SUB GROUP–1 ON MINERAL EXPLORATION AND DEVELOPMENT (OTHER THAN COAL AND LIGNITE) FOR TWELFTH FIVE YEAR PLAN (2012-2017)

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Framework Considerations from ToRs

1. Assess the reserves and resources of all ores/minerals as per UNFC.
2. Review the National Mineral Inventory to improve the quality and standard of information and to assess the balance life of mineral inventory based on consumption pattern of various ores.
3. Strategy for development and conservation perspective of 10 to 15 years.
4. Zonation or prioritization of mineral resource 'mineral belts'.
5. Speedy exploitation of proven mineral deposits.
6. Technological gaps in mineral exploration deep seated deposit regional and detailed exploration.
7. Ores/minerals keeping in view the national priorities demand availability of resources of strategic importance.
Framework ….. Contd

8. Access to pre-competitive geological and exploration data, GIS based information Mining Tenement information.

9. Role of various State and Central Institutions like GSI, IBM and State Directorates of Geology & Mining etc. and suggest enhancements in their role so effective in facilitating growth of the mining industry through geo scientific partnership.

10. Promotional Role of Central and State Govt. agencies in context of NMP, 2008 for mineral exploration particularly for those minerals in which the resource base is poor.

11. Measures to encourage and facilitate offshore mining geo scientific activities.

12. To assess and indicate investment that would be required to be made by the Central and State Governments for promotional exploration in the XII Plan, if deemed necessary to be carried out as a matter of national policy.
MINERAL WEALTH AND MINING

- Mineral assets play a direct role in the growth and prosperity and hence substantial investments is essential for exploration of these assets through different agencies having the requisite skills.
- India having 2.4% of the global area, sustains 17.5% (Census-2011) of the world population.
- Our per capita consumption of minerals and its products is one of the lowest in the world.
- Since independence, the value of mineral production increased from a level of Rs. 58 crores in 1947 to Rs.53,793 crores in 2008-09 (excluding fuel minerals) amounting to a growth of 927 times in about 62 years.
Geo-scientific data base for mineral prognostication.

- India has a total land area of 3.28 million sq. km. of which 2.42 million sq km comprises hard-rock terrain, while the rest is occupied by a thick alluvial cover.

- Obvious Geological Potential (OGP) area is 5.71 lakh sq km for solid fuel and non-fuel schedule 1 mineral resources. Besides, the country has potential for minor minerals over large area.
GSI : Access and Data Availability on Geological Exploration

- GSI has adopted a Data Dissemination Policy which has made available significant amount of its baseline data on digital format in its Portal.
- All 1:50K Geological Maps digitised and available - 4905 Sheets
- Digital GCM maps on 1:50K with distribution contours 42 to 59 elements of 300 sheets are available
- Digitised ground GP Maps on 1:50K of 84 Maps are available
- Digitised data of GM, GCM and GPM of 84 Sheets available (in parts of Andhra Pradesh, Karnataka, Orissa, Maharashtra, Haryana, Uttar Pradesh, Assam, West Bengal, Meghalaya, Tamil Nadu and Jharkhand)
Geo-scientific data base for mineral prognostication.

- Coverage of 98.31% of the country (out of total mappable area of 3.146 million sq. km.) by geological mapping on 1:50,000/63,360 scale.
- Reconnoitory survey of 1.97 million sq.km. of Exclusive Economic Zone (2.014 million sq. km.) within territorial waters and in EEZ beyond territorial waters.
- Airborne geophysical survey (TOASS) of 291,976 sq. km. was covered by deploying multisensors.
- Coverage of 147,795 sq. km. in geologically critical areas of the country by specialized (1 : 25,000) thematic mapping.
- Geological mapping of 19000 sq. km. in Antarctica through participation in all the 30 scientific expeditions – GSI officers gave leadership in 8 teams.
- Path breaking research data in Petrology, Palaeontology, Geochronology, Geophysics and Geochemistry.
- Creation of large database/information (Geoinformatics) necessary for infrastructure development, water resources, power projects, engineering projects, environment assessment, coastal zone development, natural hazard management.
# DIFFERENT AGENCIES DOING GEOLOGICAL EXPLORATION IN INDIA

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Activity</th>
<th>GSI (1)</th>
<th>MECL (2)</th>
<th>IBM (3)</th>
<th>DGEM (4)</th>
<th>AMD (5)</th>
<th>MOIL (6)</th>
<th>NGRIC (7)</th>
<th>NIOC (9)</th>
<th>NCAOR (10)</th>
<th>DES (11)</th>
<th>ONGC (12)</th>
<th>CMPDI (13)</th>
<th>Univ. (14)</th>
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<tr>
<td>1</td>
<td>Regional Systematic mapping on progressive scale</td>
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<td>2</td>
<td>Regional exploration for minerals</td>
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</tr>
<tr>
<td>3</td>
<td>Detailed exploration for minerals</td>
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<td>Geomorphological and lineament mapping</td>
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<tr>
<td>7</td>
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<td></td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>8</td>
<td>National Mineral Inventory and Register of Mining Tenement</td>
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<td></td>
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</tbody>
</table>
Exploration Agencies - GSI

- **Geological Survey of India (GSI)** was established in 1851 is one of the oldest geological surveys of the world.
- It was formed with the responsibility of mineral search and exploration, both on – and off – shore, as one of the specified tasks. This activity comprises multidisciplinary surface and sub-surface probes, through well defined stages (P-I, P-II, E-I and E-II) within the realm of Preliminary Exploration, as defined in the GSI Misc. Pub.58, 1981 and BIS booklet IS 12595, 1989
- The accredited function of GSI in this field comprises search and prospecting for all minerals, except oil and gas and atomic minerals, leading to resource evaluation upto “Probable” category. Different stages of exploration by GSI are in conformity with the exploration inputs for G4, G3, G2 (partly) stages of UNFC system. The resource estimation is currently classified as indicated resource (332), inferred resource (333) and reconnaissance resource (334).
- **The salient features of the NMP 2008 include facilitating role by the government agencies including the GSI. The Government agencies will concentrate only in areas where the private sector investments are not forthcoming. In conducting exploration for minerals special attention will be given by the government agencies to the development of the strategic minerals through systematic investigation.**
Exploration Agencies - GSI

- GSI has already published General Information Dossiers (GID) and updating Detailed Information Dossier (DID) in respect of important minerals. Geology and mineral resources of the states have been published as Miscellaneous Publication 30.
- GSI has already built up portal to disseminate information to public through progress reports, records, memoirs and maps on different scales.
- A High Powered Committee (HPC) was appointed by the Government of India to study in depth and recommend the repositioning of the GSI.
- As per the HPC report a new Vision and Charter for GSI has been adopted. GSI has been restructured in the form of five Missions (comprising – Baseline data generation; Natural Resource Assessment; Geoinformatics; Fundamental and Multidisciplinary geoscience and Training and Capacity development) In addition 3 support systems to provide administrative, S&T and policy support and human resource management involving recruitment, promotion and training for placing suitable persons at key positions.
- A new Data Dissemination Policy has been adopted by GSI. The CGPB mechanism has been revamped. The GSI is being modernized by the acquisition of the modern survey and laboratory equipments on a fast track basis.
Exploration Agencies - MECL

- Mineral Exploration Corporation Ltd. (MECL) was carved out of GSI in the year 1972 with the sole objective of reducing the gap between the discovery of the mineral prospect and its commercial exploitation. It carries out detailed mineral exploration as a follow up of the GSI’s regional exploration.

- Its activities enhance the confidence level of resource estimation both in quantity and the quality to “Pre-feasibility mineral resources (221) / Measured mineral resources” categories.

- MECL as a premier detailed mineral exploration agency of the Government has played a vital role in the development of mineral industry in India.

- In consonance with the objectives of the National Mineral Policy-2008, the salient features of the exploration reports are uploaded in the MECL website for the benefit of the perspective investors.

- Ministry of Mines had included Repositioning of MECL in light of New Mineral Policy-2008 in the Results-Framework Document for the year 2010-2011. This was necessary as MECL is the only exploration company under Government. Accordingly, the above Document has been prepared by hiring MECON as Consultant and the draft has been forwarded to the Ministry of Mines.
Exploration Agencies – NGRI, AMD, State DGMs

- National Geophysical Research Institute (NGRI), Atomic Minerals Directorate for Exploration and Research, are some of the organisations directly or indirectly involved in exploration activities.

- Almost all State Governments have Directorates of Mines & Geology (DMG). Generally the exploration efforts of DMG's are concentrated on surface shows.
  - The role of the State DMGs has been to award/renew Reconnaissance Permits (RP), Prospecting Licence (PL) and Mining lease (ML) as per the MMRD Act, 1957 and MCR, 1960.
  - The exploration by State Governments is mainly confined to the freehold and the leasehold areas of the State Mineral Development Corporations.
Exploration Agencies – PSUs & Private Sector

- The Public Sector Undertakings (PSUs) such as HCL, NALCO, NMDC, MOIL, CIL, SCCL, SAIL, KIOCL, NLC and the joint venture companies of the Government such as HZL and BALCO are engaged in the exploration in their lease hold and mining areas.
- Private sector companies like M/s RIO TINTO Exploration Ltd., BHP Minerals Pvt. Ltd., ANGLO AMERICAN Exploration India Pvt. Ltd., GEO MYSORE Services Pvt. Ltd., DE BEERS India Surveys Pvt. Ltd., etc are conducting exploration mostly in their leasehold areas towards planning and development of mines.
### RESOURCE AUGMENTED BY STATE DGM’s DURING XI PLAN (2006-07 to 2009-10)
(Resource in million tonnes except stated otherwise)

<table>
<thead>
<tr>
<th>Sl No</th>
<th>Mineral commodity</th>
<th>DGM</th>
<th>Resource</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bauxite</td>
<td>Chhattisgarh</td>
<td>12.5</td>
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<tr>
<td></td>
<td></td>
<td>Orissa</td>
<td>0.125</td>
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<td>2</td>
<td>Clay</td>
<td>Kerala</td>
<td>52.37</td>
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<td>3</td>
<td>Coal</td>
<td>Chhattisgarh</td>
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<td></td>
<td>Maharashtra</td>
<td>49.00</td>
</tr>
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<td>4</td>
<td>Sillimanite</td>
<td>Maharashtra</td>
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<td>5</td>
<td>Lignite</td>
<td>Gujarat</td>
<td>134.34</td>
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<tr>
<td></td>
<td></td>
<td>Rajasthan</td>
<td>2.712</td>
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<td>6</td>
<td>Calcite</td>
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<td>Dimension Stone</td>
<td>Nagaland</td>
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<td></td>
<td></td>
<td>Karnataka</td>
<td>3.67</td>
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<td></td>
<td></td>
<td>Rajasthan</td>
<td>2.60</td>
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<td>8</td>
<td>Limestone</td>
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<td></td>
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<td>MP</td>
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<td></td>
<td></td>
<td>Rajasthan</td>
<td>613.5(cement) 382(SMS)</td>
</tr>
<tr>
<td></td>
<td>Resource</td>
<td>State</td>
<td>Amount</td>
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<td>------------</td>
</tr>
<tr>
<td>9</td>
<td>Dolomite</td>
<td>MP</td>
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<td>Iron Ore</td>
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<td>Orissa</td>
<td>213.18</td>
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<td>Karnataka</td>
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<td>Maharashtra</td>
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<td>11</td>
<td>Building Material</td>
<td>Madhya Pradesh</td>
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</tr>
<tr>
<td>12</td>
<td>Laterite+BIF</td>
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<td>Manganese</td>
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<td>25,000(tonnes)</td>
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<td>14</td>
<td>Quartz</td>
<td>Gujarat</td>
<td>22.94</td>
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<td></td>
<td></td>
<td>Karnataka</td>
<td>7784(tonnes)</td>
</tr>
<tr>
<td>15</td>
<td>Feldspar</td>
<td>Karnataka</td>
<td>2100(tonnes)</td>
</tr>
<tr>
<td>16</td>
<td>Diamond</td>
<td>Orissa</td>
<td>Discovered olivine Lamproite with good recovery of diamond</td>
</tr>
</tbody>
</table>
The GSI has undertaken an extensive programme of modernization during XI plan period as per guidelines laid down by an Expert Panel on Modernisation of GSI, constituted by Ministry of Mines.

