of limestone in 2010-11. The share of 15 mines, each in the production range of 2 to 3 million tonnes was 15% of the total production. About 26% of the total production was contributed by 44 mines, each producing 1 to 2 million tonnes annually. The remaining 23% production was reported by 476 mines during the year. Twenty three principal producers contributed about 78% of the total production. About 6% of the production was reported by public sector mines same as in the previous year.

About 95% of the total production of limestone during 2010-11 was of cement grade, 3% of iron & steel grade and the rest 2% consisted of chemical and other grades.

Andhra Pradesh was the leading producing state accounting for 22% of the total production of limestone, followed by Rajasthan (18%), Madhya Pradesh (13%), Gujarat (9%), Tamil Nadu, Chhatishgarh and Karnataka (8% each), Himachal Pradesh (5%), Maharashtra (4%) and the remaining 5% was contributed by Odisha, Uttar Pradesh, Jharkhand, Meghalaya, Bihar, Kerala, Assam and Jammu & Kashmir (Table - 3 to 6).

Mine-head stocks of limestone at the end of the year 2010-11 were 12.9 million tonnes as against 12.4 million tonnes at the beginning of the year (Table-7).

Average daily labour employment in limestone mines in 2010-11 was 18,935 as against 20,989 in the previous year. Prices of limestone are furnished in the General Review on 'Prices'.

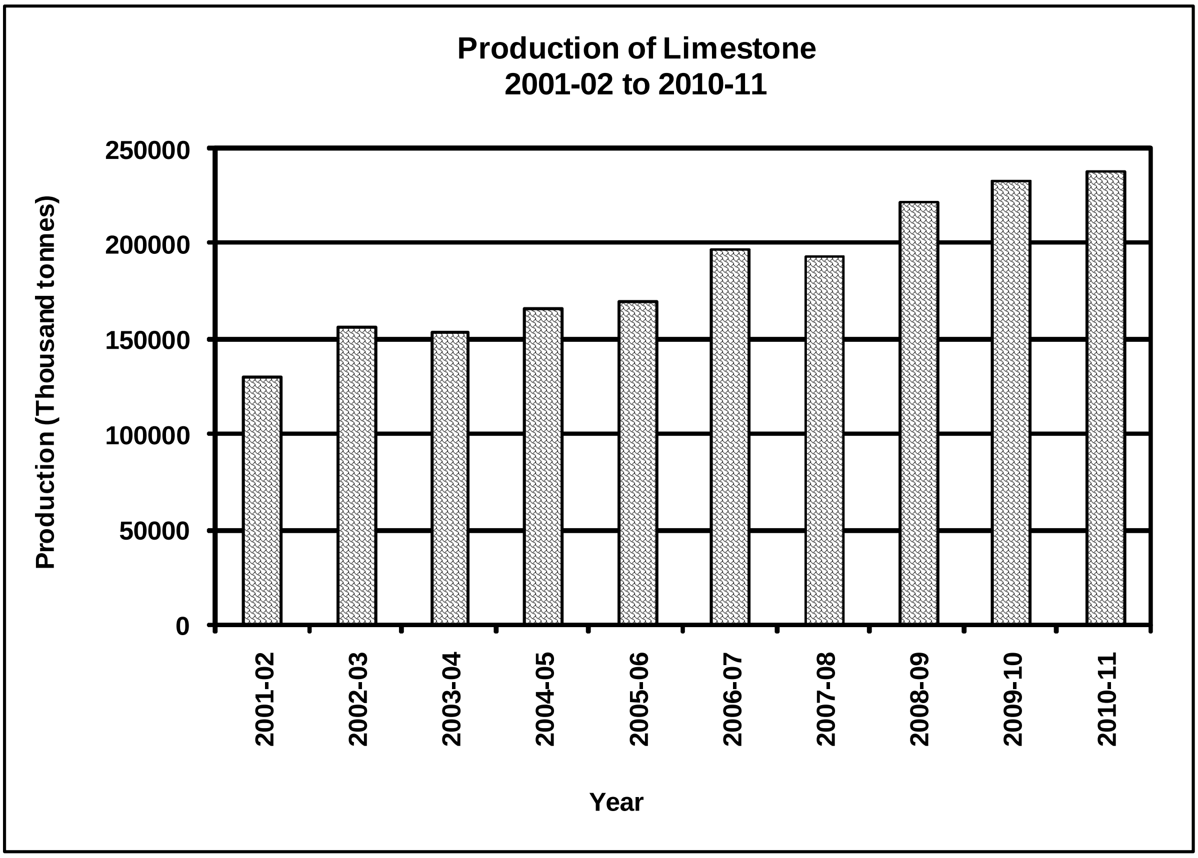


Table – 3 : Principal Producers of Limestone 2010-11

Name and address of producer	Location of mine	
	State	District
Ultra Tech Cement Ltd., 'B' Wing,Ahura Centre 2nd Floor, Mahakali Caves Road, Andheri (E), Mumbai-400 093, Maharashtra.	Andhra Pradesh Chhattisgarh Gujarat Karnataka Madhya Pradesh Maharashtra Rajasthan Tamil Nadu	Kurnool Raipur Amreli Gulbarga Neemuch Chandrapur Chittorgarh Jaipur Nagaur Ariyalur Perambalur
Ambuja Cement Ltd, P.O. Ambujanagar, Tq.: Kodinar, Junagadh-362 715, Gujarat.	Chhattisgarh Gujarat Himachal Pradesh Maharashtra Rajasthan	Raipur Junagadh Solan Chandrapur Pali
The ACC Ltd, Cement House, 121, Maharshi Karve Road, Mumbai - 400 020, Maharashtra.	Andhra Pradesh Chhattisgarh Himachal Pradesh Jharkhand Karnataka Madhya Pradesh Maharashtra Rajasthan Tamil Nadu	Adilabad Durg Bilaspur Singhbhum (West) Gulbarga Katni Yavatmal Bundi Coimbatore
Jaiprakash Associates Ltd, Sector - 128, Noida - 201 304, Uttar Pradesh.	Gujarat Madhya Pradesh Uttar Pradesh	Kachchh Rewa Sidhi Sonbhadra
Shree Cement Ltd, Bangur Nagar, Post Box No.33, Beawar - 305 901, Rajasthan.	Rajasthan	Ajmer Pali
The India Cement Ltd, DhunBuilding 4th Floor, 827, Anna Salai, Chennai - 600002, Tamil Nadu	Andhra Pradesh Tamil Nadu	Cuddapah Nalgonda Rangareddi Ariyalur Perambalur Tirunelveli Thoothukudi Virudhunagar
Kesoram Industries Ltd, 9/1, R.N. Mukherjee Road Kolkata - 700 001.	Andhra Pradesh Karnataka	Karimnagar Gulbarga

(Contd.)

Table - 3 (Contd.)

Name and address of producer	Location of mine	
	State	District
Binani Cement Ltd, 706, Om Tower, 32, Chowringhee Road, Kolkata - 700 071, West Bengal.	Rajasthan	Sirohi
Madras cement Ltd, Ramamandiram P.O.Rajapalayam - 626117, Virudhunagar, Tamil Nadu.	Andhra Pradesh Karnataka Tamil Nadu	Krishna Chitradurga Ariyalur Perambalur Thoothukudi Virudhunagar
Lafarge India Private Ltd, Bakhtawar 14th Floor, 229, Nariman Point, Mumbai-400 021.	Chhattisgarh	Jangir-Champa Raipur
Dalmia Cement Ltd, P O: Dalmiapuram Thiruchirapalli-621 651,	Andhra Pradesh Tamil Nadu	Cuddapah Ariyalar Perambalur Thiruchirapalli
J. K. Cement Works Kamla Tower, Kanpur-208 001, Uttar Pradesh.	Rajasthan Karnataka	Chittorgarh Nagaur Bagalkot
Birla Corporation Ltd, Birla Building, 9/1, R.N.Mukherjee Road, Kolkata - 700 001, West Bengal.	Madhya Pradesh Rajasthan	Satna Chittorgarh
J. K. Lakshmi Cement Ltd, P.O.:Jaykaypuram, Sirohi, Rajasthan.	Rajasthan	Sirohi
Century Textiles & Industries Ltd, Century Bhawan, Dr. Annie Besant Road, Mumbai- 400 025, Maharashtra.	Chhattisgarh Madhya Pradesh Maharashtra	Raipur Satna Chandrapur
Chettinad Cement Corp. Ltd, 4th Floor, Rani Seethai, Hall Building, 603, Anna Salai, Chennai - 600 006 Tamil Nadu.	Tamil Nadu	Ariyalar Dindigul Karur Perambalur
Zuari Cement Ltd, Krishna Nagar, Yerraguntla, Kadapa-516 311 Andhra Pradesh.	Andhra Pradesh	Cuddapah Nalgonda

(Contd.)

Table - 3 (Contd.)

Name and address of producer	Location of mine	
	State	District
Prism Cement Ltd, 305, LaxmiNiwas Apartments, Ameerpeth, Hyderabad-500 016 Andhra Pradesh.	Andhra Pradesh Madhya Pradesh	Kurnool Satna
A.P. Mineral Dev. Corp. Ltd, Rear Block, 3rd Floor, HMWSSB Premises, Khairatabad, Hyderabad - 500 004.	Andhra Pradesh	Adilabad
My Home Industries Ltd, 9th Floor, Block-3, My Home Hub, Madhapur, Hyderabad-500081 Andhra Pradesh.	Andhra Pradesh	Nalgonda

(Contd.)

Table - 3 (Concld.)

Name and address of producer	Location of mine	
	State	District
Penna Cement Industries Ltd, Plot No:-705, Road No:-03, Banjara Hills, Hyderabad.-500 034 Andhra Pradesh.	Andhra Pradesh	Anantpur
Steel Authority of India Ltd. 10- Camac Street, Industry House, Kolkata – 700 017.	Chhattisgarh Jharkhand Madhya Pradesh	Durg Garhwa Katni Satna
Sagar Cements Ltd, 8-2-472/B/2, Road No. 1, Banjara Hills, Hyderabad – 500 034, Andhra Pradesh.	Andhra Pradesh	Nalgonda

Table – 4 : Production of Limestone, 2008-09 to 2010 -11(P)
(By States)

(Qty in '000 tonnes; Value in ₹ '000)

State	2008-09		2009-10		2010-11 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**221573**	**29219744**	**232950**	**32477596**	**237774**	**32254917**
Andhra Pradesh	51818	6386659	49560	6419110	51750	6526323
Assam	365	85384	396	93537	349	82991
Bihar	533	156594	567	203330	873	277837
Chhattisgarh	15789	2208173	15160	2231873	19096	2890099
Gujarat	21952	2274585	23322	2864989	22152	2594745
Himachal Pradesh	8158	773324	8411	824371	11467	1171695
Jammu & Kashmir	165	23727	278	59777	154	26991
Jharkhand	1943	351690	1924	384303	1737	271079
Karnataka	15774	1482328	17959	1718707	18548	1865056
Kerala	535	165864	533	169645	529	128354
Madhya Pradesh	30565	4249682	28967	3795849	30547	3909142
Maharashtra	10484	1202790	9433	1069248	8919	1053748
Meghalaya	2929	597892	3249	757175	1460	289112
Odisha	2978	831117	2937	843098	3736	1094803
Rajasthan	38918	5513166	47180	6971469	43505	6163400
Tamil Nadu	18190	2866664	20619	3717570	20087	3530359
Uttar Pradesh	477	50105	2455	353545	2865	379183

Table – 5 : Production of Limestone, 2009-10 and 2010-11(P)
(By Frequency Groups)

Production group (In tonnes)	No. of mines		Production for the group ('000 tonnes)		Percentage in total production		Cumulative percentage	
	2009-10	2010-11	2009-10	2010-11	2009-10	2010-11	2009-10	2010-11
AllGroups	**565(1)**	**553**	**232950**	**237774**	**100.00**	**100.00**	-	-
Up to 10000	212(1)	216	532	495	0.23	0.21	0.23	0.21
10001 - 50000	116	104	2795	2596	1.20	1.09	1.43	1.30
50001 - 100000	39	38	2711	2615	1.16	1.10	2.59	2.40
100001 - 200000	39	36	5587	5096	2.40	2.14	4.99	4.54
200001 - 300000	16	20	3635	5035	1.56	2.12	6.55	6.66
300001 - 400000	15	12	5249	4230	2.25	1.78	8.80	8.44
400001 - 500000	13	7	6006	3135	2.58	1.32	11.38	9.76
500001 - 600000	11	11	6157	6051	2.64	2.54	14.02	12.30
600001 - 700000	7	6	4723	3866	2.03	1.63	16.05	13.93
700001 - 800000	5	13	3832	9751	1.64	4.10	17.69	18.03
800001 - 900000	11	5	9394	4051	4.03	1.70	21.72	19.73
900001 - 1000000	9	8	8570	7643	3.68	3.22	25.40	22.95
1000001 - 2000000	43	44	63100	60813	27.10	25.58	52.50	48.53
2000001 - 3000000	14	15	34078	36813	14.63	15.48	67.13	64.01
3000001 & above	15	18	76581	85584	32.87	35.99	100.00	100.00

Figures in parentheses indicate associate mine of limestone with dolomite.

Table – 7 : Mine-headStocks of Limestone, 2010-11
(ByStates/Grades)

(In '000 tonnes)

State	At the beginning of the year					At the end of the year (p)				
	Grades					Grades				
	Cement	Iron & Steel	Chem.	Others	Total	Cement Steel	Iron	Chem.	Others	Total
India	**10943**	**1127**	**244**	**58**	**12372**	**8969**	**729**	**3209**	**32**	**12939**
AndhraPradesh	1346	97	-	-	1443	1371	48	14	-	1433
Assam	75	-	-	-	75	98	-	-	-	98
Bihar	22	-	-	-	22	-	-	-	-	--
Chhattisgarh	74	83	++	10	167	148	44	-	2	194
Gujarat	3423	-	75	-	3498	882	-	3012	-	3894
HimachalPradesh	50	187	-	-	237	19	76	-	-	95
Jammu&Kashmir	28	-	-	-	28	2	-	-	-	2
Jharkhand	32	207	-	2	241	177	-	-	23	200
Karnataka	2331	-	-	-	2331	3273	22	-	-	3295
Kerala	32	-	-	-	32	56	-	-	-	56
MadhyaPradesh	795	10	-	-	805	852	10	-	-	862
Maharashtra	29	-	-	-	29	336	59	-	-	395
Meghalaya	40	-	-	-	40	1	-	1	-	2
Odisha	87	543	-		630	157	466	-	3	626
Rajasthan	1439		-	46	1485	1027	4	-	-	1031
Tamil Nadu	1140	-	169	-	1309	570	-	182	4	756

Table – 6 : Production of Limestone, 2009-10 & 2010 -11
(By Sectors/States/Districs/Grades)

(Qty in '000 tonnes; Value in ₹ '000)

State/District	2009-10							2010-11(P)						
	Grades					Total		Grades					Total	
	No.of mines	Cement	Iron & Steel	Chem.	Others	Qty	Value	No. of mines	Cement	Iron & Steel	Chem.	Others	Qty	Value
India	**565(1)**	**220365**	**8551**	**3881**	**153**	**232950**	**32477596**	**553**	**224900**	**8281**	**3930**	**663**	**237774**	**32254917**
Public sector	37	10008	3654	-	89	13751	3051478	33	11198	3435	-	503	15136	3177985
Private sector	528(1)	210357	4897	3881	64	219199	29426118	520	213702	4846	3930	160	222638	29076932
Andhra Pradesh	**84**	**49142**	**418**	**-**	**-**	**49560**	**6419110**	**79**	**51349**	**364**	**37**	**-**	**51750**	**6526323**
Adilabad	2	3536	-	-	-	3536	413157	3	3731	-	-	-	3731	446293
Anantapur	6	1682	-	-	-	1682	303516	4	1762	-	-	-	1762	262258
Cuddapah	6	6803	-	-	-	6803	815573	6	8799	-	-	-	8799	974650
Guntur	5	3355	-	-	-	3355	415199	6	2322	-	-	-	2322	306769
Karimnagar	1	1565	-	-	-	1565	438200	1	1293	-	-	-	1293	428578
Krishna	7	3358	418	-	-	3776	657033	7	2949	364	-	-	3313	601186
Kurnool	29	9311	-	-	-	9311	1241202	23	9651	-	37	-	9688	1130270
Nalgonda	25	16159	-	-	-	16159	1742425	25	17052	-	-	-	17052	1949149
Ranga Reddy	3	3373	-	-	-	3373	392805	4	3790	-	-	-	3790	427170
Assam	**4**	**396**	**-**	**-**	**-**	**396**	**93537**	**4**	**349**	**-**	**-**	**-**	**349**	**82991**
Karbi Anglong	1	193	-	-	-	193	53507	1	237	-	-	-	237	61763
North Cachar Hills	3	203	-	-	-	203	40030	3	112	-	-	-	112	21228
Bihar	**2**	**567**	**-**	**-**	**-**	**567**	**203330**	**5**	**873**	**-**	**-**	**-**	**873**	**277837**
Rohtas	2	567	-	-	-	567	203330	5	873	-	-	-	873	277837
Chhattisgarh	**33(1)**	**15005**	**122**	**-**	**33**	**15160**	**2231873**	**38**	**18887**	**179**	**-**	**30**	**19096**	**2890099**
Bastar	4	15	-	-	7	22	3680	6	5	-	-	19	24	4099
Bilaspur	(1)	2	-	-	-	2	210	-	-	-	-	-	-	-
Durg	17	852	122	-	26	1000	256202	20	1004	179	-	11	1194	325811
Janjgir-Champa	2	2296	-	-	-	2296	320218	3	2140	-	-	-	2140	329559
Raigarh	2	5	-	-	-	5	852	2	9	-	-	-	9	1153
Raipur	7	11835	-	-	++	11835	1650703	6	15729	-	-	-	15729	2229469
Rajnandgaon	1	++	-	-	-	-	8	1	++	-	-	-	++	8

(Contd.)

Table - 6 (Contd.)

State/District	2009-10							2010-11(P)						
	Grades					Total		Grades					Total	
	No.of mines	Cement	Iron & Steel	Chem.	Others	Qty	Value	No. of mines	Cement	Iron & Steel	Chem.	Others	Qty	Value
Gujarat	**112**	**19464**	**-**	**3858**	**-**	**23322**	**2864989**	**109**	**18421**	**-**	**3731**	**-**	**22152**	**2594745**
Amreli	2	6921	-	++	-	6921	867977	2	6240	-	-	-	6240	762127
Jamnagar	18	1375	-	653	-	2028	191991	18	1172	-	767	-	1939	193022
Junagadh	50	6610	-	2074	-	8684	1067779	52	5476	-	1887	-	7363	916450
Kachchh	3	3282	-	++	-	3282	301552	3	4370	-	++	-	4370	365005
Porbandar	39	1276	-	1131	-	2407	435690	34	1163	-	1077	-	2240	358141
Himachal Pradesh	**24**	**7882**	**529**	**-**	**-**	**8411**	**824371**	**23**	**11024**	**443**	**-**	**-**	**11467**	**1171695**
Bilaspur	1	3850	-	-	-	3850	396571	1	3888	-	-	-	3888	377928
Sirmour	21	398	529	-	-	927	172974	20	353	443	-	-	796	147443
Solan	2	3634	-	-	-	3634	254826	2	6783	-	-	-	6783	646324
Jammu & Kashmir	**2**	**278**	**-**	**-**	**-**	**278**	**59777**	**1**	**154**	**-**	**-**	**-**	**154**	**26991**
Pulwama	2	278	-	-	-	278	59777	1	154	-	-	-	154	26991
Jharkhand	**18**	**93**	**1801**	**-**	**30**	**1924**	**384303**	**15**	**200**	**1506**	**-**	**31**	**1737**	**271079**
Bokaro	1	-	-	-	1	1	263	1	1	-	-	-	1	252
Garwah	3	-	124	-	-	124	58695	3	120	-	-	-	120	26935
Hazaribagh	5	40	9	-	-	49	11841	3	30	-	-	-	30	5222
Palamau	1	-	38	-	-	38	11289	1	22	-	-	-	22	6233
Ranchi	1	-	-	-	-	-	-	1	-	-	-	4	4	902
Singhbhum (West)	7	53	1630	-	29	1712	302215	6	27	1506	-	27	1560	231535
Karnataka	**56**	**17911**	**48**	**-**	**-**	**17959**	**1718707**	**63**	**18494**	**54**	**-**	**-**	**18548**	**1865056**
Bagalkot	43	1352	-	-	-	1352	162075	50	2649	-	-	-	2649	327462
Belgaum	3	44	-	-	-	44	9764	4	26	-	-	-	26	4921
Chitradurga	2	248	-	-	-	248	31764	2	183	-	-	-	183	18539
Gulbarga	4	16069	-	-	-	16069	1447266	4	15428	-	-	-	15428	1443184
Shimoga	1	-	48	-	-	48	10873	1	-	54	-	-	54	13354
Tumkur	3	198	-	-	-	198	56965	2	208	-	-	-	208	57596

(Contd.)

Table - 6 (Contd.)

State/District	2009-10							2010-11(P)						
	Grades					Total		Grades					Total	
	No.of mines	Cement	Iron & Steel	Chem.	Others	Qty	Value	No. of mines	Cement	Iron & Steel	Chem.	Others	Qty	Value
Kerala	**1**	**533**	-	-	-	**533**	**169645**	**1**	**529**	-	-	-	**529**	**128354**
Palakkad	1	533	-	-	-	533	169645	1	529	-	-	-	529	128354
Madhya Pradesh	**72**	**27986**	**981**	-	-	**28967**	**3795849**	**72**	**29727**	**820**	-	-	**30547**	**3909142**
Damoh	3	1648	-	-	-	1648	192151	2	1454	-	-	-	1454	194946
Jabalpur	1	-	-	-	-	-	-	2	-	-	-	-	-	-
Katni	20	1511	959	-	-	2470	552357	22	4030	815	-	-	4845	896267
Neemuch	2	4980	-	-	-	4980	408311	2	4676	-	-	-	4676	424019
Rewa	8	7000	-	-	-	7000	715671	8	6472	-	-	-	6472	792524
Satna	37	11920	22	-	-	11942	1804105	35	11882	5	-	-	11887	1417022
Sidhi	1	927	-	-	-	927	123254	1	1213	-	-	-	1213	184364
Maharashtra	**26**	**6956**	**2477**	-	-	**9433**	**1069248**	**21**	**6106**	**2813**	-	-	**8919**	**1053748**
Chandrapur	7	5956	2469	-	-	8425	945738	8	5282	2813	-	-	8095	915096
Yavatmal	19	1000	8	-	-	1008	123510	13	824	-	-	-	824	138652
Meghalaya	**8**	**3249**	-	-	-	**3249**	**757175**	**8**	**1320**	-	**140**	-	**1460**	**289112**
Jaintia Hills	5	1306	-	-	-	1306	221286	6	1248	-	-	-	1248	221340
Khasi Hills East	3	1943	-	-	-	1943	535889	2	72	-	140	-	212	67772
Odisha	**16**	**2728**	**209**	-	-	**2937**	**843098**	**9**	**3667**	**69**	-	-	**3736**	**1094803**
Bargarh	1	686	-	-	-	686	256709	1	1079	-	-	-	1079	385577
Korapat	3	255	-	-	-	255	23630	1	170	-	-	-	170	19038
Sundergarh	12	1787	209	-	-	1996	562759	7	2418	69	-	-	2487	690188

(Contd.)

Table - 6 (Concld.)

State/District	2009-10							2010-11(P)						
	Grades					Total		Grades					Total	
	No.of mines	Cement	Iron & Steel	Chem.	Others	Qty	Value	No. of mines	Cement	Iron & Steel	Chem.	Others	Qty	Value
Rajasthan	**23**	**45287**	**1803**	**-**	**90**	**47180**	**6971469**	**23**	**41061**	**1970**	**-**	**474**	**43505**	**6163400**
Ajmer	1	1744	-	-	-	1744	228483	1	1139	-	-	-	1139	158427
Banswara	-	-	-	-	-	-	-	1	429	-	-	-	429	52232
Bundi	1	790	-	-	-	790	126414	1	803	-	-	-	803	138956
Chittorgarh	6	12759	-	-	-	12759	1615678	6	9794	-	-	-	9794	1047783
Jaipur	1	2503	-	-	-	2503	287794	1	3100	-	-	-	3100	322086
Jaisalmer	2	186	1803	-	90	2079	678850	2	-	1970	-	474	2444	679720
Kota	1	2009	-	-	-	2009	313366	1	1139	-	-	-	1139	187670
Nagaur	4	597	-	-	-	597	132190	4	717	-	-	-	717	146886
Pali	2	13084	-	-	-	13084	1773648	2	12163	-	-	-	12163	1622841
Rajsamand	1	10	-	-	-	10	972	1	10	-	-	-	10	1314
Sikar	1	++	-	-	-	++	17	-	-	-	-	-	-	-
Sirohi	3	11605	-	-	-	11605	1814057	3	11767	-	-	-	11767	1805485
Tamil Nadu	**83**	**20433**	**163**	**23**	**-**	**20619**	**3717570**	**81**	**19874**	**63**	**22**	**128**	**20087**	**3530359**
Ariyalur	18	11087	-	-	-	11087	1934141	18	10361	-	-	26	10387	1690382
Coimbatore	2	1045	-	-	-	1045	193188	2	1068	-	-	-	1068	231708
Dharmpuri	1	++	-	-	-	++	111	-	-	-	-	-	-	-
Dindigul	6	2801	-	-	-	2801	562806	6	2908	-	-	-	2908	609659
Karur	2	35	-	-	-	35	6855	1	1	-	-	-	1	102
Madurai	1	2	-	-	-	2	469	1	5	-	-	-	5	1284
Namakkal	6	23	-	-	-	23	7550	5	9	-	-	-	9	1771
Perambalur	7	1485	-	-	-	1485	201453	7	1412	-	-	-	1412	201417
Salem	11	460	-	-	-	460	171583	11	15	-	-	-	15	2458
Tiruchirapalli	3	1041	-	-	-	1041	104347	2	1550	-	-	-	1550	167426
Tirunelveli	16	1460	163	23	-	1646	330748	17	1128	63	22	102	1315	333821
Thoothukudi/Tuticorin	5	647	-	-	-	647	119208	6	924	-	-	-	924	172082
Virudhunagar	5	347	-	-	-	347	85111	5	493	-	-	-	493	118249
Uttar Pradesh	**1**	**2455**	**-**	**-**	**-**	**2455**	**353545**	**1**	**2865**	**-**	**-**	**-**	**2865**	**379183**
Sonbhadra	1	2455	-	-	-	2455	353545	1	2865	-	-	-	2865	379183

Figures in parentheses indicate associate mine of limestone with dolomite.

Limeshell

The production of limeshell at 29,843 tonnes during 2010-11 decreased by 52% as compared to the preceding year due to low productivity and less demand in the market.

There were 5 reporting mines in 2010-11 as against 6 in the previous year. Three principal producers accounted for 96% of the total production during the year. The share of public sector in 2010-11 was 46% and the remaining 54% was from private sector.

Kerala was the leading producer of limeshell contributing about 62% of the total production followed by Karnataka (38%) (Table - 8 to 10).

Mine-head stocks of limeshell at the end of 2010-11 was 6,901 tonnes as against 950 tonnes at the beginning of the year (Table - 11).

The average daily employment of labour during the year 2010-11 was 329 as against 369 in the previous year.

Table – 8 : Principal Producers of Limeshell 2010-11

Name and address of producer	Location of mines	
	State	District
The Travancore Cement Ltd, Nattakom, Dist. Kottayam, Kerala-608 013.	Kerala	Kottayam
Late P. S. Gaonkar, C/o:Praksh P. Gaonkar, Matakeri, Aryadurga temple Road, Ankola, Uttar Kannada, Karnataka.	Karnataka	Uttar Kannada
The Vaikom Limeshell Co-op. Society Ltd, No. 3145, Pallippurathussery, Vaikom Dist.Kottayam, Kerala-686 606.	Kerala	Kottayam

Table – 9 : Production of Limeshell, 2008-09 to 2010-11 (By States)

(Qty in tonnes; value in ₹'000)

State	2008-09		2009-10		2010-11 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**97856**	**73256**	**62215**	**50917**	**29843**	**28075**
Andhra Pradesh	1355	437	-	-	-	-
Karnataka	56422	30985	39880	25406	11375	6636
Kerala	40079	41834	22335	25511	18468	21439

Table – 10 : Production of Limeshell, 2009-10 and 2010-11 (By Sectors/States/Districts)

(Qty in tonnes; value in ₹ '000)

State/District	2009-10			2010-11(P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India	**6**	**62215**	**50917**	**5**	**29843**	**28075**
Public sector	1	16885	16327	1	13795	13119
Private sector	5	45330	34590	4	16048	14956
Karnataka	**4**	**39880**	**25406**	**3**	**11375**	**6636**
Udupi	1	1676	719	1	998	482
Uttara Kannada	3	38204	24687	2	10377	6154
Kerala	**2**	**22335**	**25511**	**2**	**18468**	**21439**
Kottayam	2	22335	25511	2	18468	21439

Table – 11 : Mine-head Stocks of Limeshell, 2010-11 (P)
(By States)

(In tonnes)

State	At the beginning of the year	At the end of the year
India	**950**	**6901**
Kerala	-	-
Karnataka	950	6901

Limekankar

The production of limekankar at 383,816 tonnes in 2010-11 increased by 15% during the year as compared to that in the previous year owing to more demand.

There were two reporting mines in 2010-11. Almost the entire production of limekankar was reported from Tamil Nadu and a nominal production was reported by one mine located in Andhra Pradesh (Table-12 to 14).

Mine-head stocks at the end of 2010-11 were 133,458 tonnes as against 128,163 tonnes at the beginning of the year (Table-15).

The average daily labour employment in 2010-11 was 15 as against 29 in the preceding year.

Table – 12 : Producers of Limekankar 2010-11

Name and address of producer	Location of mines	
	State	District
Madras Cements Ltd, Ramamandiram, Rajapalayam, Dist. Virudhunagar, Tamil Nadu-626 117.	Tamil Nadu	Virudhunagar
D. Kailas Sharma, DFN Area, Shreeram Nagar, Dist. Vizianagaram, Andhra Pradesh-535 101.	Andhra Pradesh	Vizianagaram

Table - 13 : Production of Limekankar, 2008-09 to 2010-11
(By States)

(Qty in tonnes; value in ₹ '000)

State	2008-09		2009-10		2010-11 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**434332**	**76167**	**335067**	**58754**	**383816**	**51124**
Andhra Pradesh	1598	439	780	254	615	196
Tamil Nadu	432734	75728	334287	58500	383201	50928

Table – 14 : Production of Limekankar, 2009-10 and 2010-11
(By Sectors/States/Districts)

(Qty in tonnes; value in ₹ ’000)

State/District	2009-10			2010-11(P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India	**3**	**335067**	**58754**	**2**	**383816**	**51124**
Private sector	3	335067	58754	2	383816	51124
Andhra Pradesh	**2**	**780**	**254**	**1**	**615**	**196**
Vizianagaram	2	780	254	1	615	196
Tamil Nadu	**1**	**334287**	**58500**	**1**	**383201**	**50928**
Virudhunagar	1	334287	58500	1	383201	50928

Table – 15 : Mine-head Stocks of Limekankar 2010-11 (P) (By States)

(In tonnes)

State	At the beginning of the year	At the end of the year
India	**128163**	**133458**
Andhra Pradesh	29	44
Tamil Nadu	128134	133414

Chalk

The production of chalk at 175 thousand tonnes in 2010-11 decreased by 6% as compared to previous year.

There were 128 reporting mines of chalk in both the years 2009-10 and 2010-11. In both the years the entire production of chalk was reported by private sector mines located in Gujarat. The contribution of 15 principal producers in total production during 2010-11 was 34% (Table- 16 to 18).

Mine-head stocks of chalk at the end of 2010-11 was 79 thousand tonnes as against 75 thousand tonnes at the beginning of the year (Table 19).

The average daily employment of labour during 2010-11 was 1,297 as against 1,294 in the previous year. Prices of chalk are furnished in the General Review on 'Prices'.

Table – 16 : Principal Producers of Chalk 2010-11

Name & address of producer	Location of mine	
	State	District
Porbandar Industrial Products Harish Mansion, Box.27, Porbandar-360 575 Gujarat.	Gujarat	Porbandar
Dolar Rai Mulji Bhai Thanki C/o Naresh I. Thanki, Near Income Tax Office, Bhojeshwar Plot, Dist. Porbandar Gujarat.	Gujarat	Porbandar
Rambhai Kanabhai Sagar At - Aditpara Adityana- 360 545 Dist. Porbandar Gujarat.	Gujarat	Porbandar

(Contd.)

Table - 3 (Concld.)

Name & address of producer	Location of mine	
	State	District
P. Dattani & Co. M. G. Road, Porbandar-360 575 Gujarat.	Gujarat	Porbandar
Krishna Minerals Adityana - 360 545 Dist. Porbandar, Gujarat.	Gujarat	Porbandar
Shrinathji Minerals & Chemcal Industries Adityana - 360 545 Taluka- Ranavav Dist. Porbandar, Gujarat.	Gujarat	Porbandar
Shrinathji Minerals Adityana - 360 545 Taluka- Ranavav Dist. Porbandar, Gujarat.	Gujarat	Porbandar
Dawoodi Pulverizing Works 226, G.I.D.C. Estate, Porbandar – 360 577 Gujarat.	Gujarat	Rajkot
Iqbal Haji Younoos Supediwala Plot, Dhoraji Dist. Rajkot, Gujarat.	Gujarat	Rajkot
Global Minechem Industries Udhalavadar (Dhank) Upleta – 360 490, Dist. Rajkot, Gujarat.	Gujarat	Rajkot
Patel Ramji VirjiA dityana - 360 545, Dist. Porbandar, Gujarat.	Gujarat	Porbandar
Universal Mineral Industries Barvan Ness, Taluka: Ranavav, Post: Ranavav –360 560, Dist. Porbandar, Gujarat.	Gujarat	Porbandar
Khyati Minerals Adityana- 360 545, Dist. Porbandar, Gujarat.	Gujarat	Porbandar
Patel Jivabhai Kalabhai & Thakarshi Kalabhai & Co. Adityana- 360 545, Dist. Porbandar, Gujarat.	Gujarat	Porbandar

Table – 17 : Production of Chalk, 2008-09 to 2010-11
(By State)

(Qty in tonnes; value in ₹ '000)

State	2008-09		2009-10		2010-11 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**203085**	**77251**	**185218**	**71087**	**174914**	**65220**
Gujarat	203085	77251	185218	71087	174914	65220

Table – 18 : Production of Chalk, 2009-10 & 2010-11
(By Sector/State/Districts)

(Qty in tonnes; value in ₹ '000)

State/District	2009-10			2010-11(P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India	**128**	**185218**	**71087**	**128**	**174914**	**65220**
Private sector	128	185218	71087	128	174914	65220
Gujarat	**128**	**185218**	**71087**	**128**	**174914**	**65220**
Jamnagar	9	10185	3803	9	12955	4968
Junagadh	3	4704	1702	3	6673	2216
Porbandar	94	144867	56916	94	129263	49587
Rajkot	22	25462	8666	22	26023	8449

Table – 19 : Mine-head Stocks of Chalk, 2010-11(P)
(By State)

(In tonnes)

State	At the beginning of the year	At the end of the year
India	**74929**	**78697**
Gujarat	74929	78697

Marl

Production of marl during 2010-11 was 4.37 million tonnes as compared to 5.91 million tonnes in the preceding year. The entire production of marl was reported as associated mineral with limestone in both the years by 11 mines. The entire production was fromprivate sector mines.

Gujarat contributed 86% production and the remaining 14% was from by Tamil Nadu (Table - 20 to 22).

Mine-head stock at the end of 2010-11 was 410 thousand tonnes as against 570 thousand tonnes at the beginning of the year (Table - 23).

Table – 20 : Principal Producers of Marl, 2010-11

Name and address of producer	Location of mine	
	State	District
*Ultratech Cement Ltd, Second Floor,B-Wing, Ahura Center, Mahakali Caves, Andheri (E), Mumbai–400 093.	Gujarat	Amreli
*Saurashtra Cement Ltd, Near Railway Station, Ranavav-360 560, Dist.- Porbandar, Gujarat.	Gujarat	Porbandar
*Gujarat Sidhee Cement Ltd, Sidheegram–362 276, Veraval-Kodinar Highway, Tal. - Sutrapada, Dist.-Junagadh, Gujarat.	Gujarat	Junagadh
* Ambuja Cement Limited, P.O-Ambujanagar – 362 715, Tal.-Kodinar, Dist.-Junagadh Gujarat.	Gujarat	Junagadh
*Madras Cement Ltd, Ramamandiram, Rajapalayam–626 117, Tamil Nadu.	Tamil Nadu	Ariyalur
*Dalmia Cement (Bharat) Ltd, Dalmiapuram–621 651, District–Tiruchirappalli, Tamil Nadu.	Tamil Nadu	Tiruchirapalli
*The India Cements Ltd. "Dhun Building", 827, Anna Salai, Chennai-600 002 Tamil Nadu.	Tamil Nadu	Ariyalur

** Producing as an associated mineral with limestone.*

Table – 21 : Production of Marl, 2008-09 to 2010-11 (P)
(By States)

(Qty in tonnes, value in ₹ '000)

State	2008-09		2009-10		2010-11(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**4167452**	**193919**	**5908226**	**381599**	**4374531**	**256118**
Gujarat	4008452	188259	4284658	245373	3748504	206929
Tamil Nadu	159000	5660	1623568	136226	626027	49189

Table – 22 : Production of Marl, 2009-10 and 2010-11(P)
(By Sectors/States/Districts)

(Qty in tonnes; Value in ₹ '000)

State/District	2009-10			2010-11(P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India	**(11)**	**5908226**	**381599**	**(11)**	**4374531**	**256118**
Private sector	(11)	5908226	381599	(11)	4374531	256118
Gujarat	**(6)**	**4284658**	**245373**	**(6)**	**3748504**	**206929**
Amreli	(2)	2487945	165397	(2)	2263145	143176
Junagadh	(3)	1166823	68638	(3)	893619	53102
Porbandar	**(1)**	**629890**	**11338**	**(1)**	**591740**	**10651**
Tamil Nadu	(5)	1623568	136226	(5)	626027	49189
Ariyalur	(3)	787468	97312	(3)	423627	39131
Tiruchirapalli	(2)	836100	38914	(2)	202400	10058

Figures in parentheses indicate associated mines with limestone.

Table – 23 : Mine-head Stocks of Marl, 2010-11 (P)
(By States)

(In tonnes)

State	At the beginning of the year	At the end of the year
India	**569958**	**410296**
Gujarat	236150	188830
Tamil Nadu	333808	221466

MINING & MARKETING

In India, limestone mines are worked by opencast method. Captive mines are mechanised and supply feed to cement and iron & steel units. Some mines have well laid road-cum-rail routes and aerial ropeways. The large mines are developed by forming benches in overburden and limestone bed. The face length, width and height of the benches correspond to the mining machinery deployed and production schedule and may be up to 30-300 m x 25 m x 3-8 m. Heavy earth-moving machinery like 3.3 to 4 cu. m capacity hydraulic excavators in combination with 10-35 tonne dumpers are normally used. Other mines are mainly opencast and are worked by semi-mechanised and manual mining methods.

In Andhra Pradesh, limestone production from Adilabad and Kurnool districts is used in paper mills, sugar, cement and steel plants. Tile, mossaic, chip and polished stonemakers also use limestone.

Limestone produced in Bihar is supplied mainly to cement plants, foundries and lime kiln units.

In Raipur and Durg districts of Chhattisgarh the limestone produced is suitable for Iron & Steel Industry. The Bhilai Steel Plant obtains its requirements of limestone from Nandini mines in Durg district. The cement grade limestone is also produced in the region. M/s Lafarge India Ltd, Raipur, Chhattisgarh is one of the principal producers of cement grade limestone.

Limestone produced in Gujarat is consumed mainly in cement and chemical industries and also in textile, foundries and steel plants. The dolomitic limestone in Gujarat is used for making slabs and tiles.

Limestone in Himachal Pradesh is supplied to cement plants, paper industry, sugar mills and lime kilns. The production from Bilaspur district is despatched to fertilizer unit of National Fertilizers Ltd, (NFL) at Naya Nangal.

Limestone in Jammu & Kashmir is suitable for cement manufacture. In limestone bands in Anantnag district, magnesia content is low and does not exceed 1.70 percent.

In Karnataka, limestone is supplied generally to paper mills and cement plants. However, limestone of Gulbarga district, commonly known as "Shahabad stones", is used as flag stone or flooring stones.

Limestone from Madhya Pradesh is used in cement, sugar, paper, steel and lime industries.

In Maharashtra, apart from cement and sugar industries, limestone is used in Ferro-manganese Industry as flux and also in Tanning Industry.

Limestone mined in Rajasthan is consumed in captive cement plants on a large scale. Limestone of Nagaur district is utilised as feed for white cement plants as well as in steel plants as low silica SMS grade flux and in Chemical Industry. Crystalline limestone of Rajasthan is widely known as a decorative ornamental stone. The limestone worked in Bundi district and Raghunathgarh in Jaipur district is an excellent flagstone, for use as a paving stone. Kota limestone is suitable for cement manufacture and also for lime burning.

The limestone produced in Dehradun-Garhwal areas of Uttarakhand used to be supplied to Sugar, Paper, Steel, Glass, Chemical and Cement Industries in the past.

Limestone in Tamil Nadu is consumed by various industries like Cement, Steel, Paper, Foundry, Fertilizer and Chemicals.

Limeshell from Kerala is used mainly in Chemical, Cement and White cement Industries. It is also used in the manufacture of polyfibre and in Tanning industry.

USES

Limestone used for industrial purpose falls under 'major mineral' while the use of limestone in lime kilns and for building purposes comes under 'minor mineral' as per Mines and Minerals (Development and Regulation) Act, 1957

The threshold value of limestone has been revised vide Ministry of Mines, IBM, Notification No.T-45031/CGBM/2007(PF),dated 16.10.2009, as follows:

(i) For limestone deposits in Chhattisgarh, Gujarat, Himachal Pradesh, Madhya Pradesh, Maharashtra, Rajasthan, Uttarakhand & Uttar Pradesh - CaO - 34% (min), MgO - 4% (max).

(ii) For limestone deposits of Andhra Pradesh, Jharkhand, Karnataka, Kerala, Odisha & Tamil Nadu - CaO - 35% (min), MgO - 4% (max), SiO_2 - 18% (max) & Alkalies - 0.5% (max).

The principal use of limestone is in the Cement Industry. Other important uses are as flux in metallurgical processes; in Glass, Ceramic, Paper, Textile and Tanning Industries; for manufacture of calcium carbide, alkali and bleaching powder; for water purification and sugar refining; in fertilizer (calcium ammonium nitrate) and as soil conditioning agent in agriculture; crushed stone for ballast and filler in concrete and asphalt; as rectangular slab in lithography. The whiting (chalk and precipitated limestone) is used as a filler in rubber, oilcloth, paint, cosmetic, toothpaste, shoe polish, etc. Limestone is also used in underground mine dusting to prevent the propogation of explosions.

Lime is prepared by heating limestone in kilns up to 1000^{o} C. The CO_2 released is effluxed and 'quicklime' (CaO) formed remains as hard white lumps. This when slaked with water and mixed with sand, forms mortar or plaster. Commonly, the commercial lime is prepared as dry hydrated lime $Ca(OH)_2$ by adding to quicklime just the right amount of water (18 parts to 56 parts of CaO). The value of lime for most purposes depends upon its CaO (or CaO + MgO) content.

The manufacture of metallic calcium is one of the latest uses of lime. Calcium is used in reducing organic compounds, desulphurising petroleum, debismuthising lead production of hard lead alloys and calcium-silicon alloys, and in the manufacture of calcium hydride which is further used as an efficient hydrogen carrier.

Limeshell is used mainly in Chemical and White cement Industries. It is also used in the manufacture of polyfibre and in Tanning industry. Lime kankar is used in Cement Industry.

SPECIFICATIONS

Cement Industry

Limestone containing 45% (min) CaO and above is usually preferred in the manufacture of cement. Magnesia, sulphur and phosphorus are regarded as deleterious elements. Limestone should have less than 3% magnesium oxide (MgO), maximum tolerance being 5 percent. The presence of P as P_2O_5 more than 1% slows down considerably the setting time of Portland Cement. Indian cement manufacturers prescribe that the limestone should have CaO 42% (min), Al_2O_3 1 to 2%, Fe_2O_3 1 to 2%, SiO_2 12 to 16% and MgO 4% (max). The broad chemical specifications of cement grade limestone (r.o.m.) for cement manufacture suggested by the National Council for Cement and Building Materials, New Delhi, are given in Table-24.

Table – 24 : Broad Chemical Specifications of Cement Grade (Run-of-Mine) Limestone (Clause 6.1.1)

Oxide component/ Other Constituents	Acceptable range for manufacture of Ordinary Portland Cement (33, 43 & 53 Grade) (percent)	Limiting values taking into consideration other types of cements, scope of beneficiation and blending (percent)
CaO	44-52	40(min)
MgO	3.5(max.)	5.0(max)
SiO_2	To satisfy LSF, silica	–
Al_2O_3	Modules and alumina	–
Fe_2O_3	Modules	–
TiO_2	<0.5	<1.0
Mn_2O_3	<0.5	<1.0
R_2O (Na_2O + K_2O)	<0.6	<1.0
Total S as SO_3	<0.6	<0.8
P_2O_5	<0.6	<1.0
Cl	<0.015	<0.05
Free silica	<8.0	<10.0

Source : *Report on Norm for limestone deposits for cement manufacture by National Council for Cement and Building Materials, New Delhi, May 2001.*

Iron & Steel Industry

In Iron & Steel Industry, limestone is used both in blast furnace and steel melting shop as a flux after calcining. It is also added as flux in self-fluxing iron ore sinters. It has two basic functions in steel making, first to lower the temperature of melting and second to form calcium silicate which comes out as a slag, as it combines with silica in iron ore.

For use in the blast furnace, the calcium carbonate ($CaCO_3$) content in limestone should not be usually less than 90 percent. The combined SiO_2 and Al_2O_3 should not exceed 6% though up to 11.5% is allowed; MgO should be within 4% and sulphur and phosphorus as low as possible.

In Steel Melting Shop (SMS), insolubles in limestone should not exceed 4 percent. Good fluxing limestone should naturally be low in acid constituents like silica, alumina, sulphur and phosphorus. Limestone should be dense, massive, preferably fine-grained, compact and non-fritting on burning.

BIS has prescribed specifications for flux grade limestone for use in steel plants as per IS : 10345 - 2004 (Second Revision; Reaffirmed 2009).

Glass Industry

Glass Industry requires high calcium limestone (94.5% $CaCO_3$) and 97.5% of combined $CaCO_3$ and $MgCO_3$. Iron and other colouring matters are regarded as objectionable and Fe_2O_3 should be up to 0.20% (max). For colourless glass, limestone should contain 98.5% $CaCO_3$ (min), iron content as Fe_2O_3 should not be more than 0.04%; and for bottle glass, Fe_2O_3 up to 0.05% is used. The BIS specifications (IS : 997 - 1973; First Amendment, Reaffirmed 2008) for limestone for use in Glass Industry are as follows:

Silica as SiO_2	2.5%
Total iron (Fe_2O_3)	
a) Calcite or marble	0.05%
b) Limestone	0.10%
c) Dolomitic limestone or dolomite	0.15%
Lime (as CaO)	53.0%
Total lime and magnesia (as CaO + MgO)	54.50%

Chemical Industry

The calcium carbide manufacturers generally prefer lime containing 95% CaO (min) with limitations of not more than 3% SiO_2, not more than 0.95% phosphorus and other impurities not exceeding 2%. For the manufacture of bleaching powder also, lime containing 95% and above CaO is required. Total Fe_2O_3+Al_2O_3+MnO_2 should be less than 2%; MgO should be below 2% and SiO_2 less than 1.5%. Bleaching powder is prepared by absorption of chlorine by dry hydrated lime. The hydrated lime should not contain more than 2% excess water. Iron and manganese oxides lead to unsuitability of the product and iron oxides tend to discolour the bleached material. Magnesia renders the bleaching powder hygroscopic. Silica and clay impede solution and settling of bleaching powder.

Sugar Industry

In Sugar Industry, lime is used for clarification of cane and beet juice, viz, removing the impurities from the juice and also for precipitating sugar from impurities. Milk of lime 1% in volume of cane juice is added to pre-heated juice. Limestone used in Sugar Industry must be high in active lime (CaO 80% min), but low in iron, alumina and silica. Magnesia should be less than 1 percent. Excess silica is undesirable because it separates as a gelatinous precipitate which covers the sugar crystals and retards their growth and filteration. Magnesia is objectionable because magnesium carbonate is soluble in sugar juice. Presence of iron tends to colour the finished product.

The BIS specifications of limestone for chemical industries are furnished in Table - 25.

Table – 25 : Specifications of Limestone for Chemical Industry (Bleaching Powder, Caustic Soda, Calcium Carbide and Sugar Industries) (IS : 3204 - 1978;First Revision, Reaffirmed 2010)

Characteristics	Requirement in percent by mass for			
	Bleaching powder	Caustic soda	Calcium carbide	Sugar
Loss on ignition	46.0	46.0	46.0	44.0
SiO_2 (max)	0.75	–	1.0	2.0
Fe_2O_3 (max)	0.15	–	0.25	–
CaO (min)	54.00	53.0	54.0	50.0
MgO (max)	2.00	1.0	0.8	1.0
Mn_2O_3 (min)	0.06	–	–	–
CO_2 (min)	42.00	42.00	42.00	41.00
S (max)	–	–	0.1	–
P (max)	–	–	0.01	–
$Al_2O_3+Fe_2O_3$ (max)	–	–	0.50	1.5
$SiO_2+Al_2O_3+Fe_2O_3$ (max)	–	3.0	–	–

Fertilizer Industry

Limestone is used only as carrier in the manufacture of calcium ammonium nitrate fertilizer. For this purpose, limestone should contain $MgCO_3+CaCO_3$ 85% (min), SiO_2 5% (max) and acid insolubles 14% (max).

Foundry Industry

The chemical requirements of limestone for use in foundries as per BIS specification (IS : 4140 -1978); has been withdrawn.

INDUSTRY & CONSUMPTION

India was the second largest producing country of cement in the world after China. There were 171 large cement plants having an installed capacity of 290.48 million tonnesin 2010-11 in addition to mini and white cement plants having estimated capacity of around 6 million tonnes per annum. The total installed capacity of cement in 2010-11 was thus about 296.48 million tpy against 276.77 million tpy in the preceding year. Besides, there are three white cement plants having a total 9,90,000 tpy capacity. The total production of cement reached 216.28 (estimated) million tonnes in 2010-11 compared to 204.95 million tonnes in the preceding year.

In 2010-11, the total cosumption of limestone & other calcareous minerals/ materials, as reported by different industries was 213.12 million tonnes. Cement was the major consuming industry accounting for 94% consumption, followed by iron and steel (4%) and chemical (1%). The remaining consumption was reported by sugar, paper, fertilizer, glass, metallurgy, foundry, etc. Consumption of limestone and other calcareous materials from 2008-09 to 2010-11 is given in Tables - 26(A), 26(B) and 26(C). Information on consumption of limestone in Iron & Steel industry by principal plants is given in Table - 26(D).

Table – 26 (A) : Reported Consumption of Limestone, 2008-09 to 2010-11 (By Industries)

(In tonnes)

Industry	2008-09		2009-10(R)		2010-11(P)	
All Industries	**160732700**		**191960000**		**190649600**	
Aluminium	223300	(4)	225200	(4)	213600	(4)
Alloy steel	84600	(9)	84500	(9)	84500	(9)
Cement	149628200	(105)	179935400	(110)	178111200	(111)
Chemical	1508900	(21)	1508900	(22)	1508900	(22)
Fertilizer	150000	(4)	149200	(5)	149800	(5)
Ferro-alloys	11200	(17)	8200	(19)	8200	(19)
Foundry	24300	(27)	24800	(27)	24800	(27)
Glass	94600	(27)	95700	(27)	95200	(27)
Iron & Steel	6239100	(22)	7251000	(25)	7635800	(25)
Metallurgy	42800	(2)	41400	(2)	41400	(2)
Paper	128600	(16)	124600	(16)	124600	(16)
Sugar (e)	650500	(10)	671500	(10)	815200	(10)
Others**	1946600	(37)	1839600	(36)	1836400	(36)

Figures rounded off. Data collected on non-statutory basis.
Figures in parentheses denote the number of units in organised sector reporting consumption.*
(includes reported companies and/or estimates, whenever required).*
** *Include asbestos products, ceramics, explosive, lead & zinc, paint, pesticide, pharmaceutical, refractory, rubber, sponge iron, textile, vansapati and zinc.*

Table – 26 (B) : Reported Consumption of Other Calcareous Minerals/Materials, 2008-09 to 2010-11 (By Industries)

(In tonnes)

Industry	2008-09	2009-10(R)	2010-11(P)
All Industries (A+B+C+D)	**22924700**	**23136600**	**22469600**
(A) Cement {(i) + (ii)}	22901800(117)	23113700(128)	22446700(129)
(i) Other Calcareous Material	19672500(105)	19857300(115)	19246500(116)
B F Slag	5305000 (35)	5575800(40)	5308800(40)
Fly ash/flue dust	14114200 (60)	14000900(66)	13679700(67)
$CaCO_3$ sludge / Lime sludge	253300(10)	280600 (9)	258000(9)
(ii) Other Calcareous Minerals	3229300(10)	3256400(11)	3200200(11)
Limeshell	28900 (1)	16900(1)	13300(1)
Calcareous sea sand	++(1)	++(1)	++(1)
Marble	651500 (3)	651500 (3)	651500 (3)
Marl	2548900 (5)	2588000(6)	2535400(6)
(B) Paper / Limeshell	13400 (1)	13400 (1)	13400 (1)
(C) Glass / B F Slag	9500 (3)	9500 (3)	9500 (3)
(D) Fertilizer/Limeshell	++(1)	++ (1)	++(2)

Figures rounded off. Data collected on non-statutory basis.
Figures in parentheses denote the number of units in organised sector reporting consumption.*
(includes reported companies and/or estimates, whenever required).*

Table – 26 (C) : Reported Consumption of Limestone & Other Calcareous Minerals/Materials 2008-09 to 2010-11 (By Industries)

(In tonnes)

Industry	2008-09	2009-10(R)	2010-11(P)
All Industries	**183657400**	**215096600**	**213119200**
Aluminium	223300 (4)	225200 (4)	213600 (4)
Alloy steel	84600 (9)	84500 (9)	84500 (9)
Cement	172530000 (105)	203049100 (109)	200557900(110)
Chemical	1508900 (21)	1508900 (22)	1508900 (22)
Fertilizer	150000 (4)	149200 (5)	149800 (5)
Ferro-alloys	11200 (17)	8200 (19)	8200 (19)
Foundry	24300 (27)	24800 (27)	24800 (27)
Glass	104100 (27)	105200 (27)	104700 (27)
Iron & Steel	6239100 (22)	7251000 (25)	7635800 (25)
Metallurgy	42800 (2)	41400 (2)	41400 (2)
Paper	142000 (17)	138000 (17)	138000 (17)
Sugar	650500 (10)	671500 (10)	815200 (10)
Others**	1946600 (40)	1839600 (39)	1836400(39)

Figures rounded off. Data collected on non-statutory basis.
Figures in parentheses denote the number of units in organised sector reporting consumption.*
(includes reported companies and/or estimates, whenever required).*
** *Include asbestos products, ceramic, electrode, explosive, lead & zinc, mining machinery, paint, pesticide, pharmaceutical, refractory, rubber, sponge iron, textile, vansapati and zinc.*

Table – 26 (D) : Reported Consumption of Limestone in Iron & Steel Industry, 2008-09 to 2010-11 (By Principal Plants)

(In tonnes)

Plant	2008-09	2009-10	2010-11
Bhilai Steel Plant	1071619	1030235	1189162
Bokaro Steel Plant	921989	886291	968545
Durgapur Steel Plant	426695	12000	56000
IISCO Steel Plant	63369	36000	36000
Rourkela Steel Plant	334498	104000	293690
Visvesvaraya Iron & Steel Plant	23689	31744	31608
Visakhapatnam Steel Plant(e)	456000(e)	891590	966730
JSW Steel Ltd	183038	192925	NA
Tata Steel Ltd(e)*	780111	1404690	1386375
IDCOL, Kalinga Iron Works Ltd	13528	15132	12728
Llyod Steel	14438	11899	NA
Mandovi Pellets	17500(e)	NA	NA
KIOCL Ltd	45340	24687	58748
VISA Steel Plant	8729	13880	4439
Neelachal Ispat Nigam Ltd	62558	79353	79340
Jayaswal Neco Industries Ltd	83463	96578	69651
Sunflag Iron & Steel Co.Ltd	22339	39288	25667

FOREIGN TRADE

Exports

Exports of limestone decreased to 1.04 million tonnes in 2010-11 from 2.41 million tonnes in the previous year. Limestone in bulk was exported mainly to neighbouring countries, viz, Bangladesh (94%) Bhutan and Nepal besides other countries. During the same period, exports of chalk also decreased to 689 tonnes from 1,655 tonnes in the previous year. Chalk was exported mainly to Nepal and Philippines.

Exports of bleaching powder were 18,258 tonnes in 2010-11 as compared to 16,506 tonnes in the previous year. Bleaching powder was exported mainly to Iran (12%), Kenya (8%) Egypt (6%), Cameroon and Algeria (5% each) and Ivory Coast (4%) besides other countries.

In 2010-11 about 1,135 tonnes of calcium carbide was exported as against 971 tonnes in the previous year mainly to UAE and Oman (Tables - 27 to 30).

Imports

Imports of limestone increased to 5.04 million tonnes in 2010-11 from 3.90 million tonnes in the previous year. Imports of chalk in 2010-11 were 3,185 tonnes as against 1,659 tonnes in the previous year. Limestone was imported mainly from UAE (47%) and Oman (38%), while chalk was imported mainly from Malaysia (56%) and Egypt besides other countries.

Imports of calcium carbide increased slightly to 56,479 tonnes in 2010-11 from 51,598 tonnes in the previous year. Calcium carbide was imported mainly from China (56%) and Bhutan (37%). In 2010-11, imports of bleaching powder were 72 tonnes as against 42 tonnes in the previous year (Tables - 31 to 34).

Table – 27 : Exports of Limestone
(By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**2405783**	**1537749**	**1040693**	**710924**
Bangladesh	2349597	1260831	979897	357894
UK	9499	52905	12741	76134
Bhutan	12721	34761	15005	58682
China	-	-	4311	32284
Belgium	2452	25172	3018	31161
Nepal	8058	25804	8757	20815
Saudi Arabia	956	18665	3001	19070
Italy	1300	12832	1201	15197
France	1562	14242	2116	13873
USA	8763	3835	1035	12774
Other countries	10875	88702	9611	73040

Table – 28 : Exports of Chalk
(By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**1655**	**9527**	**689**	**2726**
Nepal	234	1037	368	1343
Philippines	100	204	116	441
South Africa	200	793	60	341
Tanzania	-	-	8	209
USA	-	-	2	45
Djibouti	-	-	25	45
Egypt	7	40	8	44
Nigeria	4	32	11	42
Kenya	37	31	2	42
Bahrain	2	4	5	41
Other countries	1071	7386	84	133

Table – 29 : Exports of Bleaching Powder (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**16506**	**736984**	**18258**	**764016**
Iran	2274	110620	2123	109500
Kenya	1395	77598	1543	78156
Egypt	1052	60502	1136	61729
Cameroon	769	51441	877	51801
Ivory Coast/Cote-D' Ivoire	1012	63074	759	41385
Algeria	1292	47075	892	37890
Ghana	361	20268	447	25840
Dominican Rep.	264	15720	416	24801
Senegal	528	33613	415	23128
UAE	589	21691	405	22158
Other countries	6970	235384	9245	287628

Table – 30 : Exports of Calcium Carbide (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**971**	**34557**	**1135**	**44469**
UAE	686	25704	963	35173
Oman	144	4457	101	6834
Bangladesh	-	-	34	1504
Nepal	1	33	35	623
Singapore	-	-	1	308
Kenya	++	10	1	23
Kuwait	-	-	++	4
Other countries	140	4353	-	-

Table – 31 : Imports of Limestone (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**3899308**	**6191762**	**5035678**	**7043286**
UAE	1219689	1806635	2345706	2941381
Oman	1543580	1811627	1935210	2326287
Malaysia	207158	651100	186458	629885
Thailand	615062	1195085	329728	479835
Vietnam	58719	241179	62350	294312
Egypt	5182	15182	38195	124501
Philippines	141862	186486	50661	69186
China	192	12277	36892	49686
UK	2721	34537	3572	38833
Australia	43182	76876	18759	33597
Other countries	61961	160778	28147	55783

Table – 32 : Imports of Chalk (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**1659**	**11477**	**3185**	**17140**
Malaysia	1321	5928	1786	8006
Egypt	156	445	926	3006
France	42	1127	138	2250
Korea, Rep. of	8	705	18	1020
Vietnam	-	-	240	960
China	69	1085	39	825
Japan	-	-	8	411
USA	10	44	11	271
Italy	4	188	4	198
UK	21	427	13	165
Other countries	28	1528	2	28

Table – 33 : Imports of Calcium Carbide
(By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**51598**	**1665734**	**56479**	**1904603**
China	26756	818553	31625	986450
Bhutan	22277	767056	21038	787431
South Africa	1946	59238	3749	128363
Hong Kong	-	-	22	823
Malaysia	-	-	23	802
UK	-	-	22	734
Other countries	619	20887	-	-

Table – 34 : Imports of Bleaching Powder
(By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**42**	**1911**	**72**	**3156**
China	40	1560	59	3000
Bangladesh	-	-	12	122
Unspecified	-	-	1	34
Other countries	2	351	-	-

FUTURE OUTLOOK

India has huge resources of limestone distributed over different parts of the country. India is comfortably placed in the world in annual capacity and production of cement. Cement-grade limestone occurs in all the limestone-bearing areas, while SMS, BF and chemical-grade limestones occur in selective areas. Increase in steel production in the country has escalated the demand for SMS and BF grade limestone. Concerted efforts to locate SMS and BF grade limestone along with cement- grade limestone are imperative to meet the growing demand.

As per the Report of the Working Group, Planning Commission of India, the total limestone requirement during 12th Plan (2012-2017) with growth scenario of cement @ 10%, 11% and 12% for the respective GDP growth of 8%, 9% and 10% is projected at 3,163 million tonnes, 3,253 million tonnes and 3,385 million tonnes, respectively.

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

MAGNESITE

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

54 Magnesite

Magnesite ($MgCO_3$) is a carbonate of magnesium. It is usually found as irregular veins in serpentine and formed by replacement of dolomite and limestone. Calcium and silica are, therefore, the most common impurities observed in magnesite along with Fe_2O_3 and Al_2O_3. It is a very important mineral for the manufacture of basic refractories, which are largely used in the steel industry. In commerce, the term 'magnesite' refers not only to the mineral, but also to many products, obtained by calcining the natural carbonate; e.g., caustic magnesite (magnesia obtained by calcining crude magnesite at comparatively low temperatures, 700 to 1000° C, and retaining 2 to 7% CO_2 as carbonate) and dead-burnt or refractory magnesite (magnesia obtained by calcining magnesite at high temperatures, 1500 to 1800° C, usually containing less than 0.5% CO_2). Pure magnesite calcined at still higher temperatures (1600 - 1800° C) to expel carbon dioxide completely is termed as 'periclase' (MgO) in the trade.

RESOURCES

The total reserves/resources of magnesite as per UNFC system as on 1.4.2010 are about 335 million tonnes of which reserves and remaining resources are 42 million tonnes and 293 million tonnes, respectively. Substantial quantities of resources are established in Uttarakhand (69%), followed by Rajasthan (16%) and Tamil Nadu (12%). Resources are also located in Andhra Pradesh, Himachal Pradesh, Jammu & Kashmir, Karnataka and Kerala.

Occurrences of magnesite in Tamil Nadu are low in lime and high in silica whereas those of Uttarakhand are high in lime and low in silica. The gradewise and statewise reserves and resources of magnesite are given in Table - 1.

PRODUCTION, STOCKS & PRICES

Production of magnesite in 2010-11 at 230 thousand tonnes decreased by 24% as compared to that in the previous year due to labour problems. There were 9 reporting mines in 2010-11 and 8 in the previous year. Five principal producers accounted for 96% output during the year 2010-11. About 65% production of magnesite was contributed by public sector during 2010-11 as against 62% in the preceding year.

Tamil Nadu continued to be the leading state with a share of 72% in total output during 2010-11 followed by Uttarakhand 25%. The remaining 3% was contributed by Karnataka (Tables-2 to 4).

Mine–head stocks at the end of the year were 60 thousand tonnes as against 88 thousand tonnes at the beginning of the year (Table-5).

The average daily employment of labour during the year was 839 as against 899 in the the previous year. The prices of magnesite are furnished in the General Review on Prices.

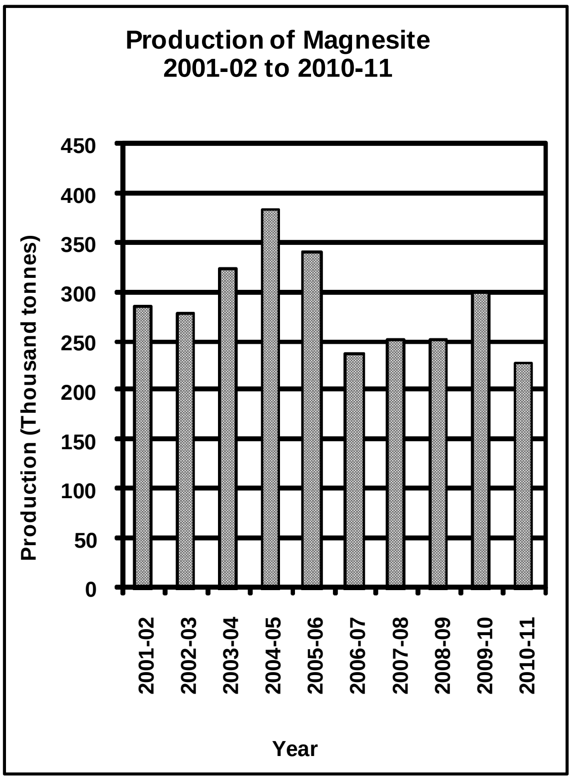


Table – 1 : Reserves/Resources of Magnesite as on 1.4.2010 (By Grades/States)

(In '000 tonnes)

	Reserves				Remaining resources								Total resources (A+B)
	Proved STD111	Probable STD121	Probable STD122	Total (A)	Feasibility STD211	Pre-feasibility STD221	Pre-feasibility STD222	Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
All India : Total	**20851**	**7786**	**13313**	**41950**	**1776**	**2244**	**32326**	**59010**	**59652**	**138169**	**45**	**293222**	**335172**
By Grades													
High Grade	2616	-	2	2618	600	-	3	2	-	25	-	630	3248
Medium Grade	11676	7326	11038	30040	1159	222	317	64	109	14637	-	16508	46548
Beneficiable/Low	3237	202	53	3492	-	84	479	648	31558	117216	-	149985	153477
High & Medium Mixed	-	-	-	-	18	173	2290	-	-	100	-	2581	2581
Medium & Low Mixed	1239	257	-	1496	-	429	29237	58271	27766	414	-	116117	117613
Others	2085	-	2025	4110	-	1336	-	24	-	2525	-	3885	7995
Unclassified	-	-	-	-	-	-	-	-	-	83	-	83	83
Not-known	-	-	194	194	-	-	-	-	219	3170	45	3434	3628
By States													
Andhra Pradesh	-	-	-	-	-	-	-	-	-	80	-	80	80
Himachal Pradesh	-	-	-	-	-	-	-	-	-	298	-	298	298
Jammu & Kashmir	2610	740	-	3350	600	100	-	-	-	150	45	895	4245
Karnataka	332	202	163	697	18	-	499	88	10	2734	-	3349	4046
Kerala	-	-	-	-	-	-	-	2	-	38	-	40	40
Rajasthan	1024	57	2045	3126	-	1420	76	-	149	49033	-	50678	53804
Tamil Nadu	12462	5968	7474	25904	997	27	474	17	737	12355	-	14607	40511
Uttarakhand	4424	818	3632	8874	162	697	31277	58902	58756	73481	-	223275	232149

Figures rounded off.

Table – 2 : Principal Producers of Magnesite, 2010-11

Name & address of producer	Location of mine	
	State	District
Tamil Nadu Magnesite Ltd, 5/53, Olamur Main Road, Jagir Ammapalayam, Dist. Salem - 636 302, Tamil Nadu.	Tamil Nadu	Salem
Almora Magnesite Ltd, At Metela, P.O. Billori, Dist. Bageshwar, Uttarakhand.	Uttarakhand	Bageshwar
Dalmia Maganesite Corpn. Ltd, Dalmia Cement (Bharat) Ltd, Dist.Salem-636 012, Tamil Nadu.	Tamil Nadu	Salem
S. Sunder Rajan, Gori medu, Periagolapatti, Post - Kannankurchi, Dist. Salem - 636 008, Tamil Nadu.	Tamil Nadu	Salem
N.B. Minerals Corporation Opp. Bhatt Colony, Nawabi Road, Haldwani, Dist. Nainital, Uttarakhand-263 139	Tamil Nadu	Salem

Table – 3 : Production of Magnestie, 2008-09 to 2010-11
(By States)

(Qty in tonnes; value in ₹ '000)

State	2008-09		2009-10		2010-11(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**252880**	**363514**	**301070**	**435118**	**229734**	**341520**
Karnataka	9591	14668	6437	13591	6974	14409
Tamil Nadu	188564	281693	235446	349195	164756	257984
Uttarakhand	54725	67153	59187	72332	58004	69127

Table – 4 : Production of Magnestie, 2009-10 & 2010-11
(By Sectors/States/Districts)

(Qty. in tonnes; value in ₹ '000)

State/District	2009-10			2010-11(P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India	**8**	**301070**	**435118**	**9**	**229734**	**341520**
Public sector	4	185536	263720	5	149627	212904
Private sector	4	115534	171398	4	80107	128616
Karnataka	**2**	**6437**	**13591**	**2**	**6974**	**14409**
Mysore	2	6437	13591	2	6974	14409
Tamil Nadu	**4**	**235446**	**349195**	**5**	**164756**	**257984**
Salem	4	**235446**	**349195**	5	**164756**	**257984**
Uttarakhand	**2**	**59187**	**72332**	**2**	**58004**	**69127**
Bageshwar	1	46567	60343	1	46492	62154
Pithoragarh	1	12620	11989	1	11512	6973

Table – 5 : Mine-head Stocks of Magnesite 2010-11(P) (By States)

(In tonnes)

State	At the beginning of the year	At the end of the year
India	**88454**	**60300**
Karnataka	4829	6638
Tamil Nadu	83107	53599
Uttarakhand	518	63

MINING AND MARKETING

Magnesite is being worked by opencast method by developing benches up to 7.5 m height and width up to 45.50 m. In Salem area (Tamil Nadu), magnesite is found chiefly as encrustations, veins and stringers in ultra basic rocks like dunite and peridotite. Stringers and veins occurring irregularly in fractures of rocks giving rise to different patterns, such as, cross-veins, stockworks and ladder veins are broken and magnesite is sorted out. Major magnesite producing mines in Salem area belong to Tamil Nadu Magnesite Ltd (a State Government Undertaking), Dalmia Magnesite Corporation (a private sector enterprise) and Burn Standard Company (a Central Government Undertaking). These mines, by and large, are mechanised and use compressors, wagon drills, jackhammers, power shovels, loaders, dumpers, dozers and pumps. Normally, Ammonium Nitrate Fuel Oil Mixture (ANFO) with about 15% of high explosives as booster is used for blasting. The powder factor may go up to 10. The blasted rock or run-of-mine material containing 25 to 30% magnesite in situ is subjected to manual sorting.

The hand-picked crude magnesite is further subjected to sorting and dressing in the dressing yard. Magnesite lumps which are not considered fit for dressing (containing 10 to 20% silica) constitute 2 to 6% of the run-of-mine. These lumps are hand-picked and stacked separately as rejects. The remaining material is further dressed to obtain usable magnesite containing less than 3% silica. The usable magnesite hardly constitutes 4 to 8% of blasted rocks even though run-of-mine contains 20 to 30% magnesite. Magnesite mine in Karnataka is worked by Tata Steel. In Uttarakhand, Almora Magnesite Ltd and Magnesite & Minerals Ltd are the important producers having mines in Bageshwar and Pithoragarh districts, respectively.

Magnesite is marketed generally after calcination; that is, after converting it into lightly calcined or caustic magnesite by heating the mineral to 800^{o} to $1{,}000^{o}$ C and dead-burnt variety to $1{,}800^{o}$ C.

USES AND SPECIFICATIONS

The major proportion (about 98%) of magnesite mined is used for conversion in calcined form which finds many applications. The other industries where raw magnestite is used are mosaic tiles, electrodes, chemicals and manufacture of magnesium metal. Magnesite is also used in fertilizers and by food processing industry. Raw magnesite is dead-burnt for making basic refractory bricks, basic refractory mortars, ramming mass, tar/pitch impregnated magnesite, magnesia-carbon bricks, slide-gate plates and other refractories. Caustic calcined magnesite is used for manufacturing sorel cement (magnesium oxychloride), castable refractories and extraction of magnesium metal. It is also the source material for manufacture of magnesium compounds like magnesium sulphate (Epsom salt) and other salts used in paper and pharmaceutical industries. In paper industry, magnesium bisulphate produced from magnesite was used as cooking liquor for preparing pulp. It is also used in textile, rubber, glass, ceramic, etc. industries and as animal feed stuff. Fused magnesia finds application as insulating material in tubular heating elements in electrical industry and refractory brick linings in steel furnaces.

Refractory Industry

In India, about 96% consumption is accounted by refractory industry. In the manufacture of refractories, deleterious constituents are SiO_2, CaO, Fe_2O_3 and Al_2O_3. The permissible limits for these constituents are governed by its end-use. The refractory bricks are made from dead-burnt magnesite by judicious blending of different types of raw magnesite before dead-burning or of different qualities of dead-burnt magnesite prior to brick making.

Indian steel plants use domestic dead-burnt magnesite (DBM) bricks containing up to 5% silica and 2.5% maximum CaO. By and large, Indian refractory makers prefer magnesite for making high grade DBM containing MgO 45.5% (min), SiO_2 2.5% (max) and CaO 1.5% (max).

The BIS has prescribed the IS specification (14303-1995, Reaffirmed 2010) for magnesite for use in refractory industry. The said specification has laid down five grades of magnesite as follows:

S. No.	Constitutent	Requirements, Percent				
		Grade 1	Grade 2	Grade 3	Grade 4	Grade 5
i)	MgO, min	45.00	43.00	42.50	45.00	43.00
ii)	CaO, max	0.75	0.75	0.75	2.00	2.00
iii)	Al_2O_3, max	0.50	0.50	0.50	0.50	0.50
iv)	Fe_2O_3, max	0.50	0.50	0.50	2.50	2.00
v)	SiO_2, max	2.00	3.00	4.00	1.00	2.00
vi)	Size*	25-75 mm	25-75 mm	25-75 mm	50-100 mm	50-100 mm

** Unless and otherwise agreed to.*

Chemical Industry

The BIS specification (IS : 3607-1979, First Revision, Reaffirmed 2010) has prescribed the following specifications for magnesite for use in chemical industry:

S.No.	Characteristic	Requirement
i)	Loss on ignition, percent by mass, min	48.0
ii)	Silica (as SiO_2), percent by mass, max	2.0
iii)	Alumina (as Al_2O_3), percent by mass, max	0.3
iv)	Iron oxide (Fe_2O_3), percent by mass, max	0.4
v)	Magnesium (as MgO), percent by mass, min	45.0
vi)	Calcium (as CaO), percent by mass, max	1.0

CONSUMPTION

Reported consumption of magnesite increased to 240 thousand tonnes in 2010-11 against 238 thousand tonnes in 2009-10 because of higher consumption reported by ferro-alloys industry. Almost 95% consumption was reported for refractory purposes (including iron and steel plants). Chemical industry consumed magnesite for producing magnesium sulphate. Magnesite consumption pattern by industries is shown in Table - 6.

Table – 6 : Reported Consumption of Magnesite[1]
2008-09 to 2010-11
(By Industries)

(In tonnes)

Industry	2008-09	2009-10(R)	2010-11(P)
All Industries	**320800**	**238300**	**240500**
Alloy steel (as refractory)	1600 (2)	1600 (1)	1600(1)
Ferro-alloys	4500 (7)	4700(9)	6800(10)
Foundry (as refractory)	900 (5)	1100 (6)	1100 (6)
Paper	1800 (1)	1800 (1)	1800 (1)
Refractory[2] (including Iron & steel)	311600 (44)	228700(36)	228800(36)
Others (abrasive, asbestos products, ceramic, chemical, glass and rubber).	400(10)	400(8)	400(1)

Figures rounded off. Data collected on non-statutory basis.

Figures in parentheses denote the number of units in organised sector reporting consumption.*

*(*Includes actual reported consumption and/or estimates made wherever required).*

1: *Includes consumption of imported magnesite and magnesite equivalent to dead-burnt magnesite.*

2: *Besides, imported sea water magnesia which was about 5,000 tonnes each during 2007-08, 2008-09 and 2009-10 and 2010-11 were consumed in refractory industries.*

INDUSTRY

Dead-burnt Magnesite (DBM)

When the raw magnesite is calcined between 1,660-1,800^{o} C, carbon dioxide is expelled completely and a dense product 'dead-burnt magnesite' is obtained. Dead-burnt magnesite refers to the magnesite that is unreactive, namely 'dead' because it has been calcined at a temperature high enough to enable it to be used in brick making or monolithic hearths without undue difficulty arising out of hydration or shrinkage.

Caustic Magnesia

Low calcined magnesite, also known as caustic magnesia, is obtained by calcining magnesite in a shaft or rotary kiln betwen 800 and 1,000^{o} C. Because of incomplete dissociation, it still contains 8 to 10% carbon dioxide as carbonate. Low calcined magnesia when mixed with water forms a feebly plastic paste. Industries like paper, rubber, ceramic, asbestos products, glass, etc. use caustic magnesia.

Fused Magnesia

Fused magneisa is produced by the fusion of the high-grade magnesite in Higgin's or electric arc tilt furnaces between 2,500 and 3,000^{o} C. It is resistant to the action of molten metals, basic slags and fluxes and high temperatures. It is used in the form of moulded vessels and as compressed material for covering resistant elements of the furnaces used in the melting of lead, tin, etc.

There were fourteen major plants manufacturing dead-burnt magnesite and six plants producing lightly-calcined magnesite, two magnesium metal extracting plants, one pilot plant and one plant of seawater magnesia (Table - 7). By-product magnesium carbonate and other magnesium salts were also produced during salt manufacture from seawater. Tamil Nadu Magnesite Ltd, (Tanmag) is one of the largest producers producing DBM in a rotary kiln, sintered at 1,750^{0} C. In addition, it has five oil fired vertical shaft kilns which heat magnesite to 1,000-1,100^{0} C for caustic calcined grades.

Table - 7 : Manufacturing Plants of Dead-Burnt Magnesite (DBM) , Lightly Calcined Magnesite, etc.

Name of the plant	Location	Installed capacity (tpy)
Tamil Nadu Magnesite Ltd	Salem, Tamil Nadu	30000 (DBM) 19500 (calcined magnesite)
Ramakrishna Magnesite Mines	-do-	3000 (calcined magnesite)
Burn Standard Co. Ltd	-do-	54000 (DBM) 18000 (calcined magnesite)
Dalmia Magnesite Corporation	-do-	72,000 (DBM)
Salem Refractories	-do-	18000 (DBM)
Badrinath Refractory	-do-	900 (DBM) 2000 (calcined magnesite)
Khaitan Hostambe Spinels	-do-	30000 (DBM) 10000 (magnesite chrome clinker)
Ponkumar Magnesite Ltd	-do-	26500 (DBM)
Tamil Nadu Products Ltd	-do-	3000 (calcined magnesite)
Tata Refractories Ltd	-do-	25000 (DBM) 2000 (calcined magnesite)
Orissa Industries Ltd	Barang, Sundergarh, Odisha	5000 (DBM)
-do-	Chandak, Pithoragarh, Uttarakhand	45000 (DBM)
Almora Magnesite Ltd	Haldwani, Bageshwar, Uttarakhand	30,000 (DBM, calcined semicalcined magnesite)
Magnesite & Minerals Ltd	Pithoragarh, Uttarakhand	45000 (DBM)
Himalayan Magnesite Ltd	-do-	20000 (DBM) 3000 (calcined magnesite)
J & K Minerals Ltd	Chipprian, Panthal, Udhampur, Jammu & Kashmir	30000 (DBM) 75000 (sized magnesite)
Hansaflon Plastochem Ltd	NA	1500 (Fused magnesia)
Birla Periclase (Presently closed)	Visakha-patnam, Andhra Pradesh	50000 (seawater magnesia)

Sea Water Magnesia (SWM)

Sea water or lake bitterns is an alternative source to obtain magnesia by chemical reaction. The main raw materials required other than sea water are, dolomite or limestone, fresh water and sulphuric acid. The magnesia content of sea water is about 0.2%, and even by enrichment with dolomite, around 300 kilograms sea water needs to be processed to obtain a kilogram magnesia. The sea water magnesia can be used to manufacture dead-burnt magnesite, caustic magnesia and the magnesium compounds.

Birla Periclase, Visakhapatnam, Andhra Pradesh, had commenced commercial production of sea water magnesia in February 1998. The installed capacity of the plant was 50,000 tonnes per annum. For the extraction of sea water magnesia, high purity limestone is needed. The plant had suspended production operations since December 1998.

Marine By-products

Carbonates, chlorides and sulphates of magnesium are obtained as by-products in the production of common salt by solar evaporation. Salt Commissioner, Jaipur, reported 8,550 tonnes and 13,643 tonnes production of magnesium chloride in 2009-10 and 2010-11, respectively. By- product magnesium sulphate production of 61 tonnes was also reported during 2010-11 by the Salt Commissioner. The production is normally reported from the salt pans in Tuticorin, Tamil Nadu and Jamnagar-Gandhidham, Gujarat.

Magnesium Metal

India's primary magnesium metal production capacity is estimated at 900 tpy. Tamil Nadu Magnesium & Marine Chemical Ltd (TMML), Salem, Tamil Nadu, has suspended production since 1992. Southern Magnesium & Chemical Ltd is likely to be the sole producer in India with 600 tpy capacity. India's production of primary magnesium metal was estimated at 200 tonnes per annum during the years 2008 to 2010 (Table - 8).

TRADE POLICY

As per the Foreign Trade Policy (FTP) 2009-2014, as amended and effective from 05.6.2012, exports and imports of all grades and varieties of magnesite under heading no. 2519 are allowed freely.

Table – 8 : Magnesium Metal Extracting Pilot Plants

Name of plant	Location	Pilot/Metal extracting plant
Central Electro-Chemical Research Institute (CECRI)	Karaikudi, Tamil Nadu.	Pilot plant
Southern Magnesium & Chemical Ltd	Rajahmundry, Andhra Pradesh	Metal extracting plant
Tamil Nadu Magnesium & Marine Chemicals Ltd	Tamil Nadu	-do-

WORLD REVIEW

The world reserves of magnesite was estimated at around 2,500 million tonnes in terms of magnesium content, excluding large resources of magnesium-bearing substitutes, such as, dolomite, brucite and olivine. Further, magnesium compounds could be recovered economically from well and lake brines and from sea water. The latter, which contains 0.13% magnesium by weight, was a major source of metal and compounds. The world reserves of magnesite are given in Table -9.

The world production of magnesite was estimated at 21.8 million tonnes in 2010. China continued to be the leading producer, accounting for about 64% production, followed by Russia (12%) and Turkey (5%) . The world production of magnesite is given in Table -10.

Worldwide, over 98% raw ore producers convert it to magnesia for commercial application, mainly in refractory industry (75%) based on both the sintered and fused forms generally called DBM and electrofused magnesia (EFM), respectively, for lining furnances used in steel production, non-ferrous metals, cement, glass, ceramic and petrochemicals. Primary producers of magnesium metal and alloys were China, USA and Russia. The consuming market segments are aluminium alloying, die-casting and desulphurisation.

China

China Direct Industries, Inc. announced restarting production of primary magnesium at two facilities-Baotou Changxin Magnesium Co., Ltd in Inner Mongolia, with a capacity of 20,000 tpy and Taiyuan Changxin Magnesium Co. Ltd in Shanxi Province, with a capacity of 10,000 tpy. The company production at the facilities was to begin in 2010. Magnesium Resources Corp. of China Ltd. was to build a magnesium plant in the Haicheng district with a production capacity of 200,000 tpy of magnesium metal and 50,000 tpy of magnesium alloys. The first phase of the project was expected to be completed in mid-2010. Fugu Xintian Magnesium alloy Co. Ltd. (Shaxi Province) planned to double its magnesium ingot production capacity to 20,000 tpy. The company planned to set up a new production line with a capacity of 10,000 tpy of pure magnesium and 10,000 tpy of magnesium alloys to be completed by 2010 - end .

Malaysia

The first production of magnesium from CVM Minerals Ltd.'s plant in Malaysia began in June 2010, although commercial-scale production was yet to start. The facility in Taiping in the state of Perak uses dolomite feedstock for a Pidgeon-process plant. The initial production capacity was 15,000 tpy.

Table – 9 : World Reserves of Magnesite (By Principal Countries)

(In '000 tonnes of magnesium content)

Country	Reserves
World : Total (rounded)	**2,500,000**
Australia	95000
Austria	15000
Brazil	160000
China	550000
Greece	30000
India*	6000
Korea, North	450000
Russia	650000
Slovakia	35000
Spain	10000
Turkey	49000
USA	10000
Other countries	390000

***Source**: Mineral Commodity Summaries, 2012.*
**As Per UNFC System, as on 1.4.2010, the total resources of magnesite in India are estimated at 335 million tonnes.*

Table – 10 : World Production of Magnesite (By Principal Countries)

(In '000 tonnes)

Country	2008	2009	2010
World : Total	**24600**	**20000**	**21800**
Australia	148	366	295$^{(e)}$
Austria	837	545	757
Brazil	421	410	439
China	15600	13000	14000
Greece	361	381	396
India*	253	286	239^{e}
Korea, Dem. P. R. of	150	150	150
Russia	2600	2600	2600
Slovakia	806	478	650
Spain	441	434	460
Turkey	2143	861	1000^{e}
Other countries	840	489	814

***Source:** World Mineral Production, 2006-2010.*
** India's production of magnesite in 2008-09, 2009-10 and 2010-11 was 253 thousand tonnes, 301 thousand tonnes and 230 thousand tonnes, respectively.*

FOREIGN TRADE

Exports

The exports of magnesite increased to 22,763 tonnes in 2010-11 from 10,595 tonnes in the previous year. Out of total exports in 2010-11, those of fused magnesia were 67 tonnes, non-calcined magnesite 891 tonnes, calcined magnesite 169 tonnes, other magnesite 17,185 tonnes, magnesium oxide 4,448 tonnes and just 3 tonnes of dead-burnt magnesite. Exports were mainly to Vietnam (57%) Malaysia (8%), Netherlands (6%) and UAE (4%). Exports of magnesium and scrap were 87 tonnes in 2010-11 compared to 25 tonnes in the previous year. Exports were mainly to Singapore and Malaysia (Tables - 11 to 18).

Imports

Imports of magnesite decreased to 54,929 tonnes in 2010-11 from 66,118 tonnes in the previous year. Out of total imports in 2010-11, those of fused magnesia were 7,869 tonnes, non-calcined magnesite 478 tonnes, calcined magnesite 13,239 tonnes, dead-burnt magnesia 16,579 tonnes, other magnesite 10,500 tonnes and magnesium oxide 6,264 tonnes. Imports were mainly from China (44%) followed by Ireland (28%), Japan (9%) and Netherlands (4%). Imports of magnesium and scrap increased to 11,151 tonnes in 2010-11 from 8,644 tonnes in the previous year. Imports were mainly from China (Tables - 19 to 26).

Table – 11 : Exports of Magnesite : Total (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**10595**	**141740**	**22763**	**198972**
Vietnam	74	1117	12976	81374
Netherlands	3407	45224	1395	16936
Saudi Arabia	1618	21877	558	8072
Djibouti	428	5624	348	4440
UAE	1498	21775	943	13221
Bahrain	444	6433	555	7771
Indonesia	439	4436	611	6764
Sudan	164	2741	366	6134
South Africa	25	304	636	9575
Malaysia	165	644	1929	7657
Other countries	2333	31565	2446	37028

Table – 12 : Exports of Magnesia (Fused) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**6**	**23**	**67**	**1638**
Pakistan	–	–	38	1197
Nigeria	–	–	28	437
Sri Lanka	–	–	1	3
Other Countries	6	23	++	1

Table – 13 : Exports of Magnesite (Not Calcined) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**625**	**8425**	**891**	**13442**
Thailand	50	1753	66	2680
Djibouti	–	–	156	2237
South Africa	–	–	53	1072
U K	2	157	93	1062
UAE	100	1485	63	999
Ethiopia	–	–	50	813
Sri Lanka	252	1443	121	803
Sudan	++	3	52	793
Canada	2	22	19	578
Oman	14	465	12	459
Other countries	205	3097	206	1946

Table – 14 : Exports of Magnesite (Calcined) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**38**	**671**	**169**	**2730**
Sudan	13	287	102	1821
Japan	–	–	40	540
Bangladesh	–	–	27	369
Other countries	25	384	–	–

Table – 15 : Exports of Magnesite: Dead-Burnt Magnesia (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**76**	**1390**	**3**	**88**
Italy	–	–	3	88
Other Countries	76	1390	–	–

Table – 16 : Exports of Magnesium Oxide (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**6139**	**78132**	**4448**	**61311**
South Africa	25	304	583	8503
Baharain	420	5880	546	7609
Saudi Arabia	1549	20470	510	7544
U A E	605	7670	491	6569
Indonesia	420	4288	527	5873
Netherlands	1577	16313	495	5380
Pakistan	45	599	123	3207
Latvia	–	–	216	3192
Djibouti	270	3553	190	2194
France	88	1118	132	1768
Other countries	1140	17937	635	9472

Table – 17 : Exports of Magnesite (Other) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**3711**	**53099**	**17185**	**119763**
Vietnam	–	–	12976	81374
Netherlands	1830	28911	900	11556
Malaysia	165	644	1929	7657
UAE	717	11235	389	5652
Sudan	++	4	212	3519
Egypt	254	4128	141	2242
Nigeria	143	1176	211	2070
Indonesia	19	149	84	891
Ethiopia	–	–	75	877
Oman	48	490	18	618
Other countries	535	6362	250	3307

Table – 18 : Exports of Magnesium & Scrap (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**25**	**9405**	**87**	**6587**
Singapore	4	2484	11	3203
Malaysia	1	277	4	897
Vietnam	–	–	27	769
Iran	–	–	42	435
Mauritius	–	–	++	367
Kuwait	–	–	1	260
USA	5	906	++	207
UK	–	–	++	119
UAE	2	2171	++	113
Spain	++	23	++	42
Other countries	13	3544	2	175

Table – 19: Imports of Magnesite : Total (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**66118**	**2053878**	**54929**	**1590290**
China	23351	529510	24363	551660
Ireland	31629	1096329	15209	476329
Japan	5446	225207	4862	209956
Netherlands	330	14294	1980	66724
USA	622	31809	961	49227
Australia	1096	35077	1874	44674
UK	92	6444	497	28262
Israel	230	20414	228	20468
Belgium	10	541	375	11366
Unspecified	–	–	2471	73385
Other countries	3312	94253	2109	58239

Table – 20 : Imports of Magnesia (Fused) (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**11846**	**327914**	**7869**	**244338**
China	10986	302145	6113	190332
Japan	221	7682	370	12213
Netherlands	–	–	300	10578
Vietnam	–	–	200	8037
Australia	181	3889	143	1779
Mexico	–	–	20	1630
UK	5	518	3	275
Unspecified	–	–	720	19493
Other Countries	453	13680	++	1

Table – 21 : Imports of Magnesite (Not Calcined) (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**412**	**17890**	**478**	**11829**
Japan	379	12907	191	7500
UK	–	–	62	2803
Pakistan	–	–	220	1362
Italy	–	–	4	97
Thailand	–	–	1	67
Other Countries	33	4983	–	–

Table – 22 : Imports of Magnesite (Calcined) (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**21758**	**752797**	**13239**	**415407**
Ireland	21185	735933	9915	315254
Netherlands	–	–	500	15466
Japan	19	1701	357	10151
Spain	425	12567	262	5894
Russia	–	–	180	5265
Czech Rep.	40	1101	180	5176
China	71	939	100	4075
German	–	–	40	1138
Australia	–	–	2	72
Unspecified	–	–	1703	52898
Other countries	18	556	++	18

Table – 23 : Imports of Magnesite : Dead-Burnt Magnesia (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ ’000)	Qty (t)	Value (₹ ’000)
All Countries	**13950**	**267092**	**16579**	**320044**
China	11095	189794	14205	256968
Australia	913	31124	1144	27097
Netherlands	270	12280	500	19340
Ireland	–	–	168	6246
Turkey	–	–	200	4127
Pakistan	–	–	163	1967
Greece	19	476	75	1886
Slovak Rep	1296	26081	76	1530
Unspecified	–	–	48	883
Other countries	357	7337	–	–

Table – 24 : Imports of Magnesite (Other) (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ ’000)	Qty (t)	Value (₹ ’000)
All Countries	**13475**	**455700**	**10500**	**328451**
Ireland	9229	318747	5126	154829
Japan	3314	109494	3191	108710
Netherlands	60	2014	680	21341
Australia	–	–	587	15798
Belgium	6	354	371	11100
China	515	15436	311	8589
Spain	27	598	107	2617
UK	3	343	36	2095
Greece	–	–	60	1591
USA	9	635	5	1373
Other countries	312	8079	26	408

Table – 25 : Imports of Magnesium Oxide (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**4677**	**232483**	**6264**	**270221**
China	684	21196	3634	91695
Japan	1513	93423	753	71381
USA	613	31106	956	47854
Israel	198	15649	228	20468
Germany	53	7985	64	5969
UK	83	5461	396	23073
France	9	2798	7	2291
Greece	220	8329	80	2689
Korea Rep	20	1200	22	1378
Chinese Taipei	_	_	92	1374
Other countries	1284	45336	32	2049

Table – 26 : Imports of Magnesium & Scrap (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**8644**	**1333187**	**11151**	**1566701**
China	8280	1251708	10292	1408427
UK	11	17084	54	13703
USA	2	2782	71	17287
Austria	7	12103	6	10007
Russia	++	3596	459	78607
Switzerland	++	45	8	4878
Nigeria	128	11502	153	11152
Korea Rep	1	2326	43	10085
Malaysia	–	–	24	3206
Italy	11	8105	4	2373
Other countries	204	23936	37	6976

FUTURE OUTLOOK

Indian refractory industry, where more than 90% magnesite is used, is experiencing range of challenges. Demand for refractories is promising with India's cement and steel industries growth.

