

HIGHLIGHTS OF ACHIEVEMENTS IN SURVEY AND MAPPING AND MINERAL EXPLORATION DURING 10TH FIVE YEAR PLAN

1.0. SURVEY & MAPPING:

- 1440 sq.km. Systematic Geological Mapping on 1:50,000 scale
- 41,994 sq km of Specialised Thematic Mapping on 1:25,000 scale
- 1,30,816 lkm. Aero-Geophysical Multi-Sensor Survey
- 1,13,174.80 sq. km. Geochemical Mapping on 1:50,000 scale.
- 70,183.30 sq. km. Ground Geophysical Mapping on 1:50,000 scale.
- 15,878 l.km. of Bathymetric and 12,337 l.km. of Magnetic Surveys within EEZ of India.
- 15,140 sq km seabed-mapping within Territorial Waters

2.0 Highlights of the mineral findings are as follows:

GSI in its aim to augment the mineral resources of the country through concept oriented search and regional mineral appraisal involving multidisciplinary integrated approach, has established the following resources:

Gold

- A total of 50.44 million tonnes (m.t.) of Au resource have been estimated, based on the exploration carried out for the last 15 years, with an average grade of 1.92gm/tonne from Bhukia Gold Project of Banswara district, Rajasthan
- The investigation of gold at Parasi, Ranchi district, Jharkhand has established a resource of 1.51 m.t. of gold ore with an average grade of 2.47 g/t gold.
- In Pahardia block, West Singhbhum District, Jharkhand, gold ore resources have been established to 0.58 m.t. with an average grade of 3.73 g/t Au.
- Provisional resources of 0.132 m.t. with 2.09 g/t Au in Dugocha North block and 0.216 m.t. with 3.05 g/t Au in Dugocha Central block have been estimated in Udaipur district, Rajasthan.
- The analytical results of borehole (DCH – 18) indicated an auriferous zone of 4.14 ppm gold over a width of 8.25 m in addition to auriferous massive sulphides (9.5 m width 0.75 ppm gold) in Dugocha Main block, Udaipur district, Rajasthan.
- A provisional resource of 1.113 m.t. of ore containing 1.16 to 6.28 g/t Au in Dona South block and 0.098 million tonnes of ore averaging 3.85 g/t Au in Dona North block have been estimated in Anantapur district, Andhra Pradesh
- Gold ore resource of 0.293 m.t. with average grade of 2.00 g/t over a width of 1.79m has been estimated in Ajjanahalli East Block, Tumkur District, Karnataka.

Diamond

- Processing of 208 tonnes of weathered material from TK-4 kimberlite pipe, Timasamudram village, Anantapur district, Andhra Pradesh, yielded a total number of 507 gem quality diamonds weighing 133.13 carats. The biggest crystal weighs about 2.035 carats. The pipe, discovered by GSI, is 14 m in length with a maximum width of 6 m. explored upto 39 m till date.
- Two Kimberlite pipes (MNK- 3, 4) were identified near Kottala village and two more suspected bodies (MNK-5, 6) were identified near Chilakaladona and east of Buduru villages in Ibrahimpur – Mantralayam area, eastern Dharwar craton, Kurnool district; in Andhra Pradesh.
- Newly discovered kimberlite body (P-15) is located at about 300m north of P-2 kimberlite body of Wajrakarur – Lattavaram of Andhra Pradesh.
- Gem quality diamonds weighing 3.90 carats recovered from Pipe no. P-2 of Wajrakarur kimberlite field of Andhra Pradesh. Two diamonds weighing 0.13 carat and 0.04 carat respectively have been recorded from CC4 (Chigicherla) pipe in Andhra Pradesh.

