

CHAPTER II

GSI TODAY



2.1.0. Introduction

2.1.1. The Geological Survey of India (GSI) now functions under a charter, which was formulated for the first time in 1974, as a sequel to the Subramanyam Committee report (1971), and this charter identified 14 main functional activities. The Charter was last revised in June 2003 in line with recommendations of the Varma Committee. The principal functions of GSI as laid down in its Charter are:

- Preparing and updating geological, geophysical and geochemical maps of the country and its offshore area.
- Exploring and assessing mineral and energy resources of the country and its offshore areas.
- Systematically exploring the shallow subsurface domain of the country and developing and maintaining national drill core libraries and documentation centers.
- Conducting research in Earth sciences and promoting application of the new knowledge for effecting management of the Earth system and its resources.
- Fostering and promoting the understanding of geological knowledge to reduce risk to life and property from geological hazards and addressing societal issues to enhance quality of life.
- Creating and maintaining earth science databases and acting as a national repository of earth science data generated by various organizations and disseminating these in public domain for developmental, educational and societal needs.
- Holding, protecting and maintaining collections of rare and representative geological materials as national geological monuments, museums and parks.
- Representing India in international bodies, participating in international collaborative scientific projects and developing data sharing networks with other countries.
- Providing consultancy services and undertaking commercial projects in the country and abroad.
- Undertaking such other activities, including training, as may become necessary in the light of developments in the field of Earth and planetary sciences and related subjects.
- [Reprinted from the Gazette of India: Extraordinary, No. 146,
- June 13, 2003, Part-1, Section-1 Pages 1-2]

2.1.2. GSI's work encompasses practically the entire gamut of Earth science activities reflecting the broad nature of responsibilities envisaged for it. Earth science by its very nature is highly multi-disciplinary and the scale and diversity of human activity makes it essential that GSI, in order to remain



relevant, has to factor in very challenging requirements into its organizational structure and its capacity human as well as scientific. The degree to which GSI is able at once to specialize as well as to develop multi-disciplinary knowledge is crucial for it to remain relevant.

2.2.0 Organisational Structure

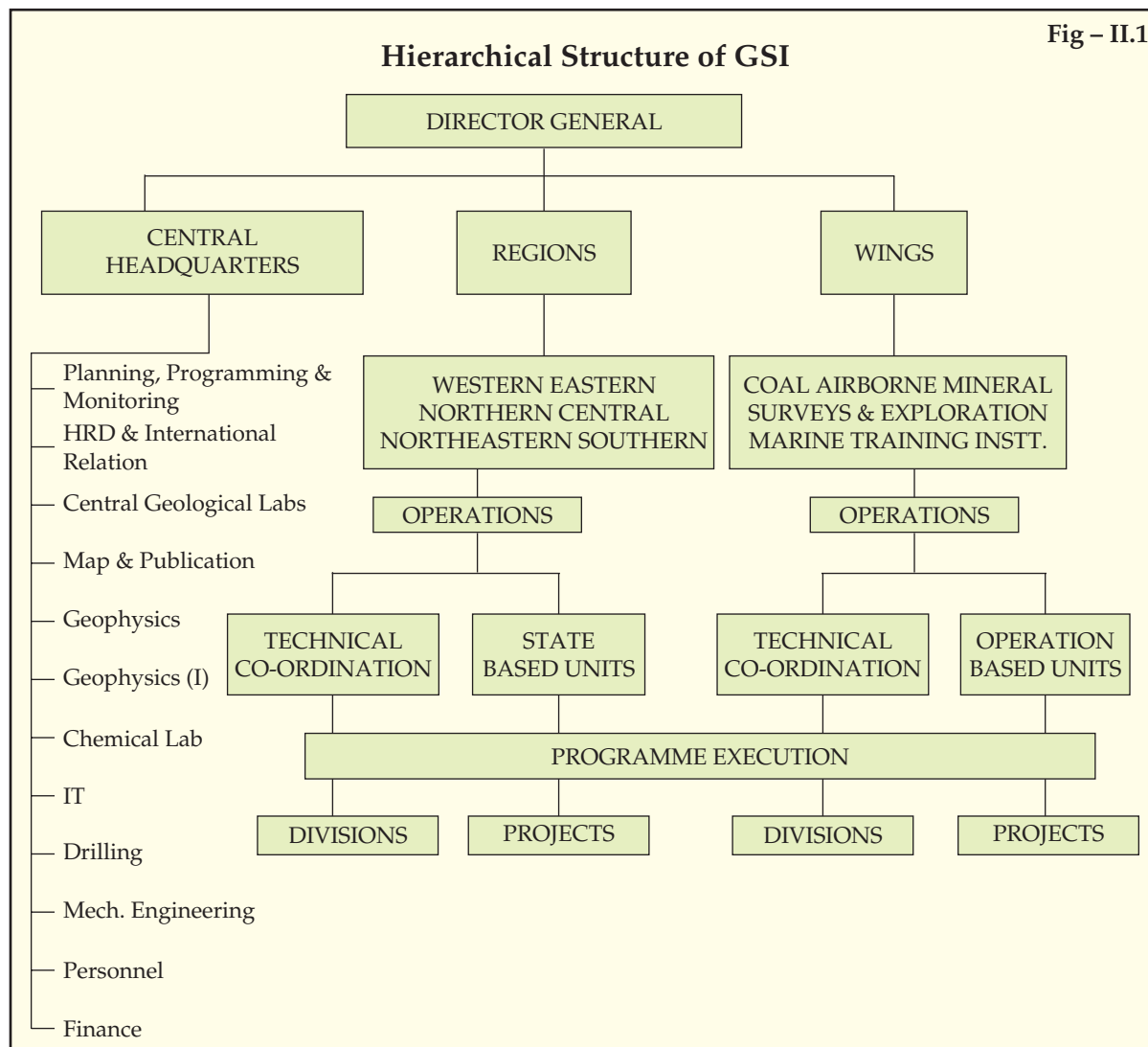
2.2.1. The Geological Survey of India is formally a subordinate office of the Ministry of Mines, but has considerable operational autonomy due to the scientific nature of its work. The organizational structure of GSI is already substantially oriented to meet the needs of specialization as well as multidisciplinary study. This has been achieved organizationally by creating multi-disciplinary Regional Units with Operational sub-units on the one hand, and through a system of separate specialized 'Wings' which interact with the Regional units on the specialized subject matters to the extent necessary.