During XI plan period, the target of technological infusion in mineral sector of GSI was to strengthen the state of the art equipment in chemical laboratories like ICP-MS, higher version of AAS, ICPAES, XRF, XRD etc.

In order to improve the quality of exploration for mineral resources of the country the airborne survey is strengthened by procurement of heliborne multi-sensor airborne survey system comprising on board sensors like magnetic, gravity, time domain electromagnetic (TDEM) and gamma ray spectrometry and hyper spectrometry for which GSI has finalized the process of procurement of equipments.

Ground geophysical surveys are also being strengthened by procuring new instrument like Multi Electrode Resistivity-IP unit, Multi Frequency EM profiling unit, Micro Gravimeter and Sub Audio Magnetic unit.
In India the task of preparation of inventory of mineral resources was included in the charter of functions of the Indian Bureau of Mine in the year 1968.

The first National Mineral Inventory (NMI) was released by IBM in 1971 covering 17 important minerals.

It was increased to 47 minerals of importance for the core industries like Iron & Steel, Cement, Chemical, Fertilizer, etc. by 1974.

The sources of data were the exploration agencies including Geological Survey of India, State Directorates of Mining & Geology and the individual mining organisations both in the public and private sectors.

Updating of National Mineral Inventory at 5 years intervals was formalised and from 1.4.95 the five yearly updation of inventory was carried out for 61 minerals.

The updation of 1.4.2000 covered 64 minerals and was completed on 31.3.2002.

GSI was entrusted with the responsibility of national mineral inventory for coal and lignite.
The available resources in NMI as on 1.4.2000 were codified as per UNFC, covering 64 non-coal, solid minerals.

The NMI database maintained by IBM was modified in collaboration with BRGM, France by October, 2003.

The CMPDI was given the responsibility to implement the UNFC in the inventory of coal and lignite.

The last inventory as on 1.4.2005 covering 65 minerals was completed in 2007 fully in accordance with UNFC.

The present structure of the National Mineral Inventory (NMI) covers mineral prospects/deposits/mines in freehold and leasehold areas, their status, infrastructure, geology & exploration, ore characteristics, reserve/resource estimation, details of feasibility, details of mining along with production data, etc.
Present status of National Mineral Inventory (NMI).

- The updation of UNFC compliant NMI as on 1.4.2005 for 65 minerals was completed in March 2007.
- Presently provisional figures as on 1.4.2010 are available for 22 minerals.
- NMI presently comprises total 17,195 deposits of which 8,824 are in Freehold areas, 653 in public sector leasehold, 7,641 private leasehold and 77 in partly leasehold.
- 64 minerals have been grouped into 7 groups such as Metallic Minerals – Ferrous Group; Metallic Minerals–Non-Ferrous Group, Precious and Semi-Precious Minerals, Strategic Minerals, Fertilizer Minerals and Non-Metallic Minerals.
- The detailed account of resources in Reserve Category, Remaining Resource Category and gradewise availability of the mineral resources, their distribution in freehold areas, leasehold areas and the details on exploration activities have been covered in mineral-wise reviews.
Quality data dissemination.

Through Local Area Network and Wide area Network connecting the various offices of IBM and the Ministry of Mines, instant data retrieval has been facilitated. District-wise updated reserves/resources of all minerals as on 1.4.2005 and total reserves/resources as on 1.4.2010 of selected minerals are also available on IBM Website.

Three types of standard output are generated –

1. The district-wise, category-wise, grade-wise and sector-wise resources/reserves of all the minerals
2. Deposit-wise summary information showing location, resources/reserves, grades and status of each deposit
3. Deposit-wise detailed information showing data on geology, exploration, reserves/resources as per UNFC, grade, chemical analysis, physical characteristics, infrastructure, etc.

The leasehold areas have been further classified into private, public, captive and non-captive. Publication on “NMI as on 1.4.2005 at a glance” and a handbook on “National Mineral Inventory as on 1.4.2005” has been brought out by the IBM as a ready reference to mineral inventory.

Mineral reserves/resources are also disseminated regularly through “Indian Mineral Year Book” and by posting on IBM web site (ibm.gov.in). The deposit-wise detailed information output sheets for freehold areas are disseminated to interested public on nominal charges.
Balance life of mineral inventory

- The total resources considered for working out life indices of important minerals requires a cautious approach.
- The entire group of mineral commodities has been classified based on indigenous availability as “Abundant Minerals”, “Adequate Minerals”, “Deficit Minerals” and “Scarce Minerals”.
- The detailed analysis of the abundantly, adequately, deficit and scarcely available minerals as per the National Mineral Inventory has been used to identify the gap areas.
IBM : Tenement Registry

- The IBM is to maintain a database in digitized form comprising both a Resource Inventory and a Tenement Registry in accordance with the UNFC system.

- The Tenement Registry will also give information of both Leasehold Areas as well as Freehold Areas in terms of green field, brown field and relinquished areas including areas given up by the GSI and other reconnaissance permit/prospecting licence holders.

- It is envisaged that the data would be maintained online giving instant information to prospective investors on what is available for reconnaissance, prospecting and mining.

- Summaries of work done by public agencies will be kept in the form of meta-data in the public domain and detailed reports will be made available to interested investors on cost recovery basis.
**Areas of Concern Emerging during the XI th Plan**

- Investments in exploration are still grossly inadequate despite the geological potential.
- Both in terms of the data generation by the national survey organization and in terms of the concession framework and access to capital for exploration, there are huge inadequacies which need to be addressed to provide the requisite investor confidence.
- Exploration and mining regulatory system at Central level and even more so at State level are inadequate.
- There is a need to ensure increase in mineral resources and reserves, and prepare policies to meet raw material requirement.
- There is very little investment in R&D on mining, exploration and mining technologies, beneficiation, development of new materials including alloys and high purity materials. Links between exploration efforts, mining activities and downstream activities (including recycling) are practically non-existent.
Major Thrust Areas in the XIIth Plan

- Thrust will be given on the Geomorphological and Lineament Mapping (GMM) on 1:50,000 scale, National Geochemical mapping (NGCM) of the Obvious Geological Potential (OGP) areas, Hyper Spectral Mapping (HSM) in OGP areas and National Aeromagnetic Surveys by the National Agencies including GSI.
- Conducting of High risk exploration for deep-seated mineral deposits.
- Legislations on Transferability of the mineral concession.
- Repositioning of MECL in promotional role for concealed mineral deposit exploration.
- Adoption of Globally acceptable reporting system for assessing mineral reserves/resources.
- Incentivise the private sector for explorations.
- Develop beneficiation techniques for zero waste mining.
Augmenting Role of GSI for Mineral Exploration

- To step-up the exploration efforts on the high priority minerals by redefining the role and capabilities of GSI.
- Leveraging the existing data with GSI for enhancing the private sector participation
- Substantially enhance the effectiveness of GSI, IBM and PSUs by redefining the mandate for them undertaking capability building and setting in place an effective monitoring mechanism.
- The Geological Survey of India has accorded a Mission status to GSITI with the objective of Training and capacity building for different domains of activities in tune with the recommendation of High Power Committee (HPC)
- The Training Institute has been revamped with a network of Six Regional Training Institutes and Ten Field Training Centres.
- GSI is the main repository of geoscientific data in the country. There is a strong need for organising and storing the data so that retrieval becomes more efficient and responsive to the specific requirements of the geoscientific communities, mineral industries and planners.
Aeromagnetic Surveys, NGCM, Ground Geophysical Mapping

- **National Aeromagnetic Mapping Program**: Aeromagnetic survey is used as a reconnaissance tool to aid in geological mapping and determination of strategy for finding buried deposits under cover of overlaying soil, weathered and loose rock and water. The objective of the aeromagnetic survey is for Preparation of seamless aeromagnetic map of India at altitude level of 120m and line spacing of 500m for geological mapping, mineral exploration, structural and tectonic studies. Expert committee in their report suggested for line spacing as per the terrain and suggested 250m line spacing which is under consideration.

- Year wise break up of the likely aeromagnetic survey work for XII th Plan is as follows:

<table>
<thead>
<tr>
<th>Field Season</th>
<th>Area to be covered</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013-14</td>
<td>Aerogeophysical survey of area under cover of Deccan traps</td>
</tr>
<tr>
<td>2014-15</td>
<td>Aerogeophysical coverage of area under cover of Deccan traps and continuation over rest of peninsular plateau and coastal plains.</td>
</tr>
<tr>
<td>2015-16</td>
<td>Continuation of aerogeophysical surveys over peninsular plateau and coastal plains</td>
</tr>
<tr>
<td>2016-17</td>
<td>Aerogeophysical surveys over Northern Mountain regions</td>
</tr>
</tbody>
</table>


Hyperspectral Survey:
Remote sensing technique using Hyperspectral (mainly airborne) are being used as an important tool for mineral exploration, particularly the hydrothermal alteration zones where country rocks get altered into distinct mineral assemblages. GSI has taken up Pilot Projects of hyperspectral mapping during the XIth Plan. This work will continued during the XII th Plan. Besides, during XII th Plan GSI is proposing to create a terrain wise spectral library for all the Obvious Geological Potential areas.

Geochemical Mapping
The first phase (Phase-1) of the nation wide Geochemical Mapping Programme in India was initiated by GSI at the beginning of X Five Year Plan and will span over a period of XI, XII and XIII Five Year Plan. In the first phase of NGCM programme, a total of 8.13 lakh sq km area spreading over 1132 numbers of toposheet (including 5.71 lakh sq km of obvious geological potential area) has been set as target and this target has to be completed by the end of XIIIth Plan. The National Geochemical Mapping (NGCM) Project has completed nine years since its inception in F. Y. 2002-2003 (F.S. 2001-2002). An area of 2,00,714 sq km which is about 24.69% of the total area to be covered during phase I or 6.12% of the country’s total area has been covered systematically in different parts of the country.

During the XII Plan, about 2,83,500 sq km area spreading over 810 number of toposheet is likely to be covered under Geochemical Mapping
Ground Geophysical mapping
Systematic ground gravity-magnetic mapping for the preparation of G-M maps of the country in 1:50,000 scale is the mission of GSI. This involves acquiring G-M data at an average frequency of one station per every 2.5 sq. km over the entire Indian shield, the Indo-Gangetic plain, the Eastern and Western Ghat areas including the coastal plains and other covered areas. During the XII Plan, about 2,60,000 sq km area (300 toposheet) is likely to be covered under Geophysical Mapping

Regional Exploration (Mission II)
- With the help of baseline geo-science data, Geological Survey of India has identified an area of 5.71 sq km as obvious geological potential (OGP) for scheduled 1C minerals, most of the area of which is located in Peninsular part of India. The major part of the exploration activities of GSI during the XIIth Plan period will be concentrated in OGP areas.
- During the XII Plan drill core libraries established in the Regional Offices will be strengthened and shall finalize a concept framework document and shall establish a National Drill Core Repository in line with best International Practices, as indicated in HPC document and new draft MMDR Act
### Additional mineral resource / reserves established by GSI and MECL during the first four year of XI plan (in million tonnes)

