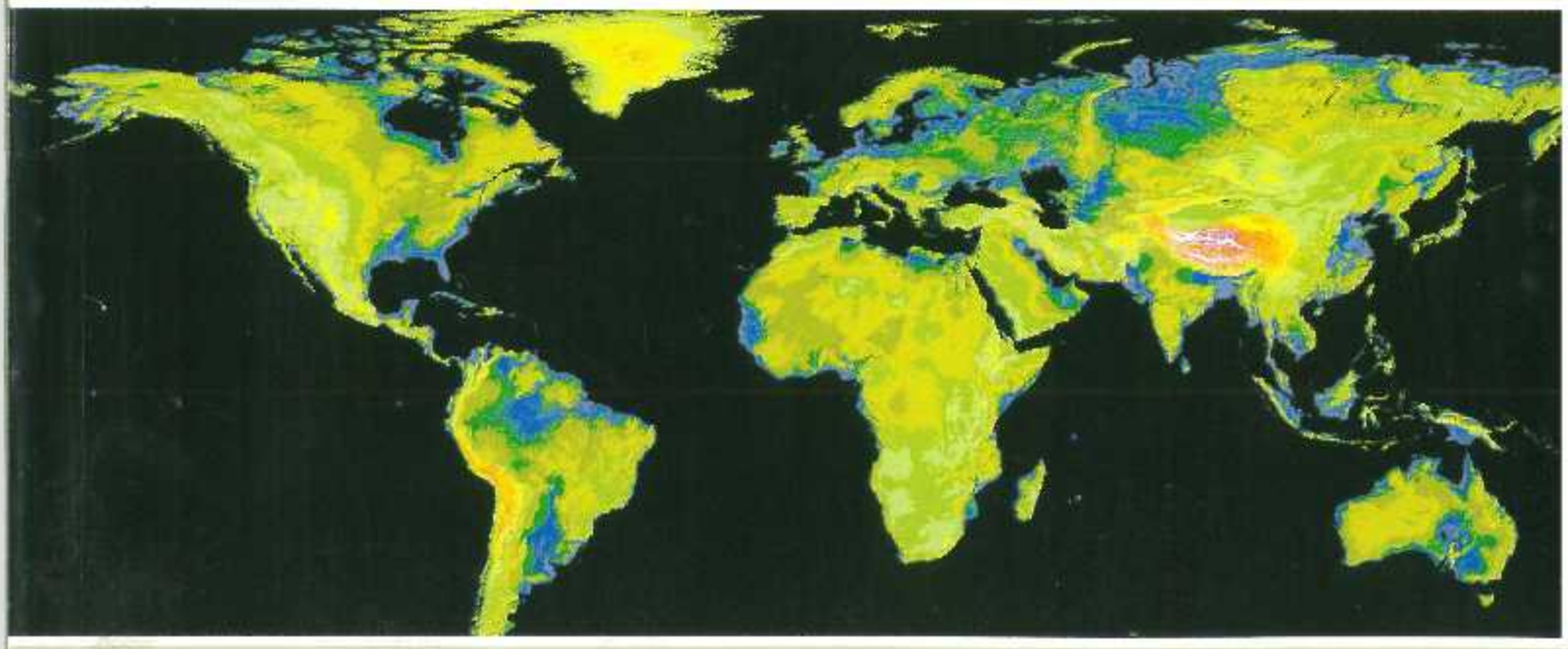
GOVERNMENT OF INDIA
MINISTRY OF MINES

Indian Mineral Scenario

2009-10



June 2011

भारत सरकार
Government of India

खान मंत्रालय
Ministry of Mines

Indian Mineral Scenario 2009-10

Issued by
Controller General
Indian Bureau of Mines

June 2011

Cover Design : EssKay Advertising, Nagpur
Printed at : Aqua Process, Nagpur

Chapter – I

Introduction

The Ministry of Mines of the Government of India is responsible for the conduct of survey and exploration of all minerals (other than natural gases, petroleum and atomic minerals); for mining and metallurgy of non-ferrous metals like aluminium, copper, zinc, lead, gold, nickel etc.; and for administration of the Mines and Minerals (Development and Regulation) Act, 1957 in respect of all mines and minerals (other than coal, natural gas and petroleum).

Geological Context

India is divided into three physiographic-tectonic provinces, namely,

- the Indian Peninsula comprising : 19,00,000 sq.km
- the Indo-Gangetic Alluvial plains (and desert) comprising : 7,00,000 sq. km
- Extra Peninsular (Himalayas & Naga-Lushai belt) comprising : 5,00,000 sq. km

The total area of the country is 3.287 million sq. km out of which 2.386 million sq. km (in the Peninsula and Himalayan region) is comprised of hard rock and another 0.901 million sq. km comprises Quaternary Formations i.e. which are less than 1 million years old.

Geologically, the country is represented by rocks ranging in age from Archaean (pre 2500 million years from now) to recent. However, no single province is represented by rocks where the entire geological time spectrum covering a span of nearly 4600 million years of earth's history occurs. Moreover rocks of similar age, in different areas, are of diverse nature.

The major Stratigraphic units of Peninsular India can broadly be represented as follows:

Table – 1

Eon	Era	Period	Stratigraphy
Phanerozoic	Cenozoic		
	Cenozoic – Mesozoic (100 – 58 Ma*)	Early Cretaceous to Lower Paleocene	Lava (basalt) flows with intertrappean sediments (Deccan Traps)
	Mesozoic (251–100 Ma*)	Triassic to Early Cretaceous	Sandstone-shale sequences (Upper Gondwanas)
	Upper Palaeozoic (360 –251Ma*)	Late Carboniferous to Permian	Sandstone shale/clay sequences with coal (Lower Gondwanas)
Proterozoic	Meso to Neo Proterozoic (542–1800Ma*)	-	Sandstone-Carbonate-shale sequences (Cudappah / Vindhyan Supergroups etc)
	Palaeo Proterozoic (1800–2500 Ma*)		Mainly meta sediments and granites/gneisses
Archaean	Meso to Neo Archaean (Pre 2500 Ma*)	-	Basement granites and meta-sedimentaries

*Ma = Million annum

The oldest rocks found in India are of Archaean eon [Age 3200-2500 Ma] and these are abound at many places. The Archaean rocks are predominantly igneous to volcano-sedimentary and sedimentary rocks which have undergone extensive deformation with attendant high-grade metamorphism. These rocks include economic potential sequences such as Banded Iron Formations (BIF) and volcanic massive sulfide deposits. In fact Archaean rocks in India, as elsewhere in the world, are storehouses of mineral wealth.

The Archaean rocks are followed by the rocks of the Proterozoic age [2500 Ma to 542 Ma]. These occur in long narrow belts formed within the Archaean crust and comprise volcano, volcano-sedimentary and sedimentary rock sequences and are generally highly deformed. However, younger Proterozoic rocks are relatively undeformed sedimentary sequences mildly metamorphosed and occur at several places in Peninsular India. These sandstone-carbonate-shale sequences are collectively called as the 'Purana' rocks and individually basin wise these are referred to as the 'Cudappah' Super Group, the 'Vindhyan' Super Group etc. Seven such major Purana basins occupy nearly a fifth of Peninsular India. These rocks are storehouses of minerals like barytes, asbestos, limestones, sandstones, diamonds, dolomites and also minor minerals like glass sand, pyrite, etc.

In Peninsular India, rocks for the major part of the Palaeozoic era [542 to 360 Ma] are missing and probably were never deposited. However during later part of the Palaeozoic era, i.e. around 360 Ma [carboniferous period] deposition of the Gondwana sequences of rocks commenced, initially with glaciated sediments followed subsequently by rocks having carboniferous beds i.e. coal. This deposition of fluvial sediments of sandstone-coal-shale [ranging in thickness between 1 and 4 km] took place along certain basins within a basement of Archaean-Proterozoic rocks and these basins were concomitantly sinking with deposition, resulting in thick sequences of sediments including carbonaceous beds during the Carboniferous to Trissaic period [360 Ma to 206 Ma]. The Gondwana rock basins in India are disposed along the Son-Narmada-Damodar trend, Satpura-Wainganga and Damodar basins, Mahanadi basin, Pranihita-Godavari basin etc. The major portion of coal in India is derived from the Gondwana sediments.