The non-refractory markets will also see strong demand particularly environmental, flame retardants and hydrometallurgy. There is need to explore and exploit magnesite for future demand. The consumption of magnesite in the organised sector has increased because of higher consumption reported by refractory industry. The apparent domestic demand of magnesite is estimated at 403,000 tonnes by 2011-12 and at 622,000 tonnes by 2016-17 at 9% growth rate as per the report of the Sub Group, Planning Commission of India.

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

MANGANESE ORE

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

55 Manganese Ore

Manganese in alloy form is an essential input in steel making and is one of the most important metals in an industrial economy. Manganese ores of major commercial importance are (i) pyrolusite (MnO_2, Mn 63.2%); (ii) psilomelane (manganese oxide, containing water and varying amounts of oxides of Ba, K and Na as impurities; Mn commonly 45-60%); (iii) manganite (Mn_2O_3. H_2O, Mn 62.4%); and (iv) braunite ($3Mn_2O_3$, $MnSiO_3$, Mn about 62% and SiO_2 about 10%).

Indian manganese ore deposits occur mainly as metamorphosed bedded sedimentary deposits associated with Gondite Series (Archaeans) of Madhya Pradesh (Balaghat, Chhindwara & Jhabua districts), Maharashtra (Bhandara & Nagpur districts), Gujarat (Panchmahal district), Odisha (Sundergarh district) and with Kodurite Series (Archaeans) of Odisha (Ganjam & Koraput districts) and Andhra Pradesh (Srikakulam &Visakhapatnam districts).

RESOURCES

The total resources of manganese ore in the country as on 1.04.2010 are placed at 430 million tonnes as per UNFC system. Out of these, 142 million tonnes are categorised as reserves and the balance 288 million tonnes are in the remaining resources category. Gradewise, ferro-manganese grade accounts for 8%, medium grade 11%, BF grade 34% and the remaining 47% are of mixed, low, others, unclassified, and not-known grades including 0.35 million tonnes of battery/chemical grade.

Statewise, Odisha tops the total resources with 44% share followed by Karnataka 22%, Madhya Pradesh 13%, Maharashtra 8%, Andhra Pradesh 4% and Jharkhand & Goa 3% each. Rajasthan, Gujarat and West Bengal together shared the reamining about 3% resources (Table - 1).

EXPLORATION & DEVELOPMENT

Details of exploration carried out for manganese ore by various agencies during 2010-11are given in Table - 2.

PRODUCTION, STOCKS AND PRICES

The production of manganese ore at 2.88 million tonnes during 2010-11 increased by 16% as compared to that in the previous year owing to increase in market demand.

There were 141 reporting mines during 2010-11 as against 142 in the previous year. Besides, manganese ore production was reported by nine and seven mines of iron ore in 2009-10 & 2010-11, respectively, as associated mineral. In all 85 producers reported production of manganese ore in 2010-11. Five principal producers operating 26 mines contributed 69% production. About 69% of the total production was reported by 15 mines, each producing more than 50,000 tonnes per annum, while 16% was contributed by 14 mines (including one associate mine) each in the production range of 20,000 to 50,000 tonnes. The remaining 15% production was reported by 113 manganese and 6 associate mines each producing up to 20,000 tonnes.

In 2010-11, twenty public sector mines jointly accounted for 45% of the total production. The contribution of captive mines was 11% of the total production.

As regards gradewise composition of production in 2010-11, 66% production was of lower grade (below 35 % Mn), 22% of medium grade (35-46%Mn) and 10% was of high grade (46% Mn and above). Production of manganese dioxide was 54,202 tonnes (2%) during the year as against 65,756 tonnes (3%) in the previous year.

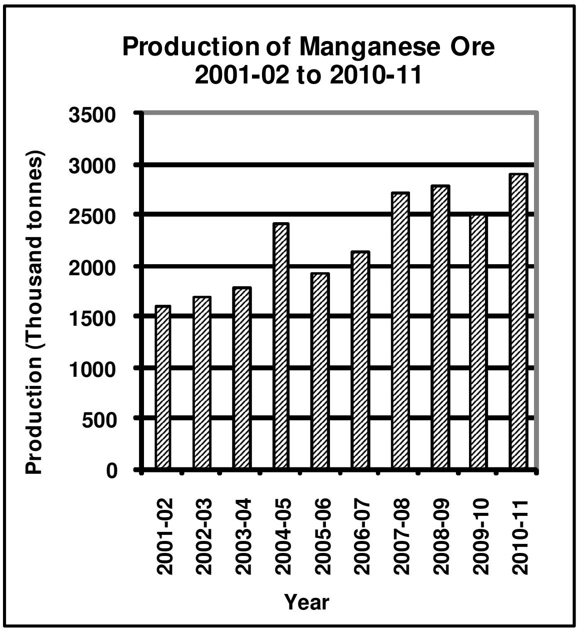


Table – 1 : Reserves/Resources of Manganese Ore as on 01.04.2010
(By Grades/States)

(In '000 tonnes)

State/Grade	Reserves				Remaining resources								Total
	Proved	Probable		Total	Feasibility	Pre-feasibility		Measured	Indicated	Inferred	Reconnsaissance	Total	resources
	STD111	STD121	STD122	(A)	STD221	STD221	STD222	STD331	STD332	STD333	STD334	(B)	(A+B)
All India : Total	**97427**	**11591**	**32961**	**141979**	**23530**	**27593**	**51075**	**5732**	**23726**	**151703**	**4644**	**288003**	**429982**
By Grades													
Battery/Chemical	67	–	45	112	–	8	–	4	26	202	–	240	352
Ferro-manganese	9985	1053	1832	12870	692	3349	2214	3703	3031	9267	330	22586	35456
Medium	4736	194	3764	8694	8482	1356	9595	388	1333	18382	498	40034	48728
BF	33282	3076	13536	49894	5680	8975	11338	360	10835	58109	664	95961	145855
Mixed	1214	188	361	1763	–	66	51	–	–	9400	2100	11617	13380
Medium & BF mixed	6346	900	5017	12263	101	1432	4665	548	1087	23441	750	32024	44287
Ferro-manganese, medium & BF mixed	28879	1998	3665	34542	5928	5751	11387	80	1862	6099	55	31162	65704
Ferro-manganese & BF	1604	253	569	2426	77	320	7678	189	1506	4132	–	13902	16328
Low (-)25% Mn	1505	2	140	1647	464	349	764	237	3713	1925	54	7506	9153
Others	4763	1055	2053	7871	1082	1767	384	223	14	2554	28	6052	13923
Unclassified	3762	1617	1788	7167	191	4212	2348	–	29	13271	165	20216	27383
Not-Known	1284	1255	191	2730	833	8	651	–	290	4921	–	6703	9433
By States													
Andhra Pradesh	1719	596	1841	4156	412	130	251	188	4176	7877	410	13444	17600
Goa	420	32	222	674	156	1674	3814	48	261	6968	–	12921	13595
Gujarat	–	–	–	–	–	–	–	–	–	2954	–	2954	2954
Jharkhand	1250	620	1586	3456	396	211	3053	–	–	6594	–	10254	13710
Karnataka	11455	1827	2820	16102	6056	3730	7523	2227	7385	52893	270	80084	96186
Madhya Pradesh	30094	1944	2954	34992	7769	3934	1719	2179	943	4190	–	20734	55726
Maharashtra	10000	2210	108	12318	497	3010	12001	–	1589	4655	84	21836	34154
Odisha	41354	4361	22784	68499	8244	14906	22714	1090	9371	61343	3880	121548	190047
Rajasthan	1134	–	647	1781	–	–	–	–	–	4030	–	4030	5811
West Bengal	–	–	–	–	–	–	–	–	–	200	–	200	200

Figures rounded off.

Table : 2 : Details of Exploration Activities for Manganese Ore, 2010-11

Agency/ State/ District	Location/ Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of bore-holes	Meter-age		
GSI							
Madhya Pradesh Jhabua.	-	-	-	-	-	-	Reconnaissance stage investigation (G-4) was taken up in a Aravalli belt to delineate Mn ore bearing quartzite-phyllite sequence through large scale mapping, pitting, trenching, sampling, geophysical survey and scout drilling. The work is in progress.
Maharashtra Nagpur.	Parseoni extn. area	Detailed mapping	0.6	-	-	21 pit	Prospecting (G-3) stage investigation was continued in this area in 2010-11. Detailed mapping was carried out around old workings of Savali and Mohgaon area along with pitting, trenching and geophysical, magnetic & gravity surveys. The Savali old working has a length of 54 m with width varying from 1 m to 7.5 m and depth up to 5 m. The manganese ore is braunite with subordinate psiomelane/pyrolusite bands of 160 m length and widths varing from 1 m to 1.5 m. These were delineated by digging pits in Savali block. Chemical analysis of pit samples so far received indicated low phosphorus manganese ore. In Mohgaon area 10 manganese ore bands varying in length from 30 m to 75 m and width varying from 0.5 m to 2.5 m were delineated. Drilling will be taken up after the interpretation of geological & geophysical work. The work is continued.
Odisha							
Kendujhar	Damurda South block, Bolani South Block & Bolani NE Block	–	–	07	537.75 m	–	Prospecting (G-3) stage investigation has been carried out. The manganese ore in the area occures with duricrusted laterite near the surface. The nature of ore is lumpy, friable and powdery. seven boreholes were completed and two boreholes are in progress. All the 7 boreholes intersected mineralised zones which have a strike length of 300 m. Thickness varied from 0.20 m to 12.0 m with Mn > 10%(V.E.). Analytical data of samples received so far showed Mn content varying from 10.44% to 42.16% and Fe from 11.17 % to 22.61%. Inferred ore resources were estiamted at about 0.152 million tonnes with an average grade of 18.98% Mn.

Table - 2 (Contd.)

Agency/ State/ District	Location/ Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
Odisha							
Kendujhar	Balagorha-Champausahi area	–	–	–	–	–	Reconnaissance stage investigation (G-4) was continued in the area to search for potential manganese ore bodies which occur as lenses and pockets within the manganiferrous laterite on the dip slope of the hills. The manganese ore is of both hard and soft in nature. Mineralisation is recorded along the fracture planes of brecciated chert as cavity feelings and within the porous and cavernous laterite. A potential Mn mineralised zone over 300 m strike length and 30-40 m and width has been delineated. The work is in progress.
Directorate of Geology							
Maharashtra							
Nagpur	Parseoni Area	1:25000	37.0	-	-	-	Manganese exposures were noticed near Village Savali & Mohgaon. Trenching of 39.0 cu m was carried out and samples were collected from surface and pits.
Directorate of Geology and Mining							
Odisha							
Kendujhar	Harmutu Gemlai Rugudihi Panduliposi	1:25,000	50.0	-	-	47 rock 10 manganese ore	Few manganese occurrences near Panduliposi, west of Harmutu and Chordiaburu Hill did not appear to be promosing.
GMDC							
Gujarat							
Panchmahals	Shivrajpur	1:1000	424.20 (ha)	10	1200	-	Manganese occured as lenticular deposit in metamorphic rocks belonging to Champaner series of Aravalli system. Deposits are of epigenetic origin. Pyrolusite and psilomelane are the principal minerals. The belt is 22 km long with 0.5 km width. Thickness of orebody varied from few cm to 5 m.
MOIL							
Madhya Pradesh							
Balaghat	Tirodi mine Teh - Katangi	1;1000	1.2 Hect.	01	76	-	As on 01.04.2011, 1.61 million tonnes of in situ reserves were estimated .
	Balaghat mine At Bharweli	–	–	02	1401	-	About 24.58 million tonnes manganese ore resources were estimated.

(Contd.)

Table - 2 (Concld.)

Agency/ State/ District	Location/ Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
MOIL							
Maharashtra							
Bhandara	Dongri Buzurg Mine Teh. Tumsar	–	–	04	1095	–	As on 01.04.2011, 11.22 million tonnes of in situ reserves were estimated .
-do-	Chikla mine Post - Sitasongi Teh. Tumsar	–	–	02	380	–	Estimated 4.22 million tonnes of manganese ore reserves as on 01.04.2011.
Nagpur	Beldongri Mine Teh. Parseoni	–	–	–	–	–	As on 01.04.2011, about 0.40 million tonnes reserves of manganese ore were estimated .
-do-	Gumgaon Mine Vill. Teghai Teh. Saoner	–	85.897 hect	04	1001.90	–	Exploratory mining of 38 m was carried out. As on 01.04.2011. 4.34 million tonnes of manganese ore resources were estimated.
-do-	Kandri mine/vill Teh. Ramtek	–	–	–	779		Estimated 3.50 million tonnes of manganese ore reserves as on 01.04.2011.
-do	Mansar Mine Teh. Ramtek	–	–	-	187	–	Estimated about 4.66 million tonnes of manganese ore resources.

The average metal content was 33.43% Mn in 2010-11 as against 34.65% Mn in the previous year.

Madhya Pradesh & Odisha being the leading producing states accounted for 25% and 23% of the total production, respectively, in 2010-11. Next in the order of production were Maharashtra (22%), Karnataka (14%) and Andhra Pradesh (10%). The remaining about 6% of the total production was reported from the states of Gujarat, Goa, Jharkhand and Rajasthan (Tables - 3 to 7).

The mine-head stocks increased to 798 thousand tonnes at the end of 2010-11 from 625 thousand tonnes at the beginning of the year (Tables - 8 (A) and 8 (B).

The average daily employment of labour strength in manganese ore mines was 13,480 in 2010-11 as against 13,806 in the previous year. Prices of manganese ore are furnished in the General Review on "Prices".

Table – 3 : Principal Producers of Manganese Ore, 2010-11

Name & address of Producer	Location of mine	
	State	District
MOIL Ltd. (formerly)Manganese Ore (India) Ltd, MOIL Bhavan, 1A, Katol Road, Chhaoni, Nagpur – 440 013, Maharashtra.	Madhya Pradesh Maharashtra	Balaghat 1. Bhandara 2. Nagpur
Tata Steel Ltd, 24, Homi Mody Street, Fort, Mumbai – 400 001.	Odisha	1. Kendujhar 2. Sundergarh
The Orissa Manganese & Minerals (P) Ltd, At Post Koira via, Rourkela - 770 048, Dist. Sundergarh, Odisha.	Odisha	Sundergarh
The Sandur Manganese & Iron Ores Ltd, Lakshmipur, Sandur, Dist. Bellary, Karnataka.	Karnataka	Bellary
Gujarat Mineral Development Corp. Ltd, Mnaganese Project, Shivarajpur, Ta Halol, Dist. Panchmahal, Gujarat.	Gujarat	Panchmahal

Table – 4 : Principal Producers of Manganese Dioxide, 2010-11

Name & address of Producer	Location of mine	
	State	District
MOIL Ltd, MOIL Bhavan, 1A, Katol Road, Chhaoni, Nagpur – 440 013, Maharashtra.	Maharashtra	Bhandara
Tata Steel Ltd, 24, Homi Mody Street, Fort, Mumbai – 400 001.	Odisha	Kendujhar
Orissa Manganese & Minerals (P) Ltd, P.O. Koira – 770 048, Dist. Sundergarh, Odisha.	Odisha	Sundergarh
Mangilal Rungta, P. O. Chaibasa – 833 201, Dist. West Singhbhum, Jharkhand.	Odisha	Kendujhar
Orissa Mineral Development Co Ltd, P.O. Thakurani – 758 035, Via - Barbil, Dist. Kendujhar, Odisha.	Odisha	Kendujhar

Table – 5 : Production of Manganese Ore, 2008-09 to 2010-11(P) (By States)

(Quantity in tonnes; value in ₹ '000)

State	2008-09		2009-10		2010-11(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**2789025**	**17737032**	**2491950**	**11905233**	**2881080**	**13695816**
Andhra Pradesh	184552	307092	260628	332916	282876	471780
Goa	1170	2776	770	1047	590	2750
Gujarat	-	-	55090	27270	173383	86041
Jharkhand	16044	14025	39875	41472	5759	25463
Karnataka	332686	638173	301163	611165	404948	756354
Madhya Pradesh	726114	6234950	607148	4094882	722109	4672602
Maharashtra	680629	7364783	613520	4618651	623078	4224429
Odisha	839930	3163383	605313	2165165	651699	3431440
Rajasthan	7900	11850	8443	12665	16638	24957

Table – 6 (A) : Gradewise Production of Manganese Ore, 2009-10 (By Sectors/States/Districts)

(Quantity in tonnes; value in ₹'000)

State/ District	No. of mines	MnO_2	Production By Grades: Mn Content above 46%	35% - 46%	25% - 35%	below 25%	Total Quantity	Value
India	**142(9)**	**65756**	**327283**	**621346**	**1178704**	**298861**	**2491950**	**11905233**
Public sector	20(1)	13557	291899	303171	433249	139087	1180963	8362139
Private sector	122(8)	52199	35384	318175	745455	159774	1310987	3543094
Andhra Pradesh	**35**	**-**	**-**	**10470**	**221285**	**28873**	**260628**	**332916**
Adilabad	11	-	-	-	-	16223	16223	45399
Vizianagaram	24	-	-	10470	221285	12650	244405	287517
Goa	**2**	**-**	**-**	**770**	**-**	**-**	**770**	**1047**
South Goa	2	-	-	770	-	-	770	1047
Gujarat	**1**	**-**	**-**	**-**	**-**	**55090**	**55090**	**27270**
Panchmahal	1	-	-	-	-	55090	55090	27270
Jharkhand	**3(3)**	**96**	**150**	**1284**	**36240**	**2105**	**39875**	**41472**
Singbhum West	3(3)	96	150	1284	36240	2105	39875	41472
Karnataka	**19**	**-**	**-**	**68798**	**216379**	**15986**	**301163**	**611165**
Bellary	10	-	-	68798	169209	775	238782	501340
Chitradurga	4	-	-	-	4270	-	4270	12493
Davangere	2	-	-	-	36179	15211	51390	74914
Shimoga	1	-	-	-	221	-	221	155
Tumkur	2	-	-	-	6500	-	6500	22263
Madhya Pradesh	**25**	**-**	**212431**	**103933**	**158163**	**132621**	**607148**	**4094882**
Balaghat	23	-	212431	101853	106849	105459	526592	3941004
Chhindwara	1	-	-	-	1558	-	1558	3116
Jhabua	1	-	-	2080	49756	27162	78998	150762
Maharashtra	**15**	**13557**	**82289**	**229935**	**283620**	**4119**	**613520**	**4618651**
Bhandara	3	13557	42280	173723	182965	5	412530	3169390
Nagpur	12	-	40009	56212	100655	4114	200990	1449261
Odisha	**40(6)**	**52103**	**32413**	**206926**	**253804**	**60067**	**605313**	**2165165**
Kendujhar	20(5)	51535	31827	117554	114662	9875	325453	988668
Sundergarh	20(1)	568	586	89372	139142	50192	279860	1176497
Rajasthan	**1**	**-**	**-**	**-**	**8443**	**-**	**8443**	**12665**
Banswara	1	-	-	-	8443	-	8443	12665

Figures in parentheses indicate associated mines of iron ore.

Table – 6 (B) : Gradewise Production of Manganese Ore, 2010-11 (P) (By Sectors/States/Districts)

(Quantity in tonnes; value in ₹ 000)

State/ District	No. of mines	MnO_2	Production By Grades: Mn Content above 46%	35% - 46%	25% - 35%	below 25%	Total Quantity	Value
India	**141(7)**	**54202**	**286274**	**625933**	**1464047**	**450624**	**2881080**	**13695816**
Public sector	20	4455	245314	282203	528909	238077	1298958	8090634
Private sector	121(7)	49747	40960	343730	935138	212547	1582122	5605182
Andhra Pradesh	**36**	**-**	**-**	**5600**	**239683**	**37593**	**282876**	**471780**
Adilabad	11	-	-	-	-	16463	16463	52304
Vizianagaram	25	-	-	5600	239683	21130	266413	419476
Goa	**4**	**-**	**-**	**200**	**240**	**150**	**590**	**2750**
South Goa	4	-	-	200	240	150	590	2750
Gujarat	**1**	**-**	**-**	**-**	**-**	**173383**	**173383**	**86041**
Panchmahal	1	-	-	-	-	173383	173383	86041
Jharkhand	**2(1)**	**184**	**1020**	**2271**	**1629**	**655**	**5759**	**25463**
Singbhum West	2(1)	184	1020	2271	1629	655	5759	25463
Karnataka	**20**	**-**	**-**	**64459**	**315519**	**24970**	**404948**	**756354**
Bellary	10	-	-	64459	237637	-	302096	546632
Chitradurga	5	-	-	-	243	2552	2795	5321
Davangere	2	-	-	-	65982	22368	88350	164676
Shimoga	1	-	-	-	124	50	174	224
Tumkur	2	-	-	-	11533	-	11533	39501
Madhya Pradesh	**28(1)**	**-**	**20573**	**484035**	**282090**	**150250**	**722109**	**4672602**
Balaghat	24(1)		20541	674355	179964	84753	544488	3955153
Chhindwara	1	-	318	9680	13423	14387	37808	187524
Jhabua	1	-	-	-	88703	51110	139813	529925
Maharashtra	**19**	**4455**	**47522**	**225459**	**341847**	**3795**	**623078**	**4224429**
Bhandara	4	4455	13918	146720	257776	357	423226	2762128
Nagpur	15	-	33604	78739	84071	3438	199852	1462301
Odisha	**30(5)**	**49563**	**31998**	**243909**	**266401**	**59828**	**651699**	**3431440**
Kendujhar	15(4)	48348	31582	146269	143452	15884	385535	1583002
Sundergarh	15(1)	1215	416	97640	12294	43944	266164	1848438
Rajasthan	**1**	**-**	**-**	**-**	**16638**	**-**	**16638**	**24957**
Banswara	1	-	-	-	16638	-	16638	24957

Figures in parentheses indicate associated mines of iron ore.

Table – 7 : Production of Manganese Ore, 2009-10 and 2010-11(P) (By Frequency Groups)

(Quantity in tonnes)

Production Group	No. of mines 2009-10	No. of mines 2010-11	Production 2009-10	Production 2010-11	Percentage in total Production 2009-10	Percentage in total Production 2010-11	Cumulative % 2009-10	Cumulative % 2010-11
Total	**142(9)**	**141(7)**	**2491950**	**2881080**	**100.00**	**100.00**		
Up to 1000	53(3)	54(1)	19132	11971	0.77	0.42	0.77	0.42
1001 - 5000	39(3)	31(3)	103176	71115	4.14	2.47	4.91	2.89
5001 - 10000	13	7(1)	96529	44424	3.87	1.54	8.78	4.43
10001 - 20,000	11(1)	21(1)	159319	298041	6.39	10.34	15.17	14.77
20,001 - 30,000	6	2	144072	56200	5.78	1.95	20.95	16.72
30,001 - 40,000	3(2)	8(1)	182040	277218	7.31	9.62	28.26	26.34
40,001 - 50,000	2	3	85791	139751	3.44	4.85	31.70	31.19
50,001 & above	15	15	1701891	1982360	68.30	68.81	100.00	100.00

Figures in parentheses indicate associated mines of iron ore.

Tabe – 8 (A) : Mine-head Stocks of Manganese Ore at the beginning of 2010-11 (By States and Grades)

(In tonnes)

State	Grades : Mn content					
	MnO_2	above 46%	35% - 46%	25% - 35%	Below 25%	Total
India	**8204**	**25770**	**120916**	**245217**	**225158**	**625265**
Andhra Pradesh	–	–	257	25401	9517	35175
Goa	–	-	-	1175	768	1943
Jharkhand	–	44	191	6849	554	7638
Karnataka	–	-	–	24941	85454	110395
Madhya Pradesh	–	9355	14716	20013	92384	136468
Maharashtra	3767	8422	16702	13926	10373	53190
Odisha	4437	7949	89050	149883	26108	277427
Rajasthan	–	–	–	3029	–	3029

Tabe – 8 (B) : Mine-head Stocks of Manganese Ore at the end of 2010-11(P) (By States and Grades)

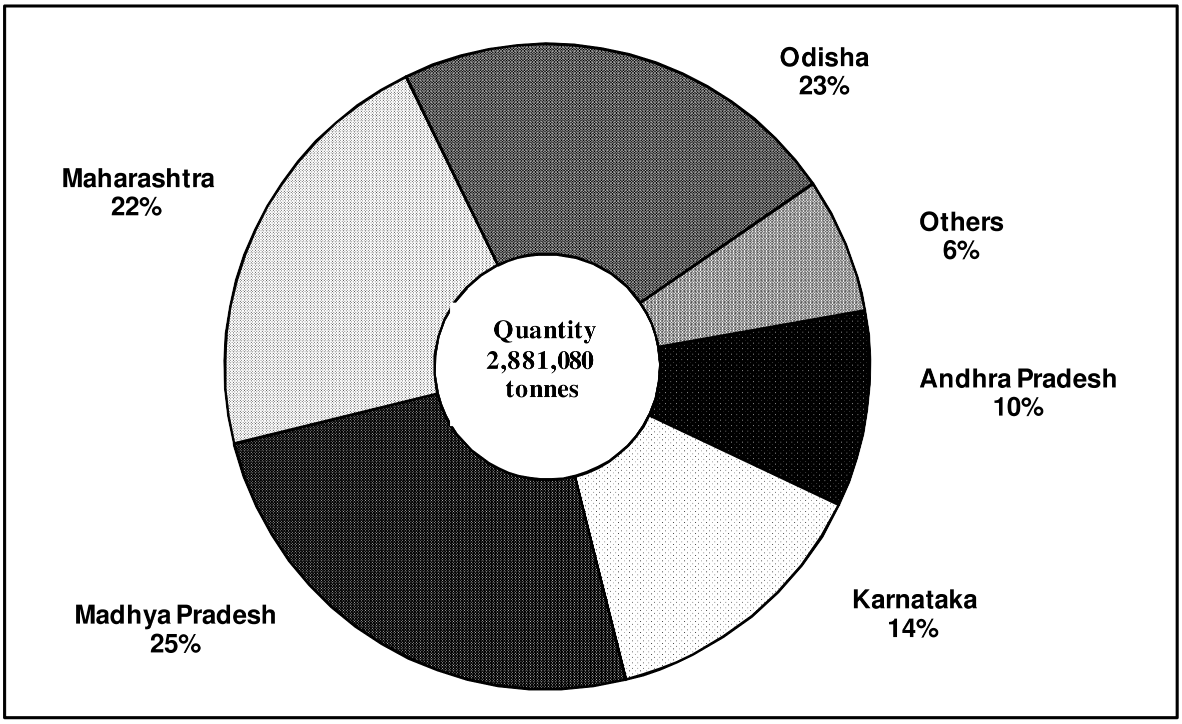
(In tonnes)

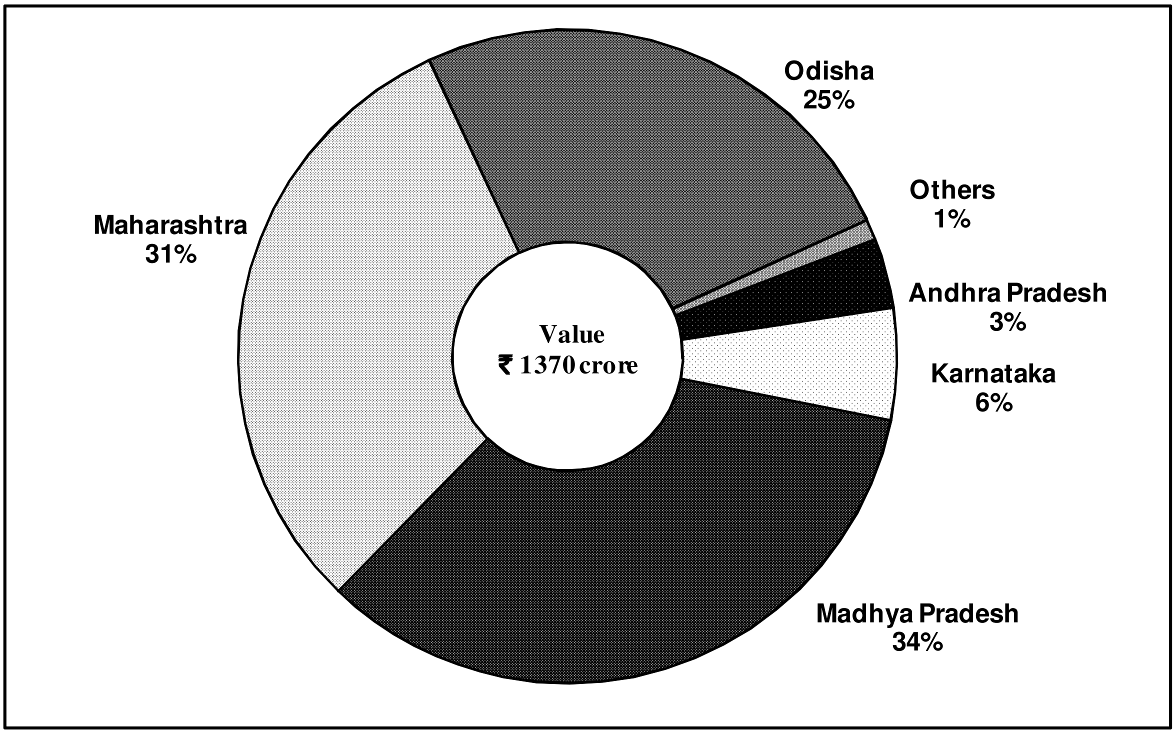
State	Grades : Mn content					
	MnO_2	above 46%	35% - 46%	25%-35%	Below 25%	Total
India	**4894**	**23941**	**156782**	**436332**	**176057**	**798006**
Andhra Pradesh	–	–	257	38809	3413	42479
Goa	–	–	-	4665	150	4815
Jharkhand	7	289	332	4032	285	4945
Karnataka	–	–	84	25335	48478	73897
Madhya Pradesh	–	10367	17290	90205	93113	210975
Maharashtra	1784	7581	63627	65110	12094	150196
Odisha	3103	5704	75192	206544	18524	309067
Rajasthan	–	–	–	1632	–	1632

MINING, PROCESSING, MARKETING & TRANSPORT

Manganese ore mining in the country is carried out by opencast as well as by underground methods. Of the 141 mines, 8 are underground (3 in Madhya Pradesh and 5 in Maharashtra). Seven underground mines were operated by MOIL, a public sector company, and one by M/s J.K. Minerals, Balaghat (Madhya Pradesh), a private company. All the underground mines are mechanised or semi-mechanised and adopt cut and fill method of stoping. In Kandri mine, hydraulic sand stowing is introduced in place of manual filling system. The system is faster, cheaper and requires less manpower. Conventional timber supports are replaced by cable bolting pre-mining support to increase safety and productivity. In Balaghat underground mechanised mine, overhand flat back cut and fill method with rock bolting support and sand stowing to fill up the voids is being practised with a level interval of 30 m and size of stope block as 30 m x 30 m to 60 m x 30 m. Side Dump Loaders (SDL) of 0.66 cu m bucket capacity were also deployed in underground levels for mechanised loading of run of mine (r.o.m.) in stopes. Tyre mounted Rocker shovel was also introduced in Balaghat mine for mechanised loading of ore from ore drive at stripping area. Deepening of vertical

Quantity and Value of Manganese Ore Production in Different States, 2010-11





shaft was completed in Balaghat and Beldongri mines of MOIL. Sinking of vertical shafts is in proress at Mansar and Ukwa mines.

The open-pits are worked manually by benching method, using portable compressors, jackhammers and dumper trucks. Tirodi mine of MOIL is worked by opencast mechanised method. Height of the benches in overburden is kept at 7.5 m and that in the ore at 6 m. Drills of 100 mm dia with 0.9 to 1.7 m^3 capacity of shovels and 20-25 tonnes dumpers are used for production, loading & transport.

The workings vary from shallow depth in lateritoid-type deposits in Odisha, Karnataka and Goa to deep operations in deposits of a more regular nature found in Madhya Pradesh, Maharashtra and Andhra Pradesh. Where the overburden is soft, bulldozers are used. In a few cases, tramways are laid up to the working face and loaded tubs pushed manually to the dumping ground. In Odisha, Goa and Karnataka, ore is worked by loosening the ground either with crowbars or by blastings. After picking up manganese ore, the waste is removed to the dumping ground. Mining of bedded ore in Madhya Pradesh and Maharashtra is generally carried out by drilling and blasting.

Hand sorting and visual grading are adopted widely to upgrade the ore. Scrubber is also used for washing the ore at some mines. Manual as well as mechanised jigging is done in a few mines.

MOIL has set up an integrated manganese ore beneficiation plant at Dongri Buzurg mine in Bhandara district, Maharashtra, with 4 lakh tonnes annual capacity to process r.o.m. The plant is equipped with handling, crushing, wet screening, drying and magnetic separation facilities in one complex. MOIL has installed a manganese ore beneficiation plant of 500,000 tonnes per annum capacity at Balaghat mine in order to conserve mineral and profitably utilise low/medium grade ore. The plant facilities include crushing, wet screening, classification and jigging operations.

The plant upgrades the low/medium fines into high grade and the value addition is around 3-4 times, in case of low grade fines. The company is planning to set up a sintering plant for agglomeration of these fines. After agglomeration these fines will be utilised in ferro-alloys production.

Most of the producers market manganese ore directly to the industrial units. In a few cases, especially in case of supplies of special type of ore or a semi-processed product, middlemen are found to be involved in marketing. Ore from mines is usually sold to the domestic consumers, either at the rail-head or ex-plant. In case of integrated iron and steel and ferro-manganese industry, the units draw their supplies largely from captive mines. However, special ore types for specific purposes are obtained from other producers. In case of ore meant for export, producers other than MOIL supply it to MMTC, the canalising agency, either at rail-head or at the port. MOIL exports its own ore.

Transport of manganese ore from mines to rail-head is generally done by trucks from where it is transported to ports by rail wagons. From the mine of MOIL in Balaghat district, Madhya Pradesh, the ore is transported by aerial ropeways to the loading bins at the rail-heads. Battery loco was introduced for underground transport of r.o.m. tub from ore pass chute to skip bunker. In Goa, ore, in bulk, is carried by road-cum-river routes up to Marmugao harbour and in a few cases by rail where the mines are close to the railways. The ore loading at river-head into barges is carried out both manually and mechanically.

ENVIRONMENTAL PROTECTION

MOIL carried out mass afforestation work to maintain ecological balance at mines. R&D work was taken up by them for reclamation of old mined out areas and to ascertain the impact of manganese mining on ecology including air and water pollution. At Gumgaon mine, a sericulture project has been established as a part of socio-economic programme and even on waste debris dumps, a forest has been developed.

MOIL has planted about 17.14 lakh saplings till 2010-11 including 53,000 saplings during 2010-11 at different mines. The major species planted are Shishum Cassia, Teak, Neem, Eucalyptus and Mangoes. A drive has been initiated for plantation of jatropa saplings in arid/ dry and waste dumps, whose seeds will be utilised for production of bio-fuels on trial basis.

Chandrapur ferro-alloys plant & SAIL (formerly Maharashtra Electrosmelt Ltd) has continuously taken steps towards gainful utilisation of high MnO slag in silico-manganese production, lumpy silico-manganese slag as rail ballast and for road construction as a step towards solid waste management.

Manganism - a health condition attributed to manganese poisoning - has been reported to be detected in case of five persons working with BHP Billiton's Metalloys manganese alloys plant in South Africa. Manganism shows symptoms similar to Parkinson's disease and psychotic behaviour but conditions of development of the disease are not properly understood.

USES & SPECIFICATIONS

Classification of manganese ore, ferruginous manganese ore, silicious manganese ore, dioxide manganese ore, and manganiferous iron ore is laid down by BIS vide specification no. IS : 11895- 2006 (Reaffirmed 2008). Manganese ore is an important material in iron and steel metallurgy where it is used both in the ore form as such and as ferro-manganese. Manganese improves strength, toughness, hardness and workability of steel, acts as a deoxidiser and desulphuriser and also helps in getting ingots free from blowholes. About 90 to 95% world production of manganese ore is used in metallurgy of iron and steel. Manganese has no satisfactory substitute in its major applications. The specifications of manganese ore by different industries are detailed below:

In iron and steel industry, the BIS:11281-2005(Reaffirmed 2008) specification is laid down for manganese ore. However, specifications based on the user industry indicate that normally manganese ore containing 28 to 35% Mn is used. Ore size generally varies from 10 to 40 mm. For other constituents general stipulations are Fe: 16 to 22%, SiO_2: 2 to 8%, Al_2O_3: 5 to 8% and P: 0.3% maximum.

For manganese ore used in ferro-manganese industry, besides manganese content, other important considerations are high manganese to iron ratio and a very low content of deleterious phosphorus. Specifications of manganese ore for ferro-manganese, are prescribed by the Bureau of Indian Standards vide IS: 4763-2006, Second Revision, Reaffirmed 2010. BIS has also laid down the specifications of manganese ore sinters for blending for ferro manganese production vide IS:12596-1989 (Reaffirmed 2009). User's specifications of manganese ore for ferro-manganese/silico-manganese industreis are furnished in Table- 9.

Manganese dioxide is used for manufacturing dry cell batteries in which it functions as a depolariser of hydrogen. For use in dry cell battery, BIS has prescribed Specification No. IS:11153-1996 (First Revision, Reaffirmed 2010) for manganese dioxide. Suitability of ore depends not only on manganese dioxide content but also on its crystallographic structure. Ore having predominant gamma structure is required. The ore must have high manganese dioxide and low iron contents, a certain degree of porosity and moderate hardness. It should be free from metallic compounds such as copper, nickel, cobalt, arsenic, lead and antimony which are electronegative to zinc (container). The user industry specifications are MnO_2 70% (min), Fe 6% (max), moisture 4% (max), Cu 0.02% (max) and Ni 0.02% (max). The size requirement lays down that 90% material should pass through 300 mesh and 100% through 100 mesh. User industry specifications for electrolytic manganese dioxide (EMD) used in dry cell battery are MnO_2 90% (min), Fe (as oxide) 0.05% (max), moisture 4% (max), Pb 0.15% (max) and pH 4.5 to 5.6. The size requirements are same as those for manganese dioxide ore.

In chemical industry, generally high-grade material is used for potassium permanganate. Ore containing MnO_2 80% (min), SiO_2 5% (max), Fe_2O_3 5% (max) and 200 to 250 mesh ore size is used. In glass industry, ore analysing MnO_2 80% (preferably 86% min), Fe_2O_3 5% (preferably 0.75% max), SiO_2 2.8% (max), Al_2O_3 1.1% (max), BaO 1.3% (max), CaO 0.4% (max) and MgO 0.4% (max) is consumed.

Table – 9 : User's Specifications of Manganese Ore in different Ferro-manganese/Silico-manganese Units

Name and location of plant	Specifications of ore consumed
Andhra Pradesh	
Ferro-Alloys Corp. Ltd, Shreeram Nagar, Dist. Vizianagram.	Mn: 70-75% C: 6-8%
Nav Bharat Ferro-Alloys Ltd, Paloncha, Khammam.	Mn: 28-50%, P: 0.1-0.3%, SiO_2: 8-30% Fe :5-8%
Chhattisgarh	
Chhattisgarh Electricity Co. Ltd, Siltara, Raipur.	Mn: 28-30% (Low P) Mn: 37-40%, 42-44%, 46% (High P)
Monnet Ispat & Energy Ltd, Raipur	Mn: 46 - 28% Fe : 16 - 05% SiO_2: 34 - 06% S & P: 0.05 - 0.28% Size: 0 - 100% (lumps & fines)
Hira Group of Industries, Raipur	
i) Jain Carbides & Chemicals Ltd, Raipur (Unit-I).	Mn: 32-35%
ii) Jain Carbides & Chemicals Ltd, Raipur (Unit-II).	Mn: 32-35%
Karnataka	
S.R. Chemicals & Ferro Alloys, Belgaum.	Mn: 38-40%, Fe: 18-23%
Thermit Alloys Ltd, Shimoga.	Mn: 48-54%
Kerala	
INDSIL Hydro Power and Manganese Ltd, Pallatheri Palakkad.	Fe-Mn ratio 1:3 to 5% (50%) 1:5 to 8% (50%) P: 0.05% max Al_2O_3: 3 to 5% max
Madhya Pradesh	
MOIL, Ferro-manganese Plant, Bharveli, Dist. Balaghat	Mn: 46-48%
Maharashtra	
Chandrapur Ferro Alloys Ltd. (Formerly Maharashtra Electro-Smelt Ltd,) Chandrapur.	Mn: 38-46%, Fe: 6-17% SiO_2+Al_2O_3: 10-16% P: 0.5-0.25% max +100 mm 10% max +10-100 mm, 80-85% min +5-10 mm 10% max
Nagpur Power & Industries Ltd, Nagpur.	Mn: 42-46%, Fe: 7-8%, SiO_2: 3.6%, Al_2O_3: 6-7%, P: 0.10-0.12% Size: 5-25 mm
Natural Sugar & Allied Ind. Ltd, Sai Nagar Ranjani, Dist. Osmanabad	Size: 10-80 mm
Odisha	
Tata Steel Ltd, Joda, Keonjhar.	Mn: 43%, min. (for FeMn) 36% min. (for SiMn), Size: 10-75 mm (for FeMn & SiMn) **Captive Mn Ore** — **Size (mm)** Below 35% — (10-75) + 5% 35% to 46% — (10-75) + 5% 46% to 49% — (10-75) + 5% Dioxide + 49% — (10-75) + 5% **MOIL, Mn Ore** Below 35% — (10-75) + 5% Imported Mn 46 to 49% — (10-75) + 5%
Tamil Nadu	
Silcal Metallurgical Ltd, Ramanujanagar, Coimbatore.	Mn: 35-40% & above Size: 35 mm
West Bengal	
Cosmic Ferro Alloys Ltd, Bankura.	Size: 75 mm

Requirement of manganese dioxide for explosive and pyrotechnic industries as laid down in IS : 5713-1981 (First Revision, Reaffirmed 2011) by BIS is as follows: MnO_2 80% by mass (min), moisture 1% (max), matter soluble in water 0.2% (max) and water soluble chlorides (as NaCl) 0.05% (max). There are three types of material with above composition depending upon the particle size: Type A, Type B and Type C. Particle size (max) is 600 micron for Type A, 150 micron for Type B and 74 micron for Type C ore. In addition, grit content should be 1% (max) for Type A ore. For match industry, the MnO_2 content shall be 50% (min).

Pyrolusite is used generally to impart glaze to the pottery and to make coloured bricks. It also finds use as driers for oils, varnishes and paints. Manganese sulphide is used in the manufacture of salts and in calico printing. Manganese chloride is used in cotton textile as a bronze dye. Manganese salts are used in photography and in leather and matchbox industries.

CONSUMPTION

The reported consumption of manganese ore in all industries was about 3.48 million tonnes in 2010-11 as against 2.92 million tonnes in 2009-10. Silico-manganese (64%) and ferro-alloys (31%) industries together accounted for about 95% consumption followed by iron & steel (4%). The remaining (1%) was shared by battery, chemical, zinc smelter, alloy steel, glass, and abrasive industries (Table-10).

The reported consumption of ferro-manganese in 2010-11 increased to 123 thousand tonnes from 119 thousand tonnes in the previous year. Iron & steel industry was the bulk consumer of ferro-manganese accounting for about 93% consumption in 2010-11. The remaining 7% was consumed in alloy steel, foundry and electrode industries. Consumption of silico-manganese which was 194,600 tonnes in 2009-10 has marginally increased to 199,800 tonnes in 2010-11 (Tables - 11 & 12).

Table – 10 : Reported Consumption of Manganese Ore[1/], 2008-09 to 2010-11
(By Industries)

(In tonnes)

Industry	2008-09	2009-10(R)	2010-11(P)
All Industries	**2625900**	**2915800**	**3477600**
Alloy steel	100(1)	100(1)	100(1)
Battery[2/]	16900(6)	14900(6)	14600(6)
Chemical	1600(2)	1600(2)	1600(2)
Ferro-alloys	912000(22)	843000(28)	1070000(29)
Glass	100(2)	200(1)	200(1)
Silico-Manganese	1545500(e)	1919700(e)	2250000(e)
Iron & steel (incl pelletisation)	148000(11)	134600(17)	139400(17)
Zinc smelters	1700(2)	1700(2)	1700(2)

Figures rounded off.
Data collected on non-statutory basis.
Figures in parentheses denote the number of units in organised sector reporting consumption.*
(*) Includes actual reported consumption and/or estimates made wherever required)
1/ Besides, there are a number of SSI units manufacturing ferro-manganese and silico-manganese, data for which are not available. Excludes consumption of manganese ore fines which are used in making sinters which are in turn used in the manufacture of ferro-manganese, data for which are not available.
2/ Excludes consumption of indigenous and imported electrolytic manganese dioxide (EMD) which was estimated at about 5,500 tonnes each during 2008-09, 2009-10 and 2010-11, respectively. Also excludes consumption of natural manganese dioxide in the manufacture of EMD.

Table – 11 : Reported Consumption of Ferro-manganese, 2008-09 to 2010-11 (By Industries)

(In tonnes)

Industry	2008-09	2009-10(R)	2010-11(P)
All Industries	**120700**	**118800**	**122800**
Alloy steel	7900(10)	7900(10)	7900(10)
Electrode	500(9)	500(9)	500(9)
Foundry	700(18)	700(19)	700(19)
Iron & steel	111600(13)	109700(14)	113700(14)

Figures rounded off.
Data collected on non-statutory basis.
Figures in parentheses denote the number of units in organised sector reporting consumption.*
(Includes actual reported consumption and/or estimates made wherever required).*

Table – 12 : Reported Consumption of Silico-manganese, 2008-09 to 2010-11 (By Industries)

(In tonnes)

Industry	2008-09	2009-10(R)	2010-11(P)
All Industries	**195800**	**194600**	**199800**
Alloy steel	3100(5)	3100(5)	3100(5)
Foundry	200(3)	200(3)	200(3)
Iron & steel	192500(17)	191300(21)	196500(21)

Figures rounded off.
Data collected on non-statutory basis.
Figures in parentheses denote the number of units in organised sector reporting consumption.*
(Includes actual reported consumption and/or estimates made wherever required).*

INDUSTRY

Manganese alloy is the largest produced ferro-alloy in the world with a share of about 41% of the global production of ferro-alloys. Manganese is an essential requisite for iron and steel production owing to its capability for sulphur fixing, de-oxidising and good alloying properties. For production of one tonne of ferro-manganese, about 2.6 tonnes of manganese ore, 0.5 tonne of reductant and 3 MWH of electricity inputs are required. As per Indian Ferro Alloys Producers' Association (IFAPA), the total installed capacity of manganese alloys including ferro-manganese/silico-manganese in the country was estimated to be around 2.75 million tonnes per annum.

MOIL had set up a High Intensity Magnetic Separation Plant and 1,000 tpy Electrolytic Manganese Dioxide (EMD) Plant at Dongri Buzurg mine. The plant is under expansion to 1,500 tpy capacity. In 2010-11 about 805 tonnes of EMD was produced as against 1,150 tonnes in 2009-10. Ferro-manganese plant of 10,000 tonnes per annum capacity has been set up at Bharveli, Balaghat. It produced 9,081 tonnes ferro-manganese in 2010-11 as against 9,555 tonnes in 2009-10.

Ferro-manganese

The total production of various types of manganese alloys (high carbon ferro-manganese, medium carbon ferro-manganese and low carbon ferro-manganese) in 2010-11, as per Indian Ferro Alloys Producers' Association was about 4.04 lakh tonnes as against 3.56 lakh tonnes in 2009-10.

Silico-manganese

Silico-manganese is a combination of 60-70% Mn, 10-20% silica and about 20% carbon. As per the IFAPA, production of silico-manganese increased to 13 lakh tonnes in 2010-11 from 11.2 lakh tonnes in 2009-10. MOIL is considering setting up ferro-manganese and silico-manganese plants through joint venture companies with RINL and SAIL. SAIL & MOIL Ferro Alloys Pvt. Ltd will set up 31,000 tpy ferro-manganese and

75,000 tpy silico-manganese plants at Nandini near Bhilai, Chhattisgarh. The other joint venture company RINL MOIL Ferro Alloys Pvt. Ltd will set up a 20,000 tpy ferro manganese and 37,500 tpy silico-manganese plants at Bobbili, Vizianagaram district, Andhra Pradesh.

The major factor driving the production of manganese alloys is high production growth of low nickel austenitic stainless steel with India emerging as the largest producer of this steel where manganese is added substituting the expensive nickel.

Iron & Steel

Iron & steel industry was the second major consumer of manganese ore wherein manganese ore is used directly as a blast furnace feed. Details on consumption, specifications and source of supply of manganese ore to major iron & steel plants in the country in 2009-10 and 2010-11 are given in Table-13.

Dry Battery

Consumption of manganese dioxide ore in this industry was reported by 6 units which together accounted for 14,600 tonnes in 2010-11, (excluding EMD). The demand was met through imports, supported by indigenous production of manganese dioxide and EMD.

Dry battery industry also consumes EMD along with natural manganese dioxide ore. There are two plants producing EMD; one owned by MOIL in Bhandara district with 1,000 tpy capacity (under expansion to 1,500 tpy capacity) and the erstwhile Union Carbide Ltd at Thane, Maharashtra, with 2,500 tpy capacity.

SUBSTITUTES

Cost and technology militate substitution in major applications. However, for economic reasons, there is only limited substitution in minor applications in chemical and battery industries. The steel industry has, however, made great strides in economising the use of manganese, largely through changes in steel-making techniques.

TECHNICAL POSSIBILITIES

The deep-sea nodules can be a potential resource of manganese in the next century. There is a trend towards using lower grades of ores in ferro-manganese production. New steel-making practices and techniques are reducing the amount of manganese consumed in the process. However, counter balancing this to some extent is a trend towards higher manganese specifications for modern steels.

TRADE POLICY

Export Policy

The Foreign Trade Policy, 2009-14 and the policy on export puts restrictions on exports of manganese ore as follows:

HS Code	Item description	Policy	Nature of restriction
2602 0000	Manganese ores excluding the following: Lumpy/blended manganese ore with more than 46% Mn	State Trading Enterprise	Exports through (a) MMTC (b) MOIL for manganese ore produced in MOIL mines
2602 0010	Lumpy/blended manganese ore with more than 46% Mn	Restricted	Export permitted under licence

Import Policy

Imports of manganese ore and concentrates including ferruginous manganese ores and concentrates containing 20% or more manganese (calculated on dry weight basis), agglomerated manganese ore sinters, etc. are freely allowed.

WORLD REVIEW

The total world reserve of manganese ore is approximately 630 million tonnes of metal content which is unevenly distributed (Table-14). Reserves are located in South Africa (24%), Ukraine (22%), Brazil (17%), Australia (15%) and India (9%). Only a small fraction of global manganese reserves is clearly economic. This fact continues to support interest in deep-sea manganese nodules, which constitute an enormous untapped resource. Most nodules are found in areas of deep-sea floor at water depths of 5 to 7 km. The Pacific Ocean alone is estimated to contain about 2.5 billion tonnes nodules containing about 25% Mn, making them similar in abundance to low-grade land-based deposits. Most major steel-making nations lack manganese

Table – 13 : Consumption, Specifications and Source of Supply of Manganese Ore in Different Iron and Steel Plants, 2009-10 and 2010-11

Plant	Production of pig iron/hot metal (tonnes)		Consumption of Mn-ore (tonnes)		Specifications of ore consumed	Source
	2009-10	2010-11	2009-10	2010-11		
Bhilai Steel Plant, Bhilai Nagar, Durg, Chhattisgarh	Hot metal 5370002	Hot metal 5707852	7119	25656	Size: 25 to 85 mm Mn: 30% min SiO: 30% max Al_2O_3: 5% max	MOIL/Ramtek Goberwahi, Gua Mines SAIL, RMD P: 0.3% max
Bokaro Steel Plant, Bokaro, Jharkhand.	Hot metal 4065568	Hot metal 4107760	NA	NA	Mn: 30% max SiO_2+Al_2O_3 : 20.5% max -10 mm -15% max +40 mm -10% max	-
Durgapur Steel Plant, Durgapur, West Bengal.	Hot metal 2174000	Hot metal 2143000	NA	NA	Mn: 30.0% min Fe: 15-28% SiO: 3.3% max Al_2O_3: 7.5% max	-
Rourkela Steel Plant, Rourkela, Odisha	Hot metal 2267765	Hot metal 2303301	2106	249	-	-
IISCO Steel Plant Burnpur, Dist. Burdwan. West Bengal.	Hot metal 502000	Hot metal 495000	NA	NA	Mn (dry) 30% (min.) -10 mm - 10.0% max +40 mm - 15% max	-
Visvesvaraya Iron and Steel Ltd, Bhadravati, Shimoga Karnataka.	Hot metal 126000	Hot metal 131000	NA	NA	-	-
KIOCL Ltd. Pellet Plant Mangalore, Dakshin Kannad, Karnataka	Hot metal 62150	Hot metal Nil	Nil	Nil	Fe: 25-50% min MnO_2: 44% min SiO_2 +Al_2O_3 : 12% max	Milan Minerals, Karnataka
Visakhapatnam Steel Plant, Visakhapatnam, A.P.	3900000	3830000	14700	7100	Mn: 28%, (min) Fe: 16% SiO_2: 25% max Size: 10-60 mm(BF) (-) 10 mm (SP)	Garividi, Andhra Pradesh
IDCOL, Kalinga Iron Works Ltd, Barbil, Keonjhar, Odisha.	Hot metal 89216	Hot metal 57543	3218	2506	Size: 10-40 mm	From own/ local mines
Tata Steel Ltd Jamshedpur, Bihar	Hot Metal 7231424	Hot metal 7502688	NA	NA	NA	-
Kirloskar Ferrous Industries Ltd, Berinahalli, Koppal, Karnataka.	Pig iron NA	Pig iron NA	NA	NA	Mn: 28% min Fe: 20% min SiO_2 : 8% max Alkalies: 1% max Size: 10 to 40 mm 90% min under & over size: 5% max each	SMIORE, Adarsha Mining Co., Omkaramma
LANCO Industries Ltd, Chittoor, Andhra Pradesh	Hot metal NA	Hot metal NA	NA	NA	NA	NA
Visa Steel Ltd, Kalinganagar Jajpur, Odisha	Hot metal 170040	Hot metal 46233	690	302	below 35% Mn Mines	Siljoda
Sunflag Iron & Steel Co.Ltd, Bhandara	Hot metal 205502	Hot metal 193992	265	NA	-	-
Jaiswal Neco Industries Ltd, Raipur.	Hot metal 534940	Hot metal 436483	13642	10620	Mn:26-28% Size:10-60 mm	-

resources. North America had less than 1% world reserves. Besides, United States have lean grade reserves and potentially high extraction cost. This situation has created an active global trade in manganese ore and manganese alloys.

World production of manganese ore in 2010 was estimated to be around 42.8 million tonnes as compared to 33.9 million tonnes in 2009. China was the leading producer contributing about 33% followed by South Africa (17%), Australia (15%), India and Gabon (7% each) (Table-15). The production of manganese ore is linked with the production of steel. The steel industry consumes it in the form of ore and manganese alloys.

China

China was the world's largest consumer of manganese and producer of manganese alloys and electrolytic manganese metal (EMM) in the world. In 2010, China also was leading producer of EMD in the world.

Japan

Nippon Mining & Metals Co. Ltd started a recycling plant on demonstration scale for used lithium-ion batteries to extract value-bearing metals such as cobalt, lithium, manganese and nickel. The plant in Fukui was expected to recover about 6 tonnes per month of manganese.

FOREIGN TRADE

Exports

Exports of manganese ore decreased to about 118 thousand tonnes in 2010-11 from 289 thousand tonnes in 2009-10. Out of the total exports in 2010-11, exports of manganese ore having +46% Mn were 16,147 tonnes, ore having 30 to 35% Mn were 30,858 tonnes and manganese ore (others) were 68,708 tonnes. Exports were mainly to China (82%) and Bhutan (16%). Exports of manganese oxide (total) increased to 2,169 tonnes in 2010-11, as against 1,313 tonnes in the previous year. Manganese oxide exports in 2010-11 comprised manganese dioxide 719 tonnes and other oxides 1,450 tonnes. Exports were mainly to Spain (12%) and Italy (12% each). In 2010-11 exports of manganese and alloys (including waste & scrap) increased to 120 tonnes compared to 68 tonnes in the previous year. Exports of un-wrought manganese alloys in 2010-11 were at 52 tonnes (Tables - 16 to 26).

Imports

Imports of manganese ore increased considerably to about 1.3 million tonnes in 2010-11 from 798 thousand tonnes in 2009-10.South Arica (45%), Australia (28%), Gabon (7%) and Brazil (4%) were the main suppliers of manganese ore in 2010-11. Imports in 2010-11 comprised manganese ore having +46% Mn were 531,465 tonnes, manganese ore having 35 to 46% Mn were 752,600 tonnes, manganese ore having 30 to 35 % Mn were 3,097 tonnes and manganese ore (others) were 12,481 tonnes. In 2010-11, imports of manganese oxides were 7,254 tonnes. Imports of manganese oxides comprised manganese oxide and other than manganese dioxides 1,709 tonnes. Imports were mainly from China (97%) and Singapore (1%). During 2010-11, imports of manganese & alloys (including waste and scrap) were (13,982 tonnes, out of which manganese alloys (unwrought) comprised 10,967 tonnes and NES 417 tonnes. Imports of manganese & alloys were mainly from China (Tables - 27 to 36).

Table – 14 : World Reserves of Manganese Ore (By Principal Countries)

(In '000 tonnes of contained metal)

Country	Reserves
World : Total (rounded)	**630000**
Australia	93000
Brazil	110000
China	44000
Gabon	21000
India*	56000
Mexico	4000
South Africa	150000
Ukraine	140000
Other countries	Small

Source: Mineral Commodity Summaries, 2012.
** India's total UNFC resources of manganese ore as on 1.04.2010(p) are estimated at 430 million tonnes.*

Table – 15 : World Production of Manganese Ore (By Principal Countries)

(In '000 tonnes)

Country	2008	2009	2010
World : Total	**38100**	**33900**	**42800**
Australia	4819	4444	6470
Brazil	2400	2300	2600
China(e)	11000	12000	14000
Gabon	3250	2000	3200
Ghana	1089	1013	1194
India*	2789	2440	2891
Kazakhstan	2485	2457	1094
South Africa	6808	4576	7172
Ukraine@	1447	1000(e)	1450
Other countries	2013	1670	2729

Source: World Mineral Production, 2006-2010.
@ : Marketable
**India's production of manganese ore in 2008-09, 2009-10 and 2010-11 was 2,789 thousand tonnes,2,492 thousand tonnes and 2,881 housand tonnes, respectively.*

Table – 16 : Exports of Manganese Ore : Total (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**289468**	**1167004**	**117963**	**836888**
China	251065	898909	96380	457950
Bhutan	6903	118273	19165	365367
Bangladesh	-	-	1078	9652
Israel	-	-	1340	3896
Saudi Arabia	-	-	++	23
Other countries	31500	149823	-	-

Table – 17 : Exports of Manganese Ore (46% or more Mn) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**3371**	**59208**	**16147**	**286225**
Bhutan	3371	59208	16147	286225

Table –18 : Exports of Manganese Ore (35% or more but below 46% Mn) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**–**	**–**	**2250**	**7552**
China	–	–	2250	7552

Table - 19 : Exports of Manganese Ore (30% or more but below 35% Mn) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹000)	2010- 11 Qty (t)	2010- 11 Value (₹'000)
All Countries	**104737**	**402400**	**30858**	**147030**
China	97997	375049	29780	137378
Bangladesh	-	-	1078	9652
Other countries	6740	27351	-	-

Table – 20 : Exports of Manganese Ore (Others) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**161660**	**650669**	**68708**	**396081**
China	133368	469134	64350	313021
Bhutan	3092	51960	3018	79141
Israel	-	-	1340	3896
Saudi Arabia	-	-	++	23
Other countries	25200	129575	-	-

Table – 21 : Exports of Manganese Oxide : Total (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**1313**	**31394**	**2169**	**69063**
Spain	-	-	263	10474
Italy	250	6502	253	9651
Indonesia	24	853	152	6489
Thailand	46	1297	110	5023
Russia	48	1515	124	4859
Malaysia	226	5597	178	3750
Saudi Arabia	100	4611	119	2651
Korea, Rep. of	96	1441	200	2632
Poland	-	-	50	2345
Chinese Taipei/ Taiwan	-	-	55	2306
Other countries	523	9578	665	18883

Table – 22 : Exports of Manganese Dioxide (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**458**	**10213**	**719**	**15000**
Korea, Rep. of	90	1177	200	2632
Poland	-	-	50	2345
Bangladesh	21	251	107	1903
Philippines	-	-	71	1421
Kuwait	-	-	52	1265
Japan	-	-	20	1194
Sri Lanka	45	997	45	1177
Saudi Arabia	++	4	79	969
UAE	54	1298	19	737
USA	1	434	20	688
Other countries	247	6052	56	669

Table – 23 : Exports of Manganese Oxide (Other than Manganese Dioxide) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**855**	**21181**	**1450**	**54063**
Spain	-	-	263	10474
Italy	250	6502	253	9651
Indonesia	–	–	152	6489
Thailand	20	589	110	5023
Russia	24	779	124	4859
Malaysia	226	5597	178	3750
Chinese Taipei/ Taiwan	–	–	55	2306
UK	-	-	50	2043
Saudi Arabia	100	4607	40	1682
Vietnam	1	162	38	1599
Other countries	234	2945	187	6187

Table – 24 : Exports of Manganese & Alloys (Incl. Waste & Scrap) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**68**	**64327**	**120**	**111963**
Germany	5	3390	30	28083
UAE	-	-	16	19394
Italy	10	11388	16	18484
Ghana	18	33884	13	17560
Sweden	8	7378	7	7385
Camerron	-	-	25	5501
Czech Republic	++	62	2	2915
Brazil	1	1607	2	2702
Ukraine	-	-	4	2177
Central African Republic	-	-	++	1758
Other countries	26	6618	5	6004

Table – 25 : Exports of Manganese & Alloys : (Unwrought) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**23**	**19109**	**52**	**57021**
Germany	5	3390	30	28083
Italy	10	11388	16	18484
Czech Republic	-	62	2	2903
Brazil	1	1607	2	2702
Indonesia	6	1082	1	909
Malaysia	-	-	1	883
Armenia	-	-	++	712
Iran	++	128	++	558
Romania	++	733	++	513
Korea, Rep. of	++	350	++	419
Other countries	1	369	++	855

Table – 26 : Exports of Manganese & Manganese Base Alloys : (Waste/Scrap) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**1**	**188**	**-**	**-**
Saudi Arabia	1	188	-	-

Table – 27 : Imports of Manganese Ore : Total (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**797933**	**7470849**	**1299643**	**17813482**
South Africa	359959	2891368	578953	6369494
Australia	220175	2050748	363984	5675871
Gabon	91735	958622	156036	2702187
Brazil	69647	772974	54656	929357
Ivory Coast	36757	454485	42077	614386
China	-	-	25905	350860
Singapore	7805	190242	7403	192663
Zambia	1557	25695	10220	178208
France	-	-	8279	176399
Turkey	-	-	13576	147134
Other countries	10298	126715	38554	476923

Table – 28 : Imports of Manganese Ore (46% or more Mn) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**283146**	**3227378**	**531465**	**8247614**
Australia	85281	992032	167106	2745065
South Africa	146589	1495317	185923	2371782
Gabon	33415	411558	94524	1753526
China	-	-	21183	298209
Ivory Coast	6847	91576	15809	257916
Singapore	7805	190242	7353	191484
France	-	-	8279	176399
Zambia	1557	25695	6830	125451
Brazil	-	-	5448	98067
Indonesia	652	7465	7386	75630
Other countries	1000	13493	11624	154085

Table – 29 : Imports of Manganese Ore (35% or more but below 46% Mn) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**512498**	**4212534**	**752600**	**9386983**
South Africa	213370	1396051	384126	3908413
Australia	134894	1058716	196878	2930807
Gabon	58320	547064	61512	948661
Brazil	69647	772974	48757	828189
Ivory Coast	28549	340275	26268	356470
Turkey	-	-	10512	113467
Burkina Faso	-	-	5435	72433
China	-	-	4722	52651
Zambia	-	-	2675	40133
Tanzania	-	-	2007	29236
Other countries	7718	97454	9708	106523

Table – 30 : Imports of Manganese Ore (30% ore more but below 35%) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**299**	**3126**	**3097**	**30401**
South Africa	-	-	2401	25646
Brazil	-	-	451	3101
Indonesia	-	-	245	1654
Other countries	299	3126	-	-

Table – 31 : Imports of Manganese Ore (Others) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**1990**	**27811**	**12481**	**148484**
South Africa	-	-	6503	63653
Indonesia	545	4029	2149	37362
Turkey	-	-	3064	33667
Zambia	-	-	715	12623
Singapore	-	-	50	1179
Other countries	1445	23782	-	-

Table – 32 : Imports of Manganese Dioxide (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**5941**	**489003**	**7254**	**473538**
China	5661	462246	7057	451483
Belgium	14	4789	28	5202
Japan	16	6286	49	3614
Germany	12	4902	10	3380
USA	23	2925	24	2861
Singapore	26	958	40	2632
Hong Kong	-	-	23	1704
UK	3	753	6	1500
Korea, Rep. of	-	-	16	1107
Unspecified	-	-	1	42
Other countries	186	4144	++	13

Table – 33 : Imports of Manganese Oxide (Other than Manganese Dioxide) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**1213**	**148747**	**1709**	**150331**
Belgium	580	77701	717	74767
South Africa	140	12735	338	34201
China	231	77710	195	23105
Israel	31	2525	344	6365
Germany	19	17038	9	4280
Norway	100	7314	25	2388
Japan	7	3291	6	2032
Canada	-	-	20	1036
Switzerland	-	-	50	856
USA	39	3186	1	802
Other countries	66	7247	4	499

Table – 34: Imports of Manganese & Alloys (Incl. Waste & Scrap) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**11214**	**1351356**	**13982**	**2028316**
China	10114	1202834	11451	1656069
Hong Kong	45	5194	660	76766
Vietnam	204	24153	451	61914
USA	5	6265	116	60487
UAE	-	-	495	59771
South Africa	749	80910	596	58613
France	20	14952	25	18582
Germany	26	6432	6	6108
Korea, Rep. of	++	16	40	5746
Namibia	-	-	40	4926
Other countries	51	10600	102	19334

Table – 36 : Imports of Manganese & Alloys, NES : (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**65**	**17275**	**417**	**74661**
China	52	7939	370	52489
USA	1	764	11	6115
Germany	5	3711	6	6108
Russia	-	-	7	4861
Vietnam	-	-	20	2448
Indonesia	-	-	2	2042
Chinese Taipei/ Taiwan	-	-	1	513
UK	++	30	++	85
Other countries	7	4831	-	-

Table – 35 : Imports of Manganese & Alloys : Unwrought (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**7884**	**968421**	**10967**	**1543355**
China	6877	838178	9662	1332433
Vietnam	204	24153	431	59466
South Africa	669	72480	596	58613
USA	4	5501	85	51939
France	18	13179	25	18582
Hong Kong	45	5194	60	7409
Korea, Rep. of	++	16	40	5746
Namibia	-	-	40	4926
Malaysia	-	-	25	3003
Sweden	-	-	3	1217
Other countries	67	9720	++	21

FUTURE OUTLOOK

Production of crude steel is the single most important factor in the demand for manganese ore. Steel industry accounts for approximately 90% world demand for manganese. Carbon steel is the principal market accounting for 65 to 70% manganese consumption.

As per the Report of the Working Group for 12 th Plan Period (2012-17), Planning Commission of India estimated production of manganese ore would be about 4.56 million tonnes by 2011-12 and 6.70 million tonnes by 2016-17 at 8% growth rate. The apparent consumption is estimated at 4.98 million tonnes by 2011-12 and 7.31 million tonnes by 2016-17 at 8% growth rate.

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

MARBLE

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

56 Marble

Marble is a 'minor mineral' as defined in Clause (e) of Section 3 of Mines and Minerals (Development & Regulation) Act, 1957. The term "marble" is derived from the Latin word Murmur which in turn is said to have been coined from Greek word Marmorous meaning shining stone. It is known for its pleasant colours, smooth and uniform texture, moderate hardness, amenability to be quarried into big blocks, smooth & shiny polished surface and silky feel. Marble occupies a unique position among other dimension stones because of its aesthetic value.

In terms of geological definition, it is a metamorphosed limestone produced by recrystallisation under condition of thermal and also regional metamorphism. In commercial parlance, all calcareous rocks capable of polish are classed as marbles. Furthermore, serpentine rocks, containing little calcium or magnesium carbonates, if attractive and capable of taking good polish are also classed as marbles. The calcareous stones like onyx, travertine and some limestone have also been classed as marbles. Marble is not a prime export commodity like the dimension stone, granite. Its internal demand has always remained high and most of the production added with recent increase in imports is consumed within the country. Marble is the most preferred stone in India among all dimension stones. Most of the units in the marble industry are in the small scale sector.

RESOURCES

The occurrences of marble have been reported from many states, viz, Rajasthan, Gujarat, Haryana, Andhra Pradesh, Madhya Pradesh, Jammu & Kashmir, Maharashtra, Sikkim, Uttar Pradesh and West Bengal. Among the above states, marble deposits of economic importance are localised in Rajasthan, Gujarat, Haryana, Andhra Pradesh and also in Madhya Pradesh as per the recent reports.

Rajasthan has the distinction of having the best among Indian resources of good quality marble. Out of 32 districts, 20 districts have marble in one or the other form. The important regions of marble occurrences in Rajasthan are:

i) Udaipur - Rajsamand - Chittorgarh region;
ii) Makrana - Kishangarh region;
iii) Banswara - Dungarpur region;
iv) Andhi (Jaipur) - Jhiri (Alwar) region; and
v) Jaisalmer region.

The important deposits of marble in Rajasthan are given in Table - 1.

Table – 1 : Important Deposits of Marble in Rajasthan

Sl.No.	Name of deposit	District
i)	Agaria, Amet, Kilwa, Morwad, Dharmita, Katre, Parvati Koyal, Morchana, Arana, etc.	Rajsamand
ii)	Makrana, Borawad (White), Chosira Dwagri (Pink), Kumari	Nagaur
iii)	Kesariaji (Rikhabdeo), Odwas	Udaipur
iv)	Babarmal (Devimata), Rajnagar	Udaipur
v)	Tripura Sundari-Talai-Odabagi-Bhimkund-Vithaldeo, Prithvipura, Paloda, etc.	Banswara
vi)	Andhi, Bhainslana, Todi-ka-Bas	Jaipur
vii)	Jhiri, Sariska, Rajgarh, Badampur, Moti-Dungri, etc.	Alwar
viii)	Selwara-Dhanwar-Koteswar	Sirohi
ix)	Jahazpur, Kekri, Manoharpur, Asind, Banera, Shahpura	Bhilwara
x)	Kalyanpur-Narwar-Sardhana	Ajmer
xi)	Patan-Rampura, Kela-Dungari	Sikar
xii)	Dagota	Dausa
xiii)	Umar	Bundi
xiv)	Sabla, Nandli-dad, Peeth, Manpur, Dachki, etc.	Dungarpur
xv)	Mandal, Deh	Chittorgarh
xvi)	Pachori Chadi, Moriya Munjasar, etc.	Jodhpur
xvii)	Bar-Sendra Sarangwa, Sevari, Kundal	Pali
xviii)	Dunkar, Bidasar, Dujara	Churu
xix)	Mooisagar, Amarsagar, Habur, Naripa	Jaisalmer

The marbles of Rajasthan are in various colours and shades. The Makrana area is famous for pure white crystalline marble. Other varieties found in Makrana area are Albeta, Adanga, Dongri Pink, etc. The marble from Rajsamand area is mined extensively. It is off-white and greyish-white. The internationally acclaimed variety of green marble comes from Rikhabdeo-Kesariaji area, 60 km away from Udaipur. The green marble has various shades of green with white and black network and patches. The marble from Babarmal is pink and is marketed as Indian Pink. It is a fine-grained hard marble having black and white bands. The marble from Bhilwara is white to off-white, fine to medium-grained hard marble having black and white bands. The marble from Banswara is white to off-white dolomitic marble and is soft. It is used generally for cladding purpose. The white to greyish-white marbles of Jaipur area are being sold under the trade name Andhi Pista, a white marble having green laths of serpentine; onyx; Indo-Italian and Black Marble. The Bhainslana marble is dark-black.

Gujarat has vast resources of marble in Banaskantha, Bharuch, Vadodara, Kachchh and Panchmahal districts. The Ambaji area in Banaskantha district and Chinchpura area in Vadodara district are the main producing centres. The white marble of Ambaji is known for its amenability to carving. Other deposits in Banaskantha district are Jarivav, Kumbharia, Kateswar, Bheroj and Khikla. Marble of Vadodara district occurs in various shades, viz, green, white, pink and cream. Marble of Bharuch varies in colour from black to green and red. The yellow marble of Kachchh is thin-bedded, sometimes fossiliferous and blockable deposits occur at Bhulawara- Chinchpura belt.

In Haryana, marble deposits are located in the district of Mahendragarh. Most important localities are Antri-Beharipur, Zainpur, Chappra-Bibipur, Nangaldurgu, Islampur and Dhanota-Dhancholi. Marble of this area occurs in variegated colours and banded forms. It enjoys the reputation as 'Patiala Marble' with black and white bands.

Of late, the world-famous marble rocks 'Bhedaghat' near Jabalpur in Madhya Pradesh have attracted entrepreneurs from Rajasthan. The extension of these rocks in between Jabalpur and Katni is being quarried. The marble from these areas is exploited for its off-white, fine-grained, banded attributes. A number of quarries are under operation.

Marble deposits of Maharashtra are of calcitic and dolomitic type which are located in the areas of Katta-Hiwara, Kadbikhera, Sakaritola, Pauni, Chorbaoli, Deolapar, Mansar, Kandri, Chargaon, Junewani villages in Nagpur district. In Katta-Hiwara, the marble is light-pink to grey in colour. The marble of Kadbikhera-Sakaritola is pink calcitic marble while the marble deposits of Mansar and Kandri areas are dolomitic type.

In Uttarakhand, thick impersistent bands of white marble occur in massive limestone in Pithoragarh district.

In Mirzapur district of Uttar Pradesh, two marble deposits at Hingha and Geria are of good quality and can yield blocks for limited requirement.

In Jharkhand, huge deposits of marble are available in Semra-Salatua and adjoining areas of Palamu. Pink marble occurrences are reported from Hesadih area, Singhbhum district.

The marbles of Khammam area of Andhra Pradesh are white and green. Occurrences of pink, purple, yellow and variegated marbles are reported in Cuddapah, Kurnool and Anantapur districts. The dolomitic marble of Cuddapah, Kurnool and Anantapur districts is other upcoming resource centre for off-white, coloured, greyish-black marbles which take good polish and are being exploited by private entrepreneurs.

On the basis of available data, IBM has prepared a mineral inventory of marble reserves and resources as per UNFC system as on 1.4.2010 which is furnished in Table - 2. The total resources of all grades of marble are placed at 1,931 million tonnes. Of these, only about 276 million tonnes (14%) fall under 'reserve' category and about 1655 million tonnes (86%) under 'remaining resources' category. Gradewise, about 27% resources fall under unclassified and not-known grades, 55% under off-colour grade and 17% under white colour grade. The available data on marble resources reveal that about 64% resources are in Rajasthan and 21% in Jammu & Kashmir. The remaining resources are distributed mainly in Gujarat, Chhattisgarh, Maharashtra, Haryana, Uttarakhand and Sikkim in descending order.

Table – 2 : Reserves/Resources of Marble as on 1.04.2010
(By Grades/States)

(In 000' tonnes)

State/Grade	Reserves				Remaining resources								Total resources (A+B)
	Proved STD111	Probable STD121	Probable STD122	Total A	Feasibility STD211	Pre-feasibility STD221	Pre-feasibility STD222	Measurred STD331	Indicated STD332	Interred STD333	Reconnsaissance STD334	Total B	
All India : Total	**103736**	**172661**	**98**	**276495**	**-**	**29842**	**72289**	**-**	**107129**	**1445708**	**-**	**1654968**	**1931463**
By Grades													
White Colour	72700	124504	-	197204	-	-	81	-	-	133442	-	133523	330727
Off Colour	31036	48059	-	79095	-	27805	48352	-	107129	809104	-	992390	1071485
Unclassified	-	-	-	-	-	-	21870	-	-	498512	-	520382	520382
Not-Known	-	98	98	196	-	2037	1986	-	-	4650	-	8673	8869
By States													
Andhra Pradesh	-	-	-	-	-	-	-	-	-	3	-	3	3
Chhattisgarh	-	-	-	-	-	-	-	-	-	83000	-	83000	83000
Gujarat	-	-	-	-	-	26571	45000	-	17129	34871	-	123571	123571
Haryana	-	-	-	-	-	1234	1602	-	-	19492	-	22328	22328
Jammu & Kashmir	-	-	-	-	-	-	-	-	-	404703	-	404703	404703
Maharashtra	-	324	-	324	-	-	81	-	-	57642	-	57723	58047
Rajasthan	103736	172337	98	276171	-	2037	25606	-	90000	837615	-	955258	1231429
Sikkim	-	-	-	-	-	-	-	-	-	2382	-	2382	2382
Uttarakhand	-	-	-	-	-	-	-	-	-	6000	-	6000	6000

Figures rounded off.

PRODUCTION

The total production value of marble increased to ₹ 1282 crore in 2009-10 from ₹1151 crore in 2008-09. Rajasthan alone accounted for 94% output value followed by Gujarat and Madhya Pradesh. Production value was less than 1% in Odisha, Andhra Pradesh, Jammu & Kashmir and Jharkhand in 2009-10 (Table - 3).

MINING AND PROCESSING

Mining of marble or, for that matter, any dimension stone is different from conventional mining practices. In conventional mining method, mined out minerals are obtained in small-size fractions whereas in dimension stone mining, large-size intact blocks without minor cracks or damages are extracted.

Marble mining in India is quite old and has been perfected by trial and error method for extracting larger blocks by manual means. Advent of advanced mining machinery and improved methods of cutting and mining have largely transformed the marble mining methods and have led to increased production. Presently, mining of marble is done by manual, semi-mechanised and mechanised means. But in general, majority of mines adopt the semi-mechanised method of mining. The various stages in mining marbles are as follows:

The removal of overburden is generally carried out with heavy earth-moving machinery. In some cases, the weathered zone is removed by drilling holes by jackhammers and slim drill machines. These holes are charged with explosives and under controlled blasting methods, the overburden material is loosened out. It is then removed using heavy earth-moving machinery, such as excavators, tippers and loaders.

After removal of overburden and capping, the marble is exposed at suitable places. After studying the topography and keeping in view the further development of quarry, a key block is marked for removal or for quarry front cut. At this stage, it is necessary to study the joint or fracture pattern in order to ascertain recovery of large-size block.

In manual operation, a line of shallow holes is made and by driving in wedges with feathers by continuous hammering, a fracture is developed along the already drilled holes, and the block is made free from all the sides. The block thus freed from the in situ rock is either pulled by chains or pulley system or is pushed by driving logs, etc. After the block is toppled, it is again cut and dressed for getting a parallel-piped shape.

In the semi-mechanised operation, jack-hammers, slim drills, line drilling machines are used for drilling holes in a predetermined line. The remaining operation is more or less similar to manual mining except for lifting and pulling where cranes, winches, dozers, etc. are used. But in the above mentioned processes, the wastage is high and the size of the blocks recovered is small and seldom free from defects. However, to overcome these problems, the quarry front cut is made by using slim drill machines, diamond wire saw, quarry master, diamond belt saw machines and chain saw machines.

Table – 3: Value of Production of Marble, 2007-08 to 2009-10
(By States)

(Qty in tonnes; value in ₹ '000)

State	2007-08		2008-09		2009-10 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**8420407**	**6741120**	**9062889**	**11506043**	**10973347**	**12819800**
Andhra Pradesh	20748	18227	183	176	160	170
Gujarat	284094	448310	284094	448310	284094	448310
Jammu & Kashmir	-	-	606	76	764	96
Madhya Pradesh	267732	192591	217655	288084	217492	290965
Rajasthan	7847833	6081992	8560351	10769397	10470837	12080259

Source: *State Governments*
Figures have ben repeated whereever necessary due to non-availability of data.

The slim drill machines and quarry masters are used to drill holes through which diamond wire saw is passed and the block is cut by continuous motion of the diamond wire saw. Once the block is cut, it is toppled with the help of hydrobags, pneumatic pillows, air-jacks, etc. The blocks cut this way are of exact sizes with minimum losses. The lifting and loading of blocks are done by Derrick cranes and using various types of loaders.

Processing of marble is done in two stages. The first stage of processing involves cutting the blocks into 2 to 3 cm thick slabs by using gang saws, wire saws and circular saws. In marble tile plant, the required thickness of tiles is 10 or 12 mm. For cutting, circular saws are used. In general, the slabs are sold as it is but in case of tiles, they are polished using various pneumatically-operated or other polishing machines, such as, line polishers, trimmed and cut to size, buffed and chamfered using different types of machines before being sold.

Rajasthan has about 95% processing capacity in the country. There are a number of gang saws and many automatic tiling plants that are in operation. Important processing centres in the State are Makrana, Jaipur, Alwar, Ajmer, Udaipur, Nathdwara, Rajsamand, Abu Road and Kishangarh. The capacity for marble slab production in the state is around 1,000 million sq ft per annum and for polished tiles, it is 3,000 million sq ft. In Gujarat, there are about 22 processing units located at Ahmedabad, Ambaji and Vadodara. India has a rich tradition of processing stones and carving jalis, pillars, garden furniture, floral and other design by expert craftsmen. The craftsmen have developed their art using manual means and simple tools. Presently, art collectors from world over seem to demand hand-carved articles produced especially in Makrana. Congruent with this trend, Stone Fairs are regularly organised in Rajasthan to promote stone artifacts produced and to provide the necessary impetus to sculptors and craftsmen.

CLASSIFICATION

A variety of marbles are produced and marketed under various trade names. On the basis of colour, shade and pattern. These are i) Plain White Marble, ii) Panther Marble, iii) White-Veined Marble, iv) Plain Black Marble, v) Black Zebra Marble, vi) Green Marble, vii) Pink Adanga Marble, viii) Pink Marble, ix) Grey Marble and x) Brown Marble.

In addition, many new varieties of marble have been brought into the folds of classification especially after opening of new mining areas. The important new types other than the ones classified by BIS are given below:

1. Yellow marble from Jaisalmer.
2. Pista marble (amphibolite variety) from Andhi-Jhiri belt, Jaipur, Alwar and Dausa districts, Rajasthan.
3. Brown green and golden ultramafics from Dunkar, Churu district, Rajasthan.
4. Chocolate-brown and English teak wood marble from Jodhpur district, Rajasthan.
5. Parrot green marble from Jhilo in Sikar district, Rajasthan.
6. Chocolate-brown or wood-finish marble from Mandaldeh, Chittorgarh district, Rajasthan.
7. Purple marble from Tripura Sundari in Banswara district, Rajasthan.
8. Blue marble from Desuri in Pali district, Rajasthan.

The marbles have also been classified by their genesis and chemical composition as under:

i) Calcite Marble: It is a crystalline variety of limestone containing not more than 5% magnesium carbonate. Colour and designwise, it may vary from grey to white to any colour, and even figurative light- brown to pink.

ii) Dolomitic Marble: It is a crystalline variety of limestone containing not less than 5% or more than 20% magnesium carbonate as dolomite molecules.

iii) Dolomite Marble: It is a crystalline variety of dolomite containing in excess of 20% magnesium carbonate as dolomite molecules. It has variegated colours and textures. As the whiteness increases, the lustre and translucency increases to an extent that it starts resembling with onyx. The main advantage of this marble is availability of exotic colours and patterns and its low maintenance cost. Marbles of Banswara in Rajasthan and Chhota Udaipur in Gujarat belong to this category.

iv) Siliceous Limestone: It is a limestone containing high silica with smooth appearance due to fine-grained texture. It is difficult to cut and polish this type of marble but once polished, it gives a pleasant look. It is available in several colours and designs. The pink marble of Babarmal and Indo-Italian variety from Alwar belongs to this category.

v) Limestone: Several varieties of limestone are being exploited and used as marble. The Oolitic limestone of UK, Black Marble of Bhainslana, Katra & Sirohi and Golden-yellow Marble of Jaisalmer belong to this category. This type requires frequent maintenance in the form of polishing as they are non-metamorphosed and hence are softer in nature.

vi) Serpentine or Green Marble: This marble is characterised mainly by the presence of a large amount of serpentine mineral. It has various shades of green varying from parrot-green to dark-green and is known for having varying degrees of veinlet intensities of other minerals, chiefly carbonate of calcium and magnesium. Most of the green marbles from Gogunda, Rikhabdeo, Kesariyaji and Dungarpur belong to this category. This marble is mostly used for panelling. The darker variety of this marble, which is so dark-green that it looks like black, has been termed as Verde Antique.

vii) Onyx: It is a dense crystalline form of lime carbonate deposited usually from cold water solutions. It is generally transparent to translucent and shows a characteristic variegated colour layering due to mode of deposition. Such type of marble is found in Kupwara district in Jammu and Kashmir. It is used for making decorative articles.

viii) Travertine Marbles: It is a variety of lime- stone regarded as a product of chemical precipitation from hot springs. The depositional history has left exotic patterns, when this is cut into thin slabs and polished it become translucent.

POLICY

The Central Government has brought-forth Marble Development and Conservation Rules, 2002 (notified on 15.5.2002) for conservation, systematic development and scientific mining of marble with a purpose to provide a uniform framework that would be applicable throughout the country. The maximum period for which a lease may be granted shall not exceed thirty years and minimum period shall not be less than twenty years. Further, no lease is to be granted unless there is mining plan duly approved by the State Government or any person authorized in this behalf by that Government. Normally, the minimum area of the lease to be granted should not be less than 4 hectares and maximum area shall not exceed 50 hectares.

As per the Export-Import Policy , 2009-14, and the Foreign Trade Policy thereunder, the imports of crude or roughly-trimmed, marble & travertine blocks, slabs and ecaussine & calcareous monumental or building stone are restricted while imports of alabaster are freely allowed under heading No. 2515. On the other hand the import of items falls under ITC(HS) Code 68022110 to 68022190 are freely allowed. The Ministry of Commerce and Industry, Deptt. of Commerce, vide notification No.65 (RE-2010)/ 2009-14. S.O.1802(E), dated 4.8.2011 has amended in the Schedule I (Imports) of the ITC(HS) Classification of Export and Import items. After amendment the entry would read as "Import permitted freely provided cif value is US$60 and above per square metre".

The total import of Rough Marble Blocks under Exim Code No. 25151100 and 25151210 will be subject to a ceiling of 5 lakh tonnes for the whole of the licensing year 2011-12.

Import of marble, classified under chapter 25 and 68 from Bhutan shall be subjected to a combined annual quota of 10 lakh sq.ft (5,882 tonnes). The quota shall come into effect immediately from the date of this Notification (i.e.No.69 (RE - 2010)/ 2009-14 dated 1.9.2011 and shall operate on financial year basis. Monitoring and allocation of the quota shall be made by the Government of Bhutan. The annual quota for import of marble from Bhutan will now be 5,882 tonnes. Previously it was 1,847 tonnes.

USES AND SPECIFICATIONS

Marble is used widely in buildings, monuments and sculptures. Its utility value lies in its beauty, strength and resistance to fire and erosion. Marble has its application in interior and exterior wall cladding, interior and exterior paving, fireplace facing and hearth, lavatory tops, residential and commercial counter tops, table tops, statues and novelty items. The other non-conventional uses of marble are in toothpaste, paint, whiting, agricultural lime, etc.

Different marble varieties are used basically as both interior and exterior vertical wall cladding and flooring. Their use as structural elements (masonry), statues, epitaphs, graves, etc. is quantitatively less with funeral art accounting for the largest percentage. In interior application such as for floors, marble is used in the form of 20 mm thick cut-to-size slabs. The slabs are also used for interior and outer facings, stairs, table tops, kitchen platforms, etc. The tiles in sizes ranging from 10 x 10 cm to 60 x 60 cm are used for floors, dadoes and for skirting in thickness ranging from 10 to 20 mm. The selected marble blocks free from cracks and other inclusions are used for making artifacts, such as carved figures, handrails and balustrade for staircases, jalis, fire places, flower vases and many other pieces of art.

Indian standards for marbles (blocks, slabs and tiles) IS:1130-1969 (reaffirmed in 2008) are summarised as under:

i) Classification: Marble shall be classified as white and coloured categories.

ii) General requirements: Marble shall be free from foreign inclusions and prominent cracks.

iii) Sizes: Marble blocks shall be supplied in lengths ranging from 30 to 250 cm, widths 30 to 100 cm and thicknesses 30 to 100 cm. The slabs shall be supplied in lengths ranging from 70 to 250 cm, widths 30 to 100 cm and thicknesses from 20 to 150 mm. The tiles shall be supplied preferably in sizes of 10 x 10 cm, 20 x 20 cm, 30 x 30 cm, 40 x 40 cm, 50 x 50 cm and 60 x 60 cm with thickness ranging from 18 to 24 mm in the same piece.

Other sizes as agreed upon by supplier and purchaser may also be supplied.

iv) Physical properties: The physical properties of blocks, slabs and tiles shall conform to the requirements, as given under:

Physical Properties of Marble

Sl. No.	Characteristic	Requirement	Method of Test
1)	Moisture absorption after 24 hours immersion in cold water	0.4% max. by weight	IS : 1124-1974
2)	Hardness	3 min.	Mohs' scale
3)	Specific gravity	2.5 min.	IS : 1122-1974

v) Workmanship: The edge of slabs and tiles shall be true. The finishes shall be sand and/or abrasive-finish, honed-finish or polished-finish.

ENVIRONMENT

The environmental degradation of the land due to marble mining is much less than the environmental degradation caused by the waste from marble processing plants.

The environmental degradation during mining of marble is akin to any opencast mining activities, i.e., degradation and removal of top soil, mined out pits disturbing local flora & fauna and water table of the area. In addition, the rejected blocks, unsized blocks and rubbles generated from mining of blocks and from overburden when dumped unsystematically pose serious hazards.

Recently, utilisation of smaller blocks in tiling plant has created a new way for judicious utilisation of the mineral resource.