<table>
<thead>
<tr>
<th>Mineral</th>
<th>GSI</th>
<th>MECL (reserve)</th>
<th>Public Sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal</td>
<td>10109.64</td>
<td>11393</td>
<td></td>
</tr>
<tr>
<td>Lignite</td>
<td>0.70</td>
<td>3413</td>
<td></td>
</tr>
<tr>
<td>Copper Ore</td>
<td>124.15</td>
<td>39.79</td>
<td></td>
</tr>
<tr>
<td>Lead-Zinc</td>
<td>6.93</td>
<td>8.38</td>
<td></td>
</tr>
<tr>
<td>Iron Ore</td>
<td>66.85</td>
<td>168.77</td>
<td></td>
</tr>
<tr>
<td>Manganese Ore</td>
<td>10.69</td>
<td>-</td>
<td>(MOIL) 5.03</td>
</tr>
<tr>
<td>Chromite</td>
<td>-</td>
<td>2.03</td>
<td></td>
</tr>
<tr>
<td>Bauxite</td>
<td>1.97</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Limestone (Cement)</td>
<td>1065.74</td>
<td>1.92</td>
<td></td>
</tr>
<tr>
<td>Limestone (SMS)</td>
<td>235.28</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gold Ore</td>
<td>56.33</td>
<td>19.21</td>
<td></td>
</tr>
<tr>
<td>PGE</td>
<td>0.54</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Graphite</td>
<td>0.76</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Glass sand</td>
<td>-</td>
<td>320.53</td>
<td></td>
</tr>
</tbody>
</table>
GEOSCIENTIFIC DATAMANAGEMENT in GSI

- Data management, their archival and dissemination for developmental, educational and societal needs – GSI PORTAL IS REFERRED AS INDUSTRY STANDARD

MISSION

APPLICATION DATA
HR, PAY, FSP, ADMIN, etc

MAP, PUBLICATIONS, UNPUB. REPORTS

MAP SERVICES

GEO-SCIENTIFIC DATA

GSI Portal

USERS
### Geodatabase – GSI Portal

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<th>Metadata uploaded</th>
<th>Image uploaded</th>
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<td>Atlas</td>
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<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Coalfield maps</td>
<td>10</td>
<td>3</td>
</tr>
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<td>3</td>
<td>District Resource maps</td>
<td>351</td>
<td>336</td>
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<td>Geological Quadrangle maps</td>
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<td>6</td>
<td>International maps</td>
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<td>5</td>
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<td>7</td>
<td>Entire India maps</td>
<td>12</td>
<td>8</td>
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<td>8</td>
<td>Marine maps</td>
<td>27</td>
<td>24</td>
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<td>9</td>
<td>Mineral belt maps</td>
<td>120</td>
<td>114</td>
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<tr>
<td></td>
<td></td>
<td><strong>848</strong></td>
<td><strong>674</strong></td>
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### Regions / Missions

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<td>NER</td>
<td>1978</td>
<td>1142</td>
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<tr>
<td>WR</td>
<td>4480</td>
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<td>SR</td>
<td>5371</td>
<td>2073</td>
<td>340</td>
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<td>CR</td>
<td>4490</td>
<td>2549</td>
<td>600</td>
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<td>ER</td>
<td>4639</td>
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<td>274</td>
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<td>820</td>
<td>379</td>
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<tr>
<td>Coal</td>
<td>901</td>
<td>613</td>
<td>819</td>
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<tr>
<td>Marine</td>
<td>536</td>
<td>0</td>
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</tr>
<tr>
<td>CHQ</td>
<td>2010</td>
<td>1814</td>
<td>10</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>30241</strong></td>
<td><strong>17327</strong></td>
<td><strong>7573</strong></td>
</tr>
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</table>
Mineral exploration Strategy for India

**Geoscience data availability**

- Increase **geo-physical and geochemical baseline data from 4-6% of the landmass currently to 20-30%** in 5 years (prioritised mineral belt area of 570,000 square km). This will require a funding of INR 1800-2000 crore over 5 years
  - GSI should **hire geo-survey organizations** through a competitive global tender for baseline data generation; GSI should set aside Rs 360-400 crore per year in the XII plan through an increased outlay facilitated by the Planning Commission. Funds from the mineral cess proposed in the new regime can also be used. Ensure implementation support mechanisms are in place e.g., proper quality checks, measures to coordinate between multiple sub-contractors, etc (through GSI supported by an external agency).
  - Once the states see the value of baseline survey leading to higher discoveries, and starting the XIIIth plan, shift the ownership of baseline data generation to states

**Digitize and make the baseline data available** (on request if free restriction needs to be curtailed for security reasons) to enable juniors and exploration companies in the exploration effort
  - Make the digitized geological data available on request (which is currently available internally)
  - Ensure that the additional baseline data generated (geo physical and geo chemical) is digitized to be made available quickly

- Use the enhanced baseline data generated to support the two routes to mining lease (ML)
  - GSI does regional resource assessment activities leading to auction of known mineralised areas (ML or PL)
  - Private mining companies enter at RP stage leading to ML. Ensure that the geoscience data generated by companies is submitted back and is documented for future reference
Mineral exploration Strategy for India (Contnd)

Policy environment
Reduce permit delays, provide security of tenement and transferability (discussed in separate section)
- Provide fiscal incentives for exploration through tax deductions/ tax credits for investing in mining exploration (e.g. flow through share program in Canada similar to Infrastructure bonds in India)

Technology for exploration
- Reduce delays and hindrances in importing the best in-class technology e.g. it takes 5-6 months to get permissions to do airborne survey. Private players would automatically source best-in-class technology and move the appropriate associated R&D activities to India as a critical scale builds up

SOURCE: Ministry of Mines annual report, McKinsey analysis
Needs to increase its spend on baseline data generation by 8 times

### GSI's yearly\(^1\) spend on surveying and mapping

<table>
<thead>
<tr>
<th>Year</th>
<th>Rs crore</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>34</td>
</tr>
<tr>
<td>2009</td>
<td>47</td>
</tr>
<tr>
<td>2010</td>
<td>43</td>
</tr>
<tr>
<td>2011</td>
<td>53</td>
</tr>
</tbody>
</table>

**Proposed annual spend**

360-400

### Increasing baseline data – key recommendations

- To hire geo-survey organizations through a competitive global tender to increase geo-physical and geochemical baseline data from 4-6% of the landmass currently to 20-30% in 5 years (prioritised mineral belt)

- Proposed annual investment in the XII plan – Rs 360-400 crore each year

- Ensure implementation support mechanisms are in place e.g., proper quality checks, measures to coordinate between multiple sub-contractors, etc

---

1 Financial year

SOURCE: Ministry of Mines annual report, McKinsey analysis
Identification of technological gaps/constrains in mineral exploration

- Historically, multiple issues have constrained the capture of the full potential of the minerals wealth in the country. These include:
  - Insufficient survey and exploration
  - Unattractive investment environment
  - Lack of a clear system for disposal of government prospected mineral ore bodies
  - Methodology of grant of concession. Delays and uncertainty in the approval process
  - Multiplicity of agencies in decision making leading to delays in investment. The prospective investors need to interact and obtain clearances from 10 different agencies compared to only 4 agencies and single window facilitation in Western Australia. Consequently, the mining clearance in India takes 11 to 7 years in an average compared to 18 months in Western Australia.
  - Inadequate supporting infrastructure and insufficient legislative framework (Act and Rules) and poor enforcement
  - Perception of mining in terms of ecological & environment practices
  - Social issues are becoming more prominent and are likely to impose constraints on mining, if not addressed within a holistic framework.
  - Perception that benefits from mining related activities are not flowing for local area development
Country lagged behind in development of modern exploration, exploitation and beneficiation technology with the result country is unable to explore / exploit high value deep seated concealed deposits and low grade surface deposits.

Most of the exploration activities in the country are of conventional type (based mostly on geological data) with restricted input from geochemistry, geophysics and remote sensing.

Areas of weakness is in application of sophisticated modern techniques, wider application of latest techniques of remote sensing, regional geophysical and geochemical surveys, multi sensor aerial surveys and proper interpretation of data by computer using latest software's.

Requires infusion of high end technologies in the field of exploration particularly for deep seated and concealed deposits.

Exploration has been carried out mostly to assess the resources up to depth of 120 m even though exploration and exploitation techniques for deep seated bodies exists up to a depth of 2,500m.

Requires quality structural, geophysical and geochemical data.

Manpower Skill Development

Necessary to induct improved drilling techniques and equipments.

Requires world class information infrastructure – world class enterprise solutions to improve the quality, accessibility and sharing of information with all the stakeholders.

Additional information necessary for ascertaining the status of a prospect / deposit in the geological, feasibility and economic axis of UNFC.
Suggested measures for filling up the gaps / constrains

- Rework legislative framework to bring in transparency, investor confidence, sustainability concepts and better regulation
- Ensure early passage of the new Mines and Minerals (Development and Regulation) Bill 2011, replacing the existing Mines and Minerals (Development and Regulation) Act, 1957, after suitably addressing the concerns of the relevant stakeholders
- Substantially step up the exploration efforts on the high priority minerals by redefining the role and capabilities of GSI, leveraging the existing data with GSI, enhancing the private sector participation, ensuring strict compliance and addressing the constraints of the current concession process (through legislation)
- Substantially enhance the effectiveness of GSI, IBM and PSUs by redefining the mandate for them undertaking capability building and setting in place an effective monitoring mechanism.
- Establish a forum and mechanism to interact with the key stakeholders channelize their genuine requirements into the agenda of the Ministry of Mines and facilitate timely implementation of initiatives particularly infrastructure creation (e.g., rail infrastructure creation)
- Position IBM as technical regulator and Strengthen DGMs as field regulators
Draft MMDR Act addresses many of the concerns of investors like providing security of tenure, and transferability of licence etc.

To attract the private investors the following measures are suggested as indicated in the new MMDR Act:

- Expeditious grant of concessions and simplification of procedures
- Transparency in the transactions
- Application of e-governance in the transactions
- **Training capacity building / Strengthening of the State Directorates for taking up exploration.**
- Seamless transition from RP to PL and PL to ML,
- Free transferability of concessions without prior approval.
- Healthy revenue and taxation policies.
- Scrapping of concept of reservation of areas and Healthy competition between the government/ private sector activities.

Mineral Concessions may be granted on first-in-line system or on basis of competitive bidding as per the availability of exploration data.

Re-introduction of LAPL will help locating deep seated and concealed deposit. Provision for giving incentive for LAPL may help in attracting more investors.
Geological concept oriented specific exploration programme / targets to be identified in known mineral belt and new geological environment from available regional data base (geological, geophysical and geochemical) by applying computer aided processing, interpretation and deposit modeling, particularly for identifying deep seated / concealed deposits

To collect, collate, synthesize geological maps, regional ground magnetic data, aeromagnetic data, airborne multi-sensor data aided with satellite imageries

for this both aircraft and helicopter should be fitted with modern ‘Time Domain’ EM system along with latest available magnetic, spectrometric and gravity system

Application of hyper spectral imaging system (airborne and satellite) is expected to improve target selection

Developing a three dimensional geological mapping at the depths of interest for exploration by carrying out 2D and 3D seismic profiling in hard rock terrain.

MT (magneto telluric) surveys to be used for various basemetal, precious stone exploration and as well as kimberlitic mapping for targeting diamond
Regional geochemical surveys need to be strengthened with matching strengthening of analytical capabilities by inducting latest analytical instrumental facility with lower detection limit.

To enhance the pace of drilling and for getting quality / reliability of sub-surface information it is necessary to induct improved techniques and equipments such as reverse circulation drilling with inbuilt system for controlled deflection of borehole path and combination of coring and non-coring operations in a single borehole. Drilling is a vital area of weakness in the Indian scene. There is an urgent need to introduce modern drilling technology for faster progress and better results.

Country lack quality information infrastructure for sharing of geoscientific information with all the stakeholders. GSI along with continuation of mineral search activity would now have to work more towards facilitating the investors by providing basic geologic information.