2.2.2. The Director General (DG) as the head of the GSI has the overall responsibility of planning and execution of programmes of the organization. The DG, GSI is supported at the Central Headquarters (CHQ) by 12 Sr. Dy. Directors General/Dy Director Generals (DDG), as in-charge of Policy & Planning, International Relations & Human Resources, Central Geological Laboratory, Information Technology, Map & Publications, Finance and Personnel, etc. There are six regions (geographically based) and three specialized Wings (activity based) for programme execution. Senior Deputy Director General/Deputy Director General (HAG/SAG level) head each of these Regions/Wings and function as "Head of Department"(HOD) to oversee the formulation and implementation of annual programmes, exercise budgetary control, allocate resources, determine the relative priorities and effect executive and other controls on Divisions/Projects within the Regions/Wings. Each Region/Wing has a headquarter unit for planning, finance and administration. Operational units at State level, headed by a Deputy Director General, execute the programmes in the field.

2.2.3. The Wings are headed by a Sr. Deputy Director General/Dy. Director General, have operational units located in areas of interest based on the specialization of that Wing.

2.2.4. The Operational Units of the Regions and the sectors of the Wings are further divided into Divisions headed by Directors. Unlike the Operational unit, the area jurisdiction of the Division is not fixed, but varies with the programme under execution. Multi-disciplinary activities are generally taken up in a 'project' mode by pooling resources at the operational level. A generalized hierarchical structure of GSI is presented below (Fig. - II.1):

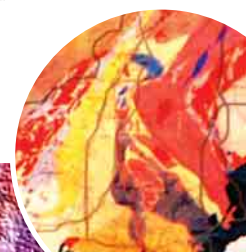
2.2.5. The officers heading the Divisions and Projects initiate action for programme formulation, coordinate the approved project work, evaluate and analyze the data, interact with other disciplines and supporting streams and finalize the scientific and technical reports. The scientific manpower staffing the Division/Project is determined on the basis of the work programme of the field parties actually engaged in data collection at the ground level and in laboratories, synthesis and preparation of reports and bringing out publications. The support resources to the geological investigations are provided in-house, from complementary disciplines like geophysics, chemistry, drilling, mechanical engineering, materials management etc. at regional and operational levels. The support services have separate cadres and overall management is with the Central Headquarters, with a Deputy Director General each in charge of Support and Technical Services (STSS) and Engineering Services. Mechanisms for periodical review at different management levels exist to ensure programme implementation and monitoring.