The processing waste of marble cutting plants comes out in the form of 'Marble Slurry'. This marble slurry is being dumped by the processing plants at the nearest site available or in the notified areas marked for dumping near the plants. When this slurry dries up, it leads to serious environmental pollution. The major environmental problems due to marble slurry are listed below:

1) The slurry when dumped on open land affects adversely the productivity of the land as it reduces the porosity and prevents ground water recharge.
2) Areas with dumped slurry cannot support vegetation.
3) After drying, the finer fraction of slurry becomes airborne and causes serious air pollution which is not only detrimental to human beings but also to vegetation and machinery.

The TIFAC (Technology Information Forecasting and Assessment Council) in collaboration with Regional Research Laboratories and Central Building Research Institute (CBRI), Roorkee, have found many uses of slurry by developing masonry cement, distempers, tiles, cellular concrete, gypsum plaster- based plane/fibre-reinforced boards and blocks.

WORLD REVIEW

Resources of natural stones are substantial in the world and almost every country produces dimension stones. Major exporting countries of marble in the world, are China, Italy, India, Spain, Turkey, Greece, Brazil and Portugal.

FOREIGN TRADE

Exports

Exports of marble (total) increased to 321,293 tonnes in 2010-11 from 275,502 tonnes in the previous year. Out of total marble exported in 2010-11, exports of dressed marble at 251,567 tonnes constituted 78% while exports of other marbles at 69,726 tonnes accounted for remaining 22%. Exports were mainly to China (25%), Nepal and Egypt (13% each), and Italy (11%) (Tables 4 to 6).

Imports

Imports of marble (total) increased to 512,169 tonnes in 2010-11 from 431,022 tonnes in the previous year. Imports of dressed marble at 427,558 tonnes shared 83% imports in 2010-11 while the remaining 17% imports were of other marbles. Main suppliers of marble were Italy (39%), followed by Turkey (26%), China (8%), Vietnam(6%), and Oman (5%) (Tables 7 to 9).

Table – 4 : Exports of Marble : Total (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**275502**	**3045855**	**321293**	**3110107**
China	77239	656096	79937	726247
Egypt	32725	288867	41897	342588
Nepal	34431	229049	40686	252622
USA	10455	283753	8028	227319
Hong Kong	24373	157414	31752	190310
UAE	11860	156368	12067	189233
Italy	8359	142908	34714	148175
Saudi Arabia	5507	81244	5370	83247
Algeria	3391	43289	4372	54058
Turkey	5827	81878	3327	45962
Other countries	61335	924989	59143	850346

Table – 5 : Exports of Marble (Dressed)
(By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**211359**	**2003559**	**251567**	**2020044**
China	73195	612396	76581	679284
Nepal	33082	221775	36754	241734
Egypt	19006	120625	30038	202360
Hong Kong	24331	154867	31752	190288
UAE	7444	97471	7031	107256
USA	6323	140943	3491	93758
Italy	5450	82074	29219	45000
Saudi Arabia	2182	35355	2171	31326
Libya	2817	36974	1301	21830
Algeria	1515	18388	1969	21830
Other countries	36014	482691	31260	385378

Table – 6 : Exports of Marble (Others)
(By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**64143**	**1042296**	**69726**	**1090063**
Egypt	13719	168242	11859	140228
USA	4132	142811	4537	133561
Italy	2909	60834	5495	103175
UAE	4416	58898	5036	81977
Saudi Arabia	3325	45889	3199	51921
China	4044	43700	3356	46963
Turkey	3092	42215	2559	36564
Russia	818	19020	1633	34490
Algeria	1876	24900	2403	32228
Pakistan	2012	25547	2501	28581
Other countries	23800	410240	27148	400375

Table – 7 : Imports of Marble
(By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**431022**	**8418728**	**512169**	**10320860**
Italy	137948	2525286	201393	3817669
Turkey	128121	2199576	135298	2187663
China	35959	1107700	40652	1375278
Oman	17359	534620	26647	721818
Vietnam	38264	580655	30525	481221
Egypt	37581	596175	21957	350643
Sri Lanka	4477	173106	8243	324137
Spain	9055	183807	13102	246687
Greece	4645	109504	7059	189634
Iran	7004	110851	6917	105339
Other countries	10609	297448	20376	520771

Table – 8 : Imports of Marble (Dresssed)
(By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**312665**	**5136712**	**427558**	**7273477**
Italy	103308	1674271	185546	3216369
Turkey	98138	1545232	127156	1989780
Vietnam	33570	494153	28651	403520
Oman	10117	231932	17472	383407
Egypt	35854	522676	20801	311682
China	7860	215411	8936	254726
Spain	6516	118890	11039	184123
Iran	6503	102127	6811	101655
Greece	3627	72178	4919	95199
Norway	371	11744	2725	55412
Other countries	6801	148098	13502	277604

Table – 9 : Imports of Marble (Others)
(By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**118357**	**3282016**	**84611**	**3047383**
China	28099	892289	31716	1120553
Italy	34640	851014	15847	601300
Oman	7242	302688	9175	338412
Sri Lanka	3712	153411	6870	269436
Turkey	29983	654343	8142	197882
Greece	1018	37326	2140	94434
Portugal	132	5811	1778	85447
Vietnam	4694	86501	1874	77701
Spain	2539	64917	2063	62563
Egypt	1727	73499	1156	38961
Other countries	4571	160217	3850	160694

FUTURE OUTLOOK

As per the Report of the Working Group for 12th Plan, Planning Commission of India, the growth is continuing and the demand for marble and other dimension stones, viz, granite, sandstone, etc. and stone products is anticipated to grow at around 15% CAGR. A similar rate of growth in exports can also be achieved with the help of suitable policy framework, infrastructure and other facilities which are expected to be provided to the industry. The Working Group has recommended that there is a strong need for well-planned, concerted and dedicated efforts towards export promotion of Indian stones. The emphasis needs to be on popularisation of Indian stones in both the traditional markets and exploration of new avenues by strengthening the activities of the Centre for Development of Stones (C-DOS) in Rajasthan by upgrading it into a national centre of excellence. Centre for Development of Stones (C-DOS), Rajasthan, which is a state government agency has been recommended to be upgraded and re-designated as a National agency for technology/ skill upgradation, market development support etc. for marble. A separate national agency is required to be established in southern India for development of granite and other stones. The Working Group has stressed on the alternative option for exporting granite and marble in processed form to maximise export earnings to develop and promote artifacts and special decorative and ornmental items of high value addition. There is tremendous skill in the country, which can be explored and supported with special incentives. This can certainly bring about substantial foreign exchange addition, as well as significant employment generation.

The Working Group has observed that the present investment in dimensional stone industry in India is estimated at ₹ 20,000 crore. It is expected that given the right policy support, the total turnover of the sector estimated to be around ₹ 30,000 crore (2009-10) will increase to over ₹ 40,000 crore by 2012-13, and double every five years considering an estimated growth rate of 15%. To sustain this growth, it is estimated that investment in this sector will have to go up to about ₹1,07,500 crore by 2022-23 (including foreign investment).

The Working Group has also made the following suggestions :

In order to promote the dimension stone industry by taking country as a whole there is a need to have a suitable rate of royalty in all the states.

Initiatives need to be taken in the form of fiscal measures as customs and excise duties to encourage import of dimension stones rather than finished products. This will encourage value addition and transfer of technology in the field of dimension stones in the country, which will contribute employment generation and foreign exchange earnings for GDP growth.

The dimensional stone sector should be given the status of industry so that it can qualify for the fiscal benefits, like financial incentives, low cost loans, etc.

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

MICA

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

57 Mica

The mica group represents 34 phyllosilicate minerals that exhibits a layered or platy structure. Commercially important mica minerals are muscovite (potash or white mica) and phlogopite (magnesium or amber mica). Granitic pegmatites are the source of muscovite sheet while phlogopite is found in areas of metamorphosed sedimentary rocks into which pegmatite rich granite rocks have been intruded. It possesses highly perfect basal cleavage due to which it can easily and accurately split into very thin sheets or films of any specified thickness. It has a unique combination of elasticity, toughness, flexibility and transparency. It possesses resistance to heat and sudden change in temperature and high dielectric strength. It is chemically inert, stable and does not absorb water.

Over hundred years, India has enjoyed the monopoly in the production and export of sheet mica in the world. Of late, there has been a steady downfall in the production of mica. This declining trend could be attributed to the slow down in the demand of natural mica in the world market due to technological improvements that facilitate use of reconstituted mica and emergence of mica substitutes. However, there are sufficient resources in the country to meet the domestic requirement and export demand.

RESOURCES

Most important mica-bearing pegmatites occur in Andhra Pradesh, Bihar, Jharkhand, Maharashtra and Rajasthan. Occurrences of mica pegmatites are also reported from Gujarat, Haryana, Karnataka, Kerala, Odisha, Tamil Nadu and West Bengal.

As per UNFC, the total resources of mica in the country as on 1.4.2010 are estimated at 532,237 tonnes out of which 190,741 tonnes are placed under reserves category and 341,496 tonnes under remaining resources category. Andhra Pradesh leads with 41% share in country's total resources followed by Rajasthan (21%) Odisha (20%), Maharashtra (15%), Bihar (2%) and balance (less than 1%) in Jharkhand (Table - 1).

PRODUCTION, STOCKS & PRICES

Mica (Crude)

The production of mica (crude) at 1,293 tonnes in 2010-11 increased by about 22% as compared to the preceding year.

There were 31 reporting mines during 2010-11 as against 32 in the previous year. Seven mines, each producing above 100 tonnes annually accounted for 84% of the total output and four mines each producing 20 to 100 tonnes annually contributed about 11%. The remaining 5% was the contribution of 20 Mica mines and one felspar mine each producing less than 20 tonnes annually. The entire production was reported from private sector during the year under review. Six principal producers accounted for 85% of the total output. Andhra Pradesh contributed almost entire (99%) of the total production. Remaining one percent production was reported from Rajasthan (Tables - 2 to 5).

The mine-head stocks of mica (crude) were 212 tonnes at the end of 2010-11 as against 245 tonnes at the beginning of the year (Table - 6).

The average number of daily labourers employed in mica mines during 2010-11 was 433 as against 402 in the previous year. The domestic prices of mica are furnished in the General Review on Prices.

Table – 1 : Reserves/Resources of Mica as on 1.4.2010
(By Grade/States)

(In kg)

Grade/State	Reserves				Remaining resources								Total resources (A+B)
	Proved STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
		STD121	STD122			STD221	STD222						
All India : Total	**169840721**	**15268960**	**5631767**	**190741448**	**21427000**	**11317310**	**118867638**	**52723690**	**42504035**	**94427443**	**228415**	**341495531**	**532236979**
By Grade													
Unclassified	169840721	15268960	5631767	190741448	21427000	11317310	118867638	52723690	42504035	94427443	228415	341495531	532236979
By States													
Andhra Pradesh	162325190	15247003	2789885	180362078	7794000	5101000	-	3750000	5502145	18277005	-	40424150	220786228
Bihar	-	-	74233	74233	-	-	-	-	-	12992434	7700	13000134	13074367
Jharkhand	-	-	-	-	-	-	-	-	-	1494430	170700	1665130	1665130
Maharashtra	-	-	-	-	-	-	65916000	-	-	15120000	-	81036000	81036000
Odisha	-	-	-	-	-	6216000	52024000	-	20328000	26712000	-	105280000	105280000
Rajasthan	7515531	21957	2767649	10305137	13633000	310	927638	48973690	16673890	19831574	50015	100090117	110395254

Figures rounded off.

Mica (Waste and Scrap)

The production of mica (waste and scrap) at 5,820 tonnes in 2010-11 decreased by 28% as compared to that of the previous year. The contribution of Andhra Pradesh was 79% of the total production of mica (waste & scrap) followed by Rajasthan 21%.

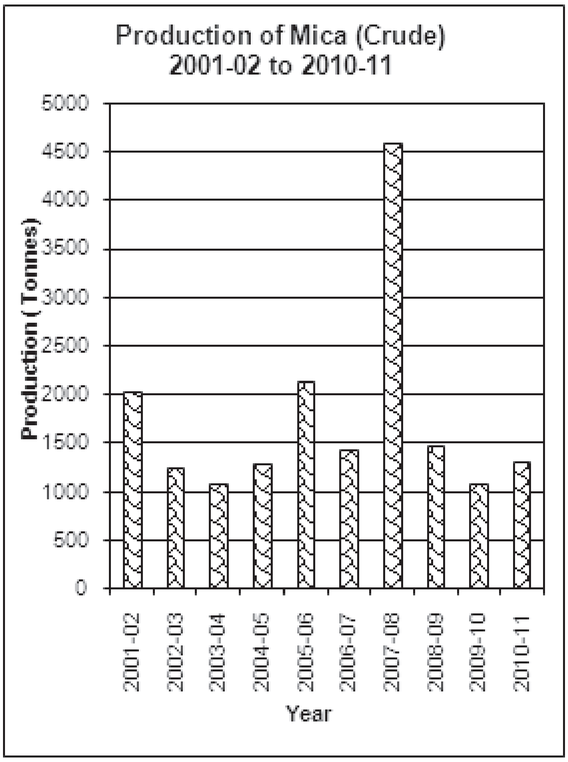


Table – 2 : Principal Producers of Mica, 2010-11

Name & address of producer	Location of mine	
	State	District
Dwarakananad Reddy, & 7 others, Manguta layout, 1-C, Vaibhav Apartment, Nellore, Andhra Pradesh.	Andhra Pradesh	Nellore
Mahanth Mica Mines, Managing Partner, Smt. C. Leenaja Reddy, Plot No.7, Door No. 8, Ist Main Road, Kasturba Nagar, Chennai, Tamil Nadu.	Andhra Pradesh	Nellore
S.V.K.D. & U.M. Mining Co., Usman Saheb Pet, Nellore - 2, Andhra Pradesh.	Andhra Pradesh	Nellore
Seethamma Mining Co., P.O. Kalichedu, Mandal Sydapuram, Dist. Nellore, Andhra Pradesh.	Andhra Pradesh	Nellore
Sree Kalyanarama Company, Palace Venkatagiri (Town), Nellore, Dist. Nellore, Andhra Pradesh.	Andhra Pradesh	Nellore
Sri Lakshmi Sai Durga Mining Co. 3-188-1, Dhurjetti Nagar, Post-Gudur-1, Dist. Nellore, Andhra Pradesh.	Andhra Pradesh	Nellore

Table – 3 : Production of Mica (Crude and Waste & Scrap), 2008-09 to 2010-11 (By States)

(Qty in tonnes; Value in ₹'000)

State	2008-09		2009-10		2010-11(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
Mica (Crude)						
India	**1462**	**42728**	**1061**	**39940**	**1293**	**43963**
Andhra Pradesh	1436	42468	1057	39817	1277	43586
Rajasthan	26	260	4	123	16	377
Mica (Waste & Scrap)						
India	**5685**	–	**8098**	–	**5820**	–
Andhra Pradesh	4297	–	4394	–	4616	–
Rajasthan	1388	–	3704	–	1204	–

Table – 4 : Production of Mica (Crude and Waste & Scrap), 2009-10 and 2010-11 (By Sectors/States/Districts)

(Qty in tonnes; value in ₹'000)

State/District	2009-10			2010-11(p)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
Mica (Crude)						
India	**32(3)**	**1061**	**39940**	**31(4)**	**1293**	**43963**
Private sector	32(3)	1061	39940	31(4)	1293	43963
Andhra Pradesh	**29**	**1057**	**39817**	**28(1)**	**1277**	**43586**
Khammam #	-	–	–	1	–	–
Nellore	29	1057	39817	27(1)	1277	43586
Rajasthan	**3(3)**	**4**	**123**	**3(3)**	**16**	**377**
Ajmer	-	-	-	(1)	6	195
Bhilwara	2(3)	4	123	2(2)	10	182
Rajsamand #	1	–	–	1	–	–
Mica (Waste & Scrap) #						
India	*	**8098**	–	*	**5820**	–
Private sector	*	8098	–	*	5820	–
Andhra Pradesh	*	**4394**	–	*	**4616**	–
Khammam	*	-	–	*	50	–
Nellore	*	4394	–	*	4566	–
Rajasthan	*	**3704**	–	*	**1204**	–
Bhilwara	*	3293	–	*	1104	–
Rajsamand	*	411	–	*	100	–

* *Mines covered under mica (crude).*
\# *Production of mica (waste & scrap) only.*

Table – 5 : Production of Mica (Crude), 2009-10 and 2010-11(P) (By Frequency Groups)

(Qty in tonnes)

Production group	No. of mines		Production for the group		Percentage in total production		Cumulative percentage	
	2009-10	2010-11	2009-10	2010-11	2009-10	2010-11	2009-10	2010-11
All Groups	**32(1)**	**31(1)**	**1061**	**1293**	**100.00**	**100.00**	–	–
Up to 2	13(1)	12	5	2	0.47	0.15	0.47	0.15
2 to 4	3	2	8	5	0.75	0.38	1.22	0.53
4 to 6	2	1	9	5	0.85	0.38	2.07	0.91
6 to 8	-	1(1)	-	13	-	1.01	2.07	1.92
8 to 20	3	4	42	38	3.96	2.94	6.03	4.86
20 to 30	2	3	45	77	4.24	5.96	10.27	10.82
30 to 40	2	-	72	-	6.79	-	17.06	10.82
40 to 100	2	1	128	69	12.06	5.34	29.12	16.16
Above 100	5	7	752	1084	70.88	83.84	100.00	100.00

Table – 6 : Mine-head Stocks of Mica (Crude), 2010-11(P) (By States)

(In tonnes)

State	At the beginning of the year	At the end of the year
India	**245**	**212**
Andhra Pradesh	243	208
Rajasthan	2	4

MINING, MARKETING AND TRANSPORT

There are about 31 working mica mines in the country and majority of them are located in Andhra Pradesh. All the mica mines were opened up first as prospecting pits. These trial workings were later developed into opencast workings of 5 to 10 m depths known as Upper Challa. The nature & quality of the yield decide as to whether underground method has to be adopted for mining of mica, especially mica-bearing pegmatites. Overhand cut-and-fill method of mining with flat-back and waste-fill methods are practised in mica mines. Pegmatite is opened up by striking vertical or inclined shaft. As mica is confined to hanging wall and footwall contacts and sometimes to core zone, driving and stoping is done only in these areas. The entire pegmatite body is not subjected to stoping, and wall and roof are generally self-supporting. The mines are developed to maximum 100 m depths. Non-coring extension drilling is being practised for underground drivages. Most of the mines have installed haulages for transport of material, electric fans for ventilation and pumps for dewatering.

There has been change in method of mining in some of the mines in recent years. The old method was tunneling, but now some of the old mines have been made into open quarries. With this system, mines now produce felspar, quartz mica and vermiculite. This system has also enabled use of heavy machinery which resulted into increase in production.

Crude mica produced from the workings is transported to the surface where it is cobbed manually to remove the gangue minerals like quartz, felspar and other associated minerals including waste mica. Skilled labourers dress the hand-cobbed mica with sickle, knife and scissors. During dressing, the part of mica containing deformities, such as fractures, unevenness and cracks, is removed and only the better material is retained as blocks. Such blocks are classified into various sizes and qualities on the basis of visual estimates. The mica so rejected during dressing is sold as scrap. Mica processing is a labour-intensive activity requiring special skills. The art of manual processing of mica has been acquired by the Indian workers through generations. It has been a cottage industry in the mica mining areas of Bihar, Andhra Pradesh, Jharkhand and Rajasthan.

CONSUMPTION

Complete picture regarding the consumption of mica is not available as there is no adequate coverage of information on various mica-consuming industries. Sheet mica is used mainly in electrical and micanite industries while scrap mica is used in the manufacture of mica paper and ground mica which, in turn, is used in asphaltic roofing, welding electrode, paint, rubber, insulation bricks, etc.

USES

Natural sheet mica is used in electrical and electronic industries in the form of blocks, splittings and films or built-up mica called “micanite". Sheet mica is used to manufacture fabricated and micanite products, such as capacitors and commutator segments. Micanite or built-up mica is partly overlapped, irregular-shaped and arranged as splittings cemented together with either an organic or inorganic binder. Other uses of sheet mica include gauge glasses of high pressure steam boilers, diaphragms of oxygen-breathing equipment, marker dials of navigation compasses, quarterwave plates for optical instruments, window covers for radiation pyrometers & thermal regulators, stove window, chimneys for gas & petromax lamps, diaphragms in microwave transmitters and insulation wrappers for high tension radar coils. Besides, high quality natural mica sheets are used in helium-neon lasers where mica sheet works as retardation plate. Of late, mica washers have gained extensive use in computer industry.

Mica paper or reconstituted mica is a paper-like material made by depositing fine flakes of scrap mica as a continuous mat which is then dried. Mica paper is usually impregnated with organic binder. Primary end-uses of mica paper are the same as for micanite or built-up mica.

Micanite is used in electrical insulation mainly because natural mica sheet of sufficient thickness is not always available. This is used in copper commutator segments of DC universal motors and generators, moulding plates from which V-rings are cut and stripped for use in commutators. These moulding plates also find use in the form of tubes and rings as an insulator in transformers, armatures and motor starters. As flexible plates, micanite is also used in electric motors and generator-armatures, field coil insulators & magnet and commutator core insulation. Similarly, as heater plates, micanite is used where high insulation strength at high temperature is required.

In the construction sector, mica scrap/ground mica is used in jointing cement for gypsum boards, asphaltic roofings and damp-proof seals, and insulation boards. The use of ground mica in building boards is a new development. Ground mica acts as reinforcing filler in plaster for textured coatings. Mica is used in insulation bricks, slabs and tiles because of its excellent thermal and insulating properties. Dry-ground 50 mesh mica is used in the flux coating for arc welding electrodes, with flux containing 3 to 5% mica powder. In paints, mica in the form of powder is used as filler and as an extender because it provides a smoother consistency, improved workability and imparts increased resistance to water penetration and weathering. Mica is used mainly in four types of paints, such as bituminous emulsions, exterior paints, fire-retardant paints and pearlescent pigments. Drilling muds or fluids form an important market for ground mica. Mica is added to drilling fluids to get off the lost circulation zones. The platy structure of mica facilitates the overlapping of particles to form a tight layer or wall, thereby preventing further fluid loss.

Ground mica is used in the rubber industry as a dusting agent and as an inert filler in the production of rubber. Mica fillers increase the hardness, tensile strength and tear resistance of rubber articles. In plastic industry, mica is used as a filler and reinforcer in thermoplastics to improve the electrical properties, flexural strength & modulus, stiffness, heat deflection temperatures and resistance. Dry-ground mica powder is used in small quantities in cosmetic applications. The property of high resistance of mica to the effect of the sun rays, moisture, gases, water and other chemicals, enables the use of dry-ground mica powder in small quantity to improve the decorative coating and lustre of wallpaper, printing and ceiling papers, etc. Wet-ground mica powder is used in paints, cosmetics, rubber, etc. as a filler. Small quantities of scrap mica/ground mica are also used in industries like foundries as coating to foundry cores and moulds, as a dry lubricant to prevent hot bearings from seizing up, etc.

SUBSTITUTES

Mica and its products can be substituted to some extent by using alumina, ceramics, bentonite, glass, mylar polystyrene, fused quartz, silicon, talc, bakelite, teflon, nylon and synthetic mica.

Scrap

Some lightweight aggregates, such as diatomite, vermiculite and perlite may be substituted for ground mica when used as filler. Ground synthetic fluorophlogopite, fluorine-rich mica, may replace natural ground mica for uses that require thermal and electrical properties of mica.

Sheet Mica

Many products can be substituted for mica in electrical and electronic uses. Substitutes include Acrylic, Benelex, Cellulose acetate, Delrin, Duranel N, Fibreglass, Fishpaper, Kel F, Kydex, Kapton Lexan, Lucite, Mylar, Nylon, Nylatron, Nomex, Noryl, Phenolics, Plexiglass, Polycarbonate, Polyester, Styrene, Teflon, Vinyl-PVC and Vulcanised Fibre. Mica paper made from scrap mica can be substituted for sheet mica in electrical and insulation applications.

SPECIFICATIONS

Over the years, the Bureau of Indian Standards (BIS) has realised the importance of mica and mica products and has prepared standards for (a) processed mica, (b) fabricated mica and (c) mica-based products. BIS has brought out the following specifications for mica for various purposes:

IS: 1175 – 1981(First Revision, Reaffirmed

2011): Deals with methods of grading and classification of muscovite mica blocks, thins and films according to visual size, visual qualities and presence of structural imperfections.

IS: 1885 (Part-53)-1980 (Reaffirmed 2007): Deals with electrotechnical vocabulary, part-53, Mica.

IS: 2001-1968: Deals with specifications of fixed silvered mica capacitors.

IS: 2464-1963 (Reaffirmed 2008): Deals with specifications of built-up mica for electrical purposes.

IS: 9043-1979 (Reaffirmed 2011): Deals with grading (by size) of phlogopite mica blocks, thins, films and splittings.

IS: 9044-1979 (Reaffirmed 2011): Deals with methods of measuring thickness of mica blocks, thins, films and splittings.

IS: 9045-1979 (Reaffirmed 2011): Deals with thermal classification of phlogopite mica splittings.

IS : 9299 (Part 3/Sec.1)- 1979 (Reaffirmed 2003): Deals with rigid mica material for commutator separators.

IS: 9299 (Part3/Sec.2)–1982 (Reaffirmed 2003) : Deals with moulding mica materials for electrical purposes.

IS : 9299 (Part 3/Sec. 3) – 1982 (Reaffirmed 2008): Deals with flexible mica flake tape for insulation of electrical machines.

IS : 9299 (Part 3/Sec. 4) (Reaffirmed 2008): Deals with rigid mica materials for heating equipment.

IS : 13357 : Methods of grading and visual classification of muscovite mica splittings.

INDUSTRY

Although there are a number of mica-based industrial units located at various parts of the country, detailed information about them is not available. Indian Telephone Industries Ltd, Bengaluru; Indian Mica and Micanite Industries, Jhumritalaiya; Meenakshi Sundaram Mica Mines, Nellore; Master Insulation Corporation Pvt. Ltd, Bengaluru; etc. are some of the known consumers of sheet mica for the manufacture of various mica-based products. The Mica Silvering and Capacitor Plant of MMTC at Giridih, Jharkhand has been closed. Other units of MMTC, such as Mica Paper Plant, Micronised Mica Powder Plant and Mica Insulating Material Plant, are all located at Abhrak Nagar in Koderma district, Jharkhand. Besides MMTC, Arun Mica Industries Ltd, Bhilwara and Metores Corporation Pvt. Ltd, Kolkata, are also reported to have produced mica powder. Details of projects of MMTC for mica-based products are furnished below:

Micronised Mica Powder Plant

The Mica Powder Plant set up at Jhumritalaiya in Koderma district, Jharkhand, has an annual production capacity of 900 tonnes of different grades of mica powder ranging from 325 to 1,000 mesh. One such unit was set up in Chennai which consumed Gudur mica scrap. Two small wet-ground mica powder units were known to be working in Nellore district of Andhra Pradesh. These plants consumed scrap mica produced in Gudur area of Nellore district. Dry-ground mica is exported to Asian and European countries after meeting the domestic requirement.

Mica Paper Plant (Mechanical Disintegration Process)

The plant was set up in collaboration with M/s Nippon Rika Rogyosho Co. Ltd. It has a production capacity of 600 tpy mica paper and is registered under 100% Export-oriented Unit Scheme.

Mica Paper-based Insulating Material Project (Phase I)

The project to manufacture insulating material based on mica paper and mica splitting was set up in collaboration with M/s ALK, West Germany. It has a production capacity of 45 tpy mica paper-based insulating material.

Mica Splittings

The manufacture of splittings was one of the biggest generators of employment in the mica industry. This big section of the Mica Industry is now at the ebb, mainly due to accumulated old stocks and the use of mica paper in micanite production. There are a number of units in the country, which are producing micanite from mica splittings.

Changed market requirement and technological developments in mica processing technologies globally led to activities at Mica Division of MMTC coming to a halt and the Abhrak Nagar factory of mica has wound up its operation since 2002-03.

TRADE POLICY

As per the Foreign Trade Policy for 2009-14 and the effective Export-Import Policy, exports and imports of all varieties of mica blocks, splittings, powder, waste and scrap under heading 2525 are allowed without restrictions.

WORLD REVIEW

There has been no formal evaluation of world reserves of sheet mica because of the sporadic occurrence of this mineral. Large deposits of mica- bearing rocks are known to exist in countries, such as Brazil, India and Madagascar. Reserves of scrap and flake mica are available in clay deposits, granite, pegmatite and schist and are considered more than adequate to meet anticipated world demand in the foreseeable future. The data on world reserves of mica (natural), sheet are given in Table - 7.

The world output of mica was 330 thousand tonnes in 2010. China and USA were the leading producers of mica, followed by Republic of Korea, Canada and Finland (Table - 8).

Muscovite mica production was delivered from the USA, Russia, China and Rep. of Korea. Sheet mica supply was confined largely to India and to a lesser extent, Russia and Argentina.

Table – 7 : World Reserves of Mica (Natural), Sheet (By Principal Countries)

Country	Reserves
World : Total	**Very Large**
India	Very large
Russia	Moderate
USA	Very small
Other countries	Moderate

Source: *Mineral Commodity Summaries, 2012.*

Table – 8 : World Production of Mica (By Principal Countries)

(In '000 tonnes)

Country	2008	2009	2010
World: Total	**380**	**290**	**330**
Argentina	9	9	8^e
Canada^e	17	15	15
China^e	139	91	126
Finland	11	10^e	10^e
France @	20$^{(e)}$	8	8
Iran	1	7	7^e
Korea, Rep. of #	49	27	36
Russia^e	10	9	9
Spain @	4	4^e	7$^{(e)}$
USA*	84	90^e	90^e
Other countries	36	20	14

Source: *World Mineral Production, 2006-2010.*

\# *Mainly sericite*

@ *Including mica recovered from mica schists and/or kaolin beneficiation.*

* *Sold or used by producers*

FOREIGN TRADE

Exports

Exports of mica (total) increased substantially to 125,357 tonnes in 2010-11 from 94,216 tonnes in the previous year. Almost all the exports were in the form of mica (unmanufactured) at 124,796 tonnes (comprising blocks - 3,008 tonnes, splittings - 1,999 tonnes, powder - 85,560 tonnes, and waste & scrap - 34,221 tonnes). The exports of mica (worked) were 561 tonnes (comprising washers & discs - 55 tonnes, sheets &. washers & discs - 55 tonnes, sheets & strips - 36 tonnes, micanite & other built up mica - 13 tonnes, other worked mica - 353 tonnes and mica bricks -100 tonne). Besides, nominal quantities of condenser films, plates, cuts, NES were also exported. In 2010-11, exports were mainly to China (61%), Belgium (7%), Japan (4%), USA & Germany (3% each) and Rep. of Korea (2%) (Tables - 9 to 22).

Imports

Imports of mica (total) increased marginally to 1,687 tonnes in 2010-11 from 1,661 tonnes in the previous year. Out of the total imports in 2010-11, imports of mica (unmanufactured) were 409 tonnes (comprising powder-126 tonnes, splittings-258 tonnes and waste & scrap-25 tonnes). Besides, nominal quantity of block mica was also imported. The remaining 1,278 tonnes imports were of mica (worked) which included condenser films, plates, cuts, and NES-92 tonnes, sheets & strips-203 tonnes, micanite and other built up mica-22 tonnes and other worked mica - 956 tonnes, besides 1 tonne of washers & discs (Tables - 23 to 34).

Table – 9 : Exports of Mica : Total (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**94216**	**1620533**	**125357**	**2220119**
China	53972	753324	76280	1156306
Japan	4858	177772	5513	219948
Belgium	7010	139620	8739	174506
USA	2826	94194	3858	137957
Germany	1526	28203	3258	46564
Mexico	3	3621	55	41960
Finland	2310	45916	1800	40887
Hong Kong	257	42073	904	39744
UK	1029	36873	1278	34250
Korea, Rep. of	760	22536	2793	31172
Other countries	19665	276401	20879	296825

Table – 10 : Exports of Mica (Unmanufactured) : Total (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**93341**	**1319956**	**124796**	**1870866**
Belgium	7007	134868	8738	172558
China	53920	714191	76211	1090345
Finland	2310	45353	1800	40251
Germany	1502	14869	3248	37649
Japan	4756	118809	5475	160281
Korea, Rep. of	756	15701	2790	25849
Netherlands	2583	40579	384	3102
Russia	384	20901	653	25907
Saudi Arabia	2785	17114	3386	18890
USA	2292	55625	3829	94191
Other countries	15046	141946	18282	201843

Table – 11 : Exports of Mica (Blocks) (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**1400**	**71381**	**3008**	**107538**
Japan	907	40967	1401	59224
China	41	13290	361	19078
Russia	10	3387	175	7736
Czech Republic	1	200	96	4680
Belgium	24	996	174	4254
Brazil	40	1582	98	2928
Korea, Rep. of	101	3345	80	2200
Bangladesh	215	1120	522	1615
Hong Kong	–	–	9	1195
USA	11	729	17	1125
Other countries	50	5765	75	3503

Table – 12 : Exports of Mica (Splittings) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**2704**	**74207**	**1999**	**61712**
Kazakhstan	12	3143	83	14505
China	354	18476	434	14108
USA	135	14733	73	10267
Russia	22	10785	16	5413
Germany	5	514	162	3701
Chinese Taipei/ Taiwan	++	48	40	3512
Brazil	70	2113	29	1894
Japan	527	5686	30	1686
Kuwait	90	1794	108	1619
Bangladesh	1033	3735	574	1320
Other countries	456	13180	450	3687

Table – 13 : Exports of Mica (Powder) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**62073**	**778727**	**85560**	**1254584**
China	31089	375319	47869	718964
Belgium	6402	116937	8159	155848
Japan	2250	48277	3046	77144
USA	1881	33987	3224	72549
Finland	2300	43833	1700	37769
Korea, Rep. of	590	11287	2636	22363
Germany	1030	9724	2163	18492
Saudi Arabia	2494	15583	3074	17417
Iran	1006	5320	1832	11494
UK	949	6414	1195	10205
Other countries	12082	112046	10662	112339

Table – 14 : Exports of Mica (Waste & Scrap) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**27164**	**395641**	**34221**	**446517**
China	22436	307106	27539	337822
Japan	1072	23879	998	22227
Germany	464	4206	923	15400
Russia	252	5956	462	12662
Belgium	499	13755	405	12456
USA	265	6176	515	10250
Hong Kong	189	3457	451	9194
Romania	68	1636	198	4485
Iran	230	2477	498	4376
Czech Republic	458	13655	121	3293
Other countries	1231	13338	2111	14352

Table – 15 : Exports of Mica (Worked) : Total (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**875**	**300577**	**561**	**349253**
China	52	39133	69	65961
Germany	24	13334	10	8915
Hong Kong	49	38109	127	21930
Japan	102	58962	38	59666
Korea, Rep. of	4	6833	3	5323
Malaysia	3	2805	9	7259
Mexico	3	3574	34	41772
Netherlands	21	9357	41	15992
UK	28	30182	27	23181
USA	534	38570	29	43765
Other countries	55	59718	174	55489

Table – 16 : Exports of Mica (Condenser Films) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	–	–	**8**	**515**
China	–	–	**8**	**373**
Russia	–	–	++	**96**
Germany	–	–	++	**45**
Other countries	–	–	++	**1**

Table – 17 : Exports of Mica (Cond. Films, Plates, Cuts (NES) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	++	**1307**	**4**	**2685**
USA	++	371	2	1551
Netherlands	–	–	1	719
Belgium	++	35	1	178
Germany	++	313	++	115
Poland	–	–	++	83
Italy	–	–	++	36
Sudan	–	–	++	2
Other countries	++	588	++	1

Table – 18 : Exports of Mica (Washers & Discs) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**498**	**23229**	**55**	**60770**
Mexico	3	3497	34	41751
USA	470	5222	6	7605
Japan	3	2998	3	3064
Czech Republic	–	813	1	1097
Brunei	–	119	1	828
Spain	–	302	1	757
Canada	–	1004	3	748
Hong Kong	15	2719	1	729
China	4	2451	1	635
Brazil	1	729	1	506
Other countries	2	3375	3	3050

Table – 19 : Exports of Mica (Sheets & Strips) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**8**	**4833**	**36**	**26602**
China	++	53	8	7629
UK	-	-	3	3387
USA	1	994	4	2232
Hong Kong	++	82	3	1972
Japan	-	-	2	1897
Russia	-	-	++	1498
Belgium	-	-	++	1440
Czech Republic	-	-	1	1072
Canada	3	770	3	824
Brazil	++	136	1	715
Other countries	4	2798	11	3936

Table –20 : Exports of Micanite & Other Built-Up Mica (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**10**	**3894**	**13**	**4342**
South Africa	1	339	2	723
Turkey	–	–	5	446
Brazil	++	125	1	413
Malaysia	1	176	1	396
Egypt	2	573	2	354
Hong Kong	2	711	1	308
UK	1	584	++	272
Germany	–	–	++	258
Singapore	–	–	++	230
Denmark	–	–	++	230
Other countries	3	1386	1	712

Table – 21 : Exports of Mica (Bricks) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	20010-11 Qty (t)	20010-11 Value (₹'000)
All Countries	**1**	**1289**	**100**	**1568**
Bhutan	–	–	100	1456
UK	–	–	++	73
Poland	++	584	++	39
Other countries	1	705	-	-

Table – 22 : Exports of Mica Worked (Others) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**358**	**266025**	**353**	**253286**
China	48	36629	60	57697
Japan	99	55964	33	54705
USA	63	31455	17	32377
UK	27	28795	24	19411
Hong Kong	32	34597	122	18921
Netherlands	21	9252	40	15272
Germany	24	12674	10	8251
Malaysia	1	2002	6	6581
Korea, Rep. of	3	5920	2	4752
Russia	3	4000	1	3474
Other countries	37	44737	38	31845

Table – 23 : Imports of Mica : Total (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**1661**	**422697**	**1687**	**411461**
Switzerland	276	91845	344	169561
Austria	190	103041	335	114179
China	547	43288	536	53999
UK	318	87860	112	16525
Malaysia	51	14565	43	15099
Germany	34	17122	44	13042
Korea, Rep. of	6	5524	6	4981
USA	27	6225	14	4247
Japan	43	38130	39	3899
Swaziland	15	3768	8	2533
Other countries	154	11329	206	13396

Table – 24 : Imports of Mica (Unmanufactured) : Total (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**379**	**15874**	**409**	**13603**
China	208	7118	186	3959
Japan	17	1644	23	2243
USA	15	1705	9	1205
Sri Lanka	10	258	35	714
Germany	-	-	5	610
China	-	-	9	560
Norway	–	–	9	524
Spain	3	498	2	422
Netherlands	–	–	1	291
Unspecified	-	-	118	2467
Other countries	126	4606	12	608

Table – 25 : Imports of Mica (Blocks) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**++**	**137**	**++**	**12**
Brazil	-	-	++	12
USA	++	129	-	-
Other countries	++	8	–	–

Table – 26 : Imports of Mica (Splittings) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**191**	**5739**	**258**	**4707**
China	174	4886	136	2165
Brazil	–	–	4	74
Unspecified	-	-	118	2467
Other countries	17	853	++	1

Table – 27 : Imports of Mica (Powder) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**72**	**6343**	**126**	**8529**
Japan	17	1644	23	2243
China	30	1740	50	1793
USA	13	1539	9	1205
Germany	-	-	5	610
Chinese Taipei/Taiwan	-	-	9	560
Norway	–	–	9	524
Spain	3	498	2	422
Netherlands	-	-	1	291
Sri Lanka	–	–	10	260
France	2	168	2	182
Other countries	7	754	6	339

Table – 28 : Imports of Mica (Waste & Scrap) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**116**	**3655**	**25**	**455**
Sri Lanka	10	258	25	455
Other countries	106	3397	–	–

Table – 29 : Imports of Mica (Worked) : Total (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**1282**	**406823**	**1278**	**397858**
Switzerland	276	91845	344	169561
Austria	190	103041	335	114179
China	339	36171	350	50040
UK	317	87471	111	16445
Malaysia	51	14565	43	15099
Germany	34	17122	39	12432
Korea, Rep. of	6	5524	6	4981
USA	12	4474	5	3042
Swaziland	15	3768	8	2533
Sweden	8	3289	5	2085
Other countries	34	39553	32	7461

Table – 30 : Imports of Mica (Condenser Films, Plates, Cuts, NES) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**115**	**22377**	**92**	**48778**
Switzerland	35	7410	61	39875
Germany	12	1540	17	3651
UK	63	11993	9	1942
Austria	–	–	2	2011
China	1	90	3	299
Other countries	4	1344	-	-

Table – 32 : Imports of Mica (Sheets & Strips) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**136**	**10535**	**203**	**9356**
China	114	5383	123	4956
UK	18	2671	80	4388
Japan	–	–	++	12
Other countries	4	2481	-	-

Table – 31 : Imports of Mica (Washers & Discs) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**5**	**384**	**1**	**221**
China	4	79	1	143
USA	++	42	++	78
Other countries	1	263	-	-

Table – 33 : Imports of Micanite & Other Built-up Mica (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**27**	**3809**	**22**	**2122**
China	27	3809	9	1159
Japan	–	–	13	963

**Table – 34 : Imports of Mica Worked (Others)
(By Countries)**

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**999**	**369718**	**956**	**335992**
Switzerland	240	83393	283	129686
Austria	189	102985	333	112167
China	193	26809	214	43484
Malaysia	51	14565	43	15099
UK	236	72806	22	9115
Germany	22	15582	18	7498
Korea, Rep. of	6	5524	6	4981
USA	8	3092	5	2965
Swaziland	15	3768	8	2533
Sweden	8	3289	5	2085
Other countries	31	37905	19	6379

FUTURE OUTLOOK

Over hundred years, India has enjoyed the monopoly in the production and export of sheet mica in the world. But recently, production of mica has showed a continuous declining trend due to slow down in the demand of natural mica in the world market because of technological developments in use of mica and emergence of mica substitutes. However, there are sufficient resources in the country to meet the domestic requirement and export demand. Complete picture regarding the consumption of mica is not available. Sheet mica is used mainly in electrical and micanite industries while scrap mica is used in the manufacture of mica paper.

World demand for sheet mica is expected to decline. This would, however, be compensated by the anticipated growth in demand for scrap mica and value-added mica-based products. Therefore, the world market conditions are expected to be favourable for mica exports. However, to take full advantage of the prevailing situation and for boosting exports, it would be necessary for Indian Mica Industry to manufacture and export fabricated and value- added mica-based products, such as mica paper, micanite sheets and mica-based paper.

As per the Report of the Sub Group for the 12th Plan (2012-17), Planning Commission of India, there appears to be good demand for wet ground mica especially in the manufacture of pearlescent pigments which are increasingly used in the automotive industry. The Sub Group has recommended that establishment of wet ground mica plants based on imported know-how in the country needs to be encouraged. The quality of Indian ground mica powder is acceptable to foreign buyers. However, they prefer that the material should be free from iron and consistency in the mesh size in the powder. The Sub Group has underlined the need for efforts in this direction. It has also opined that process know-how for recovery of substantial concentration of lithium, rubidium and cesium values contained in some of the mica deposits in the country needs to be developed.

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

MOLYBDENUM

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

58 Molybdenum

Molybdenum is a refractory metal used principally as an alloying agent in steel, cast iron & superalloys to enhance strength and wear and corrosion resistance. It does not occur in nature in free state. Usually, it is found in chemically combined form with other elements. Molybdenite (MoS_2) is the principal ore of molybdenum. About two-thirds of global molybdenum production is as by-product of copper mining and only about one-third is obtained from primary molybdenum mines. In India, by-product concentrates of molybdenum are produced intermittently from uranium ore of Jaduguda mine belonging to Uranium Corporation of India Ltd (UCIL) in Jharkhand. The internal demand for molybdenum and its products is met mostly through imports.

RESOURCES

Despite some major discoveries and noteworthy addition in NMI, India continues to lack in several critical minerals; one of them is molybdenum. In India, molybdenum is associated generally with copper, lead and zinc ores. Rakha copper deposit in Jharkhand contains 45 to 48 ppm molybdenum. Malanjkhand copper deposit in Madhya Pradesh contains 0.04% recoverable molybdenum. Dariba-Rajpura lead-zinc deposit in Rajasthan contains molybdenum besides bismuth, arsenic and cadmium. The multimetal deposit at Umpyrtha in Khasi and Jaintia Hills, Meghalaya, reportedly contains molybdenum in association with copper, lead and tungsten. Molybdenum deposit in Karadikuttam in Madurai district, Tamil Nadu, contains 0.02 to 0.14% recoverable molybdenum.

As per the UNFC System, the resources of molybdenum ore in the country as on 1.4.2010 are estimated at about 19.29 million tonnes containing about 12,640 tonnes MoS_2. The above resources are located in Tamil Nadu (9.97 million tonnes), Madhya Pradesh (8 million tonnes) and Karnataka (1.32 million tonnes) (Table-1).

EXPLORATION & DEVELOPMENT

In Vellampatti area, Dharmapuri district, Tamil Nadu, which was explored by GSI during FS 2009-10, an inferred resource (333) of 2.74 million tonnes of molybdenum ore with an average grade of 0.102% Mo has been estimated.

In Tamil Nadu, GSI has undertaken further investigation work at prospecting stage (G-3) during FS 2010-12 for molybdenum in Harur-Uttangarai molybdenum belt in Vellakkal Central block of Dharmapuri district. Three boreholes BH-1 to 3 have been drilled. The maiden borehole BH-1 intersected the shear zone between 80.70 m and 108.50 m depths. Visible molybdenite mineralisation was rarely noticed in the shear zone. A total of 42 core samples collected from this borehole have analysed Mo values up to 220 ppm. Borehole BH-2 intersected sheared quartzo-felspathic gneiss, sheared epidote-hornblende gneiss and quartz vein. The shear zone is characterised by sericitisation in quartzo-felspathic portions and chloritisation in mafic rich portions of the country rock. A total of 128 core samples collected from this borehole have analysed Mo values up to 200 ppm. In borehole BH-3, molybdenite specks with galena and pyrite are noticed. Random samples from borehole cores analysed for rhenium during the earlier phase of investigation has indicated average Re value of 6 ppm from 16 samples.

USES

Molybdenum is a versatile alloying agent for alloy steel, cast iron, nickel, cobalt and titanium alloys. For desired metallurgical properties, it is used in the form of molybdic oxide or ferro-molybdenum. It is used in different proportions for imparting desired properties, such as increased strength, hardness and resistance to corrosion, temperature and chipping. It also finds application in permanent magnet alloys. As a refractory metal, it is used in many electrical and electronic components and as resistance element in electric furnaces and other

Table – 1 : Reserves/Resources of Molybdenum as on 1.4.2010
(By Grades/States)

(In tonnes)

Grade/State	Reserves Total (A)	Remaining resources Pre-feasibility STD221	Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	Total resources (A+B)
All India : Total								
Ore	**-**	**1500000**	**36000**	**569304**	**17013628**	**167800**	**19286732**	**19286732**
Contained MoS_2	**-**	**1050**	**83**	**287**	**11169**	**50**	**12639**	**12640**
By States								
Karnataka								
Ore	-	-	-	-	1320900	-	1320900	1320900
Contained MoS_2	-	-	-	-	1719	-	1719	1719
Madhya Pradesh								
Ore	-	-	-	-	8000000	-	8000000	8000000
Contained MoS_2	-	-	-	-	5020	-	5020	5020
Tamil Nadu								
Ore	-	1500000	36000	569304	7692728	167800	9965832	9965832
Contained MoS_2	-	1050	83	287	4431	50	5901	5901

Figures rounded off.

equipment which are operated at extremely high temperatures. Its non-metallurgical uses are in lubricants, catalysts, pigments, as an additive in oil and greases, in aerosol sprays, in reducing surface friction and as an antiwear and antifriction agent in plastics.

SUBSTITUTES

There is little substitution for molybdenum in its major application, viz, as an alloying element in steel and cast irons. Because of the availability and versatility of molybdenum, industry has sought to develop new materials that benefit from the alloying properties of the metal. Potential substitutes for molybdenum include chromium, vanadium, niobium (columbium) and boron in alloy steels; tungsten in tool steels; tungsten and tantalum for refractory materials in high temperature electric furnaces and chrome-orange, cadmium-red and organic-orange pigments for molybdenum orange.

MINING

Molybdenum concentrate is produced intermittently incidental to uranium mining at Jaduguda mine of UCIL.

INDUSTRY AND CONSUMPTION

Usually, molybdenum is used in the form of roasted concentrates, oxide or ferro- molybdenum in the defence industries. HCL has installed a pilot plant for producing molybdenum concentrate from copper ore containing 0.3% Mo at Rakha mine, East Singhbhum district, Jharkhand. However, molybdenum recovery at Rakha is not found economical.

Molybdenum is used chiefly in the form of ferro-molybdenum. The production of ferro-molybdenum increased from 2,822 tonnes in 2009-10 to 3,050 tonnes in 2010-11. The reported consumption of ferro-molybdenum in 2010-11 was 992 tonnes and 855 tonnes in 2009-10. Alloy steel industry alone accounted for about 70% consumption followed by iron & steel (24%) and foundry (6%). The data on production and consumption of ferro-molybdenum are given in Tables - 2 and 3, respectively.

Non-ferrous Technology Development Centre at the Defence Metallurgical Research Laboratory, Hyderabad, has a pilot plant for producing molybdenum powder. Institute of Minerals and Materials Technology (formerly RRL), Bhubaneswar, is carrying out basic research on recovery of molybdenum from spent catalysts.

Table – 2 : Production of Ferro-molybdenum 2006-07 to 2010-11

(In tonnes)

Year	Production
2006-07	3120
2007-08	2899
2008-09	2112
2009-10	2822
2010-11	3050

Source: *Indian Ferro-Alloys Producers' Association.*

Table – 3 : Reported Consumption of Ferro-molybdenum, 2008-09 to 2010-11 (By Industries)

(In tonnes)

Industry	2008-09(R)	2009-10(R)	2010-11(P)
All Industries	**971**	**855**	**992**
Alloy steel	693(8)	574(8)	695(8)
Foundry	63(9)	57(9)	57(9)
Iron & steel	215(8)	224(9)	240(9)

Figures rounded off.
Data collected on non-statutory basis.
Figures in parentheses denote the number of units in organised sector reporting consumption.*
(Includes actual reported consumption and for estimates made wherever required).*

TRADE POLICY

As per Foreign Trade Policy, 2009-2014, imports of molybdenum ores & concentrates under heading No. 2613 and molybdenum and articles thereof under heading No. 8102 are allowed freely, except molybdenum waste & scrap (under ITC-HS Code No. 8102 9700) which are restricted.

WORLD REVIEW

The world reserves of molybdenum are over 10 million tonnes, located mainly in China (43%), USA (27%), Chile (12%), Peru (5%), besides Russia, Armenia, Canada and Mexico (Table-4). Identified world resources of molybdenum are about 19 million tonnes, which are adequate to supply world needs in foreseeable future.

The world production of molybdenum in terms of metal increased to 2.50 lakh tonnes in 2010 from 2.29 lakh tonnes in the previous year. China, USA and Chile together accounted for about 77% of world production (Table-5).

Table – 4 : World Reserves of Molybdenum (By Principal Countries)

(In '000 tonnes of molybdenum content)

Country	Reserves
World: Total (rounded)	**10000**
Armenia	200
Canada	220
Chile	1200
China	4300
Iran	50
Kazakhastan	130
Kyrgyzstan	100
Mexico	130
Mongolia	160
Peru	450
Russia(e)	250
USA	2700
Uzbekistan(e)	60

Source: *Mineral Commodity Summaries, 2012.*

Table – 5 : World Mine Production of Molybdenum (By Principal Countries)

(In tonnes of metal content)

Country	2008	2009	2010
World: Total	**223000**	**229000**	**250000**
Armenia	4472	4365	4377
Canada	8602	8721	8261
Chile	33639	34786	37044
China	81000	93500	100000
Mexico	7812	10167	10849
Peru	16721	12295	16963
Russia(e)	4800	4800	4800
USA	55900	47800	56000(e)
Other countries	10054	12566	11708

Source*: World Mineral Production, 2006-2010.*

In North America, most Canadian molybdenum reserves are porphyry molybdenum and porphyry copper-molybdenum. The La Caridad was a leading producer.

In Chile, the Chuquicamata and ET Teniente were among the largest deposits in the world.

Armenia

ZCMC was about to complete the final stages of ore processing facility at their Karajan copper-molybdenum mine in Syunik province. It was expected to be one of the largest mills by production capacity in the CIS countries.

Australia

Pre-feasibility study on Merlin deposit (discovered in 2008) is expected to start soon. Indicated resources of this deposit are 6.5 million tonnes of 1.3% Mo and 23 g/t rhenium, with expected production of 5,300 tpy of Mo and 7.5 tpy of rhenium. The production is expected to start in 2012 with an initial life of 9 years.

Canada

TCMC was expected to resume expansion of Endako Mine. By the end of 2011, the expansion of the mill would raise the annual production of molybdenum to around 6,800-7,300 tonnes of molybdenum. Taseko Mines Ltd announced expansion and modernisation of its Gibraltor Mine in British Columbia by the last quarter of 2010 this would raise the production to 430 tonnes of molybdenum from 285 tonnes in 2009.

Chile

Plant expansion initiated in mid 2008 at Los Pelambres mine of Antofagasta plc. was sucessfully completed on schedule in 2010. As a result, molybdenum production increased by 13% in 2010.

Molybdenos y Metales S.A. announced that construction of Molynor Industrial Complex in the port city of Mejillones in northern Chile which began in 2008 was fully operational in January 2010. The new plant was expected to be of 13,600 tpy molybdenum capacity.

USA

There were ten producing mines: one primary mine each in Colorado (Henderson), Idaho (Thompson Creek), Nevada (Ashdown) and New Mexico (Questa); six by-product producers in Arizona (Sierrita & Bagdad), Utah (Bingham Canyon) and one each in Montana, New Mexico (Chino) and Nevada (Robinson). Exploration at the Bingham Canyon Mine of Rio Tinto identified a new copper-molybdenum-gold porphyry system below the present open pit. The 450-550 million tonnes deposit was of 0.1-0.15% Mo grade compared to 0.045% Mo average grade in the open pit. The new reserves will enable the mining operation to last till 2028.

FOREIGN TRADE

Exports

Exports of molybdenum ores & concentrates declined sharply to 938 tonnes in 2010-11 from 9,056 tonnes in the previous year. In 2010-11 exports were mainly to Spain (57%) and Thailand (43%). Exports of molybdenum and scrap increased to 15 tonnes in 2010-11 from 7 tonnes in 2009-10. Exports were mainly to Germany and Poland (Tables - 6 and 7).

Imports

Imports of molybdenum ores & conc. were 4,382 tonnes in 2010-11 compared to 3,751 tonnes in the previous year. Imports were mainly from USA (37%), Chile (21%), Mexico (11%) and Canada (9%). Imports of molybdenum and scrap increased to 412 tonnes in 2010-11 from 297 tonnes in the previous year. China (63%) and Austria (19%) were the main suppliers.

Table – 6 : Exports of Molybdenum Ore & Conc.
(By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹ '000)
All Countries	**9056**	**33227**	**938**	**24570**
Spain	_	_	535	16195
Thailand	_	_	400	6698
Germany	_	_	1	1566
Kuwait	_	_	2	111
Other countries	9056	33227	_	_

Table – 7 : Exports of Molybdenum & Scrap
(By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**7**	**39440**	**15**	**48922**
Poland	4	19818	3	16978
Germany	++	566	7	7523
USA	++	1120	1	7154
Austria	++	1479	1	3624
France	++	1017	1	2963
Italy	++	1688	_	2416
Brazil	++	1934	++	1366
Japan	++	834	++	1184
Belgium	++	495	++	821
Colombia	++	1153	++	751
Other countries	3	9336	2	4142

Table – 8 : Imports of Molybdenum Ore and Conc.
(By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**3751**	**3336296**	**4382**	**6086645**
USA	673	654709	1618	2341606
Chile	1248	1146953	928	1254313
Mexico	31	43370	478	639672
Canada	307	257592	388	519776
China	121	151937	247	317830
Thailand	130	175318	146	227182
Netherlands	545	404929	126	204157
Korea, Rep. of	50	54670	153	170946
Belgium	155	136321	82	125993
Germany	240	89731	38	50057
Other countries	251	220766	178	235113

Table –9 : Imports of Molybdenum & Scrap
(By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**297**	**664803**	**412**	**932478**
China	191	366195	259	547882
Austria	49	134707	77	201321
USA	18	48045	35	71839
UK	1	5062	21	36534
Germany	12	36203	10	36247
Japan	13	42924	3	13011
Singapore	++	560	1	3586
Sweden	++	2454	1	3088
Switzerland	++	103	1	2276
Unspecified	1	1688	1	2381
Other countries	12	26862	3	14313

FUTURE OUTLOOK

The main end-use of molybdenum is in steel making. The principal use for molybdenum will continue as an additive in steel manufacturing, especially in alloys and stainless steel and in chemicals/catalysts. The petroleum refining and automotive catalytic application sectors continue to be strong markets for molybdenum. Strong growth in superalloys and stainless steel can be expected in the near future.

In India, it is expected that demand for molybdenum will be increasing and this internal demand for molybdenum will continue to be met through imports.

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

NICKEL

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

59 Nickel

Nickel, when added in small quantity to iron, increases its properties manifold and makes the product hard and stainless. The reason behind the demand of primary nickel in the entire world is for the production of stainless steel. When it is used in plating, it makes the surface tarnish-resistant and provides polished appearance.

Nickel is not produced from primary sources in the country and the entire demand is met through imports. However, it is being recovered as nickel sulphate crystals, a by-product obtained during copper production.

OCCURRENCES & RESOURCES

Important occurrence is nickeliferous limonite in the overburden of chromite in Sukinda Valley, Jajpur district, Odisha, where it occurs as oxide. A suitable process is being developed for its utilisation. Nickel also occurs in sulphide form along with copper mineralisation in East Singhbhum district, Jharkhand.

In addition, it is found associated with uranium deposits at Jaduguda, Jharkhand and process is being developed for its recovery. Other reported occurrences of nickel are from Karnataka, Kerala and Rajasthan. Polymetallic sea nodules are another source of nickel.

As per UNFC, as on 1.4.2010, the total resources of nickel ore have been estimated at 189 million tonnes. About 92% resources; i.e., 175 million tonnes are in Odisha. The remaining 8% resources are distributed in Jharkhand (9 million tonnes) and Nagaland (5 million tonnes). Nominal resources are reported from Karnataka (0.23 million tonnes) (Table - 1).

INDUSTRY

Nickel sulphate is produced as a by-product at the Ghatsila Copper Smelter of HCL in Jharkhand. The sulphide copper ore from Ghatsila area contains nickel in small quantity along with other important metals like gold and cobalt. The installed annual capacity of the plant to produce nickel sulphate is 390 tonnes. However, the production of nickel sulphate has not been reported since 2004-05. Ronuk Industries, Mumbai,is also reported to produce nickel sulphate. Sterlite (Tuticorin) has developed innovative method to produce pure commercial grade nickel sulphate from electrolyte by solvent crystallisation. The pilot-scale trials are in progress. Jhagadia Copper Ltd, also has plans to recover nickel sulphate at its copper metal plant at Jhagadia, Bharuch district, Gujarat.

Table –1: Reserves/Resources of Nickel Ore as on 1.4.2010
(By Grades/States)

(In million tonnes)

Grade/State	Total reserves (A)	Remaining resources: Pre-feasibility STD221	Pre-feasibility STD222	Measured STD331	Indicated STD332	Inferred STD333	Total (B)	Total resources (A+B)
All India : Total	–	**21**	**21**	**31**	**53**	**63**	**189**	**189**
By Grades								
+ 0.9% Ni	–	13	8	–	18	3	42	42
0.5 to 0.9% Ni	–	8	13	31	21	21	94	94
(+)0.5% Ni, unclassified	–	–	–	–	14	39	53	53
Not-known	–	–	–	–	–	–	–	–
By States								
Jharkhand	–	–	–	–	2	7	9	9
Karnataka	–	–	–	–	–	++	++	++
Nagaland	–	–	–	–	–	5	5	5
Odisha	–	21	21	31	51	51	175	175

Figures rounded off.

Nickel sulphate is an important compound used commercially in the country in nickel plating, in dip baths for enamelling, in preparation of nickel compounds and as a catalytic nickel.

RESEARCH & DEVELOPMENT

Department of Ocean Development

The Department of Ocean Development, under its Polymetallic Nodules (PMN) Programme, has set up on behalf of HZL; a semicontinuous demonstration pilot plant to process 500 kg per day polymetallic nodules for extraction of metal values at Udaipur. The Department of Ocean Development collected 45 tonnes nodules for this purpose. Regional Research Laboratory (RRL) (now IMMT), Bhubaneswar and HZL, Udaipur, are pursuing the R&D efforts for optimising the metal recovery/processing steps.

Institute of Minerals and Materials Technology (formerly RRL), Bhubaneswar

The Nickel Technology Proving Plant set up at Institute of Minerals and Materials Technology (formerly RRL), Bhubaneswar, is a joint (R&D) pilot project of Council of Scientific & Industrial Research (CSIR) and HZL. In this project, all the experimental studies on nickel plant have been completed.

IMMT is also engaged in extraction of nickel and cobalt from lateritic nickel/chromite overburden of Odisha through microbial route using acidophilic micro-organism. Up to 35% Ni and 50% Co recovery was achieved through mechano-chemical activation and pelletisation of chromite overburden. In a span of 60 days, 70% Ni and 60% Co recovery was achieved. The technology could be exploited in ultramafic complexes of Sukinda Valley. At present, it is to be scaled up to 10-tonne scale to generate process data and basic engineering details with support from OMC Ltd for its commercial implementation at Sukinda mine site.

IMMT developed a process for production of nickel concentrate from chromite overburden nickeliferrous lateritic ores. A process was also developed for extraction of nickel from solutions containing nickel and sodium sulphate and an improved process for dissolution of nickel-cobalt mixed sulphides. Patents were granted for all the three processes in India.

USES

The most important use of nickel is in production of stainless steel and other corrosion-resistant alloys. It is used in plating to make hard, tarnish-resistant, polished surfaces. Conventional plating is still much in favour but other techniques, such as electrolytic coating or sintered slurry coating, are used for applications like turbine blades, helicopter rotors, rolled steel strips and extrusion dies. Nickel is an important ingredient in coins. Finely divided nickel is used as a catalyst in hydrogenation. Other commercial uses are in ceramics, special chemical vessels, rechargeable nickel-cadmium storage batteries, electronic circuits, in computer hard discs, jewellery, green colouring of glass and preparation of nickel compounds.

CONSUMPTION

World over stainless steel is the major end-use sector of nickel having over 66% consumption share. Other uses include non-ferrous alloys (12%), electroplating (11%), other steel alloys, including casting (10%) and other chemical applications, like nickel-cadmium battery (6%). Domestic reported consumption of ferro-nickel during 2008-09 , 2009-10 and 2010-11 was 2,120 tonnes, 2,124 tonnes and 2,133 tonnes respectively, all in alloy-steel industry.

SUBSTITUTES

Aluminium, coated steels, plain chromium steels and plastics can replace stainless steel to a limited extent in many construction and transportation applications. Nickel-free speciality steels are sometimes used in place of stainless steel within the power-generating, petrochemical and petroleum industries. Titanium alloys or speciality plastics can substitute nickel metal or nickel-based alloys in highly corrosive chemical environments.

TRADE POLICY

As per Foreign Trade Policy, 2009-2014, imports of nickel ores & concentrates (heading no. 2604) and metal (heading no. 7503) are allowed freely. However, some forms of metal waste & scrap (ITC-HS Code No. 7503 0090) are restricted.

WORLD REVIEW

The world reserve of nickel is estimated at 80 million tonnes of metal content. Australia (30%), New Caledonia (15%), Brazil (11%), Russia (8%), Cuba (7%), Indonesia & South Africa (5% each) and Canada (4%) together accounted for around 85% nickel reserves (Table-2). The identified land-based reserves analysing on an average of 1% nickel or more contain at least 130 million tonnes nickel. About 60% of nickel reserves are in laterites and 40% in sulphide deposits. In addition, extensive deep-sea resources of nickel are in manganese crusts and nodules, covering large areas of the ocean floor, particularly in the Pacific Ocean.

Table – 2: World Reserves of Nickel (By Principal Countries)

(In '000 tonnes of nickel content)

Country	Reserves
World: Total (rounded)	**80000**
Australia	24000
Botswana	490
Brazil	8700
Canada	3300
China	3000
Colombia	720
Cuba	5500
Dominican Republic	1000
Indonesia	3900
Madagascar	1600
New Caledonia	12000
Philippines	1100
Russia	6000
South Africa	3700
USA	–
Other countries	4600

***Source**: Mineral Commodity Summaries, 2012.*

Table – 3: World Mine Production of Nickel (By Principal Countries)

(In '000 tonnes of metal content)

Country	2008	2009	2010
World: Total	**1599**	**1374**	**1552**
Australia	200	166	170
Brazil	67	41	50
Canada	260	135	158
China	80	82	80
Colombia	77	72	72
Cuba	67	60	66
Dominican Republic	19	-	–
Indonesia	223	184	217
New Caledonia	103	96	130
Russia	267	262	270
South Africa	32	35	40
Other countries	204	241	299

***Source:** World Mineral Production, 2006-2010.*

In 2010, world mine production of nickel increased to 1.55 million tonnes by (13%) as compared to 1.37 million tonnes in the previous year. Russia (17%), Indonesia (14%), Australia (11%), Canada (10%), New Caledonia (8%), China & Colombia (5% each) and Cuba (4%) were the principal producers (Table-3). Philippines, South Africa and China showed increase in production, whereas all other countries showed decline in production, significant among them are Canada, Australia and Indonesia.

During 2009 & 2010 due to improvement in global economy many nickel mines/producers restarted their projects. Significant among them were Vale Inco of Canada, Miitel Nickel mine in Western Australia and Minmetals in China. Rio Tinto acquired a mining permit in Indonesia with expected annual capacity of 46,000 tonnes Nickel. Lounge Lizard Nickel Sulphide deposit of Kagara Ltd and Poseidon Nickel's Mt. Windarra project in Western Australia started producing during 2010.

FOREIGN TRADE

Exports

Exports of nickel and alloys including waste & scrap decreased marginally to 1,496 tonnes in 2010-11 from 1,524 tonnes in the previous year. Out of the total alloys and scrap exported in 2010-11, nickel alloys were 1,328 tonnes, while nickel waste & scrap were 168 tonnes. Exports were mainly to USA (15%), Latvia (11%), Thailand (7%) and Netherlands (6%) (Tables - 4 to 6).

Imports

During 2010-11, imports of nickel ores & concentrates were 219 tonnes compared to 91 tonnes in the previous year. Imports were mainly from Canada. Imports of nickel & alloys including scrap were 33,306 tonnes in 2010-11 compared to 23,909 tonnes in the previous year. Out of total alloys and scrap imported in 2010-11, nickel alloys were 33,264 tonnes, while nickel waste & scrap was 1042 tonnes as compared to 987 tonnes in the previous year. Imports in 2010-11 were mainly from Australia (26%), Russia (23%), Norway (8%) and Finland (7%) (Tables - 7 to 11).

Table – 4 : Exports of Nickel and Alloys Incl. Scrap (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**1524**	**1103460**	**1496**	**1491393**
USA	255	143394	227	254298
Latvia	53	55287	161	197123
Thailand	100	84099	98	116536
Netherlands	16	17319	92	83865
Turkey	36	34728	60	61364
Japan	100	63672	73	57402
Korea Rep. of	22	22870	44	53884
France	40	40202	27	45154
Iran	27	32224	39	44629
Unspecified	-	-	34	46816
Other countries	875	609665	641	530322

Table – 5: Exports of Nickel & Alloys (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value ('₹000)
All Countries	**1375**	**1041448**	**1328**	**1415750**
Belgium	75	73161	7	7979
France	40	40201	27	45154
Iran	27	32224	39	44630
Korea Rep.of	21	22432	44	53735
Latvia	53	55286	161	197123
Netherlands	16	17319	78	79179
Saudi Arabia	24	29146	39	42132
Thailand	100	84099	98	116536
Turkey	36	34728	60	61364
USA	218	134981	206	245449
Other countries	765	517871	569	522469

Table – 6: Exports of Nickel Waste & Scrap (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**149**	**62012**	**168**	**75643**
Belgium	–	–	2	814
Germany	10	5379	11	2845
Japan	63	32642	50	30516
Korea, Rep. of	1	437	++	148
Malaysia	–	–	50	18170
Netherlands	–	–	14	4687
Spain	38	15052	–	–
UAE	–	–	++	132
UK	–	–	20	9458
USA	37	8413	21	8849
Other countries	++	89	++	24

Table – 7: Imports of Nickel Ores & Conc. (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**91**	**80938**	**219**	**143868**
Canada	91	80938	100	95771
USA	–	–	94	27023
Uganda	–	–	20	16631
Russia	–	–	05	4443

Table – 8: Imports of Nickel and Alloys Incl. Scrap (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**23909**	**19473718**	**33306**	**32130836**
Russia	5634	4497734	7617	8960268
Australia	4160	3357258	8713	6724080
Norway	1962	1527531	2722	3157862
Finland	2251	1675001	2213	2437819
Canada	1671	1361864	1533	1780861
UK	1136	933276	1444	1515437
USA	459	599518	1072	1211727
South Africa	105	84478	919	950422
China	165	148154	635	824034
Germany	755	631727	582	695047
Other countries	5611	4657177	5856	3873279

Table – 9: Imports of Nickel & Alloys (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ 000)
All Countries	**22922**	**19242826**	**32264**	**31797943**
Russia	5606	4482844	7617	8960268
Australia	4160	3357258	8679	6710696
Norway	1962	1527531	2722	3157862
Finland	2251	1675001	2213	2437819
Canada	1671	1361864	1533	1780861
UK	1033	914224	1370	1488071
USA	425	592819	992	1191647
South Africa	105	84478	919	950422
China	165	148154	635	824008
Germany	441	575502	449	665767
Other countries	5103	4523151	5135	3630522

Table – 10: Imports of Nickel Waste & Scrap (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹'000)
All Countries	**987**	**230892**	**1042**	**332893**
UAE	70	26151	390	134296
Turkey	125	36842	108	34186
Germany	314	56225	133	29280
UK	103	19052	74	27366
Saudi Arabia	42	11625	88	23611
Kuwait	36	14964	51	20539
USA	34	6700	80	20080
Australia	-	-	34	13384
Bangladesh	15	4870	33	12036
Switzerland	21	3725	19	5570
Other countries	227	50738	32	12545

Table – 11 : Imports of Nickel
(By Items)

All Items	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Items	**23909**	**19473718**	**33306**	**32130836**
Nickel & alloys	22922	19242826	32264	31797943
Nickel & alloys: unwrought	2320	1801998	2839	3429767
Nickel except electroplated anode	17593	13908899	24461	24842709
Nickel: worked	21	16097	8	7984
Nickel & alloys: worked	373	462519	613	686971
Bars, rods, plates, sheets foils of nickel	590	692069	663	824564
Bars, rods, plates, sheets foils of nickel alloys	1404	1671838	1267	1618292
Electroplated andode of nickel	5	7704	19	26244
Nickel Mattes	++	241	6	8814
Nickel oxide/sinters	264	336880	1	692
Nickel & alloys, worked NES	352	344581	2387	351906
Nickel scrap	987	230892	1042	332893

FUTURE OUTLOOK

About 60 to 70% of world nickel demand is for the production of stainless steel. Nickel accounts for 10 to 20% input cost in stainless steel production depending on the nickel content. The future outlook for nickel depends mainly on the production of stainless steel which is one of the main drivers for nickel produced. The production of stainless steel is estimated to be 5.00 million tonnes by 2016-17 as per the 12th Five Year Plan Report.

India will have no option but to depend on imports for this metal till a technology to recover nickel from the overburden of chromite ore in Odisha is established on a commercial scale.

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

OCHRE

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

60 Ochre

Natural pigments occurring in various colours like yellow, red, brown and white are named earth colours or ochres. The pigmentary quality is mainly due to the presence of iron oxide; hydrated iron oxide imparts yellow colour and anhydrous iron oxide red. A mixture of ferrous and ferric oxide imparts mainly brown besides other shades. Occurrences of ochre have been reported from several states in the country.

RESOURCES

Deposits of red ochre are found chiefly in West Godavari and Visakhapatnam districts in Andhra Pradesh; Banaskantha district in Gujarat; Bidar district in Karnataka; Satna and Gwalior districts in Madhya Pradesh; Nagpur district in Maharashtra; and Chittorgarh and Udaipur districts in Rajasthan. Deposits of yellow ochre are found in Guntur and Kurnool districts in Andhra Pradesh; Jabalpur, Mandla, Satna and Shahdol districts in Madhya Pradesh; and Nagpur district in Maharashtra.

The total resources of ochre as on 1.4.2010 as per the UNFC system, are estimated at 144.26 million tonnes. Out of these resources, about 54.94 million tonnes are reserves and 89.31 million tonnes are remaining resources. Of the total, about 87% resources are of red ochre,11% of yellow ochre and remaining 2% of grades "not-known". About 81% resources are concentrated in Rajasthan, followed by Andhra Pradesh 8%, Madhya Pradesh 7% and Gujarat about 2%. The remaining 2% resources are located in Karnataka, Maharashtra ,Jharkhand and Uttar Pradesh (Table - 1).

PRODUCTION, STOCKS & PRICES

The production of ochre at 1.17 million tonnes in 2010-11 decreased by about 7% as compared to that in the previous year.

There were 24 reporting mines in 2010-11 as against 21 in the previous year. Besides, the production of ochre was also reported as an associated mineral from 14 mines. Six principal producers accounted for 83% of the total production during the year. The entire production of ochre was reported from private sector in both years.

Rajasthan continued to be the leading producing State of ochre, contributing 94% of the total production in 2010-11 followed by Andhra Pradesh 3%, Madhya Pradesh 2%. Gujarat, Jharkhand & Karnataka together share remaining one percent output (Tables - 2 to 5).

Mine-head stocks of ochre at the end of 2010-11 were 160 thousand tonnes as against 163 thousand tonnes at the beginning of the year (Table - 6).

The average daily employment of labour strength in 2010-11 was 289 as against 287 in the previous year. Domestic prices of ochre are furnished in the General Review on Prices.

MINING & PROCESSING

Ochre is worked by shallow open-pit mining. In certain areas, it is worked underground by board- and-pillar method. Red and yellow ochres occur separately in different bands, depending upon the hydration either in the same mine or in different mines. The run-of-mine contains gritty matter which is removed by levigation.

Table – 1 : Reserves/Resources of Ochre as on 1.4.2010
(By Grades/States)

(In tonnes)

	Reserves				Remaining resources								Total resources (A+B)
	Proved STD111	Probable STD121	Probable STD122	Total (A)	Feasibility STD211	Pre-feasibility STD221	Pre-feasibility STD222	Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
All India : Total	**39863403**	**683093**	**14395680**	**54942176**	**15897677**	**13232482**	**21008598**	**2477593**	**3232246**	**32701243**	**769250**	**89319089**	**144261265**
By Grades													
Red Ochre	37974003	192682	13661485	51828170	15694029	12293432	18915924	1840981	927381	23070808	769250	73511805	125339975
Yellow Ochre	1654547	457712	687865	2800124	17680	758567	1682025	596612	2218504	8501906	-	13775294	16575418
Not-known	234853	32699	46330	313882	185968	180483	410649	40000	86361	1128529	-	2031990	2345872
By States													
Andhra Pradesh	1692839	344121	631277	2668237	-	97810	1199762	347681	-	6569575	-	8214828	10883065
Gujarat	12243	32699	65047	109989	-	-	26520	6971	6210	2906608	-	2946309	3056298
Jharkhand	63695	-	4361	68056	-	-	-	-	147039	-	-	147039	215095
Karnataka	-	-	-	-	-	-	1766367	-	-	-	20000	1786367	1786367
Madhya Pradesh	486269	128178	41027	655474	253245	1549706	1094108	267721	2141616	3732142	749250	9787788	10443262
Maharashtra	22260	-	16000	38260	17680	38080	100980	6010	6010	286000	-	454760	493020
Rajasthan	37586097	178095	13637968	51402160	15626752	11546886	16820861	1824210	896371	19196918	-	65911998	117314158
Uttar Pradesh	-	-	-	-	-	-	-	25000	35000	10000	-	70000	70000

Figures rounded off.

Table – 2 : Principal Producers of Ochre, 2010-11

Name & address of producer	Location of mine	
	State	District
*Mohd. Sherkhan Pathan P. O. Sawa-312 613 Dist. Chittorgarh, Rajasthan.	Rajasthan	Chittorgarh
*Mohmmed Sayeed Khan M/s Popular Khanij, Sawa-312 613, Dist. Chittorgarh, Rajasthan.	Rajasthan	Chittorgarh
*Smt. Tamanna Begum W/o Sherkhan, Post: Sawa, Taluka & Dist.Chittorgarh, Rajasthan.	Rajasthan	Chittorgarh
Shri Indramal Dorji Post: Sawa-312613 Dist. Chittorgarh, Rajasthan.	Rajasthan	Chittorgarh
Piyush Sharda Village: Nimbahera, Post: Nimbahera, Dist. Chhittorgarh, Rajasthan.	Rajasthan	Chittorgarh
Suresh Prakash Sharda Near Novelty Cinema, Nimbahera, Dist. Chittorgarh, Rajasthan.	Rajasthan	Chittorgarh

** Producing ochre as an associated mineral.*

Table – 3 : Production of Ochre, 2008-09 to 2010-11
(By States)

(Qty in tonnes; value in ₹'000)

State	2008-09		2009-10		2010-11(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**766382**	**70694**	**1258207**	**226881**	**1169843**	**149673**
Andhra Pradesh	25227	2741	34093	4690	35219	4839
Gujarat	280	28	649	65	2715	289
Jharkhand	_	_	–	–	1200	205
Karnataka	777	113	4156	4862	6657	17742
Madhya Pradesh	17923	1741	39201	4990	29454	4228
Rajasthan	722175	66071	1180108	212274	1094598	122370

Table – 4: Production of Ochre, 2009-10 and 2010-11
(By Sector/States/Districts)

(Qty in tonnes; value in ₹'000)

State/District	2009-10 No. of mines	2009-10 Quantity	2009-10 Value	2010-11(P) No. of mines	2010-11(P) Quantity	2010-11(P) Value
India	**21(14)**	**1258207**	**226881**	**24(14)**	**1169843**	**149673**
Private sector	21(14)	1258207	226881	24(14)	1169843	149673
Andhra Pradesh	**3(2)**	**34093**	**4690**	**3(2)**	**35219**	**4839**
Godawari West	(1)	22400	3584	(1)	23750	3848
Kurnool	3(1)	11693	1106	3(1)	11469	991
Gujarat	**2**	**649**	**65**	**1**	**2715**	**289**
Patan	2	649	65	1	2715	289
Jharkhand	**-**	**-**	**-**	**1**	**1200**	**205**
Singhbhum (West)	-	-	-	1	1200	205
Karnataka	**(2)**	**4156**	**4862**	**(3)**	**6657**	**17742**
Bellary	(2)	4156	4862	(3)	6657	17742
Madhya Pradesh	**7(3)**	**39201**	**4990**	**8(1)**	**29454**	**4228**
Jabalpur	(1)	120	8	1	1088	762
Rewa	1(1)	3639	305	1	250	20
Satna	5(1)	33632	4496	5(1)	25916	3226
Umaria	1	1810	181	1	2200	220
Rajasthan	**9(7)**	**1180108**	**212274**	**11(8)**	**1094598**	**122370**
Bhilwara	(1)	180	18	-	-	-
Bikaner	(1)	23034	2303	(2)	12802	1841
Chittorgarh	7(5)	1134919	206108	9(5)	1026121	115165
Udaipur	2	21975	3845	2(1)	55675	5364

Figures in parentheses indicate number of associated mines.

Table – 5 : Production of Ochre, 2009-10 and 2010-11 (P)
(By Frequency Groups)

(Qty in tonnes)

Production group	No. of mines 2009-10	No. of mines 2010-11	Production for the group 2009-10	Production for the group 2010-11	Percentage in total production 2009-10	Percentage in total production 2010-11	Cumulative percentage 2009-10	Cumulative percentage 2010-11
All Groups	**21(14)**	**24(14)**	**1258207**	**1169843**	**100.00**	**100.00**	–	–
Up to 5000	11(6)	13(5)	27402	42329	2.18	3.62	2.18	3.62
5001 to 10000	2(1)	2(1)	24677	19546	1.96	1.67	4.14	5.29
10001 to 20000	3	3(2)	39895	72910	3.17	6.23	7.31	11.52
20001 to 30000	1(2)	2(1)	70764	81599	5.62	6.98	12.93	18.50
30001 & above	4(5)	4(5)	1095469	953459	87.07	81.50	100.00	100.00

Figures in parentheses indicate number of associated mines.

CONSUMPTION

Reported consumption of ochre in 2010-11 in the organised sector was estimated at 410 thousand tonnes of which cement industry alone consumed about 98%. The remaining consumption was together shared by ceramic, foundry, glass, paint and paper industries. A sizeable quantity is believed to have been consumed by small-scale units as well as cottage industries. However, consumption data in this sector are not available (Table-7).

Ochre is used in colour - washes, distempers, oil paints, lacquers, primers and also for imparting colour to paper and cement. It dominates the market because of its cheapness, abundance in occurrence and good pigmentary quality.

At present, synthetic ferric oxide and other pigments are manufactured extensively and these possess better pigmentary properties than natural ochre. Synthetic products are fast replacing the natural ones, particularly because of quality.

Table – 6 : Mine-head Stocks of Ochre 2010-11(P) (By States)

(In tonnes)

State	At the beginning of the year	At the end of the year
India	**162837**	**159739**
Andhra Pradesh	4635	4863
Chhattisgarh	6180	6180
Gujarat	344	824
Jharkhand	140	1293
Karnataka	16512	18931
Madhya Pradesh	25999	25234
Rajasthan	109027	102414

Table – 7 : Reported Consumption of Ochre, 2008-09 to 2010-11 (By Industries)

(In tonnes)

Industry	2008-09	2009-10(R)	2010-11(P)
All Industries	**297300**	**382600**	**410000**
Cement	287400 (7)	372700 (7)	400000 (7)
Ceramic	8900 (1)	8900 (1)	8900 (1)
Glass	++ (2)	++ (2)	++ (2)
Paint	1000(10)	1000 (10)	1100(10)

Figures rounded off. Data collected on non-statutory basis.

Figures in parentheses denote the number of units in organised sector reporting industrial consumption.*

(*) Includes actual reported consumption and/or estimates made wherever required.

Note: *Data on consumption of ochre (including oxide) relate to units reporting from organised sector only. The data do not include consumption in small-scale units, cottage industries, colour washing, construction industry, etc.*

FOREIGN TRADE

Exports

Exports of ochre increased to 9,016 tonnes in 2010-11 from 8,661 tonnes in the previous year. Out of total exports in 2010-11, exports of earth colours were 7,476 tonnes, red oxide 1,288 tonnes, persian red 29 tonnes and yellow ochre 223 tonnes. Exports were mainly to Philippines (27%), Saudi Arabia (13%) and UAE (8%). Exports of earth clay in 2010-11 were 2,521 tonnes compared to 3,305 tonnes in the previous year. Exports were mainly to Saudi Arabia, UAE and Nepal (Tables - 8 to 13).

Imports

Imports of ochre decreased to 1,324 tonnes in 2010-11 from 2,378 tonnes in the previous year. Out of total imports in 2010-11, imports of earth colours were 50 tonnes, red oxide 1,086 tonnes, Persian red 135 tonnes and yellow ochre 53 tonnes. Imports of ochre were mainly from Indonesia (40%), Thailand (27%), China (15%) & USA (8%). Imports of earth clay were 83 tonnes in 2010-11 as against 29 tonnes in the previous year. The imports were mainly from Spain (Tables - 14 to 19).

Table – 8 : Exports of Ochre : Total (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**8661**	**102014**	**9016**	**109290**
Philippines	2784	17861	2399	14391
Saudi Arabia	514	5231	1154	11760
Korea, Rep. of	488	7377	540	9107
UAE	393	5273	695	8749
Thailand	434	5430	417	5380
Kenya	407	6554	189	5129
Taiwan	261	3573	302	4738
Tanzania	177	2410	237	4599
Indonesia	186	1832	345	3893
Malaysia	485	8103	213	3691
Other countries	2532	38370	2525	37853

Table – 9 : Exports of Ochre: Earth Colours (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**7556**	**75808**	**7476**	**75020**
Philippines	2749	16822	2346	14064
Korea, Rep. of	488	7377	540	9107
Saudi Arabia	463	4636	891	8453
Thailand	429	5112	415	4928
Taiwan	261	3573	302	4738
UAE	385	4883	394	4436
Turkey	113	2015	221	3487
Germany	145	2013	211	2990
UK	137	1945	225	2788
Indonesia	52	297	277	2696
Other countries	2334	27135	1654	17333

Table – 10 : Exports of Ochre: Yellow Ochre (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**4**	**290**	**223**	**4360**
Tanzania	-	-	11	932
USA	-	-	50	595
Egypt	-	-	19	491
Ethopia	-	-	3	423
Philippines	-	-	53	327
Djibouti	-	-	20	236
Spain	-	-	16	229
Saudi Arabia	1	87	5	221
UAE	-	-	2	220
Greece	-	-	13	152
Other countries	3	203	31	534

Table – 11 : Exports of Persian Red (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**20**	**1295**	**29**	**1626**
Italy	-	-	12	1447
Egypt	-	-	17	179
Other countries	20	1295	-	-

Table –12 : Exports of Ochre: Red Oxide (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**1081**	**24620**	**1288**	**28284**
Kenya	159	4535	90	4226
UAE	8	389	299	4093
Saudi Arabia	50	508	258	3086
Malaysia	110	1790	150	2556
Nepal	96	4070	53	2104
Tanzania	58	1405	32	1977
Uganda	-	-	24	1754
Indonesia	134	1535	68	1197
Djibouti	-	-	30	1126
Zambia	5	1092	6	821
Other countries	461	9296	278	5344

Table – 13 : Exports of Earth Clay (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**3305**	**18392**	**2521**	**13050**
Saudi Arabia	910	5915	1632	6896
Mozambique	80	1045	160	1981
USA	-	-	38	1125
UAE	188	944	240	988
Nepal	266	1106	228	830
Kenya	55	239	50	315
Israel	4	26	16	297
Oman	-	-	32	235
Sri Lanka	86	708	39	141
Bangladesh	500	1495	60	132
Other countries	1216	6914	26	110

Table – 14 : Imports of Ochre: Total (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**2378**	**123482**	**1324**	**141001**
Indonesia	271	29472	535	60124
Thailand	321	37382	357	40057
China	206	15412	203	18760
USA	340	18887	102	10368
Germany	2	568	71	6100
Italy	16	6169	46	2366
Hong Kong	15	4705	5	1446
Switzerland	1	722	1	734
Singapore	++	10	2	529
Other countries	1206	10155	2	517

Table – 15 : Imports of Ochre: Earth Colours (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**1155**	**6865**	**50**	**2404**
China	-	-	50	2140
USA	++	245	++	252
Germany	-	-	++	12
Other countries	1155	6620	-	-

Table – 16 : Imports of Ochre: Yellow Ochre (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**78**	**5364**	**53**	**6733**
China	67	2602	42	3968
Italy	8	1902	6	1438
Thailand	-	-	5	975
Germany	++	6	++	343
USA	-	-	++	8
Other countries	3	854	++	1

Table – 17 : Imports of Persian Red (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**++**	**179**	**135**	**15796**
Indonesia	-	-	86	9678
China	-	-	49	5392
USA	++	175	++	726
Other countries	++	4	-	-

Table – 18 : Imports of Red Oxide
(By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**1145**	**111074**	**1086**	**116068**
Indonesia	271	29472	449	50446
Thailand	321	37382	352	39082
USA	340	18467	102	9381
China	139	12810	62	7260
Germany	2	558	71	5745
Hong Kong	15	4705	5	1446
Italy	8	4267	40	928
Switzerland	1	722	1	734
Singapore	++	10	2	529
Japan	1	80	1	331
Other countries	47	2601	1	186

Table – 19 : Imports of Earth Clay
(By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**29**	**744**	**83**	**4275**
Spain	10	352	73	2189
Germany	-	-	10	2083
UK	++	2	++	2
Other Countries	19	390	++	1

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

PERLITE

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

61 Perlite

Perlite is a type of volcanic glass with pearly lustre. It expands and becomes porous when heated. Colour of crude perlite is light grey to glossy black whereas the colour of expanded perlite ranges from snowy white to greyish white. Distinguishing feature apart from other volcanic glasses is that perlite when heated to about 850-900°C expands 4 to 20 times its original volume. This expansion is due to the presence of 2 to 5% combined water in crude perlite which when heated vaporises to form countless tiny bubbles. Expanded perlite is not only amazingly light weight, but also has exceptional physical properties. Unexpanded (raw) perlite has a bulk density around 1100 kg/m^3 (1.1 g/cm^3), while typical expanded perlite has a bulk density of about 30-150 kg/m^3.

Perlite is used in industry in both the forms- Crude Perlite and Expanded Perlite. Most perlite is expanded to produce ultra light perlite by heating. Crude perlite is prepared by crushing and screening to various size fractions.

Typical Analysis of Crude Perlite (in percentage)

SiO_2	72-76
Al_2O_3	11-17
K_2O	4-5
Na_2O	2.9-4.0
CaO	0.5-2.0
Fe_2O_3	0.5-1.5
MgO	0.1-0.5
TiO_2	0.03-0.20
H_2O	2-3

RESOURCES

The only deposit of perlite is located in the Village Patanvav, Rajkot district, Gujarat. It is found to occur in Osam Hill in the form of discontinuous sill. The total resources of perlite as per UNFC system as on 1.4.2010 are estimated at 2.41 million tonnes, out of which 12% are high-grade, 12% medium-grade, 6% low-grade and the remaining 70% fall under unclassified category. Out of the total resources, about 18% fall under reserves and rest 82% are remaining resources (Table-1).

Table – 2: Reserves/Resources as on 1.4.2010 of Perlite
(By Grades/States)

(In '000 tonnes)

Grade/State	Reserves				Remaining resources				Total resources
	Proved	Probable		Total	Pre-feasibility		Reconnaissance	Total	
	STD111	STD121	STD122	(A)	STD221	STD222	STD334	(B)	(A+B)
All India :Total	**140**	**-**	**288**	**428**	**683**	**307**	**988**	**1978**	**2406**
By Grades									
High	19	-	132	151	-	132	-	132	283
Medium	79	-	103	182	-	118	-	118	300
Low	42	-	53	95	-	57	-	57	152
Unclassified	-	-	-	-	683	-	988	1671	1671
By State									
Gujarat	140	-	288	428	683	307	988	1978	2406

Figures rounded off

PRODUCTION AND STOCKS

There was no production of perlite since 2007-08 and no stocks were reported at the beginning or end of the year.

USES

There are different uses of perlite in both crude and expanded form. These uses can be grouped under three general categories - construction, horticultural and industrial applications.

Construction Applications

In the construction and manufacturing fields, expanded perlite on account of its acoustic properties is used in light weight plasters and mortars, insulation, ceiling tiles and as filter aids.

In addition to providing thermal insulation, perlite enhances fire resistance, reduces noise transmission and is resistant to rot, vermin and termites. Perlite is also ideal for insulation against low temperature.When perlite is used as an aggregate in concrete, a light weight, fire resistant, insulating concrete is produced that is ideal for roof decks and other applications. Perlite is also used as an aggregate in portland cement and gypsum plasters for exterior applications and for fire protection of beams and columns. Other construction applications include under-floor insulation, chimney lining, paint texturing, ceiling tiles and roof insulation boards.

Horticultural Applications

In horticultural application, expanded perlite is used throughout the world as a component of soil-less growing mixes, where it provides aeration and optimum moisture retention for superior plant growth. Studies have shown that outstanding yields are achieved with perlite hydroponic systems. Other benefits of perlite in horticulture are its neutral pH and the fact that it is sterile and weed-free. In addition, its light weight makes it ideal for growing plants in small containers. Besides, perlite is a good carrier for fertilizer, herbicides & pesticides and for pelletising seed. Horticultural perlite is used both by home gardeners as well as commercial growers. In greenhouse plantations, landscaping and for in-house plants, use of perlite has shown encouraging results. Approximately 10% of annual perlite consumption world over is reported under horticultural applications.

Industrial Applications

Industrial applications of perlite are the most diverse, ranging from high performance fillers for plastics to cements, for petroleum, water and geothermal wells. Other applications include its use as a filter media for pharmaceuticals, food products, chemicals and water for municipal systems and swimming pools.