The next major peninsular geological event was in the Mesozoic era (65 Ma) when massive basaltic lava flows occurred, forming lava sheets, presently covering about 5 lakh sq. km in the area called the Deccan Trap. The Deccan Trap consists of flow upon flow of lava, some thick, some thin, and at places intercalated with sediments (Intertrapeans). The flows cover parts of Gujarat (Kachchh), Madhya Pradesh, Maharashtra, Karnataka and Andhra Pradesh extending upto Belgaum in Karnataka, Rajamundhri in Andhra Pradesh and Amarkantak in Madhya Pradesh. A large part of the Deccan Trap lava pile is under the Arabian Sea. The basalts of the Deccan Trap provide building stones and road metal and bauxite in the form of laterite.

The Indo Gangetic plain occurs on the convex side of the Himalayan and Burmese mountain arc and this plain parallels the Himalayan front for over 2000 km. The sediments of the Indo-Gangetic plain consist of alluvial material in layers of sands and clays, with a depth of 3000 m in the northwest

(Punjab plains) to over 6700 m in the central part (U.P., Bihar). These sediment layers lie over the older formations of the Indian shield, and have deposited in the foredeep of Himalayas and this foredeep itself includes a frontal belt and a shelf zone which were created during the different phases of mountain building activities in the Himalayas. The basement to the foredeep is an extension of the Indian shield as depicted by three fault control ridges below the sediments, namely the Delhi-Hardwar ridge which is a continuation of the north-northwest Aravalli range, the Faizabad ridge which is a northeast extension of the Bundelkhand massif, and the Mungher-Saharsa ridge which is an extension of the Satpura belt. The area is drained by many major rivers, served by a large number of streams. Since the alluvium conceals the solid geology of its floor, it is of interest mainly on account of its tectonic and hydrological parameters, particularly because the entire area is highly populated.

The Extra-Peninsula consists of tectonic mountain chains of recent origin and the area is therefore unstable and fragile. The Himalayas which extend over a length of nearly 2500 km is a series of parallel ridges. The initial mountain building process which initiated formation of the Himalayas started some 70-75 million years ago consequent to the collision of two continental tectonic plates. The rocks in the Himalayas are highly deformed and depict several phases of tectonic deformation. The Himalayas can be divided into six primary geotectonic zones that occur in almost parallel belts with each belt having a characteristic a tectonic environment. These belts from south to north are designated as Sub Himalayas (Siwaliks); Lesser (Lower) Himalayas; Higher (greater) Himalayas; Tethyan (Tibetian) Himalayas; Indus-Tsangpo suture zone; and the Trans-Himalayan batholith.

The Sub-Himalayan zone comprises clastic sediments (molasse) and has experienced folding and faulting, resulting in the Siwalik hills. These rocks have been over thrust by the rocks of Lesser Himalayan Zone along the Main Boundary Thrust Fault (MBT), while the Sub-Himalayan rocks are bounded in the south by a fault system referred as the Himalayan Frontal Thrust. The Lesser Himalayan Zone which is bounded by MBT in south and Main Central Thrust (MCT) in the north consists primarily of sedimentary rocks with low grade metamorphism which have been folded into series of anticlines and synclines. The MCT is a longitudinal thrust fault and at many places consists of highly mylonitized and retrograde metamorphic assemblages of highly deformed rocks which at places are several kilometers thick. The higher Himalayan zone marks the axis of orogenic uplift and comprises mica schists, quartzites, paragneises and leucogranites. These rocks have experienced multi-phased deformation. The deformation along the MCT brings the rocks

of higher Himalayas over the lower Himalayas. The Tethyan Himalayan zone comprises thick marine sediments of the continental shelf and have undergone very low grade metamorphism. The Indus-Tsangpo Suture zone is nearly 2000 km long and hosts a complete succession of ophiolite, oolistoliths, cherts, serpentinites and dunites, and mafic to felsic lavas. This zone marks the Suture line along which the Tethys Ocean was consumed. The Trans Himalayan zone is a linear plutonic complex comprising gabbros, diorites and granites and probably developed in phases ranging in age between 110 and 40 million years ago. This complex is partly covered by fore-arc rocks and continental molasse.

The Himalayas house a large number of glaciers which are of paramount importance in determining the water budget of the North Indian rivers. Thus the Extra Peninsular Region of India requires geoseismological, landslide, geoengineering and glaciology studies on a large scale.

Along the north-eastern margin of India, immediately east of the Ganga-Bramhaputra sediments, a north-south trending belt of Mesozoic-Cenozoic sediments of shelf affinity occur which have been folded into a series of north trending west vergent folds and thrusts. This zone, along the Indo-Burman arc exhibits development of prominent strongly curved fold ranges with sharp bends "festoons" with ophiolites in the eastern part of the zone. The Burmese orogenic belt continues southwards into Andaman & Nicobar islands which further extends into Sumatra. Further east, in the Chindwin-Irrawaddy valley of Burma, petroleum bearing Cenozoic rocks occur, which extend into the north Andaman sea.

On the continental margins along the western margin of India four sedimentary basins occur namely Bombay basin which comprises Tertiary clastics and limestones having a thickness of 3000 m to 8000 m overlying the Deccan traps. Hydrocarbon accumulation has taken place in this basin in the limestones of late Eocene-Oligocene age and the Kachhch basin which exhibits continuous sedimentation from the mid Jurassic with minor gaps up to Holocene, of limestone, sandstone and shale having thickness of 3000 m on the continental side to 9000 m towards the shelf side with sediments having Tethyan affinity. Other marginal basins are in Kerala. On the eastern margin of India there exists a shelf with an average 100 m depth and with a width of nearly 2.5 km near Chennai to over 210 km near Kolkata (Ganga delta).

Chapter – II

Policy and Mineral Legislation

India is richly endowed with many minerals. Under the Constitution, mineral rights and the administration of mining laws are vested in the respective State Governments. The Central Government, however, regulates the development of mines and minerals under the Mines and Minerals (Development and Regulation) Act, 1957 (MMDR Act in short) and the rules framed thereunder. The MMDR Act 1957 came into force on 1.6.1958 and a number of amendments have been made in 1972, 1986, 1994 and 1999. Further, amendment of MMDR Act, 1957 was taken up in 2010 concomitant with the new National Mineral Policy 2008 which is presently posted on the website of Ministry of Mines for suggestions/comments from mining/mineral entrepreneurs. This statute empowers the Central Government to formulate rules for:

- The grant, renewal, etc. of reconnaissance permits, prospecting licences and mining leases for major minerals. Accordingly, the Mineral Concession Rules, 1960 have been framed under Section 13 of MMDR Act 1957.

- The conservation and development of minerals. Accordingly, Mineral Conservation and Development Rules, 1988 have been framed under Section 18 of the MMDR Act 1957 for major minerals. These Rules are not applicable to atomic, fuel and minor minerals. Powers are vested under Section 15 of the Act in the respective State Governments to frame Minor Mineral Concession Rules. Accordingly, all State Governments and some Union Territories have framed their own Rules.

- The Granite Conservation and Development Rules, 1999 and Marble Development and Conservation Rules, 2002 have also been framed under Section 18 of the MMDR Act, 1957 for conservation and systematic development of granite and marble resources in the country, respectively.

- For giving effect to the new National Mineral Policy 2008, the Ministry of Mines has drafted a new Mines and Minerals (Development & Regulation) Act.