2.3.0. Organizational Setup:

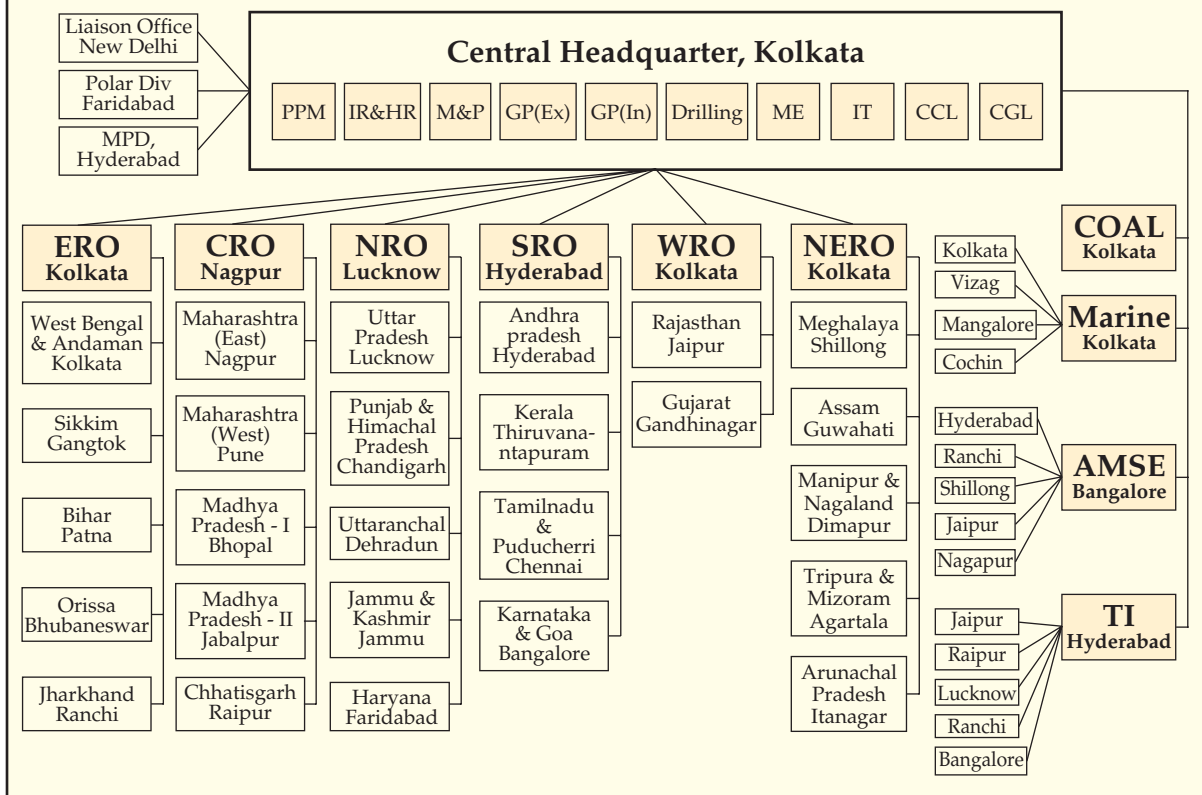
- GSI has its Central Headquarters at Kolkata and six **Regional offices** (geographically based) at Kolkata, Shillong, Lucknow, Jaipur, Nagpur and Hyderabad.
- There are three **Specialized Wings** (activity based) viz., Coal, Marine, Airborne Mineral Surveys & Exploration (AMSE) with headquarters at Kolkata, Kolkata and Bangalore and also a Training Institute at Hyderabad.
- GSI's operational units are located in thirty-three cities/towns spread throughout the country, mostly State Capitals except at Aizwal, Delhi, Kohima, Imphal, Port Blair, Panjim and Shimla.

2.3.1. Fig. II.2 below provides location of CHQ, Regional/Wings and Operational Units: (Note: Under SRO 'Puducherry' and Goa are to be included alongwith Tamilnadu and Karnataka, respectively. This figure depicts the geographical location of the offices of GSI under different regions and wings and needs modification to depict the operational locations.) and Fig. II.3 depicts set up of Region/Wings and Operational Units.



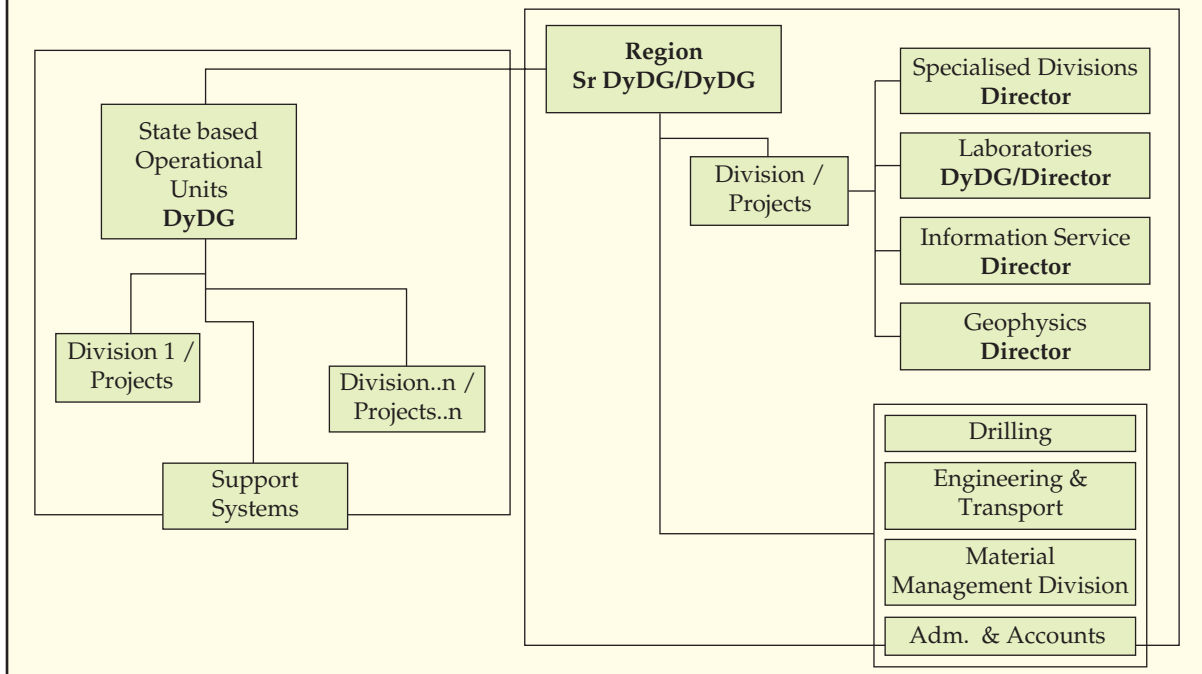
**Locations of Central Headquarter,
Regional/Wings Headquarter and Operational Units**