Perlite finds application additionally as an abrasive in soaps, cleaners and polishes. Its high resistance to heat is taken advantage of in manufacturing refractory bricks, mortars and pipe insulation. Crude perlite is used in retention of heat in foundry and ferro-alloys industry. Small quantities of perlite are also used in cryogenic insulation and in ceramics as clay.

SUBSTITUTES

There are a number of materials that can be used in place of perlite for many of its applications. These materials (such as vermiculite, diatomite, pumice, expanded clay, shale, etc.) may be used in place of perlite without losing any of the benefit that perlite provides. Alternative materials can be substituted for all uses of perlite, if necessary. Long-established competitive commodities include slag.

WORLD REVIEW

The world reserves of perlite are placed at 700 million tonnes of which Greece and USA accounted for 50 million tonnes each (Table-2).The available world production of perlite in 2010 in respect of principal countries was estimated at 3.32 million tonnes. Greece (23%), China (21%), USA (11%), Japan (6%) and Turkey (5%) were the leading producers. Other important producers were Hungary, Italy, Mexico, Russia and Armenia (Table-3). The USA was believed to be the largest consumer of processed, crude and expanded perlite in 2011. Total consumption of processed and expanded perlite in the USA in 2011 was expected to remain relatively low compared to 2010 which was 546 thousand tonnes.

Table – 2 : World Reserves of Perlite
(By Principal Countries)

(In '000 tonnes crude ore)

Country	Reserves
World: Total (rounded)	**700,000**
Greece	50,000
USA	50,000
Other countries*	600,000

***Source**: Mineral Commodity Summaries, 2012.*
***Note**:Figures for Japan, Turkey & Mexico included with other countries.*

Table – 3 : World Production of Perlite
(By Principal Countries)

(In '000 tonnes)

Country	2008	2009	2010
World: Total	**3005**	**3454**	**3318**
Armenia[e]	35	35	35
China[e]	700	700	700
Greece	1000	863	760
Hungary	132	82	80
Italy[e]	60	60	60
Japan[e]	230	220	210
Mexico	43	51	32
Russia[e]	45	45	45
Turkey[e]	160	160	160
USA	434	348	375
Other countries	166	890	861

***Source:** World Mineral Production, 2006-2010*

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

PLATINUM AND PALLADIUM

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

63 Platinum and Palladium

Platinum and palladium belong to platinum group of metals (PGM). The six platinum group elements or PGEs (Ru, Rh, Pd, Os; Ir and Pt), are a family of six greyish to silver-white metals, except for osmium which has a slight bluish tinge with close chemical and physical affinities. These six elements are classified into two groups with reference to the specific gravity of gold (19.2). The elements, Ru, Rh, Pd (sp. gr. ~12-12.4) are lighter, while the other three elements, Os, Ir and Pt are heavier than gold with sp. gr. in the range of 21.0-21.5. Major applications of platinum and palladium are in automotive sector for emission control and in chemical and petroleum refining.

RESOURCES

In India, appreciable values of platinum group of elements (PGE) were traced in the Precambrian mafic/ultramafic complexes in Sukinda and Nuasahi sectors of Odisha and Sittampundi in Tamil Nadu. Sampling of chromite ore bodies and their associated rocks revealed occurrence of PGE in these areas. Preliminary assessment of PGMs in Sukinda ultramafic field indicated isolated anomalous values in chromite. Platinum values of 2 to 400 ppb and palladium values of 1 to 500 ppb were established on analysis. The limonite cappings over ultramafic rocks showed combined platinum and palladium values between 40 and 290 ppb. In Boula-Nuasahi ultramafic complex, the easternmost chromite band known as Shankar-Ganga load, investigations revealed potential PGM mineralisation. In Sittampundi Complex, Salem district, Tamil Nadu, analysis of chromite bands showed 0.03 to 0.75 ppm Pt and 0.1 to 1.0 ppm Pd, whereas amphibolite samples showed 0.03 to 0.05 ppm Pt and 0.03 to 0.5 ppm Pd. A platinum-rich chromite-ferro-chromite breccia zone stretching to about hundred metres in gabbroic matrix was identified in the southern extension of the already known Boula-Nuasahi area in Keonjhar district, Odisha. In Usgaon area, Southern Goa, PGM samples analysed up to 0.03 ppm Pt and 0.03 to 0.15 ppm Pd. In recent past, occurrences of PGE mineralisation were reported in mafic-ultramafic complex of Shimoga schist belt in Davangere district of Karnataka. Three zones having 10 to 830 ppb of platinum and 50 to 1500 ppb of palladium were established.

The major part of 15.7 tonnes UNFC resources of PGMs estimated so far, i.e. 14.2 tonnes are located in Nilgiri, Boula-Nuasahi and Sukinda areas in Odisha and remaining 1.5 tonnes in Hanumalpura area in Shimoga schist belt of Karnataka. About 49% resources are in pre-feasibility category and the remaining in inferred and reconnaissance category. The resources of PGM as on 1.4.2010 as per UNFC system are given in Table-1.

EXPLORATION

GSI carried out exploration in various areas in the states of Andhra Pradesh, Karnataka, Kerala, Manipur, Maharashtra, Odisha (Jointly with OMC Ltd.) and Tamil Nadu. DMG, Karnataka conducted exploration work in Mandya district. The details are given in Table-2.

USES

Platinum and palladium are primarily used as catalyst in controlling the toxicity of emissions from automobile, chemical and petroleum refining plants. Nearly half of the total platinum used worldwide is as catalysts in catalytic convertors in automobiles. Catalysts for automobile sector use platinum and palladium. Automobiles that run on diesel predominantly use platinum for catalytic conversion. The chemical inertness and refractory properties of these metals are conducive for their applications in electrical, electronics, dental, medical fields and glass industry. These metals are also used as catalyst in various chemical processes, viz, in organic synthesis in hydrogenation,de-hydrogenation and isomerisation, production of nitric acid as also in the manufacture of fertilizers, explosives & polymers and fabrication of laboratory equipment.

Platinum, palladium and a variety of complex gold-silver-copper alloys are used as dental restorative materials. The unique properties of platinum find varied applications in the medical field. Platinum's excellent compatibility with living tissue, as it does not get affected by the oxidising reaction of blood, enables its utility in pacemakers.

Table – 1: Reserves/Resources of PGM as on 1.4.2010

(In tonnes of metal content)

State	Reserves Total (A)	Remaining resources				Total resources (A+B)
		Pre-feasibility STD 222	Inferred STD 333	Reconnaissance STD 334	Total (B)	
India	**-**	**7.7**	**6.5**	**1.5**	**15.7**	**15.7**
Karnataka	-	-	-	1.5	1.5	1.5
Odisha	-	7.7	6.5	-	14.2	14.2

The primary usage of PGM is in chemotherapy for treatment of cancer. It has the ability to prevent division of certain living cells, a remarkable characteristic which finds profound application in treatment of cancer. Besides, platinum-iridium alloys are extensively used in prosthetics and biomedical devices.

Platinum's excellent conductivity lends itself for use in the electrodes of phosphoric acid fuel cells for generating electricity. Another significant use of platinum and its alloys, in cast or wrought form are in jewellery. Platinum-iridium alloys find major application in making crucibles for growing crystals. Glass made with platinum and rhodium is used in housing construction, flat screen televisions, computer monitors, display panels, automobile displays, factory monitoring equipment, etc. Recenlty, a new metallic glass featuring micro-alloys of palladium with silicon, germanium, silver, etc. was reportedly developed at University of California. The glass is charecterised by strength and toughness. Platinum is used to enhance storage capacity of devices, such as, computer hard discs, cell phones, digital cameras and personal music players. Recently, palladium-silver resistors have been used in secondary lightning surge protection devices. In electronic industry, palladium use is for multi-layer ceramic capacitors (MLCC). The effect of miniaturisation of MLCC has not reduced the quantum of palladium used as more number of MLCC are required for the same electronic device.

Rhodium usage is also on the rise in the automotive industry apart from fibre glass. Platinum is the catalyst used by fuel cells to convert hydrogen and oxygen to electricity. Palladium is also likely to play a role in fuel cells.

SUBSTITUTES

It is usually easier to substitute metals of the platinum group for one another, especially in alloys, than to use alternative materials, which is evident from the total dominance of ruthenium-based resistors over the palladium-silver resistors for high-powered applications. Substitutes in electrical use include tungsten, nickel, silver, gold and silicon carbide. Alternative catalysts include nickel, molybdenum, tungsten, chromium, cobalt, vanadium, silver and rare earths. Rhenium, however, has been used most satisfactorily as substitute for platinum as a catalyst in petroleum refining. Stainless steel and ceramics can be substituted where resistance to corrosion is the primary concern. Some motor vehicle manufacturers have substituted platinum by palladium in catalytic converters, especially for petrol engines. Particulate matter and residual sulphur contaminates palladium and hence it was excluded from catalysts used in diesel vehicles. A new technology now allows up to 25% substitution of platinum in diesel catalytic converters with palladium.

Similarly, manufacturers of electronic parts are also reducing the average palladium content of the conductive pastes used to form the electrodes of multilayer ceramic capacitors, substituting base

Table – 2 : Details of Exploration Activities for PGM, 2009-10

Agency/ State/ District	Location/ Area/ Block	Mapping		Drilling		Sampling	Remarks
		Scale	Area (sq km)	No. of bore-holes	Meterage	(No.)	Reserves/resources estimated
GSI/							
Andhra Pradesh							
	Konda Motu - Enamuralagutta Ramgiri Schist belt	1:12500	67	-	-	-	NNW-SSE trending narrow discontinuous, linear ultra mafic bodies over a strike length of 13 km and ranging in thickness from 10 m to 100 m were traced. The bands show pinching & swelling. EPMA study has indicated presence of chrome- spinel with magnetite.
Karnataka							
	Nuggehalli-Bakhtara-halli (Nuggehalli Schist belt)	1:12500	36	-	-	-	A reconnaissance stage (G-4) study was taken up involving mapping, pitting & trenching. For selective field traverses and detailed mapping, same area was selected. In Hanumalapura block-A, Davanagere district, on the basis of exploration during 2005-08, a resource of 0.84 million tonnes of PGE ore with 0.5 g/t to 2.93 g/t was estimated. About 110 cu m of pitting & trench-ing along with sampling was done. Work is continued.
Kerala							
Palakkad and Mala-ppuram	Attapadi valley Maddalapara Kalkandi & Narasimukku	1:12500	115	-	-	-	A reconnaissance stage (G-4) study was initiated. In these areas some lithounits were found to contain gold grains. Large scale mapping, sampling & analysis was done in Kalkandi where chromite bearing ultramafics were identified. The XRD analysis has indicated graphite, stibnite, pyrite, arsenopyrite, etc.
Maharashtra							
Chandrapur	Heti	-	-	-	-	-	A prospecting stage (G-3) operation was taken up to assess economic potentiality of delineated earlier PGE & Ni zones within gabbro-norite-pyroxenite bodies. Two parallel mafic- ultramafic zones having anomalous PGE values were mapped intermittently over 600 m. Bed rock, trench & borehole samples were studied in which some minor associated minerals in barytes-sphalerite-cassiterite-REE were also detected. In a borehole, presence of nickel cobalt at various depths was also confirmed.

Table-2 (Contd.)

Agency/ State/ District	Location/ Area/ Block	Mapping		Drilling		Sampling	Remarks
		Scale	Area (sq km)	No. of bore-holes	Meterage	(No.)	Reserves/resources estimated
Maharashtra							
Sindhudurg	Kankavali- and Janoli	-	-	-	-	-	A reconnaissance stage (G-4) investigation was commenced to delineate zones of PGE, nickel & chromium mineralisations within mafic-ultramafic rocks. A chromiferous zone of 8 m width was delinated in Dewalawadi during large scale mapping of NW & SE strike extensions. Near Harkul Budruk, chromiferous schist & chromite bearing quartz vein was located. Near old Vadge chromite mine, samples have indicated values of 650 ppb total PGE.
Manipur							
Ukhrul	Siruhi, Gamnom, Pushing	1:50000	100	-	-	-	The reconnaissance stage (G-4) study was continued to assess potentiality of PGE in chromiferous dunite, peridot-ite and pyroxenite. Eighteen chromite bands/ lenses having massive chromite with maximum size of 20 m X 2 m were delineated. The ore with 44% to 59% Cr_2O_3 was of Alpine type podifrom chromite.
Odisha							
Keonjhar	Bangur and Banaipank Leaseholds	-	-	-	-	-	A prospecting stage (G-3) operation was taken up as a sponsored item with Odisha Mining Corporation (OMC) in its lease hold areas such as Bangur & Banaipank. The mapping and sampling indicated that the ultramafic brecciated zone was a host to PGE. In Banaipank area, soil and laterite sampling was done on a grid pattern to check possible extensions of potential ultramafics. The results of chemical analysis of the in situ soil profile at depth of 0.75 m from B & C horizons showed anomalous zone of high values of 7,910 ppm Cr and 362 ppm of Ni.

Contd.

Table-2 (Contd.)

Agency/ State/ District	Location/ Area/ Block	Mapping		Drilling		Sampling	Remarks
		Scale	Area (sq km)	No. of bore-holes	Meterage	(No.)	Reserves/resources estimated
Tamil Nadu	Solvanur, Karappadi Mallanaya-kanpalaiga	-	-	6	254.30	42	A reconnaissance stage (G-4) study was continued in this block of Mettuppalaiyam mafic-ultramafic complex in which scout drilling, detailed mapping, pitting & trenching was also carried out. Out of proposed ten boreholes, six were completed. Of these, one was in Solavanur, two in Karappadi and three in Mallanayakanpalaiyam block to various depths. The meta-pyroxenite, Chromitite bands were intersected and different widths of PGM mineralisation and values ranging from 238 ppb of Pt, 451 ppb of Pd to 388 ppb of Pt and 683 ppb of Pd were recorded. Work is continued.
	Mettupalaiyam Belt	1:12500	163	-	-	145	A reconnaissance stage (G-4) investigation for PGE was taken up, involving mapping and sampling.
	Tasampalaiyam block	-	-	-	-	-	A reconnaissance stage (G-4) study was continued in this block of Sittampundi layered mafic-ultramafic complex. Close spaced trenching was done in western part (T3, T4 sectors) to trace continuity and assess grade of PGE bearing bands. The 2 km long T3 sector was divided into 6 segments, viz, A to F. Two zones i.e. northen and southern were delineated. Northen zone extendes to all 6 segments & shows values of 0.95 ppm to 3.68 ppm of Pt+ Pd , whereas southern is traceble in B & E segments & with 22.89 ppm of Pt+Pd. The T4 sector extends up to 1.5 km. It was divided into 5 segments, viz. A to E. The segment C covering 230 m has shown anomalous values in 5 to 7 bands of chromitite/ chromiferous meta-pyroxenite having different widths & values of PGE.
	Karunagalpatti block	-	-	3	-	-	In about 1.1 km long sector C1 of Chettipalaiyam block of Sittampundi complex, based on scout drilling done during 2006-08, result of surface and subsurface data, a reconnaissance resource of about 0.252 million tonnes of PGE ore with an average grade of 1.44 ppm Pt+Pd was envisaged.

Contd.

Table-2(Concld.)

Agency/ State/ District	Location/ Area/ Block	Mapping		Drilling		Sampling	Remarks
		Scale	Area (sq km)	No. of bore-holes	Meterage	(No.)	Reserves/resources estimated
DMG							
Karnataka							
Mandya	Karighatta schist belt	1:50000	80	-	-	12	Work will continue in next field season. The area has mafic and ultramafic sequences of Sargur group like peridoties & serpentinites.

metals or silver-palladium pastes which contain significantly less palladium.

Technical Possibilities

The spent converters contain platinum and palladium in 3:1 ratio, but heavy shift towards use of palladium to meet stringent emission controls will change this proportion of recovery.

The emergence of polymer electrolytic membrane (PEM) fuel cells developed for passenger cars and trucks will boost prospects of platinum in near future by replacing the high energy battery-operated options for emission controls. The costs of higher range of driving and quick refuelling of fuel cells are, however, 10 times more than the cost of petrol engine.

The development of Solid Oxide Fuel Cell (SOFC) in Japan will eliminate the use of platinum converter as it is compact and gives consistent performance because conversion of conventional fuels into hydrogen is avoided.

Research and Development

The mineral processing department of the Institute of Minerals & Material Technology (IMMT), Bhubaneswar (CSIR) was envisaging research focused on recovery of PGE values from the low tenor hosts like Boula-Nausahi igneous complex, by adopting suitable beneficiation tests and development of process flow sheet for recovery of PGE from Indian ores. The methods adopted elsewhere in the world perhaps may not suit in India as here, the PGE occurs in oxide of chromium and sulphide facies, in very fine inclusions & exsolution form.

WORLD REVIEW

The largest reserves of PGMs are located in Bushveld Complex in South Africa. The world reserves of PGMs are estimated at 66,000 tonnes concentrated mostly in South Africa (95%), followed by Russia (2%) and USA (1%) (Table-3).

The world mine production of PGMs slightly increased to 482 tonnes of contained metals in 2010 from 462 tonnes in 2009. South Africa continued to be the leading producing country of PGM, contributing about 60% of world production, followed by Russia (30%), USA (8%) and Canada (2%) (Table-4).

Recycling of PGMs was from three main sources, i.e., autocatalysts, electronics and jewellery. Globally, the share of platinum recovery from autocatalysts increased by 31% in 2010 as compared to 2009. Similarly, an increase of 32% in recovery from jewellery was recorded over 2009, whereas recovery from electronic secter remained static.

In case of palladium, recovery from autocatalysts rose by 37% as compared to 2009. The recovery from eletronics increased by 11% and that from jewellery decreased by 14% over 2009.

Global platinum consumption rose by 16% of the total consumption, autocatalyst industry accounted for 46% and jewellery 31%. Palladium consumption also rose by 23% in 2010, of which 57% was by autocatalyst industry and 15% by electronics industry. About 74% of world consumption of platinum in jewellery was by China.The consumption of platinum as equipment in glass industry surged from 311 kg in 2009 to 10,700 kg in 2010.

Canada

The Lac des Isles mine of North American Palladium Ltd was reopened in 2010 after favourable metal prices in the market. Xstrata plc continued to produce PGM as by- products from its Sudbury nickel mining operation, but at a lower level due to long drawn strikes..

South Africa

During 2010, the production of platinum and palladium incresed by 5% & 9%, respectively. The world's leading PGM producer, Anglo America Platinum Ltd's newer operations on the western limb of Bushveld complex had higher output than the older ones. Production of PGM from Nkomati Nickel mine doubled after a large-scale expansion programme.

Zimbabwe

The phase I expansion project at Zimplats mine of Impala was near its full production capacity and 4.2 million tonnes of ore was milled in 2010. The phase II expansion was envisaged to complete in 2014 to reach its full capacity of 8,400 kg platinum per year.

.

FOREIGN TRADE

Exports

Exports of platinum alloys and related metals decreased to 3,167 kg valued at ₹ 22 crore in 2010-11 from 10,587 kg valued at ₹ 64 crore in the previous year. Exports in 2010-11 comprised platnium unwrought, platinum powder and others at 201 kg, 4 kg & 2,953 kg, respectively. Export of other metals of platinum group was 2,962 kg entirely to Germany.

In 2010-11, 642 kg of platinum-clad base/ precious metals were exported mainly to USA. There were no exports in 2009-10 (Tables - 5 to 10).

Imports

Imports of platinum alloys and related metals decreased in 2010-11 to 5,072 kg valued at ₹ 845 crore as against 6,215 kg valued at ₹ 789 crore in the previous year. Imports in 2010-11 comprised platinum (powder, unwrought & others) 2,275 kg, platinum (others) 577 kg and other metals of platinum group 2,220 kg. Imports were mainly from UK (41%), South Africa (20%), USA, Italy & Russia 6% each. Besides, there were imports of platinum-clad base/precious metals to the tune of 5 kg in 2010-11 China was the main supplier (Tables - 11 to 17).

Table – 3 : World Reserves of PGMs
(By Principal Countries)

(In tonnes)

Country	Reserves
World: Total (rounded)	**66000**
Canada	310
Russia	1100
South Africa	63000
USA	900
Other countries	800

Source: *Mineral Commodity Summaries, 2012.*
Note: Figures for Colombia, Zimbabwe included with other countries.

Table – 4 : World Mine Production of PGMs
(By Principal Countries)

(In tonnes of metal content)

Country	2008	2009	2010
World: Total	**475.00**	**462.00**	**482.00**
Canada(e)			
Platinum	8.50	4.00	3.60
Palladium	14.70	6.90	6.20
Other platinum metals	1.0	0.50	0.40
Russia			
Platinum	25.00	24.40	26.50
Palladium	113.80	113.10	115.70
Other platinum metals(e)	2.60	2.20	2.20
South Africa			
Platinum	146.14	140.82	147.79
Palladium	75.54	75.12	82.22
Other Platinum metals	54.09	55.45	57.29
USA			
Platinum	3.58	3.83	3.45
Palladium	11.94	12.66	11.00
Other countries	18.11	23.02	25.65

Source*: World Mineral Production, 2006-2010*

Table – 5 : Exports of Platinum Alloys & Related Metals : Total (By Countries)

Country	2009-10 Qty (kg)	2009-10 Value (₹'000)	2010-11 Qty (kg)	2010-11 Value (₹'000)
All Countries	**10587**	**643700**	**3167**	**223645**
USA	290	407998	129	84479
Switzerland	-	-	22	65169
UK	62	84162	2928	42756
Gemany	4	805	10	10540
Italy	6	5989	3	7534
UAE	3	179	2	5444
Malaysia	1	305	5	3111
Canada	4	308	1	1105
Belgium	1	64	38	1000
Oman	-	-	6	977
Other countries	10216	143890	23	1530

Table – 6 : Exports of Platinum (Unwrought) (By Countries)

Country	2009-10 Qty (kg)	2009-10 Value (₹'000)	2010-11 Qty (kg)	2010-11 Value (₹'000)
All Countries	**10216**	**215423**	**201**	**166712**
U S A	-	-	34	76033
Switzerland	-	-	18	44968
UK	52	68469	128	36898
UAE	1	127	2	5444
Canada	-	-	1	1105
Oman	-	-	6	977
Hong Kong	-	-	8	749
Saudi Arabia	-	-	2	477
Germany	-	-	1	41
Spain	-	-	1	19
Other countries	10163	146647	++	1

Table – 7 : Exports of Platinum (Others) (By Countries)

Country	2009-10 Qty (kg)	2009-10 Value (₹'000)	2010-11 Qty (kg)	2010-11 Value (₹'000)
All Countries	**80**	**19898**	**2953**	**38182**
Switzerland	-	-	4	20200
Italy	-	-	3	7533
UK	10	15693	2800	5858
Malaysia	-	-	5	3111
Belgium	-	-	38	1000
France	-	-	10	225
USA	20	7	91	194
Egypt	1	382	1	55
Mauritus	-	-	1	6
Other countries	49	3816	-	-

Table –8 : Exports of Platinum (Powder) (By Countries)

Country	2009-10 Qty (kg)	2009-10 Value (₹'000)	2010-11 Qty (kg)	2010-11 Value (₹'000)
All Countries	**290**	**408537**	**4**	**8252**
USA	270	407991	4	8252
Other countries	20	546	-	-

Table –9 : Exports of Other Metals of Platinum Group (By Countries)

Country	2009-10 Qty (kg)	2009-10 Value (₹'000)	2010-11 Qty (kg)	2010-11 Value (₹'000)
All Countries	**1**	**22**	**2962**	**48681**
Germany	-	-	2962	48681
Other countries	1	22	-	-

Table – 10 : Exports of Platinum-Clad Base/Precious Metal (By Countries)

Country	2009-10 Qty (kg)	2009-10 Value (₹'000)	2010-11 Qty (kg)	2010-11 Value (₹'000)
All Countries	-	-	**642**	**25368**
USA	-	-	638	24634
Belgium	-	-	1	610
UK	-	-	1	105
China	-	-	1	11
France	-	-	1	8
Other countries	-	-	-	-

Table – 11 : Imports of Platinum Alloys and Related Metals (By Countries)

Country	2009-10 Qty (kg)	2009-10 Value (₹'000)	2010-11 Qty (kg)	2010-11 Value (₹'000)
All Countries	**6215**	**7893762**	**5072**	**8451719**
UK	1628	1584662	2105	3088588
South Africa	199	337115	1037	1835593
USA	168	175815	319	655032
Russia	149	128629	328	419756
Belgium	14	30355	230	539372
China	1	39	56	327311
Germany	202	238580	134	276412
Italy	253	56130	297	259315
Norway	29	74242	96	244385
Saudi Arabia	-	-	90	200879
Other countries	3572	5268196	380	605076

Table – 12 : Imports of Platinum (Powder, Unwrought & Others) (By Countries)

Country	2009-10 Qty (kg)	2009-10 Value (₹'000)	2010-11 Qty (kg)	2010-11 Value (₹'000)
All Countries	**4210**	**6938320**	**2275**	**5872712**
UK	411	913287	738	1853466
South Africa	129	270808	441	1123150
Germany	113	228427	103	244525
Finland	64	140978	71	179424
USA	56	130053	265	637259
Belgium	11	24896	205	510307
China	-	-	52	316672
Norway	28	69741	96	244385
Italy	6	15094	85	224516
Saudi Arabia	-	-	65	170568
Other countries	3392	5145036	154	368440

Table – 13: Imports of Other Metals of Platinum Group By Countries

Country	2009-10 Qty (kg)	2009-10 Value (₹ '000)	2010-11 Qty (kg)	2010-11 Value (₹ '000)
All Countries	**1191**	**716974**	**2220**	**2202898**
UK	796	501344	1144	964443
South Africa	57	63185	565	696639
Russia	108	41461	273	277144
Japan	18	11267	47	42338
Saudi Arabia	-	-	25	30311
Belgium	2	4655	25	29065
Germany	7	1911	13	26230
Spain	-	-	3	11373
Korea, Rep. of	-	-	52	42778
Unspecified	-	-	50	59375
Other countries	203	93151	23	23202

Table – 14: Imports of Platinum (Others) By Countries

Country	2009-10 Qty (kg)	2009-10 Value (₹ '000)	2010-11 Qty (kg)	2010-11 Value (₹ '000)
All Countries	**814**	**238468**	**577**	**376109**
U K	421	170031	223	270680
Italy	186	32339	211	34538
U S A	79	16701	52	17111
South Africa	13	3122	31	15804
Japan	13	4279	16	14675
Russia	-	-	4	13166
Switzerland	11	1709	2	639
Hong Kong	-	-	1	639

Table – 15 : Imports of Platinum-Clad Base/Precious Metal (By Countries)

Country	2009-10 Qty (kg)	2009-10 Value (₹'000)	2010-11 Qty (kg)	2010-11 Value (₹'000)
All Countries	**22**	**537**	**5**	**405**
China	-	-	4	30
USA	1	20	1	375
Other countries	21	517	-	-

Table – 16 : Imports of Platinum -Unwrought (By Countries)

Country	2009-10 Qty (kg)	2009-10 Value (₹'000)	2010-11 Qty (kg)	2010-11 Value (₹'000)
All Countries	**3938**	**6363433**	**1157**	**3065756**
South Africa	45	101820	315	801596
UK	336	748780	252	651370
USA	21	53116	140	319750
China	-	-	52	316672
Belgium	11	24896	124	308615
Germany	81	164515	72	170376
Italy	6	15094	58	148276
Russia	41	87168	51	129446
Finland	18	40435	41	100728
Norway	28	69741	22	55808
Other countries	3351	5057868	30	63119

Table – 17 : Imports of Platinum -Powder (By Countries)

Country	2009-10 Qty (kg)	2009-10 Value (₹'000)	2010-11 Qty (kg)	2010-11 Value (₹'000)
All Countries	**272**	**574887**	**1118**	**2806956**
UK	75	164507	486	1202096
South Africa	84	168988	126	321554
USA	35	76937	125	317509
Belgium	-	-	81	201693
Norway	-	-	74	188577
Saudi Arabia	-	-	65	170568
Switzerland	-	-	52	133075
Finland	46	100543	30	78696
Italy	-	-	27	76240
Germany	32	63912	31	74149
Other countries	-	-	21	42799

FUTURE OUTLOOK

India is not a platinum group elements (PGE) producing country and is meeting its demand entriely by imports. The demand for PGEs is expected to touch 80 tonnes by 2017 and may touch 120 tonnes by 2025, as per the Report of the Sub Group for 12th Plan period. Assuming the success of sustained efforts directed towards mining of the known resources at BNUC (Odisha) and development of a beneficiation flow sheet during the 12th Plan, a plant of 2 tonnes per annum capacity can be envisaged by the middle of the 13th Plan. The Sub Group recommends that the preparation of beneficiation feasibility report in this regard may be assigned to any National Laboratory on priority basis. It expects that an additional 10-20 tonnes per annum should be recovered from recycling by 2017.

PGEs especially platinum and palladium are considered as a safe investment like gold. Platinum being more resistant to corrosion has also got several industrial applications, It is used in the automobile industry as oxidation catalyst in catalytic converters to control exhaust emissions. There has been an increase in demand for these metals during the last decade because of increased demand from the automobile industry and that from the emerging Asian markets particularly in China and India. However, platinum is losing market share to palladium in petrol-driven engines and palladium has started to replace some platinum in diesel catalytic converters. The automobile sector plays a crucial role in the demand for platinum. The Kyoto protocol on exhaust emissions and the commercial success of the fuel cell technology development, on which sustained efforts are being made world over are the key drivers for the future demand of platinum, palladium and rhodium .

About 40% of the world supply of platinum is consumed by the jewellery sector. Palladium, rhodium, iridium and ruthenium are used in electronic and electro-chemical industries, while osmium finds applications in the medical field, such as in chemotherapy and pace-makers (alloy of Pt and Os). These metals are poised to play a vital role in fuel cell technology once the economic viability of fuel cell is established, for which sustained efforts are being made around the world. As the supply of all PGEs together is less than 600 tonnes with about 500 tonnes coming from mine production, the boom in the demand for platinum jewellery and also as an investment can be expected. South African local issues, compounded by falling grades, deep mining, etc. are likely to determine whether sufficient platinum and rhodium supply can be foreseen, which in turn will dictate future prices.

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

PETROLEUM AND NATURAL GAS

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

62 Petroleum and Natural Gas

The domestic production of crude oil at 37.7 million tonnes in 2010-11 increased by 12% over 2009-10. The net production of natural gas (utilised) rose by 10% to 52,222 mcm in 2010-11. The refining capacity in the country at 193.39 million tonnes per annum as on 1.4.2011 was 11 million tonnes higher over preceding year and was 4.3% of the world refinery capacity.

RESOURCES

As on 1.4.2011, total reserves of crude oil are estimated at 757 million tonnes (327 million tonnes in onshore and 430 million tonnes in offshore areas). Those of natural gas are placed at 1,241 billion cu m (284 billion cu m in onshore and 957 billion cu m in offshore areas) (Table - 1).

Table – 1 : Reserves of Crude Oil and Natural Gas in India as on 1.4.2011 (P)

(Crude oil in million tonnes; natural gas in billion cu m)

Area	Crude oil	Natural gas
India	**757.44**	**1240.92**
Onshore	**327.64**	**284.36**
Andhra Pradesh	5.23	40.58
Assam*	176.50	127.93
Gujarat	137.42	78.97
Tamil Nadu	8.49	36.88
Offshore	**429.79**	**956.57**
Western offshore @	403.60	420.91
Eastern offshore#	26.19	535.66

* *Includes Arunchal Pradesh, Nagaland and Tripura.*

@ *Includes Bombay High offshore, Rajasthan and JVC. Also includes Madhya Pradesh (Coal Bed Methane) in case of natural gas.*

Includes JVC/Private parties in case of crude oil and West Bengal (Coal Bed Methane) in case of natural gas.

Source: *Indian Petroleum and Natural Gas Statistics, 2010-11, Ministry of Petroleum and Natural Gas, Govt. of India.*

EXPLORATION & DEVELOPMENT

The ONGC and OIL, the two National Oil Companies (NOCs) and a few private and joint venture companies were engaged in exploration and production activities of oil and natural gas in the country. As on 1.4.2011, there were in all 426 oil/gas fields under these companies including offshore areas.

In public sector, ONGC's jurisdiction extended to 377 fields – Cambay basin (Gujarat) – 101 oil/ gas fields, Upper Assam – 36 fields, Assam & Assam Arakan – 6 fields, Jodhpur (Rajasthan) – 7 fields, Krishna-Godavari basin (Andhra Pradesh) – 50 fields, Cauvery basin (Tamil Nadu) – 28 fields, Assam Arakan Fold Belt (AAFB) in Tripura - 11 fields and Assam & Assam Arakan in Nagaland – 3 fields, besides, 98 offshore fields in the Mumbai offshore, and 2 in Cambay basin in West Coast and 35 offshore fields in Cauvery, Mahanadi, Andaman and Krishna-Godavari basins (shallow and deep) in East Coast. OIL, a public sector company was engaged in 19 fields – Upper Assam basin in Assam (14 fields) and Arunachal Pradesh (1 field), Jaisalmer basin (Rajasthan) (3 fields) and Bikaner-Nagaur basin (Rajasthan) - 1 field. Private/Joint venture companies were engaged in Cambay basin (Gujarat) at 27 fields, AAFB basin (Arunachal Pradesh) at 1 field, Assam basin (Assam) at 1 field, Rajasthan at 7 fields and Raniganj (South) basin (West Bengal) at 1 field in onshore areas. In offshore areas, these companies covered 2 fields in Cauvery basin and 3 fields in Krishna-Godavari basin on the East Coast and 2 fields in Mumbai basin and 3 fields in Cambay basin on the West Coast.

Highlights of exploration carried out by ONGC and OIL during 2010-11 are furnished below:

During 2010-11, **ONGC** carried out seismic surveys and generated a total of 4,501 GLK of 2D and 3,331 sq km of 3D seismic data acquired in the onland part and 8,615 GLK of 2D and 16,024 sq km of 3D seismic data have been acquired in offshore part. A total of 125 exploratory wells with a meterage of 379,660 and 256 development wells with a meterage of 500,094 have been drilled. A total of 24 exploratory wells – 15 onland and 9 offshore areas – were successful with hydrocarbon finds. Exploratory efforts of ONGC during 2010-11 resulted in 24 new hydrocarbon finds: Virgovindpura -3, Vemerdi - 1, Karnnagar - 1, Vadaal- 1, Limborda East - 1, Vadatal - 3, Matar - 12, Aliabet - 2, in western onland; West Kesavadasupalem - 1, Lakshminarasimhapuram - 1, Malleswaram - 1, Vygreswaram Southwest - 1 in Krishna Godavari basin onland; North Kovilkallappal - 1, Kuthanalur - 12 in Cauvery basin onland; Ad -30 (ADAK), C-23-9, C-1-6, GK-28-2, GK-28-3 in Western offshore; GS-KV-1,GS-21-3, GS-29-6 in Krishna Godavari basin offshore and MDW-10 in Mahanadi offshore.

During 2010-11, ONGC as a consortium has been awarded 16 blocks (3 on land, 6 shallow water and 7 deep water blocks) in the NELP-VIII round. Out of these 16 blocks, ONGC is the operator in 12 blocks, OIL in two blocks, consortium partner BGEPIL in one block and ONGC & OIL are joint operators in one block.

The ultimate reserve accretion of oil-equivalent gas (O+OEG) in 2010-11 (as on 1.4.2011) in domestic assets of ONGC was 83.56 million tonnes. The total ultimate reserves of oil-equivalent gas (O+OEG) as on 1.4.2010 was 2,594.92 million tonnes.

During 2010-11, OIL covered, under onshore seismic survey, 644.61 2D(GLKM) and 370.10 3D (SQKM) in Assam & Arunachal Pradesh; 102.92 3D (SQKM) in Andhra Pradesh and 346.55 2D (GLKM) in Mizoram.

OIL carried out exploratory onshore drilling of 104,635 m in 31 wells in Assam, 5,333 m in 2 wells in Arunachal Pradesh and 7,160 m drilling in 4 wells in Rajasthan.

The details of discoveries of oil/gas made by OIL during 2010-11 in Assam are given below:

i) The well Jengoni-2, South of Makum North Hapjan area, Assam, encountered three gas bearing sands within Tipam formation and one oil bearing sand tested in Brail formation.

ii) The well Makum-33, Located in West Makum structure, encountered three possible hydrocarbons bearing sand within Brail, five hydrocarbon possible oil bearing sand within Lakadong Therria formation and one gas bearing sand tested in Langpar formation.

iii) The well Madhakali-1, lies on Madhakali structure. The well encountered one oil bearing sand, tested within Lakadong+Therria formation. The discovery of presence of commercial oil in this well has opened up a new area for exploration within Moran ML.

iv) The well Balimara-1, lies on Balimara structure, encountered four possible hydrocarbous bearing sand ranges within Kopili formation. The discovery of oil in this well has opened up new area for exploration within Dumduma ML.

V) The well Mahakali lies on Mahakali structure and is located about 2.5 km northwest of Kasomari-1 well. The well encountered a number of hydrocarbon (possibly oil) bearing sand ranges within Lakadong- Therria formation. The discovery of oil in this well opened up new area of exploration within Hugrijan ML.

vi) The well NHK - 292, tested hydrocarbon within Girujan sand and produced gas. This discovery of gas by workover operation has opened up a new area for exploration within Hugrijan ML within Girujan reservoir.

The total recoverable reserves of crude oil and natural gas estimated by OIL at the end of 2010-11 (as on 31.3.2011) were 44.51 million and 33.88 billion cu m, respectively.

In 2010-11, public sector companies drilled 420 wells (347 in onshore and 73 in offshore areas) with a meterage of 1,006 thousand (781thousand in onshore and 225 thousand in offshore areas). The particulars of exploratory and development drilling carried out by public sector companies are given in Table-2.

Table – 2: Details of Drilling for Oil and Natural Gas* 2010-11(P)

State/Area	Wells (No.)	Meterage ('000)
ONSHORE	**347**	**781**
Assam	72	234
Gujarat	215	370
Others	60	177
OFFSHORE	**73**	**225**
Bombay High	73	225
Grand Total	**420**	**1006**

* *Relates to Public Sector Companies.*
Source: *Basic Statistics on Indian Petroleum and Natural Gas, 2010-11.*

RELIANCE INDUSTRIES LIMITED

It was yet another successful period for RIL's oil and gas exploration and production business. The Company made five oil discoveries in the on-land exploratory blockCB–ONN–2003/1 (CB-10 A&B) in the Cambay basin, awarded under the NELP-V round of exploration bidding. These discoveries are significant as this play fairway is expected to open more oil pool areas, leading to better hydrocarbon potential within the block. The block covers an area of 635 sq. km. in two parts, viz. Part A & Part B. RIL holds 100% participating interest (PI) in the block.

The Company also made a gas discovery in the exploration block KG-DWN-2003/1 (KG-V-D3) of NELP-V. The deep water block KG-DWN-2003/1 is located in the Krishna basin, about 45 km. off the coast in the Bay of Bengal. The block covers an area of 3,288 sq. km. in which RIL holds a 90% participating interest. During the period, the following six discoveries were notified to the Directorate General of Hydrocarbons(DGH), Government of India, viz Dhirubhai-47 in Well AF1 in CB-10 block, Dhirubhai-48 in Well AJ1 in CB-10 block, Dhirubhai-49 in Well AT1 in CB-10 block, Dhirubhai-50 in Well AN1 in CB-10 block, Dhirubhai-51 in Well AR1 in CB-10 block, Dhirubhai-52 in Well W1 in KG-V-D3 block.

The Company has also submitted initial proposal for commerciality to DGH for review and discussion for the discoveries in D33 in GS-01 block, D39 and D41 in KG-V-D3 block and D36 in KG-D4 block.

KG-D6 was the single largest source of domestic gas in the country in 2011 and accounted for almost 35% of the total gas consumption in India. The gas from KG-D6 catered to demand from 57 customers in critical sectors like fertilizer, power, steel, petrochemicals and refineries. The gas from KG-D6 accounted for about 44% of the total domestic gas production paving the way for increased energy independence for the country.

RIL has submitted an integrated appraisal programme for all discoveries in Part A of CB-10 block. Further, RIL has been continuing with the appraisal activities for the other discoveries in KG-D6, KG-V-D3 and CB-10 blocks. In FY-11, RIL has relinquished CB-ON/1 block due to poor prospects. Currently, RIL's portfolio consists of 28 exploration blocks.

The Panna-Mukta fields produced 9.3 MMBL of crude oil and 52.1 BCF of natural gas in 2011 – a decline of 31% and 25% respectively, over the previous year. The lower volumes are on account of complete shutdown due to failure of the single point mooring system (SPM) and parting of anchor chains 4 and 5 to the SPM during July to October 2010.

Tapti fields produced 1.2 MMBL of condensate and 95.2 BCF of natural gas in 2011 – a decline of 22% over the previous year.

RIL has 13 blocks in its international conventional portfolio, including 2 in Peru, 3 in Yemen (1 producing and 2 Exploratory), 2 each in Oman, Kurdistan and Colombia, one each in East Timor and Australia; amounting to a total acreage of over 99,145 sq. km.

RIL holds 3 CBM blocks in Sohagpur (East), Sohagpur(West) and Sonhat. So far, RIL has completed the following work in the Sohagpur (East) and Sohagpur (West) blocks: (i) Over 40 core holes drilled, logged and tested for gas content, permeability and coal properties (ii) 31 wells air drilled and tested for productivity (iii) 75 hydraulic fracturing jobs done (iv) 5 cavitations completion wells and 2 sets of in-seam horizontal wells.

PRODUCTION

Petroleum (Crude)

Production of petroleum (crude) in the country at 37.7 million tonnes in 2010-11 registered an increase of 11.9% as compared to that in the previous year. Bulk of the total production (74.3%) was shared by the public sector companies. Private sector companies accounted for the remaining 25.7%.

Offshore areas continued to be the largest producer of petroleum (crude) in 2010-11 and had a share of 56.4% of the country's total output. Next in order were Gujarat with a contribution of 15.7%, Rajasthan with 13.7% and Assam with 12.5%. The remaining 1.7% production was reported by Andhra Pradesh, Tamil Nadu and Arunachal Pradesh.

During 2010-11, the production of petroleum (crude) recorded increase in Rajasthan by 1051.9% and marginal increase in Andhra Pradesh where as, there was a decline in production in Arunachal Pradesh by 11.5%, offshore areas by 2.7% and Tamil Nadu by 2.1% as compaired to the previous year (Table - 3).

Natural Gas (Utilised)

The production of natural gas (utilised) at 52,222 mcm was an increase of 10% in 2010-11 as compared to that in the previous year.

Offshore areas continued to be the largest producers of natural gas (utilised) with a share of 83.6%. Next in order were Assam 5.1%, Gujarat 4.3%, Andhra Pradesh 2.7%, Tamil Nadu 2.1%, Tripura (1.2%) and Rajasthan 0.8%. Arunachal Pradesh and West Bengal accounted for the remaining 0.2% production.

Statewise analysis revealed that Rajasthan, offshore areas, Arunchal Pradesh, Tripura and West Bengal recorded an increase in production, whereas, Gujarat, Andhra Pradesh, Tamil Nadu and Assam recorded decrease in production of natural gas in 2010-11 as compared to that of previous year. The production of natural gas increased in Rajasthan by 80.8%, Offshore areas by 12.5%, Arunchal Pradesh by 10%, Tripura by 8.2% and West Bengal by 7.9%. The decline in production was recorded in Gujarat by 7.4%, Andhra Pradesh by 6.4%, Tamil Nadu by 5% and Assam by 0.8%.

As much as 48.7% of the total production came from the public sector companies, whereas, the remaining 51.3% was the share of the private sector companies during the year 2010-11 (Table - 5). Domestic prices of petroleum (crude) in 2008-09 to 2010-11 are furnished in Table-4.

Employment

A total of 141,929 persons were employed in the petroleum industry as on 31.3.2011, as compared to 139,865 persons in the preceding year. Out of these, 33,984 persons were employed in exploration and production, 31,836 in refining, and the balance 76,109 in marketing, pipelines, R & D and others.

Table – 4 : Prices of Petroleum (Crude) 2008-09 to 2010-11

(In ₹ per tonne)

Grade	Market	2008-09	2009-10	2010-11
Indigenous*	Onshore	28354	24233	28829
Indigenous*	Offshore	30507	26187	31525
Indigenous*	Offshore & Onshore	29796	25530	30614
Imported	c.i.f. Indian Port (average)	26672	23817	27535

* *Relates to basic prices of petroleum crude is all inclusive Gross (pre-discount) price.*

Source: *Basic Statistics on Indian Petroleum & Natural Gas, 2010-11 for indigenous crude prices and DGCI&S,Kolkata for average imported crude prices.*

Table – 3 : Production of Petroleum (Crude), 2008-09 to 2010-11 (By States)

(Quantity in '000 tonnes; value in ₹ '000)

State	2008-09		2009-10		2010-11(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**33508**	**533851466**	**33690**	**607894611**	**37712**	**680466654**
Public sector	28834	459385018	28427	512930250	28030	505766873
Private sector	4674	74466448	5263	94964361	9682	174699781
Andhra Pradesh	289	4604365	304	5485306	305	5503350
Arunachal Pradesh	102	1625070	131	2363734	116	2093077
Assam	4674	74466448	4740	85527470	4719	85148550
Gujarat	5946	94732029	5960	107540869	5905	106548462
Rajasthan	–	–	447	8065565	5149	92907372
Tamil Nadu	265	4221996	239	4312461	234	4222242
Offshore	22232	354201558	21869	394599206	21284	384043601

Table – 5 : Production of Natural Gas (Utilised), 2008-09 to 2010-11
(By States)

(Quantity in million cu metres; value in ₹'000)

State	2008-09		2009-10		2010-11(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**32845**	**121073731**	**47496**	**177751215**	**52222**	**195438015**
Public sector	24755	91252252	25511	95473540	25448	95237766
Private sector	8090	29821479	21985	82277675	26774	100200249
Andhra Pradesh	1524	5617792	1479	5535078	1384	5179545
Arunachal pradesh	30	110586	40	149698	44	164668
Assam	2573	9484631	2703	10115831	2682	10037240
Gujarat	2605	9602590	2444	9146538	2263	8469155
Rajasthan	216	796222	239	894445	432	1616737
Tamil Nadu	1242	4578279	1178	4408601	1119	4187797
Tripura	553	2038477	564	2110739	610	2282892
West Bengal	20	73724	38	142213	41	153440
Offshore	24082	88771430	38811	145248072	43647	163346541

INDUSTRY

The total refining capacity of 21 units in operation in the country was about 193.4 million tpy in April 2011, with a share of about 4.29% in the estimated world refinery capacity of 4,512 million tpy. In 2010-11, refinery crude throughput increased to 206.15 million tonnes from 192.77 million tonnes in 2009-10 (Table-6).

In the next few years, the following additional refining capacities are reportedly expected to come on stream: (i) 15.0 million tonnes - IOCL, Paradeep, (ii) 1.4 million tonnes - HPCL, Mumbai, and (iii) 9.0 million tonnes - HPCL-Mittal Energy Ltd, Bhatinda.

A joint venture has been established for setting up the greenfield Guru Gobind Singh Refinery Project at Bhatinda with Mittal Energy Pvt. Ltd. The project has an initial capacity of 9 million tpy and is expected to be completed by 2011. There are also reports of the LN Mittal Group signing an MoU with HPCL, Total (of France), GAIL and OIL for jointly developing a 15 million tpy refinery cum petrochemicals complex in Visakhapatnam at a cost of $ 6 billion.

The capacity of Essar's 10.5 million tpy refinery at Vadinar in Gujarat is expected to rise to 12 million tpy after debottlenecking. CPCL's capacity augmentation at Manali in Tamil Nadu from 9.5 to 11.2 million tpy is underway.

Reliance Petroleum Ltd (RPL), promoted by RIL and Chevron India Holdings Pte. Ltd, Singapore, has been formed to set up a greenfield petroleum refinery and polypropylene plant located in SEZ in Jamnagar, Gujarat, adjacent to RIL's existing refinery and petrochemicals complex. The refinery has a total atmospheric distillation capacity of about 580 kilo barrels per stream day (KBPSD), while the polypropylene plant has a production capacity of 0.9 million tpy. The refinery and plant were commissioned in December, 2008 and production started from January 2009.

Production of various petrochemicals from these refineries from 2008-09 to 2010-11 is given in Table-7.

Table – 7 : Production of Petroleum Products from Refineries
2008-09 to 2010-11

(In '000 tonnes)

Product	Production		
	2008-09	2009-10	2010-11
A) FROM CRUDE OIL	**150516**	**179769**	**190364**
1.Light distillates	**40222**	**51197**	**55197**
(a) LPG	6996	8091	7538
(b) Motor spirit	16020	22537	26135
(c) Naphtha	14826	17105	17531
(d) SBPS/Hexane	81	67	78
(e) Others	2380	3397	3916
2. Middle distillates	**80309**	**93790**	**99776**
(a) Kerosene	8223	8545	7702
(b) ATF	8071	9296	9570
(c) HSD	62889	73281	78053
(d) LDO	606	472	578
(e) Others	520	2195	3874
3.Heavy ends	**29985**	**34782**	**35391**
(a) Furnace oil	14749	15828	18659
(b) Lube oils	874	950	737
(c) Bitumen	4713	4889	4478
(d) Petroleum coke	4241	3709	2632
(e) LSHS/HHS/RFO	2935	2518	1860
(f)Total Waxes	74	67	185
(g) Others	2399	6753	6840
B) FROM NATURAL GAS			
LPG	2162	2243	2168

Source: *Indian Petroleum & Natural Gas Statistics, 2010-11, Ministry of Petroleum & Natural Gas, Government of India.*

Table – 6 : Installed Capacity and Crude Throughput in Refineries

(In '000 tonnes)

Refinery	Annual installed capacity (as on 1.4.2011)	Refinery Crude throughput		
		2008-09	2009-10	2010-11
Total	**193390**	**160772**	**192768**	**206154**
Public/Joint Sector	**122890**	**112223**	**112117**	115461
IOCL, Guwahati, Assam	1000	1076	1078	1118
IOCL, Barauni, Bihar	6000	5940	6184	6207
IOCL, Koyali, Gujarat	13700	13852	13206	13561
IOCL, Haldia, West Bengal	7500	6042	5686	6878
IOCL, Mathura, Uttar Pradesh	8000	8601	8107	8880
IOCL, Bongaigaon, Assam	2350	2163	2220	2008
IOCL, Digboi, Assam	650	623	600	651
IOCL, Panipat, Haryana	15000	13070	13615	13660
BPCL, Mumbai, Maharashtra	12000	12262	12516	13020
BPCL (formerly KRL), Kochi, Kerala	9500	7739	7875	8732
Bharat Oman Refineries Ltd, Bina@	6000	-	-	-
HPCL, Mumbai, Maharashtra	6500	6652	6965	6752
HPCL, Vizag, Andhra Pradesh	8300	9155	8796	8200
CPCL, Manali, Tamil Nadu	10500	9718	9580	10104
CPCL, Narimanam, Tamil Nadu	1000	418	517	703
MRPL, Mangalore, Karnataka	11820	12577	12498	12662
NRL, Numaligarh, Assam	3000	2251	2619	2255
ONGC, Tatipaka, Andhra Pradesh	70	84	55	69
Private Sector	**70500**	**48549**	**80652**	**90693**
RPL, Jamnagar, Gujarat	33000	35636	34415	34517
RPL (SEZ), Jamnagar, Gujarat*	27000	–	32735	41303
Essar Oil Ltd,Vadinar, ** Gujarat.	10500	12913	13502	14873

Figures rounded off.

Source: *Indian Petroleum and Natural Gas Statistics, 2010-11, Ministry of Petroleum & Natural Gas, Government of India.*

@Commissioned on 1.4.2011, BORL is a joint venture company promoted by BPCL with Oman Oil Company Ltd.(OOCL)

** Commissioned on 25.12.2008; production started from January, 2009.*

*** Commissioned on 24.11.2006; production started from December, 2006.*

Note: *CPCL and BRPL are subsidiaries of IOCL; NRL of BPCL and MRPL of ONGC.*

CONSUMPTION

Total consumption of petroleum products (excluding Refinery Boiler Fuel) increased by 3.98 million tonnes in 2010-11 over the previous year. Consumption of some Light Distillates (LPG, motor spirit and naphtha) increased slightly in 2010-11. Consumption of Middle Distillates like HSD, ATF also increased. However, consumption of Heavy Ends recorded decrease of furnace oil/ LSHS. The consumption of various petroleum products from 2008-09 to 2010-11 is given in (Table-8).

Table – 8 : Consumption of Petroleum Products 2008-09 to 2010-11

(In '000 tonnes)

Product	2008-09	2009-10	2010-11*(P)
Grand Total	**145511**	**149415**	**157657**
1. Light distillates	**39878**	**38995**	**41433**
(a) LPG	12344	13135	14328
(b) Motor Spirit	11258	12818	14192
(c) Naphtha	13911	10134	10691
(d) Others	2365	2908	2222
2. Middle distillates	**66378**	**71120**	**74949**
(a) SKO	9303	9304	8928
(b) ATF	4423	4627	5079
(c) HSDO	51710	56242	59990
(d) LDO	552	457	455
(e) Others	390	490	497
3. Heavy ends	**27343**	**27693**	**25402**
(a) Furnace oil/LSHS	12588	11629	10878
(b) Lubes & greases	2000	2539	2508
(c) Bitumen	4747	4934	4566
(d) Petroleum coke	6166	6586	5487
(e) Others	1842	2005	1963
Total (1+2+3)	**133599**	**137808**	**141784**
4. Refinery Boiler fuel	**11912**	**11607**	**15873**

* Excludes data in respect of RIL SEZ Refinery as it is presumed that all products have been exported and not consumed domestically.

Source : *Indian Petroleum & Natural Gas Statistics,2010-11, Ministry of Petroleum & Natural Gas, Government of India.*

ALTERNATIVE SOURCES

With the ever-increasing dependence on petroleum imports due to stagnant domestic production and spiralling growth in demand, the Government is encouraging the development of alternative sources of hydrocarbons. With this view, the Government has identified coal bed methane, gas hydrates, hydrogen, bio-diesel and ethanol for vigorous exploration development.

Coal Bed Methane

The coal and lignite seams contain varying amounts of methane depending on the rank of the carbonaceous matter, the depth of burial and the geotectonic setting of basins. The commercial production of such methane, better known as coal bed methane (CBM), is a proven technology and has added to the natural gas production of USA (the major producer), Australia and China.

Within the next few years, CBM is expected to emerge as a new source of natural gas production in the country. India has emerged as the fourth country in the world capable of producing CBM on commercial scale with the commencement of commercial production from July 2007.

Gas Hydrates

Gas hydrates are formed when gas and water mixtures are subjected to high pressure and low temperature conditions in the sea, usually in water depths of more than 800 m, within sediments just below the sea bottom. They are also formed in some permafrosts of the world. Gas hydrates may be an important source of hydrocarbon energy in the future. The gas hydrates also act as a cap under which natural gas can get accumulated.

There are numerous potential offshore areas of gas hydrates accumulation within India's Exclusive Economic Zone. A National Gas Hydrate Programme (NGHP) is in place and various R&D studies are in progress to develop vast resources of gas hydrates in western and eastern offshore and Andaman offshore areas. Based on the detailed geoscientific studies carried out by NGHP through NIO, 10 sites in Mahanadi, Krishna-Godavari and Kerala-Konkan Basins and Andaman Sea have been short-listed for drilling/coring of gas hydrates in deep waters.

India is the third country after USA and Japan, where R&D work on gas hydrates has started. The sustained efforts carried out by the Directorate General of Hydrocarbons (DGH) with IODP & USA, the drillship JOIDES Resolution collected samples from Indian offshore in April-August 2006 period under agreement between DGH and a US consortium of companies. During drilling/coring by the drillship, huge quantities of gas hydrates have been detected in one of the wells in KG basin.

National Institute of Ocean Technology (NIOT), Chennai, has developed a Remotely Operated Vessel (ROV) which can go down to ocean bed and remain there to map the gas hydrates and collect samples. An Indo-Russia Gas Hydrate Centre is also set up at NIOT in 2004 to support the Integral Long Term Programme (ILTP) of Russia.

The DGH convened an International Conference on Gas Hydrates in February 2008 to deliberate on scientific results and the outcome of the Expedition-I gas hydrate coring/drilling programme and status of similar programmes in other countries. There are recent reports of a large find of methane hydrate deposit in the KG basin. A German research project is understood to be making large investments for the exploration of the deposit and working along with the DGH, National Institute of Oceanography (NIO) and others. A MoU was recently signed by DGH with the Leibniz Institute of Marine Sciences, Germany for methane production from gas hydrates.

Oil Shales

Resource assessment of oil shale deposits in Assam and Arunachal Pradesh was in progress with the expertise of an international company. Field work in respect of data collection was initiated.

Hydrogen

Hydrogen is receiving worldwide attention as a clean fuel and efficient energy storage medium for automobiles. Hydrogen can replace or supplement oil used in road transportation. Hydrogen production technologies can be both fossil fuel based and renewable resource based. However, substantial research and development is needed to establish use of hydrogen as an alternative fuel in a cost-effective manner. For development of hydrogen as a fuel, the Ministry of Petroleum & Natural Gas has set up a Hydrogen Corpus Fund with contribution from five major Oil Companies and Oil Industry Development Board (OIDB). A road map has been set up by Indian Oil Corp. (R&D), the nodal agency for the hydrogen research project, for hydrogen production, dispensing, storage and application. Demonstration projects in pipeline include using 10% hydrogen in CNG at IOC R&D Centre at Faridabad and a similar demonstration project later in Delhi. Another such mixture dispensing station is planned to be set up as demonstration project by IOC with funding from Ministry of New & Renewable Energy (MNRE) and Hydrogen Corpus Fund.

Bio-diesel

Bio-diesel is chemically treated vegetable oil/animal fat which can be mixed with conventional diesel to be used as transport fuel. It is extracted from the seeds of the trees like Mahua, Karanja, Kusum, Dhupa, Undi, Simarouba, Sal, Pilu, Jojoba, Tumba, Nahor, Kokum, Rubber-seed, Cheura, Wild-Apricot, Tung, Neem, Mango, Kernel and Jatropha. Many of these plants can be grown in waste and degraded lands. The R&D studies indicated that a bio-diesel/diesel blend results in a fuel that is non-toxic, biodegradable and nonflammable with a very high flash point. It enhances the life of the engine and results in less pollution. In Uttar Pradesh, BPCL has launched a bio diesel project covering one million acres wasteland to produce one million tonnes bio-diesel by 2015.

The oil marketing companies are experimenting with blending of bio-diesel in high speed diesel to the extent of 5%. BIS has already amended the specifications of diesel to permit blending of bio-diesel in diesel.

Ethanol

To reduce dependence on imported oil by way of encouraging use of indigenous sources of energy, Ministry of Petroleum & Natural Gas had notified on 20.9.2006, the scheme of 5% ethanol-blended petrol (EBP), in accordance with BIS specifications, to be sold in notified areas subject to condition. The EBP has been applicable to the entire country (except NE States, Jammu & Kashmir, Andaman & Nicobar Islands and Lakshadweep) with effect from 1.11.2006. The requirement of ethanol for 5% EBP programme in whole country is about 0.56 million KL per annum, whereas the supply during 2009 was 15% of the requirement. Due to shortfall in supply of ethanol the EBP programme was adversely affected.

POLICIES AND CONTRACTS

On 9.2.2005, the Government had approved a proposal of Ministry of Petroleum & Natural Gas to pursue natural gas imports from Iran, Myanmar and Central Asian Countries through onland transnational pipelines. In pursuance of the Cabinet decision, the Government is discussing the 60 MMSCMD Iran-Pakistan-India (IPI) project with the Governments of Iran and Pakistan, particularly relating to transportation tariff and transit fee for passage of pipeline through Pakistan. India has become an offcial member of the Turkmenistan-Afghanistan-Pakistan-India (TAPI) Gas Pipeline Project in April 2008. The total capacity of the project is 90 MMSCMD and the length is about 1,680 km.

One of the landmarks in Liberalisation Policy in petroleum sector is encouragement to participation of foreign and other Indian companies in exploration and development activities. A number of contracts have been signed with both foreign and Indian companies to undertake exploration activities and development of fields on production-sharing basis. Similarly, the Government is encouraging National Oil Companies to aggresively pursue equity oil and gas opportunities overseas.

The Government has decided to build a Strategic Crude Oil Reserve of 5 million tonnes through a special purpose vehicle (SPV) named Indian Strategic Petroleum Reserves Ltd (ISPRL) - a subsidiary company of OIDB. The locations selected are : (i) Visakhapatnam, Andhra Pradesh, (storage capacity 1.33 million tonnes), (ii) Mangalore, Karnataka (1.5 million tonnes), and (iii) Padur, Karnataka (2.5 million tonnes). The target date for mechanical completion of the facilities are November 2011, November 2012 and December 2012, respectively.

The Government had initiated bids under the New Exploration Licensing Policy (NELP) in 2000 to accelerate and expand exploration of oil and gas in the country. A total of 235 blocks had been awarded in various rounds of NELP, spanning 2000-2010. The details of the exploration blocks awarded in NELP rounds are as below :

Round	Month, year	No. of blocks awarded	Area (sq km)
NELP-I	April,2000	24	228472
NEPL-II	July, 2001	23	263050
NELP-III	Feb., 2003	23	204588
NELP-IV	Feb., 2004	20	192810
NELP-V	Dec., 2005	20	113687
NELP-VI	March, 2007	52	306331
NELP-VII	Dec., 2008	41	112988
NELP-VIII	June,2010	32	52603

Subsequently, the Government invited offers on 15 October 2010 for exploration of oil and natural gas under NELP-IX by 28th March 2011. A total 74 bids were received for 33 blocks by closing date against a total 34 blocks on offer.

In order to explore and produce new sources of natural gas from coal-bearing areas, the Government had formulated a CBM Policy in 1997 and implemented in 2000 providing attractive fiscal and contractual framework for exploration and production of CBM which is an environment friendly clean gas fuel similar to conventional natural gas.

The Government of India has awarded 26 CBM blocks in Jharkhand (6), Madhya Pradesh (5), Andhra Pradesh (2), Chhattisgarh (3), Maharashtra (1), Rajasthan (4), Gujarat (1) and West Bengal (4) in different coalfields of India under CBM-I to III. In fourth round, the Government of India has awarded 7 CBM blocks in Assam, Chhattisgarh, Madhya Pradesh, Odisha and Tamil Nadu. Exploration activities have established significant finds in eastern and central India. Commercial production of CBM has commenced from July 2007.

The Ministry of Petroleum & Natural Gas has formulated a Bio-diesel Purchase Policy which came into force on 1.1.2006. The Policy is a statement of intent towards purchase of bio-diesel by the oil-marketing companies. The policy, inter alia, identifies 20 purchase centres to be set up by public sector.

WORLD REVIEW

The world proved reserves of crude oil and natural gas at the end of 2010 were estimated at 188.8 billion tonnes and 187.1 trillion cu m, respectively (Tables - 9 and 10). The largest share of reserves of world crude oil is available in Middle East (54.4%) followed by South & Central America (17.3%), Europe & Eurasia (10.1.%), Africa (9.5%), North America (5.4%) and Asia Pacific (3.3%).

Of the total world reserves of natural gas, Middle East possesses the largest share (40.5%) followed by Europe & Eurasia (33.7%), Asia Pacific (8.7%), Africa (7.9%), North America (5.3%) and South & Central America (4.0%).

The world crude oil production in 2010 increased to 3.90 billion tonnes from 3.81billion tonnes in 2009. OPEC countries, namely, Algeria, Angola, Ecuador, Indonesia, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, UAE and Venezuela had a share of about 39% in the world crude oil production in 2010. Russia (13%), Saudi Arabia (12%), USA (9%), Iran & China (5% each), Canada & Mexico (4% each) and Brazil, Iraq, Kuwait, Norway, UAE & Venezuela (3% each) were the principal producers of crude petroleum.

The world production of natural gas also marginally increased to 3.28 trillion cu m in 2010 from 3.11 trillion cu m in 2009. OPEC countries had a share of 15% in the world natural gas production in 2010. Russia (20%), USA (19%), Canada (5%), Iran (4%), China, Indonesia & Norway (3% each) and Netherlands, Qatar and Saudi Arabia (2.5% each) were the chief producers of natural gas in 2010 (Tables - 11 and 12).

The world consumption of oil in 2010 was estimated as 4,028 million tonnes, while that of natural gas was 2,858 million tonnes oil equivalent. Consumption of oil and natural gas in India in the same period was 155 million tonnes (with 3.9% share) and 55.7 million tonnes oil equivalent (with 1.9% share), respectively.

Oil prices remained in range of US$ 70 to 80 per barrel for much of the period in 2010, before rising to US$ 94 per barrel in fourth quarter. With the OPEC production cuts implemented in 2008-09 was still in place, average oil prices of the year as a whole were US$ 79.5 per barrel, the second highest on record.

Table – 9 : World Proved Reserves of Crude Oil*
(By Principal Countries)

(In billion tonnes)

Country	Reserves
World: Total	**188.8**
Brazil	2.0
China	2.0
Canada	5.0
Iran	18.8
Iraq	15.5
Kazakhstan	5.5
Kuwait	14.0
Libya	6.0
Nigeria	5.0
Russian Federation	10.6
Saudi Arabia	36.3
UAE	13.0
USA	3.7
Venezuela	30.4
Other countries	20.8

* *At 2010 end.*
Source: *BP Statistical Review of World Energy, June, 2011.*

Table – 10 : World Proved Reserves of Natural Gas*
(By Principal Countries)

(In trillion cu m)

Country	Reserves
World : Total	**187.1**
Algeria	4.5
Australia	2.9
Bangladesh	0.4
China	2.8
Indonesia	3.1
Iran	29.6
Iraq	3.2
Kazakhstan	1.8
Malaysia	2.4
Myanmar	0.3
Nigeria	5.3
Norway	2.0
Pakistan	0.8
Qatar	25.3
Russian Federation	44.8
Saudi Arabia	8.0
Turkmenistan	8.0
UAE	6.0
USA	7.7
Uzbekistan	1.6
Venezuela	5.5
Other countries	21.1

* *At 2010 end.*
Source: *BP Statistical Review of World Energy, June, 2011.*

Table – 11 : World Production of Crude Petroleum (By Principal Countries)

(In million tonnes)

Country	2008	2009	2010
World : Total	**3911**	**3810**	**3901**
Algeria	86	78	78
Angola	92	87	91
Brazil	99	105	111
Canada	136	134	141
China #	190	189	203
Iran	210	202	203
Iraq	115	118	120
Kuwait #	137	121	123
Libya	85	77	76
Mexico	163	154	153
Nigeria	103	99	115
Norway	121	115	105
Russia	488	494	505
Saudi Arabia	515	460	468
UAE	143	126	131
United Kingdom	67	64	59
USA	309	335	345
Venezuela[e]	132	125	127
Other countries	720	727	747

Source: *World Mineral Production, 2006-2010*
@ Including shares of production from the Neutral Zone.
 # Including oil from shale and coal.

Table – 12 : World Production of Natural Gas (By Principal Countries)

(In billion cu m)

Country	2008	2009	2010
World: Total	**3183**	**3111**	**3278**
Algeria	87	80	80
Canada	168	156	151
China	80	85	96
Indonesia	74	87	93
Iran	116	131	139
Malaysia	61	60	63
Netherlands	79	75	84
Norway	99	104	106
Qatar	77	89	85
Russia	664	584	649
Saudi Arabia	80	78	84
Turkmenistan	66	36	42
United Kingdom	75	63	60
USA #	571	583	611
Uzbekistan	64	61	60
Other countries	822	839	875

 # Dry gas.
Source: *World Mineral Production, 2006-2010.*

FOREIGN TRADE

Exports

Exports of crude petroleum decreased sharply to one thousand tonnes in 2010-11 as compared to 34 thousand tonnes in the preceding year. Almost all the exports were to Liberia. Exports of natural gas in 2010-11 increased considerably to 27,244 tonnes against 9,293 tonnes in 2009-10. Exports were almost entiraly to Nepal (Tables - 13 and 14).

Exports of petroleum products (total-including light distillates, middle distillates and heavy ends) increased by 16% to 59.13 million tonnes in 2010-11 as compared to 50.97 million tonnes in the preceding year.

Imports

Imports of crude petroleum decreased marginally to 153.12 million tonnes in 2010-11, over the preceding year level of 153.63 million tonnes. Imports were mainly from Saudi Arabia (17%), Nigeria (11%), Iran & Iraq (10% each), Kuwait (9%), UAE (8%) and Venezuela (7%). Imports of natural gas increased to 9.77 million tonnes in 2010-11 from 9.11 million tonnes in 2009-10. Main suppliers were Qatar (82%) and Nigeria & Trinidad (3% each) (Tables - 15 and 16).

Imports of petroleum products (total) at 17.34 million tonnes in 2010-11 increased by 19% as compared to 14.60 million tonnes in the preceding year. Besides 8.95 million tonnes LNG was imported in 2010-11 as against 8.83 million tonnes in 2009-10.

Table – 13 : Export of Petroleum (Crude) (By Countries)

Country	2009-10		2010-11	
	Qty ('000 t)	Value (₹'000)	Qty ('000 t)	Value (₹'000)
All Countries	**34**	**888968**	**1**	**548**
Liberia	–	–	1	519
Bahrain	–	–	++	22
UAE	–	–	++	7
Other countries	34	888968	–	–

Table – 14 : Export of Natural Gas (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**9293**	**379069**	**27244**	**1191530**
Nepal	9103	370624	26310	1161118
UAE	–	–	743	24357
Bhutan	190	8440	191	6050
Australia	–	–	++	5
Other countries	++	5	–	–

Table – 15 : Import of Petroleum (Crude) (By Countries)

Country	2009-10 Qty ('000 t)	2009-10 Value (₹'000)	2010-11 Qty ('000 t)	2010-11 Value (₹'000)
All Countries	**153629**	**3659009475**	**153120**	**4216162484**
Saudi Arabia	26883	662926267	26300	742434361
Nigeria	13020	338025741	16259	478602505
Iran	22086	482632149	16083	419376295
Iraq	13883	330483468	14767	407338682
Kuwait	14612	345518335	14383	398933596
UAE	10433	257204535	12657	358151739
Venezuela	6238	133174667	10147	237195738
Angola	8039	199866389	8418	231685253
Oman	5220	129409190	4782	140478140
Qatar	4615	113525153	4836	140095419
Other countries	28600	666243581	24488	661870756

Table – 16 : Import of Natural Gas (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**9110571**	**110672243**	**9765763**	**146481792**
Qatar	6795541	75656047	8053130	115831607
Nigeria	118292	1620901	292968	5644138
USA	–	–	184419	4304426
Egypt	177547	3388279	177724	4006308
Trinidad	162035	2292702	263200	3576395
Saudi Arabia	–	–	129601	1766532
Yemen Republic	–	–	137513	1694371
UK	–	–	68150	1651114
Norway	–	–	60000	1500510
Unspecified	49688	626072	213497	3180563
Other countries	1807468	27088242	185561	3325828

FUTURE OUTLOOK

The country is deficient in oil resources and most of the domestic requirements are met through imports. This trend is likely to continue in future till the crude oil production in the country increases. Several measures were taken by the Government to intensify exploration and enhance hydrocarbon reserves. These included development of new as well as existing fields, implementation of Enhanced Oil Recovery Schemes, recourse to specialised technology, enlisting the services of international experts and encouraging participation of private and joint-venture companies in the exploration programme.

Some of the recommendations of the Working Group on Petroleum & Natural Gas Sector for the 12th Five Year Plan (2012-17) are as follows:

Exploration & Production Sector

i. ONGC is to develop marginal fields located in west coast and other gas discoveries in east coast area during 12th Plan period. This will result in increase in natural gas production of ONGC by about 28 MMSCMD in 2016-17.

ii. A National Data Repository (NDR) will comprise of reliable exploration and production data for India, with provisions for seamless access. Online data management would be drawn up which would be an essential part of an Open Acreage Licensing Policy (OALP).

iii. Crude oil production is expected to increase by about 22% over the production in 11th Five Year Plan period. Natural gas production is expected to increase by about 57% during 12th Five Year Plan period.

iv. OALP is expected to give further momentum to oil and gas exploration activities in the Indian sedimentary basins. An estimated area of about 3.96 lakh sq km is to be offered under NELP/OALP during 12th Plan.

Acquisitions of Assets Abroad.

i. During the 12th Plan period, four oil PSUs together target to produce about 67 million tonnes of oil equivalent of oil and gas from overseas with an anticipated investment to the tune of ₹ 114,760 crore.

Natural Gas

i. With a targeted GDP growth rate of over 9%, India's energy demand is expected to grow at 5.2%.

ii. GOI has adopted a multi-pronged strategy to enhance availability of natural gas in the country through (a) intensification of domestic E&P activities through NELP, (b) Coal Bed Methane Exploration & Production activities, (c) Developing underground Coal Gasification and (d) Target Unconventional sources like Shale Gas, Gas Hydrates, etc.

iii. Price sensitivity is a major issue which is limiting LNG imports and hence, it is imperative to launch progressive reforms across the gas value chain. LNG imports into the country and development of downstream markets to ensure off take will remain at the core of the natural gas sector in the days to come.

Refining

i. Transformation in the Indian refining Sector to continue. Refinery capacity is expected to increase from 232.3 million tpy in 2011-12 to 310.9 million tpy by the end of 12th Plan.

ii. Refinery configurations to undergo further change. Hydrogen production and management, sulphur removal and recovery, changing hydrocarbon species in product pool will continue to drive these changes. The emphasis on green technologies will add to these changes.

iii. Refinery-Petrochemicals integration is an essential driver to economic growth as well as corporate profitability. Significant opportunity exists for refinery-petrochemical integration.

iv. Dependence on crude oil imports is likely to go up from around 80% in 2011-12 to 86.7% in 2016-17.

v. Existing port-infrastructure needs to be strengthened to handle additional Crude and POL imports/exports.

vi. In order to ensure energy security in case of any emergency, strategic storage facilities are under construction at Visakhapatnam, Mangalore and Padur. A scheme for filling crude oil in the caverns has been proposed.

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

POTASH

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

64 Potash

Potassium is one of the three essential plant nutrients, the other two being nitrogen and phosphorus. It is supplied commercially as potash, i.e., potassium-bearing minerals, ores and processed products.

Bedded marine evaporite deposits and surface & sub-surface potash-rich brines are principal sources of potash. The principal ore is sylvinite, a mixture of sylvite (KCl) and rock salt (NaCl). In India, resources exist mainly as polyhalite, sylvite and glauconite. However, there is no commercial exploitation and the entire requirements of potassic fertilizers for direct application as well as for production of complex fertilizers are met through imports.

RESOURCES

As per UNFC system, total resources of potash as on 1.4.2010 are estimated at 21,816 million tonnes in the country. Rajasthan alone contributes 94% resources, followed by Madhya Pradesh 5% and Uttar Pradesh the remaining 1% (Table - 1).

OCCURRENCES

Glauconitic sandstones/greensands deposits which are available in plenty can be used as an alternative indigenous resource for potash. Glauconite is essentially a complex hydrous silicate of iron and potassium chiefly with ferric oxide and partly with ferrous oxide. It contains 4-7% K_2O.

In India, glauconite is commonly associated with sand/sandstones, shale, marl and occasionally with limestone. Glauconitic sandstones of Vindhyan Group represent oldest glauconite deposits which are well developed in Son Valley region covering parts of Madhya Pradesh and Uttar Pradesh. In Madhya Pradesh, occurrences are in Sidhi and Satna districts. In Banda and Mirzapur districts of Uttar Pradesh, deposits of same origin are located. Glauconite occurs in shale, limestone and Tal formations at Duggada and Tal Valley in Garhwal and at Mussoorie, Dehradun districts in Uttarakhand. In Rajasthan, glauconitic sandstones/shales occur in Chittorgarh, Kota, Karauli, Jaisalmer and Barmer districts. In Gujarat, glauconite is found in Ukra formation at Guneri in Kachchh district. In Himachal Pradesh, glauconite of hydrothermal origin is found in Kumla-Kathwar area of Sirmaur district. In Kerala, glauconite occurs in Quilon Limestone and sea bed sediments of Thiruvananthapuram coast.

USES

Potash is an essential nutrient for protein synthesis and it aids plants to use water more efficiently. Glauconitic sandstones/greensands are used directly in acidic soils in eco-friendly manner, as glauconitic sand mixes homogeneously with the soil and provides potash as nutrient for plants. It also increases soil fertility and improves soil texture, porosity and permeability due to more or less uniform grain size. Potassium chloride (KCl) is the principal fertilizer product equivalent to 60 - 62% of K_2O. Other salts for fertilizer use are potassium sulphate, potassium magnesium sulphate and potassium nitrate. Potassium chloride and potassium nitrate are also used in the manufacture of glass, ceramics, soap, synthetic rubber and chemicals. Potassium nitrate is used in explosive manufacture as well.

CONSUMPTION

Reported domestic consumption of potash increased to 1.88 million tonnes in 2010-11 in fertilizer industry from around 1.21 million tonnes in 2009-10 (Table-2). Apparent consumption of potash fertilizer was 5.2 million tonnes in 2009-10 and 4.6 million tonnes in 2010-11 based on export-import data.

Table – 1 : Reserves/Resources of Potash as on 1.4.2010 (By Grades/States)

(In million tonnes)

Grade/State	Reserves Total (A)	Remaining resources: Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	Total resources (A+B)
All India : Total	–	**18142**	**3652**	**22**	**21816**	**21816**
By Grades						
Glauconite	–	878	1068	22	1968	1968
Polyhalite	–	13985	2179	–	16164	16164
Sylvite	–	2072	404	–	2476	2476
Unclassified	–	1206	–	–	1206	1206
By States						
Madhya Pradesh	–	1206	–	–	1206	1206
Rajasthan	–	16936	3461	22	20419	20419
Uttar Pradesh	–	–	190	–	190	190

Figures rounded off.

Table – 2 : Reported Consumption of Potash Salt 2008-09 to 2010-11

(In tonnes)

Industry	2008-09	2009-10(R)	2010-11(P)
All Industries	**746400**	**1209500**	**1884900**
Fertilizer	746400 (9)	1209500(11)	1884900 (11)

Figures rounded off.
Data collected on non-statutory basis.
Figures in parentheses denote the number of units in organised sector reporting consumption.*
*(*Includes actual reported consumption and/ or estimates made wherever required).*

WORLD REVIEW

The world reserves are estimated at approximately 9,500 million tonnes of K_2O content located mainly in Canada, Russia, Belarus, Germany, Brazil, China, USA, Israel and Jordan (Table-3).

The world production of potash in 2010 was 33.6 million tonnes in terms of K_2O content as against 20.7 million tonnes in 2009. Canada remained the leading producer of potash with 29% share in total production in 2010, followed by Russia (18%), Belarus (15%), Germany (9%), China (7%) and Jordan & Israel (6% each). (Table-4).

Table – 3 : World Reserves of Potash (By Principal Countries)

(In '000 tonnes of K_2O content)

Country	Reserves
World: Total (rounded)	**9500000**
Belarus	750000
Brazil	300000
Canada	4400000
Chile	130000
China	210000
Germany	150000
Israel	40000
Jordan	40000
Russia	3300000
Spain	20000
United Kingdom	22000
USA	130000
Other countries	50000

Source: *Mineral Commodity Summaries, 2012.*

Table – 4 : World Production of Potash
(By Principal Countries)

(In '000 tonnes of K_2O content)

Country	2008	2009	2010
World: Total	**32800**	**20700**	**33600**
Belarus	4967	2485	5223
Canada (Chloride)	10379	4318	9788
China	1980	2062	2345
Germany (Potassic salt)	3280	1825	3023
Israel (Chloride)	2134	2446	2041
Jordan	1200	1199	2141
Russia	5935	3691	6128
USA (Potassic salt)	1100	700	900
Other countries	1825	1974	2011

Source: *World Mineral Production, 2006-2010*

FOREIGN TRADE

Exports

Exports of potash fertilizer were 29,512 tonnes in 2010-11 as against 29,606 tonnes in the previous year. Exports were mainly to Sri Lanka (79%). Exports of potassium nitrate decreased to 1,334 tonnes in 2010-11 from 2,543 tonnes in the previous year. Exports were mainly to Thailand, USA, Nigeria and Malaysia. There were no exports of potassium salts (natural) in 2010-11 as compared to 10 tonnes in 2009-10 (Tables - 5 to 7).

Imports

Imports of potash fertilizer decreased to 4.62 million tonnes in 2010-11 from 5.19 million tonnes in the previous year. Russia & Israel (18% each), Canada (16%), Jordan (13%) and Belarus (10%) were the main suppliers in 2010-11. Imports of potassium nitrate also decreased to 466 tonnes in 2010-11 from 530 tonnes in the previous year. Israel and China were the main suppliers of potassium nitrate in 2010-11 (Tables - 8 and 9).

Table – 5 : Exports of Potash fertilizers
(By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**29606**	**830878**	**29512**	**587651**
Sri Lanka	987	22945	23254	445680
UAE	6	232	2454	56378
Iran	++	7	1620	29825
Pakistan	73	1274	1307	27358
Saudi Arabia	2	86	298	9460
Malaysia	185	6877	99	4284
Egypt	116	2292	60	2862
Oman	25	738	102	1507
Nigeria	22	184	50	1449
Hong Kong	-	-	55	1322
Other countries	28190	796243	213	7526

Table – 6 : Exports of Potassium Nitrate
(By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**2543**	**136932**	**1334**	**91950**
USA	68	8948	280	43167
Thailand	1187	59070	823	38189
Nigeria	138	6409	108	4257
Malaysia	261	12054	54	2257
Indonesia	48	2754	35	1719
UAE	56	3231	14	990
Saudi Arabia	20	1008	10	441
Argentina	-	-	3	283
Ghana	-	-	2	161
Bangaladesh	50	2969	3	159
Other countries	715	40489	2	327

Table – 7 : Imports of Potash Fertilizers (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**5188833**	**120184457**	**4617512**	**77338258**
Russia	925293	20787082	848623	14397870
Canada	828068	19409250	740224	12687321
Israel	750445	17557539	834576	12507306
Jordan	527520	12471834	593280	10338649
Belarus	771587	19280336	464053	7906643
Latvia	223195	4829501	418127	7099925
Germany	200945	4824925	204852	3646490
Ukraine	523915	11397162	108061	1790409
UK	140366	3231009	103994	1755717
Spain	52153	546407	86645	1472811
Other countries	272346	5849412	215077	3735117

Table – 8 : Imports of Potassium Nitrate (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**530**	**43787**	**466**	**22620**
Israel	24	1580	216	12264
China	456	39156	175	7157
Jordan	24	1400	72	2867
Netherlands	1	252	1	248
Germany	6	254	2	83
USA	3	246	++	1
Other countries	16	899	-	-

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

PYROPHYLLITE

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

65 Pyrophyllite

Pyrophyllite ($Al_2O_3 . 4SiO_2 . H_2O$) is a hydrous silicate of aluminium. It resembles closely with talc in many physical and optical properties but differs in chemical composition in that talc contains magnesia instead of alumina. Pyrophyllite finds application in high grade ceramics & refractories and also as a filler in pesticide industry. Production of pyrophyllite is mainly reported from Chhatarpur, Tikamgarh and Shivpuri districts of Madhya Pradesh, Mahoba and Lalitpur districts of Uttar Pradesh and Keonjhar district of Odisha.

RESOURCES

The total resources of pyrophyllite in India as per UNFC system as on 1.4.2010 are placed at 56.08 million tonnes of which about 41%; i.e., 23.27 million tonnes are in reserves category. Madhya Pradesh accounts for 56% resources, followed by Odisha(22%) and Uttar Pradesh (10%). The remaining (12%)resources are in Andhra Pradesh, Maharashtra and Rajasthan. Gradewise, refractory grade accounts for 24%, followed by insecticide grade and ceramic grade (22% each) and insecticide and ceramic mixed grade18%. The remaining 14% are others, unclassified and not-known grades (Table - 1).

EXPLORATION & DEVELOPMENT

In 2010-11, DGM, Maharashtra, carried out geological survey around Walni Khatgaon Village in Sindevahi tehsil of Chandrapur district by mapping and drilling 539 metre. Resources of 0.40 million tonnes of pyrophyllite-sillimanite were estimated duing 2010-11. So far 3.12 million tonnes of resources have been proved in this area .

PRODUCTION, STOCKS & PRICES

The production of pyrophyllite at 2.34 lakh tonnes during 2010-11 registered a decrease of about 3% as compared to that in the previous year.

There were 29 reporting mines in 2010-11 as against 33 in the preceding year. Besides, the production of pyrophyllite was also reported as an associated mineral by three mines in Maharashtra. Eight principal producers accounted for 94 % of total production during the year. The share of public sector in the total production was 4% in 2010-11, where as it was 5% in the previous year.

Four mines each reporting more than 10,000 tonnes annual production accounted for about 70 % of total production and 15mines including one associated mine each reporting annual production between 1000 to 10,000 tonnes contributed about 28 % of total output. Remaining 2% production was from 13 mines including one associated mine.

Madhya Pradesh continued to be the leading producing state which accounted for 88% of output, followed by Uttar Pradesh 12%. Nominal production was reported from Maharashtra during the year (Table - 2 to 5).

Mine-head stock of pyrophyllite at the end of 2010-11were 83 thousand tonnes as against 120 thousand tonnes at the beginning of the year (Table - 6).

The average daily employment of labour in pyrophyllite mines during 2010-11 was 1,196 as against 1,200 in the previous year (Table - 7). Domestic prices of pyrophyllite are furnished in the General Review on "Prices".

Table – 1: Reserves/Resources of pyrophyllite as on 1.4.2010
(By Grades/States)

(In tonnes)

Grade/State	Reserves				Remaining resources								Total resources (A+B)
	Proved STD111	Probable STD121	Probable STD122	Total (A)	Feasibility STD211	Pre-feasibility STD221	Pre-feasibility STD222	Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
All India : Total	**12146045**	**6888351**	**4241055**	**23275451**	**3256515**	**4919285**	**6595687**	**3976532**	**3963980**	**9786686**	**308766**	**32807451**	**56082902**
By Grades													
Refractory	3823529	3102412	907499	7833440	624548	780518	215441	1622096	437442	2155126	17161	5852332	13685772
Ceramic	73495	1718367	1422374	3214236	2084359	585761	860549	1712387	1155394	2416999	43200	8858649	12072885
Insecticide	2530529	1034194	179740	3744463	100714	2061915	1627759	213300	2045592	2357243	-	8406523	12150986
Insecticide & Ceramic mixed	4550634	763591	828162	6142387	439128	1292905	606892	327187	139811	998364	-	3804287	9946674
Others	855667	263541	610850	1730058	-	-	3200000	-	60570	60585	-	3321155	5051213
Unclassified	222979	6246	163180	392405	2300	195037	63895	94450	49848	1571161	248405	2225096	2617501
Not-known	89212	-	129250	218462	5466	3150	21150	7112	75323	227209	-	339410	557872
By States													
Andhra Pradesh	245019	41841	171143	458003	121475	33360	-	-	75201	662193	-	892229	1350232
Jharkhand	858	-	328	1186	-	-	-	-	-	-	-	-	1186
Madhya Pradesh	6779943	5239637	2622217	14641797	585596	3451594	2062603	2407790	3753640	4418648	248405	16928276	31570073
Maharashtra	702680	-	281072	983752	-	-	-	958000	-	2185696	-	3143696	4127448
Odisha	3329278	1001802	525100	4856180	1973032	194121	3920129	80	40	1331393	17161	7435956	12292136
Rajasthan	139650	-	187041	326691	54308	38989	110709	232212	68587	277249	-	782054	1108745
Uttar Pradesh	948617	605071	454154	2007842	522104	1201221	502246	378450	66512	911508	43200	3625241	5633083

Figures rounded off.

Table – 2: Principal Producers of Pyrophyllite, 2010-11

Name and address of producer	Location of mine	
	State	District
Khajurao Minerals, Post Box No-25, Chhatarpur- 471 001, Madhya Pradesh.	Madhya Pradesh	Chhatarpur
Jindutta Mineral Pvt. Ltd., Post Box No. 27, Distt. Chhatarpur – 471 001, Madhya Pradesh.	Madhya Pradesh	Chhatarpur
Ishwar Mining & Ind. Corpo.(P) Ltd., Charan Kamal 7, Ishwar Nagar, Mathura Road, New Delhi – 65.	Madhya Pradesh	Shivpuri
M/s Eastern Minerals 35, Vivekanand Marg, Cantt. PO- Jhansi-284002, Distt- Jhansi Uttar Pradesh.	Madhya Pradesh	Tikamgarh Chhatarpur

Contd

Table – 2 concld.

Name and address of producer	Location of mine	
	State	District
J.K. Minerals C1 & C2 Industrial Estate, Gwalior Road, Jhansi - 284 003, Uttar Pradesh.	Uttar Pradesh	Jhansi Lalitpur
M. P. State Mining Corp Ltd. Paryavas Bhavan, Area Hills, Jail Road Bhopal – 462 011, Madhya Pradesh.	Madhya Pradesh	Chhatarpur
Vinod KumarTrivedi Gandhi Nagar, Vill-Gourhahi, P.O: Gourhahi, Dist-Mahoba(UP)	Uttar Pradesh	Mahoba
Goura Udyog Audyogic Utpadan Sahkari Sam Vill-Gourhahi, Post: Gourhahi, Dist-Mahoba(UP).	Uttar Pradesh	Mahoba

Table – 3 : Production of Pyrophyllite, 2008-09 to 2010-11

(By States)

(Qty in tones; value in ₹'000)

State	2008-09		2009-10		2010-11(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**255699**	**55831**	**240747**	**60425**	**234487**	**52129**
Andhra Pradesh	32	5	26	4	-	-
Jharkhand	4629	2315	1007	614	-	-
Madhya Pradesh	210662	44306	209127	53123	205633	45853
Maharashtra	2127	625	1446	461	1299	394
Odisha	15655	2949	11926	2748	-	-
Uttar Pradesh	22634	5631	17215	3475	27555	5882

Table -4: Production of Pyrophyllite, 2009-10 to 2010-11

(By Sectors/States/Districts)

(Qty in tonnes; value in ₹ '000)

State/District	2009-10			2010-11(P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India	**33(2)**	**240747**	**60425**	**29(3)**	**234487**	**52129**
Public sector	1(1)	12916	3356	1(1)	10076	2623
Privatesector	32(1)	227831	57069	28(2)	224411	49506
Andhra Pradesh	**1**	**26**	**4**	**-**	**-**	**-**
Cuddapah	1	26	4	-	-	-
Jharkhand	**1**	**1007**	**614**	**-**	**-**	**-**
Saraikela Kharaswan	1	1007	614	-	-	-
Madhya Pradesh	**21**	**209127**	**53123**	**20**	**205633**	**45853**
Chhatarpur	12	153226	36818	10	154289	32006
Shivpuri	1	27789	9726	1	20716	6785
Tikamgarh	8	28112	6579	9	30628	7062
Maharashtra	**(2)**	**1446**	**461**	**(3)**	**1299**	**394**
Bhandara	(2)	1446	461	(3)	1299	394
Odisha	**2**	**11926**	**2748**	**-**	**-**	**-**
Keonjhar	2	11926	2748	-	-	-
Uttar Pradesh	**8**	**17215**	**3475**	**9**	**27555**	**5882**
Jhansi	3	1464	331	3	3265	720
Lalitpur	3	10317	2146	3	7757	1646
Mahoba	2	5434	998	3	16533	3516

Figures in parentheses indicate number of associated mines with kyanite & sillimanite

Table - 5: Production of Pyrophyllite, 2009-10 and 2010-11 (p)
(By Frequency Groups)

(Qty. in tonnes)

Production group	No. of mines		Production for the group		Percentage in total Production		Cumulative Percentage	
	2009-10	2010-11	2009-10	2010-11	2009-10	2010-11	2009-10	2010-11
All Groups	**33(2)**	**29(3)**	**240747**	**234487**	**100.00**	**100.00**	-	-
Up to 500	12(1)	9(2)	2322	3255	0.96	1.39	0.96	1.39
501 – 1000	2	1(1)	1907	1243	0.79	0.53	1.75	1.92
1001 – 2000	6(1)	6	10176	9261	4.23	3.95	5.98	5.87
2001 – 5000	4	2	12572	7175	5.22	3.06	11.20	8.93
5001 – 10000	3	7	21907	50057	9.10	21.35	20.30	30.28
10001-15000	2	1	23633	16361	9.82	6.98	30.12	37.26
15001 & above	4	3	168230	147135	69.88	62.74	100.00	100.00

Table -6: Mine-head Stocks of Pyrophyllite, 2010-11(P)
(By States)

(In tonnes)

State	At the beginning of the year	At the end of the year
India	**119795**	**83271**
Andhra Pradesh	13	35
Jharkhand	65	104
Madhya Pradesh	77109	40037
Maharashtra	745	667
Odisha	2337	877
Rajasthan	204	-
Uttar Pradesh	39322	41551

MINING, MARKETING AND TRANSPORT

All pyrophyllite mines in the country are being operated manually, except a few semi-mechanised opencast mines in Madhya Pradesh, which deploy excavators and payloaders. In some mines benches of height varying from 1.5 to 3.5 m and width varying from 4 to 10 m have been developed in overburden. For ensuring qualitative improvement in the mine environment and ecology, some mine owners have planted trees like Acacia, Shishum, Eucalyptus, Jamun and Mango. Pyrophyllite is sorted out by experienced workers on visual assessment and then transported to grinding units to obtain 70 to 300 mesh powder as per the requirement of consumers.