- The Offshore Areas Mineral (Development & Regulation) Act, 2002 – to provide for development and regulation of mineral resources in the territorial waters, continental shelf, exclusive economic zone and others maritime zones of India and to provide for matters connected therewith or incidental thereto – was notified on 31st January, 2003. The Act has come into force on 15.01.2010. The Controller General, Indian Bureau of Mines declared as the administering authority for the purpose of the said Act, had notified that the mineral bearing Offshore blocks, as contained in the Schedule, shall be available for the grant of Exploration Licence.

Subsequently the Controller General vide Notification dated 7.6.2010 had notified 26 mineral bearing Offshore blocks in the Bay of Bengal and 37 mineral bearing Offshore blocks in Arabian Sea, for grant of Exploration Licence. In response to the above notification, a total of 377 applications were received till the last date i.e. 14.09.2010 stipulated for the purpose.

National Mineral Policy, 2008

The Government has approved the new National Mineral Policy(NMP), 2008 on 13th March 2008 replacing the Policy of 1993. The new National Mineral Policy has enunciated policy measures like assured right to next stage of mineral concessions, transferability of mineral concession and transparency in allotment of concession, in order to reduce delays which are seen as impediments to investment and technology flow in the mining sector in India. The mining policy also seeks to develop a sustainable framework for optimum utilisation of the country's natural mineral resources for industrial growth in the country and at the same time improving the life of people living in the mining areas, which are generally located in the backward and tribal regions of the country.

Basic Features of the New National Mineral Policy, 2008

• Strengthening Geological Survey of India

In order to exploit the country's geological potential, the new policy recognizes that it is important that scientific prospecting is carried out in search of its rich mineral wealth, and it needs to be ensured that regional and detailed explorations are carried out systematically in the entire geologically conducive mineral bearing area of the country using state-of-the-art techniques and in a time bound manner. To this effect, the new Policy propounds that the Geological Survey of India (GSI) will be strengthened to the maximum extent possible. However, since the task of regional exploration is mammoth, the new Policy recognizes that along with GSI, private sector investment in the risk bearing areas of survey, exploration and prospecting needs to be encouraged to enable exploration of country's mineral resources.

• Geological Programming Board

For an effective coordination of the regional exploration work by government agencies, the new policy lays down that the existing arrangement of the Central Programming Board of the Geological Survey of India shall be revamped to ensure that projects and programmes are prioritized in line with the national policy goals and are chalked out after taking into account the exploration work undertaken by the private sector so that the disaggregated projects are discussed appropriately at the State Level Committees and other technical forums before being incorporated into the annual programme.

- **Improving regulatory environment to attract risk capital**

The new NMP seeks to ensure that the regulatory environment be improved so as to make it more conducive for inflow of investment and technology into prospecting and mining. To this effect, it enunciates that there is a need to develop capital market structures to attract risk investment into survey and prospecting.

The new Mineral Policy further enunciates that security of tenure will be assured along with transparency in the allocation of concessions and new instruments will be introduced and terms and conditions of existing instruments will be liberalized where needed. Simultaneously, the regulatory environment will be tightened to ensure adherence to commitments in respect of expenditure, data filing and so on. Transparency and fair play in the allocation of ore bodies for mining will be ensured. Eligibility conditions will be strictly enforced. Procedures for grant of concessions will be streamlined so as to minimize delays.

- **Inventorizing resource and reserves**

Prioritization of development of a proper inventory of resources and reserves, mining tenement registry and a mineral atlas has been laid down in the new policy. Enforcement of mining plans for adoption of proper mining methods and optimum utilization of minerals were sought to be ensured. For this purpose, the Geological Survey of India and the Indian Bureau of Mines will be strengthened with manpower & equipment and skill sets, too, will be upgraded to the level of state-of-the-art.

- **Value addition**

The new Policy recognizes that as the country develops and industry grows, assured availability and proximity of mineral resources will play an important role in giving a competitive edge to Indian Industry. Keeping in view the multiplier effect of processing of minerals into metals on downstream industrialization, the Policy enunciates that value addition will be actively encouraged. At the same time the new Policy makes it clear that such value addition will go hand in hand with the growth of the mineral sector as a stand along industrial activity and while appropriate linkage between exploitation of minerals and their end use including the development of industry based on the minerals will be supported wherever feasible — any slowdown in an industrial sector using a particular mineral would not be allowed to affect the growth of mining activity for that mineral. Therefore the new Policy seeks to promote employment and tertiary sector spin offs from both value addition as well as from mining so as to maximize the contribution of the mineral sector to the country's gross domestic product.

- **Revenues**

The new Policy is based on the factum that India is a federal structure with a single economic space. However, the new Policy also recognizes that the legitimate fiscal interests of mineral-rich States need to be protected. In this direction, the new Policy states that the revenues from minerals will be rationalized to ensure that the mineral bearing States get a fair share of the value of the minerals extracted from their grounds. New sources of revenue will be developed for the States and state agencies involved in mineral sector development and regulation will be encouraged to modernize in the areas of prospecting as well as regulation. The States will be assisted to overcome the problem of illegal mining through operational and financial linkages with Indian Bureau of Mines.

- **R&D scientific exploration and mining**

The Policy also lays stress on the need to promote the use of state-of-the-art exploration techniques, scientific mining and optimum use of mineral through ore dressing and beneficiation technologies. A special impetus will be given to research and development and to the establishment of appropriate educational and training facilities for human resource development to meet the manpower requirements of the mineral industry. The new Policy enunciates that a comprehensive institutional framework for Research & Development and Training will be developed.

The new National Mineral Policy, 2008, seeks to set the policy direction for further liberalization of the mineral sector and some of the legislative changes being undertaken in accordance with the Policy are:

➢ Reaffirmation of the absolute right of a prospector to obtain a Mining Lease in the areas where he has done the requisite work, implying seamless transition from regional exploration i.e., Reconnaissance Permits (RP) to Prospecting Licences (PL) and to Mining Leases (ML).

➢ Unbundling of prospecting from mining, whereby prospector may invest, find and sell the data/mineral concession after obtaining due permission of the State Government.

➢ Introducing competition and a level playing field by ensuring an arms length between the Government as a regulator and Government as a miner.

➢ Promoting auction of ore bodies fully prospected at public expense for transparency in allotment.

➢ For attracting large investments and high technology in mining sector, a new instrument to be known as Large Area Prospecting Licence would be introduced. The new instrument would however not be granted for bulk minerals (like iron ore, bauxite, limestone etc.) which do not need risk investment and high technology.

➢ Duration of all concessions will be rationalized and areas of operations enlarged suitably within each state.

➢ State Governments will be allowed to give preference to a "value adder" in case of multiple applicants for a concession subject to other eligibility requirements. At the same time State Governments cannot hold back grant of mineral concession if no "value adder" is available.

➢ Reducing delays in the grant of mineral concessions.

➢ Ensuring fair compensation to the State Government by:

* Moving to an ad valorem basis royalty system.
* Increase in dead rent on escalating scale on unused areas, to dissuade idle holding of resources.
* Levy of fees on transfer of concessions.
* Several fold increase in penalties on illegal mining.

Additional initiatives reflected in the New National Mineral Policy

➢ Creating an Empowered-cum-Coordination Committee at Central and State levels to help reduce delay in grant of mineral concessions.

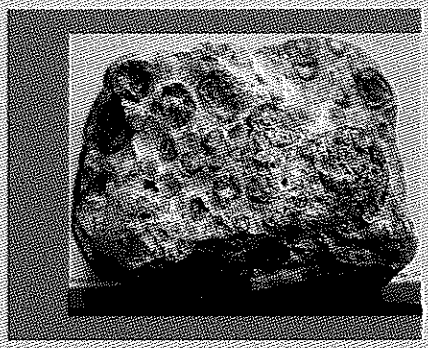
➢ Setting up of a Mining Tribunal, which can be approached by an applicant in case of failure to adhere to time limits, and as a dispute redressal body.