Fig – II.2



Regions/ Wings and Operational Units - Set up

Fig – II.3



2.3.1. GSI Liaison Office – New Delhi: Liaison Office of Geological Survey of India acts as a camp office of D.G., GSI. The work assigned to Delhi Liaison Office comprises Co-ordination, representation and interaction with the Ministry of Mines, DST, Planning Commission, Ministry of Defence and other Central Government Departments/ agencies on issues related to GSI activities. Accordingly:-

- Head of the Office represents GSI in the various meeting in Ministry of Mines and other Departments at New Delhi in matters such as programme formulation, personnel policy etc.
- A Cadre Management Cell was set up in the Liaison Office in February 1998 to coordinate the career progression policy issues of Group A and B services and HR related matters.

2.4.0. Programming:

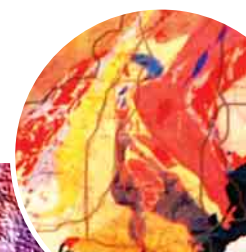
2.4.1. All the programmes of GSI are guided by the Government policies and directives and follow the recommendations of the ongoing Five-Year Plan document. The GSI has evolved a mechanism for formulation and detailing of the programmes in the Earth science area, through close co-ordination between GSI, stakeholder Ministries and Organizations and State Geological Departments to avoid duplication of work and ensure synergy. The principal mechanism for this is the Central Geological Programming Board. State Level Programming Boards provide inputs from the State Departments of Mining and Geology while subcommittees of the Central Board provide the inputs from within GSI (including special programmes) as well as from stakeholder Ministries and Organizations. The consolidated programme, prioritized on the basis of resources available, is brought before the Central Geological Programming Board (CGPB) which sets out the final programme for the ensuing field season, State-wise and activity-wise.

2.4.2. The Central Geological Programming Board was set up on 27.07.1966 by a Government resolution with the objective of:-

- (i) Coordination and evaluation of programmes of various departments and organizations engaged in geological activities.
- (ii) Definition of priorities of exploration projects in relation to national development plans.
- (iii) Making arrangements for the training of Geologists, Drilling Engineers, Mining Engineers, etc.
- (iv) Review and advising Government on various steps which would lead to speedier exploration of essential minerals.

2.4.3. The composition of the Board has undergone minor changes from time to time. The National Mineral Policy, 2008 has called for revamping of the CGPB to ensure that the programmes taken up are in line with national policy goals and take into account the exploration work undertaken by the Private Sector. Accordingly the CGPB has been revamped through a Resolution No. 4[2]97-M.I dated 12th March, 2009 which takes into account many of the relevant concerns being brought out in this Report. The main changes are:

- The Composition has been made more broad based to include the range of public institutions engaged in geoscience and also to increase representation to the Private Sector.
- A full time secretariat is envisaged for the CGPB



- 10% of GSI's Plan Schemes budget will be earmarked to cater to State level priorities
- The 7 Sub Committee have been expanded to 12 Committees with wider participation. New Committees have been constituted on 'Geoinformatics', 'Fundamental and Multidisciplinary Geoscience', and 'Geoscience for sustainable development'.

2.4.3. Presently the Board meets annually to approve the Annual (Field Season) programmes and to resolve coordination issues and implementation problems but is now expected to meet twice a year.

2.5.0 Range and Volume of Activities

2.5.1 GSI's activities are currently organized around seven Plan schemes:

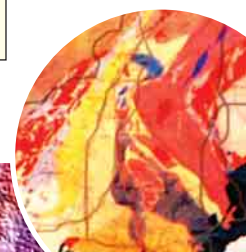
<i>Schemes</i>	<i>Components/Activities</i>
● Survey & Mapping	: Specialized Thematic Mapping, Geochemical Mapping, Geophysical Mapping, Systematic Geological Mapping, Airborne and Marine Surveys.
● Mineral Exploration	: Exploration for coal (including lignite), gold, base metal, diamond and other minerals
● Specialized Investigation	: Geotechnical, environmental, landslide related studies, earthquake & seismological, glacial, geothermal and desert geological studies.
● Research & Development	: Research work on petrology, palaeontology, geochronology, (Including Antarctic & Arctic exploration) chemical, geophysical and other photogeological and remote sensing studies and Antarctic & Arctic studies.
● Information/ Dissemination	: Map compilation, Publication on various Earth science subjects, Information Technology
● Human Resource Development	: Training
● Modernization	: Acquisition and replacement of instruments/equipments