CONSUMPTION

The reported domestic consumption of pyrophyllite was at 8,000 tonnes in 2010-11 Refractory was the main consuming industry accounting for about 78% and the ceramic industry consumed the remaining 22% (Table -7).

Table - 7 : Consumption of Pyrophyllite, 2008-09 to 2010-11 (By Industries)

(In tonnes)

Industry	2008-09	2009-10(R)	2010-11(P)
All Industries	**7200**	**7400**	**8000**
Ceramic	1800(4)	1800(4)	1800(4)
Refractory	5400(7)	5600(9)	6200(9)

Figures rounded off. Data collected on non-statutory basis. Figures in parentheses denote the number of units in organised sector reporting consumption.*
*(*Includes actual reported consumption and/or estimates made whereever required).*

USES AND SPECIFICATIONS

Pyrophyllite is harder than talc and unlike talc, pyrophyllite does not flux when fired. It is, therefore, used in high-grade ceramic products, electric insulators and refractories. Pyrophyllite imparts thermal shock resistance to ceramic bodies. It is also used as filler and dusting powder in various industries. In glass industry, pyrophyllite is used instead of felspar as a source of aluminium. Owing to its softness and mode of occurrence in lumps it is used extensively in handicraft industries for making various articles.

Low thermal expansion and shrinkage characteristics of pyrophyllite make it a useful ingredient in ceramic blends and may substitute either pitcher (grog) or silica. Pyrophyllite allows faster firing cycles in the manufacture of whiteware. In production of stoneware and chinaware, more mechanical strength as well as improved whiteness can be achieved at lower firing temperature. Hence, pyrophyllite is consumed in refractory as well as in wall tiles, sanitaryware, electrical porcelain and other ceramic and vitreous china products.

The BIS has prescribed the following specifications for pyrophyllite for ceramic industry (IS:11477-2011).

The consumers in refractory industry generally prefer pyrophyllite, containing 26 to 28% Al_2O_3 to 4% alkali and having 23 to 25 PCE (orton cone). For insecticide industry, the specifications of talc/steatite can also be applicable to pyrophyllite as given below:

Loss on ignition	:	7% max.
Matter soluble in HCl	:	3% max.
Fe_2O_3	:	1.5% max.

WORLD REVIEW

The world reserves of pyrophyllite are quite large and sufficient to meet the world demand. The world reserves of talc and pyrophyllite are given in Table - 9. Reserves of pyrophyllite are not available separately.

The world production of pyrophyllite in 2010 increased to 1.51 million tonnes from 1.49 million tonnes in the previous year. The Republic of Korea was the leading producer accounting for 45%, followed by Japan 22%, India 13% ,South Africa 8% and Thailand 7% . (Table - 10).

The prices of pyrophyllite are normally influenced by alumina content, levels of iron and other impurities, colour, abrasiveness, absorbency, etc.

Table - 9 : World Reserves of Talc and Pyrophyllite (By Principal Countries)

(In '000 tonnes)

Country	Reserve base
World : Total (rounded)	**Large**
Brazil	230000
China	Large
Finland	Large
France	Large
India*	75000
Japan	100000
Korea, Republic of	14000
USA **	140000
Other countries	Large

Source*: Mineral Commodity Summaries, 2012*

* *India's resources of pyrophylite as per UNFC System as on 1.4.2010are estimated at 56.08 million tonnes.*

** *Excludes pyrophyllite.*

Table - 10 : World Production of Pyrophyllite

(In '000 tonnes)

Country	2008	2009	2010
Total	**1737**	**1492**	**1513**
Argentina	9	10[e]	10[e]
India	256	242	204
Japan[e]	350	340	340
Korea, Republic of	893	617	674
Morocco	26	33	27
Peru	--	19	19
South Africa	81	115	123
Thailand	106	100[e]	100[e]
Vietnam	16	16	16

Source: *World Mineral Production, 2006-2010*

India's production of pyrophyllite in 2008-09, 2009-10 and 2010-11, was 256 thousand tonnes, 241 thousand tonnes and 234 thousand tonnes, respectively.

FUTURE OUTLOOK

The use of pyrophyllite in ceramic industry seems to be static whereas the refractory applications are facing the problems as most other refractory minerals due to change in technology and reduction of refractory consumption per tonne of metal. Pyrophyllite will continue to face competition from bentonite and attapulgite in carrier applications. However, use in filler applications appears to be stable.

The apparent demand of pyrophyllite is estimated at around 288 thousand tonnes by 2011-12 and at 442 thousand tonnes by 2016-17 at 9% growth rate, as per the report of the Sub-Group-II of Working Group for 12th Five Year Plan, Planning Commission of India.

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

QUARTZ & OTHER SILICA MINERALS

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

66 Quartz & Other Silica Minerals

The term 'quartz' is often referred to as a synonym for silica. Silica (SiO_2) is one of the ubiquitous materials in the earth's crust. Quartz, quartz crystals, quartzite, silica sand, sand (others) and moulding sand are all coined together in one generic name 'silica minerals'. This is because all these commodities are essentially crystalline silicon dioxide (SiO_2) with variations mostly related to their crystalline structure and presence of minor or trace impurities. Silica occurs in several forms giving rise to different varieties.

Crystalline Varieties

The important varieties of crystalline quartz are vein quartz (massive crystalline quartz); milky quartz (white, translucent to opaque); ferruginous quartz (containing brown limonite and red haematite and almost opaque); aventurine quartz (containing glistening flakes of mica or haematite); cat's eye (opalescent greenish quartz with fibrous structure); rock crystal (clear, colourless, well-crystallised transparent quartz); amethyst (clear-purple or violet-blue), transparent quartz; rose quartz; smoky quartz; etc. Occurrences of massive crystalline quartz in veins or pegmatites have been recorded in almost all the states.

Clastic or Granular Varieties

These varieties include sand consisting largely of unconsolidated quartzose grains (0.06 mm to 2 mm diameter), gravel consisting of largely unconsolidated coarse quartzose grains or pebbles (2 mm to 8 mm in diameter), sandstone and quartzite. The occurrences are reported from Andhra Pradesh, Bihar, Delhi, Haryana, Karnataka, Kerala, Madhya Pradesh, Rajasthan,Tamil Nadu, Uttar Pradesh, etc. The silica sand from Naini area in Allahabad district, Uttar Pradesh is of a very high quality.

Cryptocrystalline Varieties

This group includes chalcedony, agate, jasper, onyx, flint and chert. These varieties appear non-crystalline (amorphous) in hand specimens, but under microscope show double refraction which reveals their concealed crystalline nature. These varieties are reported from Gujarat, Uttar Pradesh, Tamil Nadu, Andhra Pradesh, Maharashtra, Madhya Pradesh, Karnataka and Punjab. The most important occurrences of agate are in Ratnapur, Rajpipla area and further west between Tapi and Narmada rivers in Bharuch district, Gujarat, where it is found as pebbles in varying sizes associated with clay washed down by the river flow. Other occurrences of economic importance are reported from Amravati, Aurangabad, Buldhana, Chandrapur, Nashik and Pune districts in Maharashtra; beds of Krishna and Godavari rivers in Andhra Pradesh; Dumka district in Jharkhand; Dhar, Mandsaur, Sihore and Shahdol districts in Madhya Pradesh; and Kachchh district in Gujarat.

RESOURCES

As per the UNFC system as on 1.4.2010 , the total resources of quartz and silica sand in the country are estimated at 3,499 million tonnes out of which 12% i.e. 429 million tonnes are placed under reserves category while 88% i.e. 3,070 million tonnes are placed under remaining resources category. Resources by grades reflect foundry & moulding grade as 19%, glass grade 14%, ceramic & pottery grade 11% and ferro-silicon grade as 5%. The unclassified, others, sodium silicate and not-known grades account for about 51% of the total resources. Haryana alone accounts for about 52% resources, followed by Rajasthan (9.5%), Tamil Nadu (6.5%), Anadhra Pradesh (6%), Maharashtra (5%), Jharkhand (4.5%) and Karnataka and Gujarat (3% each) (Table - 1).

The total resources of quartzite in the country as per the UNFC system as on 1.4.2010(Provisional) are estimated as 1,251 million tonnes of which reserves are about 87 million tonnes and remaining resources are 1,165 million tonnes . Bulk resources of about 50% are located in Haryana followed by Bihar (22%), Maharashtra (7%), Punjab (6.5%), Odisha (5%) and Jharkhand (3%). Resources of refractory grade are 37%, ceramic & pottery grade 18% and BF grade 5%. The remaining 40% resources are of low, unclassified, others and not-known grades (Table - 2).

EXPLORATION & DEVELOPMENT

Exploration for quartz and silica minerals was conducted by DMG, Rajasthan and DMM, West Bangal. Details of exploration carried out for quartz and other silica minerals during 2010-11 are given in Table - 3.

Table – 1 : Reserves/Resources of Quartz & Silica Sand as on 1.04.2010

(By Grades/States)

(In '000 tonnes)

Grade/State	Reserves				Remaining resources								Total resources (A+B)
	Proved STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measurred STD331	Indicated STD332	Interred STD333	Reconnsaissance STD334	Total (B)	
		STD121	STD122			STD221	STD222						
All India: Total	**272,972**	**35,079**	**121,173**	**429,223**	**185,399**	**322,454**	**321,760**	**58,683**	**259,116**	**1,907,994**	**14,402**	**3,069,808**	**3,499,031**
By Grades													
Glass	103,129	15,139	40,524	158,792	46,785	23,815	51,528	2,176	8,707	175,356	5,922	314,289	473,082
Ferro-silicon	4,889	96	6,479	11,464	9,022	16,023	20,409	98	65,126	57,175	-	167,853	179,317
Sodium silicate	1,622	38	1,594	3,254	533	1,490	5,143	-	146	31,245	11	38,568	41,822
Ceramic and Pottery	96,746	1,554	32,111	130,411	12,935	23,781	59,764	7,328	12,826	148,729	-	265,362	395,773
Foundry and Moulding	46,285	15,999	20,891	83,175	58,339	36,249	116,140	16,984	38,301	302,462	7,672	576,148	659,323
Abrassive	2,405	7	13	2,425	-	249	1,861	-	10	3,508	-	5,628	8,053
Others	10,844	116	11,398	22,358	38,280	62,210	14,649	116	25	862,023	220	977,523	999,881
Unclassified	4,600	353	2,828	7,781	11,869	154,593	33,209	31,982	39,669	190,442	17	461,781	469,562
Not-known	2,453	1,778	5,333	9,564	7,634	4,045	19,058	-	94,307	137,053	560	262,657	272,220
By States													
Andhra Pradesh	33,590	3,320	35,772	72,683	16,664	6,242	25,109	5,404	10,965	65,867	6,099	136,349	209,031
Assam	-	-	-	-	-	-	-	-	-	1,790	-	1,790	1,790
Bihar	-	-	2,121	2,121	-	-	-	-	-	24,652	-	24,652	26,773
Chhattisgarh	141	-	46	187	385	-	620	56	-	191	7,672	8,924	9,111
Goa	-	-	-	-	-	20	1,736	-	-	18,248	-	20,004	20,004
Gujarat	16,042	684	19,256	35,982	17,133	5,110	11,774	2,144	2,999	25,629	-	64,789	100,771
Haryana	-	46	8,317	8,363	35,553	252,759	182,478	27,837	39,767	1,264,473	-	1,802,868	1,811,231
Himachal Pradesh	1	-	7	8	99	-	-	-	-	2,928	-	3,027	3,035
Jammu & Kashmir	-	-	-	-	-	-	-	-	-	3,110	-	3,110	3,110
Jharkhand	563	4	8,671	9,238	2	989	3,299	518	1,026	141,342	107	147,283	156,521
Karnataka	8,677	3,809	2,375	14,861	12,402	4,970	8,276	205	100	49,508	525	75,987	90,848
Kerala	-	38	-	38	404	1,959	3,354	14,611	30,241	77,528	-	128,096	128,135
Madhya Pradesh	144	11	14	169	51	-	86	47	316	2,191	-	2,692	2,861
Maharashtra	12,356	2,085	10,884	25,326	29,372	15,172	48,391	-	355	58,374	-	151,663	176,989
Meghalaya	-	-	-	-	-	-	-	-	177	6,906	-	7,083	7,083
Odisha	438	69	860	1,367	1,161	1,503	2,599	90	63,385	3,836	-	72,573	73,940
Punjab	-	-	-	-	-	-	-	-	-	3,927	-	3,927	3,927
Rajasthan	132,135	10,472	27,757	170,364	40,583	13,344	23,433	3,202	7,658	73,883	-	162,104	332,468
Tamil Nadu	60,063	9	93	60,166	29,644	4,892	7,523	3,387	95,837	27,150	-	168,432	228,598
Tripura	-	-	-	-	-	-	-	225	-	264	-	490	490
Uttar Pradesh	8,042	14,530	3,977	26,549	1,946	15,482	3,071	957	6,290	51,590	-	79,337	105,886
West Bengal	779	-	1,022	1,801	-	11	11	-	-	4,607	-	4,629	6,430

Figures rounded off.

Table – 2 : Reserves/Resources of Quartzite as on 1.4.2010
(By Grades/States)

(In '000 tonnes)

Grade/State	Reserves				Remaining resources								Total resources (A+B)
	Proved STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
		STD121	STD122			STD221	STD222						
All India : Total	**59004**	**1647**	**25948**	**86599**	**33217**	**105018**	**147686**	**93116**	**113611**	**669453**	**2548**	**1164649**	**1251248**
By Grades													
Refractory Grade-I	52958	268	21894	75120	4549	626	11470	829	1067	239474	1730	259745	334865
Refractory Grade-II	1520	406	485	2411	146	461	-	3183	21490	97836	-	123116	125527
Ceramic / Pottery	558	9	1015	1582	16195	35826	72771	-	3599	90702	-	219093	220675
Low	985	-	1000	1985	468	3863	18	37	-	8460	-	12846	14831
Ferro-silicon	-	-	-	-	169	692	3034	-	376	-	523	4794	4794
B.F.	242	-	1258	1500	-	606	809	197	275	62822	295	65004	66504
Others	1079	907	210	2196	9488	757	2025	588	-	3012	-	15870	18066
Unclassified	163	-	86	249	2203	55769	55479	67347	55674	133095	-	369567	369816
Not-known	1500	58	-	1558	-	6418	2080	20935	31130	34053	-	94616	96174
By States													
Andhra Pradesh	2114	406	2131	4651	548	1009	7481	-	4390	5209	295	18932	23583
Arunachal Pradesh	-	-	-	-	-	-	-	-	-	5270	-	5270	5270
Bihar	-	32	-	32	146	461	20054	5287	22822	227531	-	276301	276333
Chhattisgarh	1404	-	1267	2671	3086	3926	2195	-	-	14706	-	23913	26584
Haryana	-	-	-	-	15702	89742	112365	86951	85333	231887	-	621980	621980
Himachal Pradesh	25	-	16	41	16	-	-	-	-	-	-	16	57
Jammu & Kashmir	1500	58	-	1558	-	-	-	-	-	-	-	-	1558
Jharkhand	1079	-	174	1253	-	-	-	197	275	38869	-	39341	40594
Karnataka	390	-	1011	1401	-	-	190	-	-	-	1730	1920	3321
Madhya Pradesh	-	-	-	-	-	-	-	-	-	832	-	832	832
Maharashtra	48700	-	19480	68180	9516	28	1639	-	-	11353	-	22536	90716
Odisha	3629	1151	1783	6563	4204	9834	3744	681	-	34851	523	53837	60400
Punjab	-	-	-	-	-	-	-	-	116	81796	-	81912	81912
Rajasthan	163	-	86	249	-	18	18	-	-	706	-	742	991
Sikkim	-	-	-	-	-	-	-	-	675	16444	-	17119	17119

Figures rounded off.

Table – 3 : Details of Exploration Activities for Quartz & Quartzite, 2010-11

Agency/ State/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
QUARTZ							
DMM, West Bangal Bankura	Kendua dihi, P S Ganga Jalghatti	1:4545	0.5	-	-	08	Two trenches dugged. Inclusion of minor quartz veins were noticed. Resources were not estimated.
DMG Rajasthan Tonk	N/v Tirodi, Mandolai etc. Tq - Todarai Singh	1:50000 1:10000 1:2000	115 11.5 1.15	-	-	-	Garnetiferrous mica schist of light grey to brownish grey, highly foliated comprising of quartz were located N/v Tordi.
Rajsamand	N/v Tikhi Tq - Deogarh	1:10000	20	-	-	17	Pegmatite bands were identified which is potential for mineral quartz.
QUARTZITE							
MECL Assam Nagaon	Jiajury Quartzite Block Phase II	-	-	9	655	-	Thickness of friable quartzite vary from 40 to 60 m with 85 to 90% SiO_2. Estimated 320.53 million tonnes of quartzite resources under measured category with Av. grade of 88.42% SiO_2, 0.93% Fe_2O_3, 5.12 % Al_2O_3, 0.13% CaO and 0.11% of MgO.

PRODUCTION, STOCK & PRICES

QUARTZ

The production of quartz at 457 thousand tonnes in 2010-11 decreased by 13% due to non availability of enviormental clearance to some mines. There were 87 reporting mines in 2010-11 as against 92 in preceding year. Besides, the production of quartz was also reported from 46 mines as an associated mineral as against 49 mines in preceding year. The share of public sector mines, in the total output was about 2% during the year. The share of 10 principal producers was about 61% of the total output.

Andhra Pradesh continued to be the major producing state of quartz in the year 2010-11 also accounting for 43% of the total production followed by Rajasthan 25%, Jharkhand 16% Gujarat 8%, West Bengal 3%, Maharashtra 2%, and the remaining 3% production was contributed by Chhasttisgarh, Karnataka, Odisha and Tamil-Nadu. About 56% of the production during the year 2010-11 was reported by nine mines including 3 associated mines having production above ten thousand tonnes. Seventeen mines including three associated mines having annual production between five thousand to ten thousand tonnes contributed about 25% of the total production.The remaining was the contribution of 107 mines including 40 associated mines having annual production below five thousand tonnes (Tables - 4 to 7).

The mine-head stocks of quartz at the end of the year were 335 thousand tonnes as against 247 thousand tonnes in the beginning of the year (Table - 8).

The average daily labour employed in quartz mines in 2010-11 was 972 as against 751 in the previous year. Domestic prices of quartz are furnished in the General Review on 'Prices'.

Table – 4 : Principal Producers of Quartz 2010-11

Name & address of producer	Location of mine	
	State	District
Shri Ram Minerals Industries, C/o Goyar Enterprises, Bagda Bhawan, Opposite Jyoti Petrol Pump, Road No. 1, Vishwakarma Industrial Area, Jaipur - 302 013, Rajasthan.	Rajasthan	Tonk
Shri Vijaya Gimpex Mining Pvt. Ltd., Shriram Chamber Kamalapuri Colony , Phase III Hyderabad-500 073, Andhra Pradesh.	Andhra Pradesh	Mahaboob-Nagar
*Dolphin Feldspar Pvt. Ltd, Kot's court, 4 th Floor, 6-3-1239/2/A, Raj Bhawan Rd., Somajiguda, Hyderabad, Andhra Pradesh.	Andhra Pradesh	Mahaboob-Nagar
*Sandeep Kumar M/s Vishwa Karma Minerals, Chandwa, Dist. - Latehar, Jharkhand.	Jharkhand	Latehar
Mh. Mahmood Alam, At - Itkey, P.O.- Barikhap Dist. - Latehar Jharkhand.	Jharkhand	Latehar

(Conctd.)

Table - 4 (Concld.)

Name & address of producer	Location of mine	
	State	District
Dilipsingh P.Solanki, C/O Latesh H. Pandye, Pattha Talawadi, Near Hanuman Mandir , Godhra-389 001, Gujarat.	Gujarat	Pancha-Mahal
V. B. C. Woods Distillation Pvt. Ltd, III Floor, Progressive Towers Kheiratabad, Hyderabad- 500 004, Andhra Pradesh.	Andhra Pradesh	Medak
P. V. Ramana Reddy, Chella Chelimala, P.O.-Dhone Dist. - Kurnool Andhara Pradesh.	Andhra Pradesh	Kurnool
Anandraj Singh, (Raj Minerals) 8-4-316, Sanath Nagar, Hyderabad-500 018, Andhra Pradesh.	Andhra Pradesh	Medak
B. Sanjeeva Reddy, H.No. 6-200, Rly. Station Rd., Betamcherla-518 599 Dist. - Kurnool Andhra Pradesh.	Andhra Pradesh	Kurnool

** Associated mines with felspar.*

Table – 5 : Production of Quartz, 2008-09 to 2010-11 (By States)

(Qty in tonnes; value in ₹ '000)

State	2008-09		2009-10		2010-11(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**430734**	**75564**	**528066**	**95759**	**456829**	**82331**
Andhra Pradesh	139837	22138	182040	29642	197653	31873
Chhattisgarh	1846	258	384	54	655	92
Gujarat	77400	8031	85343	8764	36837	4782
Jharkhand	39434	5607	68331	13420	72413	7034
Karnataka	17500	1289	275	108	10	3
Madhya Pradesh	-	-	-	-	1889	155
Maharashtra	15989	3619	12650	2761	10144	2252
Odisha	1500	375	1570	257	-	-
Rajasthan	120512	23769	154698	29471	114703	22857
Tamil Nadu	10589	9324	6952	7898	7542	9898
West Bengal	6127	1154	15823	3384	14983	3385

Table – 6 : Production of Quartz, 2009-10 & 2010-11
(By Sectors/States/Districts)

(Qty in tonnes; value in ₹ '000)

State/District	2009-10			2010-11(P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India	**92(49)**	**528066**	**95759**	**87(46)**	**456829**	**82331**
Public sector	2	5191	6823	2(1)	9375	9439
Private sector	90(49)	522875	88936	85(45)	447454	72892
Andhra Pradesh	**26(11)**	**182040**	**29642**	**31(14)**	**197653**	**31873**
Anantapur	2	15	2	2	65	10
Khammam	1	451	68	2	48	7
Krishna	2	445	67	2	193	29
Kurnool	2	1695	236	4	25333	2661
Mahaboobnagar	7(5)	105218	17657	7(6)	103125	17117
Medak	4	40978	6259	4	27250	4689
Nalgonda	1	2600	481	1	2383	441
Nellore	3(6)	7146	1353	2(8)	17200	3320
Ranga Reddy	1	8	1	3	5134	810
Visakhapatnam	1	8579	1716	1	7199	1354
Vizianagaram	2	14905	1802	3	9723	1435
Chhattisgarh	**1**	**384**	**54**	**1**	**655**	**92**
Jashpur	1	384	54	1	655	92
Gujarat	**7**	**85343**	**8764**	**5**	**36837**	**4782**
Panchamahal	7	85343	8764	5	36837	4782
Jharkhand	**9(3)**	**68331**	**13420**	**9(3)**	**72413**	**7034**
Deoghar	1	1590	223	1	1925	221
Dumka	1	7527	941	1	5807	900
Hazaribagh	(1)	1174	229	(1)	785	124
Jamtara	(1)	5126	589	(1)	6370	764
Latehar	4(1)	18218	1944	4(1)	51793	4022
Ranchi	1	30	4	1	*	*
Saraikala-Kharsawan	1	20136	6947	1	*	*
Singhbhum (East)	1	14530	2543	1	5733	1003
Karnataka	**(1)**	**275**	**108**	**(1)**	**10**	**3**
Bengaluru	(1)	275	108	(1)	10	3
Madhya Pradesh	**-**	**-**	**-**	**2(1)**	**1889**	**155**
Balaghat	-	-	-	1(1)	1559	124
Chhatarpur	-	-	-	1	330	31

(Conctd.)

Table - 6 (Concld.)

State/District	2009-10			2010-11(P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
Maharashtra	**4**	**12650**	**2761**	**4**	**10144**	**2252**
Bhandara	3	12552	2749	3	10008	2233
Chandrapur	1	98	12	1	136	19
Odisha	**1(1)**	**1570**	**257**	-	-	-
Sundergarh	1(1)	1570	257	-	-	-
Rajasthan	**33(33)**	**154698**	**29471**	**22(26)**	**114703**	**22857**
Ajmer	8(9)	24823	4218	7(12)	18230	3476
Alwar	1	260	52	1	110	22
Bhilwara	3(19)	11055	1430	1(13)	4492	630
Chittorgarh	2	359	90	2	166	42
Rajsamand	4(5)	9962	1849	2(1)	2172	198
Sikar	4	4718	743	1	930	233
Sirohi	2	4090	614	2	1396	227
Jaipur	1	7853	1178	1	5545	832
Pali	1	350	140	-	-	-
Tonk	6	90213	18980	4	81662	17197
Udaipur	1	1015	177	1	*	*
Tamil Nadu	**8**	**6952**	**7898**	**10(1)**	**7542**	**9898**
Coimbatore	1	1092	218	-	-	-
Dharmapuri	1	230	173	-	-	-
Dindigul	2	632	568	3	141	39
Karur	1	1055	211	1	448	90
Madurai	2	469	301	2	2830	1615
Nammakal	1	3474	6427	1	3455	6981
Salem	-	-	-	3	*	*
Tiruvarur	-	-	-	(1)	668	1173
West Bengal	**3**	**15823**	**3384**	**3**	**14983**	**3385**
Bankura	1	13305	2795	1	8650	1687
Birbhum	1	1076	301	1	1091	417
Purulia	1	1442	288	1	5242	1281

Figures in parentheses indicate number of associated mines of quartz with felspar, mica, silica sand and asbestos.
** Reported labour and/or production of felspar.*

Table – 7 : Production of Quartz, 2009-10 & 2010-11(P)
(By Frequency Groups)

(Qty in tonnes)

Production group	No. of mines		Production for the group		Percentage in total production		Cumulative percentage	
	2009-10	2010-11	2009-10	2010-11	2009-10	2010-11	2009-10	2010-11
All Groups	**92 (49)**	**87 (46)**	**528066**	**456829**	**100.00**	**100.00**	-	-
Up to 500	34 (23)	40 (22)	9552	6426	1.81	1.41	1.81	1.41
501-1000	9 (10)	6 (7)	14220	9656	2.69	2.11	4.50	3.52
1001-5000	29 (12)	21(11)	85862	72480	16.26	15.86	20.76	19.38
5001-10000	10(2)	14(3)	93162	113549	17.64	24.86	38.40	44.24
10001 & above	10 (2)	6(3)	325270	254718	61.60	55.76	100.00	100.00

Figures in parentheses indicate number of associated mines of quartz, felspar, mica, silica sand and asbestos.

Table – 8 : Mine-head Stocks of Quartz 2010-11(P)
(By States)

(In tonnes)

State	At the beginning of the year	At the end of the year
India	**246785**	**335347**
Andhra Pradesh	146018	203375
Chhattisgarh	-	114
Gujarat	3948	3979
Jharkhand	2384	3584
Karnataka	11947	13812
Madhya Pradesh	170	9347
Maharashtra	5786	2629
Odisha	584	945
Rajasthan	75431	94660
Tamil Nadu	40	2605
West Bengal	477	297

SILICA SAND

The production of silica sand at 3.08 million tonnes in 2010-11 increased by about 21% over the previous year due to increase in demand from cement plants.Gujarat, the major producing state, reported increase of about 160% in comparison with the previous year.

During the year under review, there were 114 reporting mines as against 132 in the preceding year. Besides, the production of silica sand was also reported as an associated mineral by four mines during the year. Ten principal producers accounted for about 62% of the total production. The share of public sector in the total production was 4% in 2010-11, same as in the preceding year.

Gujarat was the leading producing state and accounted for 39% of the total production during the year, followed by Andhra Pradesh(37%), Maharashtra (9%), Rajasthan(6%), Uttar Pradesh (4%), Jharkhand (3%) and Karnataka (1%). The remaining one percent production was the contribution of Kerala and Tamil Nadu.

About 60% production of silica sand was contributed by 9 silica sand mines and one associated mine, each producing more than 50 thousand tonnes annually. About 37% was contributed by 50 silica sand mines and two associated mines, each producing five thousand to fifty thousand tonnes. The remaining 3% output was contributed by 55 silica sand mines and one associated mine, each producing less than 5,000 tonnes annually (Tables 9 to 12).

Mine-head stocks of silica sand at the end of 2010-11 were 4,996 thousand tonnes as against of 3,260 thousand tonnes at the beginning of the year (Table 13).

The average daily employment of labour in 2010-11 was 1,938 as against 2,392 in the previous year. Domestic prices of silica sand are furnished in the General Review on 'Prices'.

Table – 9 : Principal Producers of Silica Sand 2010-11

Name & address of producer	Location of mine	
	State	District
N. G. Mahida At & P.O. -Bhilod-393 135, Dist. Bharuch Gujarat.	Gujarat	Bharuch
Kumaraswamy Silica Mines, Momidi P.O., Chillakur - Mandal, Distt. Nellore, Andhra Pradesh.	Andhra Pradesh	Nellore
Sanghi Industries Ltd, Post - Sanghipuram Dist. Kachchh, Gujarat-370 511.	Gujarat	Kachchh
Bhavani Minerals At &P.O. - Bhilod-393 135 Tehsil - Valia, Dist. Bharuch, Gujarat.	Gujarat	Bharuch
D. Sundra Rami Reddy P.O.-Chinthavaram Dist. Nellore, Andhra Pradesh.	Andhra Pradesh	Nellore

(Conctd.)

Table - 9 (Concld.)

Name & address of producer	Location of mine	
	State	District
Bundi Silica Sand Supply Co. Kanhaiyalal Ghatiwala, Rishabh Bhavan, New Colony Gumanpura, Dist. Kota - 324 007, Rajasthan.	Rajasthan	Bundi
Nishita Mines & Minerals 6/160, East Street, Gudur, Dist. Nellore Andhra Pradesh	Andhra Pradesh	Nellore
Y. Janaki Rama Reddy Village and Post -Varagali Mandal:-Chillakur, Dist. Nellore, Andhra Pradesh.	Andhra Pradesh	Nellore
Mohd. Sher Khan Pathan S/o Gulbaz Khan Vill- Banesti P.O. - Sawa, Dist. Chittorgarh Rajasthan.	Rajasthan	Chittorgarh
Southern Silica Mines 7/105, Mitta Palem Street Gudur, Dist. Nellore, Andhra Pradesh.	Andhra Pradesh	Nellore

Table - 10 : Production of Silica Sand, 2008-09 to 2010-11 (By States)

(Qty in tonnes; value in ₹ '000)

State	2008-09		2009-10		2010-11(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**2836804**	**366083**	**2545988**	**408559**	**3081468**	**342351**
Andhra Pradesh	1251780	61684	958934	64205	1132270	61541
Gujarat	368720	32025	465530	40569	1210046	80626
Jharkhand	120170	38772	91597	32818	85236	29275
Karnataka	107266	12961	109468	15206	39272	4900
Kerala	46965	17112	33988	20220	14215	10993
Madhya Pradesh	40	5	-	-	-	-
Maharashtra	341866	92503	271517	90831	264191	69427
Odisha	7381	1845	2800	700	-	-
Rajasthan	398540	82051	418311	103878	194073	57274
Tamil Nadu	12009	3396	10476	5688	12526	5211
Uttar Pradesh	182067	23729	183367	34444	129639	23104

Table – 11 : Production of Silica Sand, 2009-10 and 2010-11
(By Sectors/States/Districts)

(Qty in tonnes; value in ₹ '000)

State/District	2009-10			2010-11(P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India	**132(4)**	**2545988**	**408559**	**114(4)**	**3081468**	**342351**
Public sector	5	106925	29883	7	129169	34316
Private sector	127(4)	2439063	378676	107(4)	2952299	308035
Andhra Pradesh	**50**	**958934**	**64205**	**42(1)**	**1132270**	**61541**
Kurnool	5	3477	673	3	2652	423
Nellore	44	948459	62972	39(1)	1129618	61118
Prakasam	1	6998	560	-	-	-
Gujarat	**14(1)**	**465530**	**40569**	**16(1)**	**1210046**	**80626**
Bharuch	9(1)	406026	36777	12(1)	992039	72393
Kachchh	1	29615	360	1	194677	5815
Sabarkantha	1	5651	1837	1	4095	1353
Surat	1	30	4	1	105	13
Surendranagar	2	24208	1591	1	19130	1052
Jharkhand	**1(1)**	**91597**	**32818**	**1(1)**	**85236**	**29275**
Sahibganj	1(1)	91597	32818	1(1)	85236	29275
Karnataka	**20**	**109468**	**15206**	**15**	**39272**	**4900**
Gulbarga	3	13250	1193	-	-	-
Haveri	4	24760	2823	4	3567	393
Udupi	8	44540	8778	7	18250	2792
Uttar Kannad	5	26918	2412	4	17455	1715
Kerala	**7**	**33988**	**20220**	**6**	**14215**	**10993**
Alappuzha	7	33988	20220	6	14215	10993
Maharashtra	**15**	**271517**	**90831**	**13**	**264191**	**69427**
Ratnagiri	6	11791	3479	5	27196	5823
Sindhudurg	9	259726	87352	8	236995	63604
Odisha	**1**	**2800**	**700**	**-**	**-**	**-**
Sundergarh	1	2800	700	-	-	-
Rajasthan	**9(2)**	**418311**	**103878**	**7(1)**	**194073**	**57274**
Alwar	1	6088	974	1	6023	829
Bharatpur	4	108025	16478	2	4960	843
Bundi	1	79977	39909	1	99235	34732
Chittorgarh	1(1)	139591	36852	1(1)	76220	18960
Dausa	1	17764	3535	-	-	-
Bikaner	(1)	4030	790	-	-	-
Sikar	1	62836	5340	-	-	-
Karauli	-	-	-	1	2645	662
Sawai Madhopur	-	-	-	1	4990	1248
Tamil Nadu	**4**	**10476**	**5688**	**6**	**12526**	**5211**
Kanchipuram	2	3254	3351	3	3459	3253
Villupuram	2	7222	2337	3	9067	1958
Uttar Pradesh	**11**	**183367**	**34444**	**8**	**129639**	**23104**
Allahabad	9	177266	33278	6	122390	22260
Chitrakut	2	6101	1166	2	7249	844

Figures in parentheses indicate number of associated mines with agate, kaolin & quartz.

Table – 12 : Production of Silica Sand, 2009-10 & 2010-11 (P)
(By Frequency Groups)

(Qty in tonnes)

Production group	No. of mines		Production for the group		Percentage in total production		Cumulative percentage	
	2009-10	2010-11	2009-10	2010-11	2009-10	2010-11	2009-10	2010-11
All Groups	**132(4)**	**114(4)**	**2545988**	**3081468**	**100.00**	**100.00**	-	-
Up to 500	9	18(1)	2165	3223	0.09	0.11	0.09	0.11
501 to 1000	5	6	3743	4826	0.15	0.16	0.24	0.27
1001 to 3000	26	21	53511	38511	2.10	1.25	2.34	1.52
3001 to 5000	18(1)	10	71732	40712	2.82	1.32	5.16	2.84
5001 to 10000	32(1)	14	234386	95634	9.20	3.10	14.36	5.94
10001 to 15000	9	5	110051	61185	4.32	1.99	18.68	7.93
15001 to 25000	12	11	234753	200972	9.22	6.52	27.90	14.45
25001 to 50000	9	20(2)	324262	777906	12.74	25.24	40.64	39.69
50001 and Above	12(2)	9(1)	1511385	1858499	59.36	60.31	100 .00	100.00

Table – 13 : Mine-head Stocks of Silica Sand 2010-11 (P)
(By States)

(In tonnes)

State	At the beginning of the year	At the end of the year
India	**3260050**	**4995834**
Andhra Pradesh	2284966	2245585
Gujarat	358318	2202484
Jharkhand	17993	22777
Karnataka	64343	59044
Kerala	27365	9744
Maharashtra	242234	187495
Odisha	570	570
Rajasthan	185882	184006
Tamil Nadu	158	46
Uttar Pradesh	78221	84083

QUARTZITE

Production of quartzite at 118 thousand tonnes in 2010-11 increased by 5% as compared to that in the previous year .

There were 12 reporting mines during the year and 14 in the previous year. Besides, production of quartzite was reported by one associated mine in the current year and 4 associated mines in the preceding year. During 2010-11, five principal producers accounted for about 84% production. Entire output of quartzite was reported from mines operated in the private sector.

Bihar was the leading producing state in 2010-11 contributing about 54% production, followed by Jharkhand (21%), Karnataka (9%), AndhraPradesh (6%), Odisha & Rajasthan (4% each) and Maharashtra (2%) (Tables-14 to 16).

Mine-head stocks of quartzite at the end of the year 2010-11 were 24 thousand tonnes as against 38 thousand tonnes at the beginning of the year. (Table-17).

The average daily employment of labour during the year under review was 183 as against 285 in 2009-10. Domestic prices of quartzite are furnished in the General Review on Prices'.

Table – 14: Principal Producers of Quartzite, 2010-11

Name & address of producer	Location of mine	
	State	District
Khalsa Stone Works, Albert Road, Jamalpur, Munger, Bihar.	Bihar	Munger
Bharat Mining Company, Post - Sunder Nagar, Dist. Singhbhum East Jharkhand.	Jharkhand	Singhbhum- East
Janardan Singh At:-Shitalpur, P.O. -Dariyapur, Dist. Munger, Bihar.	Bihar	Munger
Shivanandi.Mamadapur Vill. -Saundatti, Ditt. Belgaum, Karnataka-591 126.	Karnataka	Belgaum
Sunrise Stone Works At - Sujawalpur, P.O. - Shankarpur Dist. Munger, Bihar.	Bihar	Munger

Table – 15 : Production of Quartzite, 2008-09 to 2010-11 (By States)

(Qty in tonnes; value in ₹ '000)

State	2008-09		2009-10		2010-11(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**97458**	**31459**	**112652**	**37377**	**118179**	**35422**
Andhra Pradesh	595	89	122	18	7717	4309
Bihar	33760	13027	56394	20855	63350	19785
Chhattisgarh	50	8	50	8	-	-
Jharkhand	2014	201	10737	2147	24658	5242
Karnataka	5500	1513	7437	2054	11200	2667
Maharashtra	1054	264	2481	620	2455	614
Odisha	47451	13149	29886	11093	4608	2354
Rajasthan	7034	3208	5545	582	4191	451

Table – 16 : Production of Quartzite, 2009-10 & 2010-11 (By Sectors/States/Districts)

(Qty in tonnes; value in ₹ '000)

State/District	2009-10			2010-11(P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India	**14(4)**	**112652**	**37377**	**12(1)**	**118179**	**35422**
Private sector	14(4)	112652	37377	12(1)	118179	35422
Andhra Pradesh	**2**	**122**	**18**	**4**	**7717**	**4309**
Cuddaph	2	122	18	2	83	12
Srikakulam	-	-	-	1	2218	1318
Vizianagaram	-	-	-	1	5416	2979
Bihar	**3**	**56394**	**20855**	**3**	**63350**	**19785**
Munger	3	56394	20855	3	63350	19785
Chhattisgarh	**1**	**50**	**8**	-	-	-
Rajnandgaon	1	50	8	-	-	-
Jharkhand	**1**	**10737**	**2147**	**1**	**24658**	**5242**
Singhbhum (East)	1	10737	2147	1	24658	5242
Karnataka	**2**	**7437**	**2054**	**1**	**11200**	**2667**
Belgaum	2	7437	2054	1	11200	2667
Maharashtra	**(1)**	**2481**	**620**	**(1)**	**2455**	**614**
Bhandara	(1)	2481	620	(1)	2455	614
Odisha	**4(3)**	**29886**	**11093**	**2**	**4608**	**2354**
Jharsuguda	2	23692	9965	1	4590	2352
Keonjhar	(2)	1336	200	-	-	-
Mayurbhanj	1	2581	253	1	18	2
Sonepur	1	477	63	-	-	-
Sundergarh	(1)	1800	612	-	-	-
Rajasthan	**1**	**5545**	**582**	**1**	**4191**	**451**
Sawai Madhopur	1	5545	582	1	4191	451

Figures in parentheses indicate associated mines of pyrophyllite and quartz.

Table – 17: Mine-head Stocks of Quartzite 2010-11 (P) (By States)

(In tonnes)

State	At the beginning of the year	At the end of the year
India	**38342**	**23697**
Andhra Pradesh	4372	10189
Bihar	9325	4239
Chhattisgarh	555	-
Jharkhand	1918	1822
Karnataka	1687	2100
Maharashtra	490	199
Odisha	19995	5148
Rajasthan	5712	4478

SAND (OTHERS)

The production of sand (others) at 1.92 million tonnes in 2010-11decreased by 11% as compared to that in the previous year due to lower demand.

There were thirteen reporting mines in 2010-11 as against twelve in the previous year. The Singareni Collieries Co. Ltd, having ten mines in Andhra Pradesh contributed 87% production of sand (others). Twelve percent production was from three mines of Western Coalfields Ltd located in Chandrapur district of Maharashtra. The remaining one percent was reported as an associated mineral by a private sector limestone mine located in Jaintia Hills district of Meghalaya (Tables - 18 to 20).

All mines were captive in nature and contract labour was employed by the producers.

Mine-head stocks at the end of 2010-11 was 263 thousand tonnes as against 318 thousand tonnes at the beginning of the year (Table - 21).

Table – 18 : Producers of Sand (Others), 2010-11

Name & address of producer	Location of mine	
	State	District
Singareni Collieries Co.Ltd, P.O. Kothagudam Collieries, Bhadrachalam Road,Station, S. C. Railway, Dist.- Khammam-507 101, Andhra Pradesh.	Andhra Pradesh	Adilabad Karimnagar
Western Coalfields Ltd, Sasti Colliery, P.O. - Sasti, Dist. Chandrapur, Maharashtra.	Maharashtra	Chandrapur
Cement Manufacturing Company Ltd, Lumshnong, P.O. - Khliehriat, Dist-Jaintia Hills, Meghalaya-793 200.	Meghalaya	Jaintia Hills

Table –19 : Production of Sand (Others), 2008-09 to 2010-11 ((By States)

(Qty in tonnes; value in ₹ '000)

State	2008-09		2009-10		2010-11(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**1808185**	**106971**	**2159405**	**101399**	**1916366**	**103969**
Andhra Pradesh	1338315	55406	1763495	75083	1673137	90600
Maharashtra	469870	51565	395910	26316	233009	11734
Meghalaya	-	-	-	-	10220	1635

Table – 20 : Production of Sand (Others), 2009-10 & 2010-11 (By Sectors/States/Districts)

(Qty in tonnes; value in ₹ '000)

State/District	2009-10			2010-11(P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India	**12**	**2159405**	**101399**	**13(1)**	**1916366**	**103969**
Public sector	12	2159405	101399	13	1906146	102334
Private sector	-	-	-	(1)	10220	1635
Andhra Pradesh	**10**	**1763495**	**75083**	**10**	**1673137**	**90600**
Adilabad	4	616903	28609	4	736668	45855
Karimnagar	5	1135693	45928	6	936469	44745
Vijaynagaram	1	10899	546	-	-	-
Maharashtra	**2**	**395910**	**26316**	**3**	**233009**	**11734**
Chandrapur	2	395910	26316	3	233009	11734
Meghalaya	-	-	-	**(1)**	**10220**	**1635**
Jaintia Hills	-	-	-	(1)	10220	1635

Table – 21: Mine-head Stocks of Sand (Others), 2010-11 (P)
(By States)

(In tonnes)

State	At the beginning of the year	At the end of the year
India	**317948**	**262849**
Andhra Pradesh	199320	168300
Maharashtra	118628	94549

AGATE

The production of agate was 19 tonnes in 2010-11 as compared to 11 tonnes during the preceding year. There was only a single private sector mine of agate which was situated in Bharuch district of Gujarat (Tables - 22 to 24).

Mine-head stocks of agate at the end of 2010-11 was 25 tonnes as against 57 tonnes at the beginning of the year (Table -25).

The average daily employment of labour was 11 in 2010-11 as against 3 in the previous year.

Table – 22 : Producer of Agate 2010-11

Name & address of producer	Location of mine	
	State	District
Almiya I. Saiyad, 16, Vyapar Bhawan, Himmatnagar, Gujarat.	Gujarat	Bharuch

Table – 23 : Production of Agate, 2008-09 to 2010-11
((By States)

(Qty in tonnes; value in ₹ '000)

State	2008-09		2009-10		2010-11(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**-**	**-**	**11**	**6**	**19**	**10**
Gujarat	-	-	11	6	19	10

Table – 24 : Production of Agate, 2009-10 & 2010-11
(By Sectors/States/Districts)

(Qty in tonnes; value in ₹ '000)

State/District	2009-10			2010-11(P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India	**1**	**11**	**6**	**1**	**19**	**10**
Private sector	1	11	6	1	19	10
Gujarat	**1**	**11**	**6**	**1**	**19**	**10**
Bharuch	1	11	6	1	19	10

Table – 25 : Mine-head Stocks of Agate, 2010-11 (P)
(By States)

(In tonnes)

State	At the beginning of the year	At the end of the year
India	**57**	**25**
Gujarat	57	25

JASPER

No production of jasper was reported during 2009-10 and 2010-11. The only mine which reported production in 2008-09, wound up its operation due to lack of demand (Table - 26).

Table –26 : Production of Jasper, 2008-09 to 2010-11
((By States)

(Qty in tonnes; value in '000)

State	2008-09		2009-10		2010-11(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**99**	**51**	-	-	-	-
Rajasthan	99	51	-	-	-	-

MINING

Mining for silica minerals is carried out by manual opencast method. Quartz produced in the form of lump along with other associated minerals is invariably hammered to pieces and manually sorted before it is despatched to the consuming industries. It is sometimes crushed and marketed. Glass sand is generally screened and washed to remove all the deleterious constituents for its use in glass industry.

APMDC owns two crushing plants located at Mahaboobnagar district in Andhra Pradesh with crushing capacity of 45 tonnes and 1,000 tonnes a month, respectively. Besides, Maharashtra Minerals Corp. Ltd has a 50,000-tonnes per year beneficiation plant at Phondaghat in Sindhudurg district. The plant has advanced technology in washing both by water and chemicals and further grading it in required fractions.

HEALTH HAZARDS

Respirable silica is still a cause of major concern to miners and consumers since many minerals especially, industrial sand and gravel contain crystalline silica, There is a potential threat of workers getting subjected to "silicosis" in quartz, silica sand and gravel mines Occupational safety measures & regulations to monitor the levels of crystalline silica in these mines are mandatory. In the USA, the Occupational Safety and Health Administration (OSHA) listed "crystalline silica" as one of their top five priorities for formulation of necessary rules. The OSHA, on the basis of significant information put out by International Agency for Research on Evaluation of Cancer, has declared that any material containing more than 0.1% crystalline silica should indicate its carcinogenic hazard.

USES

Quartz, quartzite and silica sand are used in various industries like glass, refractory, foundry, ceramic, cosmetic, electrical, abrasives, paints, etc. The primary use of silica is in the manufacture of virtually all types of glasswares, ceramics and ceramic glazes. Other major uses are in metallurgy, (where silica is used as a refractory, foundry mould, fluxes and as a source of silicon for the production of silicon metal and ferro-silicon and other ferro-alloys), silicon carbide manufacture, chemical & construction sectors and as a natural abrasive. Known for its piezoelectric properties, high quality quartz crystal is used in electronic devices, multiple telephone lines, depth-sounding devices, range finders, chronometers, etc.

Sand is also used as a fireproofing material, for sandstowing in mines, soundproofing material and as a filler. Silica sand is also used to maintain or increase the permeability of oil and gas-bearing formations; its application as a filler in acid proof cements, putty, paints, epoxy & polyester resins is inevitable. Besides, it is widely used in horticulture, as a filtration medium, and for ornamental purposes as well. Silica flour is used as a filler in plastic and rubber products.

Flint and chert are used in abrasives and tube-mill lining. Besides, chert is used in crushed form as aggregate for concrete and road surfacing. Rounded pebbles of chalcedony are used as balls in ball mill for finer crushing and grinding felspar, calcite and barytes. The different cryptocrystalline varieties of transparent and translucent chalcedony are valued as semiprecious stones and are carved out into a variety of ornaments and used for making different ornamental wares or articles of decoration. Agate pieces after cutting and polishing are sold as semiprecious stones. Big pieces are used in making mortars and pestles for laboratory use. Agate cut into requisite shapes is also used as fulcra of scientific balances and in making edges, planes and bearings of precision instruments.

INDUSTRY & SPECIFICATIONS

In India, quartz, quartzite and silica sand are used mainly in glass, foundry, ferro-alloys and refractory industries and also as building materials. According to its suitability for different purposes, it may be named as building sand, paving sand, moulding or foundry sand, refractory sand or furnace sand, filter sand, glass sand and grinding & polishing sand.

Glass

Main use of silica minerals is in the manufacture of different types of glasses, i.e. glass containers, bottles, amber glass containers, clear flint glass, vacuum bottles and other glasswares. It is reported that a large fraction of the requirement of flat glass, container glass, glass fibre and glass tablewares is being produced by about 100 large- scale producers Most of them are located in Gujarat,Mumbai, Kolkata, Bengaluru and Hyderabad. There are more than 600 medium and small cottage-scale industries. The production during 2009-10 and 2010-11 of bottle glassware was 896,636 tonnes and 795,881 tonnes(up to Dec. 2010), respectively.

The natural silica sand is the preferred material in glass industry, but in some cases where the glass plants are located far away from silica deposits, crushed quartz is also used. For use in glass industry, the silica sand must be uniform in chemical composition, size and shape of grains. Uniform grain size promotes even melting in the glass tank. The sand should not be coarser than 20 or 30 mesh and finer than 100 to 120 mesh. As a general rule, the grains should be angular rather than rounded, because angular grains melt more readily than the rounded ones.

For glass manufacturing, the silica sand should be fairly free from contaminations of clay materials, pebbles, etc. Silica sand usually contains iron oxide, calcium oxide, potassium oxide and sodium oxide in small amounts. Iron is the most objectionable impurity because it imparts colouration to the glass. The common permissible limits of iron oxide in silica sand for use in the manufacture of different types of glass are as follows:

Glass type	Fe_2O_3 %
Optical glass	0.005-0.008
Flint or soda-lime glass	0.02-0.05
Plate glass	0.1-0.2
White bottles or window glass	0.2-0.5
Dark bottle glass	0.5-0.7

BIS has laid down specifications for glass making sands vide IS:488-1980(Second Revision, Reaffrimed 2008).

Chromium compounds, alumina, lime and magnesia are the other deleterious impurities. Chromium compounds are undesirable because these compounds impart more colouration to the glass than iron. Alumina tends to decrease transparency and makes the batch more difficult to melt. The maximum quantity of alumina permissible in sand is 1.5 percent. The maximum permissible limit for lime and magnesia is about 0.05% and for alkalies it is 0.01% or less.

Ceramic

The Ceramic Industry in India ranks fifth in the world in terms of production of ceramic tiles. Ceramic industry comprises ceramic tiles, sanitaryware and crockeryware items. These products are manufactured both in large- and small- scale sectors. In organised sector, there were 16 units for ceramic tiles with an installed capacity of 2.1 million tonnes per year, 16 units for potteryware with 43,000 tpy installed capacity and 7 units for sanitaryware with 1,43,000 tpy capacity in the country (Table - 27).

Table – 27 : Ceramic Industry

Industry	Unit	2009-10		2010-11(e)	
		No. of Units	Production	No. of Units	Production
Ceramic Tiles	million sq m	16 + 200 SSI Units	340.00	16 +200 SSI Units	391.00
Potteryware	tonnes	16 + 1200 SSI Units	72956	16 + 1400 SSI Units	80000
Sanitaryware	tonnes	7 + 210 SSI Units	431475	7 + 200 SSI Units	480000

Source: *Ministry of Commerce & Industry, Department of Industrial Policy & Promotion, Annual Report, 2010-11.*

In the small-scale sector, there were over 210 units of sanitaryware with capacity of 53,000 tpy and over 1400 plants of potteryware with a capacity of 3 lakh tpy.

Ceramic whiteware contains about 40% silica, besides other constituents except for bone china in which it is not used at all. The silica serves to provide whiteness, renders the ceramic body to dry easily and provides compatability between the body and the glass to prevent crazing or peeling. Main source of silica for this application is silica sand. In addition, silica flour is used in formulation of ceramic body for enamels and frits. Silica flour produced by fine grinding of quartzite, sandstone or lump quartz is used in enamels. The silica flour normally contains more than 97.5% SiO_2, less than 0.55% Al_2O_3 and less than 0.2% Fe_2O_3. Purity and small particle size (BS mesh-200) are fundamentally important for silica in manufacture of ceramics. BIS has prescribed the specifications of quartz for ceramic industry vide IS: 11464-2011 (First Revision).

Foundry

The Indian foundry industry is the largest in the world. This industry is well established in the country and is spread across a wide spectrum consisting of large, medium, small and tiny sector. A special feature of domestic foundry industry is its geographical clustering i.e. Coimbatore cluster is famous for pump sets castings, Kolhapur and Belgaum cluster for automotive castings, Rajkot cluster for diesel engine castings and Batala and Jalandhar cluster for machinery parts and agriculture implements.

A large number of foundries in both ferrous and non-ferrous sectors are functioning in the organised sector in the country. Most of the foundry units use moulding sand having 40 to 65 A.F.S. (American Foundrymen's Society) numbers.

Silica sand is used in both foundry cores and moulds because of its resistance to thermal shock. Silica content of 85% is used in iron casting. In steel foundries, silica content should be at least 95%. BIS has laid down specifications of high silica sand for use in foundries vide IS: 1987-2002 (Second Revision, Reaffirmed 2007).

Natural moulding sand contains variable amount of clay which acts as a bond between the sand grains. These sands, therefore, possess strength, plasticity and refractoriness to varying extent depending upon the clay minerals present. When it contains more clay, it is blended with river sand, which is relatively clay-free so as to get the optimum properties desired in the sand mixture.

Washed grains shall be mostly sub-angular to rounded shape. As far as possible, the sand shall be free from gravel. As per IS:3343-1965 (Reaffrimed 2008), natural moulding sand for use in foundries shall be of three main grades, namely, A, B and C with respect to clay content.

Grade	Clay (%)
A	5 to 10
B	10 to 15
C	15 to 20

Refractoriness of the natural moulding sand based on sintering temperature range should be as follows:

Grade A - 1350 to 1450 ^{o}C

Grade B - 1200 to 1350 ^{o}C

Grade C - 1100 to 1200 ^{o}C

Washed sand grains are required to be sub-angular to rounded shape.

Silica flour is particularly used in the steel foundry in dressing for moulds and cores and also as essential ingredient in the moulding sand mixtures. It is also used to obtain elevated temperature strength, high density and resistance to metal penetration in cores. Silica flour is produced by crushing, washing and grading high- grade quartz/quartzite rocks or white silica sand or other deposits sufficiently pure to get the desired material.BIS has laid down specifications of silica flour for use in foundries vide IS: 3339-1975(Reaffirmed 2008).

Refractory

Quartz and quartzite are used in the manufacture of refractory silica bricks. However, recently these bricks are being replaced by basic linings of magnesite, dolomite or natural types such as bauxite, etc. in LD basic oxygen and electric furnaces. Silica reacts readily with basic slag and is therefore unsuitable in the basic steel making process. Nevertheless, silica bricks continue to be used in coke ovens, ceramic kilns, glass tank crowns and as blast furnace chequers in some steel mills. Silica bricks have excellent load resistance capacity at high temperature. For the manufacture of refractory bricks, silica mineral should be free from aluminosilicates (felspar, mica, etc.), as aluminosilicates adversely affect refractoriness of the bricks. Silica rock (raw material) should be hard, having high bulk density and low porosity.

Fluxes

Massive quartz, quartzite, sandstone and unconsolidated sands are the main sources of silica that get used as flux in smelting base metal ores where iron and basic oxides are slagged as silicates. Silica is also used to balance the lime and silica ratio of the blast furnace mix. The silica content for this purpose must be as high as 90% with minor amounts of impurities like iron and alumina up to 1.5% maximum. BIS has laid down IS: 13676-1993(Reaffirmed 2008) for quartzite for iron making in blast furnance.

Ferro-silicon and Other Alloys

Ferro-silicon contains about 75-90% silicon and minor amounts of iron, carbon, etc. It is estimated that for the manufacture of one tonne ferro-silicon of 70-75% grade, about 1.78 tonnes quartz is required besides other raw materials like coke, iron scrap, etc. Quartz is the major source of silica in the manufacture of ferro-silicon. Occasionally, quartzite is also used. However, use of quartzite is restricted as it contains higher alumina and iron and more likely that it would break down in the furnace. Lump silica in the size range from 3/4 to 5 inches are generally preferred. Ferro-silicon is produced by smelting a mixture of quartz, metallic iron (steel scrap and turnings) and a reducing agent like coke, charcoal or wood chips.

Quartz suitable for ferro-silicon production should have more than 98% SiO_2, less than 0.4% Al_2O_3 and not more than 0.2% each of Fe_2O_3, CaO and MgO. Phosphorus or arsenic should not be present in quartz. If Al_2O_3 is more than the prescribed limit, it affects reduction in the electric furnace. Alkali has a tendency to promote a sticky slag which contaminates the products. If higher iron (more than 0.3%) is present in quartz, the fusion in the furnace takes place at lower temperature and affects reduction process. Another important factor is that quartz should have good thermal stability at 1200 ^{o}C or more. BIS has laid down IS: 13054-1991(Reaffirmed 2008) for use of quartz/ quartzite for production of ferro-alloys.

As per Indian Ferro Alloys Producers' Association, 35 units having a capacity of 205,750 tpy were established for the production of ferro-silicon. However, presently only 20 units are in operation with a total capacity of 145 thousand tpy. The production of ferro-silicon was estimated at around 117 thousand tonnes in 2010-11 List of principal producers of ferro-silicon is furnished in Table - 28.

Table – 28 : Principal Producers of Ferro-silicon

Name of the plant	Installed capacity (tpy)
Ferro Alloys Corp. Ltd, (Ferro Alloys Division), Vizianagaram, Andhra Pradesh.	72500 (Total)
Navbharat Ferro-alloys Ltd, Paloncha, Dist. Khammam, Andhra Pradesh.	9300
VBC Ferro Alloys Ltd, Medak, Andhra Pradesh.	19000
GMR Technologies & Ind. Ltd, Ravivalasa, Dist. Srikakulam, Andhra Pradesh.	25000 (Total)
Akshay Ispat & Ferro Alloys Ltd, Namchi Distt., South Sikkim, Sikkim.	6000
Hindustan Malleables & Forgings Ltd, Dhanbad, Jharkhand.	1800
Anjaney Ferro-alloys Ltd, Mihijam, Dist. Dumka, Jharkhand.	NA

(Contd.)

(Table -28 Concld.)

Name of the plant	Installed capacity (tpy)
Sandur Manganese & Iron Ore Ltd, Vyasankere, Bellary, Karnataka. (closed)	24000
Sri Laxmi Electro Smelters (Pvt.) Ltd, Erumathala, Aluva, Kerala.	NA
Indsil Electrosmelts Ltd, Pallabhari, Dist. Pallakad, Kerala.	NA
Indian Metals & Ferro Alloys Ltd, Therubali, Dist. Cuttack, Odisha.	53000
The Silical Metallurgic Ltd, Puducherry.	10560
Snam Alloys Ltd, Village Kariamanickam, Puducherry.	12000
V.S.K. Ferro-alloys Ltd, Thuthipet, Puducherry.	3000
Hindustan ferro-Alloys, Hamirpur, Uttar Pradesh.	3200

Silico-manganese, a combination of 60-70% manganese, 10-20% silicon and 20% carbon, substitutes low carbon ferro-manganese in steel industry. The production of silico-manganese including medium and low carbon silico-manganese was estimated at 1,299 thousand tonnes in 2010-11. The details of silicon ferro-alloys are also discussed in the review on 'Ferro-Alloys'.

Silicon Metal

A high purity quartz containing about 99.80% SiO_2, without any other contaminant, is used in the production of silicon metal. The production of silicon metal is similar to that for ferro-silicon except that no iron is added. The alumina and iron contents are specified to be below 0.1% each with calcium and phosphorus contents each restricted to 0.005 percent. For production of one tonne of silicon metal, about 2.6 tonnes silica is consumed. Specifications of silica minerals to be used in different industries are given in Table - 29.

Table – 29 : BIS Specifications of Silica Minerals for various Industries

Industry	Mineral consumed	BIS No.	Physical specifications	Grade	Chemical Specifications SiO_2 (%)	Al_2O_3 (%)	Fe_2O_3 (%)	CaO (%)	MgO (%)	TiO_2 (%)	P (%)	Remarks
Glass	Silica sand	IS: 488 1980 (Second Revision; Reaffirmed 2008)	–	Special Gr.	99	0.020 (min)	–	–	–	0.10		For manufacturing high-grade colourless glass, viz, crystal glass, tableware and decoratedware.
				Gr. I	98.0 (min)	0.04 (max)	–	–	–	0.10 (max)	–	For manufacturing decolourised glassware, viz, containerware, lampware, etc.
				Gr. II	97.5 (min)	0.07 (max)	–	–	–	0.10 (max)	–	For manufacturing glassware where slight tint is permissible.
				Gr. III	97% (max)	0.2 (max)	–	–	–	–	–	For manufacturing of decolourised and some coloured glasses.
Foundry	Silica flour	IS:3339 1975 (First Revision; Reaffirmed 2008)	–	–	98.0 (min)	–	–	–	–	–	–	100% silica flour should pass through 150-micron I.S. sieve and atleast 95% through 75-micron sieve. The fusion temperature should be >1700 °C.
Iron (BF)	Quartzite	IS:13676 -1993 (Reaffirmed 2008)	Lumpy, Hard, Non-friable of size -150 to +10 mm	–	96-98	2-4	–	–	–	–	–	After prescribed thermal stability test on -25+19 mm material, +19 mm fraction should be more than 55% and -5 mm fraction should be less than 5%.

(Contd.)

(Table -29 Concld.)

Industry	Mineral consumed	BIS No.	Physical specifications	Grade	Chemical Specifications SiO$_2$ (%)	Al$_2$O$_3$ (%)	Fe$_2$O$_3$ (%)	CaO (%)	MgO (%)	TiO$_2$ (%)	P (%)	Remarks
	Banded Hematite Quartzite	-do-	-do-	–	48-50	1.0 (max)	50-52 (Fe)	–	–	–	–	After prescribed tumbling test on +5 mm material, +5 mm fraction should be more than 90%.

Note: *In addition, BIS has prescribed following specifications: - silica for paint industry (IS : 67 - 1998; Second Revision; Reaffirmed 2002), High-silica sand for use in foundries (IS : 1987-2002; Second Revision), Quartz & quartzite for production of ferro-alloys (IS : 13054-1991; Reaffirmed 2003).*

CONSUMPTION

The consumption of quartz and silica sand was estimated at 1.45 million tonnes in 2010-11. Major consuming industries were glass (36%), cement (19%), ferro-alloys (17%), foundry (9%), fertilizer (7%). and ceramic(6%). Other industries such as iron & steel, alloy steel, insecticide, refractory, abrasive, etc. consumed the remaining 6%.

The consumption of quartzite was estimated around 273 thousand tonnes out of which iron and steel industry consumed about 63%, followed by ferro-alloys (18%), refractory (17%) and cement (2%).

The estimated consumption of moulding sand in 2010-11 was 64,800 tonnes. Major consuming industries were foundry (64%), followed by iron & steel (29%) and mining machinery (6%).

The total ferro-silicon consumed by various industries in 2010-11 was estimated at 42,900 tonnes. Major consuming industries were iron & steel (85%), alloy steel (10%) and foundry (5%). Besides, reported consumption of ferro-silico-magnesium was 13 tonnes in foundry industry in 2010-11.Estimated consumption of ferro-chrome-silicon was 460 tonnes in alloy steel industry (Tables - 30 to 35).

POLICY

Foreign Trade Policy (FTP) for 2009-2014 and the amended Export and Import Policy incorporated in the FTP freely allows the import of quartz and quartzite lumps and powder as also silica sand and quartz sands under headings 2505 and 2506. However, the exports of silica sands and quartz sands under heading 2505 are restricted and permitted under licence. The export of river sand to Maldives is permitted, subject to 'No Objection Certificate' by CAPEXCIL within the annual ceiling of 1,185,455 tonnes for 2011-12.

SUBSTITUTION

In order to reduce the potential threat of "silicosis," a variety of materials are used as substitutes for silica. Basic and neutral refractories (including magnesite, mag-chrome, dolomite and high alumina bricks) have replaced silica in a large number of applications. Chromite, olivine and zircon are alternatives to foundry sands. Garnet and to a lesser extent, olivine are used in sand blasting to avoid the risk of silicosis. Wollastonite is more favoured than free silicon for use in the ceramic industry, again due to the risk of silicosis. In electronic industry, replacement of natural quartz crystal by cultured quartz crystal is increasing steadily.

Table – 30 : Reported Consumption of Quartz/Silica Sand, 2008-09 to 2010-11 (By Industries)

(In tonnes)

Industry	2008-09	2009-10(R)	2010-11(P)
All Industries	**1457600**	**1451500**	**1453100**
Alloy steel	14500(10)	14500(10)	14500(10)
Cement	280500(14)	278100(14)	271100(14)
Ceramic	71500(38)	76300(38)	86800(38)
Ferro-alloys	218400(33)	208300(35)	244200(36)
Fertilizer	105800(4)	105800(4)	105800(4)
Foundry	129900(32)	136400(33)	138100(33)
Glass	574900(52)	569900(52)	529900(52)
Iron & steel	13500(1)	13500(1)	13500(1)
Others (Abrasive, asbestos, chemical, dry cell battery, electrical, paint, pesticide, refracatory and rubber)	48600 (75)	48700(75)	49200(77)

Figures rounded off. Data collected on non-statutory basis.
Figures in parentheses denote the number of units in organised sector reporting consumption.*
*(*Includes actual reported consumption and/or estimates made wherever required).*

Table – 31: Reported Consumption of Quartzite, 2008-09 to 2010-11 (By Industries)

(In tonnes)

Industry	2008-09	2009-10 (R)	2010-11(P)
All Industries	**273600**	**278600**	**273400**
Cement	17600(2)	1100(2)	5400(2)
Ferro-alloys	50300(11)	45300(12)	48000(12)
Foundry	800(4)	800(4)	800(4)
Iron & steel	148600(20)	173700(22)	171400(22)
Pelletisation (Iron & steel)	2400(1)	2400(1)	2400(1)
Refractory	53800(13)	55200(13)	45300(13)
Sponge iron	100(1)	100(1)	100(1)

Figures rounded off. Data collected on non-statutory basis.
Figures in parentheses denote the number of units in organised sector reporting consumption.*
*(*Includes actual reported consumption and/or estimates made wherever required).*

Table – 32 : Reported Consumption of Moulding Sand, 2008-09 to 2010-11 (By Industries)

(In tonnes)

Industry	2008-09	2009-10(R)	2010-11(P)
All Industries	**59900**	**66000**	**64800**
Foundry	54300(15)	41700(14)	41700(14)
Iron & steel	1400(4)	20100(6)	18900(6)
Mining machinery	4100(3)	4100(3)	4100(3)
Others (Sugar & textile)	100(7)	100(7)	100(7)

Figures rounded off. Data collected on non-statutory basis.
Figures in parentheses denote the number of units in the organised sector reporting consumption.*
(includes reported companies and/or estimates, whenever required).*

Table – 33 : Reported Consumption of Ferro-Silicon, 2008-09 to 2010-11 (By Industries)

(In tonnes)

Industry	2008-09	2009-10 (R)	2010-11 (P)
All Industries	**42200**	**41900**	**42900**
Alloy steel	4000(7)	4100(7)	4100(7)
Electrode	++(2)	++(2)	++(2)
Ferro-alloys	-	++(1)	++(1)
Foundry	2100(20)	2200(21)	2200(21)
Iron & steel	36100 (17)	35600(20)	36600(20)

Figures rounded off. Data collected on non-statutory basis.Figures in parentheses denote the no of units in organised sector reporting consumption.*
*(*Includes actual reported consumption and/or estimates made wherever required).*

Table – 34 : Reported Consumption of Ferro-Silicon-Magnesium, 2008-09 to 2010-11 (By Industries)

(In tonnes)

Industry	2008-09	2009-10 (R)	2010-11 (P)
All Industries	**13**	**13**	**13**
Foundry	13 (2)	13 (2)	13 (2)

Figures rounded off. Data collected on non-statutory basis. Figures in parenthesis denote the number of units in organised sector reporting consumption.*
*(*Includes actual reported consumption and/or estimates made wherever required).*

Table – 35 : Reported Consumption of Ferro-Chrome-Magnesium, 2008-09 to 2010-11 (By Industries)

(In tonnes)

Industry	2008-09	2009-10 (R)	2010-11 (P)
All Industries	**460**	**460**	**460**
Alloy steel	460 (1)	460 (1)	460 (1)

Figures rounded off. Data collected on non-statutory basis. Figures in parenthesis denote the number of units in organised sector reporting consumption.*
*(*Includes actual reported consumption and/or estimates made wherever required).*

WORLD REVIEW

Basically, silica is abundant in the earth's crust. Sand and gravel reserves of the world are large. Quartz-rich sand and sandstone are the main sources of industrial silica sand which occurs throughout the world. Reserves of natural quartz crystal suitable for electronics or optical use in the world are limited. The world's dependence on these reserves will continue to decline because of the increased usage of cultured quartz crystal as an alternate material. Electronic applications accounted for the most industrial uses of quartz crystal, followed by optical application.

All quartz crystals used for electronics were cultured. The world production of industrial silica sand and gravel by principal countries is given in Table - 36.

Table – 36: World Production of Sand and Gravel (Industrial), 2008 to 2010 (By Principal Countries)

(In '000 tonnes)

Country	2008$^{(e)}$	2009$^{(e)}$	2010$^{(e)}$
World: Total (rounded)	**121000**	**106000**	**121000**
Australia	5300	5200	5300
Belgium	1800	1800	1800
Canada	1990	1300	1171
Chile	1400	1400	1400
Czech Republic	1000	1364	1400
France	5000	5000	5000
Germany	8190	6450	7000
India*	1700	1700	1800
Iran	2000	1500	1500
Italy	13800	13800	9800
Japan	4500	3500	3078
Mexico	2780	2770	2480
Norway	1500	1500	1500
Poland	4000	4385	2730
South Africa	3650	2310	2910
Spain	5000	5000	5000
Turkey	1200	1250	4000
UK	5600	5600	3760
USA	30400	25000	29900
Other countries (rounded)	20200	15200	19900

Source: *Mineral Commodity Summaries, 2010 to 2012.*
** For India's production of silica minerals during 2008-09, 2009-10 and 2010-11, Tables - 5 , 10, 15, and 19 of this Review may be referred. Besides, sand is also produced as a minor mineral for use in building construction applications.*

FOREIGN TRADE

Exports

Exports of quartz and quartzite (natural) decreased considerably to 203,363 tonnes in 2010-11 from 256,421 tonnes in the previous year. Out of total exports, quartz comprised 165,532 tonnes (81%) and quartzite 37,831 tonnes (19%). Exports were mainly to Japan (23%), UAE & Bangladesh (13% each) and Vietnam (12%). Exports of silica sand increased to 12,267 tonnes in 2010-11 from 7,478 tonnes in 2009-10. Exports were mainly to Japan (41%), France (9%) and Kenya & Qatar (5% each). Exports of sand (excluding metal bearing) decreased substantially to 10,305 tonnes in2010-11 from 26,932 tonnes in the previous year. Exports were mainly to Sudi Arabia (31%), Tunisia (19%) and Oman (9%). Exports of agate (uncut) registered a downward trend with 9,448 tonnes in 2010-11 as against 39,090 tonnes recorded in the previous year. China (49%) , USA (15%) , Germany (11%) and Italy(10%) were the main buyers in 2010-11. Exports of agate (cut) increased substantially to 675 thousand carats in 2010-11 from 125 thousand carats in the previous year. Exports of flint increased to 1,688 tonnes in 2010-11 from 940 tonnes in 2009-10. Exports of silicon decreased to 165 tonnes in 2010-11 from 536 in the previous year. Exports were mainly to UAE, People's Rep.of Congo, Hong Kong and Liberia (Tables - 37 to 45).

Imports

Imports of quartz and quartzite (natural) were 496 tonnes in 2010-11 as compared to 823 tonnes in 2009-10. Out of the total imports in 2010-11, those of quartz were 412 tonnes and mainly from Sri Lanka, Spain and UK while quartzite imports were 84 tonnes as compared to 337 tonnes in the preceding year. The imports were mainly from Sri Lanka. Imports of silica sand increased substantially to 93,741 tonnes in 2010-11 from 15,384 tonnes in the previous year. Egypt, UAE, Jordan and Bhutan were the main suppliers. Imports of sand (excluding metal bearing) sharply decreased to 22 thousand tonnes in 2010-11 from 493 thousand tonnes in 2009-10. Imports were mainly from Nepal and Pakistan. Imports of flint sharply decreased to 25 tonnes in 2010-11 as compared to 862 tonnes in the previous year. China was the main supplier. Imports of agate (uncut) were 637 tonnes in 2010-11 as compared to 39 tonnes in 2009-10. Imports were mainly from China. Imports of agate (cut) were 3 thousand carat in 2010-11, mainly from China and Italy. Imports of silicon were 32,055 tonnes as compared to 24,245 tonnes in 2009-10, mostly from China (Tables - 46 to 54).

Table – 37 : Exports of Quartz And Quartzite (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**256421**	**1092657**	**203363**	**1208710**
Japan	41782	336939	47522	467239
Vietnam	15638	118830	24196	177159
UAE	33694	92392	25711	72779
Malaysia	32828	90498	8414	70694
Bangladesh	32500	75194	26031	62594
Italy	8245	65099	8141	56405
Germany	5336	32365	4516	36370
Israel	5226	27154	6310	33972
Nigeria	670	3588	4752	29134
Bhutan	35749	40828	21227	27931
Other countries	44753	209770	26543	174433

Table – 38 : Exports of Quartzite (Natural) (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**54283**	**261454**	**37831**	**275779**
Vietnam	9497	69724	9579	78092
Japan	7713	41082	7699	45789
Italy	6608	52268	5641	42058
Nigeria	670	3588	4072	25302
Israel	2229	15354	2644	20706
Germany	1752	4262	951	9936
Spain	163	1224	754	9182
Thailand	1727	11569	460	8497
Bangladesh	3360	9157	2118	4785
USA	208	2207	120	3916
Other countries	20356	51019	3793	27516

Table – 39 : Exports of Quartz (Natural) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**202138**	**831203**	**165532**	**932931**
Japan	34069	295857	39823	421451
Vietnam	6141	49106	14617	99067
UAE	33659	92185	25416	71580
Malaysia	32704	90202	8266	69888
Bangladesh	29140	66037	23913	57809
Bhutan	22464	26818	20629	27309
Germany	3584	28103	3565	26434
Iran	1133	8159	2664	22391
Thailand	1654	7156	2500	19139
Italy	1637	12831	2500	14346
Other countries	35953	154749	21639	103517

Table – 40 : Exports of Silica Sand (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**7478**	**30073**	**12267**	**145497**
Japan	421	7664	5026	93322
Korea, Rep.of	165	1217	448	5810
Qatar	34	204	565	5094
Singapore	-	-	280	4842
France	-	-	1082	4722
Kenya	64	260	633	3986
Vietnam	12	143	416	3634
Thailand	220	4105	180	3261
Malaysia	35	136	188	2675
Kuwait	125	583	529	2239
Other countries	6402	15761	2920	15912

Table – 41 : Exports of Sand (Excl. Metal Bearing) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**26932**	**88278**	**10305**	**124563**
Saudi Arabia	117	8874	3199	60146
Chinese Taipei/ Taiwan	-	-	364	27651
Tunisia	100	4108	1937	9558
Oman	198	1158	925	5344
Qatar	189	1884	322	2898
UAE	228	1509	606	2380
Canada	-	-	230	2228
Nigeria	171	943	489	2121
Egypt	-	-	45	1861
Korea, Rep. of	74	569	175	1713
Other countries	25855	69233	2013	8663

Table – 42 : Exports of Agate Uncut (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**39090**	**8750**	**9488**	**15421**
China	100	300	4637	4953
USA	19046	3131	1451	3486
Italy	-	-	946	1476
Germany	10	306	1070	1463
Hong Kong	1	66	47	1127
Australia	18587	1519	123	686
Malta	-	-	12	481
Japan	25	181	160	459
UK	53	2137	778	347
Chinese Taipei/ Taiwan	-	-	100	296
Other countries	1268	1110	164	647

Table – 43 : Exports of Agate Cut (By Countries)

Country	2009-10 Qty ('000 carat)	2009-10 Value (₹'000)	2010-11 Qty ('000 carat)	2010-11 Value (₹'000)
All Countries	**125**	**19774**	**675**	**51501**
Hong Kong	4	233	153	23424
USA	49	6136	394	10908
Germany	9	4463	17	4660
Italy	2	1288	59	4454
France	2	1709	14	2415
China	26	996	1	1340
Spain	++	80	7	854
Australia	-	-	2	698
Turkey	++	49	10	578
Japan	1	176	9	547
Other countries	32	4644	9	1623

Table – 44 : Exports of Flint (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**940**	**2653**	**1688**	**6320**
Djibouti	588	1428	1064	4034
Saudi Arabia	161	722	233	895
South Africa	-	-	81	602
UAE	-	-	106	471
Sudan	162	477	27	128
Ethiopia	-	-	26	112
Bangladesh	-	-	151	77
Nepal	1	1	++	1
Other countries	28	25	-	-

Table – 45 : Exports of Silicon (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**536**	**28455**	**165**	**23005**
Hong Kong	14	10843	26	6153
Turkey	-	-	3	3724
UAE	++	36	41	2927
Finland	-	-	3	2013
Congo, People's Rep. of	54	2731	29	2007
Liberia	17	740	22	1394
Singapore	-	-	1	1034
Sri Lanka	6	343	11	842
Nepal	31	664	8	626
Iran	-	-	1	402
Other countries	414	13098	20	1883

Table – 46 :Imports of Quartz and Quartzite (Natural) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**823**	**11964**	**496**	**8699**
Sri Lanka	352	3112	225	2932
Germany	143	4083	21	1576
Italy	19	768	42	1230
Spain	115	1112	141	1191
UK	6	223	54	1111
USA	3	251	10	510
Belgium	3	143	3	128
China	160	1432	++	17
UAE	-	-	++	3
Other countries	22	840	++	1

Table – 47 : Imports of Quartzite (Natural) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**337**	**4199**	**84**	**2510**
Italy	19	768	34	1186
Germany	++	19	++	678
Sri Lanka	309	2846	50	646
Other countries	9	566	-	-

Table – 48 : Imports of Quartz (Natural) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**486**	**7765**	**412**	**6189**
Sri Lanka	43	266	175	2285
Spain	115	1112	141	1191
UK	6	147	54	1111
Germany	143	4064	21	899
USA	3	251	10	510
Belgium	3	143	3	128
Italy	-	-	8	44
China	159	1333	++	17
UAE			++	3
Other countries	14	449	++	1

Table – 49 :Imports of Silica Sand (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**15384**	**287033**	**93741**	**413702**
Egypt	275	584	50178	91860
Italy	2562	69450	3120	43291
China	411	9042	2468	37903
Norway	141	3664	2124	34404
Bhutan	4753	34982	3729	32763
Spain	-	12	277	23191
UAE	37	1347	18223	20952
Saudi Arabia	672	2949	2938	20383
Jordan	1858	5305	6789	17199
USA	895	24503	506	17043
Other countries	3780	135195	3389	74713

Table – 50 : Imports of Sand (Excl. Metal Bearing) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**493454**	**177268**	**22379**	**28609**
Nepal	492839	165822	19744	17562
Belgium	486	6730	594	7372
Pakistan	-	-	2003	1584
China	2	56	15	1089
Germany	124	4617	4	377
Switzerland	-	-	14	305
Netherlands	-	-	3	265
France	-	-	2	55
Other countries	3	43	-	-

Table – 51 : Imports of Flint (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**862**	**5413**	**25**	**202**
China	124	1567	25	202
Hong Kong	-	-	-	-
Other countries	738	3846	-	-

Table – 52 : Imports of Agate Uncut (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**39**	**3354**	**637**	**15193**
China	11	2584	594	13692
Thailand	-	-	22	999
USA	2	59	8	286
Brazil	-	-	13	216
Other countries	26	711	-	-

Table – 53 : Imports of Agate Cut
(By Countries)

Country	2009-10 Qty ('000 carat)	2009-10 Value (₹ '000)	2010-11 Qty ('000 carat)	2010-11 Value (₹ '000)
All Countries	**++**	**1400**	**3**	**16464**
USA	++	1028	++	15422
Italy	-	-	1	429
China	-	-	2	327
Hong Kong	++	351	++	233
Indonesia	-	-	++	52
Other countries	++	21	++	1

Table – 54 : Imports of Silicon
(By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**24245**	**2186037**	**32055**	**3523172**
China	22762	2031858	28375	3087166
Vietnam	99	8971	1558	175100
France	229	27827	630	81532
Australia	524	45242	333	46201
Hong Kong	163	14724	127	14107
Norway	142	18650	75	11752
UK	15	2214	92	10264
USA	2	1457	76	10051
Chinese Taipei/Taiwan	9	3056	4	9014
Unspecified	38	3372	124	15443
Other countries	262	28666	661	62542

FUTURE OUTLOOK

In India, quartz, quartzite and silica sand are used mainly in glass, foundry, ferro-alloys, refractory industries and also as building materials. According to its suitability for different purposes, it may be named as building sand, paving sand, moulding or foundry sand, refractory sand or furnance sand and glass sand etc. However, the main use of silica minerals is in manufacture of different types of glasses, natural silica sand being the preferred material in the glass industry.

The demand for quartz, silica sand, moulding sand and quartzite is increasing over the years to cater to the requirement of ferro-silicon, silico-manganese, silico-chrome, silica refractories, glass and for moulding and casting purposes. The requirements of these products are linked up directly with iron and steel industry including alloy steel production. Further, setting up foundries and enhancing their capacities are also linked with metallurgical industry.

As per the report of the Sub-Group on 12th Plan, Planning Commission of India,the domestic demand of quartz and silica minerals is estimated at 3.15 million tonnes by 2011-12 and at 4.85 million tonnes by 2016-17 at 9% growth rate.

The total resources of quartz and other silica minerals are 4,750 million tonnes as on 1.4.2010. There are very good prospects of increasing the export of quartz and silica minerals to the neighboring countries.

In Haryana silica sand is available but due to environmental constraints mining is stopped.The Report has recommended that these constraints may be solved amicably in consultation with MoEF.

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

RARE EARTHS

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

67 Rare Earths

The rare earth group contains 17 elements, namely, scandium(Sc), yttrium(Y) and lanthanides (15 elements in the periodic table with atomic numbers from 57 to 71, namely, lanthanum (La), cerium (Ce), praseodymium (Pr), neodymium (Nd), promethium (Pm), samarium (Sm), europium (Eu), gadolinium (Gd), terbium (Tb), dysprosium (Dy), holmium (Ho), erbium (Er), thulium (Tm), ytterbium (Yb) and lutetium (Lu)). Although they tend to occur together, the 15 lanthanide elements are divided into two groups - light & heavy elements. The light elements are those with atomic numbers from 57 to 63 (La, Ce, Pr, Nd, Pm, Sm and Eu) and the heavy elements are those with atomic numbers from 64 to 71 (Gd, Tb, Dy, Ho, Er, Tm, Yb and Lu). Generally the light rare earth elements are more common and more easily extracted than the heavies. In spite of its low atomic weight yttrium has properties more similar to the heavy lanthanides and is included with this group. Scandium, besides its occurrence with other rare earth elements is also found in a number of minerals.

Rare earth elements (REE) are characterised by high density, high melting point, high conductivity and high thermal conductance. A number of rare earth minerals contain thorium and uranium in variable amounts but thorium and uranium do not constitute essential components in the composition of the minerals.

The principal sources of rare earth elements are bastnaesite (a fluorocarbonate which occurs in carbonatites and related igneous rocks), xenotime (yttrium phosphate) commonly found in mineral sand deposits, loparite which occurs in alkaline igneous rocks and monazite (a phosphate). The rare earths occur in many other minerals and are recoverable as by-products from phosphate rock and from spent uranium leaching. In India, monazite is the principal source of rare earths and thorium.

RESOURCES

The mineral monazite is a prescribed substance as per the notification under the Atomic Energy Act, 1962. AMD has been carrying out its resource evaluation for over six decades. It occurs in association with other heavy minerals, such as ilmenite, rutile, zircon, etc. in concentrations of 0.4 – 4.3% of total heavies in the beach and inland placer deposits of the country.

The resource estimation for the areas explored by AMD up to 2006 is almost complete. The resource estimates of monazite in the beach and inland placer deposits have been enhanced from 10.21 million tonnes in 2005 to 10.70 million tonnes in 2009. The statewise resources are given in Table - 1.

Table – 1 : Resources of Monazite

(In million tonnes)

State	Resources*
All India	**10.70**
Andhra Pradesh	3.74
Bihar	0.22
Kerala	1.51
Odisha	1.85
Tamil Nadu	2.16
West Bengal	1.22

Source: *Department of Atomic Energy, Mumbai.*

* *Inclusive of indicated, inferred and speculative categories.*

EXPLORATION & DEVELOPMENT

In Jharkhand, the GSI took up a Reconnaissance stage investigation (G- 4) during FS 2010-12 in Chhotanagpur Gneissic Complex around Kotam-Kutru area of Ranchi district to assess rare metal and REE potentials. The investigation was taken up based on the higher content of Cs, Li and Rb in trench and BRS samples from pegmatite bodies during earlier surveys. The area forms a part of the Chhotanagpur gneissic terrain. The ENE-WSW trending North Purulia Shear Zone (NPSZ), which cuts across the area, is the potential domain for REE mineralisation. The Kotam-Kutru Block is mostly soil covered. Sampling has been carried out in pegmatite bodies and sent for chemical analysis. The work is under progress.

In Meghalaya, the GSI took up Reconnai-ssance stage investigation (G-4) during FS 2010-12 in the peripheral part of Sung ultramafic-alkaline carbonatite complex of East Khasi Hills district to evaluate REE potential. The Sung Valley intrusive is an oval-shaped body covering about 30 sq km area within Precambrian Shillong Group.

AMD carried out exploration in Gujarat, Odisha, Kerala, Karnataka, Andhra Pradesh, West Bengal and Tamil Nadu for heavy minerals in beach sands like ilmenite, rutile, zircon, monazite, etc. Directorate of Geology, Odisha, has taken up exploration for beach sands in Puri district and along coastal tract in Jagatsinghpur district to assess the heavy-mineral contents. Details of exploration carried out by AMD, State Directorate, etc., are provided in the Review on 'Ilmenite and Rutile', Chapter 46.

PRODUCTION AND PRICES

IREL, a Government of India Undertaking and KMML, a Kerala State Government Undertaking, are actively engaged in mining and processing of beach sand minerals from placer deposits. IREL produced 16 tonnes rare earths viz, RE fluoride, cerium oxide, cerium hydrate from conversion of rare earth chlorides, in 2009-10 against 4,500 tpy installed capacity. There was no production during 2010-11. The production and prices of rare earths in India during 2008-09 to 2010-11 are given in Tables - 2 and 3, respectively.

Table – 2 : Production and Value of Rare Earths* 2008-09 to 2010-11

Year	Quantity** (tonnes)	Value (₹ lakh)
2008-09	22	27
2009-10	16	48
2010-11	Nil	Nil

Source: *Department of Atomic Energy, Mumbai.*
** Produced by IREL.*

*** Mainly Rare Earths fluoride, cerium oxide & cerium hydrate from conversion of Rare Earths chloride.*

Table – 3 : Domestic Prices of Rare Earths 2008-09 to 2010-11

(In ₹ per kg)

Year	Grade	Price	Remarks
2008-09	RE chloride	50	Ex-works, packed
	RE fluoride	135	Ex-works, packed
	RE carbonate	72	Ex-works, packed
	Cerium oxide A	145	Ex-works, packed
	Cerium oxide B	300	Ex-works, packed
2009-10	RE chloride	60	Ex-works, packed
	RE fluoride	160	Ex-works, packed
	RE carbonate	72	Ex-works, packed
	Cerium oxide A	145	Ex-works, packed
	Cerium oxide B	300	Ex-works, packed
20010-11	RE chloride	180	Ex-works, packed
	RE fluoride(lumps)	450	Ex-works, packed
	Di carbonate - Wet	150	Ex-works, packed
	Di fluoride	285	Ex-works, packed
	Cerium hydrate -Dry	500	Ex-works, packed
	Cerium oxide B	550	Ex-works, packed
	Neo. oxide - 95%	3420	Ex-works, packed
	Neo oxide - 98%	3800	Ex-works, packed

Source: *Department of Atomic Energy, Mumbai.*

MINING AND PROCESSING

Mining of beach sand is being carried out by IREL and KMML.The installed capacity of monazite (96% pure) separation plant of IREL at Manavalakurichi is 6,000 tpy while that of KMML at Chavara is 240 tpy. Details regarding mining and processing, etc. are provided in the Review on 'Ilmenite and Rutile'.

INDUSTRY

IREL has a plant at Udyogamandal, Aluva, located in Ernakulam district, Kerala, wherein the monazite obtained from Manavalakurichi is chemically treated to separate rare earths in its composite chloride form and thorium as hydroxide upgrade. Ground monazite is digested with caustic soda lye to produce trisodium phosphate (TSP) and mixed hydroxide slurry. This slurry is used for production of diverse rare earth compounds. Elaborate solvent extraction and ion exchange facilities were built to produce individual RE oxides, like oxides of Y, Ce, Nd, Pr and La of specific purities. India is the second largest supplier of yttrium in the world and the maximum production is reported from this plant in Kerala. Uranium values present in monazite which are recovered in the form of nuclear grade ammonium diuranate (ADU) are vital supplement to the indigenous supply of uranium. Thorium is separated in its pure oxalate form. A part of it is taken to OSCOM for further processing by solvent extraction to produce thorium nitrate. A small part of the purified thorium nitrate is converted to nuclear grade thorium oxide powder for supply to Bhabha Atomic Research Centre (BARC) and Nuclear Fuel Complex (NFC) for developing thorium based fuel for nuclear reactors. IREL has built a large stockpile of impure thorium hydroxide upgrade associated with rare earths and unreacted materials.

IREL is setting up a 10,000 tpy monazite processing plant (MoPP) and the environmental clearance was received in February 2011. The project is likely to commence production in the first quarter of 2012-13. IREL has entered into an agreement with Toyoto Tshusho Corporation, Japan for supplying of over 50% of Rare Earth Chloride that shall be produced at MoPP. The plant will have provision for expanding its capacity of processing monazite from 10,000 tpy to 20,000 tpy in the future. The company is also in the process of setting up plant facilities at RE Division, Aluva, to take up processing of RE chloride produced at MoPP, OSCOM to produce High Pure Rare Earths. A thorium plant is in operation since 1992 at OSCOM to produce 240 tpy mantle grade thorium nitrate.

The production of rare earth compounds from monazite at Udyogamandal plant is furnished in Table - 4.

Table – 4 : Production of Rare Earth Compounds (IREL)

(In tonnes)

Product	Specification	Installed capacity (tpy)	Production		
			2008-09	2009-10	2010-11
RE Chloride	REO 45% min. CeO_2/REO 45% min.	–	–	–	–
RE Fluoride	TO>78%, F>26% CeO_2/TO>45%	114	20.000	NA	NA
RE Oxide	–	–	–	–	–
Cerium Hydrate	Total REO>80% (dry) (30% for wet) CeO_2>68%, CeO_2/Total REO >85%	–	2.000	NA	NA
Cerium Oxide	Grade C: CeO_2 99.00% min. Grade D: CeO_2 99.95% min. CeO_2 99.99% min.				
ADU	Nuclear Grade	28	32.686	33.000	32.000
Yttrium Oxide	–	–	–	–	–

***Source**: Indian Rare Earths Ltd*
***Note**: The plant has stopped production since 2004. Hence, installed capacity is redundant for products other than RE Fluoride and ADU.*
ADU: Ammonium diuranate. RE: Rare Earths.