➢ Mechanisms for ensuring Mining Plans and Mine Closure Plans within a sustainable Development Frame work.

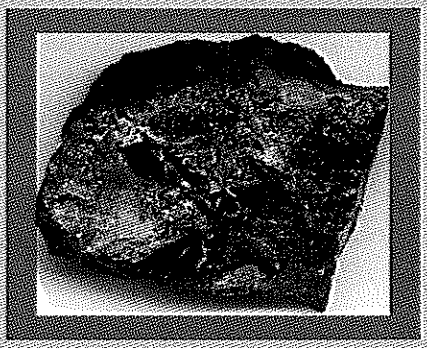
Chapter – III

Mineral Reserves / Resources

The Principal Minerals found in the country along with their estimated reserves/resources as per the United Nations Framework Classification (UNFC)* are given below:

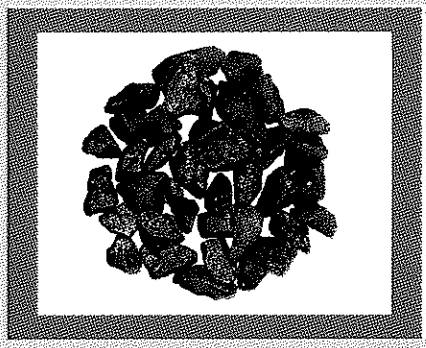


Bauxite: The total resources of bauxite in the country as per UNFC System are placed at about 3,290 million tonnes as on 1.4.2005. These resources include 899 million tonnes of Reserves and 2,391 million tonnes of 'Remaining Resources'. Orissa, Andhra Pradesh, Gujarat, Chhattisgarh, Madhya Pradesh, Jharkhand and Maharashtra are the principal States where bauxite deposits are located. Major deposits are concentrated in the East Coast Bauxite deposits of Orissa and Andhra Pradesh.



Chromite: The total resources of chromite in the country as per UNFC system as on 1.4.2005 are estimated at 213 million tonnes, comprising 66 million tonnes Reserves (31%) and 147 million tonnes of Remaining Resources (69%). In India, 95% resources are located in Orissa, mostly in the Sukinda valley in Cuttack and Jajpur districts, Orissa and the remaining 5% resources are distributed in Manipur and Karnataka with meagre quantities in the States of Jharkhand, Maharashtra, Tamil Nadu and Andhra Pradesh.

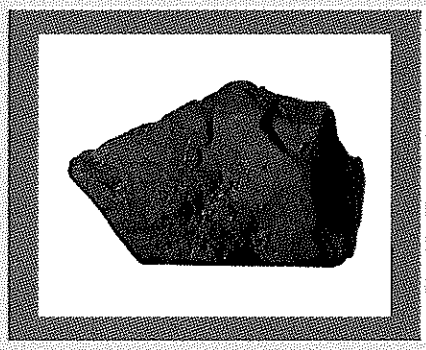
** The UNFC System is a three digit code which indicates the Economic, Feasibility and Geological Potential of the deposit. Under this scheme, classification of 111 is the highest and 334 is the lowest.*



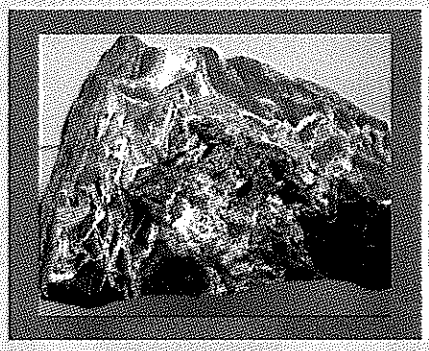
Copper: The total resources of copper ore as on 1.4.2005 as per UNFC system are placed at 1.39 billion tonnes with a metal content of 11,418 thousand tonnes. Of these, 369.49 million tonnes with a total metal content of 4,383.97 thousand tonnes fall under 'Reserves' while balance 1.02 billion tonnes with metal content of 7,033.75 thousand tonnes are 'Remaining Resources'. Rajasthan is credited with the largest resources of copper ore at 668.5 million tonnes with a metal content of 3,982 thousand tonnes followed by Madhya Pradesh and Jharkhand. Copper resources are also established in Andhra Pradesh, Gujarat, Haryana, Karnataka, Maharashtra, Meghalaya, Orissa, Sikkim, Tamil Nadu, Uttarakhand and West Bengal.

Gold: There are three important gold fields in the country, namely, Kolar Gold Field, Kolar district and Hutti Gold Field in Raichur district (both in Karnataka) and Ramgiri Gold Field in Anantpur district (Andhra Pradesh). As per UNFC as on 1.4.2005, the total resources of gold ore (primary) in the country were estimated at 390.29 million tonnes with metal content of 490.81 tonnes. Out of these, 19.25 million tonnes with metal content of 85.12 tonnes were placed under Reserves category and the remaining 371.03 million tonnes with metal content of 405.69 tonnes under Resources category. The resources include placer-type gold ore in Kerala estimated at 26.12 million tonnes containing 5.86 tonnes gold metal. Largest resources of gold ore (primary) are located in Bihar followed by Karnataka, Rajasthan, West Bengal, Andhra Pradesh, Madhya Pradesh, etc. while in terms of metal content, Karnataka remained on the top followed by Rajasthan, West Bengal, Bihar and Andhra Pradesh.

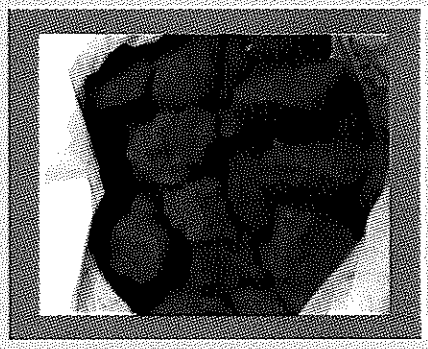
Iron Ore: Haematite and magnetite are the most important iron ores in India. About 60% of haematite ore deposits are found in the Eastern sector and about 87% of magnetite deposits occur in Southern sector, specially in Karnataka. The total resources of iron ore as per UNFC are placed at 25,249 million tonnes as on 1.4.2005. Out of these, the iron ore (haematite) resources are placed at 14,630 million tonnes of which 13,916 million tonnes (95%) resources are



distributed mainly in Orissa, Jharkhand, Chhattisgarh, Karnataka and Goa. The resources of very high-grade ore are limited and are restricted mainly in Bailadila sector of Chhattisgarh and to a lesser extent in Bellary-Hospet area of Karnataka and Barajamda sector in Jharkhand and Orissa. Iron ore (magnetite) resources are placed at 10,619 million tonnes of which only 59 million tonnes constitute Reserves located mainly in Goa, Rajasthan and Jharkhand. The remaining 10,560 million tonnes (99%) magnetite resources are under Remaining Resources category mainly in Karnataka (74%) and Andhra Pradesh (14%). Other deposits are located in Goa, Rajasthan, Tamil Nadu, Kerala, Assam, Jharkhand, Nagaland, Meghalaya, Bihar, Maharashtra and Orissa.