2.5.2 To get an idea of the nature and extent of GSI's recent work, its activities and achievements during the Xth Plan are given below in Table - II.1:

Table – II.1

GSI-Activity Domains and Achievements During 10th Plan Period

S.No.	Name of the Scheme/Project/ Programme	Plan Target	Programme Target	Achievement
1. Survey and Mapping				
	a) Ground Survey			
	i) Systematic Geological Mapping (Sq. km.)	—	1350.00	1440.00
	ii) Special Thematic Mapping (Sq. km.)	35000.00**	42894.00	41994.00
	iii) Geochemical Mapping (Sq. km.)	125280.00	110339.20	1,13,174.80
	iv) Geophysical Mapping (Sq. km.)	110000.00#	71999.35	70,183.30
	b) Aerial Survey			
	i) Multisensor/Aeromagnetic Survey [with Twin Otter (line km)]	140200.00	143269.00	130816.00*
	c) Marine Survey			
	i) Parametric Survey within EEZ and beyond	39 Cruises	39 Cruises	36 Cruises
	1. Bathymetric Survey (line km)-		26520.00 + sponsored cruises	15,878+ sponsored cruises
	2. Magnetic (line km)-		39300.00 + sponsored cruises	12,337+ sponsored cruises
	ii) Territorial Water (sq. km.)	79 cruises	69 cruises include 15285.00+ parametric surveys	67 cruises include 15,140 + parametric surveys
II. Mineral Exploration				
	a) Large-scale Mapping (Sq. km.)	5000.00**	5717.75	6000.32
	b) Detailed Mapping (Sq. km.)	150.00	148.14	164.11
	c) Drilling (meters)	487500.00	438205.54	411728.50
III. Specialized Investigation				
	[Geotechnical, Earthquake Geology & Seismology, Geoenvironment, Glaciology, Geothermal, etc] (in Nos.)	450	472	468
IV. Research & Development and Other Exploration				
	[Antarctica] (sq. km)	5000.00	5000.00	2050 + 850***
	Research (No. of Investigation)	300	338	338
V. Information Dissemination				
	(Map Publication, Information Technology, etc.) (in Nos.)	200	231	231



S.No.	Name of the Scheme/Project/ Programme	Plan Target	Programme Target	Achievement
VI. Human Resource Development				
	Training (in GSI TI) (No. of courses)	150	172 types (219 courses)	170 types (213 courses)
VII. Modernization and Replacement @ Actual Expenditure Rs 139.10 Crores				

- # The target has been modified considering necessity of coverage on a larger scale with station density of 1 in 2.5 sq. km.
- * Flying Season: October - March
- ** Target modified based on existing manpower
- *** In Antarctic Research, Thematic Mapping taken up on 1:25,000 scales instead of 1:50,000 scale
- @ Total approved plan outlay Rs. 285.00 Crores.

2.6.0. The XI-Plan Work Envisaged for GSI:

2.6.1. GSI's work envisaged for the XI Plan including targets is given below and this gives an idea about the GSI's current activities.

❖ Basic Earth Science data generation:-

- **Specialized Thematic Mapping:** Out of the total target of 2,40,000 sq. km at the initiation, 1,25,508.5 sq. km has already been covered up to X Plan Period. During the XI Plan 35,000 sq km is planned to be covered.
- **Geochemical Mapping:** Out of the total mappable area of 3.146 million sq. km of the country, the prioritized target area has been narrowed down to 13,30,000 sq. km after excluding Deccan Trap covered terrain and inaccessible Extra-Peninsular Region. Up to the end of X Plan, 1, 13,174 sq. km has already been covered. During the XI Plan 1, 80,000 sq. km (250 toposheets) is planned to be mapped.
- **Geophysical Mapping:** Systematic Geophysical Mapping on scale 1:50,000 has been planned with an average station density of one station for 2.5 sq. km over the entire shield area, Indo-Gangetic Plains, the Eastern and Western Ghat areas including coastal plains and other covered areas. Inaccessible areas of the Extra-Peninsular region are expected to be covered by Heliborne Survey. Out of the total priority targeted area of 12, 39,683 sq. km, around 70,183.3 sq. km has already been systematically covered up to X Plan. An area of 84,000 sq. km is planned to be completed in XI Plan. (XI Plan document - Target: 2, 40,000 sq. km.; but now reduced due to reduced manpower.)
- **Airborne Survey:** A state-of-the-art Heliborne Survey System (HSS) fitted with sensors like Gravity, Time domain electromagnetic, magnetic and radiometric along with hyperspectral camera is being procured in this Plan period for initiation of low altitude high resolution survey. With this and the present Twin Otter Airborne Survey System (TOASS), GSI plans to survey 76,000 sq. km (TOASS) and 1,500 sq. km (HSS), respectively.