The exploration techniques need efficient latest software for acquisition, editing, processing and evaluation and trained personnel for proper interpretation. Computer aided data processing and interpretation is required for deposit modeling and latest techniques of resource/reserve estimation also need to be developed to modern standards. These are the areas where technology import is felt necessary. Faster progress in this field is considered necessary.
Identification of National Mineral priorities: Following group of minerals are categorized as per national priority with respect to availability

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Group of Minerals</th>
<th>Category of minerals with respect to availability</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Abundant</td>
</tr>
<tr>
<td>1.</td>
<td>Fuel Minerals</td>
<td>Non Coking Coal Lignite</td>
</tr>
<tr>
<td>2.</td>
<td>Metallic Minerals</td>
<td>Iron Ore Bauxite Titanium Minerals</td>
</tr>
<tr>
<td>3.</td>
<td>Non-Metallic Minerals</td>
<td>Limestone, Dolomite, Barytes, Bentonite, Felspar, Fireclay, Fullers Earth, Clay-Kaoline, Magnesite, Sillimanite (Granular), Quartz, Quartzite &amp; Silica Sand, Garnet, Calcite</td>
</tr>
<tr>
<td>4.</td>
<td>Precious Stone</td>
<td>--</td>
</tr>
<tr>
<td>5.</td>
<td>Other/Minerals/Rocks</td>
<td>Granite (Dimension Stone), Marble, Slate, Decorative Stones</td>
</tr>
</tbody>
</table>
Draw up strategy for regional and detailed explorations

- Regional and detailed explorations shall be carried out mostly in the identified Obvious Geological Potential (OGP) area of ~ 5.7 lakhs sq km.
- During the XII Plan, as in XI Plan, intensification of exploration for low volume high value minerals such as gold, diamond, base metals, rare earths, platinum and strategic group of minerals and efforts towards augmentation of the existing resources in respect of ferrous and non-ferrous minerals, industrial minerals and fertilizer minerals will continue.
- The exploration programmes are planned keeping in with the short-term as well as long term requirements which are as follows:
  - To frame exploration strategy for minerals having poor resource cum reserve base in locales of favourable geological milieu.
  - To augment existing resource position with special emphasis on deficient and scarce minerals like copper, rock phosphate, nickel, tungsten, molybdenum, strategic minerals, rare earth, PGE, gold, diamond and silver etc., through continuous integrated multi-disciplinary exploration strategy.
  - To delineate new target areas through synthesis of multidisciplinary earth science data in vast tract of areas, for which potential is yet to be established.
Chawla Committee on allocation of natural resources advises that GSI complete its geophysical and geochemical mapping expeditiously, with the assistance of outsourcing and service contracts if necessary, so as to develop potential areas for prospecting, so that such prospects can then be competitively awarded, as provided in the legislation.

The Committee also recommends that for minerals likely to be found as surficial deposits and where prospecting does not require high technology, State governments should be incentivised and enabled to take up prospecting and exploration so that adequately prospected ore bodies can be put to bid, as also advised by Hoda committee.

as suggested in NMP 2008 CGPB has been strengthened by establishing XII Committees and should play a vital role in drawing the strategy for Regional and detailed exploration in the country.

While GSI, MECL, DMGs of the State Govts and various Centre and State PSUs will continue to perform the tasks assigned to them for exploration and survey, the private sector would in future be the main source of investment in reconnaissance and exploration and govt. agencies will expend funds primarily in area where private sector investments are not forthcoming.

To expedite completion of reconnaissance work for the entire country as early as possible an open sky policy of non-exclusivity for reconnaissance work will be adopted.
Geological Survey of India Activities for the XII th Plan Period:
A major part of the exploration activities so far carried out by GSI during the XIth Plan period is concentrated in the OGP areas and in XIIth Plan also exploration activities will be continued in these OGP areas.

Mission I

• To continue National Geo-chemical Mapping (NGCM) in Obvious Geological Potential (OGP) area
• National Geophysical Mapping in Obvious Geological Potential (OGP) area
• GSI to take up and complete Hyper Spectral Mapping (HSM) in OGP by end of 12th Plan in 1:50 k scale.
• GSI to take up a National Aeromagnetic Survey in the 12th Plan and complete it by end of 13th Plan (including an aircraft).
• GSI to complete Geo-morphological and Lineament Mapping (GMM) in 1:50K scale.
Tentative Total target proposed in respect of various components of Mineral Exploration Activities (Except Coal and Lignite) in GSI for XII Plan Mission – II

1. Large scale mapping (1:10,000 to 1:12,500): 15000 Sq.km
2. Reconnaissance mapping (1:50,000): 30,000 Sq.km
3. Detailed Mapping (1: 1000to 1:2000): 229 Sq.km
4. Drilling: 1, 90,400 m; 5. Pitting & trenching: 60,700 Cu.m
6. Geophysical Surveys: 3000 l.km
7. Geochemical and other samples: 1, 95,450 nos

Contnd...
## Mineral-wise proposed Action Plan by GSI

<table>
<thead>
<tr>
<th>Sl No</th>
<th>Mineral</th>
<th>State</th>
<th>Items</th>
<th>Quantum</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Gold</td>
<td>Andhra Pradesh, Karnataka Kerala, Tamil Nadu Rajasthan, Jharkhand, Bihar Orissa, Madhya Pradesh, Chhattisgarh, Uttar Pradesh, Uttarakhand, Arunachal Pradesh</td>
<td>Large scale Mapping (1:10,000 to 1:12,500)</td>
<td>2500 sq km</td>
</tr>
<tr>
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<td></td>
<td></td>
<td>Detailed mapping (1:1000 to 1:2000)</td>
<td>30 sq km</td>
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<td>Drilling</td>
<td>32000 m</td>
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<td></td>
<td></td>
<td></td>
<td>Pitting/trenching</td>
<td>15600 cu m</td>
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<td></td>
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<td></td>
<td>GCS and other samples. GPS</td>
<td>52000 nos 450 lkm</td>
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<tr>
<td>2.</td>
<td>Diamond</td>
<td>Andhra Pradesh, Karnataka Chhattisgarh Maharashtra Madhya Pradesh Orissa Uttar Pradesh</td>
<td>Reconnaissance Mapping (1:50,000 scale)</td>
<td>30000 sq km</td>
</tr>
<tr>
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<td></td>
<td></td>
<td>P/T</td>
<td>2200 cu m</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>GCS and other samples. Drilling GPS</td>
<td>3050 nos 4000 m 450 lkm</td>
</tr>
<tr>
<td>3.</td>
<td>PGE and Nickel</td>
<td>Andhra Pradesh, Karnataka, Goa Tamil Nadu, Kerala Maharashtra Madhya Pradesh Chhattisgarh Rajasthan, Gujarat Orissa, Jharkhand Uttar Pradesh, Jammu &amp; Kashmir Nagaland, Manipur</td>
<td>Large scale Mapping (1:10,000 to 1:12,500)</td>
<td>2500 sq km</td>
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<td></td>
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<td>Detailed mapping (1:1000 to 1:2000)</td>
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<td>Pitting/trenching (in cu m)</td>
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<td>Drilling</td>
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<td>---------</td>
<td>--------</td>
<td>---------------------</td>
<td></td>
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</tr>
</tbody>
</table>
| **Iron ore** | Orissa, Jharkhand Chhattisgarh, Madhya Pradesh, Maharashtra Karnataka Andhra Pradesh, Uttar Pradesh, Rajasthan, Meghalaya Assam | Large scale Mapping (1:10,000 to 1:12,500) 1000 Sq km  
Detailed mapping (1:1000 to 1:2000) 20 sq km  
Pitting/trenching 3800 cu m  
Drilling 7000 meter  
Geochemical and other samples 7600 no  
GPS 300 lkm |
| **Manganese** | Maharashtra, Orissa Jharkhand Andhra Pradesh Karnataka | Large scale Mapping (1:10,000 to 1:12,500) 800 sq km  
Detailed mapping (1:1000 to 1:2000) 10 sq km  
Drilling 4800 m  
Pitting/trenching 5000 cu m  
Geochemical and other samples 12000 nos  
GPS 300 |
| **Chromite** | Andhra Pradesh, Orissa | Large scale Mapping (1:10,000 to 1:12,500) 500 sq km  
Detailed mapping (1:1000 to 1:2000) 6 sq km  
Drilling 2000 meter  
Pitting/trenching 1500 cu m  
Geochemical and other samples 7500 nos  
47 |
| 7. | Basemetal | Rajasthan, Gujarat, Maharastra, Madhya Pradesh, Chhattisgarh, Haryana, Uttarakhand, Himachal Pradesh, Jammu & Kashmir, Andhra Pradesh, Karnataka, Tamil Nadu, Jharkhand, Orissa, Sikkim, Meghalaya | Large scale Mapping (1:10,000 to 1:12,500) | 2500 sq km |
| | | | Detailed mapping (1:1000 to 1:2000) | 45 sq km |
| | | | Pitting/trenching | 6000 cu m |
| | | | Drilling | 75000 meter |
| | | | Geochemical and other samples | 45000 nos |
| | | | Geophysical survey | 750 lkm |

| 8. | Bauxite | Andhra Pradesh, Madhya Pradesh, Chhattisgarh, Jharkhand, Gujarat | Large scale Mapping (1:10,000 to 1:12,500) | 500 sq km |
| | | | Detailed Mapping | 8 sq km |
| | | | Drilling | 6400 m |
| | | | Geochemical and other samples | 7000 nos |
## Mineral-wise proposed Action Plan by GSI - Contnd..

| 9. | RM-REE | Andhra Pradesh, Tamil Nadu
|     |        | Jharkhand, West Bengal
|     |        | Orissa
|     |        | Rajasthan
|     |        | Gujarat
|     |        | Meghalaya
|     | Large scale mapping (1:10,000 – 1:12500) | 500 sq km
|     | Detailed mapping (1:1000 to 1:2000) | 5 sq km
|     | Drilling | 4000 m
|     | Geochemical and other samples. | 4000 nos

| 10. | Strategic Minerals (W, Sn, Mo) | Chhattisgarh, Maharashtra, Uttar Pradesh, Uttarakhand
|     | Andhra Pradesh | Tamil Nadu
|     | Large scale Mapping (1:10,000 to 1:12,500) | 1100 sq km
|     | Detailed mapping (1:1000 to 1:2000) | 5 sq km
|     | Pitting/trenching | 600 cu m
|     | Geochemical and other samples. | 3000 nos
|     | Drilling | 4000 m

| 11. | Limestone dolomite and high Mg rocks | Andhra Pradesh, Karnataka
|     | Rajasthan | Gujarat
|     | Madhya Pradesh | Chhattisgarh
|     | Uttarakhand | Himachal Pradesh
|     | Orissa, Jharkhand | Meghalaya
|     | Large scale Mapping (1:10,000 to 1:12,500) | 1000 sq km
|     | Detailed mapping (1:1000 to 1:2000) | 20 sq km
|     | Drilling | 9000 meter
|     | Pitting/trenching | 1000 cu m
|     | Geochemical and other samples. | 9000 nos
| 12. | **Graphite** | Tamil Nadu  
Chhattisgarh  
Orissa  
Arunachal Pradesh | Large scale Mapping (1:10,000 to 1:12,500)  
400 sq km  
Detailed Mapping  
5 sq km  
Pitting Trenching  
600 cu m  
Geochemical and other samples.  
900 nos  
GPS  
300 l.kms |
|---|---|---|
| 13. | **Other Minerals**  
(Baryte, glass sand, kyanite, clay, sillimanite, gypsum etc) | Maharashtra  
Haryana, Uttar Pradesh  
Tamil Nadu  
Kerala  
Andhra Pradesh  
Rajasthan, Gujarat  
Meghalaya, Assam | Large scale Mapping (1:10,000 to 1:12,500)  
1000 sq km  
Detailed Mapping (1:1000 to 1:2000)  
10 sq km  
Pitting/trenching  
3000 cu m  
Drilling  
6000 m  
Geochemical and other samples.  
6000 nos  |
| 14. | **Fertilizer Minerals**  
(Phosphorite and Potash) | Madhya Pradesh  
Chhattisgarh  
Rajasthan  
Gujarat  
Andhra Pradesh  
Karnataka  
Uttarakhand  
West Bengal | Large scale Mapping (1:10,000 to 1:12,500)  
700 sq km  
Detailed mapping (1:1000 to 1:2000)  
5 sq km  
Pitting/trenching  
1000 cu m  
Drilling  
5000 m  
Geochemical and other samples.  
5000 nos  |
Mineral Exploration Corporation Limited activities for the XII plan