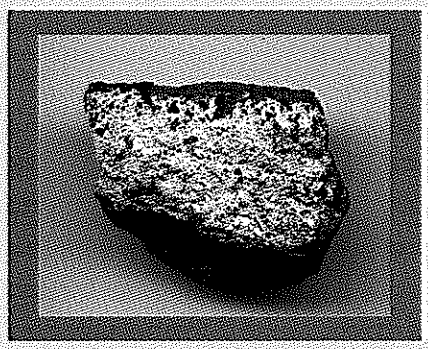


Lead-Zinc: Lead-Zinc resources are located in Rajasthan, Bihar, Maharashtra, Madhya Pradesh, Andhra Pradesh, Gujarat, Uttarakhand, West Bengal, Orissa, Sikkim, Tamil Nadu and Meghalaya. The total resources of lead and zinc ores as on 1.4.2005 as per UNFC system are estimated at 522.58 million tonnes with metal content of 7,207 thousand tonnes of lead metal and 24,260 thousand tonnes of zinc metal. Of these, 125.75 million tonnes with metal content of 2,591 thousand tonnes of lead metal and 11,093 thousand tonnes of zinc metal fall under 'Reserves' while balance 396.83 million tonnes with metal content of 4,617 thousand tonnes lead metal and 13,167 thousand tonnes of zinc metal is classified as 'Remaining Resources'.



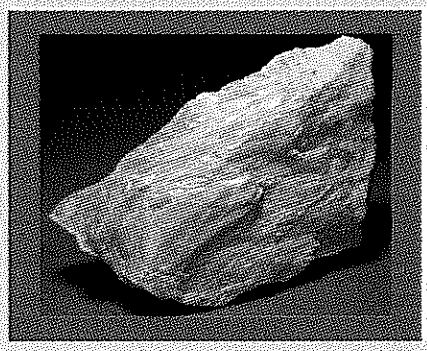
Manganese: The total resources of manganese ore as per UNFC system as on 1.4.2005 are placed at 379 million tonnes. Out of these, 138 million tonnes are categorized as Reserves and the balance 241 million tonnes as Remaining Resources. Major deposits are found in Orissa, followed by Karnataka, Madhya Pradesh, Maharashtra, Goa and Andhra Pradesh.

Minor occurrences of manganese ore are in Rajasthan, Gujarat, Jharkhand and West Bengal.

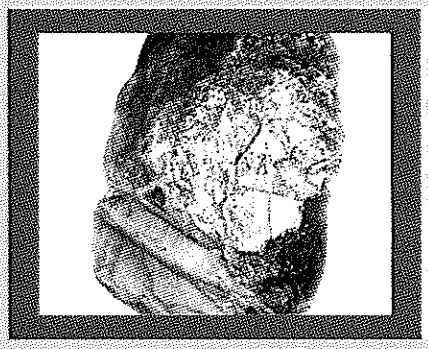


Nickel: The total resources of nickel ore as per UNFC system as on 1.4.2005 have been estimated at 189 million tonnes. About 92% resources i.e. 174.48 million tonnes are in Orissa and the remaining 8% is distributed in Jharkhand, Nagaland and Karnataka.

Tungsten: The total resources of tungsten ore as per UNFC system as on 1.4.2005 have been estimated at 87.39 million tonnes with WO_3 content of 14,2094 tonnes. All these resources are placed under 'Remaining Resources' category. The main deposits are Degana in Nagaur district, Rajasthan. It also occurs in Karnataka, Andhra Pradesh, Maharashtra, Haryana, Tamil Nadu, Uttarakhand and West Bengal.

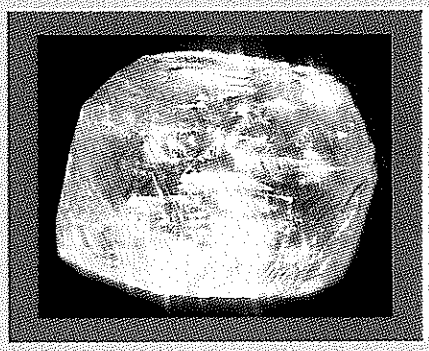


Barytes: The total resources of barytes as on 1.4.2005 as per UNFC system are placed at 74 million tonnes of which about 46% (34 million tonnes) are in 'Reserves' category and 54% (40 million tonnes) are in 'Remaining Resources' category. The Mangampet deposit in Cuddapah district (Andhra Pradesh) is the single largest barytes deposit in the world. Andhra Pradesh alone accounted for more than 94% of the country's resources. Minor occurrences of barytes are located in Rajasthan, West Bengal, Madhya Pradesh, Tamil Nadu, Himachal Pradesh, Maharashtra, Jharkhand, Uttarakhand, Karnataka and Haryana.

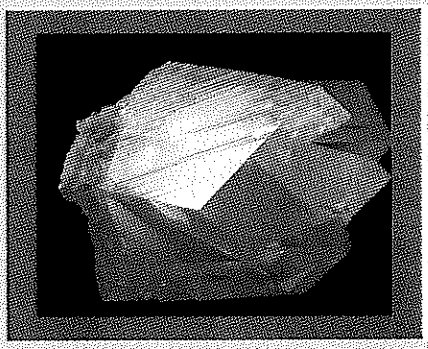


Diamond: Diamond deposits occur in three types of geological settings such as kimberlite pipes, conglomerate beds and alluvial gravels. The main diamond bearing areas in India are Panna belt in Madhya Pradesh,

Munimadugu-Banganapalle conglomerate in Kurnool district, Wajrakarur kimberlite pipe in Anantapur district, and the gravels of Krishna river basin all in Andhra Pradesh and diamodiferous kimberlite in Raipur, Bastar and Raigarh districts in Chhattisgarh. Reserves have been estimated in Panna belt, Madhya Pradesh, Krishna gravels in Andhra Pradesh and in Raipur district, Chhattisgarh. The total resources of diamond as per the UNFC system as on 1.4.2005 are placed at around 4,582 thousand carats. Out of which, about 1,206 thousand carats are under reserve category and remaining 3,376 thousand carats are under remaining resources category.

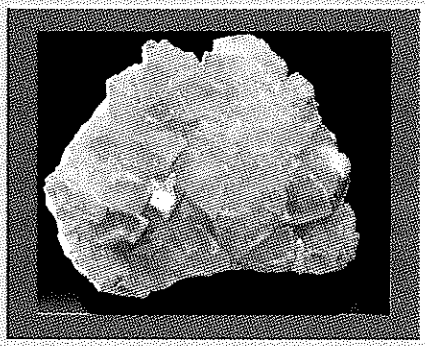


Dolomite: Total resources of dolomite as per UNFC system as on 1.4.2005 are placed at 7,533 million tonnes, out of which 985 million tonnes are under Reserve category and the balance i.e. 6,548 million tonnes are in the 'Remaining Resources' category. Dolomite occurrences are widespread in almost all parts of the country. The major share of about 90 % resources is distributed in the States of Madhya Pradesh, Andhra Pradesh, Chhattisgarh, Orissa, Karnataka, Gujarat, Rajasthan and Maharashtra.



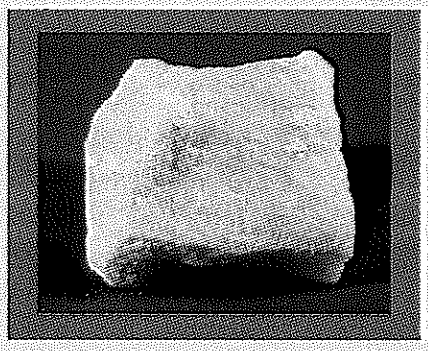
Fireclay: Fireclay occurs as a bedded deposit, mostly associated with coal measures of Gondwana and Tertiary periods. Important deposits are associated with Jharia and Raniganj coalfields in Jharkhand and West Bengal, Korba coalfield in Chhattisgarh and Neyveli Lignite field in Tamil Nadu. Notable occurrences of fireclay, not associated with coal measures are found in Gujarat, Jabalpur region of Madhya Pradesh and Belpahar-Sundergarh areas of

Orissa. The total resources of fireclay as per UNFC system as on 1.4.2005 are about 705 million tonnes in India, out of which, 59 million tonnes are under Reserve category and about 646 million tonnes are under Remaining Resources category. The resources of fireclay are substantial but resources of high-grade (non-plastic) fireclay containing more than 37% alumina are limited.