- In Atmakuru and Penukonda blocks, Anantapur district, Andhra Pradesh, four new kimberlite pipes have been discovered near Timmasamudram village and P-14 close to Dibbasanipalle (a diamond weighing 0.02 carat was recovered from Bodesanipalli(P14).
- Ten small lamproite bodies have been identified in Ramadugu, Nalgonda district, A.P.
- Another Kimberlite body on the left bank of Tungabhadra River near the village Nadigadda Malkapuram in Kurnool dt., has been located.
- Several isolated exposures of KCR occur within a tectonic corridor at North of Basna, Mahasamund district, Chhattisgarh bounded by two lineaments trending NNE-SSW to NE-SW over a length of 7.5 km with an average width of about 250m.

Base metal

- A provisional resource of 1.32 m.t. of base metal ore has been proved with 7.6% Zn, 1.73 % Pb and 0.75% Cu, 131 g/t Cd and 77 g/t Ag in Muariya block, Betul district, Madhya Pradesh.
- An resource of 3.8 m.t. of gold-copper ore of possible category has been estimated with 1.53 ppm of gold and 1.18% copper in Dhani Basri, Dausa district, Rajasthan.
- A provisional resource of 5 m.t.(approx) of copper ore with average grade of 0.55% Cu and 25ppm Ag has been estimated in Baniwala-Ki-Dhani; 12.04 m.t (approx) with 0.39 % Cu in Dokan; 5.6 m.t. (approx) with 0.3% Cu in Dokan North; 1.93 m.t. (approx) with 0.28% Cu in Kundla -ki- Dhani, Sikar district, Rajasthan.
- A provisional resource of 0.80 m.t. with 0.5 % Cu in Gangas, Rajsamand dt, Rajasthan.

Platinum Group of Elements

- In Karnataka, investigation for Platinum Group Elements or PGE mineralization at Hanumalapura Block of Tavaregere – Masanikere - Magyathahalli area in the Shimoga schist belt, Davanagere district has established a resource of 0.294 m.t. of PGE ore with average grade of 1.79ppm over a width of 1.43m.

Iron Ore

- 37.42 m.t. of iron ore estimated in different blocks in Sundergarh district, Orissa.
- Iron ore body of maximum 200m strike length and width varying between 10m to 15m. having Fe content from 60.78 % to 65.50% was located in North-Western part of Tomka-Daitari belt around Pathuriapenth-Patherguda area in Kendujhar district, Orissa.
- In North- Western part of Tomka- Daitari belt around Burhipada- Madhyapur, Kendujhar district, Orissa, two massive hard laminated iron ore bands in Burhipada (100m x 8m) and in Pangaposi (300m x 50m) were identified having Fe content varying from 64.88% to 66%.
- Selected free hold areas for Iron ore, in the NMDC blocks, in parts of Sandur schist belt, Bellary district, Karnataka have revealed a BIF band (lateritic and biscuity) of 3.8 km strike length and width varying from 100m to 150m.

Manganese

- 6.7 m.t. of Mn-ore with 20-31.84% Mn in Sundergarh and Bolangir districts, Orissa.
- A provisional resource of 0.9 m.t.of Mn ore with 20%+ Mn has been estimated in Champasar-Bharatbahal blocks, Bolangir district, Orissa.
- An additional resource of 5.962 m.t.of manganese ores with an average grade of 27% Mn (at 20% Mn cut off) has been estimated in Pacheri-Lasarda sector, Kendujhar dt., Orissa.

Caesium

- 0.01m.t. of mineralised pegmatite with 1.02% Caesium (Cs) and 0.02m.t. of aplite with 1.27% Cs in Belamu and 1131 tonnes of pegmatite with 0.65% Cs (all at 0.3% cut off) estimated at Khatanga of W.B.

Coal and Lignite

- The geological resource of coal of the country stands at 255.17 billion tonnes at the beginning of 2007 and that of lignite at 37.570 billion tonnes till 01.04.2006.
- An additional resource of 14.168 billion tonnes of coal was established from Sohagpur and Singrauli coal fields, Madhya Pradesh; Talcher and Ib coal fields, Orissa; Birbhum and Raniganj coal fields of West Bengal; Rajmahal Coal fields of Jharkhand and Tatapani-Ramkola Coal field of Chattisgarh, etc.
- An additional resource of 1249 million tonnes of lignite from Tamilnadu, Gujarat. and Rajasthan were established.