POLICY

Exploitation of beach sand minerals and participation of private sector with or without foreign companies is subject to conditions stipulated in the Beach Sand Mineral Policy notified by the Government of India in October, 1998. As per the Foreign Trade Policy, 2009-2014 and the effective policy on export and import, the import of ores and concentrates of rare earth metals (under code No. 25309040) and of rare earth oxides including rutile sand (code No. 26140031) are permitted freely. Rare earth compounds are freely exportable, but rare earth phosphates, which contain uranium and thorium are prescribed substances and controlled under Atomic Energy Act, 1962.

USES & CONSUMPTION

Rare earth materials are utilised in a wide range of critical products enabling many emerging green energy technologies, high tech applications and defence systems such as hybrid cars, plug-in-hybrid electric-vehicles (PHEVs), the latest generation of efficient windpower turbines, computer disc drives, missile guidance systems, etc. The lanthanide elements as a group have magnetic, chemical and spectroscopic properties that have led to their application in wide range of end-uses. Cerium finds application in polishing of glass items like lenses and display screens of cathode-ray tubes, liquid-crystal displays and plasma-display panels, in petrol and diesel fuels as fuel additive and along with lanthanum for replacement of cadmium in red pigments. Mixed salts of the cerium group of elements, other than fluorides, are used in medicine, non-irritating antiseptic dressings, waterproofing agents and fungicides in textile manufacture. The principal uses of commercially pure cerium compounds that are in the form of nitrate is in the manufacture of incandescent gas mantles, and cerium compounds as oxide, find use as a polishing agent of glass. Cerium compounds are also used in ceramic and glass as colouring pigments and also as catalysts in chemical industry.

Cerium, lanthanum and neodymium are used as glass additives in optical lenses and display screens, as catalysts in automobiles, in multilayer capacitors and along with yttrium in magnesium, aluminium and hydrogen storage alloys. Mischmetal which is an alloy of cerium with small amounts of other rare-earth metals is used in lighter flints, for desulphurisation in steel and foundry, and with lanthanum alloys, in batteries and hydrogen storage systems meant for electronics and hybrid cars.

Lanthanum oxide and neodymium compounds are used in special glass manufacture. Lanthanum finds application in X-ray films as phosphors; yttrium in advanced ceramics like nitrides, Y-stabilised ceramics, etc., and gadolinium in magnet alloys. Yttrium, europium and terbium are used as phosphors in displays of computers, TV, etc. and with lanthanum, cerium & gadolinium as phosphors in fluorescent and halogen lamps. Neodymium, samarium, dysprosium, praseodymium and terbium have application as high intensity magnets in electronics, electric motors and audio equipment. Lanthanum, erbium and ytterbium have application in fibre optics and lasers. Lanthanum and yttrium find application as solid oxide fuel cells. Scandium is used mainly in aluminium alloys for sporting goods. Scandium in minor amounts is used in semiconductors and speciality lighting including halogen bulbs. Mixed rare earth products find use as catalysts in petroleum refining and fluid cracking.

The main application for neodymium-iron-boron (Nd-Fe-B) magnets are in automobiles for anti-lock brakes, and in computer hard disk drives, videos, CD-ROMs used in many small-size electronic consumer products, such as, digital cameras, where major advantage is their small sizes. Nickel metal hydride (Ni MH) batteries, containing mischmetal, a mixture of rare earth compounds, are used mainly in portable electronic equipment, such as, laptops, camcorders and mobile phones. The market for batteries for portable electronic equipment though is growing strongly, the Ni MH batteries are increasingly replaced by lithium-ion batteries.

Monazite contains about 25.28% P_2O_5 which can be recovered as a by-product for manufacture of fertilizers and production of elemental phosphorus or its salts. Besides, rare earths, thorium is recovered from monazite. It is a source of atomic energy. An important use of thorium is for addition to tungsten in minute quantity (about 0.75%) to increase the ductility of tungsten wire and thus to facilitate its drawing into filaments used in electric lamps. Metallic thorium is also used in photoelectric cells and X-ray tubes and in certain alloys. Thorium is used as catalytic agent for various processes. Amongst thorium salts, thorium nitrate is used largely in the manufacture of incandescent gas mantles. Mesothorium, the chief radioactive element recovered as a by-product in the chemical treatment of monazite, is marketed usually in the form of its bromide and used in self-luminous paints or enamels. Mesothorium is also used in the treatment of certain types of cancer and skin diseases.

The total consumption of rare earths in 2009-10 and 2010-11 was estimated at 118 tonnes and 128 tonnes, rspectively. Paints Driers/Pigments Industry was the main consumer accounting for about 59% of the total consumption followed by Cinema Arc Carbon Industry (36%) in 2010-11 (Table-5).

Table – 5 : Consumption* of Rare Earths 2008-09 to 2010-11 (By Industries)

(In tonnes)

Industry	2008-09	2009-10	2010-11
All Industries	**158**	**118**	**128**
Paints Driers/Pigments	85	92	76
Cinema Arc Carbon	66	25	46
TV Colour picture tube	-	1	-
Glass/Optical polishing	2	-	1
Glassware decolouring	-	++	1
R&D and others	5	-	4

Source: *Department of Atomic Energy, Mumbai.*
** Consumption relates to sales figures of IREL.*

WORLD REVIEW

The total world reserves are estimated at 110 million tonnes of rare-earth oxides (REO) of which China alone accounts for 55 million tonnes followed by CIS countries, USA, India and Australia (Table - 6).

China holds the leading position among producers of rare earths while Brazil, Russia & Malaysia produce monazite (Table-7). Rare earths are also produced in Kazakhstan, Kyrgyzstan and Thailand. Concentrates/ partially processed intermediate products are further processed at many locations in Europe, USA, Japan and China.

In China, the principal production centres of rare earths are located at Baotou, Inner Mangolia and in Jiangxi & Sichuan provinces. At Baotou, bastnaesite is recovered as a by-product of iron ore mining while in Sichuan and in Gansu, bastnaesite occurs as primary mineral. In Jiangxi, Guangdong, Hunan and Jiangsu provinces, the ion adsorption clays are the source of the greater proportion of world yttrium production.

The Russian rare earth industry is based on loparite, a titanium-tantalum niobate mined from Lovozero massif in the Murmansk region. Rare earth minerals have been recovered as by-products from titanium-bearing heavy sands, particularly in Australia and from tin dredging in Malaysia.

Table – 6 : World Reserves of Rare Earths (By Principal Countries)

(In '000 tonnes of REO content)

Country	Reserves
World : Total(rounded)	**110000**
Australia	1600
Brazil	48
China	55000
Commonwealth of Independent States	19000
India*	3100
Malaysia	30
USA	13000
Other countries	22000

Source: *Mineral Commodity Summaries, 2012.*

* *As per Department of Atomic Energy, Mumbai, the total resources of monazite, a source of rare earths, are estimated at 10.70 million tonnes.*

Table – 7 : World Production of Rare Earths (By Principal Countries)

(In tonnes)

Country	2008	2009	2010
Brazil (Monazite)	540	200	200(e)
China #	124500(e)	129400	118900(e)
India (Monazite)@	22	20	20
Malaysia (Monazite)	150	20	480
Russia(e)	2470	2500	2500

Source: *World Mineral Production, 2006-2010.*

\# *Includes production from iron ore extraction, bestnasite concentrates and ion absorption clays.*

@ *As per Department of Atomic Energy, Mumbai, the total production of rare earths in 2008-09 and 2009-10 was 22 tonnes and 16 tonnes, respectively. Production for 2010-11 is not available.*

FUTURE OUTLOOK

Demand for rare earths is centered around countries which manufacture components like automotive catalyst systems, fluorescent lighting tubes and display panels. The demand, therefore, is expected to emanate mainly from Europe, USA, Japan, China and Republic of Korea. China controls the entire global supply and its export limits. Mine restructuring and other policies are responsible for determining prices of rare earths which are almost manifold since 2009 due to panic buying globally.

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

SALT

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

68 Salt

Occurrences of rock salt in India are scanty. The only producer which obtains rock salt in meagre quantities, is the Hindustan Salt Ltd, Jaipur from its mines located in Mandi district of Himachal Pradesh. The main source of common salt is sea water. It is being obtained from water of salt lakes, seas, or sub-soil brines after evaporation due to solar heat.

When pure, the common salt is the mineral halite which being an essential need of human beings, is being produced from the beginning of human history. Halite is colourless or white but may contain various tints.

RESOURCES

As per UNFC system, the total resources of rock salt as on 1.4.2010 are estimated at 16.03 million tonnes in Mandi district of Himachal Pradesh. Out of the total resources, about 10.04 million tonnes are proved reserves and 5.99 million tonnes are probable reserves.

PRODUCTION, STOCKS AND PRICES

The production of rock salt in 2010-11 at 1,200 tonnes decreased by 35% as compared to that in the previous one year due to lack of market demand. There was only one reporting mine of rock salt in both the years which was in the public sector and located in Mandi district of Himachal Pradesh.

Mine-head stocks of rock salt at the end of 2010-11 was 12 tonnes as against 72 tonnes at the beginning of the year.

The average daily employment of labour strength in 2010-11 was 18 as against 24 in the preceding year. Prices of salt are furnished in the General Review on 'Prices'.

Table – 1 : Producer of Rock Salt, 2010-11

Name and address of producer	Location of mine	
	State	District
Hindustan Salts Ltd, B-427, Pradhan Marg, Malviya Nagar, Jaipur - 302 017 Rajasthan.	Himachal Pradesh	Mandi

Table – 2 : Production of Rock Salt 2008-09 to 2010-11 (By State)

(Quantity in tonnes; value in ₹'000)

State	2008-09		2009-10		2010-11(P)	
	Qty	Value	Qty	Value	Qty	Value
India	**2011**	**3630**	**1836**	**4908**	**1200**	**3380**
Himachal Pradesh	2011	3630	1836	4908	1200	3380

Table – 3 : Production of Rock Salt 2009-10 and 2010-11 (By Sector/State/District)

(Quantity in tonnes; value in ₹ '000)

State / District	2009-10			2010-11(P)		
	No.of mines	Qty	Value	No.of mines	Qty	Value
India	**1**	**1836**	**4908**	**1**	**1200**	**3380**
Public sector	1	1836	4908	1	1200	3380
Himachal Pradesh	**1**	**1836**	**4908**	**1**	**1200**	**3380**
Mandi	1	1836	4908	1	1200	3380

Table – 4 : Mine-head Stocks of Rock Salt 2010-11(P)
(By State)

(In tonnes)

State	At the beginning of the year	At the end of the year
India	**72**	**12**
Himachal Pradesh	72	12

MINING

The board-and-pillar underground method of mining was adopted in Guma rock salt mine of Hindustan Salts Ltd., when it was in operation. Mining is presently carried out only in Mandi mines. The salt deposit in Drang & Mandi mountain ranges along with JoginderNagar-Mandi Road can be exploited commercially through 'Solution Mining' process and fed directly to the industry producing caustic soda besides other plants. Hindustan Salts Ltd, is in the process of appointing consultant for the said Solution Mining Project. The project involves two stages, namely, financial evaluation of the project based on the techno-feasibility report prepared earlier for feeding a 60,000 tpy caustic soda plant with required quality of brine at Mandi. The second phase will involve formation of a new joint venture, etc. This project, if implemented, is likely to be highly profitable. There is a proposal to convert Drang salt mines to health resort by Hindustan Salts Ltd as these 225 m deep mines are free from viruses and bacteria. The proposal is subject to economic viability and approval from DGMS and other concerned departments.

USES

Salt, in addition to its culinary and domestic uses, is employed in meat packing, fish curing and its preservation, dairying, preservation & processing of hides, manufacturing of soaps and dyestuff, dyeing and finishing of fabrics, refrigeration, glazing earthenware, explosives, bakery products, for soil stabilisation, in manufacture of artificial rubber and as a wood preservative. In agriculture, salt is used for treating hay and as a fertilizer for certain crops. In countries with cold weather conditions, salt is used in controlling ice and snow on streets and highways.

Industrial Applications

Salt is an important raw material for chemical industry. It is used in the production of basic chemicals like sodium carbonate (soda ash), caustic soda, hydrochloric acid, chlorine, bleaching powders, chlorates, sodium sulphate (salt cake) and sodium metal. These basic chemicals, in turn, are used in the preparation of various end products, such as soaps, detergents, chlorinated hydrocarbons like DDT and carbon tetrachloride. Other important uses are in food processing and as freezing-point depressant in refineries and milk supply schemes, for the treatment of industrial wastes, in the manufacture of synthetic indigo, explosives, papers, purification of drinking water, etc.

The rock salt produced from Mandi mines contains 67.81% NaCl and it is not suitable for human consumption as the content of sodium chloride should be 96% NaCl (Min). It is generally used to feed cattle.

The production of salt (other than rock salt) in 2010-11 was at 18.61 million tonnes. Private sector contributes17.01 million tonnes (91.4%) of salt production in the country, whereas remaining 8.6% was contributed by public sector 0.27 million tonnes (1.5%)and 1.32million tonnes (7.1%) by cooperative sector. Statewise, Gujarat tops in salt production with 14.52 million tonnes,i.e.78% share, followed by Tamil Nadu (2.14 million tonnes - 11.5% share) and Rajasthan (1.43 million tonnes - 7.7% share). Balance 2.8% production is contributed by Andhra Pradesh and Maharashtra, while minor production is from Odisha, Karnataka,West Bengal, Goa, Himachal Pradesh and Diu and Daman. During the recovery of salt from marine sources, a variety of by-products mainly, gypsum, magnesium chloride, magnesium sulphate and liquid bromine are recovered.

Iodised Salt

A portion of rock salt produced is iodised in order to meet the requirements of goitre-endemic areas in the country. Iodised salt is produced by mixing potassium iodate with salt using spray,drip feed, dry mixing and submersion processes. Iodisation of salt is carried out in plants operated by Sambhar Salts Ltd (a subsidiary of Hindustan Salts Ltd in public sector), Kharagodah, Gujarat. About 831 plants including 67 refineries with an annual capacity of 17 million tpy produced 6.22 million tonnes iodised salt. The Hindustan Salts Ltd has also set up an iodisation plant at Ramnagar in Nainital district, Uttarakhand.

CONSUMPTION

Industrial consumption of salt is steadily increasing and has registered a record high of 10.76 million tonnes in 2010-11. During the same period, human consumption of salt was reported at 6.03 million tonnes. The industrial consumption of salt is given in Table -5.

Table – 5 : Industrial Consumption of Salt 2008-09 to 2010-11 (By Industries)

(In '000 tonnes)

Industry	2008-09	2009-10	2010-11
Total	**9534.1**	**10058.5**	**10758.6**
Caustic soda/soda ash	7345.7	7440.0	8078.4
Misc. Industries (Paper/Dye, foods, steel, oil, etc,)	2288.4	2618.5	2680.2

Source: *Salt Commissioner, Govt. of India, Jaipur.*

FOREIGN TRADE

Exports

Exports of rock salt increased to 86,968 tonnes in 2010-11 from 4,518 tonnes during the preceding year. Exports were mainly to Indonesia (59%) & Bangladesh (38%). Exports of salt (others) were 1.80 million tonnes compared to 1.54 million tonnes during 2009-10 (Table-6 & 7).

Imports

In 2010-11, imports of salts (other than common salt) were at 34,148 tonnes as compared to 30,838 tonnes in the previous year. Imports were mainly from Pakistan (92%) (Table-8).

Table – 6 : Exports of Rock Salt (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**4518**	**20107**	**86968**	**95603**
Indonesia	2	5	51000	60437
Bangladesh	423	2311	32866	25998
UK	415	3934	2125	6009
Nepal	225	1196	201	1043
USA	355	2035	309	682
Australia	145	648	94	378
Singapore	11	24	67	207
New Zealand	40	59	85	187
Canada	98	858	52	110
Japan	252	668	14	103
Other countries	2552	8369	155	449

Table – 7 : Exports of Salt (Other than common salt)
(By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**1540504**	**1934926**	**1799673**	**1707772**
China	35393	111999	455454	453386
Japan	366680	433978	422425	421128
Indonesia	149992	157631	312154	295156
Quatar	319078	266568	158892	128629
Korea, Dem; Peoples Rep. of	-	-	107300	84468
Bangladesh	214632	184632	110463	59104
Korea, Rep. of	119518	10350	79400	54080
UK	294	697	41884	45649
Malaysia	35693	284803	31176	38715
Singapore	16088	15176	32138	27073
Other countries	283136	469092	48387	100384

Table – 8 : Imports of Rock Salt
(By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**30838**	**67124**	**34148**	**82776**
Pakistan	29994	59619	31371	64570
USA	7	303	23	5033
Afghanistan	-	-	2107	3324
Thailand	361	3083	136	2061
Germany	78	988	179	1830
Denmark	5	218	34	1377
China	15	176	142	984
New Zealand	24	203	72	900
Israel	1	77	20	747
Netherlands	5	75	19	660
other countries	348	2382	45	1290

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

SELENIUM AND TELLURIUM

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

69 Selenium and Tellurium

Selenium and tellurium metals are recovered as by-products during copper, lead-zinc, gold and platinum ore processing. The principal sources of selenium are sulphide deposits and anode mud or slime obtained during electrolytic refining of copper. Tellurium is found mostly as tellurides associated with metals, such as, bismuth, lead, gold and silver. It is found with selenium in the anode slime from electrolytic copper refineries.

EXTRACTION

Selenium and tellurium metals were being recovered as allied products at Ghatsila Copper Smelter of HCL in Jharkhand, where the annual installed capacity to produce selenium is 14,600 kg. However, in recent years there has not been production of selenium and tellurium by HCL. HCL has not reported production of selenium since 2006-07 and that of tellurium since 2004-05. Hindalco Industries Ltd reported 36,810 kg and 41,274 kg production of selenium from imported copper concentrates at its Dahej Smelter in Gujarat during 2008-09 and 2009-10, respectively. Data for 2010-11 is not available. Installed capacity of selenium recovery plant of Hindalco and production during 2010-11 are not available.

USES

Selenium

In glass manufacturing, selenium powder in traces is used as a decolourant for removing the green tint caused by iron impurities in container glass and other soda-lime silica glasses. Approximately 1 kg selenium is used for about 150 tonnes of glass production. It is also used in architectural plate glass to reduce solar heat transmission. High-purity selenium compounds were used principally as photoreceptors on the drums of older plain paper copiers which are gradually being replaced by newer models that do not use selenium in the reproduction process. Dietary supplement for livestock is the largest agricultural usage of selenium. Also, selenium may be added to fertilizer to enrich selenium-poor soils.

Selenium is added to steel, copper and lead alloys to improve machinability and casting properties. Selenium is added to low antimony-lead alloys used in the support grids of lead acid storage batteries. The addition of 0.02% selenium by weight as a grain refiner improves the casting and mechanical properties of alloy. Metallurgical applications of selenium also include its use in the production of electrolytic manganese metal (EMM) wherein about 2 kg of SeO_2 is required per tonne of electrolytic manganese metal produced.

Chemical uses of selenium are in industrial and pharmaceutical applications. The principal pharmaceutical use of selenium is in anti-dandruff hair shampoos. Selenium is also used as a human dietary supplement. Miscellaneous industrial chemical uses are as lubricant, rubber compounding and catalysts.

In pigment applications, selenium is used to produce colour changes in cadmium sulphide-based pigments. Sulphoselenide red pigments have good heat stability and hence are used in ceramics and plastics, paints, inks and enamels. Selenium is used in catalysts to enhance selective oxidation and in plating solutions to improve appearance and durability. It is also used in blasting caps and gun bluing.

The use of selenium in glass has increased due to higher glass production. The use of selenium in fertilizer and supplements in the plant-animal human chain and as human vitamin supplements increased as its health benefits were documented. The use of selenium in copper-indium-gallium-diselenide (CIGS) solar cell has increased.

Selenium was recovered from used electronic and photocopier components and recycled.The estimated global consumption of selenium was in metallurgy and glass (30% each); agriculture; chemicals & pigments; electronic and other industries (10% each).

Tellurium

Tellurium is used principally as an alloying element in the production of free-machining low carbon steel where additions up to 0.1% tellurium, greatly improve machinability. It is also used as a minor additive in copper alloys to improve machinability without reducing conductivity. Tellurium catalysts are used chiefly for the oxidation of organic compounds and also in hydrogenation and halogenation reactions. Tellurium chemicals are used as vulcanising and acclerating agents in processing of rubber compounds. It finds use as a component of catalysts for synthetic fibre production and increasingly used cadmium-tellurium-based solar cells. In plain paper copiers and in thermoelectric and photoelectric devices, tellurium is used along with selenium. Mercury-cadmium telluride is used as a sensing material for thermal imaging devices. Tellurium is also used as an ingredient in blasting caps and as a pigment to produce colours in glass and ceramics. High purity tellurium is used in alloys for electronic applications.

SUBSTITUTES

High-purity silicon has replaced selenium in high-voltage rectifiers and is the major substitute for selenium in low and medium-voltage rectifiers. Other inorganic semiconductor materials, such as, silicon, cadmium, tellurium, gallium and arsenic as well as organic photoconductors are the substitutes for selenium in photoelectric applications. Amorphous silicon and organic photoreceptors are substitutes of selenium in plain paper photocopiers. Sulphur dioxide can be used as a replacement for selenium dioxide in the production of electrolytic manganese metal.

Several materials can replace tellurium in most of its uses, but usually with loss in production efficiency or product characteristics. Bismuth, calcium, lead, phosphorus, selenium and sulphur can be used in place of tellurium in many free-machining steels. Several of the chemical process reactions catalysed by tellurium can be carried out with other catalysts or by means of noncatalytic processes. The chief substitutes for tellurium were selenium and sulphur in rubber compound applications and selenium, germanium and organic compounds in electronic applications.

WORLD REVIEW

Selenium

The world reserves of selenium at 93,000 tonnes only cover the estimated contents of economic copper deposits. Selenium was obtained as a byproduct with copper. Substantial resources also exist in association with other metals, coal deposits and in uneconomic copper deposits (Table - 1).

Average world production of selenium is estimated at 3,000-3,500 tonnes per year. In 2010, the production of selenium metal in respect of 10 countries for which data is available was estimated at 1,924 tonnes. The chief producers were Japan, Germany, Belgium, Russia, Kazakhasthan, Sweden, Poland and Canada (Table - 2).

Table – 1 : World Reserves of Selenium (By Principal Countries)

(In tonnes of metal content)

Country	Reserves
World : Total (rounded)	**93000**
Canada	6000
Chile	20000
Peru	13000
Philippines	500
Russia	20000
USA	10000
Other countries*	23000

Source: *Mineral Commodity Summaries, 2012.*
*Note:*Reserves are based on identified copper deposits only.*

Table – 2 : World Production of Selenium Metal (By Principal Countries)

(In tonnes)

Country	2008	2009	2010
Belgium[(e)]	200	200	200
Canada	191	173	79[(e)]
China[(e)]	65	65	65
Finland	65	66	66
Germany[(e)]	250	230	250
Japan	754	709	754
Kazakhasthan[(e)]	130	120	130
Poland	82	80	80
Russia[(e)]	170	160	170
Sweden	139	129	130 [(e)]

Source: *World Mineral Production, 2006-2010.*

Tellurium

The world reserves of tellurium were 24,000 tonnes contained in copper resources. Concentration of tellurium could also be found in lead and gold deposits. The quantity of tellurium in deposits of coal, copper and other metals that are of sub-economic grade is several times the amount of tellurium contained in identified economic copper deposits (Table-3).

Table – 3 : World Reserves of Tellurium (By Principal Countries)

(In tonnes of metal content)

Country	Reserves*
World : Total (Rounded)	**24000**
Canada	800
Peru	3600
USA	3500
Other countries	16000

Source: *Mineral Commodity Summaries, 2012.*

* *Estimates include tellurium contained in copper resources only.*

More than 90% of tellurium is produced from anode slimes collected from electrolytic copper refining, and the remainder is derived from skimmings at lead refineries and from flue dust and gases generated during the smelting of bismuth, copper and lead ores. The anode slimes of copper and lead refineries normally contain about 3% tellurium. World refinery capacity is 500 to 600 tonnes concentrated in the USA (110 tonnes), Japan (100 tonnes), Canada (40 tonnes), former USSR (70 tonnes), Belgium (60 tonnes), Germany (50 tonnes), Peru (30 tonnes) and Philippines (100 tonnes). World tellurium consumption slightly decreased in 2009. However, there was an increase of demand for high purity tellurium in solar cells. In Japan, tellurium was used in steel industry to replace lead. Average world production of tellurium is estimated at 450-500 tonnes per year. The chief producers of refined tellurium in the world in 2010 were Japan, USA and Canada contributing an estimated 109 tonnes to the world production compared to 122 tonnes they and Peru produced in 2009 (Table-4).

Table – 4 : World Production of Tellurium Metal (By Principal Countries)

(In tonnes)

Country	2008	2009	2010
Canada	20	16	8
Japan	47	49	51
Peru	28	7	-
USA	50	50	50

Source: *World Mineral Production, 2006-2010.*

China

China was one of the principal producers and a leading consumer of selenium in 2010. China's consumption was estimated around 1,500-2,000 tonnes per year, of which about 1,000 tonnes per year was accounted for by electrolytic manganese industry. The refined selenium capacity was around 500 tpy which was likely to reach 600 tpy in near future. Apollo Solar Energy Inc. started up two mines with tellurium as primary product. The resources at Dashuigou project are 30,200 tonnes ore grading 1.09% tellurium containing 328 tonnes of tellurium while Majiagou project resources are 13,400 tonnes ore grading 3.26% tellurium containing 437 tonnes of tellurium.

FOREIGN TRADE

Exports of selenium decreased substantially to 182 tonnes in 2010-11 from 400 tonnes in the previous year. Exports were mainly to China, Philippines & Hong Kong. In 2010-11, exports of tellurium increased to 58 tonnes from 44 tonnes during the previous year (Tables-5 & 6).

Imports of selenium increased to 209 tonnes in 2010-11 as compared to 190 tonnes in the previous year. Imports were mainly from Japan, China , Rep. of Korea and Belgium. In 2010-11, imports of tellurium were at 3 tonnes compared to 9 tonnes in the previous year (Tables-7 and 8).

Table – 5 : Exports of Selenium (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**400**	**417874**	**182**	**645693**
China	90	219157	57	192723
Philippines	5	13295	47	170153
Hong Kong	190	92689	36	143794
UK	1	2603	12	35239
Singapore	3	8728	6	26164
Bangladesh	15	10182	8	16278
Italy	30	7308	3	12707
USA	-	127	3	10414
Canada	-	1403	2	7337
France	1	3692	2	6637
Other countries	65	58690	6	24247

Table – 6 : Exports of Tellurium (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**44**	**22834**	**58**	**13331**
Netherlands	-	-	5	4675
Singapore	1	3262	20	4450
Sri Lanka	-	-	++	1310
Malawi	-	-	++	1293
UAE	-	-	8	721
Australia	-	-	22	503
Bangladesh	-	-	3	379
Other countries	43	19572	-	-

Table – 7 : Imports of Selenium (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**190**	**434583**	**209**	**699503**
Japan	80	185725	68	239289
China	1	2867	46	118906
Korea, Rep. of	44	96653	30	110820
Belgium	38	90098	28	100323
Germany	13	30739	22	74951
UK	6	15306	8	30186
Chile	–	–	2	8111
Hong Kong	-	-	2	7534
USA	++	790	1	3899
Iran	-	-	1	3612
Other countries	8	12405	1	1872

Table – 8 : Imports of Tellurium (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**9**	**55532**	**3**	**35182**
Belgium	2	13898	1	15124
Korea, Rep.of	6	33155	2	14539
China	++	2236	++	2591
Japan	-	–	++	1982
Canada	++	529	++	371
Philippines	++	462	++	359
UK	1	4285	++	101
Germany	++	77	++	85
USA	++	890	++	30

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

SILVER

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

70 Silver

Silver is one of the five noble metals. It has brilliant white colour, malleability and resistance to atmospheric oxidation. It has always been a highly desired precious metal and is used in more industrial applications than any other metal. Apart from its monetary and decorative uses, its highest known electrical conductivity amongst all metals has found application in modern age; viz, for printed electric circuits, coating for electronic conductors and in alloys of gold and copper for electrical contacts. Its chloride and iodide are light-sensitive and hence used in photographic material. These two modern uses are responsible for contributing its supply as scrap.

In India, there are no native silver deposits except the small and unique Bharak deposit of silver in Rajasthan. It occurs generally with lead, zinc, copper and gold ores and is extracted as a by-product from electrolysis or chemical methods.

Silver is recovered as a co-product as well as a by-product in the country. Silver was recovered in the past as a co-product in gold refining at KGF Complex and Hutti Gold Mines in Karnataka, as a by-product in smelting and refining of lead, zinc and copper concentrates at Chanderiya and Debari smelters in Rajasthan, Tundoo and Moubandar (Ghatsila) smelters in Jharkhand and at Visakhapatnam smelter in Andhra Pradesh. The present production of silver comes from Chanderiya lead-zinc smelter of HZL and from gold refinery of HGML. In addition, Hindalco extracts silver as a by-product during smelting of imported copper concentrates at Dahej in Gujarat.

The installed capacity for recovery of silver at various plants are: HCL 9.9 tpy; HZL 168 tpy and Hindalco 150 tpy. The HZL aims to produce 500 tpy silver through revamp of operations at their Sindesar Khurd Mine. The Company has commissioned a 1.5 million tpy concentrator at the mine. The hundred thousand tpy lead smelter and 16 million oz per annum (about 497.6 tpy) of silver processing plant was likely to be completed in the first quarter of 2011-12. The work on development of the greenfield Kayar lead-zinc mine was also on schedule.

RESOURCES

As per the UNFC system, the total resources of silver ore in the country as on 1.4.2010 were estimated at about 466.98 million tonnes. Out of these, 187.56 million tonnes were placed under reserves category and 279.42 million tonnes under the 'remaining resources' category.

The total resources of silver in the country as on 1.4.2010 in terms of metal were estimated at 27,628.25 tonnes, comprising 8,039.57 tonnes under reserves and 19,588.68 tonnes under the 'remaining resources'.

By States, Rajasthan accounted for about 87% resources in terms of ore, Jharkhand 5%, Andhra Pradesh 4% and Karnataka 2%. Madhya Pradesh, Uttarakhand, Odisha, Meghalaya, Sikkim, Tamil Nadu and Maharashtra together shared 2% ore resources (Table - 1).

EXPLORATION AND DEVELOPMENT

During 2010-11, DMG, Rajasthan, continued the exploration intiated in 2008-09 in Rajsamand district for base metals and noble metals, especially gold and silver. DMG, Rajasthan, also carried out exploration in Sirohi district for noble metals (gold and silver). Details of the above explorations are given in Table - 2.

PRODUCTION

Silver was recovered as a by-product from lead and zinc concentrates and copper slime and

Table – 1 : Reserves/Resources of Silver as on 1.4.2010 (By Grades/States)

(In tonnes)

	Reserves				Remaining resources								Total resources (A+B)
	Proved STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
		STD121	STD122			STD221	STD222						
All India : Total													
Ore	**46109414**	**17655843**	**123793411**	**187558668**	**3375000**	**1048700**	**5404862**	**11140000**	**86286000**	**172171729**	**-**	**279426291**	**466984959**
Metal	**1591.85**	**1949.65**	**4498.07**	**8039.57**	**270.00**	**27.60**	**54.30**	**1045.40**	**6212.66**	**11978.72**	**-**	**19588.68**	**27628.25**
Andhra Pradesh													
Ore	-	-	-	-	-	-	-	-	-	16950000	-	16950000	16950000
Metal	-	-	-	-	-	-	-	-	-	128.13	-	128.13	128.13
Jharkhand													
Ore	-	-	-	-	-	-	-	-	-	23840000	-	23840000	23840000
Metal	-	-	-	-	-	-	-	-	-	5.22	-	5.22	5.22
Karnataka													
Ore	8681065	-	-	8681065	-	-	69462	-	-	314150	-	383612	9064677
Metal	2.67	-	-	2.67	-	-	0.48	-	-	2.92	-	3.40	6.07
Madhya Pradesh													
Ore	-	-	-	-	-	-	-	-	2096000	1120000	-	3216000	3216000
Metal	-	-	-	-	-	-	-	-	150.61	9.25	-	159.86	159.86
Maharashtra													
Ore	-	-	-	-	-	-	-	-	-	235000	-	235000	235000
Metal	-	-	-	-	-	-	-	-	-	0.23	-	0.23	0.23
Meghalaya													
Ore	-	-	-	-	-	-	-	-	880000	-	-	880000	880000
Metal	-	-	-	-	-	-	-	-	19.80	-	-	19.80	19.80

(Contd.)

Table - 1 (Concld.)

	Reserves				Remaining resources								Total resources (A+B)
	Proved STD111	Probable STD121	Probable STD122	Total (A)	Feasibility STD211	Pre-feasibility STD221	Pre-feasibility STD222	Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
Odisha													
Ore	-	-	-	-	-	960500	119000	-	-	670000	-	1749500	1749500
Metal	-	-	-	-	-	27.34	3.40	-	-	34.17	-	64.91	64.91
Rajasthan													
Ore	37428349	17220000	123729631	178377980	3375000	88200	5216400	9240000	81580000	128042579	-	227542179	405920159
Metal	1589.18	1934.40	4498.03	8021.61	270.00	0.26	50.42	883.80	6022.18	11757.93	-	18984.59	27006.20
Sikkim													
Ore	-	435843	63780	499623	-	-	-	300000	-	150000	-	450000	949623
Metal	-	15.25	0.04	15.29	-	-	-	27.60	-	13.80	-	41.40	56.69
Tamil Nadu													
Ore	-	-	-	-	-	-	-	-	330000	460000	-	790000	790000
Metal	-	-	-	-	-	-	-	-	15.87	26.68	-	42.55	42.55
Uttarakhand													
Ore	-	-	-	-	-	-	-	1600000	1400000	390000	-	3390000	3390000
Metal	-	-	-	-	-	-	-	134.00	4.20	0.39	-	138.59	138.59

Figures rounded off.

as a co-product of gold refining.

During 2010-11, the production of silver at 1,48,288 kg increased by 7% as compared to the the previous year due to higher recovery of silver at Chanderiya. The production of silver from gold refining was 206 kg in 2010-11 as against 230 kg in 2009-10 one private sector and one public sector undertaking each reported production of silver in 2010-11 (Tables-3 to 5)

In addition, Hindalco Industries Ltd recovered 44,876 kg and 45,073 kg silver from imported copper concentrates in 2009-10 and 2010-11, respectively.

Table-2 : Details of Exploration Activities for Silver, 2010-11

Agency/ State/ District	Location/ Area/ Block	Mapping		Drilling		Sampling (nos.)	Remarks
		Scale	Area (sq. km)	No. of bore holes	Meterage		
DMG Rajasthan Rajsamand	Near village Sunarkui Tehsil- Bhim	-	-	1	72	-	Indication of base metal minralisation is revealed along a thin ferruginous sheared, gossan zone, within dolomite exposed for more than 1500 m strike length
Sirohi	About 50 km From Sirhoi, Tehsil Pindwara	1:10,000	10	-	-	20	Malachite staining was seen about ½ km north of village watera at places in rocks of Delhi Super Group. A number of gossan patches with malachite staining and slag debris were seen in the north of Chanvarli near village Haren.

Table – 3 : Principal Producers of Silver, 2010-11

Name & address of the producer	Name of Plant	Location of the plant	
		State	District
M/s Hindustan Zinc Ltd Yashad Bhavan Udaipur – 313 001.	Chanderiya	Rajasthan	Chittorgarh
The Hutti Gold Mines Co. Ltd, No. 6/13, Guruappa Avenue Primrose Road Cross Bengaluru – 560 025.	Hutti	Karnataka	Raichur

Table – 4 : Production of Silver, 2008-09 to 2010-11
(By States*)

(Qty in kg; value in ₹'000)

State	2008-09		2009-10		2010-11(P)	
	Qty	Value	Qty	Value	Qty	Value
India	**105284**	**2147578**	**138780**	**3388694**	**148288**	**5437664**
Karnataka	229	5216	230	5770	206	7596
Rajasthan	105055	2142362	138550	3382924	148082	5430068

* *According to location of final processing/extraction plant.*
Excludes by-product recovery of silver by Hindalco Industries Ltd at Dahej, Gujarat from imported copper concentrates.

Table – 5 : Production of Silver*, 2009-10 and 2010-11
(By Sectors/States/Districts)

(Qty in kg; value in ₹'000)

State/District	2009-10		2010-11(P)	
	Quantity	Value	Quantity	Value
India	**138780**	**3388694**	**148288**	**5437664**
Public sector	230	5770	206	7596
Private sector	138550	3382924	148082	5430068
Karnataka	**230**	**5770**	**206**	**7596**
Raichur	230	5770	206	7596
Rajasthan	**138550**	**3382924**	**148082**	**5430068**
Chittorgarh	138550	3382924	148082	5430068

** Silver is a by-product*
(i) In Karnataka, it is recovered during refining of gold from Hutti and Uti gold ores in Raichur district.
(ii) In Rajasthan, it is recovered at Chanderiya lead-zinc smelter of HZL.
Excludes by product recovery of 44,876 kg and 45,073 kg silver by Hindalco Industries Ltd at Dahej, Gujarat from imported copper concentrates during 2009-10 and 2010-11, respectively.

WORLD REVIEW

The total reserves of silver are estimated at 530,000 tonnes. Peru, Poland, Chile, Australia, China and Mexico are the main countries having silver reserves (Table-6). Major part of the reserves is associated with base metals, such as copper, lead and zinc.

Mexico, Peru, China, Australia, Chile, USA, and Bolivia are the main producers of silver. The global primary as well as by-product mine output rose to 23,713 tonnes of contained metal in 2010 from 22,186 tonnes in the previous year. World mine production of silver is given in Table-7.

Argentina

Pan American Silver Corp. (Vancouver), the world's second leading primary silver producer reported a 4% increase in silver production at its Manantial Espejo Mine. The Company also completed assessment for its Navidad silver deposit, which contained 2,100 tonnes of measured and indicated reserves.

Australia

Australia is the fourth lagest producer of silver with 1,880 tonnes of silver produced in 2010. Its production increased by 15% as compared to the previous year. BHP Billiton's Cannington Mine became the world's leading producer of silver as a principal product in 2010.

Bolivia

Coeur d'Alene Mines Corporoation began mining silver-rich gravels which are above the 4,400 m level at its San Bartolome mine. Pan American Silver reported proven and probable reserves of 650 tonnes of silver at its San Vincente Mine, and silver production increased by15% to 94 tonnes in 2010.

China

Silver production from China, the world's third leading silver producer, increased to 3,500 tonnes by 21% as compared to the previous year. Silver was produced mainly as a by product from copper or lead and zinc mining.

Mexico

In 2010, Mexico became world's leading producer of silver as its production increased by 24% to 4,411 tonnes. The Palamarejo mine, commissioned in 2009, operated by Coeur d'Alene Mines Corporation began production of gold and and silver in second quarter of 2009. Production at Palamarejo mine increased by 89% to 180 tonnes in 2010.

Peru

Peru was the world's second ranked silver producer in 2010. Hochchild Mining's Pallancanta Mine, Compañía de Minas Buenaventura's Uchucchacua Mine and Hochchild's Arcata Mine, are among the 10 leading silver mines in the world.

Table – 6 : World Reserves of Silver*
(By Principal Countries)

(In tonnes of metal content)

Country	Reserves
World : Total (rounded)	**530000**
Australia	69000
Bolivia	22000
Canada	7000
Chile	70000
China	43000
Mexico	37000
Peru	120000
Poland	85000
USA	25000
Other countries	50000

Source: *Mineral Commodity Summaries, 2012.*
** Includes silver recoverable from base metal ores.*

Table – 7 : World Mine Production of Silver
(By Principal Countries)

(In tonnes of metal content)

Country	2008	2009	2010
World : Total	**21460**	**22186**	**23713**
Argentina	356	415	694
Australia	1926	1631	1880
Bolivia	1114	1326	1259
Canada	755	618	596
Chile	1405	1301	1287
China^{e}	2800	2900	3500
Kazakhstan *	646	614	549
Mexico	3236	3554	4411
Peru	3686	3923	3637
Poland	1161	1150	1175
Russia *	1132	1313	1145
USA	1250	1245	1280
Other countries	1993	2196	2300

Source: *World Mineral Production, 2006-2010.*
** Smelter and/or refinery production.*

FOREIGN TRADE

Exports

In 2010-11, there were no exports of silver ores and concentrate. Exports of silver in 2010-11 decreased to 55 tonnes from 62 tonnes in the preceding year. Exports were mainly to USA and Belgium. Besides, 422 kg silver-clad base metals were also exported during 2010-11 (Tables 8 and 9).

Imports

Imports of silver were 2,656 tonnes in 2010-11 against 2,075 tonnes in the previous year. Imports were mainly from Chinese Taipei/Taiwan and China (25% each), Hongkong (11%), UK and Russia (9% each) and Switzerland (7%). Imports of silver-clad base metals were 5 kg in 2010-11 as against 31 kg in the previous year. Germany was the sole supplier (Tables 10 and 11).

Table – 8 : Exports of Silver
(By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**62**	**4263083**	**55**	**1146411**
USA	15	339229	32	718639
Belgium	++	120	14	222289
Italy	3	56817	3	50512
Australia	1	16327	1	40782
Germany	++	929	1	26259
Canada	++	2803	1	18030
Iran	–	–	++	11543
France	++	4754	2	9856
Sweden	1	15143	1	8664
UK	3	26958	++	5932
Other countries	39	3800004	++	33905

Table – 9 : Exports of Silver-clad Base Metals (By Countries)

Country	2009-10 Qty (kg)	2009-10 Value (₹'000)	2010-11 Qty (kg)	2010-11 Value (₹'000)
All Countries	**26**	**34**	**422**	**2242**
USA	_	_	137	1164
UK	25	26	32	1040
Yemen Republic	_	_	251	28
Belgium	_	_	2	9
Other countries	1	8	++	1

Table – 10 : Imports of Silver (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**2075**	**45636507**	**2656**	**89531561**
Chinese Taipei/Taiwan	330	7670743	676	22944791
China	292	6975271	656	21510010
Hong Kong	222	5043947	281	10109970
UK	285	6479946	245	8620110
Russia	161	3801297	227	7886124
Switzerland	248	5911807	174	6072896
Germany	9	196198	51	1893083
U A E	131	3130020	49	1740477
Korea, Rep. of	100	2191171	39	1484929
Japan	6	138331	47	1271041
Other countries	291	4097776	211	5998130

Table – 11 : Imports of Silver-clad Base Metals (By Countries)

Country	2009-10 Qty (kg)	2009-10 Value (₹'000)	2010-11 Qty (kg)	2010-11 Value (₹'000)
All Countries	**31**	**223**	**5**	**148**
Germany	-	-	5	148
Other countries	31	223	-	-

FUTURE OUTLOOK

India is the largest importer and largest consumer of silver in the world. The average domestic consumtion of silver in the country is on an average about 3,000 tonnes per annum. Considering the current pattern of utilisation of silver in the country and the anticipated increase in the GDP, the future demand for silver is likely to exceed 6,000 tonnes per annum by 2017 as per the report of the Working Group on Mineral Exploration And Development (Other than Coal & Lignite) for the XII Five Year Plan (2012-2017).

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

SLAG – IRON AND STEEL

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

71 Slag - Iron and Steel

Slag is a by-product generated during manufacturing of pig iron and steel. It is produced by action of various fluxes upon gangue materials within the iron ore during the process of pig iron making in blast furnace and steel manufacturing in steel melting shop. Primarily, the slag consists of calcium, magnesium, manganese and aluminium silicates in various combinations. The cooling process of slag is responsible mainly for generating different types of slags required for various end-use consumers. Although, the chemical composition of slag may remain unchanged, physical properties vary widely with the changing process of cooling.

PRODUCTION

The slag produced at blast furnace during pig iron manufacturing is called blast furnace slag. The slag produced at steel melting shop is known as steel slag. Slag output obtained during pig iron and steel production is variable and depends mainly on composition of raw materials and type of furnace. Typically, for ore feed containing 60 to 65% iron, blast furnace (BF) slag production ranges from about 300 to 540 kg per tonne of pig or crude iron produced. Lower grade ores yield much higher slag fractions, sometimes as high as one tonne of slag per tonne of pig iron produced. Steel slag output is approximately 20% by mass, of the crude steel output. Data on plantwise average generation of slag in 2009-10 and 2010-11 are given in Table-1.

As per the Report of the Working Group on Cement Industry for the 12th Plan , around 10 million tonnes BF slag is c urrently generated in the country from iron & steel industry.

The information regarding capacity and production of iron and steel slag obtained from different plants in the country is given in Table - 2.

Blast Furnace Slag

At blast furnace, the slag floating over molten pig iron (hot metal) is flushed out in slag pot and then sent to slag granulating plant or to cooling pits.

Depending upon the cooling process, three types of slags are generated; namely, air-cooled slag, granulated slag and expanded slag.

Air-cooled slag is produced by allowing the molten slag to cool under atmospheric conditions in a pit. Under slow cooling conditions, escaping gases leave behind porous and low-density aggregates with special physical properties, making it suitable for many applications. When formed under controlled cooling, the slag tends to be hard and dense, making it especially suitable for use in road base and similar applications in construction.

Granulated slag is produced by quenching the molten slag by means of high-pressure water jets. Quenching prevents crystallisation, thus resulting in granular, glassy aggregates. This slag is crushed, pulverised and screened for use in various applications, particularly in cement production because of its pozzolanic characteristics.

Table – 1: Plantwise Average Generation of Slag 2009-10 and 2010-11

(In kg/tonne of hot metal)

Steel plant	Production	
	2009-10	2010-11
Bhilai Steel Plant, Durg, Chhattisgarh.	395	399
Bokaro Steel Plant Bokaro, Jharkhand	380	370-380
Rourkela Steel Plant, Rourkela, Odisha.	NA	NA
Visvesvaraya Iron & Steel Plant, Bhadravati, Karnataka.	318	NA
Durgapur Steel Plant, Durgapur, West Bengal.	NA	NA
IISCO Steel Plant, Burnpur, West Bengal.	503	NA
IDCOL Kalinga Iron Works Ltd, Barbil, Odisha.	NA	0.380
JSW Steel Ltd, Bellary, Karnataka.	NA	NA
Neelachal Ispat Nigam Ltd. Kalingnagar, Duburi, Odisha	273	287
Rashtriya Ispat Nigam Ltd, Visakhapatnam, Andhra Pradesh.	310	320
Tata Steel Ltd, Jamshedpur, Jharkhand.	279	274
VISA Steel Ltd. Kalingnagar,Odisha.	16	NA

Steel plants utilise cold slag for internal consumption and also for outside sale. The slag after cooling, is crushed and used as road metal and railway ballast. Granulated slag produced in steel plants is also sold outside to cement

Table – 2 : Plantwise Capacity and Production of Slag, 2008-09 to 2010-11

(In '000 tonnes)

Steeel Plant	Capacity for granulation ('000 tpy)	Production								
		2008-09			2009-10			2010-11		
		BF	Granulated	Steel	BF	Granulated	Steel	BF	Granulated	Steel
Bhilai Steel Plant, Durg, Chhattisgarh.	2675	2093	1571	NA	2119	1709	NA	2280	1762	NA
Bokaro Steel Plant, Bokaro, Jharkhand.	5000	1516	756	378	1550	819	384	1593	694	372
Rourkela Steel Plant, Rourkela,Odisha.	600	NA	NA	NA	NA	NA	NA	NA	NA	NA
Durgapur Steel Plant, Durgapur, West Bengal.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
IISCO Steel Plant Burnpur, West Bengal.	400	284	164	NA	253	152	NA	NA	NA	NA
Visvesvaraya Iron & Steel Plant, Bhadravati, Karnataka.	68	40	69	20	41	10	21	NA	NA	NA
Rashtriya Ispat Nigam Ltd, Visakhapatnam, Andhra Pradesh.	1440	1230	381	NA	1209	1334	NA	1224	1336	NA
IDCOL Kalinga Iron Works Ltd, Barbil,Odisha.	53	31	26	NA	31	25	NA	20	16	NA
JSW Steel Ltd, Bellary, Karnataka.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tata Steel Ltd, Jamshedpur, Jharkhand.	2100	1814	1812	1131	NA	2058	85	NA	2287	301
Visa Steel Ltd, Kalinganagar, Odisha	175	NA	14	NA	NA	16	NA	NA	9	NA
Neelachal Ispat Nigam Ltd Kalinganagar, Odisha	-	-	-	-	196	232	-	184	203	-

Table – 3 : Despatches of Granulated Slag 2008-09 to 2010-11

(In '000 tonnes)

Steel plant	2008-09	2009-10	2010-11
Bhilai Steel Plant, Durg, Chhattisgarh.	1683	1654	1741
Bokaro Steel Plant Bokaro, Jharkhand	761	809	670
Rourkela Steel Plant, Rourkela, Odisha.	NA	NA	NA
Durgapur Steel Plant, Durgapur, West Bengal.	NA	NA	NA
IISCO Steel Plant, Burnpur, West Bengal.	179	170	NA
Visvesvaraya Iron & Steel Co. Ltd, Bhadravati, Karnataka.	69	10	NA
JSW Steel Ltd, Bellary, Karnataka.	NA	NA	NA
Rashtriya Ispat Nigam Ltd, Visakhapatnam, Andhra Pradesh.	1480	1563	1321
IDCOL, Kalinga Iron Works Ltd, Barbil, Odisha.	37	25	30
Tata Steel Ltd, Jamshedpur, Jharkhand	1614	2023	2153
Visa Steel Ltd, Kalinganagar,Odisha	16	32	5
Neelachal Ispat Nigam Ltd Kalinganagar, Odisha		190	215

plants. Despatches of granulated slag during 2008-09 to 2010-11 are furnished in Table-3.

Expanded slag is formed through controlled cooling of molten slag in water or water with combination of steam and compressed air. Formation of steam and other gases enhances the porosity and vesicular nature of slag, resulting in lightweight aggregate suitable for use in concrete. However, expanded slag is not produced at any domestic iron and steel plant.

A fourth product made from blast furnace slag is mineral wool/slag wool. Cooled slag for this purpose is melted and poured through an air stream or a jet of dried stream of other gases to produce a spray of molten droplets or the same may be formed by passing the melt through a perforated or fast-spinning disc. The droplets elongate to long fibres, which are collected mechanically and layered. The material has excellent thermal insulation properties.

Steel Slag

BOF slag, commonly known as steel slag is another waste from iron & steel industry. It has shown potential for use as a raw mix component up to 10% in the manufacture of cement clinker. Steel slag can also replace granulated blast furnace slag up to 10% in the manufacture of Portland Slag Cement. Steel slags are produced at steel melting shop during steel manufacturing. To produce steel, removal of excess silicon and carbon from iron is achieved through oxidation by adding limestone and coke. The steel slag contains higher amount of iron and its physical characteristics are similar to air-cooled iron slag. The LD slag is cooled, crushed and screened. The fines are utilised in sinter making and lumps are charged in the blast furnace.

The iron content is the major basic difference between BF slag and steel slag. In BF slag, FeO is around 0.5%, whereas, in case of steel slag, total iron content varies from 16 to 23%.

The chemical analysis of granulated BF slag and steel slag generated in steel plants are given in Table - 4.

Table – 4 : Chemical Composition of Slag Generated in Steel Plants

Name of plant	Slag	Chemical composition (%)								Physical properties
		SiO_2	Al_2O_3	CaO	MgO	MnO	FeO	S	Basicity (CaO/SiO_2)	
Bhilai Steel Plant, Durg, Chhattisgarh.	BF	34.52	20.66	32.43	10.09	0.23	0.57	0.77	–	–
	Steel	14.20	1.40	42.90	9.59	1.69	18.20	1.70	–	–
Bokaro Steel Plant, Bokaro, Jharkhand.	BF	35.75	22.08	30.00	8.46	0.07	0.25	0.88	–	Size : 0.6mm to 3.2 mm
	Steel	16.00 to 19.00	1.07 to 1.17	45.00 to 53.00	6.00 to 11.00	0.38	18.00 to 25.00	– –	– –	Size: 0-5 mm & 10-40 mm –
Rourkela Steel Plant, Rourkela, Odisha.	BF	33.15	22.33	30.78	10.78	0.18	0.51	0.52	–	–
Durgapur Steel Plant, Durgapur, West Bengal.	BF	33.02 to 33.23	21.75 to 22.03	32.36 to 32.55	9.08 to 9.16	– –	0.43 –	– –	0.97 to 0.98	Size : 3 mm –
	Steel	17.23	1.15	50.24	7.04	2.46	17.25	–	2.92	–
Visvesvaraya Iron & Steel Plant, Bhadravati, Karnataka.	BF	30.40 to 35.60	21.30 to 26.40	29.83 to 35.13	7.00 to 9.00	1.00 (max)	0.60 (max)	0.90 (max)	–	Size : 1 to 5 mm Lumps
	Steel	15.00	2.00	45.00	8.00	10.00	20.00	–	–	-
IISCO Steel Plant Burnpur, West Bengal.	BF	32.60	23.30	33.70	7.60	–	–	–	–	–
Rashtriya Ispat Nigam Ltd, Visakhapatnam, Andhra Pradesh.	BF	35.33	16.60	36.89	8.48	0.12	0.51	–	–	Size : -3 mm
	Steel	17.69	1.07	50.70	10.31	1.05	16.50	1.40	–	Size : +10 mm to (-)60 mm
IDCOL, Kalinga Iron Works Ltd, Barbil, Odisha.	BF	33.00 to 34.00	24.00 to 25.00	29.00 to 30.00	8.00 to 9.00	0.50 to 0.60	0.70 to 0.80	1.00	–	Size : 0 to 6 mm
Tata Steel Ltd, Jamshedpur, Jharkhand.	BF	34.5	20.8	34.3	7.3	0.052	0.6	-	–	-100 mesh to + 1 mm
	Steel	12.65	1.16	46.23	1.76	0.45	25.06 (Fe)	0.33	–	0 mm to +300 mm
JSW Steel Ltd, Bellary, Karnataka.	BF	35.20	19.00	34.90	8.76	0.14	0.039	–	–	–
Visa Steel Ltd, Kalinganagar, Odisha	BF	33.8	15.39	35.38	10.25	0.64	0.74	0.92	–	Size : 0-5 mm & 10-40 mm
Neelachal Ispat Nigam Ltd Kalinganagar, Odisha	BF	32.62	32.62	33.25	9.91	0.40	0.55	0.62	–	

USES

Different types of slags find different uses in the industry. The air-cooled BF slag is crushed, screened and used mainly as road metal and bases, asphalt paving, railway ballast, landfills and concrete aggregate. The expanded or foamed slag binds well with cement and is used mainly as aggregate for lightweight concrete. However, it is not produced by domestic steel plants. Granulated BF slag is used as a pozzolanic material for producing portland slag cement. It is also used for soil conditioning. BF slag is used in making mineral wool for insulation purposes.

Steel slag has found use as a barrier material remedy for waste sites where heavy metals tend to leach into the surrounding environment. Steel slag forces the heavy metals to drop out of solution in water runoff because of its high oxide mineral content. Steel slag has been used successfully to treat acidic water discharges from abandoned mines.

Slags are useful alternative raw material for clinker production and such use can reduce a cement plant's fuel consumption and overall emmission of carbon dioxide per tonne of cement.The granulated slag obtained from various steel plants is dried in slag dryer. The clinker is ground in ball mill with 40-50% dry slag and 6% gypsum. The resultant product is portland slag cement. Portland blast furnace slag cement contains up to 60% ground granulated slag from steel production processes.

Slag cement has low heat of hydration, low alkali aggregate reaction, high resistance to chlorides and sulphate and it can substitute the use of 43 and 53 grades of ordinary Portland Cement. For other consuming sectors like road making, landfilling and ballasting, the cooled slag is crushed by machines or broken manually by hammers into smaller pieces and supplied to the various end-use consumers.

CONSUMPTION

The BF slag in India is used mainly in the cement manufacture and in other unorganised work, such as, landfills and railway ballast. A small quantity is also used by the glass industry for making slag wool fibres. Cement plants in the country producing slag cement require BF slag in granulated forms. Almost entire granulated slag generated by steel plants was consumed by the Indian Cement Industry in 2010-11.

The chemical analysis of granulated slag consumed during the manufacture of slag cement is given in Table-5. An Expert Group has been constituted for development of specifications for ground granulated slag for use in concrete making and oher applications.

PRICES

The prices of BF slag vary from plant to plant. As per the information available with IBM, the price of BF slag, during 2010-11, varied from ₹ 422 to 983 per tonne. Depending upon the distance between cement plants and the steel plants, much variation is observed in prices of granulated slag. The prices of granulated slag at cement factories in 2010-11 is given in Table-6.

RESEARCH & DEVELOPMENT

Increased utilisation of granulated slag benefits the portland cement producers. Producers can enhance the production capacity without additional greenhouse gas emissions like carbon dioxide.

A new granulator has been developed to cut the energy cost for granulation. This granulator consists of a variable speed rotating cup atomizer to break up the molten slag by centrifugal force and distribute it within a water-cooled cylindrical chamber. The process cools the molten slag rapidly enough to create small granules, thus minimising the need for additional crushing and grinding. Moreover, the new system offers the possibility of considerable energy recycling in the form of hot water or heated air.

Texas Industries Inc.has developed a process called Chem Star for cement clinker production. The process involves the use of steel slag. In this process, steel slag is fed into the rotary clinker kiln as a part of the raw material mix. Texas Industries Inc. claimed that clinker production could be enhanced by 15% by using this process. Commonwealth Scientific & Industrial Research Organisation (CSIRO) carried out investigations for value-added method for slag and proved a number of technically viable and commercially interesting applications of slag. The applications include (i) base course and top course for asphalt roads, (ii) anti-skid surfacing for roads on accident-prone intersections, (iii) low-strength concrete for footpaths, (iv) controlled low strength fill for backfill required for trench stabilisation and (v) concrete sub-base for rigid pavements.

Table – 5 : Analysis of Granulated Slag Consumed for the Manufacture of Slag Cement

Cement plant	Analysis in %								
	SiO_2	Fe_2O_3 / FeO	MgO	Al_2O_3/ MnO_2	CaO	S/SO_3	MnO	Insoluble residue	Glass content & size
ACC, Jamul, Durg, Chhattisgarh.	33.0 to 33.4	1.0 to 1.4	9.0 to 9.8	21.5 to 22.4	33.0 to 33.8	0.40 to 0.48	–	–	
ACC, Jhinkpani, W. Singhbhum, Jharkhand.	32.80	0.4	7.2	23.3	32.6	0.80	–	0.80	>79%
ACC Ltd, Bargarh Cement Works, Bardol, Bargarh, Odisha.	33.69	0.63	9.07	19.38/ 0.61	35.13	0.58	–	-	-
Andhra Cements Ltd, Visakhapatnam, Andhra Pradesh.	33.32 to 35.19	0.46 to 0.50	8.86 to 9.91	17.98 to 19.35	34.75 to 35.98	–	0.10 to 0.16	–	–
Century Cement, Baikunth, Raipur, Chhattisgarh.	–	–	5.5 (max)	17.0 (max)	–	2.0 (max)	–	–	–
Penna Cement Industries Ltd, Anantapur, Andhra Pradesh.	32.00	3.50	10.0	18.50	34.92	–	–	–	size : 0-2 mm
Shri Durga Cement Co. Ltd, Hazaribagh, Jharkhand.	30.00	0.80	8.00	24.00	34.00	0.80	0.2	2.4	–

Table – 6 : Prices of Granulated Slag at Cement Factories, 2010-11

Cement plant	₹/tonne	Source of supply
ACC, Jamul, Durg, Chhattisgarh.	422	Bhilai Steel Plant, Durg, Chhattisgarh and others.
Century Cement, Baikunth, Raipur, Chhattisgarh.	696	Bhilai Steel Plant, Durg, Chhattisgarh.
Dalmia Cement (Bharat) Ltd, Dalmiapuram, Tiruchirapalli, Tamil Nadu	984	–
OCL India Limited, Rajgangpur, Sundergarh, Odisha	795	Rourkela Steel Plant, Bhilai Steel Plant, Jindal Steel & Power Ltd, Raigarh, Adhunik Metaliks, Chandharipur, Vizag, Anapurna Mktg & AE, Hare Krishna Mineral Co.
Bagalkot Cement & Industries Ltd, Bagalkot, Karnataka.	732 700 671	i) JSW Steel Ltd, Bellary, Karnataka. ii) Kalyani Steel Ltd, Hospet, Karnataka iii) Kirloskar Ferrous India Ltd, Hospet, Karnataka
Penna Cement Industries Ltd, Boyareddipalli Anantapur (Andhra Pradesh).	789	JSW Cement Ltd, Chennai JSW Steel Ltd, Chennai
Malabar Cements Ltd Palakkad, Kerala	994	Jintal, Mettur

The ASA Association annually undertakes an Environmental Monitoring Programme (EMP) to monitor and assess the iron & steel slag (ISS) produced, processed and sold by its members. The programme invovles testing slag samples from member sites for their Total Metal (TM) concentration and wherever necessary, undertaking Toxicity Characteristic Leaching Procedure (TCLP) on the sample required and comparing the results against jurisdictional government regulations.

The National Slag Association has proved that iron & steel slag pose no threat to human health or to the environment. Iron & steel slags have been extensively tested using certified laboratories following USEPA and American Society for Testing materials (ASTM) procedures.

Environmental Scientists and toxicologists completed an industrywise "Human Health and Ecological Risk Assessment (HERA) which demonstrated that iron & steel slag poses no meaningful threat to human health or environment when used in a variety of residential, agriculture, industrial and construction application. Consequently the metals in the slag matrix are not readily available for uptake by human, other animals or plants, do not bioaccumulate in the foodweb and are not expected to bioconcentrate in plant tissue. Iron & steel slag may be applied safely in aquatic enivornment, such as rivers, lakes or streams without impacting water quality or aquatic life.

The study carried out by an independent nationally renownd chemical laboratory as demonstrated that blast furnace and steel slag does not pose any threat to human or plant life. The study further revealed that the use of slag has very positive environmental benefits. The use of slag in cement manufacturing significantly decrease CO_2 emmission and reduce the energy neeeded to calcine limestone. The use of slag as agregate reduces the need for virgin material and the energy use and emission produced during the mining, processing and transportation of those material.

The Working Group on Cement for 12th Plan has indentified potential areas for R&D in the Plan period. Some of these which could benefit the cause of utilisation of slags in cement industry are - use of steel slag in road construction; use of non-conventional slags from different metallurgical industries in the manufacture of cement; and activated slag cement and tiles/bricks/blocks from slag.

FOREIGN TRADE

Exports

Exports of slag (dross, etc.) in 2010-11 increased sharply to about 1,022 thousand tonnes by 53% from 670 thousand tonnes in the previous year. Exports were mainly to China (95%) and Japan (4%) (Table-7).

Imports

The imports of slag also increased manifold to 41,040 tonnes in 2010-11 from 6,497 tonnes in the previous year. Imports were almost mainly from Japan (Table - 8).

Table – 7 : Exports of Slag(Dross etc. from Iron & Steel excl. Granulated)
(By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**669607**	**1752831**	**1021662**	**4368981**
China	602120	1617609	969736	4160585
Japan	23868	50031	38001	148150
Saudi Arabia	-	-	12300	54961
Philippines	-	-	350	1707
Nepal	13138	9148	567	1262
Sudan	-	-	216	997
Italy	-	-	162	656
Oman	100	502	245	440
Kuwait	100	266	56	168
Djibouti	26	41	27	44
Other countries	30255	75234	2	11

Table – 8 : Imports of Slag
(Dross etc. from Iron & Steel excl. Granulated)
(By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**6497**	**29299**	**41040**	**269035**
Japan	6457	29037	41038	269016
China	–	–	2	19
Other countries	40	262	–	–

FUTURE OUTLOOK

Slag is used as substitute to precious clinker. This slag otherwise would have been a waste and used as a filler material. Slag, if used properly, will conserve valuable limestone deposits required for production of cement.

Portland Slag Cement (PSC) has advantages of better performance, durability and optimal production cost, besides being eco-friendly. Blended cements like PSC have multiple benefits of tangible and intangible dimensions. India is having huge slag production capacity of 10 million tonnes per annum at existing steel plants. Indian cement industry is consuming almost the entire granulated slag produced and can consume up to 70% of the blast furnace slag generated. At present, blended cement production is around 75% of total cement production. There is scope for further consumption of granulated slag in order to enhance the total production of cement.

The total cement production capacity commissioned at the end of 11th Plan by 2011-12 is 331 million tpy, about 10% higher than the Plan target. By the end of 12th Plan by 2016-17, an additional capacity of 139.7 million tpy is expected to be added. This will substantially increase the potential for use of slag in the cement anufacture.

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

SLATE, SANDSTONE & OTHER DIMENSION STONES

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

72 Slate, Sandstone & Other Dimension Stones

The principal rock types used as dimension stones other than granite and marble are slate, sandstone, limestone and quartzite. India is endowed with abundant resources of these types of dimension stones which are increasingly used domestically. These stones are also important export commodities. India is one of the largest producers of dimensional stones in the world.

1. Slate

Slate is a low-cost decorative stone used for exterior and interior decoration of buildings. It is one of the important materials used for roofing. Slate is a fine-grained, very low-to-low metamorphic rock possessing a well developed fissility (splitting attitude) parallel to the planes of slaty cleavage. It has been formed by the metamorphism of pre-existing clay rocks such as claystone, shale or siltstone. The most remarkable feature of this rock is that it has very marked cleavage planes which enable it to be split manually or mechanically into relatively thin slabs. Slate is used as school slate and also as building dimension stone. Slate has the aesthetic value like other dimension stones, granite and marble. Slate has emerged as a low cost alternative to granite and marble which are comparatively expensive. The exports of slate have increased over the years resulting in a boost to slate mining industry in the country. Micaceous and chlorite slates are generally preferred.

OCCURRENCES

The Aravalli Mountain ranges in Rajasthan and Haryana; rock assemblages under Cuddapah System in Andhra Pradesh and Tamil Nadu; and Himalayan region in Northern India have undergone metamorphism and given rise to the slate deposits along with other metamorphosed products. The availability of slates has been reported from Madhya Pradesh, Haryana, Himachal Pradesh, Jharkhand, Andhra Pradesh, Rajasthan, Uttarakhand, Bihar and Gujarat.

RESOURCES

An attempt has been made to prepare inventory of slate. This may not be complete. The total resources of slate as on 1.4.2010 as per UNFC system are placed at 2.4 million tonnes under unclassified grade. All the resources are located in Andhra Pradesh (Table - 1) .

PRODUCTION, STOCKS & PRICES

There was no production of slate during the year 2009-10 and 2010-11. The production in 2008-09 was 8,931 tonnes and there were two reporting mines in 2008-09 (Table - 2).

Value of production of slate (as dimension stones) decreased to ₹222.1 lakh in 2009-10 from ₹301.7 lakh in the previous year as per the data available (Table-4).

Table - 1 : Reserves/Resources of Slate as on 1.4.2010
(By Grades / States)

(In '000 tonnes)

	Reserves Total (A)	Remaining Resources					Total Resources (A+B)
		Feasibility STD211	Pre-feasibility STD221	Pre-feasibility STD222	Inferred STD333	Total (B)	
All India : Total	-	-	**113**	**1187**	**1069**	**2369**	**2369**
By Grade							
Unclassified	-	-	113	1187	1069	2369	2369
By State							
Andhra Pradesh	-	-	113	1187	1069	2369	2369

Figures rounded off

Table – 2: Production of Slate, 2008-09 to 2010-11
(By States)

(Qty in tonnes; value in ₹'000)

State	2008-09		2009-10		2010-11 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**8931**	**5552**	–	–	–	–
Andhra Pradesh	22	–	–	–	–	–
Madhya Pradesh	8920	5530	–	–	–	–

Table – 3: Production of Slate - Dimension Stone, 2007-08 to 2009-10
(By States)

(Qty in tonnes; value in ₹ '000)

State	2007-08		2008-09		2009-10	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**92835**	**37012**	**64286**	**30169**	**59469**	**22209**
Andhra Pradesh	83270	26821	55400	19629	46854	18261
Himachal Pradesh	6762	9467	7417	10198	9190	1838
Jammu & Kashmir	110	10	174	13	192	1440
Rajasthan	2693	714	1359	329	3233	670

MINING AND PROCESSING

Mining of slate is done by opencast method. The slate bands are exposed by removing the overburden by means of drilling and controlled blasting. The mining in many places is carried out by manual means but in some mines, semi-mechanised method of mining is also adopted. After removing a thick slab of slate, preferably of larger size, the slab is split using hammers and specially-made chisels and cutting knives. The saleable tile or slab of slate is obtained in 6 to 10 mm thickness for cladding and 20 to 35 mm thickness for flooring or for panels. The edges are cut manually by using machines to have a smooth and regular edge. The slate as building stone is marketed under the commercial names, such as Golden Copper, Green, Black, Panther, Mica, Speckled, Deoli, Mahi, Silver Grey and Peacock. Peacock is the only premier variety produced in Kund area, Haryana.

The overall recovery of slate is very low, being a fragile material among all the building/ dimension stones. Normally, huge accumulation of broken pieces in and around the slate quarry is observed incidental to mining & processing. Proper mining and processing techniques by using modern equipment may improve the situation in future.

USES AND SPECIFICATIONS

There are two main uses or applications of slate as a natural stone in building work: 1) for roofing in the form of roofing tiles, and 2) for flooring in the form of tiles and for cladding purposes.

For roofing tiles, the slate should be exfoliated easily and it should be free from minerals like iron sulphides or carbonates which in time could cause corrosion and staining on roofing tiles. For cladding or flooring purposes, the slate should be able to bear the cutting processes in required sizes, polishing or smoothening process by machines and should not peel off during the process of fixing or laying. Bureau of Indian Standard has laid down Standard IS : 6250-1981 (First revision; reaffirmed 2008) namely, Specification for roofing slate tiles (First revision) in respect of requirement of dimensions, physical properties and workmanship of slate tiles used for sloped roof covering.

2. Sandstone

Sandstone is a sedimentary rock largely made up of sand grains in size ranging from 2 mm to 120 mm of varying compositions. The sand may consist of grains of quartz, felspar and other detrital minerals with interstitial cementing material. The composition of sand particles and the cementing material, by and large, defines the colour of sandstone while the mode of formation decides the thickness of bed which gives rise to various types of sandstones.

The colour of sandstone may range from dark red to brown, earthy to buff, white, yellow and a number of other shades. The pattern of the sandstone depends upon the thickness of bed. Sandstone produced in the country is being marketed as Vindhyan Red, Rainbow, Teak, Modak, Bundi, Bansi Pink, Mandana, Dholpur Cream, etc. The sandstone may occur as massive, thick, non-splittable bands or thin beds or layers that can be split by applying slight pressure.

RESOURCES

The occurrences of sandstone in India are spread over Andhra Pradesh, Assam, Bihar, Gujarat, Haryana, Madhya Pradesh, Meghalaya, Mizoram, Karnataka, Odisha, Punjab, Rajasthan, Uttar Pradesh, Tamil Nadu and West Bengal.

The resource estimation has not been considered important because of its abundance and easy availability. Hence, there is no comprehensive inventory of sandstone. However, the Centre for Development of Stones (CDOS), a Government of Rajasthan undertaking has reported estimated reserves of sandstone at over 1,000 million tonnes in the country. Huge deposits of sandstone in Rajasthan are associated with Vindhyan and Trans-Aravalli Formations, exposed over an area of nearly 35,000 sq km covering districts of Dholpur, Bharatpur, Karauli, Sawai Madhopur, Tonk, Bundi, Jhalawar, Kota, Bhilwara and Chittorgarh. It is also found scattered in the districts of western desert plane. Splittable sandstone deposits are confined to an area of 16,000 sq km out of which 10,000 sq km lies in eastern and south-eastern Rajasthan and 6,000 sq km in western Rajasthan.

In Gujarat, fine to medium-grained sandstone of varying colours ranging from white, light-purplish, reddish-brown, cream to yellow are found in the district of Kachchh. A brownish-yellow sandstone occurs near Chabari and Mainapara in Bhachau tehsil. The sandstone at Rampur, Katada-Roha and Rajoda Dungar near Mangwana in Nakhtrana tehsil is cream coloured and is fairly hard. Extensive deposits are found around Songir, Naswadi, Ghautoli, Namaria and Lachharas in Vadodara district.

The Vindhyan and Satpura Mountains in Madhya Pradesh have vast resources of sandstone. The red, cream and white sandstone are being quarried extensively in Panna and Shivpuri districts and in many areas near Jabalpur.

In Uttar Pradesh, sandstones suitable for making slabs and tiles are located in Agra, Mirzapur, Lalitpur, Allahabad and Sonbhadra districts. The sandstone of Lalitpur district is yellow, light green and maroon and takes good polish. The sandstone in Lalitpur occurs in Madanpur and Rampura (near Deogarh) areas and is traded under the commercial name Royal Gold, Beach Sand and U.P. Green. The sandstone of Agra occurring in Tatpur area is red and mottled and is used for interior as well as exterior flooring and cladding. In Mirzapur and Sonbhadra areas, good quality buff to pale and creamish sandstone is available.

The felspathic sandstone occurring with the coal seams as overburden is also used as building stone. The Kamthi Sandstone occurring in and around tehsil Saoner, district Nagpur in Maharashtra, is being quarried in huge quantities and is used as building stone.

EXPLORATION & DEVELOPMENT

The DMG, Rajasthan, has carried out exploration for sandstone and masonry stone. The details of exploration are given in Table -4.

Table – 4: Details of Exploration Activities conducted for Sandstone, 2010-11

Agency/State/ District	Location/ Area	Mapping		Drilling		Sampling (No.)	Remarks/ Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
DMG Rajasthan							
Alwar	N/v Guwalda, Teh. Tijara,	1:50,000 1:10,000 1:4,000	180.0 10.0 0.50	–	–	18	Masonry stone : Geologically the area comprises rocks of Ajabgarh group of Delhi super group. In the area quartzite is found as the dominating rock unit. About 3.375 million tonnes of Masonry stone were estimated.
Baran	N/v Nagda, Teh. Anta,	1:50,000 1:10,000 1:2,000	115.0 12.5 1.35	–	–	-	Inferred resources of about 37.5 million tonnes were estimated.
Dhaulpur	N/v Vijaipura, Badaria, Teh. Baseri,	1:10,000 1:4,000	20 03	–	–	24	About 2.59 million tonnes resources for sandstone (blockable) and 12.96 million tonnes of sandstone splittable were estimated.
Jodhpur	N/v Halodi, (Narva) , Panchla & Janiyon ki dhani, Ghudiyala, Suveri Sasan & Jiya beri.	1:50,000 1:10,000 1:2,000	150 10 2	13	15	12	Resources were not calculated
Kota	Khan-ki Jhonpariya Teh. Digod	-	-	-	-	-	Sandstone for masonary purpose was observed in a 2000m x 500m x 10m area.

PRODUCTION

Data on production of sandstone are not available. However, Rajasthan may be producing about 90% of sandstone in the country used for building purposes and as road metal along with quartzite. Production value of quartzite and sandstone as available is given in Table-5.

Table – 5 : Value of Production of Quartzite & Sandstone*, 2007-08 to 2009-10 (By States)

(In ₹'000)

State	2007-08	2008-09	2009-10(P)
India	**3482070**	**5377586**	**6779567**
Andaman & Nicobar	32855	32855	32855
Madhya Pradesh	290378	345495	426420
Rajasthan	3158837	4999236	6320292

Source: *State Governments*

* *Used for purposes of building or for making road metal and household utensils.*

Note: *This table does not contain data with reference to Daman & Diu, Gujarat, Haryana, Manipur, Meghalaya, Nagaland, Odisha and West Bengal due to non-receipt of data for consecutive three years.*

The intensive quarrying activities in Rajashan are in the districts of Bharatpur, Sawai Madhopur, Karauli, Tonk, Bundi, Jhalawar, Kota, Bhilwara, Chittorgarh, Jodhpur, Nagaur and Bikaner. The red and blue Lower Bhander Sandstones which are exposed over a large area of about 5,000 sq km in south-eastern Rajasthan, covering Kota, Bundi, Bhilwara, Chittorgarh districts is quarried at a number of places, important ones being Bijolia, Barisal, Navanagar, Banio-ka-Talab in Bhilwara district and Dabi, Budhpura, Umarthan in Bundi district. The splittable sandstone areas are Bhanpura, Rajpura, Kasara, Chobe-ki-Guwari, Mokanpura, Berda and Bhakri in Karauli district. Other important areas of sandstone quarrying in Dholpur, Bharatpur and Sawai Madhopur districts are Sar Mathura, Bari Baseri, Hindon, Sapatra, Masalpur, Roopwas and Band-Barolla . In other districts, important places are Fidusar, Sursagar, Mandor and Balesar (Jodhpur district) and Chhoti and Badi Khatau (Nagaur district).

MINING & PROCESSING

Mining of sandstone is generally done manually by using hammers and chisels of various shapes. At the first stage, the overburden is removed which is in the form of soil, rubble or non-splittable sandstone. The hard non-splittable sandstone is drilled and blasted to expose the underlying splittable sandstone. But, with the advent of sandstone cutting and polishing machines, this operation is also executed carefully to obtain Khandas and blocks for further processing in the form of slabs.

In conventional mining, advantage of the natural vertical joints present in the range from 0.6m to 60m, is taken . The initial quarrying starts from these joints. After making the initial cut, blocks having 1.2m width, 3 to 4m length and thickness up to the nearest cleavage plane are removed.

In absence of joints, a jhiri' is opened in a line by drilling closely spaced (about 15 cm apart) oblong or eye-shaped holes (duggis) of about 8 to 10cm depth and the eye-shaped steel wedges (Gullas) are hammered in these holes by expert miners. The continuous hammering develops a crack along the holes. The mining starts from these blocks. The required length and width of the slab to be obtained is marked and cut accordingly using the same technique of wedging. The splitting of individual slab is carried out using natural bedding planeby inserting sharp wedges or by hammering alone.

The majority of quarry owners produce hand-dressed slabs and tiles in different thicknesses. But, in the present export market, machine-cut tiles are in demand. Presently, the simple edge cutting machines with single or double cutters are used for getting machine-cut tiles. The further requirement of tiles in 10 to 12 mm thickness with one side natural and other calibrated has resulted in establishing cutting and polishing units of sandstone. In Rajasthan, there are four units engaged in the production of polished sandstone tiles measuring 30 x 30 x 1 cm and 40 x 40 x 1.2 cm. The sandstone is also exported with natural, honed and polish-finishes. BIS has prescribed IS:3622-1977 (First Revision, reaffirmed 2003) as the specifications for sandstone slabs and tiles.

3. Dimensional Limestone

The limestone which is used as a dimension stone differs from the limestone used for cement making or for any other industrial purpose in two ways: firstly, chemical composition and secondly the mode of occurrence. In both the types, the major constituent is calcium carbonate but very high silica content gives limestone sufficient hardness to be utilised as dimension or building stone. The industrial limestone occurs as massive formation with less intercalations while in case of dimensional limestone, thin-bedded deposits are preferred. Limestone which is compact and amorphous in texture is known as flaggy or splittable limestone and is quarried in the form of thin slabs ranging in thickness from 12mm to 50 mm in ready-to-use form .

Limestone has been used since ancient times for construction of houses, flooring and for various other building purposes. In recent times, the use of limestone has increased manifold mainly in interior flooring, cobble stones and for decorative purposes in combination with other stones because of its various colours and shades. Depending upon the place of origin of limestone and its colour, various types of nomenclatures have been used in the trade for limestone, such as, Cuddapah Stone, Shahabad Stone, Kota Stone with different shades and colours (Kota Blue, Kota Brown, etc.), Kutch Stone, Miliolitic Limestone, etc.

OCCURRENCES

The occurrences of dimensional limestone have been reported from various states, such as, Shahabad Stone of Bijapur, Gulbarga and Belgaum districts in Karnataka; and 'Cuddapah Stone' of Kurnool, Anantpur and Guntur districts and 'Tandur Stone' of Cuddapah district, Andhra Pradesh, etc. Other coloured well-known limestones are from Betamacherla, Tadipatri, Macherla, Nereducherla and Muddimanikyam. 'Milliolitic Limestone' from Saurashtra region, 'Yellow Limestone' of Kachchh district of Gujarat, 'Kota Limestone' of Kota district and 'Yellow Limestone' of Jaisalmer district, Rajasthan are the other prime localities of dimensional limestone occurrences in India.

Rajasthan is endowed richly with the occurrence of greenish-grey 'Kota' limestone. The Kota stone has gained tremendous popularity and is widely used for flooring and cladding purposes. The important deposits of limestone are in Kota, Jhalawar, Chittorgarh and Jaisalmer districts, Rajasthan. Kota, Jhalawar, and Chittorgarh are the major producing districts of the dimensional limestone in the state. Extensive limestone deposits are found in the Upper Stage of the Lower Vindhyans, represented by limestone which has a good potential as cement-grade limestone as well as flooring stone. Certain portions of the limestone having splittable form are used extensively as flooring stones. The limestone occurs in a north-south belt from Dalla-ka-Khera to Nimbahera and extends into Madhya Pradesh, covering a distance of about 70 km. It is fine-grained, thinly bedded and has a total thickness of about 150 m. At a few places, the major portion of the limestone deposit is suitable for cement making but there are pockets containing splittable forms that can be used for building and flooring purposes directly.

Yellow limestone deposits of Jaisalmer: The yellow limestone of Jaisalmer is of Jurassic age and is found at Jaisalmer, Bada Bag, Mool Sagar and Kanod villages. It contains 42 to 51% calcium oxide and has thickness of about 3m. It is quarried in the form of blocks and can be sawed into slabs and tiles. It is also termed as yellow marble as it takes reasonably good polish.

Flaggy limestone deposits of Jhalawar and Ramganjmandi, Kota area: It belongs to Lower Vindhyan Group and is available in plenty at Sarola Kotri Chitawa and Khokhriya-Khurd. Extensive deposits are available near Ramganjmandi, Aroliya and Parolia areas. Ramganjmandi and Jhalawar Road are the main railway stations from where the splittable limestone produced is dispatched to various parts of the country. In the last few years, export market of this limestone which is popularly known as 'Kota Stone' has also been developed.

PRODUCTION

Data on production of limestone is furnished in Table-6.

Table – 6: Value of Production of Limestone*
2007-08 to 2009-10
(By States)

(In ₹ '000)

State	2007-08	2008-09	2009-10
India	**51041426**	**51882162**	**63989355**
Andhra Pradesh	28228	22940	11985
Chhattisgarh	698339	1138863	1728827
Gujarat	452899	452899	452899
Jammu & Kashmir	63099	898	967
Karnataka	-	95	115
Madhya Pradesh	6095	36094	4660
Rajasthan	4738766	5493273	4588202
Uttarakhand	45054000	44737100	57201700

Source: *State Governments*
* *Used in kilns for manufacture of lime to be used as building material.*
Figures have been repeated whereever necessary due to non-receipt of data.

MINING AND PROCESSING

Although, the mining methods as well as the processing of limestone have changed over the years yet still there is a scope for improvement in mining techniques. Simultaneously, the handling of waste and utilisation of waste rock is equally essential.

The mining of Kota Stone is carried out by opencast manual methods or by semi-mechanised methods . The Kota Stone is found in the form of natural thickness ranging from 12 to 150mm or even more. The mined out slabs are cut to size by using hammer and chisel. Diamond saws are used to cut the tiles in required thicknesses and measurements. Tiles of Kota Stone are available in various sizes and thicknesses to suit the requirement of various building projects.

This stone has a bright future and its demand can be increased manifold by adopting proper mining, processing and marketing techniques.

EXPLORATION & DEVELOPMENT

No exploration activities were reported for dimensional limestone during 2010-11.

USES & SPECIFICATIONS

Application of Kota Stone ranges from interior flooring, wall cladding to exterior use in paving and facades for building of all kinds and types.

The Kota Stone has a natural split non-slip surface. Massive, dense and fine-grained varieties are generally durable as these are not porous. These are tough and have a crushing strength of 17.8 kg/mm^2 and a high compressive strength of over 2189 kg/cm^2. Abrasion value of Kota Stone is 18.12 to 18.32 and has a high resistance to delamination and failure under freezing and thawing conditions.

Bureau of Indian Standards has adopted Specification for Limestone (Slab & Tiles) as IS : 1128 - 1974 (First Revision, reaffirmed 2008).

4. Other Dimensional Stones

In addition to the dimension stones already described, other dimension stones are being quarried and used for the construction of houses and other building purposes.

In Odisha, Karnataka, Goa and in parts of coastal states, laterite is quarried in huge quantities. It is utilised as bricks in the construction of houses and pavements.

Huge deposits of basalt in Maharashtra, Karnataka and Gujarat are used as building stones since ancient times.

Quartzite bands occurring along with phyllite schists are also utilised for building purposes.

In addition, stone aggregates, such as broken and sized pieces of limestone, dolomite, quartzite and sandstone are mixed either with cement for building and road-making purposes or with asphalt for mending road. To utilise the huge waste generated during mining and processing, a new variety of man-made stone 'Terrazo" has been developed, which is composed of stone chips set in cement, epoxy or polyacrylate and then polished. The Terrazo is an economical alternative to solid marble slabs or tiles.

5. Felsite

Felsite is a fine, evenly grained acid or intermediate igneous rock, usually occurring as dykes and veins in country rocks and in the parent plutonic mass. BIS has prescribed the specification IS:10874-1983 (reaffirmed 2010) for felsite grinding media and liner stones.

The production of felsite at 923 tonnes in 2010-11 decreased by 31% as compared to that in the previous year due to lack of demand. There were 6 reporting mines in both the years. Four producers operating 6 mines accounted for the entire production of felsite during the year. All the mines are located in Mandya and Mysore districts of Karnataka (Tables - 7 to 9).

The mine-head stock of felsite at the end of the year 2010-11 was 2,630 tonnes as against 2,879 tonnes at the beginning of the year (Table-11).

The average daily employment of labour was 36 in 2010-11 as against 41in the previous year.

Table – 7 : Producers of Felsite, 2010-11

Name and address of producer	Location of mine	
	State	District
Smt. Rajee V. Raman, 15/2, 8th Cross, 1st Main, V. V. Mohalla, Mysore–570 002, Karnataka.	Karnataka	Mysore/ Mandya
Paramshiva Mining Enterprises, No. 39 & 40, Raheja Arcade, Koramangal, Bengaluru Karnataka.	Karnataka	Mysore
B .C. Muddumadappa, New Mysore Industries, 196, 23rd Cross, 6th Block, Jayanagar, Bengaluru-560 082, Karnataka.	Karnataka	Mysore
Brindavan Mining Enterprises, Shri J. Madhu No. 165, K.R.S Road, Manti (Mogarahalli), S. R. Patna, Dist. Mandya, Karnataka.	Karnataka	Mandya

Table – 8 : Production of Felsite, 2008-09 to 2010-11
(By State)

(Qty in tonnes; value in ₹ '000)

State	2008-09		2009-10		2010-11 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**1238**	**1367**	**1337**	**1608**	**923**	**1463**
Karnataka	1238	1367	1337	1608	923	1463

Table – 9 : Production of Felsite, 2009-10 & 2010-11
(By Sector/State/Districts)

(Qty in tonnes; value in ₹'000)

State/District	2009-10			2010-11 (P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India	**6**	**1337**	**1608**	**6**	**923**	**1463**
Private sector	6	1337	1608	6	923	1463
Karnataka	**6**	**1337**	**1608**	**6**	**923**	**1463**
Mandya	2	494	745	2	340	646
Mysore	4	843	863	4	583	817

Table – 10 : Mine-head Stocks of Felsite, 2010-11 (P)
(By State)

(In tonnes)

State	At the beginning of the year	At the end of the year
India	**2879**	**2630**
Karnataka	2879	2630

TRADE POLICY

As per the export-import policy announced for the period 2009-14; and the Foreign Trade Policy as amended, the imports of slate blocks or slabs whether or not roughly trimmed or merely cut are restricted under heading no. 2514. On the other hand, worked slate and articles thereof or of agglomerated slate can be imported freely under heading no. 6803.

Import of crude or roughly trimmed/cut blocks or slabs of sandstone and other monumental or building stones; viz, Pakur Stone, stone boulders, and others, are restricted under heading no. 2516. However, sets of curbstones and flagstones of natural stone (except slate) under heading no. 6801 and worked monumental building stone (excluding slate), tiles, cubes and similar articles of natural stone including slate, under heading no. 6802 can be imported freely . Worked slate and articles of slate or of agglomerated slate under sub-heading 6803 can also be imported freely. Exports of stone aggregates which are restricted under Chapter 25, are permitted to be exported to Maldives subject to ceiling limits. The limits are 5 lakh tonnes, 5.5 lakh tonnes and 6 lakh tonnes for the years 2011-12, 2012-13 and 2013-14, respectively. The annual ceilings are monitored by CAPEXIL subject to exporters obtaining appropriate clearences.

WORLD REVIEW

Reserves of slate and other dimension stones are substantial in the world. Spain was the major exporting country for dimension stones in the world. Other important exporters of slate were China, Italy, India, Spain and Brazil. Major importers of slate were Germany, UK, USA and France.

FOREIGN TRADE

Exports

Exports of building and monumental stones (NES) increased to 1.22 million tonnes in 2010-11 from 1.05 million tonnes in 2009-10. Quantitywise, Maldives was the leading buyer sharing 35% in the total exports, followed by Bangladesh (26%) and UK (10%). Valuewise, UK was the leading buyer, contributing 25% to total value of exports, followed by USA and Belgium (11%) each (Table - 11).

In 2010-11, the total exports of slate decreased to 113 thousand tonnes from 125 thousand tonnes in 2009-10. Out of the total exports of slate during 2010-11, 19,685 tonnes was of slate (worked) while the bulk of the exports i.e. 93,781 tonnes was of slate (others). The USA was the leading buyer, accounting for over 46% value of the total slate exported followed by UK (11%) and Canada (8%) (Tables - 12 to 14) .

In 2010-11, the exports of sandstone decreased to 0.29 million tonnes from 0.63 million tonnes in the previous year. The UK was the leading buyer in 2010-11 with 42% of the total value of sandstone exported followed by Belgium with 5% (Table - 15) .

Imports

During 2010-11, imports of building & monumental stones (NES) decreased to 0.9 million tonnes from 1.87 million tonnes imported in the previous year. Bangladesh was the leading supplier contributing 29% to the total value of imports followed by Bahrain (27%).

Imports of slate during 2010-11 were 89tonnes compared to 146 tonnes in 2009-10. Imports of sandstone in 2010-11 were not reported (Tables - 16 to 18).