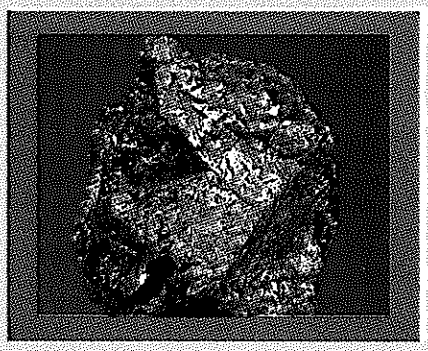


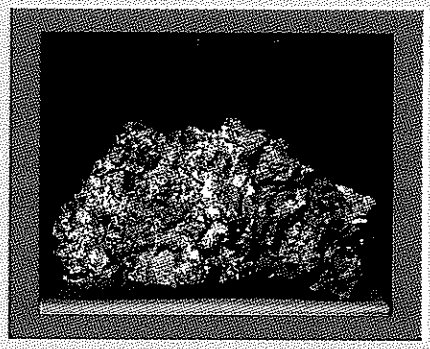
Fluorspar: The total resources of fluorite as per UNFC system as on 1.4.2005 were estimated at 20.16 million tonnes. Out of these, 9.21 million tonnes were placed under 'Reserves' category and the remaining 10.95 million tonnes under Remaining Resources' category. Major deposits of Fluorspar are located in Gujarat, Rajasthan, Chhattisgarh and Maharashtra.

Gypsum: The total resources of mineral gypsum as per UNFC system as on 1.4.2005 were estimated at 1,237 million tonnes. Of these, 69 million tonnes have been placed under 'Reserve' category and 1,168 million tonnes under 'Remaining Resources' category. The main occurrences of gypsum are located in Rajasthan, Jammu & Kashmir, Gujarat and Tamil Nadu. Rajasthan alone accounts for more than 80% of the country's resources. Minor occurrences of gypsum have been identified in Andhra Pradesh, Himachal Pradesh, Karnataka, Madhya Pradesh and Uttarakhand.

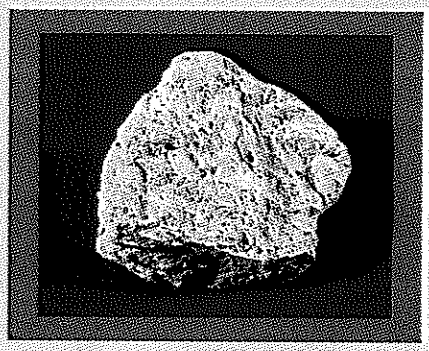


Graphite: As per the UNFC system, the total resources of graphite in the country as on 1.4.2005 are placed at about 168.77 million tonnes that comprises 10.75 million tonnes of Reserves category and the remaining 158.02 million tonnes of Resources category. Out of the total resources, Arunachal Pradesh accounts for 43% followed by Jammu & Kashmir (37%), Jharkhand (6%), Tamil Nadu (5%) and Orissa (3%). However, in term of reserves, Tamil Nadu has major share of about 37%.

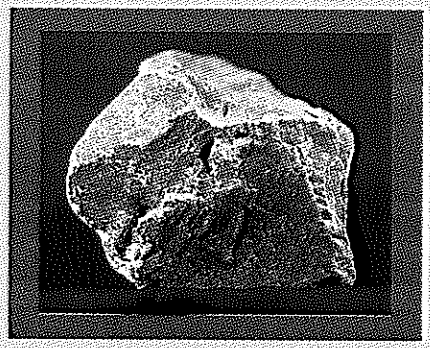




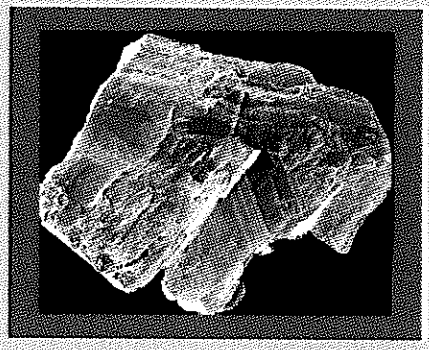
Ilmenite: The resources of ilmenite are 461.37 million tonnes as per Department of Atomic Energy. Ilmenite occurs mainly in beach sand deposits right from Ratnagiri (Maharashtra) to coastal Kerala, Tamil Nadu & Orissa. The mineral is also found in Andhra Pradesh, Bihar and West Bengal.



Kaolin: India possesses fairly large resources of china clay. The total resources as per UNFC system as on 1.4.2005 are about 2,596 million tonnes, out of which, 222 million tonnes are placed in 'Reserves' category and 2,374 million tonnes are under 'Remaining Resources' category. The occurrences of china clay are distributed in Kerala, West Bengal, Rajasthan, Orissa, Karnataka, Jharkhand, Gujarat, Meghalaya, Andhra Pradesh and Tamil Nadu.



Limestone: The total resources of limestone of all categories and grades as per UNFC system as on 1.4.2005 are estimated at 17,545 million tonnes. Of which, 12,715 million tonnes are under 'Reserves' category and 162,630 million tonnes are under 'Remaining Resources' category. Karnataka is the leading state followed by Andhra Pradesh, Gujarat, Rajasthan, Meghalaya, Chhattisgarh, Madhya Pradesh, Orissa, Maharashtra and Uttarakhand.



Mica: Important mica bearing pegmatite occurs in Andhra Pradesh, Jharkhand, Maharashtra, Bihar and Rajasthan. The total resources of mica in the country as per UNFC system as on 1.4.2005 are estimated at 393,855 tonnes, out of which only 68,570 tonnes are placed under 'Reserves' category. The rest, i.e., 325,285 tonnes is placed under 'Remaining Resources' category. Rajasthan accounts for about 51% resources, followed by Andhra Pradesh, Maharashtra and Bihar.

Chapter – IV

Mineral Production and Organisation — National Perspective

National Economy

The 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 policy, foreign trade, domestic and international taxation policies, monetary exchange rates, etc., and in turn, affect the overall growth in economy. As per GDP 2009-10, released by the Central Statistical Organisation (CSO), the Indian economy posted remarkable recovery with a growth of 7.4% in 2009-10 as compared to 6.7% in 2008-09 and is likely to grow at 9% in 2010-11. The growth rate would be about 6% in sectors viz, mining and quarrying, manufacturing, electricity, gas & water supply, construction, etc.

Mineral and Metal Production

India produces as many as 87 minerals which include 4 fuel, 10 metallic, 47 non-metallic, 3 atomic minerals and 23 minor minerals (including building and other materials). The total value of country's mineral production including minor minerals (excluding atomic minerals) in 2009-10 is estimated to be about ₹ 179,384 crore, an increase of about 3% over the previous year. Of this, fuel minerals constituted ₹ 124,088 crore (69%), metallic minerals for ₹ 32,274 crore (18%) and non-metallic minerals including minor minerals of about ₹ 23,021 crore (13%). The production of selected minerals for the years 2007-08 to 2009-10 is shown in the following table:

PRODUCTION OF SELECTED MINERALS, 2007-08 TO 2009-10

(Value in ₹Crore)