- **Marine Survey:** The commissioning of a new deep-sea vessel (as replacement to the existing one) and geotechnical research vessel with state-of-art equipment, towards the end of the XI Plan period will impart a new thrust for faster completion of the envisaged target in respect of high-resolution mapping of the seabed in near-shore and offshore areas, search for mineral and energy resources, studies related to natural hazards like tsunami and storm-surge coastal erosion, monitoring of Andaman (Barren Island) Volcano, and sponsored coastal geotechnical investigations. The target set for marine survey are as follows : R&D in deep sea -150,000 sq. km and in territorial waters - 8500 sq. km, Mineral Exploration (EEZ and beyond) - 20,000 sq. km and in territorial waters – 5000 sq. km, Geotechnical study – 1000 sq. km., Environment study – 500 sq. km.
- ❖ **Research and Development :-**
 - During the XI Plan, a total of 202 project items are to be undertaken. More research activities in priority mineral sector, aimed at developing concept-oriented exploration and ore deposit modelling and problems in Indian geology, detailed characterization of all important geotectonic/ metallogenic/orogenic belts of India, crustal evolution, preparation of Standard Reference Samples to be used for National Geochemical Mapping (NGCM), mineral exploration and other activities etc are also planned to be undertaken.
- ❖ **Natural Resource (Mineral) Survey :-**
 - The exploration activity planned in this period include preliminary prospecting in identified mineral belts followed by regional exploration in potential blocks for resource estimation in base metal, gold, Kimberlite (diamond bearing) pipes, PGE, phosphorite, apatite and iron ore. An area of 20,000 sq. km for diamond exploration and 8000 sq. km for other mineral explorations are also planned.
- ❖ **Natural Resources (Energy):-**
 - In view of the accelerated demand from the energy sector, top priority has been accorded to cover the balance potentially coal-bearing area (up to a depth of 900m) by regional exploration within the next 5 to 6 years in order to augment the resource base. 1133 sq. km area for coal and 1053 sq. km area for lignite exploration is targeted in this Plan period. In addition, 20 boreholes will be studied for Coal Bed Methane (CBM) exploration. For underground coal gasification and coal-to-oil/ coal to liquid studies, delineation of suitable coal property in Mand-Raigarh coalfields sponsored by National Agency for coal-to-oil conversion will be carried out during this plan.
- ❖ **Public Good Geoscience :-**
 - **Engineering geology:** GSI takes up geotechnical investigation for projects like Rail, Road, Tunnel, River linking projects, Mine subsidence etc. About 300 items are likely to be accomplished during this Plan.
 - **Landslide Hazard Zonation:** GSI has been identified as the nodal agency for Landslide Hazard Zonation (LHZ) studies. Real Time Monitoring of landslides for development of early warning system has been initiated. Landslide hazard zonation (Macro Meso-scale) for 6000 L.Km/ 20 locations for site-specific study has been initiated.



- **Earthquake related studies:** Activities include Active Fault Mapping including seismotectonic assessment of some interplate and intraplate faults, GPS monitoring for crustal movement study, macro-seismic (post-earthquake damage survey for assigning intensity) survey, Seismic Hazard Microzonation, Micro-seismic (aftershock) survey, recording of earthquake events at Seismic Observatories.

Observatories of GSI are located at Jabalpur, Nagpur, Khandwa and Lucknow. Three more new observatories at Agartala, Itanagar and Gangtok are expected to come up in XI plan and planning for three more seismic observatories at Barren and Narcondum volcanic zones and Car Nicobar of Andaman – Nicobar Islands during XI Plan.

- **Climate change issues:** will be addressed through studies of Coastal areas (for geomorphology and bathymetry), glaciology, desert geology, palaeo-climate studies and carbon sequestration. Beach profiling vis-à-vis near-shore bathymetry survey for certain coastal sectors are being carried out regularly by operational units as well as by Marine Wing of GSI. GSI is actively engaged in study of selected glaciers in J&K, H.P, U.P., Sikkim and Bhutan Himalayas. Backed by the experience of studying desert geology, GSI is planning to study extent of desertification, salinity changes etc. as an outcome of climatic changes particularly in the fringe areas. During XI Plan, repeat survey of 4000 sq. km is planned initially around the vulnerable areas. Palaeoclimate Studies involving an integrated approach based on Quaternary geology, palaeontology, speleology, Quaternary chronostratigraphy etc. in India as well as ice core studies from Antarctica are also underway. Initiation of studies in CO₂ sequestration in R&D mode from XI Plan onward has also been planned.
- **Environmental geology:** work include study on geological aspects of elemental contamination and toxicity in groundwater, taken up as public health hazard studies (arsenic/ fluoride toxicity etc.), EIA of urban/ industrial growth centres, domestic/ hospital/ industrial waste disposal, trace-element hazard from fly-ash in coal-based thermal power plants, nuclear waste disposal etc. are among the approximately 100 items to be taken up in XI Plan. A dedicated laboratory with specialized geochemical tests is envisioned in XI Plan.