Table – 11: Exports of Building and Monumental Stones, NES (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹ '000)
All Countries	**1053238**	**2955553**	**1217967**	**4125399**
UK	75823	640474	120798	1018176
USA	44404	349428	73949	458814
Belgium	29651	183389	78443	458147
Maldives	377152	318285	422667	384179
Italy	21635	151324	28258	244941
UAE	9164	81016	37564	152908
Bangladesh	301617	153036	313110	134819
Germany	13672	142005	16944	133521
France	4166	53075	20649	122299
Australia	4680	76044	6877	111763
Other countries	171274	807477	98708	905832

Table – 12 : Exports of Slate (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**125463**	**1980721**	**113466**	**1455831**
USA	48009	825180	40526	665963
UK	18781	230241	20157	160810
Canada	7649	116011	8760	123344
Australia	6837	94917	6130	82102
Belgium	2473	30725	3159	32496
Netherlands	3176	37499	3779	29921
Spain	2920	38186	2154	24178
Mauritius	1694	34463	1907	23956
Italy	7534	187570	2539	23590
UAE	2093	37790	1675	21759
Other countries	24297	348139	22680	267712

Table – 13 : Exports of Slate (Others) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**87349**	**1089758**	**93781**	**1034734**
USA	27407	443146	29367	411579
UK	16728	132855	19720	152029
Canada	6681	97544	6547	83570
Australia	4722	51879	4797	56530
Netherlands	2720	29964	3606	27624
Belgium	2064	23129	2574	23989
Italy	3364	35790	2427	20956
UAE	1160	11351	1573	20449
Spain	2179	26891	1953	19714
Mexico	837	9147	1445	17844
Other countries	19487	228062	19772	200450

Table – 14 : Exports of Slate (Worked) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**38114**	**890963**	**19685**	**421097**
USA	20602	382034	11159	254384
Canada	968	18467	2213	39773
Australia	2115	43039	1333	25572
UK	2053	97386	437	8781
Belgium	409	7596	585	8506
Mauritius	393	14736	365	7079
Korea, Rep. of	12	187	174	5600
Iran	75	2967	114	2643
Spain	741	11295	201	4464
Mexico	152	4590	193	3758
Other countries	10594	308666	2911	58537

Table – 15 : Exports of Sandstone (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**632406**	**4387790**	**296796**	**3003688**
UK	345667	2248421	94317	1247884
Belgium	52033	248004	21924	148231
Germany	27803	207287	18646	136583
Australia	14904	169727	9269	133825
Italy	19904	160553	13513	133743
China	3229	26398	4678	118052
UAE	19025	156433	11502	113870
Canada	19317	133946	9559	110096
France	20999	106572	16401	104490
Korea, Rep. of	10312	93834	9166	90132
Other countries	99213	836615	87821	666782

Table – 16: Imports of Building and Monumental Stones, NES (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**1874801**	**1466316**	**909936**	**1527459**
Bangladesh	295279	319839	415090	448431
Bahrain	56	6163	3231	406045
Nepal	1571616	709365	483186	332737
China	2368	133311	3071	170869
Italy	194	5007	481	32032
Turkey	110	6971	524	21813
Indonesia	411	22162	611	16197
Egypt	-	-	707	13297
Portugal	85	3609	352	10975
Norway	271	10579	173	10426
Other countries	4411	249310	2510	64637

Table – 17: Imports of Slate (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**146**	**4663**	**89**	**3678**
China	96	2256	72	2578
Germany	5	1203	8	343
Canada	-	-	1	288
Singapore	-	-	1	205
Netherlands	-	-	4	64
Hong Kong	-	-	++	22
Taiwan	-	-	1	20
USA	++	10	++	14
Unspecified	-	-	2	144
Other countries	45	1194	-	-

Table – 18: Imports of Sandstone (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**21000**	**22343**	-	-
Other countries	21000	22343	-	-

FUTURE OUTLOOK

Slate is mostly used as roofing material but other uses like cladding and flooring tiles are also gaining momentum. Slates occur widespread in the country and detailed study is required to be conducted to quantify the resources. About 80% production of slate in the country was exported, whereas remaining 20% is consumed in the domestic market. The demand for dimension stones including sandstone & others and stone products is anticipated to grow at around 15% CAGR. A similar growth is also expected in exports.

The demand for artifacts especially carved work is on the rise the world over. India with its rich tradition of craftmanship and trained artisans can embark upon the world scene.

Improved quarrying, finishing and hauling technology, availability of greater variety of stones and the rising cost of alternative construction materials are among the factors that suggest a continuing increase in demand for dimension stones in future.

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

SULPHUR AND PYRITES

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

73 Sulphur and Pyrites

In India, there are no mineable elemental sulphur reserves. Pyrites was used as a substitute for sulphur in the manufacture of sulphuric acid by M/s Pyrites Phosphates and Chemicals Ltd (PPCL). There was no production of pyrites since 2003.

The domestic production of elemental sulphur is limited to by-product recoveries from petroleum refineries and fuel oil used as feedstock for manufacturing fertilizer. In addition, during the production of non-ferrous metals from sulphide ores, sulphur is recovered in the form of by-product sulphuric acid. HZL (Vedanta) and HCL together produced about 1.05 million tonnes and 1.20 million tonnes by-product sulphuric acid from indigenous lead-zinc and copper ores in 2009-10 and 2010-11, respectively, equivalent to about 272,000 tonnes and 312,000 tonnes of contained sulphur. In addition, about 2.13 million tonnes and 2.11 million tonnes sulphuric acid equivalent to 554,000 tonnes and 549,000 tonnes of contained sulphur was indigenously produced from imported copper and zinc concentrates as by-product by Sterlite Industries, Binani Zinc Ltd and Hindalco Industries Ltd during 2009-10 and 2010-11, respectively. The total production of sulphuric acid from sulphide ores was thus about 3.18 million tonnes and 3.31 million tonnes, respectively, equivalent to about 826,000 tonnes and 861,000 tonnes of sulphur during 2009-10 and 2010-11, respectively (Table-1).

Sulphur consumption in the manufacture of sulphuric acid has been reported by some of the chemical and fertilizer industries. In fertilizer industry, the sulphuric acid is further used for manufacturing phosphoric acid and single superphosphate (SSP) from rock phosphate which is imported from Jordan, Egypt, Morocco, Togo, Israel, etc.

RESOURCES

Resources of sulphur (native) were estimated in the inferred (STD333) category. The resources are located in Jammu & Kashmir and are placed at 0.21 million tonnes as on 1.4.2010 as per UNFC System.

Total resources of pyrites in the country as per UNFC system as on 1.4.2010 are placed at 1,674 million tonnes. There are no reserves and all resources are grouped under 'remaining resources' category. Of these, about 27 million tonnes are under feasibility (STD211) category. Out of the total resources, beneficiable grade

Table - 1 : Production of By-product Sulphuric Acid, 2009-10 and 2010-11 (By Principal Producers)

(in tonnes)

Name of Producer	Production	
	2009-10	2010-11
Hindustan Copper Ltd	9,934	7,031
Hindustan Zinc Ltd	1035,588	1192,699
A. Total : From Indigenous Ores	**1045,522**	**1199,730**
Sterlite Industries (India) Ltd	1036,353	968,760
Binani Zinc Ltd	50,863	46,856
Hindalco Industries Ltd	1042,799	1097,158
B. Total : From Imported Ores	**2130,015**	**2112,774**
Grand Total : (A + B)	**3175,537**	**3312,504**

Source: Annual Reports, 2010-11, Respective Producers.

Table – 2 : Reserves/Resources of Pyrites as on 1-4-2010 (P)
(By Grades and States)

(In '000 tonnes)

Grade/State	Reserves Total (A)	Remaining resources						Total (A+B)
		Feasibility STD211	Pre-feasibility STD222	Measured STD331	Indicated STD332	Inferred STD333	Total (B)	
All India : Total	**–**	**27129**	**32597**	**9590**	**77729**	**1527356**	**1674401**	**1674401**
By Grades								
Soil Reclamation	–	–	3000	–	–	3024	6024	6024
Beneficiable	–	27129	29597	–	–	4902	61628	61628
Low	–	–	–	9590	26310	1519430	1555330	1555330
Unclassified	–	–	–	–	51419	–	51419	51419
By States								
Andhra Pradesh	–	–	–	–	–	880	880	880
Bihar	–	13462	9680	–	51419	1500000	1574561	1574561
Himachal Pradesh	–	–	–	–	–	2560	2560	2560
Karnataka	–	–	–	–	–	3000	3000	3000
Rajasthan	–	13667	22917	9590	26310	18392	90876	90876
Tamil Nadu	–	–	–	–	–	24	24	24
West Bengal	–	–	–	–	–	2500	2500	2500

Figures rounded off.

resources are 62 million tonnes, low grade 1,555 million tonnes and soil reclamation grade resources are about 6 million tonnes. Balance of about 51 million tonnes resources fall under unclassified/not-known grades. Major resources are located in Bihar and Rajasthan (Table - 2).

PRODUCTION & STOCKS

Sulphur

The production of sulphur recovered as by-product from fertilizer plants and oil refineries was at 237 thousand tonnes in 2010-11 as against 263 thousand tonnes in the preceding year.

Two fertilizer plants and eight oil refineries, all in the public sector, reported production of sulphur during the year. Of the total quantity produced in 2010-11, Indian Oil Corp. Ltd contributed about 97% of the total production . Haryana accounted for 57.6%, Uttar Pradesh 16.4%, West Bengal 10.7%, Gujarat 9.5%, Bihar 3.5%, Assam 1.4% and the remaining 0.9% was contributed by Punjab (Tables - 3 to 5).

In addition, oil refineries of M/s Bharat Petroleum Corporation Ltd have reported production of 70,000 tonnes of by-product sulphur, in 2010-11. Data on recovery by Hindustan Petroleum Corpn. Ltd is not available. Refineries of RIL also recover by-product sulphur which is in turn used as feedstock in manufacturing fertilizers and pharmaceuticals. The Vadinar refinery of Essar Oil Ltd is also reported to produce by-product sulphur.

Table - 3 : Principal Producers of By-product Sulphur, 2010-11

Name & address of producer	Location of plant/refinery	
	State	District
Indian Oil Corporation Ltd, (Refineries Division), Scope Complex, Core-II, 7, Institutional Area, Lodhi Road, New Delhi -110 003.	Assam	Guwahati Digboi
	Bihar	Begusarai
	Gujarat	Vadodara
	Haryana	Panipat
	Uttar Pradesh	Mathura
	West Bengal	Midnapur
Numaligarh Refinery Limited, Golaghat, Assam - 785 699	Assam	Golaghat
National Fertilizers Ltd, Scope Complex, Core-III, 7, Institutional Area, Lodhi Road, New Delhi -110 003.	Haryana	Panipat
	Punjab	Roopnagar

Pyrites

Pyrites Phosphates and Chemicals Ltd (PPCL) had two pyrites production units located at Amjhore (Bihar) and Saladipura (Rajasthan) besides phosphorite division in Dehradun. The Government approved closure and hiving off of these two units in July 2002 and Amjhore unit in June 2003. Hence, there was no production of pyrites since 2003.

Table – 4 : Production of By-product Sulphur 2008-09 to 2010-11 (By States)

(In tonnes)

State	2008-09	2009-10	2010-11 (P)
India	**269572**	**263124**	**236998**
Assam	566	665	3328
Bihar	10186	8681	8353
Gujarat	13293	12045	22436
Haryana	130155	146278	136622
Punjab	3894	2468	2111
Tamil Nadu	48453	41346	-
Uttar Pradesh	42915	36130	38856
West Bengal	20110	15511	25292

Table – 5 : Production of By-product Sulphur 2009-10 and 2010-11 (By Sectors/States/Districts)

(In tonnes)

State/District	2009-10		2010-11 (P)	
	No. of units	Quantity	No. of units	Quantity
India/Public sector	**9**	**263124**	**10**	**236998**
Assam	**1**	**665**	**3**	**3328**
Guwahati	1	665	1	605
Digboi	-	-	1	141
Golaghat	-	-	1	2582
Bihar/Begusarai	1	8681	1	8353
Gujarat/Vadodara	1	12045	1	22436
Haryana/Panipat	2	146278	2	136622
Punjab/Roopnagar	1	2468	1	2111
Tamil Nadu/Chennai	1	41346	-	-
Uttar Pradesh/Mathura	1	36130	1	38856
West Bengal/Midnapur	1	15511	1	25292

APPLICATIONS & USES

One of the direct uses of sulphur is in vulcanisation of rubber. Sulphur is a component of gunpowder. It reacts directly with methane to give carbon disulphide, which is used to manufacture cellophane and rayon.

Elemental sulphur is mainly used as a precursor to other chemicals. Most of the sulphur is converted to sulphuric acid (H_2SO_4), which is of prime importance to the world economy. The production and consumption of sulphuric acid is an indicator of a nation's industrial development. The principal use of the sulphuric acid is in the manufacture of phosphatic fertilizer.

Other applications of sulphuric acid include oil refining, wastewater processing and mineral extraction. Sulphur compounds are also used in detergents, fungicides, dyestuffs and agrichemicals. In silver based photography, sodium and ammonium thiosulphate are used as "fixing agents". Sulfites, derived from burning sulphur, are used to bleach paper. They are also used as preservatives in dried fruit and processed fruit products.

Sulphur is used as a light-generating medium in the rare lighting fixtures known as "sulphur lamps”. The sulphur lamp is a highly efficient full-spectrum electrodeless lighting system whose light is generated by sulphur plasma that has been excited by microwave radiation.

CONSUMPTION

The total reported consumption of elemental sulphur in 2010-11 was about 1.67 million tonnes. The main consumer of sulphur was fertilizer industry which accounted for about 73%. Chemical industry, the next important consuming industry, accounted for about 17% consumption for manufacturing carbon disulphide & dye-stuffs. Other industries like explosives, iron & steel, paint, paper, pesticides, pharmaceuticals and sugar consumed about 10% (Table - 6).

TRADE POLICY

Imports of sulphur of all kinds other than colloidal sulphur, precipitated sulphur and sublimed (flowers) sulphur under heading No. 2503 are allowed freely under the Foreign Trade Policy, 2009-14. Similarly, the imports of unroasted pyrites under heading No. 2502 are allowed freely.

WORLD REVIEW

Reserves of sulphur in crude oil, natural gas and sulphide ores are large. Because most sulphur production is a result of the processing of fossil fuels, supplies should be adequate for the foreseeable future. Because petroleum and sulphide ores can be processed long distances

Table – 6 : Reported Consumption of Sulphur 2008-09 to 2010-11 (By Industries)

(In tonnes)

Industry	2008-09	2009-10(R)	2010-11(P)
All Industries	**1647700**	**1641900**	**1669800**
Alloy steel	3600(3)	3600(3)	3600(3)
Chemical	263800(31)	270000(31)	276800(32)
Explosive	1200(2)	1200(2)	1200(2)
Fertilizer	1223200(33)	1206700(34)	1211500(34)
Iron & steel**	30600(3)	28900(3)	24400(3)
Paint	2200(2)	2200(2)	2200(2)
Paper	3800(5)	3800(5)	3800(5)
Pesticide	21800(6)	24400(6)	24600(6)
Pharmaceutical	4100(5)	4100(5)	4100(5)
Rubber	1100(9)	1700(11)	200(11)
Sugar	92000(e)	95000(e)	115300(e)
Others (Abrasive, asbestos products, dry cells battery, electrical & glass)	300(10)	300(10)	300(10)

Figures rounded off. Data collected on non-statutory basis. Figures in parentheses denote the number of units in organised sector reporting consumption.*
*(*Includes actual reported consumption and/or estimates made wherever required).*
*** The consumption relates to manufacturing sulphuric acid in the steel plants.*
(e) estimate based on sugar production.

Table – 7 : World Production of Sulphur & Pyrites (By Principal Countries)

(In '000 tonnes of sulphur content)

Country	2008	2009	2010
World: Total (Sulphur)	**65000**	**64500**	**67800**
(Pyrites)	**6600**	**5400**	**6100**
Abu Dhabi (Sulphur)	1900	1760	1800
Australia (Sulphur)	986	986	1026@
Canada (Sulphur)	8145	7461	7471
China (Sulphur)	5268	5843	6569
(Pyrites)	6022	4946	5643
Chile (Sulphur)	1541	1601	1601
Finland (Pyrites)	226	154	250
(Sulphur)	448	401	394
Iran (Sulphur)	1629	1429	1454
Germany (Sulphur)	1617	2069	1968
Japan (Sulphur)	3831	3539	3711
Kazakhastan (Sulphur)	2124	2740	3020
Korea, Rep. of (Sulphur)	1650	1559	1689
Mexico (Sulphur)	1477	1526	1417
Poland (Sulphur)	1279	734	1030
Russia (Sulphur)	7265	6217	7354
(Pyrites)	161	71	70e
Saudi Arabia (Sulphur)	3100	3214	3200
South Africa (Sulphur)	510	496e	500e
USA (Sulphur)	9443	9780	9900
Zimbabwe (Pyrites)	30	–	-
Other countries(Sulphur)	12789	13145	13446
(Pyrites)	161	229	137

Source: *World Mineral Production, 2006-2010.*
@ : Including New Zealand

from where they are produced, sulphur production may not be in the country for which the reserves were attributed. For instance, sulphur reserves from Saudi Arabia may be recovered at oil refineries in the United States.

In 2010, the world production of sulphur was estimated at 67.80 million tonnes and that of pyrites at 6.1 million tonnes in terms of sulphur content. USA (15%), Canada and Russia (11% each), China (10%), Japan and Saudi Arabia (5% each) were the major producers of sulphur. China (93%) and Finland (4%) were the major producers of pyrites (Table - 7).

Elemental sulphur is obtained from ores by conventional mining or by the Frasch method of mining sulphur (mined sulphur) or as a by-product of sour natural gas processing, sour crude refining, tar sand processing and stack gas clean-up (recovered sulphur). Recovered sulphur production accounted for over 98% world elemental sulphur production.

In Frasch method, three concentric pipes are used. The outermost pipe contains superheated water, which melts the sulphur, and the innermost pipe is filled with hot compressed air, which serves to create foam and pressure. The resulting sulphur foam is then expelled through the middle pipe. The Frasch process produces sulphur with 99.5% purity content, and it needs no further purification. Frasch sulphur production on a commercial scale was operated in Brazil and Mexico. Elemental/native sulphur was mined in China, Poland and Russia.

Canada

Sulphur recovery from natural gas has declined for several years, but increased sulphur production from oil sands offsets the decline. This trend was expected to continue.

China

For the first time, China was the leading producer of sulphur in all forms. It also was the world's leading producer of pyrites, with about 46% of its sulphur in all forms coming from that source. The country was the leading sulphur importer, with 10.1 million tonnes in 2010. Imports represented 76% of elemental sulphur consumption in China, with the Middle East as the leading source of the imports, followed by Canada. Fertilizer production consumed about three-quarters of the sulphuric acid produced in China.

In December 2009, the Govt released 2010 tariff rates for phosphate fertilizers which discourage exports during period of high domestic demand. The surcharge for the phosphate fertilizers would be 110% during Jan to May and Oct to Dec, and 7% during June to September.

The Zinjin Copper Industry Co. (a subsidiary of the Zihn Mining Group Co.) announced plans to build a 200,000 tpy copper smelting plant in the Fuijan Province. The smelter was expected to produce 700,000 tpy of sulphuric acid.

Jordan

Jordan Phophate Mines Co. signed a contract with SNC-Lavalin Group to construct a plant to produce 1.5 million tpy of sulphuric acid along with phosphoric acid. Construction of the project in EI Eshidiya began in 2010 and was expected to be completed by 2012.

Kazakhastan

Construction of a 600,000 tpy sulphuric acid plant of Kazakh phosphate began at Taraz city in southern Kazakhstan. The projet was expectd to be completed by 2012.

Mexico

Mexichem S.A .B. de C.V. reopened the Jaltipan sulphur mine in Veracrur State in May 2010. The Frasch sulphur production has been closed in 1992. Mexichem planned to operate the Jaltipan mine at a capacity of 210, 000 tpy of sulphur.

FOREIGN TRADE

Exports

Exports of sulphur (excluding sublimed, precipitated and colloidal) increased substantially to 167,009 tonnes in 2010-11 from 124,884 tonnes in the previous year. Exports were mainly to China (46%), Jordan (19%), Brazil (16%) and Israel (15%).

Exports of sulphur (sublimed, precipitated and colloidal) sharply increased to 21,917 tonnes in 2010-11 from 5,608 tonnes in the previous year. Sulphur (colloidal) alone accounted for 62.4% whereas the sublimed and precipitated sulphur together shared 37.6% exports in 2010-11. Exports were mainly to Germany, Spain, Brazil, South Africa, Iran, Portugal, etc. (Tables - 8 to 12).

Imports

Imports of sulphur (excluding sublimed, precipitated and colloidal) decreased to 13.57 lakh tonnes in 2010-11 from 15.34 lakh tonnes in the previous year. Imports were mainly from UAE (29%), Iran (21%), Qatar (19%), Saudi Arabia (11%) and Kuwait (10%).

Imports of sulphur (sublimed, precipitated and colloidal) increased sharply to 5,468 tonnes in 2010-11 from 2,369 tonnes in the previous year. Out of the total imports, 4,327 tonnes was precipitated sulphur, 1109 tonnes sublimed sulphur and 32 tonnes colloidal sulphur (Tables - 13 to 17).

Table – 8 : Exports of Sulphur (Excl. Sublimed, Precipitated & Colloidal) :Total (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹ '000)
All Countries	**124884**	**504615**	**167009**	**978329**
China	114490	309651	76454	468176
Jordan	33	507	31408	165834
Brazil	5000	48380	26200	162796
Israel	–	–	25400	99417
Chinese Taipei/ Taiwan	7	398	5428	48184
Bangladesh	2355	29551	1190	19210
Sri Lanka	689	6919	576	8019
Nepal	1590	77025	156	2107
Argentina	-	-	18	913
Mexico	-	-	20	776
Other countries	720	32184	159	2897

Table – 9 : Exports of Sulphur (Sublimed, Precipitated & Colloidal) : Total (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**5608**	**492006**	**21917**	**859708**
Germany	966	90747	1605	161769
South Africa	437	41316	837	83675
Spain	402	39162	800	80928
Brazil	-	-	13600	80784
Iran	355	32787	569	63270
Portugal	444	40478	675	60723
Czech Rep.	660	64141	570	52312
Turkey	673	62573	392	40018
Korea, Rep. of	-	-	330	31661
Other countries	1295	90089	1836	139356

Table – 10 : Exports of Sulphur (Colloidal) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**35**	**806**	**13666**	**81803**
Brazil	-	-	13600	80783
Bangladesh	-	-	45	727
Nepal	32	284	20	277
Congo, People's Rep. of	++	3	1	9
Ethiopia	-	-	++	4
Sri Lanka	2	391	++	3
Other countries	1	128	-	-

Table - 11 : Exports of Sulphur (Precipitated) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**67**	**965**	**46**	**631**
Sri Lanka	45	618	21	344
Nepal	–	–	25	286
Other countries	22	347	++	1

Table – 12 : Exports of Sulphur (Sublimed) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**5506**	**490235**	**8205**	**777274**
Germany	966	90747	1605	161769
South Africa	437	41316	837	83675
Spain	402	39162	800	80928
Indonesia	376	30711	703	65212
Iran	355	32787	569	63270
Portugal	444	40478	675	60723
Czech Rep	660	64141	570	52312
Turkey	673	62573	392	40018
Korea, Rep. of	-	-	330	31661
Chile	148	12321	276	26312
Other countries	1045	75999	1448	111394

Table – 13 : Imports of Sulphur (Excl. Sublimed, Precipited & Colloidal) : Total (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**1533628**	**6810816**	**1356774**	**10977136**
UAE	293602	1271499	386976	3099731
Iran	169300	869867	280927	2162989
Qatar	148123	670483	258175	2088622
Saudi Arabia	493391	2024956	155132	1350562
Kuwait	190206	893297	139795	1124198
Bahrain	97757	362172	42693	403805
Egypt	5726	50368	13564	116742
Japan	74665	327390	13657	107501
Italy	8500	26033	14270	94559
Unspecified	-	-	17531	148788
Other countries	52358	314751	34054	279639

Table – 14 : Imports of Sulphur (Sublimed, Precipitated & Colloidal) : Total By Countries

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value ('₹ 000)
All Countries	**2369**	**221905**	**5468**	**453101**
UAE	-	-	2338	180781
Malaysia	12761	34135	1730	166235
China	168	10848	840	66345
Japan	37	4744	122	11618
France	561	27421	220	9861
Germany	227	38484	63	7571
USA	57	3623	44	2539
Korea, Rep. of	23	699	29	1443
Canada	-	-	25	1211
Unspecified	–	–	33	3745
Other countries	20	1951	24	1752

Table – 15 : Imports of Sulphur (Colloidal) (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**17**	**386**	**32**	**2389**
Germany	–	–	5	1177
Korea, Rep. of	17	386	26	1149
USA	-	-	1	63

Table – 16 : Imports of Sulphur (Precipitated) By Countries

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**1529**	**130614**	**4327**	**360751**
UAE	-	-	2338	180781
Malaysia	912	97716	1506	145588
France	540	26040	220	9859
Japan	3	1183	90	8334
China	29	1880	63	5425
Germany	21	2185	39	4447
USA	23	1536	33	2005
Belgium	1	73	3	204
Singapore	–	–	1	190
Unspecified	–	–	33	2005
Other countries	++	1	1	173

Table – 17 : Imports of Sulphur (Sublimed) By Countries

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**823**	**90905**	**1109**	**89961**
China	139	8968	777	60920
Malaysia	364	36419	224	20647
Japan	34	3560	32	3284
Germany	206	36299	19	1947
Canada	-	-	25	1211
Belgium	-	-	14	840
Singapore	-	-	6	488
USA	34	2086	10	470
Korea, Rep. of	6	313	2	124
Italy	-	-	++	17
Other countries	40	3260	++	13

FUTURE OUTLOOK

Country being deficient in pyrites and sulphur which are essential for fertilizer industry, the Working Group on Mineral Exploration & Development (other than Coal & Lignite) for the 12th Five Year Plan (2012-17) has recommended that taxation policy intervention should be introduced to recover the sulphur going as gaseous emissions in the refinery and petro-chemical industries.

Recovered sulphur output was expected to increase significantly worldwide. Increased production, was expected tocome from Russia's increased sulphur recovery from natural gas and Asia's improved sulphur recovery at oil refineries and new development of sour gas deposits. Refineries in developing countries were expected to improve enironmental protection measures and eventually compare with the environmental standards of plants in Japan, North America, and Western Europe in future, Higher sulphur recovery is likely to result from severl factors, viz, higher refining rates, higher sulphur content in crude oil, lower allowable sulphur content in finished fuels, andreduced sulphur emissions mandated by regulations.

Some of the future gas production, however, is expected to come from unconventional natural gas resources such as tight gas, shale gas, and coal bed methane. Use of unconventional gas resources will certainly affect the sulphur supply outlook for the future as these gases have low sulphur content.

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

TALC, SOAPSTONE AND STEATITE

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

74 Talc, Soapstone and Steatite

Talc is a hydrous magnesium silicate. In trade, talc often includes: (i) the mineral talc in the form of flakes and fibres; (ii) steatite, the massive compact cryptocrystalline variety of high-grade talc; and (iii) soapstone, the massive talcose rock containing variable talc (usually 50%), which is soft and soapy in nature. Commercial talc may contain other minerals like quartz, calcite, dolomite, magnesite, serpentine, chlorite, tremolite and anthophyllite as impurities. The properties that give talc a wide variety of uses and markets are its extreme softness and smoothness, good lustre and sheen, high slip and lubricating property, low moisture content, ability to absorb oil and grease, chemical inertness, high fusion point, low electrical and heat conductivity, high dielectric strength, good retention for filler purposes, whiteness, good hiding power as pigment and high specific heat. In addition, it has the advantage of being relatively abundant. It can be easily mined and prepared for market. Rajasthan is the hub of talc activity in India.

RESOURCES

As per the UNFC system the total reserves/ resources of talc/steatite/soapstone as on 1.4.2010 are estimated at 269 million tonnes of which reserves and remaining resources are 90 million tonnes and 179 million tonnes, respectively. Substantial quantities of resources are established in Rajasthan (49%) and Uttarakhand (29%). The remaining 22% resources are in Andhra Pradesh, Bihar, Chhattisgarh, Gujarat, Jharkhand, Karnataka, Kerala, Maharashtra, Madhya Pradesh, Odisha, Sikkim and Tamil Nadu. By grades, Paper & Textile grade accounts for about 22% share in total resources followed by insecticides (19%) and cosmetics(13%). Resources of ceramic and paint grades are negligible. Others, Unclassified and Not-known grades account for about 45% resources (Table-1).

EXPLORATION & DEVELOPMENT

In 2010-11, DMM, West Bengal carried out mapping of over 10 sq km area around GOK Karmi area of Darjeeling and 51 talc samples were collected. Besides four (4) trenching and one pitting were also carried out in the area and 60,000 tonnes of resources have been estimated. Mapping of over 30 Sq km area was carried out at Lepcha Basti and Singla in Darjeeling district and 31 samples of talc have been extracted.

PRODUCTION, STOCKS & PRICES

The production of steatite in 2010-11 at 896 thousand tonnes increased by about 2% as compared to that in the previous year .

There were 113 reporting mines in 2010-11 as against 126 in the previous year. Besides , production of steatite was reported by five mines as associated mineral in both the years. Eighteen principal producers accounted for nearly 80% of the total production during 2010-11. The entire production of steatite was reported by private sector mines. About 87% production in 2010-11 was contributed by 37 mines, each producing over 5,000 tonnes annually , whereas 12% of the total output was reported by 42 mines, each producing 1000 to 5000 tonnes. The remaining about 1% of the total production was contributed by 39 mines with annual output below 1,000 tonnes.

About 69% of the production in 2010-11 was of grade other than insecticide and the remaining was of insecticide/DDT grade.

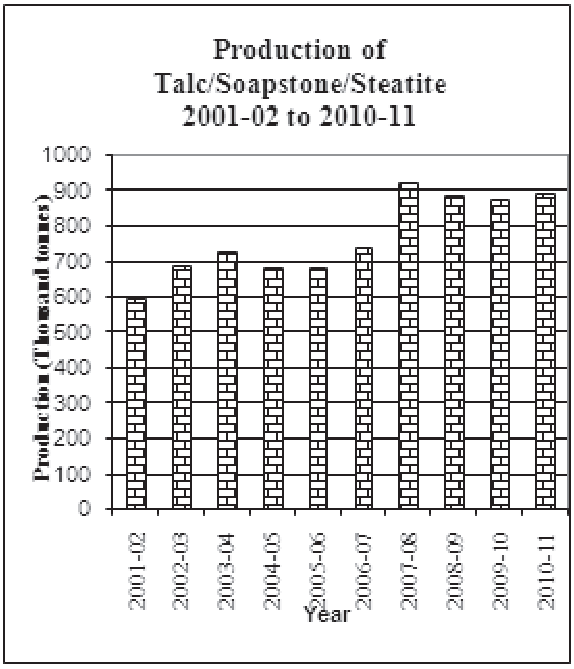


Table – 1 : Reserves/Resources as on 1.4.2010 : Talc/Steatite/Soapstone
(By Grades/States)

(In '000 tonnes)

Grade/States	Reserves				Remaining resources								Total resources (A+B)
	Proved STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
		STD121	STD122			STD221	STD222						
All India	**54615**	**8772**	**26640**	**90026**	**9732**	**12773**	**27080**	**6403**	**7256**	**115195**	**558**	**178996**	**269023**
By Grades													
Paper & textile	18852	3926	8803	31581	3564	524	5286	5201	430	13718	-	28721	60302
Cosmetics	18365	1049	6593	26008	203	1856	776	232	142	5610	-	8819	34827
Insecticide	11006	2795	5551	19353	3127	2756	11451	941	217	12661	42	31194	50547
Ceramic	410	-	558	968	-	46	87	-	35	212	344	724	1691
Paint	84	374	182	640	9	-	151	-	-	200	-	360	1000
Others	871	104	810	1785	461	3630	2095	17	100	2209	-	8513	10297
Unclassified	5026	523	4140	9690	1105	3877	6567	11	6276	71195	167	89188	98878
Not-known	-	-	3	3	1263	84	678	2	56	9388	5	11477	11479
By States													
Andhra Pradesh	1031	1044	3060	5135	71	168	1187	-	369	3777	537	6109	11243
Bihar	-	-	149	149	-	-	-	-	-	3	-	3	152
Chhattisgarh	22	-	8	30	-	-	-	-	70	8	-	78	108
Gujarat	-	-	6	6	-	20	8	-	-	4	-	31	37
Jharkhand	-	-	-	-	-	-	73	2	4	243	16	338	338
Karnataka	35	-	182	217	49	124	217	11	208	1242	-	1851	2068
Kerala	-	-	-	-	-	-	-	-	-	14390	-	14390	14390
Madhya Pradesh	-	-	-	-	4	375	954	-	1679	6107	-	9119	9119
Maharashtra	-	-	-	-	-	-	-	-	2565	14262	-	16827	16827
Odisha	123	178	112	414	31	1	109	-	-	265	-	406	820
Rajasthan	28179	2705	14770	46193	6155	7323	19196	1686	837	50768	5	85969	132162
Sikkim	-	-	-	-	-	-	60	-	-	-	-	60	60
Tamilnadu	-	-	333	333	194	210	1400	-	-	524	-	2328	2661
Uttarakhand	24684	4845	8021	37550	3228	4551	3876	4706	1524	23604	-	41487	79037

Figures rounded off.

Rajasthan, the major producing state of steatite accounted for as much as 74% of the total production in 2010-11. Among the other states, the share of Uttarakhand was 18% and that of Andhra Pradesh was nearly 7%. Nominal production was also reported from Bihar, Gujarat and Tamil Nadu.(Tables 2 to 5).

Mine-head stocks at the end of the year were 842 thousand tonnes as against 765 thousand tonnes at the beginning of the year (Table 6).

The average daily employment of the labour was 3,486 in 2010-11 as against 3,731 in the previous year. The domestic prices of talc/ steatite/ soapstone are furnished in the General Review on ' Prices'.

Table -2: Principal Producers of Steatite, 2010-11

Name & address of producers	Location of mine	
	State	District
Associated Soapstone Distributing Co. (P) Ltd., 24, Akashwani Marg, P.B.No. 3 Udaipur- 313 003, Rajasthan	Rajasthan	Udaipur
Udaipur Mineral Development Syndicate (P) Ltd., Golcha Trade Centre (GTC), 4th Floor Ajmeri Gate, MI Road, Jaipur – 302 001, Rajasthan.	Rajasthan	Bhilwara
Rajasthan Mineral & Co. B-25, Gautam Marg Hanuman Nagar Post-Vaishali Nagar Jaipur -302 021 Rajasthan	Rajasthan	Bhilwara
Katiyar Mining & Industries Corpn, 117/L/215,Naveen Nagar, Kakadeo Kanpur – 208 025, Uttar Pradesh.	Uttarakhand	Bageshwar
Nalwaya Mineral Industries (P) Ltd., 7/A, Bapu Bazar, Udaipur - 313 001, Rajasthan.	Rajasthan	Dungarpur
Parvatiya Mines, Rampur Road, Haldwani Distt. Nainital, Uttara khand	Uttarakhand	Bageshwar
Jai Polymers Co. (P) Ltd., Chirwa Ghat, Amberi Udaipur, Rajasthan.	Rajasthan	Udaipur
Mahaveer Trading Co., E – 263, Mewar Industrial Area, Madri, Udaipur – 313 001, Rajasthan.	Rajasthan	Udaipur
R.K.Singhvy* C/O Best Mineral 1, Town Hall, Link Road Udaipur Rajasthan	Rajasthan	Udaipur
Kedarnath Khaitan Khaitan Industries 5, Shivaji Nagar, Udaipur Rajasthan	Rajasthan	Udaipur

Contd.

Table-2 (Concld..)

Name & address of producer	Location of mine	
	State	District
Darshansingh Parihar Parihar Furniture, Near SBI, Bageshwar, Uttarakhand.	Uttarakhand	Bageshwar
Krishna Minerals &Traders 3/B Industrial Estate, Pratapnagar, Udaipur 313 005 Rajasthan.	Rajasthan	Rajasamand Udaipur
B. Venkateswaralu Old Bus stand P.O.Bethamecherla 518 599 Distt. Kurnool Andhra Pradesh	Andhra Pradesh	Kurnool
Rajkumar Pareek At/post- Jaliya Distt- Bhilwara Rajasthan	Rajasthan	Bhilwara
Khimuli Devi Village- Artola Post-Panuawanaula Dist- Almora 263 631 Uttarakhand	Uttarakhand	Bageshwar
Nandini Mineral Industries, B.Sridhar Reddy 3-1183,BPL Road. P.O. Bethamcherla, Distt. Kurnool – 518 599, Andhra Pradesh.	Andhra Pradesh	Kurnool
Ratanlal Deedwaniya D-4,Nagori Garden Bhilwara, 311 001 Rajasthan	Rajasthan	Bhilwara
Jagdish Singh Kalakoti Village- Kathyatwara Post- Kathyatwara Dist- Bageshwar Uttarakhand	Uttarakhand	Bageshwar

**Associated with dolomite*

Table – 3 : Production of Talc/ Steatite/Soapstone, 2008-09 to 2010-11 (By States)

(Qty. in tonnes; value in ₹ '000)

State	2008-09		2009-10		2010-11 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**888995**	**598522**	**876548**	**713708**	**895817**	**592977**
Andhra Pradesh	82439	23503	77064	24389	59336	20868
Bihar	1410	179	2235	380	2948	536
Chhattisgarh	476	48	128	32	-	-
Gujarat	122	18	2660	396	2316	289
Odisha	4	++	-	-	-	-
Rajasthan	653258	459348	647691	529722	665001	411338
Tamil Nadu	-	-	1000	200	1295	259
Uttarakhand	151286	115426	145770	158589	164921	159687

Table - 4 : Production of Steatite, 2009-10 & 2010-11 (P) (By Frequency Groups)

(Qty in tonnes)

Production group	No. of mines		Production for the group		Percentage in total production		Cumulative percentage	
	2009-10	2010-11	2009-10	2010-11	2009-10	2010-11	2009-10	2010-11
All Groups	**126 (5)**	**113 (5)**	**876548**	**895817**	**100.00**	**100.00**	**-**	**-**
Up to 500	30 (1)	30	3374	5558	0.38	0.62	0.38	0.62
501 to 1000	13	9	8823	6418	1.01	0.72	1.39	1.34
1001 to 2000	20 (2)	20 (1)	33330	31765	3.80	3.55	5.19	4.89
2001 to 5000	29 (1)	19 (2)	101558	73490	11.59	8.20	16.78	13.09
5001 to 10000	16	21(1)	111388	165425	12.71	18.47	29.49	31.56
10001 to 25000	11 (1)	7(1)	175562	123271	20.03	13.76	49.52	45.32
25001 & Above	7	7	442513	489890	50.48	54.68	100.00	100.00

Figures in parentheses indicate no. of associated mines with clay (others), dolomite and kaolin..

Table – 5 : Production of Talc/Steatite/Soapstone, 2009-10 & 2010-11
(By Sector/States/Districts/Grades)

(Qty. in tonnes; value in ₹ '000)

State/District	2009-10					2010-11 (P)				
	No.of mines	Quantity			Value	No.of mines	Quantity			Value
		Insecticide/ DDT	Other than Insecticide	Total			Insecticide/ DDT	Other than Insecticide	Total	
India	**126 (5)**	**225916**	**650632**	**876548**	**713708**	**113(5)**	**276526**	**619291**	**895817**	**592977**
Private Sector	126 (5)	225916	650632	876548	713708	113(5)	276526	619291	895817	592977
Andhra Pradesh	**30 (3)**	**57874**	**19190**	**77064**	**24389**	**22(2)**	**38777**	**20559**	**59336**	**20868**
Anantapur	5	80	5940	6020	4685	4	-	5279	5279	4416
Kurnool	25 (3)	57794	13250	71044	19704	18(2)	38777	15280	54057	16452
Bihar	**1**	**2235**	**-**	**2235**	**380**	**1**	**2948**	**-**	**2948**	**536**
Munger	1	2235	-	2235	380	1	2948	-	2948	536
Chhattisgarh	**3**	**128**	**-**	**128**	**32**	**-**	**-**	**-**	**-**	**-**
Kanker	3	128	-	128	32	-	-	-	-	-
Gujarat	**1 (1)**	**2660**	**-**	**2660**	**396**	**1**	**2316**	**-**	**2316**	**289**
Sabarkantha	1	2360	-	2360	354	1	2316	-	2316	289
Vadodara	(1)	300	-	300	42	-	-	-	-	-
Rajasthan	**58 (1)**	**107760**	**539931**	**647691**	**529722**	**54(3)**	**184964**	**480037**	**665001**	**411338**
Banswara	1	4850	-	4850	485	1	1280	-	1280	134
Bhilwara	8	49893	166664	216557	135256	5(2)	62408	171674	234082	139808
Dausa	1	1311	-	1311	328	1	424	-	424	85
Dungarpur	7	3708	37529	41237	25038	6	11995	31407	43402	21645
Jaipur	1	-	6631	6631	3846	1	-	4590	4590	2600
Karauli	2	474	3451	3925	3309	2	650	4200	4850	5203
Rajsamand	7	7833	10657	18490	6664	7	5465	10901	16366	6208
Udaipur	31(1)	39691	314999	354690	354690	31(1)	102742	257265	360007	235655
Tamil Nadu	**1**	**1000**	**-**	**1000**	**200**	**1**	**1295**	**-**	**1295**	**259**
Coimbatore	1	1000	-	1000	200	1	1295	-	1295	259
Uttarakhand	**32**	**54259**	**91511**	**145770**	**158589**	**34**	**46226**	**118695**	**164921**	**159687**
Almora	-	-	-	-	-	1	-	2705	2705	1921
Bageshwar	26	50359	84828	135187	152462	24	43276	102479	145755	146598
Pithoragarh	6	3900	6683	10583	6127	9	2950	13511	16461	11168

Figures in parentheses indicate no. of associated mines with limestone, clay (others), quartz, asbestos, kaoline and dolomite.

Table – 6 : Mine-head Stocks of Talc/ Steatite/Soapstone, 2010-11(P)
(By States/Grades)

(In tonnes)

State	At the beginning of the year			At the end of the year		
	Insecticide/ DDT	Other than Insecticide	Total	Insecticide/ DDT	Other than Insecticide	Total
India	**130917**	**634344**	**765261**	**165656**	**676211**	**841867**
Andhra Pradesh	11178	2363	13541	8597	2226	10823
Bihar	35	-	35	31	-	31
Chhattisgarh	382	-	382	354	-	354
Gujarat	169	-	169	15	-	15
Madhya Pradesh	140	-	140	-	-	-
Odisha	342	-	342	-	-	-
Rajasthan	110278	615736	726014	148195	647848	796043
Tamil Nadu	56	-	56	6	-	6
Uttarakhand	8337	16245	24582	8458	26137	34595

MINING, MARKETING & TRANSPORT

The deposits of talc are worked both by opencast and underground methods of mining. In India, almost all the mines are worked by opencast method except a few mines in Rajasthan and Andhra Pradesh where underground method of mining is followed.

In opencast method, the overburden, being hard, is removed by drilling and blasting and the mineral, being soft, is mined and transported to the stacking places manually. In some opencast pits in Rajasthan, mechanical excavators are in use. Benches are formed along the strike on the hanging wall and footwall sides to work the deposit at depth. Most soapstone mines are worked manually. Some mines are semi-mechanised and a few are mechanised. In manually worked opencast mines, drilling is sometimes done by compressor-jackhammer unit. In semi-mechanised mines, drilling and face transport are by mechanical means but face loading, sorting, etc. are carried out manually. In a few mines, small capacity shovel and matching dumpers are deployed for handling waste. In most opencast mines, loading is done manually. In some larger mines, loading and transport are done by shovel and dumper combination. In a few mines, hand trimming is carried out on the surface. Mechanical haulage transports the material through the incline.

In underground mining in Rajasthan and Andhra Pradesh, the deposit is reached from the surface through shafts or inclines depending upon the topography and the configuration of the deposit. Generally, inclines of 1.8 m x 1.8 m and 2 m x 2 m in section are developed from the surface through the soapstone mineralisation along the dip. Levels of 1.8 m x 1.8 m or 2 m x 2 m in cross-section are driven along the body at vertical intervals of 15 to 25 m. For developments, holes are drilled with compressed-air operated jackhammers. Holes in soapstone are blasted with special gelatine using ordinary detonators and safety fuses. For transportation and hoisting from underground, tipping tubs and skip hoists are used.

Talc stacked at the mine site or in stacking yard is processed by hand sorting to remove impurities like calcite, dolomite, iron oxide and quartzite. After removal of impurities grading is done visually on the basis of its whiteness. Sometimes, talc is washed to remove fine dust and impurities. It is graded into Grade 'A', Grade 'B', Grade 'C' and Grade 'D'.

Grade A

It is known as the first quality material. The colour of the mineral is pure white to slightly green. The whiteness is in the range from 90 to 95%. It is used in producing pharmaceuticals and cosmetics.

Grade B

It is known as the second quality material. The colour is pale-greenish to white. The whiteness is in the range from 85 to 90%. It is used in producing superior-grade paper, textile and ceramics.

Grade C

It is known as the third quality material. The colour is light greenish-grey. Whiteness is in the range from 78 to 85%. It is used in paper (inferior grade), paint, rubber, plastic and detergent industries.

Grade D

It is known as the fourth quality or DDT grade. The material having whiteness of 78% or below is generally classified under this grade. The colour of the material is dark greenish-grey to reddish-green. The DDT grade material is considered to be of a very poor quality. Gradewise whiteness & their specification consuming industries are given in Table-7.

Table – 7 : Gradewise Consuming Industries of Talc

Grade	Whiteness Percentage	Industry
Grade - A	90 to 95%	i) Pharmaceutical ii) Cosmetic
Grade - B	85 to 90%	i) Superior grade paper ii) Textile iii) Ceramic
Grade - C	78 to 85%	i) Paper inferior grade ii) Paint iii) Rubber iv) Plastic v) Detergent
Grade - D	78% or below	DDT

Since the industry is demanding fine powder, the technology is advancing in this direction. The pulverisers/hammer mills developed and manufactured in India are capable of giving up to 700 mesh powder. The world market prefers fine powder which can be produced by adopting new processing techniques like micronising and sterilisation of the product.

Talc is crushed and ground by hammer mills and roller mills into powder; while talc particles size is analysed by classifier. After pulverising/ processing, the material is packed in 25 kg, 50 kg, 500 kg and 1,000 kg HDPE bags for internal use and laminated bags for export purpose. The pulverised talc from the processing plants and unprocessed talc from the mines are despatched through trucks and railway wagons to various consuming centres. The important loading stations for talc in the country are Maharana Pratap Nagar (Udaipur) and Kachhola in Rajasthan and Tanakpur in Uttarakhand. For exports, nearest ports are Kandla or Mumbai.

USES & SPECIFICATIONS

Talc, in pulverised form, is mostly used as a filler in paper, textile, rubber, insecticides and fertilizer industries. Pure talc after calcining, called 'Lava', is used in the manufacture of low-loss ceramic materials essential for radio, radar, television, etc. In roofing products, such as tar, paper, asphalt shingles and roll roofing, talc acts as a fire retardant and increases weather resistance. Body and face powders (talcum powder) are prepared from the finest quality talc after adding deodorant and perfumes. Massive steatite when cut into panels is used for switchboards and acidproof tabletops in laboratory, laundry and kitchen sinks, in tubs and tanks as well as for lining alkali tanks in paper industry. Due to its high melting point (1630 ^{0}C), soapstone can be used in refractories and fire places. It is also quite useful in sculpturing.

Indian talc, especially mined in Rajasthan and Andhra Pradesh, is comparable with the best quality available in other countries. Indian talc is considered to be the second best in the world next to 'Italian talc'. In the world market, talc, free from grit, having high whiteness and high degree of soapiness feeling is very much sought after in cosmetic, filler and weighing applications. Talc having more than 92% brightness, less than 1% Fe_2O_3 and less than 1.5% $CaCO_3$ is preferred for exports.

Soapstone powder is also used as parting agent in foundry industry. Parting agents are used for easy release of moulds and cores from pattern equipment and core boxes. BIS specification IS 8250-1988 (first revision reaffirmed, 2008) prescribes use of off-white or cream-coloured material having a very smooth and slippery feel, passing completely through 75 micron IS-sieve. The material shall be predominantly magnesium silicate and chemical composition as agreed to between buyer and purchaser compatible with naturally occurring soapstone. In paint industry, foliated, fibrous or lamellar material of 300 mesh and free from silica is used. Specifications of steatite (as French chalk) used in paper, textile, pyrotechnic and rubber industries as per IS: 380-1978 (Second Revision, Reaffirmed 2003) are furnished in Table - 8. Specifications as per IS : 10429-1982 (Reaffirmed 2001) for ceramic industry and actual user specifications for insecticide industry are furnished in Table-9. BIS has prescribed specifications for use of talc in cosmetic industry vide IS: 1462-1985(Third Revision, reaffirmed 2006). The international specifications of talc for use in ceramic, cosmetic and paint industries are given in Table - 10.

Table – 8 : Specifications of Steatite (French Chalk, Technical for Use in Paper, Textile, Pyrotechnics and Rubber Industries) (IS: 380-1978, Second Revision, Reaffirmed 2003)

Parameter	Paper	Textile	Pyrotechnics	Rubber
Loss on ignition	4% (max)	4% (max)	4% (max)	4% (max)
Matter insoluble in HCl	95% (min)	95% (min)	95% (min)	95% (min)
Grit, percentage by mass, max	0.02	0.02	0.02	–
Chlorides (NaCI)	0.5% (max)	0.5% (max)	0.5% (max)	0.5% (max)
Iron (as Fe_2O_3) percentage by mass, max	0.3	0.3	0.3	–
pH 8.5 (max)	8.5 (max) (of 10% solution)	8.5 (max) (of 10% solution)	8.5 (max) (of 10% solution)	(of 10% solution)
Whiteness, reflectance to blue light of wavelength 5040 A^0 (percent, min)	80	80	80	–
Relative density	2.7-2.9 (at 27 ^oC)	2.7-2.9 (at 27 ^oC)	2.7-2.9 (at 27 ^oC)	2.7-2.9 (at 27 ^0C)
Remarks	–	–	–	*

* *Material required for preservation of rubber goods shall contain not more than 0.05%, by mass, of copper or manganese or their compound in terms of respective compounds.*

Table – 9 : Specifications of Steatite for Use in Insecticide and Ceramic Industries

Parameter	Insecticide (User)	Ceramics (IS:10429-1982)	
		Grade-I	Grade-II
Loss on ignition (% by mass, max)	7% (max)	5.5%	6.5%
Moisture and other volatile matter	1% (max)	1% (max)	1% (max)
Silica (as SiO_2) % by mass, min	–	60	56
Alumina (as Al_2O_3) % by mass, max	–	1.5	2.5
Iron oxide (as Fe_2O_3) % by mass, max	1-1.5	1.0	1.5
Calcium oxide (as CaO) % by mass, max	–	1.0	3.5
Magnesia (as MgO) % by mass, min	–	30	28
Alkali (as Na_2O + K_2O) % by mass, max	–	0.4	0.5
pH	6-7	–	–
Fineness	300 mesh	–	–
Size grading			
Material passing through 75 microns IS sieve, % by mass, min	–	99	99
Material passing through 45 microns IS sieve, % by mass, min.	–	80	80
Specific gravity	–	2.7 to 2.8	2.7 to 2.8
Fusibility (Orton Standard Pyrometric Cone)	–	18 to 23 (1522-1605 ^{o}C)	16 to 18 (1491-1522 ^{o}C)
Linear shrinkage (fired) % by length, max	–	12	–
Water absorption % by mass, max	–	0.1	–

Grade-I : Suitable for ceramic insulator industry & Grade II: Suitable for ceramic pottery industry.

Table – 10 : International Specifications for Talc

Parameter	Ceramic	Cosmetic	Paint*
MgO	30% (min)	–	88% (Mg and Ca silicates)
SiO_2	60%	0.1-1.0%	–
CaO	1% (max)	–	–
Al_2O_3	4% (max)	–	–
Fe_2O_3	1.5% (max)	–	–
Alkali	0.4% (max)	–	–
Size	-325 mesh (95%)	-200 mesh	-325 mesh
Acid soluble	6	–	–
Water soluble	–	0.1 (max)	1
Loss on ignition	–	6	7
Brightness	–	–	Over 90

* *Moisture 1%.*

CONSUMPTION

Talc is used mostly in pulverised form as a filler and extender in various industries. The non-pulverised talc is used in refractory, etc. Total reported consumption of talc/steatite/soapstone in the organised sector was at 381 thousand tonnes in 2010-11 and 375 thousand tonnes in 2009-10 . About 59% consumption in 2010-11, was in paper industry, followed by paint (20%), pesticide (11%), ceramic (7%) and cosmetic (3%) industries. Nominal consumption was shared by fertilizer, rubber, textile, chemicals and other industries. Consumption of talc/steatite/soapstone during 2008-09 to 2010-11 is given in Table-11.

POLICY

The Export-Import Policy incorporated in the Foreign Trade Policy, 2009-14 allows imports and exports of talc freely without restrictions under heading no.2526.

Table – 11 : Reported Consumption of Talc/ Steatite/Soapstone, 2008-09 to 2010-11 (By Industries)

(In tonnes)

Industry	2008-09	2009-10(R)	2010-11(P)
All Industries	**370800**	**375300**	**380500**
Ceramic	17700(23)	24000(22)	28100(22)
Cosmetic	11600(16)	12000 (14)	11400(14)
Paint	74100 (31)	74300 (31)	74600(31)
Paper	223900(48)	221300(43)	222700(43)
Pesticide	42000 (17)	42100 (16)	42100 (17)
Rubber	800 (27)	800 (26)	800 (26)
Others (abrasive, chemical, electrical, fertilizer, foundry, pharmaceutical, refractory, textile and vanaspati)	700 (32)	800 (26)	800 (26)

Figures rounded off.
Data collected on non-statutory basis.
Figures in parentheses denote the number of units in organised sector reporting consumption.*
*(*includes actual reported consumption and estimates made whenever required)*
Plastic industry also consumes talc for which data is not available.

WORLD REVIEW

The world reserves of talc and pyrophyllite are quite large and sufficient to meet the world demand. The world reserves of talc (alongwith pyrophyllite) are given in Table -12. Reserves of talc are not available separately.

The world production of talc is estimated at 7.4 million tonnes in 2010. Principal producing countries were China (27%), followed by India (11%), Brazil (8%) and Finland &USA (7% each) (Table -13).

Table – 12 : World Reserves of Talc and Pyrophyllite (By Principal Countries)

(In '000 tonnes)

Country	Reserves
World : Total (rounded)	**Large**
Brazil	230000
China	Large
Finland	Large
France	Large
India	75000
Japan	100000
Korea, Rep. of	14000
USA*	140000
Other countries	Large

** Excludes pyrophyllite.*
***Source:** Mineral Commodity Summaries, 2012.*

Table-13 : Production of Talc (By Principal Countries

In '000 tonnes)

Country	2008	2009	2010
World Total	**8100**	**7600**	**7400**
Australia	130[e]	92	80
Austria	155	111	138
Brazil@	513	577	600
China	2200[e]	2300	2000[e]
Finland	527	500[e]	500[e]
France	420[e]	420[e]	420[e]
India	888	835	829
Italy	110[e]	110[e]	110[e]
Korea, Dem.P.R. of [e]	50[e]	50[e]	50[e]
Mexico	16	33	01
Russia	150[e]	150[e]	150[e]
Spain	59	47	52
USA	706	511	530
Other Countries	2176	1864	1930

***Source:** World Mineral Production, 2006-2010.*
@ Including talc, agalmatolite and pyrophyllite

FOREIGN TRADE

Exports

Exports of steatite increased to113,411 tonnes in 2010-11 from 87,870 tonnes in the previous year. Out of total steatite exported in 2010-11, steatite blocks constituted 4,122 tonnes, steatite lumps 9,674 tonnes and steatite powder & others 99,615 tonnes. Steatite in different forms was exported mainly to Thailand (15%), China (14%) UAE (11%), Japan (7%) and Nepal, Nigeria & Philippines (4% each) (Tables - 14 to 17).

Imports

Imports of steatite increased to 10,016 tonnes in 2010-11 from 2,489 tonnes in the previous year. Out of total steatite imported in 2010-11, steatite lumps were 6,594 tonnes and steatite powder & others 3,492 tonnes. Steatite blocks imports were nominal at 1 tonne. Steatite in different form was imported mainly from pakistan (72%) China (19%), Norway (2%) and Italy & Japan (1% each) (Tables 18 to 21).

Table – 14 : Exports of Steatite (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value ('₹000)
All Countries	**87870**	**618521**	**113411**	**800844**
Thailand	9702	59948	16847	98074
China	23	109	15944	86049
UAE	7389	67897	11990	84036
Japan	4093	29145	7609	69113
Malaysia	6208	61432	3916	39673
Philippines	2996	21382	4810	33167
Indonesia	3333	15517	3826	30547
Nigeria	2886	16437	4886	28129
Kenya	2261	19716	3315	24710
Nepal	6274	26400	4889	23129
Other countries	42705	300538	35379	284217

Table –15 : Exports of Steatite Blocks (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value ('₹000)	Qty (t)	Value (₹'000)
All Countries	**4602**	**24355**	**4122**	**24693**
Japan	1580	9266	2475	15796
USA	416	3881	32	2311
Netherlands	226	3103	279	1607
Bangladesh	585	910	848	1579
UK	-	-	148	1183
China	-	-	86	1118
Nepal	976	3312	210	902
Germany	71	140	36	160
Malaysia	82	792	5	17
Canada	3	24	1	13
Other countries	663	2927	2	7

Table –16 : Exports of Steatite Lumps (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**7915**	**44587**	**9674**	**43337**
UAE	6	29	4384	19851
Spain	5348	32734	3132	10348
Belgium	107	1622	196	2925
Bangladesh	1299	3161	1036	2574
Saudi Arabia	-	-	292	1583
Japan	22	383	80	1245
Netherlands	231	2632	112	1243
Nepal	138	389	255	1157
China	-	-	45	690
USA	-	-	20	501
Other countries	764	3637	122	1220

Table –17: Exports of Steatite Powder & Others (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**75353**	**549579**	**99615**	**732814**
Thailand	9352	57949	16847	98074
China P Rep.	23	109	15813	84241
UAE	7321	67099	7605	64183
Japan	2491	19497	5054	52072
Malaysia	6101	60490	3911	39656
Philippines	2996	21382	4810	33167
Indonesia	3333	15517	3826	30547
Nigeria	2886	16437	4886	28129
Kenya	2261	19716	3262	24449
Sri Lanka	1647	18675	1909	22790
Other countries	36942	252708	31692	255506

Table – 18 : Imports of Steatite (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹000)
All Countries	**2489**	**48578**	**10016**	**127764**
China	504	13064	1904	50275
Pakistan	1091	6591	7198	41590
Italy	79	3951	142	6541
U S A	64	4193	95	5876
Japan	185	7942	117	5805
Belgium	47	2532	78	3123
U K	24	852	54	3085
Portugal	-	-	60	2426
Norway	236	3604	159	2390
Other countries	259	5849	209	6653

Table –19: Imports of Steatite Lumps (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**180**	**876**	**6594**	**38009**
Pakistan	108	593	6594	38009
Other countries	72	283	-	-

Table – 20 : Imports of Steatite Powder & Others (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹000)
All Countries	**2371**	**51254**	**3492**	**92285**
China	504	13064	1904	50275
Italy	79	3951	142	6541
Japan	185	7942	117	5805
USA	64	4193	94	5747
Pakistan	929	5673	604	3581
Belgium	47	2532	78	3123
U K	24	852	54	3085
France	116	3877	71	2659
Portugal	-	-	60	2426
Norway	236	3604	159	2390
Other countries	187	5566	209	6653

Table – 21: Imports of Steatite blocks ((By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**54**	**325**	**1**	**129**
USA	-	-	1	129
Other countries	54	325	-	-

FUTURE OUTLOOK

The apparent domestic demand for talc-steatite is estimated to be 879 thousand tonnes in 2011-12 and 1.35 million tonnes by 2016-17 at 9% growth rate. India is one of the principal sources of 'lawa' grade talc suited for specialised purposes like low ceramic materials) and of sawn shaped talc. Indian talc is considered to be the second best in the world next to Italian talc. The world market conditions for talc minerals are steadily growing . Therefore, concerted efforts are necessary to increase exports by making Indian talc suitable for world market. In view of india's large resource base and well developed production facilities that utilise modern pulverising techniques. The prospects for boosting the export of talc-steatite are rather imminent.

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

TIN

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

75 Tin

Tin is one of the earliest metals known and used mainly in bronze implements.It is a scarce element having an incidence of about 2 ppm in the earth's crust. Its unique combination of properties like non-toxic nature, high malleability, chemical inertness and ease with which it can form an amalgam and alloy with other metals has given it a special status among non-ferrous metals. Pure tin is a silvery-white metal which is soft and malleable.It does not occur naturally as metal. By far, the most important tin mineral is cassiterite (SnO_2), which, in its purest form contains 78.6% tin. The less common tin ore is stannite (Cu_2SnFeS_4). Tin is now used mostly for tin plating, soldering and in making bronze.

RESOURCES

Tin occurs in primary as well as secondary (alluvial or placer) forms. Occurrences of tin in primary as well as secondary forms have been reported from Bihar, Chhattisgarh, Haryana, Himachal Pradesh, Jammu & Kashmir, Karnataka, Odisha, Rajasthan and West Bengal. However, the only workable economic deposits in the form of alluvial or placer deposits occur in Bastar and Dantewada districts of Chhattisgarh. Tin in primary form as disseminations in the gneisses and schists of Koraput district, Odisha is another source of economic importance.

The total resources of tin ore in the country as per UNFC system, as on 1.4.2010 are placed at 83.73 million tonnes containing about 102,275 tonnes metal. About 7,131 tonnes ore containing 1,132 tonnes metal are placed under 'reserves' category and the bulk i.e. about 83.72 million tonnes containing about 101,142 tonnes metal are placed under 'remaining resources' category. The entire ore reserves are located in Chhattisgarh. About, 64% of total ore resources are located in Haryana and 36% in Chhattisgarh, while nominal resources are estimated in Odisha (Table-1).

PRODUCTION & STOCKS

Concentrates

Chhattisgarh was the only state producing tin concentrates. The production of tin concentrates in 2010-11 was 61,355 kg as against 59,016 kg in the preceding year. Six mines, one in public sector and five in private sector reported production in 2010-11. All these mines are located in Dantewada district of Chhattisgarh.

The mine-head stock of tin concentrates were 11,425 kg at the beginning of the year as against 10,994 kg at the end of the year (Tables - 2 to 5) .

The Chhattisgarh Mineral Development Corporation Limited (CMDC) purchases tin concentrates from local tribals, allowing them to collect it from the lease area. Hence, no labour was reported to have been employed in the mine owned by the CMDC Ltd, whereas Precious Minerals and Smelting Ltd employed 53 workers on average daily basis in the mines during the year as against 44 in the previous year. Prices of tin concentrates are furnished in the General review on 'Prices'.

Tin Metal

The plant owned by Precious Mineral and Smelting Limited reported production of 24,013 kg of tin metal in 2010-11 compared to 27,129 kg in the preceding year. The plant is located at Jagdalpur in Chhattisgarh. Production of tin metal is furnished in Table - 6.

Table – 2 : Producers of Tin Concentrates 2010-11

Name & address of the producer	Location of the mine	
	State	District
Chhattisgarh State Mineral Dev. Corp. Ltd, 27/520, New Shanti Nagar, Shankar Nagar Road, Raipur, Chhattisgarh.	Chhattisgarh	Dantewada
Precious Minerals and Smelting Ltd, Semi Urban Industrial Estate, Frezerpur, Jagdalpur-494 001, Chhattisgarh.	Chhattisgarh	Dantewada

Table – 1 : Reserves/Resources of Tin as on 1.4.2010
(By Grades/States)

(In tonnes)

Grade/State	Reserves				Remaining resources							Total Resources
	Proved	Probable		Total	Feasibility	Pre-feasibility		Measured	Indicated	Inferred	Total	
	STD111	STD121	STD122	(A)	STD211	STD221	STD222	STD331	STD332	STD333	(B)	(A+B)
All India : Total												
Ore	4404	1015	1713	7132	22592692	2326	31330000	168622	561080	29064345	83719065	83726197
Metal	925.75	189.76	16.92	1132.43	32222.43	652.89	54032.08	894.91	231.63	13107.75	101142.41	102274.84
By States												
Chhattisgarh												
Ore	4404	1015	1713	7132	-	1690	-	168622	559914	29063345	29793571	29800703
Metal	925.75	189.76	16.92	1132.43	-	152.11	-	894.91	209.43	13097.75	14354.2	15486.63
Haryana												
Ore	-	-	-	-	22580000	-	31330000	-	-	-	53910000	53910000
Metal	-	-	-	-	32187.8	-	54032.8	-	-	-	86220.6	86220.6
Odisha												
Ore	-	-	-	-	12692	636	-	-	1166	1000	15494	15494
Metal	-	-	-	-	34.63	500.78	-	-	22.2	10	567.61	567.61

Figures rounded off.

Table – 3 : Production of Tin Concentrates, 2008-09 to 2010-11
(By State)

(Quantity in kg; value in ₹'000)

State	2008-09		2009-10		2010-11(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**59778**	**21267**	**59016**	**22895**	**61355**	**27100**
Chhattisgarh	59778	21267	59016	22895	61355	27100

Table – 4 : Production of Tin Concentrates, 2009-10 and 2010-11
(By Sectors/State/District)

(Quantity in kg; value in ₹'000)

State	2009-10			2010-11(P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India	**5**	**59016**	**22895**	**6**	**61355**	**27100**
Public sector	1	34223	10399	1	50179	23114
Private sector	4	24793	12496	5	11176	3986
Chhattisgarh	**5**	**59016**	**22895**	**6**	**61355**	**27100**
Dantewada	5	59016	22895	6	61355	27100

Table – 5 : Mine - head Stocks of Tin Concentrates, 2010-11(P)
(By State)

(In kg)

State	Stocks at the	
	Beginning of the year	End of the year
India	**11425**	**10994**
Chhattisgarh	11425	10994

Table – 6 : Production of Tin Metal in India 2008-09 to 2010-11

(Qty. in kg; value in ₹'000)

Year	Production	
	Quantity	Value
2008-09	26568	18952
2009-10	27129	15491
2010-11(P)	24013	25086

MINING

In Govindpal-Tongpal area in Dantewada district, Chhattisgarh, tin in the form of cassiterite is being mined from the sediments deposited in the streams. The stream sediments are dug up manually with conventional implements. Subsequent panning of these sediments helps in separating the lighter gangue minerals while the heavier part is recovered as cassiterite. The CMDC purchases cassiterite concentrate at mutually agreed rates.

INDUSTRY

Precious Minerals and Smelting Ltd is a joint sector company promoted by Lunia group with CMDC Ltd. It has the only working plant producing tin ingots at present. Metal production has not been reported from M/s Dravya Industrial Chemicals Ltd from its plant located in Raipur district since 1999-2000. Similarly, production has not been reported by the lone public sector plant of CMDC in Raipur district, Chhattisgarh.

Under private sector, HAMCO Mining and Smelting Ltd, Mumbai, has a tin plant at Silvassa, Dadra & Nagar Haveli. The plant uses imported concentrates. It has a production capacity of 3,000 tpy. However, the plant has not reported production. The other plant at Choudhwar, Cuttack district, Odisha owned by Sartin Alloys Private Ltd has 300 tpy capacity for unwrought tin and 1,000 tpy capacity for lead and tin alloys. This plant is designed to process domestic as well as imported ores. This plant has also not reported any production since 2002-03.

Hindustan Tin Works Ltd is contemplating setting up a 350 million cans per annum capacity plant at Taloja in Maharashtra which will substitute the imports of cans meant mainly for beer and beverage/soft drinks.

USES & SPECIFICATIONS

Tin, as a metal, is the most preferred and environment-friendly packing material. Tin plates are used both in packaging food products like processed food, vanaspati ghee, etc. and in battery jackets and pesticide cans. The tin plate is manufactured by depositing tin on iron plate of thickness ranging from 0.17 mm to 0.60 mm. The amount of tin coating on tin plate was earlier as per BIS specification IS:597-1978 for pack-rolled tin plate and pack-rolled black plate which is now inactive. The specifications for tin ingot which is to be used for various purposes is as per IS: 26 - 1992 (Fourth Revision, Reaffirmed 2008). There shall be two grades of tin ingot; viz, Sn 99.85% and 99.75%. BIS has prescribed IS:4280-1992 (Reaffirmed 2008) for refined secondary ingots.

Tin readily forms alloys with other metals to create useful materials, such as solders, bronzes, and fusible alloys. Tin with lead forms an excellent alloy which melts at very low temperature and is used as solders in electronics or as a seal in plumbing. Tin is used in making fusible alloys to be used in safety devices such as fire sprinklers, pressure cookers, boiler plugs and electrical fuses.

Powder containing 60% silver, 27% tin and 13% copper when mixed with appropriate quantity of mercury forms excellent dental amalgam to be used for filling dental cavities.

Tin is used in cast iron to improve the microstructure and it results in higher uniform hardness. Tin bronzes are used for making gears, tubing, springs and plumbing fitments and for making bearings. Tin is also used in making high tech alloys such as zirconium-tin, used for cladding the fuel elements in thermal nuclear reactors and a niobium-tin-intermetallic compound used in certain high-performance superconducting fields such as in high-energy physics.

Tin oxide-based catalysts are used in air purification system, gas sensors and CO_2 lasers. Organotin compounds are used in agrochemicals and antifouling paints in seafaring vessels. Float glass industry is an important user of tin; it utilises a method of floating molten glass over a huge vat of molten tin. Pure tin in molten form is used to provide a flat surface as well as fire-polish on both sides of float glass which solidifies on it. It is also used in the production of lead crystal glass. Tin oxide films thicker than 1 mm on glass, produce a transparent, yet electrically conductive layer. This layer is used in de-icing windscreen, antistatic glassware, security alarm, etc.

POLICY

As per the Foreign Trade Policy, 2009-14, there are no restrictions on the export and import of tin ores and concentrates.

CONSUMPTION

The main consumers in India are the tin plate industry and solder industry. The latter advancing to become the biggest single end-use sector, over the last decade. The fastest growth rate is also expected in future. Tin plate companies; namely, Tin Plate Company of India Ltd and SAIL's Rourkela Steel Plant use tin metal in appreciable quantities for the manufacture of tin plate. The domestic tin plate market is categorised broadly into three basic market segments: edible oil and cashew, processed food and non-food for packaging. Rourkela plant's consumption of tin was 20 tonnes during 2010-11. Production of tin plates in 2009-10 was 18,024 tonnes and 7,193 tonnes in 2010-11 against an installed capacity of 85,000 tpy of tin plates. The Tin Plate Company of India Ltd consumes tin at its Golmuri Works, Jamshedpur in East Singhbhum, Jharkhand.The present installed capacity of the electrolytic tinning plant of the company is 379,000 tpy. The company produced 36,682 tonnes and 45,895 tonnes electrolytic tin plates in 2009-10 and 2010-11, respectively.

Other industry which consumes tin in substantial quantities in the country is tin solder required by high-tech and electronic sectors which have a positive impact on tin industry. The consumption in IT industry and in food/beverages packaging industry is increasing day by day.

SUBSTITUTES

The most important use of tin is in making packing materials, as it is environment-friendly. A number of materials can replace tin in its various applications; such as tetrapack for liquid food items, plastic/polycontainers for solid, semi-solid food; aluminium, glass, tin-free steel can be used in place of tin cans and containers. For tin solders, new epoxy resins, for bronze-aluminium alloys, copper-base alloys, plastic for bearing metals, compounds of lead and sodium for some tin chemicals are the other substitutes now in use in place of tin.

WORLD REVIEW

The world reserves of tin metal are estimated at 4.8 million tonnes, located mainly in China (31%), Indonesia (17%), Brazil (12%), Bolivia (8%) and Russia (7%). The world reserves of tin by principal countries are given in Table-7.

The world production of tin in 2010 decreased to 276,000 tonnes from 279,000 tonnes in the previous year. China (47%), Indonesia (16%), Peru (12%), and Bolivia (7%) were the principal producing countries (Table-8).

Yunnan Tin Group Co Ltd (China), PT Timah Tbk (Indonesia), Malaysia Smelting Corp. (Malaysia), Minsur SA (Peru), Thailand Smelting and Refining Co. Ltd (Thailand), Liuzhou China Tin Group Co. Ltd (China), Yunnan Chengfeng Non-ferrous Metals Co. Ltd (China), Empresa Metalurgica Vinto (Bolivia), Metallo Chimique NV (Belgium) and Geijiu Zi-Li Ltd (China) were the world's top 10 producers of refined tin, as per the ITRI in 2010. Global refined consumption is estimated to have increased by 13% in 2010 to 360,000 tonnes. Industrial and electronic solders accounted for 54% of refined tin demand.

Bolivia

Empresa Minera Huanuni began tender process for the construction of a large tin concentrator that would expand the throughput capacity from 1,200 tpd to 3,000 tpd. EMV planned to start work on a new Ausmelt tin smelter at the existing Vinto site. Completion was due in August 2011 and start up in September 2011.

China

Yunnan Tin Group, world's leading tin producer planned doubling of ore throughput capacity to 3,000 tpd within 9 years. First stage of 1,500 tpd would be attained by 2012, second stage expansion to 2,000 tpd by 2014 and the final 3,000 tpd cpacity would be achieved by 2019.

Morocco

Prefeasibility study on bulk underground mining of Achmmach tin project was due for completion in 2011. The mine would produce 6,000 tpy of tin-in-concentrate during Phase I, based on mining of 800,000 tpy of ore grading 1% tin.

U K

Wolf Mineral Ltd continued progress at Hemerdon Ball tungsten-tin project in Devon. The planned 3 million tpy processing plant was likely to yield 500 tpy of tin-in-concentrate.

Table – 7 : World Reserves of Tin (By Principal Countries)

(In '000 tonnes of tin content)

Country	Reserves
World : Total (rounded)	**4800**
Australia	180
Bolivia	400
Brazil	590
China	1500
Congo (Kinshasa)	NA
Indonesia	800
Malaysia	250
Peru	310
Portugal	70
Russia	350
Thailand	170
USA	-
Vietnam	NA
Other countries	180

Source: *Mineral Commodity Summaries, 2012.*

Table – 8 : World Production of Tin
(By Principal Countries)

(In tonnes of metal content)

Country	2008	2009	2010
World: Total	**274000**	**279000**	**276000**
Australia	1783	13269	18646
Bolivia	17320	19575	20190
Brazil	13899	9500	9600
China	121200	128000	129700
Congo, Dem. People's Rep.of	12817	10083	6203
Indonesia	53228	46078	43258
Malaysia	2605	2410	2668
Nigeria	1800	1800	1300
Peru[#]	39037	37503	33848
Russia[#]	1500	1200	1000[e]
Vietnam[e]	5400	5400	5400
Other countries	3411	4182	4187

Source: *World Mineral Production, 2006-2010.*
[#] *Recoverable.*

FOREIGN TRADE

Exports

There was no export of tin ores & conc. during 2010-11. Exports of tin & alloys including scrap were 1,737 tonnes as compared to 2,315 tonnes in the preceding year. Out of total exports in 2010-11, tin and alloys comprised 253 tonnes, tin and alloys worked (NES) 1,407 tonnes and tin scrap 77 tonnes. Exports were mainly to Italy (28%), UAE (8%) and Tunisia (5%) (Tables -9 to 13).

Imports

Imports of tin ores and concentrates decreased to 195 tonnes in 2010-11 from 487 tonnes in the previous year. Imports were mainly from People's Rep. of Congo (41%), South Africa (40%) and China (13%). Imports of tin and alloys including scrap were 7,494 tonnes in 2010-11 and 7,672 tonnes in the previous year. Out of the total imports in 2010-11, tin and alloys comprised 7,104 tonnes, tin and alloys (worked, NES) 347 tonnes and tin (scrap) 43 tonnes. Major suppliers were Malaysia (46%), Indonesia (17%), Belgium (10%) and Singapore (8%) (Tables - 14 to 19).

Table - 9 : Exports of Tin Ores & Conc.
(By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**7**	**371**	-	-
Other Countries	7	371	-	-

Table – 10 : Exports of Tin and Alloys Incl. Scrap
(By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**2315**	**598850**	**1737**	**376268**
Singapore	156	40525	76	46926
Italy	182	9347	490	43504
UK	25	20377	45	38071
Malaysia	407	271872	37	34274
Tanzania	148	18435	63	31596
China	6	2367	62	26867
Australia	3	1276	21	19972
UAE	191	19866	133	17837
Germany	26	6844	45	13231
Tunisia	253	13900	92	11818
Other countries	918	194041	673	92172

Table – 11 : Exports of Tin and Alloys
(By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**764**	**450443**	**253**	**196052**
Australia	0	243	21	19919
China	6	2165	29	17649
Germany	17	5111	21	11426
Iran	24	17197	-	-
Japan	21	12762	-	-
Malaysia	394	270915	34	33595
Netherland	2	2216	7	9696
Singapore	148	39757	66	45398
UK	21	19896	35	30739
USA	70	43184	1	2376
Other countries	61	36997	39	25254

Table - 12 : Exports of Tin and Alloys: Worked, NES (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**1435**	**140417**	**1407**	**173951**
China	++	192	33	9218
Egypt	-	-	149	8412
Italy	182	9347	490	43504
Oman	74	9770	2	670
South Africa	57	7884	42	3958
Sri Lanka	160	19872	32	3806
Tanzania	146	18389	63	31596
Tunisia	253	13900	92	11818
UAE	169	16075	123	10890
USA	100	13236	65	4798
Other countries	294	31752	316	45281

Table – 13 : Exports of Tin : Waste & Scrap (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**116**	**7990**	**77**	**6265**
Belgium	-	-	41	3626
Denmark	27	2588	-	-
Germany	4	337	-	-
Malawi	19	941	++	4
Mauritius	3	603	-	-
Nepal	17	309	28	1987
Saudi Arabia	-	-	5	387
Sri Lanka	3	462	1	83
UAE	20	1658	-	-
USA	20	747	-	-
Other countries	3	345	2	178

Table – 14 : Imports of Tin Ores & Conc. (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**487**	**168047**	**195**	**86167**
Congo, People's Rep. of	43	79999	79	38401
South Africa	195	69766	78	31759
China	-	-	25	10055
U A E	-	-	13	5952
Other countries	49	18282	++	++

Table – 15 : Imports of Tin and Alloys, Incl. Scrap (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**7672**	**5148447**	**7494**	**7258073**
Malaysia	2939	2083505	3460	3531029
Indonesia	1920	1256254	1289	1351742
Belgium	756	530423	754	652205
Singapore	395	228782	612	516591
China	333	80805	597	434778
Thailand	910	684110	385	381699
Chinese Taipei/ Taiwan	142	147757	101	135725
Germany	37	30410	67	66788
USA	26	7181	53	40616
Korea, Rep. of	9	6729	23	37736
Other countries	205	92491	153	109164

Table – 16 : Imports of Tin & Alloys (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**7367**	**5082623**	**7104**	**7114189**
Malaysia	2937	2080957	3446	3522535
Indonesia	1920	1256254	1289	1351742
Belgium	756	530423	754	652205
Singapore	382	225271	606	513479
Thailand	910	684078	385	381691
China	186	55929	356	370245
Chinese Taipei/ Taiwan	142	147757	94	114746
Germany	30	25581	59	59123
Korea, Rep. of	6	6495	23	37007
U S A	5	2263	30	33311
Other countries	93	67615	62	78105

Table – 17 : Imports of Tin & Alloys : Worked, NES (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹'000)	2010-11 Qty (t)	2010-11 Value (₹'000)
All Countries	**292**	**65631**	**347**	**142890**
China	147	24876	241	64533
Chinese Taipei/ Taiwan	-	-	7	20980
Italy	77	18163	24	14840
Malaysia	2	2548	14	8494
Germany	7	4829	8	7665
USA	21	4917	23	7296
Japan	1	1244	5	7013
Singapore	13	3511	6	3112
Hong Kong	18	3592	3	2856
UK	2	937	3	1583
Other countries	4	1014	13	4518

Table – 18 : Imports of Tin (Scrap)
(By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**13**	**193**	**43**	**994**
Australia	-	-	43	985
USA	-	-	++	9
Other countries	13	193	-	-

Table – 19 : Imports of Tin
(By Items)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Items	**7672**	**5148447**	**7494**	**7258073**
Tin & alloys	7367	5082623	7104	7114189
Block tin	977	639640	563	486229
Anode, cathode, etc. of tin unwrought	6017	4104691	6250	6307581
Tin base alloys, NES	218	225887	76	104911
Tin & alloys: worked	155	112405	215	215468
Tin & alloys: worked, NES	292	65631	347	142890
Tin scrap	13	193	43	994

FUTURE OUTLOOK

According to the Indian Tin Plate Manufacturers' Association (ITMA), the demand of tin plate for packaging industry in the country is growing and the consumption is expected to grow at a moderate level of 5% per annum. The per capita consumption of tin plate in India is only 0.3 kg compared with 10 kg in USA, 8 kg in Japan and 0.8 kg in China. The consumption pattern of tin in the world is: solders 28%, tin plates 27%, alloys and alloy coating 16%, PVC stabilisers 7%, tinning 5% and others 17 percent.

The demand has historically been dominated by tin - plate and soldering industries, with latter advancing to become the biggest single end-use sector over last decade. Demand is expected to continue to increase in all end-use sectors, but fastest growth rates will be in soldering industry.

In view of the likely enforcement of ban on the use of lead, lead-free solder will find market for soldering of electronic and electrical devices in the future. In other development, motor vehicle industry is showing interest in tin-zinc coatings for fuel tanks to replace lead-based fuel tank coatings.

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

TUNGSTEN

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

76 Tungsten

Tungsten is a vital metal of strategic importance. The chief sources of tungsten are minerals scheelite ($CaWO_4$) and wolframite [$(Fe,Mn)WO_4$] which are deposited by hydrothermal solutions. Tungsten has a melting point of 3,350^{0}C, the highest of all metals and it is resistant to all acids at ordinary temperatures. It is elastic, ductile and has high tensile strength and can be drawn into very thin wires. The domestic requirements of tungsten and its products are met mainly through imports. A significant amount of tungsten is recovered through recyling of scrap tungsten products.

RESOURCES

The total resources of tungsten ore in the country, as per UNFC system, as on 1.4.2010 have been estimated at 87.4 million tonnes containing 142,094 tonnes WO_3 content. All these resources are placed under 'remaining resources' category.

Resources are mainly distributed in Karnataka (42%), Rajasthan (27%), Andhra Pradesh (17%) and Maharashtra (9%). Remaining 5% resources are in Haryana, Tamil Nadu, Uttarakhand and West Bengal (Table - 1).

At Degana, Rajasthan, WO_3 value in vein deposits varies from 0.25 to 0.54% while in gravel deposit, it is, on an average 0.04%. In Sirohi deposit, Rajasthan, WO_3 content ranges from 0.02 to 2.2%. In West Bengal, Bankura deposit contains, on an average, 0.1% WO_3. In Kuhi-Khobana-Agargaon belt, GSI has identified seven mineralised zones in Sakoli basin in Bhandara and Nagpur districts, Maharashtra. The analysis showed 0.01 to 0.19% WO_3 in Kuhi block, 0.13 to 0.38% WO_3 in Khobana block and 0.48% WO_3 in Pardi-Dahegaon-Pipalgaon block. The deposit contains 0.17% WO_3 on an average. Gold ore at Mysore mine of BGML in Karnataka has been reckoned as a potential source of scheelite. The tailing dumps at Kolar Gold Fields contain about 0.035 to 0.18% WO_3.

PRODUCTION & PRICES

There was no production of tungsten ore/ concentrate during 2010-11. The production of tungsten was reported from Degana, Rajasthan and Chendapathar, West Bengal in the past. The domestic prices of tungsten ore and concentrate are furnished in the General Review on 'Prices'.

MINING & PROCESSING

Vein deposits of wolframite occurring in Degana and Chendapathar are found associated with quartz veins, the width of which varies from a few centimetres to three metres or sometimes even more. In Degana, Rajasthan, it is also associated with gravel beds overlain by 2.5 m thick sand.

Gravel mining was carried out in the past in selected areas where wolframite was found to be concentrated. The overburden sand was loosened and loaded manually and transported by tractor unit at dump sites. The payable gravel was then worked.

In case of vein deposits, ore body was cut with chisel and hammer at convenient places forming undercuts. At Degana, Rajasthan, tungsten orebody occurs in vein, stockwork and alluvial deposits. Inclined veins were developed by putting adits in the stockwork.

Degana in Rajasthan and Chendapathar in West Bengal were the only operative mines of tungsten in India producing meagre quantities of concentrate. However, owing to economic non-viability, they have been closed down.

USES

The main use of tungsten is in the form of ferro-tungsten in the making of special and alloy steels. Ferro-tungsten typically contains between 25% and 75% tungsten. The other principal use of tungsten is in the manufacture of tungsten carbide, one of the hardest synthetic materials used in industry. It is used widely in cutting and wear-resistant materials, particularly those that have to work at high temperatures. Tungsten wires form the filament in incandescent light bulbs and cathodes for electronic tubes. The metal is used in superalloys with copper or silver and in chemical industry. It is also used in armour plate and armour-piercing ordnance. Tungsten compounds are used in dyes and pigments, manufacture of paints and printing ink and also in ceramic industry for producing yellow tint. Other alloys bearing tungsten are used for ornaments, heat sinks, radiation shielding, weights and counter-weights, wear resistant parts and coatings.

Table –1: Reserves/Resources of Tungsten as on 1.4.2010 (By Grades/States)

(In tonnes)

Grade/State	Reserve Total (A)	Remaining resources							Total resources (A+B)
		Feasibility STD211	Pre-feasibility STD222	Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total B	
All India : Total									
Ore	**-**	**2230000**	**173063**	**19611152**	**23435954**	**25356049**	**16581246**	**87387464**	**87387464**
Contained WO_3	**-**	**3568**	**450**	**9914**	**20180.92**	**103415.15**	**4566.28**	**142094.35**	**142094.35**
By States									
Andhra Pradesh									
Ore	-	-	-	3640000	4700800	5952500	509000	14802300	14802300
Contained WO_3	-	-	-	5096	6574.64	8273.65	318.28	20262.57	20262.57
Haryana									
Ore	-	2230000	-	-	-	-	-	2230000	2230000
Contained WO_3	-	3568	-	-	-	-	-	3568	3568
Karnataka									
Ore	-	-	-	15361152	11805499	172921	9338246	36677818	36677818
Contained WO_3	-	-	-	2915	1775	142	1403	6235	6235
Maharashtra									
Ore	-	-	-	610000	5637250	1830000	-	8077250	8077250
Contained WO_3	-	-	-	1903	10304	3828	-	16035	16035
Rajasthan									
Ore	-	-	-	-	963666	17000628	5964000	23928294	23928294
Contained WO_3	-		-	-	1421.44	90171.5	2115	93707.94	93707.94
Tamil Nadu									
Ore	-	-	-	-	-	-	250000	250000	250000
Contained WO_3	-	-	-	-	-	-	50	50	50
Uttarakhand									
Ore	-	-	-	-	138000	-	520000	658000	658000
Contained WO_3	-	-	-	-	25	-	680	705	705
West Bengal									
Ore	-	-	173063	-	190739	400000	-	763802	763802
Contained WO_3	-	-	450	-	80.84	1000	-	1530.84	1530.84

SUBSTITUTES

Titanium, tantalum and niobium carbides can be used in some wear-resistant applications. Molybdenum tool steels and tungsten tool steels are interchangeable. In some cutting tool applications, bulk ceramic is an alternative. Tungsten remained the essentially unsubstitutable material for filaments, electrodes, and contacts in lamp & lighting applications. However, an electrodeless, non-tungsten lamp is available for commercial and industrial uses. In some applications, substitution would result in increased cost or a loss in product performance.

TECHNICAL POSSIBILITIES

Further development of new metal shaping method; i.e., laser is possible. Development of new cutting tool materials could reduce the usage. Increased use in ceramics and in catalysts is possible because of increasing use of coating on cemented carbide cutting tools to prolong tool life. Use of tungsten scrap could be increased. Tungsten compounds could be used in light-sensitive applications.

POLICY

As per the Foreign Trade Policy, 2009-14, the imports and exports of tungsten ores and concentrates can be made freely.

CONSUMPTION

The entire domestic requirements of tungsten ore/concentrates are met by imports. Sandvik Asia Ltd, Pune; Widia (India) Ltd, Bangalore; Indian Hard Metal Pvt. Ltd, Kolkata; and Rapicut Carbides Ltd, Ankaleshwar, Gujarat are the important consumers of tungsten ores and concentrates for mining machinery. Mishra Dhatu Nigam Ltd, Hyderabad and Sunflag Iron & Steel Co. Ltd, Bhandara, Maharashtra were the important consumers of ferro-tungsten for alloy steel. Annual consumption of tungsten ore/concentrate and ferro-tungsten during 2008-09 to 2010-11 is estimated at 500 tonnes and 18 tonnes, respectively.

WORLD REVIEW

The world reserves of tungsten in terms of metal content are 3.1 million tonnes, distributed broadly amongst China (61%), Russia (8%), USA (5%) and Canada (4%) (Table -2).

The world production of tungsten in terms of metal content in 2010 decreased slightly to 61,700 tonnes from 65,400 tonnes in 2009. China was the leading producer (84%), followed by Russia (5%) and Bolivia (2%) (Table-3).

Table – 2: World Reserves of Tungsten (By Principal Countries)

(In '000 tonnes of Tungsten content)

Country	Reserves
World: Total	**3100**
Austria	10
Bolivia	53
Canada	120
China	1900
Portugal	4
Russia	250
USA	140
Other countries	600

Source: *Mineral Commodity Summaries, 2012.*

Table – 3: World Mine Production of Tungsten
(By Principal Countries)

(In tonnes of metal content)

Country	2008	2009	2010
World: Total	**64700**	**65400**	**61700**
Austria	1122	887	975
Bolivia	1448	1290	1300
Canada	2795	2501	-
China	50000	51000	52000
Korea, Dem. People's Rep. of[(e)]	350	350	350
Portugal*	981	823	799
Russia*[(e)]	4000[(e)]	5500[(e)]	3000
Thailand*	582	200	326
Uzbekistan[(e)]	300	300	300
Other countries	3122	2549	2650

Source: *World Mineral Production, 2006-2010.*
** Wolframite & Scheelite.*

FOREIGN TRADE

Exports

Exports of tungsten alloys and scrap increased to 433 tonnes in 2010-11 from 80 tonnes in the previous year. Exports were mainly to USA and Germany(28%) each,UK (12%), Belgium (8%) and Sweden (7%). In 2010-11 exports of tungsten ores & concentrates increased to 32 tonnes as against no export in the preceding year (Tables - 4 and 5).

Imports

Imports of tungsten ores and concentrates drastically decreased to 1 tonne in 2010-11 from 87 tonnes in the previous year. Imports were mainly from USA. Imports of tungsten and alloys including scrap increased to 405 tonnes in 2010-11 from 356 tonnes in the previous year. Imports were mainly from China (44%), Germany (15%), Rep.of Korea (11%) and USA (8%) (Tables - 6 to 8).

WORLD REVIEW

China

The Chinese Government undertook measures to regulate the production of tungsten concentrates by forbidding foreign investment in exploration and mining in order to conserve its tungsten resources and to stabilise tungsten prices. In the processing sector, the Government encouraged the recovery of tungsten from low grade ores, mixed scheelite-wolframite concentrates and scrap. The Government also regulated tungsten exports by restricting the volumes and types of materials, products. In spite of its position as the world's leading miner of tungsten, China continued imports of tungsten concentrates in 2010.

Korea, Rep. of

Woulfe Mining Corp.commissioned a feasibility study on reopening of the Saydong tungsten- molybdenum mine. The mine had been a significant producer of tungsten before its closure in 1992. The feasbility study will evaluate1.25 million tpy underground mining, beneficiation plant, a 400,000 tpy APT plant and will consider potential to double the mining capacity to 2.5 million tpy. The company hoped to start commercial production by 2013.

Peru

Malaga Inc. doubled the mill capacity to 500 tpd of ore at its Pasto Bueno mine. The company was also expanding the mine capacity to 500 tpd and later an additonal increase in mill capacity to 600 tpd by end 2011.

Russia

Wolfram Company completed the first phase of a refractory metals plant in Unecha Bryansk Oblant, expected to produce tungsten metal powder as its main product.

U K

Wolf Minerals Ltd was studying the feasibility of redeveloping the Hemerdon tungsten-tin-mine near Plymouth. The open pit mine and milling operation will likely to produce about 360,000 tonne units per annum (about 2,850 tpy of tungsten from 2013).

Vietnam

Hazelwood Resources formed a joint venture with Asia Tungsten Products to produce ferro-tungsten containing 80% tungsten near the Haiphong Port. The first stage would produce 2,400 tpy of tungsten contained in FeW in 2011 and second stage would double the capacity. Nui Phao open pit Project of Masan Group Corp. would produce 5,300 tpy of contained tungsten besides copper, fluorite and bismuth. The project was slated to begin in 2013.