Mineral	Units	2007-08(R)		2008-09(R)		2009-10(P)	
		Qty	Value	Qty	Value	Qty	Value
All Minerals			121685.00		173248.53		179384.01
Fuel			70397.31		115371.31		124088.33
Coal	M.Tonnes	457	38464.56	493	45537.02	532	49081.52
Lignite	M.Tonnes	34	2960.88	32	3687.79	34	3878.58
Natural Gas (Utilised)	M.C.M.	32417	9968.70	32849	10107.71	47510	14780.03
Petroleum (crude)	M.Tonnes	34	19003.17	34	56038.79	34	56348.20
Metallic Minerals			29181.93		35075.99		32274.29
Bauxite	th. tonnes	22625	568.39	15460	470.32	13952	456.36
Chromite	th. tonnes	4873	2142.19	4073	2263.36	3413	1183.41
Copper Conc.	th. tonnes	150	347.13	138	409.11	124	362.54
Gold	kg.	2969	301.74	2438	315.26	2106	331.39
Iron Ore	th. tonnes	213246	23379.04	212961	28544.40	218639	26864.84
Lead Conc.	th. tonnes	126	144.39	134	136.27	136	174.34
Manganese ore	th. tonnes	2697	1206.04	2789	1773.70	2440	1269.54
Zinc Conc.	th. tonnes	1036	939.42	1224	946.66	1277	1290.85
Other met. Minerals			153.60		216.88		341.02
Non-met. Minerals			3371.31		4066.79		4286.94
Ball Clay	th. tonnes	796	14.04	998	20.08	898	18.88
Barytes	th. tonnes	1076	57.01	1686	96.64	2138	234.97
Diamond	Carats	586	0.57	536	0.45	16810	11.59
Dolomite	th. tonnes	5852	146.12	5504	155.41	5182	144.79
Fire clay *	th. tonnes	545	8.69	496	8.34	410	6.62
Garnet Abrasive	th. tonnes	1276	52.37	1151	56.59	1566	74.09
Gypsum	th. tonnes	3400	71.97	3877	99.35	3422	95.86
Kaolin	th. tonnes	1350	29.15	2084	64.17	2578	69.89
Laterite	th. tonnes	1479	21.74	1237	16.24	1221	17.32
Lime shell	th. tonnes	128	8.44	98	7.33	62	4.86
Lime stone	M. tonnes	193	2399.79	222	2921.98	229	2986.23
Magnesite	th. tonnes	253	33.43	253	36.35	286	42.26
Phosphorite	th. tonnes	1849	212.57	1804	308.76	1547	312.01
Pyroxenite	th. tonnes	289	9.07	282	13.91	279	15.39
Sand (Others)	th. tonnes	1804	7.90	1808	10.70	2159	10.20
Silica Sand	th. tonnes	4304	50.73	2832	36.57	2283	29.82
Sillimanite	th. tonnes	41	17.67	34	23.69	31	25.50
Steatite	th. tonnes	923	59.33	888	59.82	835	52.74
Wollastonite	th. tonnes	119	10.64	112	12.60	132	11.19
Other Non-met.Min.			160.09		117.80		122.73
Minor Minerals			18734.45		18734.45		18734.45

M.Tonnes - Million Tonnes th.tonnes - Thousand Tonnes , M.C.M. - Million Cubic Metre
kg - kilogram

(P) Provisional and based on monthly returns to the extent available with IBM.

** Excludes the production of fireclay, if any recovered incidental to coal mining*

Note :

(i) The value figures pertain to pithead value.

(ii) Data based on the returns received under MCDR, 1988 except coal, lignite, petroleum (crude), natural gas (utilised) and minor minerals.

(iii) Value of Petroleum (crude) is revised for the year 2009-10 on the basis of data received from the Ministry of Petroleum and Natural Gas.

Source :

1) Coal and Lignite : Coal Controller, Kolkata.

2) Petroleum (crude) and Natural Gas : Ministry of Petroleum & Natural Gas, New Delhi.

3) Minor Minerals : State Governments.

Organizations Under the Ministry of Mines

The Ministry of Mines, a Government of India, is responsible for the Mining & Mineral Sector and has a Secretariat devoted primarily for policy formulation and overall management. It has under its administrative control the following important attached/subordinate offices, Public Sector Undertakings and Research Organizations.

Attached / Subordinate Offices

- Geological Survey of India (GSI), Kolkata
- Indian Bureau of Mines (IBM), Nagpur

Public Sector Enterprises

- National Aluminium Company Limited (NALCO), Bhubaneswar
- Hindustan Copper Limited (HCL), Kolkata
- Mineral Exploration Corporation Limited (MECL), Nagpur

Autonomous Research Organizations

- National Institute of Rock Mechanics (NIRM), Kolar
- National Institute of Miners' Health (NIMH), Kolar/ Nagpur
- Jawaharlal Nehru Aluminium Research Development and Design Centre (JNARDDC), Nagpur

Geological Survey of India (GSI)

Geological Survey of India, the premier earth-science organization of the country, is the principal provider of basic geoscientific information to the Government, Industry and the Sector. The vibrant steel, coal, metals, cement and power industries which expanded phenomenally in the post-independence era bear eloquent testimony to the GSI's contribution to national development.

Established in 1856 as a Department engaged primarily in search for coal for the railways, GSI has expanded its activities manifold and has been involved either directly or indirectly in almost all areas of nation building. GSI is now the custodian of one of the largest and most comprehensive earth science database developed over the last 150 years. Its Charter of Operations (revised, 20th May, 2009) laid down by the Government of India, detailing the

scope of activities and responsibilities of the GSI, encompasses practically the entire gamut of earth science activities.

Creation and updation of national geoscientific information and knowledge base through ground, marine and airborne surveys and their dissemination are the primary goals of GSI. GSI has its Central Headquarters at Kolkata, six regional offices at Nagpur, Kolkata, Shillong, Lucknow, Hyderabad & Jaipur and a Training Institute at Hyderabad.

Indian Bureau of Mines (IBM)

The Indian Bureau of Mines (IBM) established on 1st March 1948, is a multi-disciplinary scientific and technical organisation under the Ministry of Mines with statutory and developmental responsibilities for conservation and systematic exploitation of mineral resources other than coal, petroleum and natural gas, atomic minerals and minor minerals.

Headquartered at Nagpur, IBM has 3 Zonal Offices (at Nagpur, Ajmer and Bengaluru), 12 Regional Offices and 2 Sub-Regional Offices spread all over the country. Besides, IBM has its Modern Mineral Processing Laboratory Pilot Plant constructed with UNDP assistance at Nagpur and two Regional Ore Dressing Laboratories and Pilot Plants at Ajmer and Bengaluru.

The Indian Bureau of Mines (IBM) performs regulatory functions, namely, enforcement of the Mineral Conservation and Development Rules, 1988, the relevant provisions of the Mines and Mineral (Development and Regulation) Act, 1957, Mineral Concession Rules, 1960 and Environmental (Protection) Act 1986 and Rules made thereunder. The Controller General, IBM, has been declared as an administering authority under Offshore Areas Mineral (Development & Regulation) Act, 2002. IBM also undertakes scientific, techno-economic, and research oriented studies in various aspects of mining and local geology, ore beneficiation and environmental studies.

IBM provides technical consultancy services to the mining industry for geological appraisal of mineral resources, and in preparation of feasibility reports of mining projects, including beneficiation plants. It prepares mineral maps and maintains countrywide inventory of mineral resources of leasehold and freehold areas. It also promotes and monitors community development activities in mining areas. IBM also functions as a Data Bank of Mines and

Minerals and publishes detailed statistical information. It also brings out technical publications/monographs on individual mineral commodities and bulletins of topical interest. It advises the Central and State Governments on all aspects of mineral industry, trade, legislation etc.

National Aluminium Company Limited (NALCO)

The National Aluminium Company Limited (NALCO), the largest integrated Alumina-Aluminium Plant Complex in India, was incorporated on 7th January, 1981 with its registered office at Bhubaneswar. After completion of first phase expansion at an investment of ₹ 4,200 crore in 2004, NALCO has an installed capacity of 4.8 Million Tonnes Per Year (MTPY) of bauxite mines, and 1.575 MTPY of alumina refinery at Panchapatmali, a 0.345 MTPY aluminium smelter at Angul, and a 960 MW (8X120) MW Captive Power Plant at Angul, all in Orissa and Port Handling Facilities at Visakhapatnam (Andhra Pradesh) for export of alumina and import of caustic soda. The company is an integrated and diversified mining, metal and power producer and achieved annual sales of ₹ 5,474 crore in 2008-09. It has built shipment facilities at Vizag Port, besides utilizing Kolkata and Paradeep Ports for export of aluminium. NALCO had been granted Navratna status on 28.4.2008.