The work programme for MECL has been identified keeping in view the past experiences of sharing of work in Coal & Lignite sector and opportunities available in the market vis-à-vis promotional activity to be funded by Govt. of India. It is also expected that for promotional activities, Geological Survey of India, as an accomplishment of their programme in mineral sector, would throw open several prospects for detailed exploration and accordingly provisions are made in MECL’s activity for the XIIth Plan period.

out of 10,66,325 m. of drilling planned for entire plan period, about 5,86,000 m. of drilling is kept for Coal and Lignite sector alone, 1,00,000 m. of drilling and 10,000 m. of mining has been kept for CBM and miscellaneous work from client organization both in public & private sector. The balance meterage of around 3,80,000 m. drilling and 7,500 m of mining is projected for specific mineral commodities (non-coal lignite sector) to be funded under promotional activity. The above provisions would also be utilized for the development of mineral sector in the North Eastern Region including state of Sikkim. The total provision kept for promotional drilling is about 35% of the total drilling programme envisaged for MECL for XIth Plan period.
<table>
<thead>
<tr>
<th>SL. No.</th>
<th>MINERAL</th>
<th>STATE</th>
<th>FIELD / BELT</th>
<th>EXPLORATION INPUTS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A. COAL</td>
<td>Andhra Pradesh</td>
<td>Godavary Valley C.F., Sohaipur C.F.,</td>
<td>Remote Sensing : 8 Scenes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Chhattisgarh</td>
<td>Sonhat C.F.,</td>
<td>Geophysical logging : 2,60,000m</td>
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<tr>
<td></td>
<td></td>
<td>Maharashtra</td>
<td>Mand-Raigarh C.F., Hasdo-Arand C.F.</td>
<td>Promotional Drilling : 3,00,000m</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Jharkhand</td>
<td>Ramkhola-Tatapani</td>
<td>Contractual Drilling : 1,50,000m, 4,50,000m</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Assam</td>
<td>Kamptee C.F.,</td>
<td>Sampling: 45,000 Nos.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Bhander C.F.</td>
<td>Environmental studies : 15 Nos.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Wardha Valley C.F.</td>
<td></td>
</tr>
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<td></td>
<td></td>
<td></td>
<td>Jharia C.F.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Makum C.F.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>B. LIGNITE</td>
<td>Tamil Nadu</td>
<td>Neyveli Basin, Mannargudi Basin,</td>
<td>Remote Sensing : 6 Scenes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rajasthan</td>
<td>Ramnathpuram- Basin, Barmer Sector</td>
<td>Geological Mapping : 4000 Sq.km</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gujarat</td>
<td>Nagaur Sector</td>
<td>Geophysical Survey</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Bikaner Sector</td>
<td>i. Gravity Survey : 2000 Sq.km.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Scout</td>
<td>Promotional Drilling : 312,000m</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Geophysical Logging : 250,000m</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Sampling : 31200 Nos.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Environmental studies : 15 Nos.</td>
</tr>
<tr>
<td></td>
<td>C. BASE METAL</td>
<td>Jharkhand</td>
<td>Singhbhum Copper belt</td>
<td>Environmental studies : 4 Scenes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. Copper</td>
<td>South Khetri Copper- belt</td>
<td>Geological Mapping : 10 Sq.Km.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Chitar-Kalab-Kalan Sector</td>
<td>Promotional Drilling : 20000m</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Baniwala Ki-Dhani Sector</td>
<td>Geophysical Survey : 10 Sq.km.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Pur Banera Belt</td>
<td>Sampling &amp; Analysis : 10000 Nos.</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td>Exploratory Mining : 100m</td>
</tr>
<tr>
<td>SL.</td>
<td>MINERAL</td>
<td>STATE</td>
<td>FIELD / BELT</td>
<td>EXPLORATION INPUTS</td>
</tr>
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</tr>
<tr>
<td>D.</td>
<td>GOLD</td>
<td>Andhra Pradesh Karnataka</td>
<td>Ghanpur Schist Belt Gadwal Schist Belt Veligallu Schist Belt Gani Kalva Area Ramgiri-Penkacherla Schist Belt Hutti-Muski Schist Belt Kushtigi-Hungund Schist Belt Chitradurga Schist Belt</td>
<td>Environmental Studies-4 Scenes Geological Mapping : 10 Sq.km. Promotional Drilling : 40,000m Sampling &amp; Analysis-20,000 Nos. Exploratory Mining-200m</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tamil Nadu Rajasthan Jharkhand Kerala</td>
<td>Shimoga Schist Belt Mangalur Schist Belt Extension of Kolar Schist Belt Aravalli Fold Belt (Prospects in Bhukia &amp; Adjoining area) Singhbhum Fold Belt (Prospects adjacent to Parasi Central block) Southern Granulite- Terrain</td>
<td></td>
</tr>
</tbody>
</table>
### E. FERTILISER MINERALS

<table>
<thead>
<tr>
<th>Miner</th>
<th>State(s)</th>
<th>Field/Belt</th>
<th>Exploration Inputs</th>
</tr>
</thead>
</table>
| i. Potash | Rajasthan, Madhya Pradesh, West Bengal, Andhra Pradesh | Hensneran Evaporite Group (Satipura, Jaitpur areas)  
Area between Jamar kotra-Jhabua Jhabua belt  
Singhbhum Belt / Chhotanagpur Gneissic-Terrain in Purulia district. Cuddapah basin | Environmental Studies : 4 Scenes  
Geological Mapping : 40 Sq.km.  
Promotional Drilling : 20,000m  
Geophysical Logging : 10,000m  
Sampling & Analysis: 8,000Nos.  
Exploratory mining : 200m |
| ii. Rock Phosphate | | | |

### F. STRATEGIC MINERALS

<table>
<thead>
<tr>
<th>Miner (Tin, Tungsten, Molybdenum)</th>
<th>State(s)</th>
<th>Field/Belt</th>
<th>Exploration Inputs</th>
</tr>
</thead>
</table>
| Sakoli fold belt  
Sewaria Granite  
Syenite-Carbonatite province (Sirohi area)  
Deva-ka-Bera  
Udwaria, Extension area of Degana prospect  
Harur Uttargarai belt | Maharashtra, Rajasthan, Tamil Nadu | | Environmental Studies : 3 Scenes  
Geological Mapping : 10 Sq.km.  
Promotional Drilling : 15,000m  
Sampling : 7,500 Nos.  
Exploratory Mining : 200m |

### G. HIGH TECH MINERAL

<table>
<thead>
<tr>
<th>Miner (Cesium, Lithium &amp; Rubidium and Fullerene)</th>
<th>State(s)</th>
<th>Field/Belt</th>
<th>Exploration Inputs</th>
</tr>
</thead>
</table>
| Chhotanagpur Gneissic complex  
Sewaria Granite Area  
Mangampeta Baryte Belt  
Pegmatite bearing areas | West Bengal, Rajasthan, Andhra Pradesh, Tamil Nadu | | Environmental Studies :3 Scenes  
Geological Mapping : 10 Sq.km.  
Promotional Drilling : 10,000m  
Pitting & Trenching : 1000Cu.m.  
Sampling & Analysis : 2500 Nos.  
Exploratory Mining : 200m |

Contd....
<table>
<thead>
<tr>
<th>SL.</th>
<th>MINERAL GROUP</th>
<th>STATE</th>
<th>FIELD / BELT</th>
<th>EXPLORATION INPUTS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>H.</strong></td>
<td>NICKEL &amp; COBALT</td>
<td>Orissa, Jharkhand</td>
<td>Ultra-mafic complex of Sukinda West Singhbhum district (Bonai-Keonjhar belt)</td>
<td>Geological Mapping: 5 Sq.km. Promotional Drilling: 5,000m Sampling &amp; Analysis: 4500 Nos. Environmental Studies: 2 Scenes</td>
</tr>
<tr>
<td><strong>I.</strong></td>
<td>PLATINUM GROUP OF ELEMENTS (PGE)</td>
<td>Orissa, Tamil Nadu, Andhra Pradesh, Karnataka, Jharkhand, Manipur &amp; Nagaland</td>
<td>Sukinda, Baula Nuasahi area Sitampundi layered complex Mettupalaiyam Mafic Ultrmafic complex Chimakurthi Mafic Ultrmafic complex Layered Complex in Hanumalapura and adjoining areas West Singhbhum district. Ophiolite Belt</td>
<td>Environmental Studies: 4 Scenes Geological Mapping: 25 Sq.km. Promotional Drilling: 24,000m Sampling Analysis: 12,000 Nos. Exploratory Mining: 100m</td>
</tr>
<tr>
<td><strong>J.</strong></td>
<td>FERROUS GROUP (Iron, Chromite &amp; Manganese)</td>
<td>Orissa, Madhya Pradesh, Jharkhand, Chhattisgarh, Maharashtra, Karnataka, Tamil Nadu</td>
<td>Badampahar Belt Bonai-Keonjhar Belt Tomka-Daiteri Belt Sukinda Belt Eastern Ghat Belt Mansar-Balaghat Belt Jabalpur district Bonai-Keonjhar Belt Rawghat, Bailadila &amp; Kabirdham district. Sausar Belt, Chandrapur &amp; Gadchiroli districts (Gondi-Pimpari area) Sandur Schist Belt Chitradurga Schist Belt Granulite terrain (BMQ bands in Mamakkal and Tiruvannamalai districts)</td>
<td>Environmental Studies: 4 Scenes Geological Mapping: 50 Sq.km. Promotional Drilling: 50,000m Sampling &amp; Analysis: 40,000 Nos. Exploratory Mining: 300m</td>
</tr>
<tr>
<td>SL.</td>
<td>MINERAL</td>
<td>STATE</td>
<td>FIELD / BELT</td>
<td>EXPLORATION INPUTS</td>
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</tr>
<tr>
<td>K.</td>
<td>BAUXITE</td>
<td>Orissa</td>
<td>Kadalia block in Bonai – Keonjhar Belt</td>
<td>Environmental Studies : 3 Scenes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Andhra Prades</td>
<td>Unexplored plateau in Eastern Ghat Belt</td>
<td>Geological Mapping : 15 Sq.km.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Jharkhand</td>
<td>Unexplored plateau in Eastern Ghat Belt</td>
<td>Promotional Drilling : 15000m</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Chhattisgarh</td>
<td>Lohardaga area</td>
<td>Sampling &amp; Analysis : 15000Nos.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maharashtra</td>
<td>Jamirapat, Pandripat areas</td>
<td>Exploratory Mining : 200m</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Konkan belt</td>
<td></td>
</tr>
<tr>
<td>L.</td>
<td>INDUSTRIAL MINERALS (Non-Metallic)</td>
<td>Nagaland</td>
<td>Nimi Limestone</td>
<td>Environmental Studies : 3 Scenes</td>
</tr>
<tr>
<td></td>
<td>Limestone (SMS, BF) High Mg Flux</td>
<td>Arunachal-Prades</td>
<td>Tidding, Hunli, Menga</td>
<td>Geological Mapping : 15 Sq.km.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Meghalaya</td>
<td>Litang Valley and its continuity</td>
<td>Promotional Drilling : 15000m</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Andhra Prades</td>
<td>Cuddapah Basin</td>
<td>Sampling &amp; Analysis : 15000Nos.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pradesh</td>
<td>Kaladgi Basin</td>
<td>Exploratory Mining : 100m</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Karnataka</td>
<td>Mafic-Ultramafic Complex</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Orissa</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sl no</td>
<td>Mineral</td>
<td>Deposit/District</td>
<td>Exploration inputs</td>
<td></td>
</tr>
<tr>
<td>-------</td>
<td>---------</td>
<td>--------------------------------------------------------------------------------</td>
<td>---------------------</td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Exploratory drilling for limestone</td>
<td>Malked, Sedam Taluk and Jewargi Taluk of Bhima Basin, Gulbarga District.</td>
<td>Not indicated</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Exploratory drilling for cement grade limestone</td>
<td>Melanahalli, Chikkanayakanahalli Taluk, Tumkur District</td>
<td>Not indicated</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Banded Magnetite Quartzite</td>
<td>Hulgur and Shivasamudrum, Malvalli Taluk, Mandya District</td>
<td>Not indicated</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Titaniferous magnetite</td>
<td>Teganahalli, K.R.Pet Taluk, Mandya District</td>
<td>Not indicated</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Gold</td>
<td>Shimoga scist belt, Halehikeri, south of Sagar</td>
<td>Not indicated</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Gold</td>
<td>BIF of eastern part of Sorab Taluk, Shimoga District</td>
<td>Not indicated</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>PGE</td>
<td>Sargur scist belt</td>
<td>Not indicated</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Quartz/quartzite</td>
<td>Desani, Arsikere Taluk, Hassan District</td>
<td>Not indicated</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Quartz/quartzite</td>
<td>Rayalpadu, Srinivasapura Taluk, Kolar District</td>
<td>Not indicated</td>
<td></td>
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<tr>
<td>10.</td>
<td>Steatite/soapstone</td>
<td>Bylakeri and Hosahalli, C.N.Halli Taluk, Tumkur District</td>
<td>Not indicated</td>
<td></td>
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<tr>
<td>11.</td>
<td>Ornamental stone</td>
<td>Davanagere Taluk, Davanagere District</td>
<td>Not indicated</td>
<td></td>
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<tr>
<td>12.</td>
<td>Ornamental stone</td>
<td>Mulkalmuru Taluk, Chitradurga District</td>
<td>Not indicated</td>
<td></td>
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<tr>
<td>13.</td>
<td>Low grade iron ore</td>
<td>Honnali and Basavapatna in Shimoga schist belt</td>
<td>Not indicated</td>
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</tr>
<tr>
<td>14.</td>
<td>Bauxite</td>
<td>Talgad and Mundahalli, Bhatkal Taluk, Uttar Kanada District</td>
<td>Not indicated</td>
<td></td>
</tr>
<tr>
<td>Sl no</td>
<td>Mineral Description</td>
<td>Deposit/District</td>
<td>Exploration inputs</td>
<td></td>
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<td>-------</td>
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<td>------------------------------------------------------------</td>
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<td></td>
</tr>
<tr>
<td>1.</td>
<td>Pyrophyllite</td>
<td>Phusra, P.S.Kasipur, Purulia</td>
<td>(one year item)</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Apatite</td>
<td>Kutni, P.S.Boro, Purulia District</td>
<td>(three year item)</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Apatite</td>
<td>Chrugora, P.S.Boro, Purulia District</td>
<td>(three year item)</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Databank on investigated mineral resources of West Bengal in digital format and updating of state mineral inventory.</td>
<td></td>
<td>(Five years)</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>GPS survey of established mineral resources in parts of Purulia, Bankura and Birbhum Districts for registration of georeferences of the surface extents of mineral resources to develop database for Geoinformatics</td>
<td></td>
<td>(Five years)</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Blackstone (Road metals)</td>
<td>Purulia and Midnapur Districts</td>
<td>(two year item)</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Quartz</td>
<td>Purulia District</td>
<td>(two year item)</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Clay</td>
<td>Bankura District</td>
<td>(four year item)</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Magnetite and associated minerals</td>
<td>Saltora-Mejia area, Bankua District</td>
<td>(two year item)</td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Quartz</td>
<td>Bankura District</td>
<td>(four year item)</td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Silica sand</td>
<td>Bankura District</td>
<td>(three year item)</td>
<td></td>
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<tr>
<td>12.</td>
<td>Calibration of geophysical anomalies with mineralisation values of quartz vein</td>
<td>Bankura District</td>
<td>(two year item)</td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>Blackstone (Road metals)</td>
<td>Chhatna-Saltora-Gangajalghati area, Bankua and Birbhum Districts</td>
<td>(three year item)</td>
<td></td>
</tr>
<tr>
<td>14.</td>
<td>Talc-steatite (preferably in collaboration with GSI)</td>
<td>Darjeeling district</td>
<td>(five year item)</td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td>Assessment of existing database of established mineral resources of West Bengal and further exploration in G-axis &amp; F-axis as per UNFC guidelines as required to suit the acceptability.</td>
<td></td>
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<td></td>
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<tr>
<td>16.</td>
<td>Digitisation of existing and upcoming geospatial database for developing information layers on GIS platform</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
### ACTION PLAN OF DMG, RAJASTHAN FOR THE XII PLAN