❖ **Geoinformation Management:-**

- **Information infrastructure:** Commissioning of WAN (GSI Intranet), IP telephony and video conferencing, consolidation of GSI Portal - complete product metadata, addition of new modules and 24X7 maintenance of the infrastructure. The technologies involved will mainly be GRID computing, Service-Oriented Architecture, WebGIS, XML, GeoSciML and augmentation of physical facilities. These will lead to GSI Portal acting as an active NSDI node.
- **National Geospatial Datasets:** Strengthening of Geoinformatics (Map 50K and other domains), Digital Archive, and development standards. With adoption of technologies like GIS, CAD, visualization, service oriented architecture (SOA); OGC standards, GML, GeoSciML, and Digital Cartography, GSI will deliver an edge-matched Digital Geological Map of entire country at 1:50K (~5000 toposheets) accessible through the portal.
- **Product Management:** Generation of new products and revision of old product series and archival of old, historical product series. Work will be concentrated around GIS-based map compilation, analogue-to-digital conversion and digital archival, metadata generation for all products, new scanned / pdf products and GIS database for selected compilations.

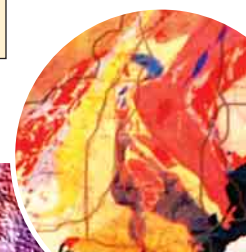
- **3D/4D integrated applications:** Collaborative project with foreign Geological Surveys (BRGM, AGSO, and BGS) towards transfer of technical know-how. GSI will have manpower trained in 3D/4D integration, visualization and analysis and techniques needed to produce 3-D maps that retain all the detail in traditional maps while extending this information into the subsurface.
- **Mobile Mapping:** All field officers and officers associated with National Geospatial datasets will be involved in this activity. Using handheld mapping tools, Internet and mobile GIS for digital data collection, data generation, transmission and storage will be done in digital format to reach a stage where there will be no more backlogs of analogue data.

2.6.2. XIth Plan Targets and Achievement During Ist Year of XI Plan is provided in Table -II.2

Table – II.2

Achievements During 2007-08 (1st Year of XI Plan)

S.No.	Name of the Scheme/Project/ Programme	Plan Target	Programme Target	Achievement
I. Survey and Mapping				
a)	Ground Survey			
i)	Systematic Geological Mapping (Sq. km)	-	699	885
ii)	Special Thematic Mapping (Sq. km)	35,000	5597	5742
iii)	Geochemical Mapping (Sq. km)	1,80,000	24858.40	24526
iv)	Geophysical Mapping (Sq. km)	84,000**	20800	23707
b)	Aerial Survey			
i)	Multisensor/ Aeromagnetic Survey [with Twin Otter (1 km)] and Heliborne Survey	77,500 sq. km	28050	15992
c)	Marine Survey			
i)	Parametric Survey within EEZ and beyond	1,50,000 sq. km as R&D projects		
	1. Bathymetric Survey (line km)		13500	3349 ; major over-hauling of R.V. Samudra Manthan was undertaken .
	2. Magnetic (line km)		13500	2015; major over-hauling of R.V. Samudra Manthan was undertaken
ii)	Territorial Water (sq. km)	500	2410+para-metric surveys	3124+ parametric surveys



S.No.	Name of the Scheme/Project/ Programme	Plan Target	Programme Target	Achievement
II. Mineral Exploration				
a)	Large scale Mapping (Sq. km)	13,530.5	1169.58	1316.50
b)	Detailed Mapping (Sq. km)	172	32.403	33.89
c)	Drilling (metre)	4,29,000	80832.20	69935.65
III. Specialized Investigation				
	[Geotechnical, Earthquake Geology & Seismology, Geoenvironment, Glaciology, Geothermal, etc] (in Nos.)		91	91
IV. Research & Development and Other Exploration				
	[Antarctica] (sq. km)		1000	\$
	Research (No. of Investigations)		63	63
V.				
	(Map Publication, Information Technology etc.) (in Nos.)		38	38
VI. Human Resource Development				
	Training (in GSI TI) (No. of courses)		32 (32)	28(40)

* Flying Season: October - March

\$ 27th Expedition (summer) completed. Mapping could not be taken up due to some logistic problems and inclement weather. However research projects were undertaken.

** Target reduced due to reduced manpower.

2.7.0. Scientific Resource With GSI:

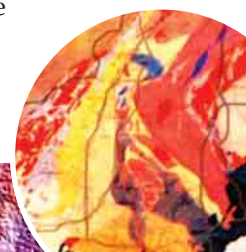
2.7.1. Laboratories

- ❖ Photo Geological & Remote Sensing (PGRS) laboratories are situated in CHQ, one each in six Regional Headquarters, and in Coal and Marine Wings. The PGRS Labs offer remote sensing application support to various operational activities utilizing remotely sensed data in digital and analogue form.
- ❖ Geotechnical laboratories located at regional headquarters can generate data on physical properties of rock, soil, coarse and fine aggregates, etc. on commercial basis. The labs have recently inducted Laser Particle Size Analyzer (Malvern make) capable of analyzing particle sizes ranging between 0.3 to 300 micrometer and Servo-controlled Compression Testing machine to determine the rock mechanics properties (Hydraulic & Engineering Instruments Co, No. HLA-592.310).
- ❖ There are in all 21 chemical laboratories situated in different parts of India including CHQ, regional headquarters and operational units and wings (Bihar, Orissa, PH-HP, J & K, Gujarat,

Maharashtra, MP, Tamilnadu, Kerala apart from Marine Wing offices at Vizag and Mangalore equipped with state-of-the-art instruments like WDXRF, ICP-MS, DMA-80, GF-AAS, HPLC, ICP-AES, CHNS etc.