Table – 4: Exports of Tungsten Ores & Conc.
(By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	–	–	**32**	**19244**
UK	–	–	32	19244

Table – 5 : Exports of Tungsten and Alloys Incl. Scrap (U)
(By Countries)

Country	2009-10		2010-11	
	Qty (kg)	Value (₹ '000)	Qty (kg)	Value (₹ '000)
All Countries	**79513**	**412084**	**432709**	**655916**
USA	35192	41179	120925	163783
Germany	527	10343	120082	90814
UK	7372	5140	51875	72076
Belgium	302	469	34281	38860
Sweden	200	1596	28659	34908
France	3202	19787	4228	27413
Iran	1963	16685	4309	27224
Brazil	101	1055	1912	22673
Japan	902	11818	2014	18166
Argentina	3278	27022	1569	17540
Other countries	26474	276990	62855	142459

Table – 6: Imports of Tungsten Ores & Conc.
(By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**87**	**1538**	**27**	**890**
USA	-	-	NA	NA
Netherland	-	-	NA	NA
Japan	-	-	NA	NA
Other countries	87	1538	NA	NA

Table – 7: Imports of Tungsten & Alloys Incl. Scrap
(By Countries)

Country	2009-10		2010-11	
	Qty (kg)	Value (₹ '000)	Qty (kg)	Value (₹ '000)
All Countries	**356156**	**702068**	**404654**	**848380**
China	168790	303852	176132	379690
Korea, Rep. of	24288	52833	46411	110168
Germany	67346	162438	60099	107476
USA	15469	39366	33473	66804
Japan	18248	47780	21993	50369
Singapore	5522	12173	12384	33738
Austria	2078	8461	8137	24929
Sweden	1364	3702	23663	23469
UK	2930	7322	5212	10150
Hong Kong	7224	10358	5319	9512
Other countries	42897	53783	11831	32075

Table – 8 : Imports of Tungsten
(By Items)

Item	2009-10		2010-11	
	Qty (kg)	Value (₹ '000)	Qty (kg)	Value (₹ '000)
All Items	**356156**	**702068**	**404654**	**848380**
Tungsten & alloys, unwrought	144892	289707	186336	352787
Tungsten filament	26816	71372	32670	69059
Tungsten wire	134454	297527	131470	349722
Tungsten, unwrought	49649	43359	30809	58870
Tungsten scrap	345	103	23369	17942

FUTURE OUTLOOK

World tungsten supply will continue to be dominated by Chinese production and exports. In India, the entire demand can only be met by imports as there is no indigenous production of tungsten concentrates.

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

VANADIUM

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

77 Vanadium

Vanadium is a scarce element. It occurs in association with titaniferous magnetite and recovered as a by-product during iron & steel manufacture. Vanadium is also concentrated in many end-products of organic material including coal and oil. In addition, vanadium present in bauxite can also be recovered as vanadium sludge from red mud during the production of alumina.

RESOURCES

In India, vanadium is associated with titaniferous magnetite which contains 0.8 to 3% V_2O_5. It also occurs in significant amounts in association with chromite, laterite, bauxite and ferro-magnesium-rich rocks, such as pyroxenite, anorthosite and gabbro.

As per UNFC system, the total estimated resources of vanadium ore as on 1.4.2010 are placed at 24.72 million tonnes with an estimated V_2O_5 content of 64,887 tonnes. Out of the total resources, the reserves are 0.41 million tonnes having 1,603 tonnes of V_2O_5 content while the remaining resources are 24.31 million tonnes having 63,284 tonnes of V_2O_5 content (Table-1).

Table – 1: Reserves/Resources of Vanadium as on 1.4.2010

(By Grades/States)

(In tonnes)

Grade/State	Reserves: Proved STD111	Reserves: Probable STD122	Reserves: Total (A)	Remaining resources: Prefeasibility STD221	Remaining resources: Prefeasibility STD222	Remaining resources: Indicated STD332	Remaining resources: Inferred STD333	Remaining resources: Total (B)	Total resources (A+B)
All India: Total									
By Grades									
Ore	**293539**	**117416**	**410955**	**1720000**	**4000000**	**232000**	**18355933**	**24307933**	**24718888**
Contained V_2O_5	**1144.8**	**457.92**	**1602.72**	**2835**	**5600**	**487.2**	**54362.25**	**63284.45**	**64887.21**
By States									
Karnataka									
Ore	–	–	–	500000	4000000	–	14884430	19384430	19384430
Contained V_2O_5	–	–	–	700	5600	–	43197.55	49497.55	49497.55
Maharashtra									
Ore	293539	117416	410955	–	–	–	58708	58708	469663
Contained V_2O_5	1144.8	457.92	1602.72	–	–	–	229	229	1831.72
Odisha									
Ore	–	–	–	1220000	–	232000	3412795	4864795	4864795
Contained V_2O_5	–	–	–	2135	–	487.2	10935.74	13557.94	13557.94

Figures rounded off

PRODUCTION

Vanadium sludge is separated as a by-product during the Bayer process for production of alumina hydrate. The vanadium sludge obtained at BALCO's Korba plant contains 6 to 10% V_2O_5, Hindalco's Renukoot plant 18.2% V_2O_5 and Muri and Belgaum plants 6 to 20% V_2O_5. Nalco is not producing vanadium sludge commercially. However, it could be extracted successfully in lab-scale studies. The sludge extracted during lab-trials typically analysed 9.35% V_2O_5.

Production of ferro-vanadium during 2006-07 to 2010-11 is given in Table-2.

Table – 2: Production of Ferro-Vanadium 2006-07 to 2010-11

(In tonnes)

Year	Production
2006-07	1139
2007-08	1585
2008-09	1501
2009-10	1389
2010-11	1500

Source: *Indian Ferro-alloys Producers' Association.*

USES

It is used primarily as an alloying element in iron & steel industry and to some extent as a stabiliser in titanium and aluminium alloys which are used in aerospace applications. It imparts toughness and strength to steel, alloys and also acts as scavenger for oxygen. Vanadium is consumed in the steel industry in a wide range of products, from low carbon flat rolled steels, high strength plates and structural steels to pipes, reinforcing bars, forging steels, rail steels and tool steels. Most of the vanadium (about 80%) is used in the form of ferro-vanadium as a means of introducing vanadium into steel. The content of vanadium in ferro-vanadium varies from 45 to 50% and sometimes it is up to 80%, depending upon the demand. The 45 to 50% grade is produced from slag and other vanadium containing material by silicothermic reduction of vanadium pentoxide in presence of steel scrap or by direct reduction in an electric arc furnace. The resultant vanadium steels can be divided into micro-alloy or low-alloy steels with less than 0.15% vanadium and high-alloy steels up to 5% vanadium. Non-metallurgical applications include as catalyst and in ceramic, chemical, pigments, health preparations and electronic industries. It is also used to produce a super conductive magnet with a field of 175,000 gauss.

New uses include vanadium secondary batteries for power plants and rechargeable vanadium redox battery (VRB) for commercial applications. The main advantages of the VRB are that it can offer almost unlimited capacity simply by using sequentially larger storage tanks, can be left completely discharged for long periods of time with no ill effect, can be recharged by replacing the electrolyte if no power source is available to charge it, and suffers no permanent damage if the electrolytes are accidentally mixed. The VRB has also been shown to have the least ecological impact of all energy storage technologies.

SUBSTITUTES

Substitution of vanadium in steel by niobium, chromium, titanium, manganese, molybdenum and tungsten is possible although at higher cost or with lower performance. Heat-treated carbon steels can replace vanadium steels in some applications. Platinum and nickel can be used in some catalytic processes but at higher cost. Presently, there is no acceptable substitute for vanadium in aerospace titanium alloys.

CONSUMPTION

Ferro-vanadium producing units in India consume either imported V_2O_5 concentrates or indigenous vanadium sludge. The domestic availability of vanadium sludge from aluminium industry is limited for ferro-vanadium production and gap is met by imports. The reported consumption of ferro-vanadium during 2008-09 to 2010-11 by various units in the organised sector is given in Table-3.

Table –3: Reported Consumption of Ferro-Vanadium, 2008-09 to 2010-11 (By Industries)

(In tonnes)

Industry	2008-09	2009-10(R)	2010-11(P)
All Industries	**480**	**569**	**960**
Foundry	6(2)	6(2)	6(2)
Alloy steel	62(5)	78(5)	68(5)
Iron & steel	412(9)	485(10)	886(10)

Data collected on non-statutory basis.
Figures in parentheses denote the number of units reporting consumption in organised sector.*
*(*includes actual reported consumption and/or estimates made, wherever required).*

WORLD REVIEW

The world reserves of vanadium in 2010 were about 14 million tonnes of metal located mainly in China, Russia, South Africa and the USA and are expected to last till next century at the current rate of consumption (Table-4). Most of the reserves are of titaniferous magnetite from which vanadium could be extracted as a by-product of iron. The resources are also available in crude oil, tar sands, phosphate rock, uraniferous sandstone and siltstone. In all these cases, extraction depends on economic recovery of the product.

Table – 4: World Reserves of Vanadium (By Principal Countries)

(In '000 tonnes of vanadium content)

Country	Reserves
World : Total (rounded)	**14000**
China	5100
Russia	5000
South Africa	3500
USA	45
Other countries	NA

Source: *Mineral Commodity Summaries, January 2012.*

The world production of vanadium in 2010 was estimated at about 67 thousand tonnes excluding vanadium recovered as a by-product of refining and burning of heavy oils. Major producing countries were South Africa, China and Russia (Table-5).

Nearly all the world's vanadium supply originates from primary sources. Five countries recovered vanadium from ores, concentrates, slag or petroleum residues. Four countries out of these mine and process magnetite-bearing ores as an important source of vanadium. Japan and the United States are probably the only countries to recover significant quantities of vanadium from petroleum residues.

Australia

Atlantic Ltd was expected to begin production at Windimurra Vanadium project (Western Australia) in mid-2011. The production was expected to be 5,700 tonnes per year of V_2O_5 and would meet about 7% of world demand. According to the current mine plan, 97.8 million tonnes of ore was expected to be generated at a cut off grade of 0.275% V_2O_5 and an average grade of 0.47% V_2O_5 during 24.5 years.

Brazil

Largo Resources Ltd (Toranto, Ontario, Canada) has completed extensive work including feasibility study on its Maracas vanadium project located in Campo Alegre de Lourdes in the state of Bahia. Estimated proven and probable reserves are placed at 13.1 million tonnes (grading 1.34% V_2O_5) to be produced during a 23 year project life span. This project was expected to produce 5,000 tonnes per year of ferro-vanadium.

Canada

The Lac Dore vanadium project of Apella Resources Inc. is an advanced vanadium project. The exploration and development would continue in 2011 and the project was expected to be the largest in North America and the second largest in the world.

China

China's Panzhihua New Steel and Vanadium Co. Ltd (a subsidiary of Panzhihua Iron and Steel Group) is the major producer that operates from Panzhihua in Sichnan Province, the largest vanadium producing region of China. The second leading vanadium producer in China is the Chengde Xinxin Vanadium & Titanium Co. Ltd, associated with the steel and vanadiferous slag production in Hebei Province.

Sino Vanadium Inc. (Xian) owns the Daquan Property in Shaanxi Province which was expected to become one of the largest global producers of V_2O_5 with indicated resources of 15.8 million tonnes at an average grade of 0.95% V_2O_5.

Madagascar

Energizer Resources Inc updated the resource estimates for its Green Giant vanadium project to include an indicated resource of 49.5 million tonnes (an average grade of 0.693% V_2O_5). Green Giant vanadium deposit is a sedimentary hosted deposit, in contrast to most vanadium deposits which are magnetite hosted. The unique characteristic of this deposit would allow to produce high purity V_2O_5 which is required in battery power and in battery storage for both automotive and large scale applications.

South Africa

Xstrata plc's Rhovan facility recorded 89%, increase in FeV production and 90% increase in V_2O_5 production in 2010 over 2009. Vameto Alloys raised production to full capaity in 2010. The company's primary end-product is Nitrovan vanadium, a speciality vanadium-nitrogen alloy which strengthens steel more efficiently than FeV.

Table – 5: World Mine Production of Vanadium (By Principal Countries)

(In tonnes of metal content)

Country	2008	2009	2010
World: Total (rounded)	**63000**	**58000**	**67000**
China[e]	18500	20800	22000
Kazakhstan[e]	1000	1000	1000
Russia[e]	23000	23000	21000
South Africa	20295	14353	22606

Source: *World Mineral production, 2006-2010.*
Note: *Include vanadium in slag product but exclude vanadium recovered as a by-product of refining and burning of heavy oil.*

FOREIGN TRADE

No exports and imports of vanadium & scrap were reported in 2010-11. A negligible quantity of vanadium ores & concentrates was exported during 2010-11 to Saudi Arabia (Table-6). Imports of vanadium ores and concentrates decreased sharply to 4 tonnes in 2010-11 from 60 tonnes in the previous year. Imports were from Germany (Table-7).

Table – 6: Exports of Vanadium Ores & Conc. (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**124**	**18554**	**++**	**1**
Saudi Arabia	-	-	++	1
Other countries	124	18554	-	-

Table – 7: Imports of Vanadium Ores & Conc. (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**60**	**7762**	**4**	**1182**
Germany	59	6936	4	1182
Other countries	1	826	-	-

FUTURE OUTLOOK

The worldwide demand for vanadium is directly related to the demand for steel. In vanadium batteries, the consumption may increase in future.

The future Indian alumina plants, being mostly based on East Coast bauxite having a very low content of vanadium, will not be able to generate adequate quantity of vanadium sludge to meet the internal demand. On the other hand, with growth of automobile and casting sectors, demand for ferro-vanadium is expected to increase and this has to be met by imports. The high growth registered in automobile sector led to increased use of vanadium in steels. The accelerated growth in the forging industry and increased demand for die steels and tool steel paved the way for increased vanadium consumption. Steps are also necessary to utilise huge vanadium-bearing titaniferous ores available in Indian states; viz, Karnataka, Maharashtra and Odisha through R&D efforts to meet the domestic demand of vanadium pentoxide and ferro-vanadium.

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

VERMICULITE

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

78 Vermiculite

Vermiculite is a term applied commercially to micaceous minerals (essentially hydrated silicates of Al, Mg and Fe), usually alteration products of biotite or phlogopite micas formed by the removal of much alkalies and addition of water. Vermiculite differs from mica in its characteristic property, i.e., exfoliation. Crude vermiculite is always exfoliated before use.

RESOURCES

The total resources of vermiculite as on 1.4.2010 as per UNFC system are placed at 2.5 million tonnes of which more than 68% are placed under reserves category. Resources are located in Tamil Nadu (75%), Andhra Pradesh (14%), Karnataka (8%), Rajasthan (2%) and Jharkhand (1%). Minor resources are located in Gujarat, Madhya Pradesh and West Bengal (Table-1).

PRODUCTION, STOCKS & PRICES

Production of vermiculite at 22,038 tonnes in 2010-11 increased by 89 % as compared to that in the previous year due to increase of demand . There were 5 reporting mines during both the years. Besides, production of vermiculite was reported as associated mineral by one mine in 2010-11as against two mines in previous year. One principal producer from Tamil Nadu and three from Andhra Pradesh reported the entire output in 2010-11. About 2% of the total production was reported as an associated mineral by an apatite mine in Andhra Pradesh. The share of public sector was 10 percent as compared to 14 percent in the preceding year.

Andhra Pradesh was the leading producing state of vermiculite in 2010-11 which accounted for 90% of the total output and remaining 10 percent was from Tamil Nadu (Tables - 2 to 4).

Mine-head stocks at the end of 2010-11 were 8,406 tonnes as against 7,181 tonnes in the beginning of the year (Tables - 5).

The average daily employment of labour during the year was 103 as against 69 in the preceding year. Domestic prices of vermiculite are furnished in the General Review on 'Prices'.

Table – 2: Principal Producers of Vermiculite, 2010-11

Name & address of producer	Location of mine	
	State	District
Dugar Insulation India (P) Ltd, Dugar House, 8/85 Raja Street, P. O. Gudur-524 102, Dist. Nellore, Andhra Pradesh.	Andhra Pradesh	Nellore
Sri Ram Murty, Industrial Estate, Plot No. 1 & 2, P O. Gudur-524 102, Dist. Nellore, Andhra Pradesh.	Andhra Pradesh	Nellore
* Andhra Phosphate (P) Ltd, 45-58-17/5, Narsimha Nagar, Visakhapatnam-530 024, Andhra Pradesh.	Andhra Pradesh	Visakhapatnam
Tamil Nadu Minerals Ltd, 31, Kamrajar Salai, “TWAD” House, Chepauk, Chennai–600 005, Tamil Nadu.	Tamil Nadu	Vellore

** Associated mine with apatite.*

Table-1: Reserves/Resources of Vermiculite as on 1.4.2010
(By Grades/States)

(In tonnes)

Grade/State	Reserves				Remaining resources								Total resources (A+B)
	Proved STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
		STD121	STD122			STD221	STD222						
All India: Total	**1628475**	**24593**	**50939**	**1704007**	**22733**	**75790**	**71744**	**35195**	**24930**	**569012**	**3600**	**803004**	**2507011**
By Grades													
Refractory	32217	-	14238	46455	-	-	-	-	-	807	-	807	47262
Unclassified	1596258	24593	36701	1657552	22733	75790	71744	35195	24930	568205	3600	802197	2459749
By States													
Andhra Pradesh	102058	24593	50939	177590	1912	3981	2750	35195	9878	119270	3600	176586	354176
Gujarat	-	-	-	-	-	-	-	-	-	1960	-	1960	1960
Jharkhand	-	-	-	-	-	-	-	-	-	30048	-	30048	30048
Karnataka	-	-	-	-	-	69050	64500	-	1562	66658	-	201770	201770
Madhya Pradesh	-	-	-	-	197	-	66	-	-	66	-	329	329
Rajasthan	-	-	-	-	20623	2759	4428	-	13000	2883	-	43693	43693
Tamil Nadu	1526417	-	-	1526417	-	-	-	-	-	343051	-	343051	1869468
West Bengal	-	-	-	-	-	-	-	-	490	5076	-	5566	5566

Figures rounded off.

Table - 3: Production of Vermiculite, 2008-09 to 2010-11
(By States)

(Qty in tonnes; Value in ₹ '000)

State	2008-09		2009-10		2010-11 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**12647**	**9423**	**11662**	**7653**	**22038**	**13417**
Andhra Pradesh	10726	4275	10060	4095	19887	9347
Tamil Nadu	1921	5148	1602	3558	2151	4070

Table – 4 : Production of Vermiculite, 2009-10 and 2010-11
(By Sectors/States/Districts)

(Qty in tonnes; value in ₹ '000)

State/District	2009-10			2010-11 (P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India	**5(2)**	**11662**	**7653**	**5(1)**	**22038**	**13417**
Public sector	1	1602	3558	1	2151	4070
Private sector	4(2)	10060	4095	4(1)	19887	9347
Andhra Pradesh	**4(2)**	**10060**	**4095**	**4(1)**	**19887**	**9347**
Nellore	3(1)	8895	2615	4	19470	8972
Visakhapatnam	1(1)	1165	1480	(1)	417	375
Tamil Nadu	**1**	**1602**	**3558**	**1**	**2151**	**4070**
Vellore	1	1602	3558	1	2151	4070

Figures in parentheses indicate the number of associated mines.

Table - 5: Mine-head Stocks of Vermiculite, 2010-11 (P)
(By State)

(In tonnes)

State	At the beginning of the year	At the end of the year
India	**7181**	**8406**
Andhra Pradesh	2429	3415
Tamil Nadu	4752	4991

USES

Unfoliated (unexpanded) vermiculite has only minor uses, such as for circulation in drilling muds and in the annealing of steel. In order to convert raw vermiculite into a product suitable for industrial use, it must be exfoliated or expanded by heating, a process termed 'exfoliation'. When heated rapidly to above 870°C, it expands readily (at right angles to the laminae) to a lightweight material by 6 to 20 times the original volume of raw material but weigh as little as 6-8 lb. per cu ft. The loose bulk density of exfoliated vermiculite is in the range of 52 to 192 kg/m^3 depending upon the grade and quality of the raw material. This expansion is because of mechanical separation of the layers when the contained water is converted into steam. Vermiculite is chemically inert, fireproof, non-conductor of electricity and a good insulator against cold and heat (both radiant and conducted), and sound. Unlike cork and other organic lightweight insulating material, it does not rot, is not attacked by vermin and has a fair mechanical strength.

Vermiculite is known for its horticultural applications. It is a common component in potting soils. It is also used as a carrier in fertilizers, herbicides and insecticides. Cementing mixtures of exfoliated vermiculite and binding agents, such as gypsum and plaster, have been important products and are applied to structural steel members in commercial buildings.

The mineral is used in various types of building boards. Fine-sized, untreated vermiculite concentrates are included in the preparation of fireproof plaster boards. The exfoliated product forms the basis of some lightweight plasterboard, whilst ground, exfoliated vermiculite is used in various refractory board products.

The principal uses of expanded vermiculite are based on its thermal insulating quality (due to presence of innumerable air cells), low density, fireproof nature and granular form. Larger vermiculite granules are used as a loose fill for thermal insulation for homes, industrial structures, cold storage, refrigeration and high temperature and low temperature industrial equipment. The medium size granules are graded to make insulating lightweight concrete, acoustic and thermal insulating plasters due to fireproof and non-moisture condensing properties, and as soil conditioner to lighten clay soil and to improve the moisture retention qualities of sandy soil. Refractory insulation, both in the form of loose fill and vermiculite bricks, is used in furnaces and kilns up to 1100°C. Minor uses are in paints, lubricants, as a packing material, as filler in plastics and in wallpaper manufacture. Finer granules are used as carriers for agricultural chemicals and as an anticaking agent in fertilizer. Another use of vermiculite is to build fireproof walls in deep mines.

The high absorbency and chemical inertness of exfoliated vermiculite has made it suitable for a wide range of absorbent packing materials as well as for packaged units for the containment of oil and similar liquids. Possible future applications include the detoxification of water and soil, nuclear waste containment and removal, and industrial spill containment and clean-up.

SUBSTITUTES

Expanded perlite is a substitute for vermiculite in lightweight concrete and plaster. Other more dense but less costly material substitutes in these applications are expanded clay, shale, slag and slate. In agriculture, substitutes include peat, perlite, sawdust, bark and other plant materials and synthetic soil conditioners.

CONSUMPTION

In 2010-11, the reported consumption of vermiculite was estimated at 800 tonnes. The asbestos-product and refractory industries were the main consumers of vermiculite (Table - 6).

POLICY

Imports of vermiculite (unexpanded) are allowed freely under Exim Code 25301010, as also those of vermiculite insulation bricks under Exim Code 69029030 as per the Export-Import Policy, 2009-2014 and the Foreign Trade Policy thereunder.

Table - 6: Reported Consumption of Vermiculite 2008-09 to 2010-11 (By Industries)

(In tonnes)

Industry	2008-09	2009-10(R)	2010-11(P)
All Industries	**800**	**800**	**800**
Asbestos products	700 (1)	700 (1)	700 (1)
Refractory	100 (5)	100 (5)	100 (5)

Figures rounded off. Data collected on non-statutory basis.
Figures in parentheses denote the number of units in organised sector reporting consumption.*
(Includes actual reported consumption and/or estimates made wherever required).*

WORLD REVIEW

Authentic data on world reserves is not available. Reserves to the tune of 60.60 million tonnes are reported from USA, South Africa, Brazil and other countries. Reserves of other producing countries such as China, Russia, Zimbabwe, Australia, etc. are not available. In 2010, the total estimated production of vermiculite was 496 thousand tonnes in respect of 8 countries for which data was available. South Africa, China and USA were the major producing countries (Tables - 7 and 8).

The Palabora Mining Co. a member of Rio Tinto plc. accounts for about 38% of world's average production and is the largest supplier of vermiculite with reserves in South Africa. Imerys was the second largest supplier of vermiculite. It has production facilities in Alice Springs, Northern Territory, Australia; Korla, China; and Shawa, Zimbabwe.

Brazil

In 2010, Brazil Minerios I.tda produced 35,000 tonnes of vermiculite at its SaO Luis De Montes Belos Mine near Goiania in Central Brazil. Brasil Minerios planned to increase production capacity to 55,000 tonnes per year in 2011 and to 80,000 tonnes by 2013.

South Africa

In 2010, South Africa was the world's leading producer & exporter of crude vermiculite. Limpopo Province, Palabora Mining Co. Ltd., (a member of Rio Tinto plc.) managed the world's largest vermiculite reserves.

Uganda

Gulf Industries Ltd (Sidney, Australia) continued development and production at the East African Namckara vermiculite deposit. East African Vermiculite project (EAVP) in eastern Uganda is considered to be one of the largest deposits.

Table – 7: World Reserves of Vermiculite (By Principal Countries)

(In '000 tonnes)

Country	Reserve
World: Total	**NA**
Australia	NA
Brazil	6600
China	NA
Russia	NA
South Africa	14000
USA[(e)]	25000
Zimbabwe	NA
Other countries	15000

Source: *Mineral Commodity Summaries, 2012.*

Table – 8: World Production of Vermiculite (By Principal Countries)

(In '000 tonnes)

Country	2008	2009	2010
Australia	8	7	8
Brazil	29	23	23(e)
China(e)	120	120(e)	130(e)
Japan(e)	6	6	6
Russia(e)	30	30	30
South Africa	200	193	199
USA(e) #	100	110	100
Zimbabwe	16	3	-

Source : *World Mineral Production, 2006-2010.*

 # Sold or used by producers.

FOREIGN TRADE

Exports

Exports of vermiculite were 1,449 tonnes in 2010-11 compared to 1,015 tonnes in 2009-10. Exports were mainly to UAE, Japan, Belgium and Norway (Table- 9).

Imports

Imports of vermiculite increased to 312 tonnes in 2010-11 from 84 tonnes in 2009-10. Imports were mainly from South Africa (Table - 10).

Table – 9: Exports of Vermiculite (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**1015**	**6398**	**1449**	**10442**
Japan	356	2640	285	2276
UAE	182	1135	298	1984
Belgium	-	-	153	1302
Spain	-	-	100	782
Norway	119	600	142	530
Turkey	66	442	72	426
USA	30	223	44	418
Israel	93	611	44	380
China	-	-	43	363
Bangladesh	-	-	69	329
Other countries	169	747	199	1652

Table – 10: Imports of Vermiculite
(By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**84**	**1906**	**312**	**7519**
South Africa	40	642	240	4347
USA	2	101	53	1641
Japan	19	844	19	1526
Saudi Arabia	-	-	++	5
Other countries	23	319	-	-

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

WOLLASTONITE

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

79 Wollastonite

Wollastonite, a metasilicate of calcium ($CaSiO_3$), contains theoretically 48.3% CaO and 51.7% SiO_2. It occurs as aggregates of bladed or needle-like crystals. Ceramic industry uses substantially, domestic production of wollastonite, as a filler. Some other uses of wollastonite are as a filler in ceramic floor and wall tiles, marine wallboard, paint, plastic and in refractory liners in steel mills, and as a partial replacement for short-fibre asbestos in certain applications, such as brake-lining. Technical improvements in filler properties in plastic and rubber have been made in recent years. A better compatibility between the polymer and the filler is achieved by chemical surface treatment of the mineral filler. Wollastonite, when treated in such a manner, results in improved flexural modules in polypropylene and improved reinforcement in nylon.

RESOURCES

Major deposits of wollastonite have been found in Dungarpur, Pali, Sirohi and Udaipur districts in Rajasthan. Besides, in Ghoda area, Banaskantha district in Gujarat and in Dharmapuri and Tirunelveli districts in Tamil Nadu, a few deposits also occur. As on 1.4.2010, the resources of wollastonite, as per UNFC system are placed at 16.57 million tonnes. Out of total resources, about 88% (14.58 million tonnes) including 2.49 million tonnes reserves are located in Rajasthan and the remaining about 12% resources (1.99 million tonnes) in Gujarat. Meagre resources are located in Tamil Nadu (3,533 tonnes) (Table-1).

Table – 1 : Reserves/Resources of Wollastonite as on 1.4.2010
(By Grades/States)

(In tonnes)

Grade/State	Reserves			Remaining Resources						Total resources (A+B)
	Proved STD111	Probable STD122	Total (A)	Feasibility STD211	Pre-feasibility STD222	Measured STD 331	Indicated STD332	Inferred STD333	Total (B)	
All India (Total)	**2289869**	**197253**	**2487122**	**3750545**	**3724191**	**76088**	**3325042**	**3206885**	**14082751**	**16569873**
By Grades										
Marketable	2289869	197253	2487122	837864	3724191	76088	–	1083475	5721618	8208740
Unclassified	–	–	–	2912681	–	–	3325042	2044800	8282523	8282523
Not-known	–	–	–	–	–	–	–	78610	78610	78610
By States										
Gujarat	–	–	–	–	–	–	–	1990000	1990000	1990000
Rajasthan	2289869	197253	2487122	3750545	3724191	76088	3325042	1213352	12089218	14576340
Tamil Nadu	–	–	–	–	–	–	–	3533	3533	3533

Figures rounded off.

PRODUCTION, STOCKS & PRICES

Production of wollastonite at 183 thousand tonnes in 2010-11 registered an increase of 38% as compared to that in the preceding year due to good demand in the market. There were 2 reporting mines during both the years. The entire production was reported from private sector mines located in Rajasthan (Tables - 2 to 4).

Mine-head stocks at the end of 2010-11 were 269 tonnes as against 1,008 tonnes at the beginning of the year (Table - 5).

The average daily employment of labour during 2010-11 was 413 as against 325 in the previous year. Prices of wollastonite are furnished in the General Review on 'Prices'.

Table – 2 : Principal Producer of Wollastonite 2010-11

Name & address of producer	Location of mine	
	State	District
Wolkem Industries Ltd, Lake House, P.P. Singhal Marg, Udaipur – 313 004, Rajasthan.	Rajasthan	Sirohi Udaipur

Table – 5 : Mine-head Stocks of Wollastonite 2010-11 (P)
(By State)

(Qty in tonnes)

State	At the beginning of the year	At the end of the year
India	**1008**	**269**
Rajasthan	1008	269

Table – 3 : Production of Wollastonite, 2008-09 to 2010-11
(By State)

(Qty in tonnes; value in ₹'000)

State	2008-09		2009-10		2010-11 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**111581**	**125957**	**132385**	**111930**	**182600**	**150093**
Rajasthan	111581	125957	132385	111930	182600	150093

Table – 4 : Production of Wollastonite, 2009-10 & 2010-11
(By Sector/State/Districts)

(Qty in tonnes; value in ₹ '000)

State/District	2009-10			2010-11 (P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India	**2**	**132385**	**111930**	**2**	**182600**	**150093**
Private sector	2	132385	111930	2	182600	150093
Rajasthan	**2**	**132385**	**111930**	**2**	**182600**	**150093**
Sirohi	1	34102	35466	1	30649	31875
Udaipur	1	98283	76464	1	151951	118218

MINING, PROCESSING & MARKETING

Wollastonite is being mined by opencast semi-mechanised method in Sirohi district, Rajasthan. The run-of-mine is selectively hand-sorted to the size 30 cm to 50 cm to remove the associated minerals, such as calcite, diopside, garnet, quartz and iron. Wollastonite, thus separated, is then crushed to various sizes at two crushing plants near Sirohi railway station, having a total capacity of 80,000 tpy by Wolkem India Ltd. Principal commercial grades produced are: White Kemolit (S1 to S5) and off-white Kemolit (H1 to H5 and LG 25) which are milled products in the size range of 100 to 500 mesh. Besides, micronised products being marketed are Wolkron (1008, 1010, 1015, 1020, 1025 and 10825) in the low aspect ratio and Kemolit 1025 and 1020 in the high aspect ratio. In addition, speciality products and surface modified products are also marketed as Kemolit and Fillex, respectively. Wolkem Industries Ltd, a wollastonite mining and processing company, meets 20% of global requirements. Investigations carried out on a sample sent by the party at Central Building Research Institute (CBRI) revealed that it could substitute chrysotile asbestos to a little extent in the manufacture of cement products. The Belkapahar deposit, Sirohi district, Rajasthan, produces wollastonite of the following grades:

Constituent	Grade-I	Grade-II	Grade-III
CaO	48.16%	47.62%	46.20%
SiO_2	46.12%	47.42%	48.00%
Al_2O_3	0.23%	0.60%	0.76%
Fe_2O_3	0.49%	0.40%	0.44%
MgO	0.20%	0.40%	0.30%
L.O.I.	1.51%	2.37%	2.71%

USES & SPECIFICATIONS

The use of wollastonite depends on the accicularity or the aspect ratio; i.e., ratio between length and width of a crystal. Wollastonite having aspect ratio in the range from 3:1 to 5:1 has little potential for reinforcing applications and hence, market is primarily confined to ceramic, metallurgical fluxes and simple filler and coating applications. Wollastonites acicular nature allows it to compete with other acicular materials, such as ceramic fibre, glass fibre, steel fiber, and several organic fibres, such as aramid and polyethylene etc. It reduces the volume of the expensive plastic or resin medium and contributes to physical and chemical properties of the finished products.

Wollastonite is used primarily in automobile brakes, ceramics, metallurgical processing, paint and plastics. Some of the properties that make it so useful are high brightness and whiteness, low moisture and oil absorption, low volatile content, and the acicular nature of some wollastonite.

Bulk demand for wollastonite in the country is in the ceramic industry for the manufacture of floor and wall tiles while small quantities are used in asbestos-cement products as a partial replacement for short fibre asbestos, paint, insecticide, marine wallboard, and welding rod industries.

In ceramics, wollastonite decreases shrinkage and gas evolution during firing. In metallurgical applications, wollastonite serves as a flux for welding, a source for calcium oxide, as slag conditioners and to protect the source of molten metal during the continuous casting of steel.

CONSUMPTION

The reported consumption of wollastonite is estimated at 3,300 tonnes in 2010-11. The ceramic industry consumed almost the entire quantity of wollastonite (Table -6).

Table – 6 : Reported Consumption of Wollastonite 2008-09 to 2010-11 (By Industries)

(In tonnes)

Industry	2008-09	2009-10(R)	2010-11(P)
All Industries	**3800**	**3800**	**3300**
Asbestos products	++(2)	++(2)	++(2)
Ceramic	3800(14)	3800(14)	3300(13)

Figures rounded off.
Data collected on non-statutory basis
Figures in parentheses denote the number of units in organised sector reporting consumption.*
*(*Includes reported consumption and/or estimates made wherever required).*

WORLD REVIEW

Reliable data on world production of wollastonite are not available. It is estimated that the world production of crude wollastonite increased by 5 to 10% in 2010 compared with that of 2009. The ceramic industry probably accounts for the major consumption of wollastonite worldwide, followed by polymers (plastic and rubber) and paint. The remaining were used in construction, friction products and metallurgical applications.

South Africa

Namaqua wollastonite (Pty) Ltd has announced plans to start mining at Magata Project, Namaqualand. Wollastonite being high in iron content, the company planned to market it for friction products, plastics and construction applications.

The countrywise production of wollastonite in 2008 to 2010 is furnished in Table-7. As per available data, China was the largest producer, followed by India and USA.

Table – 7 : World Production of Wollastonite
(By Principal Countries)

(In tonnes)

Country	2008	2009	2010
China [e]	325000	300000	300000
Finland	15600	16000	16000
India*	111581	132385	171000
Mexico	46844	29728	46548
Namibia [e]	55	-	-
USA	90000	65000	67000

Source: *World Mineral Production, 2006-2010.*

** India's production of wollastonite during 2008-09, 2009-10 and 2010-11 was 111,581 tonnes,132,385 tonnes and 182,600 tonnes, respectively.*

FOREIGN TRADE

In 2010-11, exports of wollastonite increased to 20,151 tonnes from 12,880 tonnes in the previous year. Exports were mainly to Belgium (53%), Japan (16%), Netherlands (9%), and Germany (8%) (Table - 8).

Imports of wollastonite increased considerably to 2,600 tonnes in 2010-11 compared to 351 tonnes in the previous year. Imports were mainly from Malaysia (86%), China (6%) and Mexico (3%) (Table - 9).

Table – 8 : Exports of Wollastonite
(By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**12880**	**153755**	**20151**	**230659**
Belgium	5940	67679	10727	121020
Japan	2163	20644	3324	29641
Germany	1392	23243	1619	28566
Netherlands	301	2865	1798	17321
UK	122	1750	680	9349
Australia	1251	16520	425	5865
USA	203	1990	321	5059
Iran	65	998	172	2412
Saudi Arabia	121	1685	448	2308
Unspecified	959	10412	224	3064
Other countries	363	5969	413	6054

Table – 9 : Imports of Wollastonite
(By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**351**	**3889**	**2600**	**23913**
Malaysia	-	-	2232	15816
Mexico	-	-	65	3052
China	305	2593	159	1372
Spain	41	1041	58	1309
Finland	4	194	48	1024
Germany	-	-	19	588
Japan	1	60	6	322
Italy	-	-	9	274
USA	-	-	4	156
Other countries	++	1	-	-

FUTURE OUTLOOK

Presently, India is world's second largest producer of wollastonite after China. The existing mines in the country are in a position to meet the domestic requirements of the ceramic industry as well as export demand. There is an increasing demand for wollastonite in the international markets, especially in ceramic and plastic industries and in construction activities.

The apparent domestic demand of wollastonite is estimated at 132 thousand tonnes by 2011-12 and at 203 thousand tonnes by 2016-17 at 9% growth rate, as per the Sub- Group Report for 12th Plan Period. Presently, the existing mines in the country are in a position to meet the domestic requirements of the industry as well as export demand.

The largest market for wollastonite in the world is ceramics followed by asbestos substitution, metallurgy and paints. Wollastonite is marketed under two grades, viz. high aspect ratio wollastonite and powdered (milled) wollastonite. The former type relies mainly on physical acccicularity while the latter one depends on the chemical composition of the mineral. Therefore, the Sub Group has recommended that the exports of processed wollastonite with high aspect ratio and powdered wollastonite for better unit value realisation may be encouraged.

There is an increasing demand for wollastonite in the international markets, specially in ceramic and plastic industries and in construction activities. The Report states that since, wollastonite is mined and export by only a few countries in the world, there is a scope for increasing the exports of this mineral from India in value-added form as coated powders. To augment the reserves of wolloastonite, further exploration is necessary in the states of Tamil Nadu and Gujarat in the opinion of the Sub Group.

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

ZIRCON

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

80 Zircon

Zircon ($ZrSiO_4$) is found usually as a constituent in heavy mineral sand assemblages, which include ilmenite, rutile, leucoxene, monazite and garnet in varying proportions. Zirconium and hafnium are extracted (via their salts) from zircon sand and baddeleyite (an oxide-ZrO_2). Normally, all zirconium compounds contain between 1.4% and 3% hafnium. Zircon is very stable at high temperatures and has excellent thermal shock resistance, low thermal conductivity and chemical inertness. It finds use chiefly in industries like ceramic, refractory, abrasive, foundry, chemical and speciality alloys.

RESOURCES

Zircon occurs in close association with other heavy minerals, such as ilmenite, rutile and monazite, along the coastal tracts of the country. Its concentration in the deposits is about 0.6-18.7% of the total heavy minerals. Indian zircons analyse 63-66% ZrO_2. The AMD has carried out reconnaissance investigations in parts of Gujarat, Maharashtra, Andhra Pradesh, Tamil Nadu, Kerala, Odisha and West Bengal during 2008-11. The resources estimation in these areas is almost complete. The resources of zircon are placed at 32.28 million tonnes as per DAE. The statewise break-up of the resources is given in Table-1.

Table – 1 : Resources of Zircon

(In million tonnes)

State	Resources*
Total	**32.28**
Andhra Pradesh	12.60
Bihar	0.08
Kerala	6.52
Maharashtra	0.07
Odisha	3.16
Tamil Nadu	9.46
West Bengal	0.39

Source: *Department of Atomic Energy, Mumbai.*

** Inclusive of indicated, inferred and speculative categories.*

As per the UNFC system as on 1.4.2010, compiled by National Mineral Inventory (NMI) of IBM, the total resources of zircon are placed at 3.13 million tonnes.

EXPLORATION & DEVELOPMENT

Exploratory agencies comprising GSI, Directorate of Geology, Odisha and AMD carried out exploration in the beach sands deposits which contain heavy minerals, such as ilmenite, rutile, monazite, rare earths, zircon and garnet. For details, the review on 'Ilmenite and Rutile' may be referred.

PRODUCTION AND PRICES

The production of zircon rose to 33,209 tonnes in 2010-11 from 28,049 tonnes in the preceding year. Tamil Nadu and Kerala were the leading producers, contributing 51% and 31%, resectively, to the total production, followed by Odisha (18%) (Table-2). Prices of zircon as furnished by IREL, KMML and V.V. Mineral are given in Table -3.

Table – 2 : Production of Zircon 2008-09 to 2010-11 (By States)

(In tonnes)

State	2008-09	2009-10	2010-11
India : Total*	**29158**	**28049**	**33209**
Kerala	10217	10716	10338
Odisha	5807	5906	5979
Tamil Nadu	13134	11427*	16892

Source: *Respective Producers*

** Besides,V.V. Mineral reported 7,900 tonnes production of zircon-sillimanite in 2009-10 and 8,200 tonnes in 2010-11.*

Table – 3 : Prices of Zircon, 2008-09 to 2010-11

(₹per tonne)

Period	Grade	Price	Remarks
IREL			
2008-09	Q & MK	32000	Ex-works, bagged
	OR	27000	Ex-works, bagged
w.e.f. 29.5.2008	Q & MK	34000	Ex-works, bagged
	OR	29000	Ex-works, bagged
w.e.f. 1.7.2008	Q & MK	38000	Ex-works, bagged
	OR	35000	Ex-works, bagged
w.e.f. 1.9.2008	Q & MK	40000	Ex-works, bagged
	OR	37000	Ex-works, bagged
w.e.f. 15.11.2008	Q & MK	43000	Ex-works, bagged
	OR	40000	Ex-works, bagged
2009-10			
w.e.f. 1.4.2009	Q & MK	48000	Ex-works, bagged
	OR	45000	Ex-works, bagged
w.e.f. 12.10.2009	Q & MK	44500	Ex-works, bagged
	OR	40000	Ex-works, bagged
2010-11			
w.e.f. 1.4.2010	Q & MK	44500	Ex-works, bagged
	OR	40000	Ex-works, bagged
w.e.f. 1.5.2010	Q & MK	41000	Ex-works, bagged
	OR	38000	Ex-works, bagged
w.e.f. 30.7.2010	Q & MK	44000	Ex-works, bagged
	OR	41000	Ex-works, bagged
w.e.f. 27.9.2010	Q & MK	46000	Ex-works, bagged
	OR	43000	Ex-works, bagged
w.e.f. 16.11.2010	Q & MK	50000	Ex-works, bagged
	OR	47000	Ex-works, bagged
w.e.f. 31.12.2010	Q & MK	62000	Ex-works, bagged
	OR	57000	Ex-works, bagged
KMML			
2008-09	NA	39149	–
2009-10	NA	44500 to 50000	–
2010-11	NA	NA	–
V. V. Mineral			
2008-09	66% min	30996	–
2009-10*	66% min	39546	–
2010-11	NA	NA	–

Source: *Department of Atomic Energy, Mumbai.*

Q: Quilon; MK: Manavalakurichi; OR: Odisha

* *Price of zircon-sillimanite is quoted by V. V. Mineral at ₹11,320 per tonne during 2009-10 and ₹11,500 per tonne during 2010-11.*

MINING AND PROCESSING

IREL, a Government of India Undertaking, KMML, a Kerala State Government Undertaking and V. V. Mineral, a private sector company are engaged actively in mining and processing of beach sands in India. Zircon is recovered by these companies as a co-product of mining/dredging of heavy mineral sands which include ilmenite, rutile, leucoxene, monazite, sillimanite and garnet. Beach sand deposits containing these minerals are worked from coastal tracts of Manavalakurichi in Tamil Nadu, Chavara in Kerala and Gopalpur in Odisha. As such, no deposit is being worked exclusively for zircon alone. For details regarding mining and processing etc., review on 'Ilmenite and Rutile' may be referred. A project for enhancement of zircon capacity to 4,000 tpy is being implemented by KMML at Chavara. Plantwise capacity and production of zircon during 2008-09 to 2010-11 are given in Table-4.

INDUSTRY

IREL has set up a dry grinding mill at Chavara, Kerala to produce zirflour for its application in the ceramic industry. A wet grinding mill was also set up at Chavara to produce micro-zir for its specialised application as opacifier. IREL, Chavara, produced 1,444 tonnes and 918 tonnes Zirflour during 2009-10 and 2010-11 respectively, against an installed capacity of 6,000 tpy. In addition, 1,627 tonnes microzir was produced by IREL, Chavara in 2010-11. Besides, IREL set up a small chemical plant at Manavalakurichi, Tamil Nadu to produce zircon frit, zirconium chloride etc. primarily for making supply of zircon frit to Department of Atomic Energy's Nuclear Fuel Complex (NFC), Hyderabad. A pilot plant (3.5 tpy capacity) was set up at Orissa Sand Complex (OSCOM) to produce a whole range of zirconia stabilised with CaO, MgO and rare earths.

The NFC, Hyderabad has different production facilities which include the zirconium oxide plants for processing of zircon to pure zirconium oxide and zirconium sponge plants for conversion of zirconium oxide to pure sponge metal at NFC, Hyderabad and Zirconium Complex (ZC) at Pazhayakayal, near Tuticorin, Tamil Nadu. The latter was recently commissioned on 27.11.2009. Besides, the Zircaloy Fabrication Plant produces various zirconium alloy tubings and sheet, rod and wire products. The plant has facilities for reclamation of zircaloy mill-scrap. Zircon sand is processed through caustic fusion, dissolution, solvent extraction (to remove hafnium), precipitation and calcination to obtain zirconium oxide. The pure oxide is subjected to high tempera-ture chlorination, reactive metal reduction and vaccum distillation to obtain homogeneous zirconium sponge. The sponge is briquetted with alloying ingredients and melted in vacuum arc to produce zircaloy ingots. The alloy ingots are extruded to convert into seamless tubes, sheets and bars. The total installed capacity and production of zirconium oxide and zirconium sponge plants at NFC and ZC is furnished in Table - 5.

Table – 4 : Plantwise Capacity and Production of Zircon, 2008-09 to 2010-11

(In tonnes)

Company	Location	Specification	Installed capacity (tpy)	Production		
				2008-09	2009-10	2010-11
Total			**29500***	**29158**	**28049**	**33209**
Indian Rare Earths Ltd	Manavalakurichi, Kanyakumari dist., Tamil Nadu	65% ZrO_2+HfO_2(min)	10000	5813	4527	3542
	Chavara, Kollam dist., Kerala	65% ZrO_2+HfO_2(min)	12000	7772	8124	7500
	Orissa Sand Complex, Ganjam dist., Odisha	64.25% ZrO_2(min)	5000	5807	5906	5979
Kerala Minerals & Metals Ltd	Chavara, Kollam dist., Kerala	64.81% ZrO_2	2500	2445	2592	2838
V. V. Mineral	Keeraikaranthattu, Tirunelveli dist., Tamil Nadu	66% min (ZrO_2+HfO_2)	NAS (450,000 - Total Heavy Minerals)	7321	6900**	13350**

Source: *Respective Producers and Department of Atomic Energy, Mumbai.*
** Excluding V. V. Mineral.*
*** Besides, 7,900 tonnes production of zircon-sillimanite is reported in 2009-10 and 8,200 tonnes in 2010-11.*

Table – 5 : Production at Zirconium Oxide and Sponge Plants of DAE at NFC and ZC 2008-09 to 2010-11

(In tonnes)

Plant/Location	Installed capacity (tpy)	Production		
		2008-09	2009-10	2010-11
Zirconium Oxide Plant, NFC, Hyderabad	500	543.60	527.61	544.02
Zirconium Sponge Plant, NFC, Hyderabad	250	340.12	375.84	380.25
Zirconium Oxide Plant, ZC, Pazhayakayal	500	–	18.50	276.76
Zirconium Sponge Plant, ZC, Pazhayakayal	250	–	0.73	80.27

Source*: Department of Atomic Energy, Mumbai.*

Besides, Bhalla Chemical Works Pvt Ltd operates three plants; two of which are located at Gurgaon, Haryana to manufacture zirconium derivatives (ZrO_2), based on imported zircon ore (capacity 10,000 tpy) and zirconium silicate opacifiers (capacity 5,000 tpy). One plant of the company in Rajasthan manufactures zirconium oxychloride crystals and special zirconias (capacity 10,000 tpy).

USES & CONSUMPTION

Zircon's exceptional qualities of hardness and durability makes it a must-use for the manufacture of ceramics and refractory tiles and also for a range of other high-tech applications such as armour plating on military aircraft, heat shield in space shuttles and potentially as solid oxide fuel cells in hydrogen powered vehicles and in many industrial and chemical applications. Owing to its chemical inertness, very low heat conductivity, high specific gravity, low expansion, good resistance to abrasion, high melting point and no shrinkage on being heated up to 1750^{0}C, zircon is found to be an outstanding refractory material.

In foundry industry, zircon is used as facing for foundry moulds as it increases the resistance to metal penetration and affords a uniform finish to castings. Zircon sand is preferred to silica sand because of its uniform size, higher melting point, low thermal expansion and resistance to molten metal, acidic chemicals, slag, etc. Zircon containing 64% ZrO_2 is used generally for foundry applications.

In ceramic industry, finely ground high-grade zircon and zirconium dioxide are used as opacifier in melts for vitreous enamelling and as pigment in ceramic glazes. Zirconium oxide is considered as a potential ceramic material for high temperature applications like engine components. Usually, zircon containing 65% ZrO_2 is preferred in ceramics. The toughened zirconia finds its use in ceramic coatings in jet aircraft engines and in other applications where strength and high temperature oxidation resistance are important. Zirconia ceramics are also used in automobile sensors for the microprocessor control of engines.

In chemical industry, its property of high resistance to corrosion is used where dry chlorine, hydrochloric acid and caustic alkalies are involved. Abrasive and grinding wheels made from zircon sands are used for polishing optical glasses.

Zirconium and zirconium powders are used in ammunition, primers, detonation caps, flashlight mixtures, radio tubes and in various heating elements. Hafnium-free zirconium metal is used as cladding material in atomic reactors due to its low absorption cross section for thermal neutron. Zircon is used as a natural gemstone and also processed to produce cubic zirconia - a synthetic gemstone resembling diamond.

Consumption of zircon/zirflor rose to 21,818 tonnes in 2010-11 from 15,556 tonnes in 2009-10. Consumption of zircon/zirflor during 2008-09 to 2010-11 is furnished in Table - 6.

POLICY

Zircon was classified as a 'prescribed substance', as per notifications issued under Atomic Energy Act, 1962. From the revised list notified vide S. O. No. 61(E), dated 20.1.2006, zircon has been deleted, subject to the condition that the mineral shall remain a prescribed substance till the policy on exploration of beach sand minerals notified on 6.10.1998, is adopted/revised/modified by Ministry of Mines or till 1.1.2007, whichever occurs earlier and shall cease to be so thereafter.

As per the Foreign Trade Policy, 2009-2014 and the effective policy on export and import, zirconium ores and concentrates under HS Code 26151000 can be imported/exported freely.

WORLD REVIEW

Identified world resources of zircon are estimated to exceed 60 million tonnes. World reserves of zirconium are placed at 52 million tonnes in terms of ZrO_2. Australian mineral sand deposits hold the world's largest reserves of zirconium (40%), followed by South Africa (27%). The world production of zirconium minerals was estimated at 1.4 million tonnes in 2010. Australia, South Africa, China and USA are the principal producers of zirconium minerals. Besides, Vietnam and Ukraine are also important producers (Tables - 7 and 8). Zircon finds its application in ceramics, zirconia, chemicals, refractory and foundry & castings which accounts for zircon's total world estimated consumption of about 1.3 million tonnes.

Table – 6: Consumption of Zircon/Zirflor 2008-09 to 2010-11 (By Industries)

(In tonnes)

Industry	2008-09	2009-10	2010-11
All Industries	**24846**	**15556**	**21818**
Ceramic	17019	10184	15347
Foundry	3293	2855	3292
Refractory	1410	1125	1390
Chemical	2329	698	854
TV face plates/glass	470	497	608
Others*	325	197	327

***Source**: Department of Atomic Energy, Mumbai.*
*** Include electrode, abrasive and other industries.*
***Note**: Consumption relates to sales figures of IREL. In addition, sales by KMML are 2,533 tonnes and 2,601 tonnes, respectively, in 2008-09 and 2009-10 for which industrywise break-up is not available. KMML's sales figures for 2010-11 are not available. Domestic sales figures of M/s V.V. Mineral are also not available.*

Table – 7: World Reserves of Zirconium (By Principal Countries)

(In '000 tonnes of ZrO_2)

Country	Reserves
World : Total (rounded)	**52000**
Australia	21000
Brazil	2200
China	500
India*	3400
Mozambique	1200
South Africa	14000
Ukraine	4000
USA	500
Other countries	5000

***Source:** Mineral Commodity Summaries, 2012.*
** As per Department of Atomic Energy, Mumbai, the total resources of zircon are estimated at 32.28 million tonnes.*

Table – 8 : World Production of Zirconium Minerals (By Principal Countries)

(In '000 tonnes)

Country	2008	2009	2010
World : Total	**1415**	**1268**	**1392**
Australia	528	431	540
Brazil #	25	34	37[(e)]
China[(e)]	140	130	140[(e)]
India*[(e)]	29	29	29
South Africa	404	392	381
Ukraine[(e)]	35	35	35
USA	122	100	110
Vietnam[(e)]	24	8	8
Other countries	108	109	112

Source: *World Mineral Production, 2006-2010.*
\# *Including caldasite rock containing zircon and baddeleyite.*
* *As per Department of Atomic Energy, Mumbai, India's production of zircon in 2008-09 and 2009-10 was 29,158 tonnes and 28,049 tonnes, respectively. Production for 2010-11 is not available and is estimated at 26,759 tonnes.*

Australia

Improved market conditions led Iluka Resources to significantly increase its zircon production. The increase was mainly due to start of its operations in Eucla Basin, South Australia and its operations in the Murray Basin, Victoria. Development of Dubbo Zirconia project of Alkane Resources Ltd was continuing in New South Wales. In 2010, the company operated a demonstration pilot plant to confirm process flowsheet. A definitive feasibility study was scheduled for completion by 2011.

The mine & plant designs of Astron Ltd's Donald mining project in Victoria were completed. The deposit is estimated to contain 305 million tonnes reserves with 6.2% heavy minerals comprising 19% zircon. Feasibility study of Coburn heavy minerals project of Gunson Resources Ltd was completed. The Western Australian project is estimated to contain 850,000 tonnes zircon reserves and with 40,000 tpy rate of production, it may have a mine life of 17 years.

Matilda Zircon Ltd continued development of zircon-rich heavy mineral deposits in Northern Territory and Western Australia. The Chinese zircon consumer Tricoastal Minerals Co. is to assist in development of Lethbridge Mine which began production in June, 2010.

Canada

Titanium Corp. continued its research in recovery of bitumen, volatile organic compounds and heavy minerals, including zircon from mined oil sand tailings. A demonstration plant was commissioned in 2010 at the Government's Canmet testing facilities.

China

Being a leading producer of ceramic tiles, steel and zirconium chemicals, China is also the leading consumer of zircon accounting for 40% of the world consumption. China is also the world leader in producion of zirconium chemicals with a total installed capacity of 300,000 tpy that also includes 170,000 tpy of zirconium oxychloride (ZOC).

Mozambique

Kenmare Resources plc was increasing the production at the Moma heavy minerals operations. By 2010-end, the company was also proceeding to expand the capacity by about 50%.

Russia

Lukoyanovskoye heavy mineal sands deposit of ARZM Uranium Holding Co. was under development. The mine would have 1.5 milion tpy ore sands processing plant by 2014, including up to 35,000 tpy of zircon.

Senegal

After completion of feasibility study, construction of mine and separation plants were to begin in 2011 at the Mineral Deposits Ltd's Grande Cote heavy minerals deposit. Initial production is slated to start in 2013. After full commissioning, the mine is expected to produce 80,000 tpy of zircon besides other heavy minerals totalling 575,000 tpy.

South Africa

Rio Tinto plc's tailings treatment facility at the Richards Bay Minerals heavy minerals operation was nearing completion. The production was to commence in early-2011. The facility will recover heavy mineral concentrates, including zircon, from about 30 years' mine tailings accumulation.

USA

The US producers of zircon were Du Pont and Iluka Resources. They produced zircon from their heavy mineral sands operations near Starke, Florida and Stony Creck, Virginia, respectively. Industrial Minerals Corp. Ltd (IMC) continued development of Coos Bay heavy minerals project and expected to begin producing chromite, garnet and zircon in 2012.

FOREIGN TRADE

Exports

Exports of zirconium ores and concentrates rose sharply to 31,764 tonnes in 2010-11 from 8,015 tonnes in the previous year. Exports were mostly to China. Exports of zirconium and scrap were 25 tonnes in 2010-11 as against 76 tonnes in 2009-10 (Tables - 9 and 10).

Table – 9 : Exports of Zirconium Ores & Conc.
(By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**8015**	**112724**	**31764**	**473254**
China	7940	109415	28010	312761
UAE	27	1117	703	31988
Chinese Taipei/ Taiwan	-	-	462	31411
Netherlands	-	-	1092	22138
Thailand	42	1882	343	16663
Iran	-	-	300	15858
Italy	-	-	224	10948
Saudi Arabia	-	-	181	9823
Brazil	-	-	104	6235
Japan	-	-	80	5211
Other countries	6	310	265	10218

Source: *DGCI&S, Kolkata*

Imports

Imports of zirconium ores and concentrates increased to 54,312 tonnes in 2010-11 from 34,724 tonnes in the previous year. Main suppliers were Australia and South Africa. Imports of zirconium and scrap were 12 tonnes in 2010-11 against 10 tonnes in the previous year. Imports were mainly from Italy and Sweden (Tables - 11 and 12).

Table – 10 : Exports of Zirconium & Scrap
(By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**76**	**12701**	**25**	**6895**
Japan	-	-	++	3778
Indonesia	-	-	22	1455
Malaysia	-	-	++	582
USA	2	408	++	466
China	10	151	++	318
Peru	-	-	1	139
UAE	3	210	2	137
Korea, Rep. of	-	-	++	20
Other countries	61	11932	-	-

Source: *DGCI&S, Kolkata*

Table – 11 : Imports of Zirconium Ores & Conc.
(By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**34724**	**1517772**	**54312**	**2665929**
Australia	23933	1077871	44250	2215562
South Africa	5203	214134	4848	212102
Ukraine	1520	64982	1379	61459
China	112	6308	1406	58500
Malaysia	584	23443	346	19727
Sri Lanka	1230	49920	409	16758
Italy	78	4698	196	14622
UAE	-	-	216	11032
Saudi Arabia	-	-	208	10972
Germany	-	-	235	9495
Other countries	2064	76416	819	35700

Source: *DGCI&S, Kolkata*

Table – 12: Imports of Zirconiumm & Scrap (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**10**	**1697**	**12**	**24349**
Sweden	-	-	3	8860
Italy	6	4399	6	4941
China	2	1649	1	3069
USA	1	8399	1	2983
Switzerland	-	-	++	1018
France	++	68	1	975
Netherlands	-	-	++	336
UK	++	76	++	275
Poland	-	-	++	188
Unspecified	-	-	++	1140
Other countries	1	2388	++	564

Source: *DGCI&S, Kolkata*

FUTURE OUTLOOK

The Working Group on Mineral Exploration & Development (other than coal & lignite) for the 12th Five Year Plan (2012-17) has estimated the projected demand for next five years between 86,000 and 90,000 tpy at the GDP growth rate of 8%, 9% and 10%. The projected production is expected to remain at the level of 30,000-35,000 tpy with the balance to be met by way of imports.

Indian Minerals Yearbook 2011

(Part- II)

50th Edition

ALUMINIUM & ALUMINA

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 102

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

October 2012

12 Aluminium and Alumina

The aluminium industry in India is strategically well-placed and ranks seventh largest in the world with discernible growth plans and prospects for the future. India's rich bauxite mineral base renders a competitive edge to the industry as compared to its counterparts globally. The aluminium industry in India scaled lofty notches since the establishment of the first manufacturing company, namely, Indian Aluminium Company (INDAL) in 1938. All business activities of INDAL have been merged subsequently with Hindalco Industries Limited (Hindalco).

Three major primary producers, NALCO, Hindalco Industries Ltd and Vedanta Aluminium Ltd (VAL) are at the forefront of aluminium metal. The primary producers have a strong presence in the sheet business and are enlarging their roles in the foil segment. The primary producers are also in the extrusion segment in which a large number of secondary manufacturers participate with fragmental capacities.

The overall total annual installed capacity of aluminium in the country has risen from 17.80 lakh tpy in 2009-10 to 18.56 lakh tpy during 2010-11. The actual production of aluminium comes from a plant capacity of 17.16 lakh tpy as 1.40 lakh tpy capacity is presently non-operational. Producerwise capacity of aluminium is given in Table-1.

The installed capacity of alumina plants in the country was 48.85 lakh tpy, out of which plant capacity of 46.00 lakh tpy reported alumina production during the year. Alumina capacity of 2.85 lakh tpy remained non-operational (Table-2).

PRODUCTION

Aluminium

The production of aluminium estimated at 16.21 lakh tonnes in 2010-11 registered an increase of 9.5% as compared to that in the previous year. Four plants reported production of aluminium during the year. Of these, one plant in public sector accounted for about 27% of the total production in 2010-11. The remaining 73% was reported by the private sector (Tables - 3 & 4).

During the year under review, NALCO and Hindalco (Renukoot) recorded higher production as compared to the previous year.

Table – 1 : Installed Capacity of Aluminium, 2010-11 (By Producers)

(In '000 tonnes)

Producer	Plant	Annual capacity
Total		**1856.4**
Public Sector		
National Aluminium Co. Ltd	Angul (Odisha)	460
Private Sector		
Bharat Aluminium Co. Ltd	Korba (Chhattisgarh)	350**
Hindalco Industries Ltd	Renukoot - 345 (Uttar Pradesh) Hirakud(Odisha)-161.4* Alupuram (Kerala) - closed	506.4
Madras Aluminium Co. Ltd	Mettur (Tamil Nadu)	40#
Vedanta Aluminium Ltd	Jharsuguda (Odisha)	500

Source : *Information received from the companies/Annual Reports.*
***Korba plant-I capcity of 100 thousand tonnes per year is non-operational.*
 # Plant is lying closed.
*Proposed expansion to 213 thousand tonnes per year

Table – 2 : Installed Capacity of Alumina, 2010-11 (By Producers)

(In '000 tonnes)

Producer	Plant	Annual capacity
Total		**4885**
Public Sector		
National Aluminium Co. Ltd	Damanjodi (Odisha)	2100
Private Sector		
Bharat Aluminium Co. Ltd	Korba (Chhattisgarh)	200#
Hindalco Industries Ltd	Renukoot - 700 (Uttar Pradesh) Belgaum - 350 (Karnataka) Muri - 450 (Jharkhand)	1500
Madras Aluminium Co. Ltd	Mettur (Tamil Nadu)	85#
Vedanta Aluminium Ltd	Lanjigarh (Odisha)	1000

Source : *Information received from the companies/Annual Reports/M.O.M. Annual report.*
 # Plants remained unoperational during the year.

Alumina

The production of alumina estimated at 35.77 lakh tonnes in 2010-11 increased by about 4% as compared to the previous year. Two plants of Hindalco and the plant of NALCO reported higher production of alumina as compared to the previous year. NALCO continued to be the leading producer of alumina accounting for 42% of the total production during the year under review. MALCO reported nil production during the year (Tables- 5 & 6).

Table – 3 : Production of Aluminium 2008-09 to 2010-11

(Quantity in tonnes;value in ₹ '000)

Year	Production	
	Quantity	Value
2008-09	1347127	122673933
2009-10	1480568	123771762
2010-11(e)	1621035	NA

Table – 4 : Production of Aluminium 2009-10 and 2010-11 (By Plants)

(In tonnes)

Producer	Plant	Production	
		2009-10	2010-11(P)
National Aluminium Co. Ltd	Angul	396018	443600
Hindalco Industries Ltd	Renukoot	399689	410475
	Hirakud	157205	128461
Bharat Aluminium Co. Ltd	Korba	263311	253136
Vedanta Aluminium Co. Ltd	Jharsuguda	264345	*

** Production data not received. The production was 385,363 tonnes as per Annual Report, 2011.*

Table – 5 : Production of Alumina 2008-09 to 2010-11

(Quantity in tonnes;value in ₹ '000)

Year	Quantity	Value
2008-09	3620252	41852471
2009-10	3432716	40173809
2010-11(e)	3576917	NA

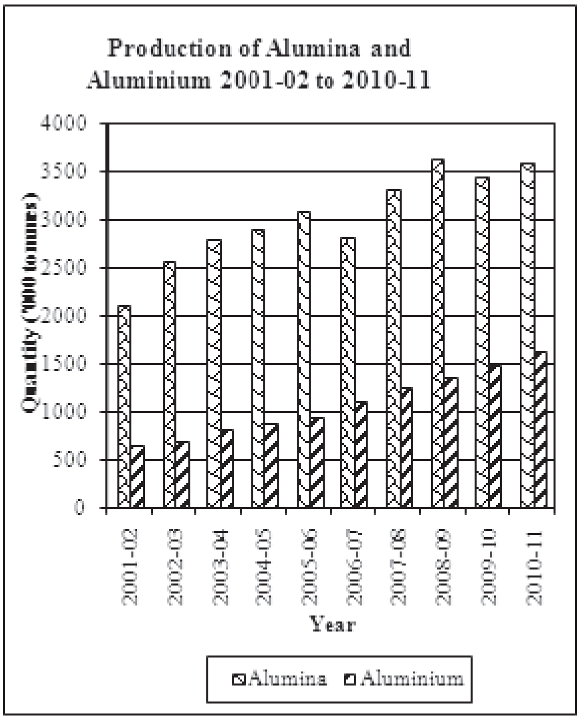


Table – 6 : Production of Alumina 2009-10 and 2010-11(P) (By Plants)

(In tonnes)

Producer	Plant	Production	
		2009-10	2010-11(P)
National Aluminium Co. Ltd	Damanjodi	1320300	1516100
Hindalco Industries Ltd	Renukoot	710123	724427
	Belgaum	378700	376200
	Muri	218500	253550
Bharat Aluminium Co. Ltd	Korba	42898	_
Vedanta Aluminium Co.	Lanjigarh	762195	*

** Production data not received. The production was 706,640 tonnes as per Annual Report, 2011.*

INDUSTRY

Five aluminium smelters of total installed capacity of 18.56 lakh tpy operated by four companies were known to be in operation in the country. Of these, NALCO is the only company in the Public Sector with installed capacity of 460,000 tpy. BALCO, earlier a Public Sector company, is now in Private Sector with stake holdings apportioned between Sterlite Industries (India) Ltd (51%) and Government of India (49%). The remaining three smelters of Hindalco and Vedanta Aluminium Ltd are in the Private Sector. The aluminium plants of NALCO and BALCO have their alumina-aluminium complexes at Damanjodi-Angul (Odisha), and Korba (Chhattisgarh), respectively.

Hindalco operates two smelters– one at Renukoot (Uttar Pradesh) and the other at Hirakud (Odisha). The third smelter of Hindalco at Alupuram (Kerala) is lying closed. The Korba-I plant of BALCO's smelter with 100,000 tpy cpacity is not operational while the 245,000 tpy Korba-II plant is presently working above its installed capacity. MALCO is a Vedanta Group Company. It did not report production of alumina and aluminium during 2010-11. It now operates in commercial power generation. It generates 100 MW power from 4 units of 25 MW each and is one of the largest private sector power suppliers in Tamil Nadu.

Hindalco has a conductor redraw capacity of 56,400 tpy at Renukoot plant and sheet rolling capacity of 205,000 tpy spread over at Renukoot (80,000 tpy), Belur (45,000 tpy), Taloja (50,000 tpy) and Mauda (30,000 tpy) plants. The company also has extrusion capacity of 31,000 tpy (comprising units at Renukoot with 23,000 tpy capacity and Alupurum, 8,000 tpy capacity).

Jindal Aluminium Ltd is also a leading producer and exporter of aluminium extrusions with a total capacity of 82,000 tpy. It also meets more than 25% domestic demand of extrusions. The available information on installed capacity of semis along with production by major plants is given in Table-7.

Hindalco's foil unit located at Silvassa has an installed capacity of 30,000 tpy and produces foils with thickness varying from 9 microns to 200 microns. Additionally, Hindalco's Kalwa plant in Thane district (Maharashtra) has foil capacity of 6,000 tpy. Kollur plant in Medak district, Andhra Pradesh has capacity of 4,000 tpy and produces a wide array of high-quality foils — from cigarette and blister foil to lidding foil in thicknesses from 50 to 7 microns.

Table – 7 : Production Facility for Aluminium Semis 2009-10 and 2010-11

(In tonnes)

Producer/product	Annual installed capacity	Production	
		2009-10	2010-11
Hindalco Industries Limited			
Rolled product	205000	205265	199821
Extruded products	31000	38909	35865
Conductor redraw rods	56400	91903	94307
Aluminium foils	40000	16920	17698
Aluminium wheels (No. of pieces)	-	1792	-
NALCO			
Aluminium wire rods	100000	-	42559
Aluminium billets	30000	-	-
Aluminium strips (smelter)	26000	-	-
Aluminium strips (RPU)	52000	-	-
Rolled products	45000	15277	21352
MALCO			
Rolled products	12000	-	-
Properzi rods	36000	N. A.	-
Bus bars	-	-	-
Aluminium wire rods	32850	N.A	27420
BALCO			
Extruded products	8000	-	-
Rolled products	72500	-	-
Properzi rods	111500	-	-
Foil product	600	-	500
Conductors	1200	-	-
Aluminium wire rods	43200	-	23430
JINDAL ALUMINIUM Ltd			
Extruded products	82000	39996	44700

Source: *Information received from individual plants/Annual Reports.*

Development & Expansion

NALCO's expansion activities were on schedule and have augmented aluminium production capacity from 4.025 lakh tonnes to 4.6 lakh tonnes per year which is being further raised to 5.67 lakh tonnes per year under current-amperage upgradation project. Expansion of alumina refinery capacity from 15.75 lakh tonnes to 21 lakh tonnes per year is completed and is being upgraded to 22.75 lakh tonnes per year under 4th stream upgradation project by June-2012. The augmentation of its power generation capacity is from 960 MW to 1200 MW. NALCO is understood to have received an in-principle approval of Government for a second greenfield aluminium project in Odisha. The proposed project to be set up has 5 lakh tpy smelter capacity and will be located near Brajrajnagar in the district of Jharsuguda, Odisha. NALCO plans to set up 42 lakh tpy bauxite mines and 14 lakh tpy alumina refinery in Andhra Pradesh. Feasibility study of the project was under progress. The company has port facilities at Visakhapatnam to export alumina at the rate of one million tpy. NALCO is pursuing to set up a one million tonne alumina refinery in Gujarat, based on supply of bauxite from Kachchh region by Gujarat Mineral Development Corporation.

Hindalco's plans to expand alumina refinery capacity at Belgaum from 3.5 lakh tpy to 6.5 lakh tpy are on hold, awaiting government's approval relating to bauxite mines.

Hindalco's greenfield projects have made significant progress. Utkal Alumina, the 1.5 million tpy alumina refining project reportedly made considerable headway. The commissioning of the plant is expected by early 2012. The other integrated aluminium project, namely, Aditya Alumina & Aluminium Project with 1.5 million tpy alumina refinery at Kans, 3.59 lakh tpy aluminium smelter at Lapanga and 900 MW captive power plant was on schedule. The smelter is expected to be commissioned in 2013 and the alumina refinery by end of 2014. A joint venture agreement on bauxite mines was signed with OMC. The company is also developing and mining coal for captive consumption jointly with Mahanadi coalfields Ltd and Neyveli Lignite Corporation Ltd. The company is also setting up 3.59 lakh tpy smelter and 900 MW captive power plant at Mahan in Madhya Pradesh, based on captive coal consumption (JV) from Sidhi district, Madhya Pradesh. It was to be commissioned in 2011. Another greenfield project, viz Jharkhand Aluminium Project at Sonahatu, 55 km from Ranchi, entails setting up a 3.59 lakh tpy aluminium smelter with 900 MW captive power plant. It is supported by 5 million tpy captive coal mine of Auranga coalfields in Jharkhand in JV with Tata Power. Land acquisition was in progress, and for other clearances, application was filed. The project is likely to be commissioned in mid-2015. In addition, company's ongoing brownfield expansions are progressing well; the Hirakud Smelter expansion from 1.55 lakh tpy to 1.61 lakh tpy has been completed in 2011. A further expansion from 1.61 lakh tpy to 2.13 lakh tpy along with a 100MW captive Power Plant will be completed in early 2012. The total aluminum smelter capacity of Hindalco has grown to 5.06 lakh tpy during 2011.

BALCO of Vedanta Group (controlled by Sterlite Industries (India) Ltd is undertaking programmes for modernisation and expansion. The present capacity of the Korba smelter is 3.5 lakh tpy. The Korba-I plant of BALCO's smelter capacity of 100,000 tpy is not operational while the 245,000 tpy Korba-II plant is presently working above its installed capacity.

Vedanta Aluminium Ltd (VAL) has 10 lakh tpy alumina production capacity at Lanjigarh in Kalahandi district, Odisha and the new 5 lakh tpy aluminium smelter capacity at Jharsuguda. The company intends to fully integrate the smelting capacity to 2.6 million tpy in near future. Construction of 1.1 million tpy smelter expansion is currently under progress.

USES

Aluminium has wide applications in various areas, such as, transport and building & architectural sectors; packaging; food & chemical industries; electrical sector; machinery & equipment; consumer durables and also in defence sector in addition to its possible new use in wagon making by Indian Railways. In automobile industry, aluminium is gradually replacing steel. Aluminium body makes car lighter and more fuel-efficient. Other important new application areas are lithographic (offset) plates required in printing, solar panels, fibre composites & reflectors and gas cylinders. India has pioneered the replacement of copper by aluminium in power transmission & distribution which has enhanced the demand for aluminium. There are 600 cable and conductor manufacturing units in the country, having a total capacity of 400,000 tpy. The major end-use of aluminium is as rolled sheets, extrusions and foils. India Foils, Pennar Aluminium and Century Extrusions are the major players in the extrusion & foil market.

Foil is a very thin sheet of rolled aluminium supplied in its pure form or as alloys. The thickness of foil ranges from the thinnest currently produced at about 0.0065 mm to thickest 0.2 mm. Material thicker than 0.2 mm is defined as sheet or strip.

CONSUMPTION

In advanced economies, aluminium is increasingly replacing wood and steel in building sector. Aluminium cans and containers are used extensively world over. Aluminium is also the ideal packaging material for pharmaceuticals and processed foods.

In India, aluminium was consumed mainly in the electrical sector (48%), followed by transport sector (15%), construction (13%), consumer durables (7%), machinery & equipment (7%), packaging (4%) and others (6%). The per capita consumption of aluminium in India is among the lowest in the world with only 1.3 kg as compared to world average of 12-15 kg.

Alumina is produced from bauxite. About one tonne of alumina is produced from three tonnes of bauxite and about one tonne of aluminium from two tonnes of alumina.

RESEARCH & DEVELOPMENT

The Hindalco's research and development work was mainly aimed at new product development; conservation of materials and resources; improvement in energy conservation; waste minimisation and reutilisation; environment preservation and sustenance; etc.

NALCO's in-house R&D units located at M&R Complex, Damanjodi and S&P Complex, Angul were into development of Integrated Technology for processing East Coast Bauxite for production of alumina in collaboration with JNARDDC; development of process for extraction of vanadium sludge; recovery of TiO_2 from plant sand; recovery of alumina from partially lateritised khondalite; characterisation of baked anode for process monitoring; determination of cell factor for prediction of net carbon consumption, etc. Manufacture of Ordinary Portland Cement (OPC) from NALCO's red mud was established. Lab scale studies related to gallium recovery were completed by NALCO in collaboration with M/s NML, Japan. Lab scale development of constructional blocks, bricks & chips from Red mud and pilot scale development are in progress in collaboration with JNARDDC, Nagpur. Similarly, in-house R & D activities like studies on utilisation of fly ash in alumina plants of NALCO, Anode bench scale studies at smelter plants for impact of different qualities of C.P. coke etc. were also on. The company also has future plans to set up 10,000 tpy nickel carbonate production plant based on the know-how of modified Caron process, developed by IMMT, Bhubaneswar. NALCO has entered into an agreement with Bharat Earth Movers Ltd (BEML) for the production of aluminium rail wagons. As per the agreement, products would be jointly developed by these two PSUs.

Recycling

The Working Group on Non-ferrous Metals set up by the Ministry of Mines, Government of India, had made strong recommendation on the need to encourage recycling in India as a long-term solution for conserving energy and resources. In India, though aluminium industry is over six decades old, the recyling sector with modern state-of-the-art technology has not really taken off.

Recycling process requires only about 5% of the 15,000/- kWh units consumed for every tonne of metal produced through the bauxite-alumina route in a modern smelter. Besides, it keeps the emission levels of green house gases to a low of 5% from the actual emission experienced during primary production. Further, for every one lakh tonne of aluminium produced annually through recycling, about six lakh tonnes per annum of bauxite resources can be conserved.

Presently, about 4.70 lakh tonnes scrap are being imported and used for recycling in addition to about 40,000 tonnes secondary metal produced by recycling of domestic scrap. Aluminium recycling is still limited to the unorganised sector, catering mostly to the utensil and casting industries. The proportion of recycled aluminium has been increasing over the years. It is expected that in the years to come, it will reach a figure of about 35-40% of total aluminium consumption. Even today there is only one recycling unit of Hindalco in organised sector at Taloja with 25,000 tonnes annual capacity. Although the plant at Taloja was suffering due to want of availability of scrap, the production from the unit has improved and the plant is now operating at 80% of the rated capacity as against 60% capacity earlier.

Most recycling units in India operate on outdated, or primitive technology that entail high levels of pollution and energy consumption. This is an area that needs to be addressed by the Indian aluminium industry. Due recognition of recycling could encourage users of aluminium particularly in transport, housing, packaging and durable sectors to broaden the organised markets for the scrap generated.

WORLD REVIEW

Globally, primary aluminium production has increased by 12% in 2010 to 41.5 million tonnes from 37.1 million tonnes in 2009. The principal producers were China (39%), Russia (10%) and Australia (5%) (Table- 8). The world production of alumina also increased to 85.6 million tonnes in 2010 in terms of contained Al_2O_3 from 77.7 million tonnes in 2009. China accounted for 34%, followed by Australia (23%), Brazil (11%) and USA (5%) in the production of alumina in 2010 (Table-9). The country-wise developments in Aluminium & Alumina sector are as follows:-

Table – 8 : World Production of Aluminium (Primary) (By Principal Countries)

(In '000 tonnes)

Country	2008	2009	2010
World: Total	**39600**	**37100**	**41500**
Australia	1974	1943	1928
Brazil	1661	1536	1536
Canada	3120	3030	2963
China	13178	12891	16195
India*	1347	1481	1610[e]
Norway	1368	1090	1400
Russia	4190	3815	3947
South Africa	811	809	807
USA	2658	1727	1727
Other countries	9293	8772	9387

Source : *World Mineral Production, 2006-2010.*

* *During 2008-09, 2009-10 and 2010-11, India's production of aluminium was 1,347 thousand tonnes,1,481 thousand tonnes and about 1,621 thousand tonnes, respectively.*

Table – 9 : World Production of Alumina (By Principal Countries)

(In '000 tonnes of Al_2O_3)

Country	2008	2009	2010
World : Total	**83000**	**77700**	**85600**
Australia	19446	19939	19957
Brazil	7822	8708	9431
China	23029	23793	28939
India*	3600	3600	3600
Ireland	1890	1240	1864
Jamaica	3995	1774	1591
Kazakhstan	1608	1608	1639
Russia	3112	2794	2857
Spain	1300	1300	1300
Suriname	2154	1536	1486
Ukraine	1673	1524	1534
USA	4298	3064	3950
Venezuela	1591	1376	1244
Other countries	7482	5444	6208

Source : *World Mineral Production, 2006-2010.*

* *During 2008-09, 2009-10 and 2010-11, India's production of alumina was 3,620 thousand tonnes, 3,433 thousand tonnes and about 3,577 thousand tonnes, respectively.*

Argentina

Aluminio Argentino S.A.I.C. (Aluar) started production in 2010 from 24 new pots that were part of an expansion of its smelter. This would bring smelting capacity from 410,000 tpy to 425,000 tpy by 2011.

Australia

Work on expansion of BHP Billiton's Worsley refinery to 4.6 million tpy from 3.5 million tpy continued. Completion was projected for early 2011. Rio Tinto announced expansion of the Yarwun refinery from 1.4 million tpy to 3.4 million tpy and was expected to be completed in August 2012.

Bahrain

Aluminum Bahrain Ltd (Alba) was planning to expand production capacity by adding more pots to two of its five potlines. The project would increase capacity of the smelter from 870,000 tpy to 970,000 tpy. The project would be completed by 2012-end.

Brazil

Expansion of the Alumar refinery from 1.5 million tpy to 3.6 million tpy was completed in 2009, and production ramp up continued in 2010. Production at full capacity was expected to be reached in mid-2011 due to difficulties with the ship-loading. Vale continued work on the CAP refinery which was expected to begin production by 2012 end with an initial production capacity of 1.9 million tpy. Brazil recycled about 98% of all aluminium beverage cans sold in the country during 2009. Brazil collected and recycled 198,800 tonnes of UBCs, the equivalent of 14.7 billion aluminium cans. For the ninth consecutive year, Brazil had the highest aluminium can recycling rate among countries that do not have mandatory recycling laws.

Canada

Exploration Orbite V.S.P.A. Inc. continued construction of a pilot plant to test the recovery of alumina from aluminous clays near Grande-Vallee, Quebec. The pilot plant at Cap-Chat, Quebec, was to be operational in early-2011. Rio Tinto was going ahead with construction of a new smelter in Saguenay, Quebec. The first phase of smelter operation would be in early-2013, with a capacity of 60,000 tpy.

China

Chinalco completed an 800,000-tpy refinery in Zunyi, Guizhou Province and an 800,000-tpy refinery in Nanchuan, Chongqing. Nanshan Longkou Donghai Alumina Co. Ltd was continuing work on expansion at its Shandong refinery. Alumina capacity at the refinery would increase from 1.2 million tpy to 1.6 million tpy when the expansion would be completed in early 2011. Guangxi Huayin Aluminum Co. Ltd started production from its refinery in Huayin, Guangxi Province. The project increased capacity from 1.6 million tpy to 2 million tpy. Shanxi Luneng Jinbei Aluminum Co. Ltd completed the first phase of expansion at its alumina refinery. A second phase expansion was underway which was to be completed in May 2011 to increase capacity from 1 million tpy to 2 million tpy. Yunnan Aluminum Co. Ltd's alumina refinery in Wenshan was to be expanded to 800,000 tpy by 2012. Guizhou Guanglu Aluminium Co. Ltd, continued construction of an 800,000-tpy alumina refinery in Qingzhen, Guizhou Province. The project was scheduled for completion by 2012. Guangdong Galuminum Group Ltd continued construction of an 800,000-tpy alumina refinery in Qingzhen, Guizhou Province. The project was scheduled to be completed in mid-2011. Louyang Xiangjiang Wanji Aluminium Ltd started work on an expansion of its alumina refinery in Louyang, Henan Province, during 2010. Capacity would increase from 800,000 tpy to 1.4 million tpy at 2011-end. Shanxi Zhaofeng Aluminium Co. Ltd. started expansion of its alumina refinery in Shanxi Province from 400,000 tpy to 1 million tpy. The project was expected to be completed at 2012 end. Shandong Chiping Xinfa started construction of an alumina refinery in Jiaokou, Shanxi Province. The refinery would have a production capacity of 2.4 million tpy and was expected to be completed by 2011-end. Chinalco started expansion of the Guangxi alumina refinery in Pingguo, Guangxi Province, which

Primary aluminum production in China increased by 26% compared with that in 2009. The Government ordered preferential power rates to be discontinued to energy-intensive sectors including primary aluminum smelters in several provinces. The Government also ordered highly polluting or inefficient smelters to be shut down. The policy was aimed at reducing energy consumption and pollution in fast growing provinces of China. The Ministry of Industry and Information Technology announced that obsolete potlines, having a combined capacity of 422,000 tpy, at 15 smelters would be permanently closed by the end of September 2010. The government of Guangxi Zhuang Autonomous Region announced strict regulations on expansion of energy-and emissions-intensive industries, including primary aluminum smelting. The provincial government of Inner Mongolia also announced similar policies, including the closure of 800,000 tpy of capacity at smelters with outdated or inefficient technology.

By early 2010, Aluminum Corp. of China (Chinalco) restarted all capacity at its primary smelters that had been shut down during 2008 and 2009. Chinalco also announced it would phase out inefficient capacity of aluminum smelters and alumina refineries by 2011. The permanent closures would involve more than 330,000 tpy of smelting capacity. Chinalco was expanding capacities to add 850,000 tpy of smelter capacity. Expansion from 150,000 tpy to 550,000 tpy at the Guangxi smelter in Pingguo began in 2010. Sichuan Aba Aluminum Smelter Co. Ltd started production from an expansion project in Wenchuan, Sichuan Province, that increased capacity from 110,000 tpy to 200,000 tpy. Bosai was also constructing an extrusion plant near the smelter to produce value-added products. Vimetco NV commissioned the first two phases of the 250,000-tpy Linfeng smelter during 2010. The third phase, with a capacity of 80,000 tpy, was expected to start production in early 2011. Kaiman Aluminum Co. started production from a new 350,000-tpy in 2010. Dongyuan Qujing Aluminum Co. Ltd completed two expansions to its smelter in Qujing, Yunnan Province, during 2010 that increased the smelter's capacity from 230,000 tpy to 380,000 tpy. Xinjiang Wujiaqu Coal & Power Co. Ltd started production from a new smelter with a capacity of 370,000 tpy. Jinning Aluminium Magnesium New Type Material Co. Ltd started production from its new smelter with a capacity of 350,000 tpy located in Zhongning county.

Indonesia

PT Aneka Tambang (Antam)'s construction of a 300,000-tpy chemical-grade alumina refinery at Tayan was expected to begin in April 2011 and the production was expected to begin in early 2014.

Kazakhstan

Eurasian Natural Resources Corp. (ERNC) was expanding the capacity of its alumina refinery from 1.25 million tpy to 1.7 million tpy. Completion of the project was scheduled for mid-2011 and would supply ENRC's nearby smelter, where an expansion project was completed in May 2010. Construction on an expansion of smelter to increase capacity from 125,000 tpy to 250,000 tpy at the Pavlodar smelter was completed and production started in mid-2010.

Saudi Arabia

Saudi Arabian Mining Co. and Alcoa began construction of the 740,000-tpy Raz as Zawr smelter and 380,000-tpy rolling mill. The project, expected to be completed in 2013, also included a 4 million tpy bauxite mine at Al Ba'itha and a 1.8-million tpy alumina refinery in Raz as Zawr which were expected to be completed in 2014.

Vietnam

Vinacomin and Chinalco started construction of a 600,000-tpy alumina refinery and an adjacent bauxite mine in Lam Dong. The refinery and mine were expected to be completed in 2012. Vinacomin and Chinalco were also constructing a 650,000-tpy alumina refinery in Nhan Co, Dak Nong Province. The refinery and mine were expected to be completed in mid-2013.

FOREIGN TRADE

Exports

Exports of alumina increased to 56.48 lakh tonnes in 2010-11 from 7.03 lakh tonnes in the previous year. Exports in 2010-11 were mainly to Bahrain (28%), Iran (22%), Ukraine (21%) and Egypt (14%). Exports of aluminium and alloys including scrap increased in 2010-11 to 5.53 lakh tonnes from 4.41 lakh tonnes in 2009-10. Exports in 2010-11 were mainly to Rep. of Korea (25%), Malaysia (9%) and Italy & Indonesia (8% each) (Tables - 10 to 12).

Imports

Imports of alumina decreased to 2.81 lakh tonnes in 2010-11 from 3.37 lakh tonnes in the previous year. Imports were mainly from Australia (69%) and China (16%) in 2010-11. Imports of aluminium & alloys and scrap increased to 8.81 lakh tonnes in 2010-11 from 7.27 lakh tonnes in the previous year. The imports were mainly from UAE (14%), China (8%), UK (7%) and Saudi Arabia & Thailand (6% each). (Tables - 13 to 15).

Table – 10 : Exports of Alumina
(By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**702657**	**9576723**	**5647794(U)**	**92024661**
China	316032	4226704	433239	6602470
Iran	123858	1541303	1225209	19445124
Egypt	57758	826090	795907	13287482
Bahrain	30001	590851	1559719	25195023
USA	5130	157034	9311	246577
Thailand	2660	81338	3846	113252
UAE	962	28628	403919	7298416
Ukraine	–	–	1198367	19329710
South Africa	1641	48320	4097	106740
Mexico	448	11942	2110	56003
Other countries	164167	2064513	12070	343864

(U) Under reference

Table – 11 : Exports of Aluminium and Alloys Incl. Scrap (By Countries)

Country	2009-10 Qty (t)	2009-10 Value (₹` '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Countries	**440762**	**49177673**	**553115**	**70907167**
Korea, Rep. of	52597	5273721	141001	16140161
Italy	1857	382067	41521	5489197
Indonesia	26624	2394290	42219	5440473
Malaysia	27042	2702742	48040	4909885
Singapore	62260	5271043	37148	3990143
USA	12576	2414808	15625	3209504
Chinese Taipei/Taiwan	4609	443623	25111	3037995
Nigeria	15599	1893283	18118	2878008
Japan	10337	1047476	22245	2433523
UAE	17046	2514194	11354	2033045
Other countries	210215	24840425	150733	21345233

Table – 12 : Exports of Aluminium (By Items)

Item	2009-10 Qty (t)	2009-10 Value (₹ '000)	2010-11 Qty (t)	2010-11 Value (₹ '000)
All Items	**440762**	**49177673**	**553115**	**70907167**
Aluminium & alloys: unwrought	284902	25923965	394648	44957109
Aluminium ingots	281712	25552818	364590	41230447
Aluminium unwrought, NES	827	94921	1692	197030
Aluminium alloys unwrought	2363	276226	28366	3529632
Aluminium powder & flakes	1865	337147	2866	443408
Aluminium & alloys: worked	63368	8871488	58934	8956682
(bars, rods, plates, profiles, etc.)				
Aluminium & alloys, worked, NES	88666	13873801	94388	16332428
Aluminium scrap	1961	171272	2279	217540

Table – 13 : Imports of Alumina (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**337072**	**6790221**	**281225**	**6924573**
Australia	279725	4332620	195243	3383175
China	29244	935366	43618	1542635
Netherlands	12370	402559	18413	689965
Germany	6895	371014	9805	487259
USA	5104	349528	2723	326768
France	1166	184654	757	63732
Japan	213	75591	87	36091
Italy	160	19408	431	37192
Saudi Arabia	-	-	6000	100487
Czech Republic	-	-	160	78235
Other countries	2195	119481	4048	179034

Table – 14 : Imports of Aluminium and Alloys Incl. Scrap (By Countries)

Country	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**726656**	**72160299**	**881144**	**101220027**
UAE	88348	7255052	122460	12817006
China	48096	8460692	71399	11770623
Thailand	40854	4315121	50749	6068244
UK	44302	3989689	61468	6028751
Saudi Arabia	40101	3160134	54434	5309039
Germany	28588	4173204	32576	5053774
Korea, Rep. of	19871	3229849	24881	4819039
Bahrain	36968	3895013	35189	4463595
Oman	25899	2534987	39326	4190652
USA	19487	1904106	39945	3955216
Other countries	334142	29242451	348717	36744088

Table – 15 : Imports of Aluminium (By Items)

Item	2009-10		2010-11	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Items	**726656**	**72160299**	**881144**	**101220027**
Aluminium & alloys: unwrought	240705	20885414	228251	25404781
Aluminium ingots	220452	18861258	211720	23417600
Aluminium unwrought, NES	6561	670504	5472	604117
Aluminium alloys, unwrought	13692	1353652	11059	1383064
Aluminium powders & flakes	1347	162621	460	86000
Aluminium & alloys: worked (bars, rods, plates, profiles, etc.)	116493	19698818	148960	26106208
Aluminium & alloys, worked, NES	28488	8006647	33199	8917323
Aluminium scrap	339623	23406799	470274	40705715

FUTURE OUTLOOK

The total production capacity of aluminium in India has increased from 1.08 million tonnes in 2006-07 to 1.86 million tonnes in 2010-11. The production of primary aluminium in India was estimated 1.62 million tonnes in 2010-11 whereas the consumption during 2009-2010 was 1.59 million tonnes, representing a “Per Capita” consumption of about 1.3 kg which was in the range of 0.5 kg about a decade back.

India occupies 6th place in the world with a share of 3.19% of world reserves of bauxite. Odisha and Andhra Pradesh account for more than 90% of country’s metallurgical grade resources. While gibbsitic bauxite resources in the world are depleting, vast gibbsitic deposits in India assume particular interest because of its ease in processing. Since gibbsitic bauxite processing has specific advantage of low energy consumption, the alumina refineries enjoy sustainable comparative cost advantage.

It is projected that aluminium production capacity in India at the end of the 12th Plan Period viz, 2016-17 would be about 4.7 million tonnes. This would require about 9.2 million tonnes of alumina. So, if all the announced alumina capacity additions fructify, India would be surplus in alumina and would be a significant player in alumina trade. To produce 13.3 million tonnes of alumina at the end of the 12th Plan period, the bauxite requirement would be about 40 million tonnes. The Report of the Sub Group for the 12th Plan Period has recommended that all efforts should be directed towards ensuring bauxite availability to the alumina refineries.