Clay

- 18 m thick good quality residual clay and upto 5 m thick sedimentary clay established in Kasargod district of Kerala. An additional resource of 2 m.t.of combined residual and sedimentary clays of refractory grade has been proved in sub-block – 1 of Palai A block, Kasargod district, Kerala.
- A resource of 1.9 m.t. of sedimentary clay and 1.93m tonnes of residual clay has been estimated in Klayikode block, Kasargod district, Kerala.

Limestone

- 1883.535 m.t .of limestone of probable resources of all grades have been estimated from Litang Valley, Jaintia Hills of Meghalaya (816.595 m.t. in Larket Block, 535.94 m.t. in Jalaphet Block and 531m.t. from Lamsortoh & Um-maju blocks).
- In Tamil Nadu exploration for limestone in Vriddhachalam Sub-basin near Patti and Senkurichi - With an overburden ratio of 1:1 a resource has been estimated as 13.64m.t. and without overburden ratio a resource has been estimated as 48.33m.t.

Bauxite

- 5.704 m.t of bauxite all grades (35% to 60% Al_2O_3) in Ratnagiri district, Maharashtra. .

Graphite

- In Tamil Nadu in Sivaganga Graphite Belt - a resource of 1.08 m.t. of graphite (Fixed Carbon average 15%) over a strike length of 800m, width of 30m and up to a depth of 30m has been estimated.

Barytes

- A new potential block for bedded barytes was located about 4-5km SE of Mangampeta mine in Pullampet sub-basin in Cuddapah district, A.P.

Dimension stone

- 1.09 million cu. m. of black, 6.6 million cu. m. of white and 15.34 million cu. m. of green varieties of dimension stone granite in 11 prospects of Orissa.

3.0. SPECIAL INVESTIGATION

i) Geotechnical Investigation

- 1004 investigations under 198 projects of Geotechnical and engineering geological studies have been undertaken for effective planning and execution of civil engineering projects for water resource management/ development/ creation of communication network, transport and other infrastructural facilities.

ii) Landslide Hazard Studies

- Geological Survey of India, being the 'Nodal Agency' for landslide related studies, was engaged in:

- Landslide Hazard Zonation mapping in Sikkim Himalaya; Lunglei town area, Mizoram; along the NH-39 between Kohima (Nagaland) and Imphal (Manipur); Ramganga Basin and Ranikhet Town of Chamoli and Almora District, Uttaranchal; Ravi Basin, Chamba District and Shimla, Himachal Pradesh etc..
- Landslide inventories of several landslides in Sikkim Himalaya, Darjeeling Himalaya, in Meghalaya, Mizoram, Nagaland, Manipur, Arunachal Pradesh, Assam, Tripura, Madhya Pradesh and Maharashtra were prepared.
- Site specific Landslide studies in Sonapur in Meghalaya and Paglajhora in Darjeeling District, West Bengal.
- As a part of landslide hazard risk mitigation programme the primary node was allotted to GSI. The DMS Control Room to be operational on 24 X 7 basis and to be connected to the Disaster Management Support Network is under construction at New Delhi Office, GSI.

iii) Earthquake Geology

- Seismic Microzonation studies taken up around urban areas;
- Completion of seismotectonic map;
- Active fault mapping and related hazard studies in Himalayan, Narmada and Kutchch areas.
- Conducted multi-institutional first level Seismic Hazard and Risk Micro-zonation (SHRM) studies in Jabalpur, M.P. and reports / maps released.
- First level Delhi mirozonation studies completed and report/ map published.
- Updating of all India earthquake database up to the year 2005.
- Taking over of Broadband Seismic Observatory, Nagpur from IMD.
- Signed MoU with IMD for integration of seismological observatories in India under national seismological network.