<table>
<thead>
<tr>
<th>Sl no</th>
<th>Mineral</th>
<th>Deposit/District</th>
<th>Exploration inputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>A few projects will be planned and executed to take up systematic delineation of suitable plots for minerals like sandstone, masonry stones, marble, granite, limestone (flooring) and schist stone/ slatestone, etc. (it involves identification of Government land, collection of revenue records, awareness generation among villagers, approval at Government level, subsequent notification for leasing out of such delineated plots, etc.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Lignite</td>
<td>Gap areas of Bikaner, Nagaur and Barmer districts. (*)</td>
<td>Not indicated</td>
</tr>
<tr>
<td>3.</td>
<td>Basemetal and Noble metals.</td>
<td>The area of Delhi Fold Belt from Banswara in the south to Khetri in the north via Udaipur, Bhilwara and Ajmer districts by deep drilling. (*)</td>
<td>Not indicated</td>
</tr>
<tr>
<td>5.</td>
<td>Gypsum, potash, fluorite, quartz, feldspar, soapstone, chinaclay, bentonite, siliceous earth, precious and semiprecious stones, etc.</td>
<td>Not indicated</td>
<td>Not indicated</td>
</tr>
</tbody>
</table>

(*)Subject to availability of special funds from Govt. of India.
### ACTION PLAN OF DMG, MAHARASHTRA FOR THE XII PLAN

<table>
<thead>
<tr>
<th>Sl no</th>
<th>Mineral</th>
<th>Deposit/District</th>
<th>Exploration inputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Manganese (Scheme in collaboration with GSI, C.R.)</td>
<td>Parseoni-Gumgaon, Nagpur district</td>
<td>Proposed for drilling. Quantum not indicated (one year item)</td>
</tr>
</tbody>
</table>

### ACTION PLAN OF MAGANENE ORE INDIA LIMITED (MOIL) FOR THE XII PLAN

<table>
<thead>
<tr>
<th>Sl no</th>
<th>Mineral</th>
<th>Deposit/District</th>
<th>Exploration inputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Manganese</td>
<td>detailed exploration by drilling in the mines of Balaghat district in Madhya Pradesh and Bhandara &amp; Nagpur districts of Maharashtra</td>
<td>36100 meterage of drilling is proposed in the area.</td>
</tr>
</tbody>
</table>
ASSESSMENT AND STRATEGY FOR SPEEDY EXPLOITATION OF THE PROVEN AND Viable MINERAL DEPOSITS

- Per capita consumption of mineral resources in India is one of the lowest in world.
- Identified resources have not yet fully exploited. Mineral potential remains underutilized for want of capital and appropriate technology.
- Necessary to assess and identify strategy to exploit discovered mineral deposits, particularly of deficit and scarce category.
- The strategy for speedy exploitation of proven and viable mineral deposit has to be envisaged keeping in mind the NMP 2008, Hoda Committee report, Strategic Plan document of MOM and Chawla Committee report.
- Strategic Plan document (of MoM) Vision is to Promote optimal utilization of India’s mineral resources for its industrial growth and socio-economic development, through scientific exploration, sustainable mining practices and geo scientific Research and development.
Strategy to achieve the goals for the speedy exploitation of the proven and economically viable deposits

- Country requires more sustained and intensive effort to augment the resource base as well as to improve the capability of exploiting the resources of marginal grades and tonnage by introducing modern technology and adequate fund flow
- Speeding up of exploration to augment resource base by synthesis of the available base line data
- Efforts should be intensified to convert resource base to reserve base by detailed exploration
- Convert the resources into reserves by undertaking feasibility and economic viability studies of the discovered mineral deposits
Reduce time lag between mineral discovery and eventual extraction

To ensure speedy clearance of mineral concession globally best, fair, transparent, and efficient process is required

Improvement in investment and technological flow can be achieved by implementing the new draft MMDR Act

States should facilitate mining activity by encouraging investors and entrepreneurs to invest exploiting the mineral wealth by improving infrastructure, easing tax laws wherever possible and by enabling the forest clearance process

State Government should immediately develop the capability for analyzing the generated data after exploration / prospecting and offering suitable prospects for competitive award. Since the State mining departments will be primarily responsible for implementing reforms in the proposed MMDR Act

Proper inventory of resource and reserves essential for planning mineral development
Efforts should be made to establish industries based on mineral near to the proven deposit wherever feasible, for speedy exploitation.

R & D activity to be intensified for exploiting the marginal grade ores, rejects and recovery of associated minerals by improving the scientific mining, ore dressing and beneficiation technologies.

Incentive should be given for using the equipment and machinery which improves the efficiency of mines.

Efforts to be made to promote small scale mining of small deposits in a scientific and efficient manner while safeguarding vital environmental and ecological concerns. Where small deposits are not susceptible to viable mining a cluster approach should be encouraged for grant of single lease to a geographically defined boundary to a consortium of small scale miners.

To encourage scientific mining and proper regulations in small and medium deposits mines it is essential that immediate steps should be initiated in association with the states to record the number of small mines and people engaged therein through extensive surveys. These mines under the ambit of a legal framework and then needs to monitor their activity.
➢ Thrust should be given for development of infrastructure for transporting minerals from pit mouth to user pint or rail head either by government or by Private Public Participation

➢ To encourage exploration and exploitation of mineral resource States should not insists on value addition. Though State Government wants to develop local industry based on availability of natural resources the location of industry is based on techno-economic decision.

➢ Effort should be made to ensure that States get a fair share of revenue levied for minerals extracted from their ground by adopting procedure which is on scientific lines and transparent as recommended in new MMDR Act and Chawla Committee report
Government will have to ensure that the costs of environmental impacts of the mining industry are not passed over to the community. This calls for:

- co-ordinated and integrated environmental management approach to the planning, management and use of all natural resources;
- Communities directly affected by mining should be enabled to participate in environmental impact assessments studies at the planning stage
- The implementation of effective and affordable measures and standards for environmental impact management, the prevention or efficient management of water, soil and atmospheric pollution, and the rehabilitation of areas affected by past mining operations;
- Ongoing research with a view to improving and strengthening the measures, standards and practice applied to managing the impacts on the environment and to control pollution.
- The mining industry will be required to reduce pollution and encouraged to promote a culture of waste minimization and creative recycling and re-use of waste products
Role of State Institutions in view of the National Mineral Policy – 2008

- There are a number of State Institutions are active in the field of mineral exploration related activities.
- GSI, MECL, IBM, State DGMs and AMD are some of the important organisations whose activities bear significant role in the Mineral Exploration in the country.
- The core strength of the different organisations are tabulated.
- GSI is implementing the HPC recommendations which involves, a changed Charter and Vision, cadre restructuring, mission mode functioning and many other issues.
- The restructuring of IBM and repositioning of MECL to harmonise with the NMP 2008 are also in process.
The Roles, Functions and Resource Base of the State DGMs

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>State</th>
<th>Role &amp; Function</th>
<th>Resource Base</th>
<th>Modernisati on Proposal</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Andhra Pradesh</td>
<td>Mineral investigation, exploration, processing of mineral concession applications, monitoring of production, collection of mineral revenue and development of Mineral based industries in the State.</td>
<td>344 (Technical) Theodolites, resistivity survey (geophysical) instruments and scintilometers; AAS, Flame Photometer, Jaw Crusher etc.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# The Roles, Functions and Resource Base of the State DGMs