The second phase expansion of NALCO's Integrated Alumina-Aluminium Complex, at an outlay of ₹ 4,091.51 crore at July, 2003 price level, approved by the Government in October, 2004, envisaging augmentation of Bauxite Mines capacity from 4.8 MTPY to 6.3 MTPY, Alumina Refinery capacity from 1.575 MTPA to 2.1 MTPA, Aluminium Smelter capacity from 0.345 MTPA to 0.46 MTPA and Captive Power Plant (CPP) capacity from 960 MW (8x120 MW) to 1200 MW (10x120), is presently under implementation.

The company is one of the lowest cost producers of alumina and aluminium in the world due to highly efficient operation and very high asset utilization with benchmark in smelting technology. With sustained quality products, the Company's export earnings account for nearly 40% of the sales turnover.

The Company exports its products to more than 30 countries worldwide. The Company has also opened stockyards in various parts of India to facilitate domestic marketing. With its consistent track record in capacity utilization, technology absorption, quality assurance, exports performance and posting of profits, NALCO is a bright example of India's industrial capability.

In addition to existing operations, NALCO has drawn ambitious plans for extensive brown field and green field expansion projects at estimated cost of Rs. 30,000 crore in the country and abroad. Further, the company has taken up steps for commissioning of a coal block (Utkal-E in Orissa) and is taking action for acquiring new bauxite mines in Andhra Pradesh and in Orissa besides setting up some forward and backward integration projects.

Hindustan Copper Limited (HCL)

HCL, a Public Sector Undertaking under the administrative control of the Ministry of Mines, was incorporated on 9th November, 1967 under the Companies Act, 1956. It was established as a Govt. of India Enterprise to undertake overall control over plans, projects, schemes and studies pertaining to the exploration and exploitation of copper deposits, including smelting and refining from the National Mineral Development Corporation Ltd. It has the distinction of being the nation's only vertically integrated copper producing company as it manufactures copper right from the stage of mining to beneficiation, smelting, refining and casting of refined copper metal into downstream saleable products.

The company markets copper cathodes, continuous cast copper rod and by-products, such as, anode slime (containing gold, silver etc.), copper sulphate and sulphuric acid. More than 90% of the sales revenue is from cathode and continuous cast copper rods. HCL's mines and plants are spread across four operating units, one each in the States of Rajasthan, Madhya Pradesh, Jharkhand and Maharashtra namely, Khetri Copper Complex (KCC) at Khetrinagar, Rajasthan, Indian Copper Complex (ICC) at Ghatsila, Jharkhand, Malanjkhand Copper Project (MCP) at Malanjkhand, Madhya Pradesh, and Taloja Copper Project (TCP) at Taloja, Maharashtra.

The Government of India nationalized the only copper producing company in the private sector, Indian Copper Corporation Ltd. at Ghatsila in Jharkhand in March, 1972 and handed over its management and ownership to Hindustan Copper Limited.

The smelter plant at Khetri Copper Complex (KCC) in Rajasthan with capacity of 31,000 tonnes was dedicated to the nation on 5th February, 1975.

In November, 1982, Malanjkhand Copper Project that comprised a large and fully mechanized open pit mine and concentrator plant was dedicated to the nation.

The continuous cast copper rod plant at Taloja Copper Project of Hindustan Copper Ltd. was commissioned in December, 1989 with an installed capacity of 60,000 tonnes.

The total installed annual capacity of HCL is 49,500 tonnes of refined copper. During 2009-10, HCL produced 28,202 tonnes of metal-in-concentrate, 17,516 tonnes of refined copper and 41,999 tonnes of wire rod.

During the year 2009-10, HCL achieved a turnover of ₹ 1,429.85 crore with a net profit of ₹154.68 crore after tax.

Mineral Exploration Corporation Limited (MECL)

The Mineral Exploration Corporation Limited (MECL) since inception in the year 1972 has been involved in undertaking mineral exploration activities. So far, it has added 139,632 million tonnes of mineral reserves to the National Mineral Inventory.

The Company manages the functioning of projects through a 2-tier system from Corporate office at Nagpur. Technical guidance to the projects, finalization of geological reports, close liaisoning with the clients and looking for new business opportunities are being carried out through its Zonal Offices located at Ranchi, Nagpur and Hyderabad. Three Regional Maintenance Centres at Ranchi, Nagpur and Hyderabad are also in operation.

MECL's gross revenue was ₹ 127.06 crore in 2009-10. It has recorded a net profit of ₹14.46 crore (after EOI & taxes). A total of 3,299 million tonnes of reserves for coal, lignite, copper, lead-zinc, and iron ore has been added to the National Mineral Inventory during 2009-10.

National Institute of Rock Mechanics (NIRM)

The National Institute of Rock Mechanics (NIRM) is a premier centre for research in applied and basic rock mechanics. Registered under the Societies Registration Act in July, 1998 in Kolar, NIRM set up under the Ministry of Mines, Government of India. The Institute provides research and consultancy services for improving safety and productivity in the mining and civil engineering sectors. It is an ISO-9001: 2008 certified Research Institute. NIRM,

since its inception has been involved in research work through both government-funded and industry sponsored S & T and consultancy projects. The Institute had lent notable support to the Industry in the following areas:

- Engineering Geology
- Engineering Geophysics
- Geotechnical Engineering
- Rock Fracture Mechanics & Materials Testing
- Engineering Seismology
- Numerical Modelling, Rock Blasting & Excavation Engineering
- Mine Design & Ground Control, Microseismics & Automation,
- Environmental Engineering, and Dimensional Stone Technology

National Institute of Miners Health (NIMH)

National Institute of Miners' Health (NIMH) was established for promotion of occupational health and hygiene in mining and mineral-based industries and for development of trained manpower in these fields. It was registered as a Society in Kolar, Karnataka, with a camp office in Nagpur in 2002.

The Institute has state-of-the-art infrastructure, equipment and highly trained manpower to conduct and carry out:

- Detailed medical examinations as per Mines Rules, 1955
- Clinical investigations
- Computerized vision screening
- Exposure assessments
- Risk assessment of work environment for dust, noise & vibration
- Risk characterization of dust for free silica, heavy metals, etc.
- Specialized tests in clinical biochemistry, Protein Biomarkers, Electrophoresis, ELISA, Spectrophotometric analysis, etc.
- HRD activities in mine related health and hygiene issues

Jawaharlal Nehru Aluminium Research Development and Design Centre (JNARDDC)

Jawaharlal Nehru Aluminium Research Development and Design Centre, Nagpur, is a "Centre of Excellence" set up in 1989 and became fully functional in 1996. The Centre is conceived as the major R&D support system for the emerging modern aluminium industry in India.

The Centre has well-established facilities for R&D activities in the field of bauxite, alumina and aluminium. Its principal preoccupation is with all aspects of the Bayer process for conversion of bauxite to alumina and electrolytic smelting from alumina to aluminium.

The Centre also offers analytical and testing facilities to other non-ferrous industries, steel plants, small-scale industries, R&D Organisations and Academic Institutions particularly in the areas of chemical and mineralogical analysis, powder characterisation, thermal mapping, micro structural studies, mechanical and non-destructive testing, failure analysis and technical information.

The Centre has successfully completed many major projects awarded by both primary & secondary aluminium producers, bauxite mine owners/importers and also by Ministry of Mines.

JNARDDC, being the nodal agency from India has undertaken the project for management of bauxite residue (red mud) in the seven nations Asia Pacific Partnership on Clean Development and Climate (AP-7). The countries involved in the partnership include USA, Australia, China, Japan, Canada and Korea.

Plate-1