iv) Environmental Geology

- 176 geo-environmental investigations comprising geo-environmental appraisal, geo-environmental impact assessment and studies on natural hazards and geomorphic processes covering public health and landslide issues carried out
- Under DOVEMAP programmes, appraisal of mineral/natural resource potential for rural development on Cadastral map carried out in 35 villages of Maharashtra.
- Completion of Indo-French collaborative research project on water quality of Subarnarekha Basin.
- Conservation of Ajanta and Ellora and other important monuments in and around Maharashtra and Madhya Pradesh
- Coastal dynamics studies along beach area of West Bengal and Orissa.

v) Geothermal and Glaciology

- Geothermal studies continued in J&K and Chattisgarh.
- GSI generated database on glacier mass balance, flow hydrometric and secular movement, recession studies, snout monitoring and also the maximum and minimum ablation.

4.0 LABORATORY STUDIES, RESEARCH AND DEVELOPMENT

- Commensurate with the scientific and technological advancements, GSI accorded high priority to laboratory studies and R & D efforts to back up the extensive fieldwork. Ultra level precision in detection is basic necessity in such studies. GSI initiated the process to procure essential sophisticated state-of-the-art equipment as a part of modernisation to strengthen chemical, petrological, geochronological and other laboratories.
- Set-up of laboratory for isotopic studies of environmental samples.
- GSI for the first time recorded the oldest age (3562 +/- 2 Ma) from any Indian rock. Besides this also solved age problems of many significant rock types.

- Studies revealed that high arsenic zone in parts West Bengal has a definite link with palaeochannel pattern and siderite concretions are the major contributor of the arsenic in the aquifer sand.
- Many research projects undertaken in Palaeontology Laboratory to understand the nature of evolution and diversification of early lives. In this context, discovery of land plants from Indian Gondwana and early mammalian tooth from Andhra Pradesh opened up a new field of palaeontological study.
- Microgravity and magnetic measurements carried out in North Eastern Parts of India for deciphering deep crustal structure in the region.
- A detailed analysis to estimate three-dimensional seismic velocity structure of the crust and upper mantle up to a depth of 60 km beneath NE India by using Local Earthquake Tomography (LET) method.
- CBM study on samples of coal seams intersected at different boreholes in Rajmahal – Birbhum Master Basin has indicated that the gas content ranges from 1.39 to 8.6 cum/ton.

5.0 DISSEMINATION OF DATA

- **Project Digital Archive remained one of the thrust areas during this period.**
- The project 'GSI Portal' is under progress for knowledge management and business process integration through Intranet and extranet. GSI Web site (www.gsi.gov.in) disseminates updated information including recent findings
- **Geological maps on 1:50K are under the process of digitisation after compilation for seamless integration in future. Out of a total compilable 4751 sheets of geological maps on 1:50,000 scale covering the entire country, 4696 Nos. of sheets have been compiled.**
- 61 nos. of Geological Quadrangle Maps published totalling 282 out of 334 (amenable).
- 15 sheets of Sea Bed Maps have been digitised bringing the total to 26 out of 50 sheets.
- Geological and Mineral map – 7 sheets ;
- 90 nos. of District Resource maps published totalling 296.
- Revised Gravity Map of India (1:2 M) published
- Sea Bed Sediment maps of EEZ of India – 11 sheets printed.
- Geomorphological, Metallogenic, Geochronological, Seismotectonic Map of India (1: 2M) and Mineral Map of India and adjoining countries (1:7.5M) completed.
- The geoscientific data acquired from various field and laboratory-based investigations are disseminated which include Records, Memoirs, Special Publications, Miscellaneous Publications, Bulletins, Monographs, Palaeontologia Indica, Indian Minerals, "GSI News" and Brochures.
- The programmes of core library, involving systematic preservation of cores, their proper documenting and preservation for future use, are progressing satisfactorily.

6.0 TRAINING

- GSI Training Institute conducts training in various disciplines of Earth Science. Besides, this also conducts customised courses for other organisations on demand.