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</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Karnataka</td>
<td>Geological and structural mapping; Mineral resources estimation; Environmental Impact Studies; Mining regulation; Mine revenue and royalty collection, etc.</td>
<td>65 (Tech) (including 33 Geologists) chemical laboratories and metallurgical laboratory</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Kerala</td>
<td>Mineral Exploration; granting of mineral concessions and collection of royalty; scrutiny of PL reports; convener of SGPB; extending mineral exploration service to Pvt. Sector.</td>
<td>15 Geologists Drilling machines, chemical laboratory and gem testing laboratory</td>
<td></td>
<td>10 more geologists and training of geologists in mineral exploration</td>
</tr>
<tr>
<td>7</td>
<td>Madhya Pradesh</td>
<td>Mining regulation and concession management.</td>
<td>54 (Tech) Chemical laboratory for analysis of limestone, dolomite, bauxite, iron ore, etc</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


Assessment of powers, roles, jurisdictions and limitations including overlapping of powers

- There is significant overlap in the activities of different agencies working in mineral exploration.
- To develop synergy in the activities of the different organization it is important that the structure and effectiveness of CGPB and SGPB is strengthened for mineral exploration programming in the Country.
- GSI and IBM have defined charter of functions, powers, roles and jurisdictions. However GSI need concentrate in developing National Map of aero-magnetics, geochemical and geophysical, besides the geological, baseline data. IBM needs to prioritise the development of online tenement registry besides its other functions.
- The State DGMs need to be strengthened with man power, equipment and skill sets either through Central assistance or through their own resources for implementing a far more extensive programme of mineral exploration and with the requirement of reassessment of reserves also with the reduction in the threshold value of 22 minerals.
- **Planning Commission must consider enhancing the Plan Funds allocation to the State DGMs for strengthening their detailed exploration and reserve estimation activities.**
Capacity Development of DGMs

- Setting up of laboratories for testing and, ore beneficiation studies.
- Creation of facilities and skilled manpower for large scale (more than 1:50 K) geological, geophysical, geochemical mapping.
- Setting up of Portals and Websites for geospatial data, mineral resource inventories, tenement data and mineral concession related data and online linking with IBM.
- Creation of mechanisms to prevent and detect illegal mining. Setting up facility for the study of remotely sensed data for detection of illegal mining and training of the DGM’s officials.
- Setting up of facilities for EIA/EMP and sustainable development studies.
- Creation of facilities for scrutiny and approval of prospecting and mining plans and mine closure plans. This needs to include management of mine closure events.
- Training and human resource development for mineral and mining sector.
- Reclamation of the abandoned mines causing environmental degradation.
Changes required in the functioning of the State Institutions in view of the NMP - 2008

- GSI need to collaborate and train the DGMs for baseline data generation,
- DGMs need to give a greater thrust on exploration; coordination with GSI on baseline data generation through CGPB/SGPB; and collaboration with Pvt. Ventures in prospecting and exploration. The resource base of the DGMs needs to be strengthened for taking up these activities on a more extensive scale.
- A percentage of the cess collected by the States, say 1%, needs to be dedicated for capacity development of the DGMs for an enhanced role in mineral exploration and mineral administration.
- MECL should also give adequate emphasis through Govt. funding for locating concealed & deep seated deposits through concept driven approach. This needs to be carried out in collaboration with GSI.
Changes required in the functioning of the State Institutions in view of the NMP - 2008

- Central agency like MECL need to continue with the detailed exploration of potential prospect through Government funding till such time the domestic private companies along with junior global companies are fully equipped into the serious exploration ventures in Greenfield areas.

- In the exploration ventures, especially in the Greenfield, close interactions with the reputed educational institutes may be highly beneficial for knowledge build up and induction of modern laboratory determination techniques.

- Utilization of low grade ores through proper blending and beneficiation techniques needs to be aggressively encouraged. IBM needs to take a lead in this regard.

- IBM needs to be strengthened to take up SDF monitoring, in mining industry / Regions, and regulatory authority in conjunction with MoEF.
Strategies for R&D and Improvement in Mineral Exploration

- Following the example of countries like Australia, Canada and USA who are highly ranked by Fraser, India needs to have a dedicated centre for R&D in Exploration.
- As the stress towards blind and deep seated deposits will need to increase, GSI and MECL in collaboration with academic institutes like ISM and IITs need to develop a centre for R&D in Exploration.
India fares poorly among mining nations in terms of score/ranking, “Mining Sector Reforms and Investment: Results of a Global Survey” and also in the Fraser Institute’s “Policy Potential Index.”

The investment inflow towards mineral exploration has not been satisfactory.

Globally, investment in mineral exploration is limited to select commodities which are (in decreasing order): gold; copper-zinc-lead-nickel; diamond; and platinum group. These are high value – low volume commodities.

India needs to encourage exploration and mining of such commodities through the initiative of private entrepreneurs. Barring reservation of sensitive areas, all area which have potential of hosting these commodities should be kept open for private investment.
Status and Review of private investment made and mineral exploration carried by Private Sector

- Investment made and exploration carried out by some important Private firms have been collated
  - Hindustan Zinc Ltd. (HZL)
  - De Beers India Private Limited
  - Rio Tinto India Pvt Ltd
  - Vale India Private Limited
  - Anglo - American Group
  - Adi Gold Mining Pvt. Ltd.
Constraints in attracting Private Investment in Exploration

- The necessary reforms for creating a conducive environment still remains to be developed

- **Central Government Policies**

  **Reservation of areas**

  Areas continue to be reserved for exploration by government agencies such as the GSI, AMD, CMPDI, DMGs, MECL and State Govt. Undertakings

  Thus private entrepreneurs are not only deprived of large areas of potentially attractive areas for conducting exploration, but are perceived as competitors by the state agencies that otherwise should function as facilitators.
Constraints in attracting Private Investment in Exploration

- **Risk Capital**
  In India, regulations do not permit ‘junior exploration companies’ to list on the stock exchanges, and consequently raise risk capital from the market. In this way, India is deprived of the services and benefits accruing from such entrepreneurs.

- **Fiscal Regime:** Globally the Indian mineral industry is one of the most highly taxed. To bring it at par with global standards is required for attracting investments.

- **State Government Procedures**
  *Security of tenure* is currently not guaranteed under prevailing regulations.
Strategies for facilitating private sector in mineral exploration

- Expeditious grant of concessions and simplification of procedures
- Transparency in the transactions
- Application of e-governance in the transactions
- Training capacity building / Strengthening of the State Directorates for taking up exploration.
- Seamless transition from RP to PL and PL to ML,
- Free transferability of concessions without prior approval.
- Healthy revenue and taxation policies.
- Scrapping of concept of reservation of areas and Healthy competition between the government/ private sector activities.
Alternate Strategy suggested by FIMI

- Confer status of ‘Standalone Activity’ on Exploration. States not to insist on Value Addition criteria for preferential processing
- Promulgate exclusive ‘Mineral Exploration Act’
- Mining leases will continue to be administered by state governments, but exploration activities to be administered by Ministry of Mines through IBM
- Instead of two stages (RP and PL) concessions, there will be single Exploration License (EL)
- There could be two types of EL
  - Large (100-5,000 sq km) EL of 5 year duration for high value commodities
  - Small (<100 sq km) EL of 3 year duration for bulk commodities
Alternate Strategy suggested by FIMI - Contnd...

- IBM will maintain Tenement Register, while GSI (in association with State Directorate) technical and scientific information, maps, data, reports, etc.

- Applications can be made to IBM online, and can be tracked electronically. This will introduce transparency in all dealings.

- Environment and Forest Clearance will not be necessary for EL.

- Concession holder would have complete freedom to choose exploration technique and methodology.

- GSI, IBM, DMGs would be facilitators, and be free to monitor progress of exploration, as well as to collect inputs for database.
Indian coastline is ~ 7500 km; total offshore area is 2.37 million sq km. (revised) as per law of the Sea, India has sovereign right over the EEZ including TW.

The Ministry of Earth Sciences (MoES) and its agencies are entrusted with the task of sea-bed exploration and mining. Cooperation between MoES and GSI is being institutionalized so as to achieve this objective within a time bound framework. The task of mapping out the extended economic zone will be expedited and completed within the time prescribed by the International Sea Convention so that no area of sea bed mining is lost to the country.
India is a pioneer investor and has been allocated a mine site of 150,000 square kilometers in Central Indian Ocean Basin for exclusive survey and exploration. Deep ocean resources represent an exceptionally large and potentially important mineral resource. Integrated systems for exploration, exploitation, mining and processing of these resources shall be expedited with the development/acquisition of necessary technologies. Appropriate mechanism for coordinating the survey and exploration of Deep Sea Bed Area will be established by the Ministry of Earth Sciences.

- Offshore surveys, search, assessment and evaluation of minerals are carried out mainly by government agencies like GSI, NIO, MOES and associated institutes, Indian Navy and ONGC

- Liberalization Policy of the Government of India opened door for investment and developmental activities in offshore area to private investors
Geoscientific activities of GSI - Offshore

The work encompasses baseline data collection (geological, geophysical), assessment of offshore mineral potential, geochemical scan for hydrocarbons, basic research and development in furtherance of understanding of various processes of earth science, industrial and port development, evaluation of natural processes and thereby mitigating the damages due to natural hazards.

- **Systematic Seabed Mapping:** Systematic seabed mapping (single beam bathymetric, magnetic and seabed sampling up to 2 to 3 m below sea floor) on reconnaissance scale within Exclusive Economic Zone (EEZ) is more or less complete (98%). Parametric Survey has been taken up to fill up the data gaps (Bathymetry, Magnetics, Swath Bathymetry, sampling, seismics, sidescan etc).
(1) Placer Mineral Resources: The resource evaluation survey has demarcated promising zones of 923 sq km in the east coast and 210 sq km area in the west coast. The heavy mineral suite is mainly represented by ilmenite, sillimanite and garnet (90% of the heavies) with minor amounts of magnetite, zircon, monazite, etc. Based on the work carried out, a total of 46 blocks of 5’ X 5’ were identified and the data provided to IBM for allocation of concessions to private investors.

(2) Sand resources: Investigations for relict marine sand within the TW and beyond have been carried out in the western offshore. Potential area of about 13750 sq km has been identified between Kollam (Quilon) and Kasargod on the basis of preliminary survey.

(3) Lime mud deposits: High grade of lime mud occurrences are found in water depth of 100 – 200 m off Andhra Pradesh and in water depth of 180 – 1200 m off Gujarat, and Andaman & Nicobar Islands.

(4) Phosphatic sediment: Phosphatic sediment (15 – 20% P2O5) found in water depths of 100 – 200 m south east of Chennai and in water depths of 200 – 1000 m and at a water depth of 350 to 550 m associated with lime mud in the offshore region of Gujarat.

(5) Manganese Nodules: Occurrence of manganese nodules has been reported from Central Indian Ocean.
Identifying the existing gap areas in geoscientific studies and promising mineral rich zones - Offshore

On examination of the work so far carried out, some of the gap areas in terms of information due to gaps in the technology and infrastructure identified:

- Multibeam bathymetry, magnetic survey and sampling in the Mid Oceanic Ridge in Indian Ocean and in the Andaman Sea.
- Investigation of Lime mud occurrences in the selected sectors in the Arabian Sea and the Bay of Bengal.
- Resource evaluation within the EEZ and beyond.
- Search for sulphides mineralization, ferromanganese and cobalt rich encrustation, phosphate rich sediments, lime mud deposits will be taken up.
- Identification of potential areas for gas-hydrate accumulation.
- Search for polymetallic nodules in selected sectors of Indian Ocean other than Central Indian Basin.
- Survey for offshore resources, mainly placer minerals and creating database of shelf and deep sea deposits and energy resources.
- Regional assessment of construction grade silica sand in Andaman & Nicobar Islands.
Strategy for offshore mineral exploration

Focus need to continue with seabed mapping in greater detail for identifying the promising mineral zones and to carry out regional and detailed exploration for the minerals in the identified mineral rich zones.

Work shall be carried by both State Agencies and the private investors.