7.0 INTERNATIONAL ACTIVITIES

- GSI is nodal agency for implementation of monitoring of IGCP Programmes
- Important ongoing bilateral activities include Indo-BRGM, Indo-South Africa and Indo-Netherlands.
- GSI rendering geological assistance and supervisory guidance for Tala Hydro Electric Project, Bhutan during its various stages of construction.
- GSI successfully organised the 4th GEOSAS and released proceeding volume (55 scientific papers)
- MOU signed for Indo-Canadian Collaborative Programme.
- Joint Inspection Team undertaken investigation in mining areas around Indo-Bhutan border to assess the quality of water system in mining area and adjoining tea gardens of North Bengal.

8.0 ANTARCTICA EXPEDITION

- GSI participated in the XXII, XXIII, XXIV and XXV Antarctica Expeditions. Geological mapping of about 2000 sq. km. and STM of 600 sq. km.; Also monitored iceberg movement. XXVI Antarctica Expedition has been launched on 9th November 2006. Work is in progress.

9.0 INTERNAL RESOURCE GENERATION

- GSI has generated approx Rs. 71.17 crores towards Internal Resource Generation.

10.0 MODERISATION

Major laboratory equipment / instruments (Geological, Geophysical, Chemical, Marine etc.), drilling rigs and accessories procured during the X Plan period is encapsulated below;

Geological :	Advance Research Polarising Microscope; Stereo Zoom Research Microscope; Trinocular Polarising Microscope; Magnetic barrier Lab Separator; Scintillation Counter Spectrometer; Induced Polarising Probe; Gas Source Mass Spectrometer; XRF Spectrometer; TL Dating; UVVS Spectrometer , TG/DTA/DSC; XRD, High Capacity Alumina Ball Mill
Geophysical :	GPR; EM Ground Conductimeter; DGPS; GPS; RG Micro Logger; Terraloc MK-6; Absolute Gravimeter; Shearwave Velocity Logger; MT Equipment
Chemical :	ICP- MS; ICP-AES; Graphite Furnace Hydrate Generator; Graphite Furnace Auto Sampler; UV VIS Spectrometer (Double Beam); XRF; AAS; DC Arc; CHNS Analyser; Ion Analyser; Standard Reference Matenals(SRM); Protace Software; Microwave Digester; Microwave Digestion Pressure Vessel; Fusion Bead Machine; Portable Multiparameter Water Analytical Kit; Single Beam Operate Spectrometer
Marine :	Cesium Magnetometer ; Marine Magnetometer; Marine Graphic Recorder; Gas chromatograph with head space sampler; HPLC; DTA; Mercury Analyser; Current Meter; Particle Size Analyser
Drill Rig & Accessories	1000m Drill Rig; Triplex Pump; Duplex Pump; NQ Wire Line Drill Rigs; BW Right Hand Drill Rod; Liquid Polymer; Core Barrel (116 mm & 76mm)
IT	GSI is establishing WAN to ensure internet connectivity, communication and collaboration using IP telephony and video conferencing. GSI enterprise portal will disseminate updated information to employee and public regarding all activities., services and products of GSI through the portal metadata bases. System Requirement Study (SRS) for development of GSI PORTAL was completed. Master data preparation for development of GSI PORTAL and its designing is being continued. The User Accepted Testing (UAT) of the various modules of GSI PORTAL is also in process.

Several high-cost items viz Blue Water Research Vessel, Geotechnical Vessel, Coastal Launch, Heliborne Survey Systems, Fixed Wing Aircraft with Time Domain Systems were also planned to be inducted as a part of the modernization programme of GSI during the X Plan, apart from the various field survey and laboratory instruments. Due to the extremely complex procedures for the procurement of such very high cost instruments, including various stages of finalisation of technical specifications through interaction with various manufacturers and consultants, mobilising resources, etc., most of these procurements could not be concluded with the X Plan period, although significant progress has been made.