GSI shall be identifying mineral rich zones along with the seabed mapping in the shallow water sector for placer minerals/ lime mud / phosphatic sediments etc and in deep water sector for Polymetallic nodules and hydrothermal deposits / gas hydrates / OTEC.

The MoES and NIO will concentrate in the deep sea sector of Central Indian Ocean Basin for identifying Polymetallic Nodules and Sulphide mineralisation as per their perspective plans.

As of now, offshore mineral exploration and mining can be prioritized for placer minerals which are available in huge quantity in the continental shelf, in particular in the inner-shelf along Orissa, Andhra Pradesh, Tamil Nadu, Kerala, Karnataka and Goa.

Efforts are on to Institutionalize of work related to Swath Bathymetry and offshore mineral investigations as per NMP 2008.
Offshore Areas (Development and Regulation) Act, 2002- gazette notification dated 7th June, 2010 notified

Draft guidelines for exploration to meet the requirement of UNFC criteria are prepared and are under finalization

To facilitate the Public sector / private sector to come forward to invest and develop the required infrastructure / technology for the offshore mineral exploration, the following measures by government may hasten the process:

• May provide consultancy services and training for entrepreneurs in the methods of exploration, infrastructure and capacity building
• Encourage introduction of special courses in Universities / Institutes for offshore mineral exploration.
• Encourage entrepreneurs to develop their own technical team and infrastructure with assistance from government, wherever required.
• Government agencies may continue preliminary exploration in new areas / extension areas.
• Develop technology for green methods of offshore mining, beneficiation, metal extraction, etc.
• While encouraging entrepreneurs to carryout exploration, mining and marketing of placer minerals, government may have mechanism in place to monitor the activities of the entrepreneurs to adhere to accepted practices of exploration, mining and marketing without damaging environment

Contnd….
Thrust areas for GSI in Marine Surveys during XII Plan:

- The major offshore activity components envisaged include mapping of seabed in near shore and offshore region, collection of parametric data on different themes, search for mineral and energy resources, environmental investigations in connection with coastal hazards like coastal and bank erosion, etc.

- The offshore surveys will receive new impetus with the induction of the replacement vessel for R.V. Samudra Manthan

- thrust areas identified are in conformity with the charter of GSI and cater to the needs and challenges of the nation, fulfilling the short term and long term socio-economic needs.

- **Deep Sea Sector**
  - Close grid seabed mapping (geological, geophysical and geochemical) along with multibeam bathymetry, multi-channel seismic, magnetic, gravimeter, side scan, deep core sampling, dredge, heat probe etc. within EEZ
  - The multibeam swath bathymetric survey within the EEZ is to be undertaken jointly by GSI and MoES under an MoU.
  - Search for sulphide mineralization in the Andaman Sea within EEZ and beyond in the Mid Oceanic Ridge System in the Indian Ocean.
The Ministry of Earth Sciences, a nodal ministry of Govt. of India is pursuing research and developmental work in respect of resources like polymetallic nodules, cobalt crusts and hydrothermal sulphides in Indian Ocean outside the EEZ of India.

India was recognized as first pioneer investor and allotted a site of 1,50,000 sq.km in the Central Indian Ocean Basin (CIOB) by Preparatory Commission of United Nations in August, 1987 for carrying out developmental work at the allotted Area. After detailed survey, India has relinquished 50% of the area to International Seabed Authority (establish in 1996 under United Nations Convention on Law of the Sea (UNCLOS) in phases as per obligation. India is one among the top 8-countries/contractors and is implementing a long–term programme on exploration and utilisation of Polymetallic Nodules.

Polymetallic Nodules Programmes:- The Polymetallic Nodules Programme of Ministry of Earth Sciences consists of four components, viz. Survey & Exploration, Environmental Impact Assessment, Technology Development (Mining), and Technology Development (Extractive Metallurgy).

Survey and Exploration: Detailed multibeam bathymetry survey was carried out. Considering all the existing data, an area of ~7860 km² has been initially identified for the First Generation Mine Site, containing 42 blocks (with 0.125 deg x 0.125 deg grid size); which had the best in abundance, grade and topography.
• **Survey and Exploration:**
  Detailed multibeam bathymetry survey was carried out. An area of ~7860 km² has been initially identified for the First Generation Mine Site, containing 42 blocks (with 0.125 deg x 0.125 deg grid size). Polymetallic nodules are copper, nickel, cobalt and manganese. The estimated resource potential in the retained area (i.e. 75,000 sq. km area in Central Indian Ocean Basin) is 380 mmt of polymetallic nodules. Abundance range in the retained area varies between 5 to 10 kg/m². Total metal content specifically Copper, Nickel and Cobalt is more than 2.5%.
  During 12th plan, the major activities under Survey & exploration would be carried out with the help of ROV to have micro-topography in selected blocks.

• **Technology Development (Mining):**
  Deep sea mining of polymetallic nodules from soft ocean floor at 5000 to 6000 m depth is a major technological challenge. NIOT has designed and developed a prototype shallow bed mining system capable of working up to a depth of 500 m. The Integrated Deep-sea Mining System has also been designed for a mining capacity of 25,000 tons per annum per module and nodule pick up rate of 8 tons/hour.

• **Environmental Impact Assessment (EIA) Study:**
  Environmental studies for mining of deep-sea polymetallic nodules were undertaken to evaluate the possible impacts of mining on deep-sea environment to fulfill one of the obligations of the country as a Pioneer Investor under the UN Law of the Sea.

**Technology Development (Extractive Metallurgy)**
A demonstration pilot plant with a capacity to process 500 kg nodules per day was commissioned successfully for extracting copper, nickel and cobalt at Hindustan Zinc Limited, Udaipur.

*Contnd....*
Activities proposed during XII Plan

- Survey would be carried out in all the known seamounts in the Eastern Arabian Sea for mapping the occurrence of multi-metal ferromanganese crust deposits, and sampling.
- Conducting necessary analytical/laboratory investigation to assess the metal enrichment in the deposits.
- Preparation of maps of seamount ferromanganese deposits in the Eastern Arabian Sea and estimating tentative resource values. Processing of the scientific data generated for preparing scientific manuscripts and technical reports

Comprehensive topographic survey of EEZ of India

- The project mainly focuses on mapping the entire EEZ of India using the state-of-the-art technologies of Multibeam apart from systematic sediment sampling and its analysis. The entire EEZ of India have been divided into two areas viz. deep water areas (> 500 m water depth) and shallow water areas (< 500 m water depth).
- Being entrusted to carry out mapping of deepwater regions of EEZ, National Centre for Antarctic & Ocean Research (NCAOR), an autonomous institute under Ministry of Earth Sciences, has so far completed an area of ~526000 km2. Around 40 sediment core samples also have been collected from the surveyed area. During the year 2010-2011, an area of ~79,700 km2 has been mapped using multibeam techniques.
INVESTMENTS REQUIRED FOR PROMOTIONAL EXPLORATION

- Mineral exploration is a high risk and high investment area of activity. Its success ratio depends much on the degree of investment, high sense of understanding of the favourable geological milieu of mineralization and the natural mineral/metal endowment in different crustal segments of the globe.

- The fast growing economies such as the “BRICS” (Brazil, Russia, India, China and South Africa) nations have been investing in their exploration ventures and have also opened up for encouraging the foreign investments.

- Some of the other nations such as Columbia, Chile, Peru, Quebec, Arizona and Western Australia have moved far ahead in attracting foreign investments in mineral sector by liberalizing their mineral policies, granting concessions in a very short time, giving incentives to the investors, bringing transparency in the administrative system and providing them high quality geological database.

- The other nations have to follow policies of these countries by the liberalizing their mineral policies in a more positive manner so as to attract more and more foreign investments.
There has been a continuous increase in the exploration expenditure except in the years 2002 and 2009 which have witnessed a decrease in the expenditure.

In the total world exploration spending of US$ 62.096 billion during 2001 – 2010, the shares of Latin America (25%), Australia (13%), Africa (15%), Pacific and South East Asia (5%), Canada (19%), US (8%) and the Rest of the World (including Europe, Middle East, Russia, CIS countries and countries of Indian Sub continent)(15%) have been US$ 15.481, 8.128, 9.432, 3.168, 11.595, 4.723 and 9.596 billions respectively.

The Latin America has registered the highest share percentage of total world exploration expenditure because of the liberal mineral policies of nations such as Chile, Peru, Brazil and Argentina which has resulted in encouraging and attracting the foreign investments.
World scenario in mineral exploration spending

- The McKinsey report has benchmarked Brazil(4), Chile(6) and Peru(7) amongst the 7 best practice mining geographies along with USA(1), Canada(2) and South Africa(3).
- The Parameters for these positioning have been financial, physical, policy and mining potential and key elements of policy and system. The exploration has been a common factor in all these parameters.
- The rest of the world including Indian Sub Continent have shown a positive trend even in 2002 when the whole world registered a negative growth in exploration spending.
- The years 2007 and 2008 have seen a sudden spurt of increase in the exploration spending globally.
- The North and South America share 35% of the world exploration expenditure during 2001 – 2010.
World scenario in mineral exploration spending

- The unique qualities of the policies of the countries highly ranked by Fraser Institute are:
  - granting small licences within 13 to 20 days for large mines typically in 30 days
  - on line system for applications and introduction of fixed timelines for processing of applications
  - single point agency for all approvals
  - providing strong infrastructural backup
  - developing Cooperative Research Centres with grants for the government
  - providing free on line access to geological and geophysical information
  - high rate of conversion of EL/PI into ML
  - fund provision under Exploration Incentive Scheme for encouraging exploration
To push forward the National Mineral Policy-2008 for encouraging the private sector investments in mineral sector, the government has initiated some measures amendments of the Mines and Minerals Regulation & Development Act, 1957, amendment of MCR, 1960 and the amendments of MCDR, 1988. process of e-dissemination of the geoscientific data by GSI, IBM and MECL sale of MECL exploration reports sustainable development of bio diversity with mining bringing transparency in the grant of mineral concessions by regular interaction of the Central and State governments inviting the private entrepreneurs in different government forum for interaction etc
Scale of private investment (including FDI) expected during XIIth Plan.

- Domestic private investment for exploration has remained insignificant in the country before and after liberalization.
- The liberalization process in the mining sector continued as a result the FDI cap for all non-atomic and non-fuel minerals has been fully opened upto 100% through the automatic route including diamonds and precious stones from February, 2006.
- From then onwards the FDI in the mining sector have been US$ 6.62 million in 2006-07, US$ 444.26 million in 2007-08, US$ 34.22 million in 2008-09 and US$ 86.63 million in the first half of 2009-10 i.e from April 2009 to September 2009 (Source: DIPP).
- To accelerate the FDI infusion the Government of India through Ministry of Mines has been interacting with Namibia, Argentina, Prospectors and Developers Association of Canada, Western Australia, Canada, Chile, South Africa, Iran, Thailand etc. through diplomatic channels, entering into MoUs, participating in and organizing exhibitions and investor’s meets.
Scale of private investment (including FDI) expected during XIIth Plan.

- Major foreign players such as De Beers India, Rio Tinto, Anglo American, Adi Gold Mining etc. are actively engaged in mineral exploration in the country

  **De Beers India** presently has 53 RPs over an area of 80,160 sq.km. It has an annual budget of US$ 2.0 million which translates into about Rs. 45 crores for the XIIth Five Year Plan Period.

  **Rio Tinto** has spent around Rs. 150 crores since 2002 till date in India on mineral exploration.

  **Anglo American** has spent US$ 5 million between 2001-2007 on base metal exploration.

  **Adi Gold** is an Indian subsidiary of M/S Pebble Creek Mining Limited, Canada intends to develop Ascot Deposit of Uttaranchal as a commercial mineral producer. It has invested US$ 13 million in India and Ascot till now.

  **HZL** has 8 RPs over an area of 4130 sq.km. Has provision for around US$ 50 million for five year period.

- It may be realized that even with the outstretched expectation of private sector contribution of US $ 1 billion for next five years the nation cannot fulfill the balance to reach the optimum level of spending of 4% of global spending on exploration.