- ❖ Mineral physics labs: are located in all the six regions of GSI apart from the one in Calcutta (CHQ) and manned by highly qualified and trained professionals and equipped with single crystal X-ray diffractometer, thermal analyzer, infra-red spectrometer.
- ❖ The Scanning Electron Microscope (SEM) laboratory was established at CHQ, GSI, Kolkata in 1977. The current SEM model in use at Kolkata, Hyderabad, and Lucknow. S440 of LEO Electron Microscopy Ltd (Carl Zeiss) with EDX of Oxford Instruments (UK).
- ❖ Electron Probe Micro Analyser are functioning at Kolkata, Hyderabad and Faridabad.
- ❖ Geodata: GSI has set up a Geoscientific Data Centre in GSI with distributed sub-centres at the Regional Headquarters and a National centre at CHQ, Kolkata. The Centres are equipped with state-of-the-art hardware and software linked through LAN, and data transmissions between the distributed centres through wide area network is expected shortly.
- ❖ Geochronology Lab: GSI has an isotope geology laboratory at Kolkata with a VG 54R Thermal Ionisation Mass Spectrometer, Sequential XRF spectrometer, Gas Source Mass spectrometer for stable isotope studies, Radiocarbon Dating Laboratory and Optically Stimulated Luminescence (OSL) dating instrument are stationed at Faridabad.
- ❖ Palaeontological Labs: Palaeontology Laboratories specializes in the study of invertebrate, vertebrate, micro-palaeontology, palaeobotany and palynology. Apart from Central Palaeontological laboratories, each region has a palaeontological laboratory engaged in research work.
- ❖ Central Petrological Laboratory is at Headquarters, Kolkata. Each region, all the three Wings and other State-based operational units are having petrological laboratory of their own to cater to the needs of the various disciplines of Earth science and also to carry out research on fundamental and applied aspects of igneous, sedimentary, metamorphic petrology, ore-mineralogy and coal petrography and clay mineralogy. Studies of meteorites are also being carried out in these laboratories.
- ❖ The Gem Testing Laboratory of GSI at Central Headquarters, Kolkata provides commercial service for identification, authentication and certification of the gemstones. The Mineralogical Report is prepared based on the non-destructive analysis of the gemstones. The study comprises determination of essential physical and optical constants along with internal inclusion pattern to arrive at the name of the mineral and its gem variety. The report also indicates a qualitative assessment of the gemstone based on 4 'Cs' (Cut, Carat weight, Colour and Clarity). Special characters like spectroscopic result, optical effects and external flaws are mentioned under the heading 'Other Characters' of the report. The instruments being used are gem microscope, gem refractometer, dichroscope, electronic balance, ultraviolet lamps and spectrometer.

2.7.2. **Ships:** The Marine Wing of GSI with its ocean-going research vessel *Samudra Manthan* and two coastal launches *Samudra Kaustubh* and *Samudra Shaudhikama*, has been carrying out sea-bed surveys within the Exclusive Economic Zone (EEZ) and Territorial Waters (TW) of India and also in the International Waters.



2.7.3. **Aircraft:** AMSE has its own aircraft (Twin Otter fixed wing) and integrated airborne geophysical system since mid-1980s. This aircraft is fitted with a Tridem-3 continuous wave electromagnetic system, MAC-3 Cesium Magnetometer and PGAM-1000 Gamma ray Spectrometer which are interfaced with a PDAS-1000 data acquisition and recording system.

2.7.4. **Human Resources:** GSI's Group A & B scientific and technical staff are categorized under 'streams' based on the nature of the work and the specialization involved. These categories are essentially as follows:

Stream	Nature of work
Geology	Main stream of GSI undertakes primarily geological mapping, mineral exploration, engineering and geotechnical investigations, seismic studies, address societal geoscience issues, research work in field of palaeontology, geochemistry, glaciology, petrology, geochronology, coastal and marine geology etc.
Geophysics:	Undertakes field geophysical investigations and related R&D activities in mineral investigations, basic data generation, specialized investigations, etc. which are fully scientific in nature and its functions are similar to and highly interactive with geology stream with field data acquisition and processing culminating in writing of scientific report. The exploration geophysicist takes up a geological problem, identifies the geophysical methods to be applied to solve it and makes field data acquisition, processing, analysis and interpretation of data in terms of physical property distribution in the surface and subsurface domain and translates these in terms of significant geological features in consultation with the geologists/geological reports or observations. Presently engaged mainly for systematic geophysical mapping (gravity- magnetic mapping) of the country on 1:50,000 scale, aero geophysical survey and geophysical survey in the marine domain, mineral exploration, earthquake studies, Microzonation and borehole geophysical logging.
Geophysics*: Instrumentation	Basically provides service aid to Geophysics and other streams (Instrumentation to maintain the instruments and accessories used. Its main function Division) is supportive. Electronic instruments used in GSI i.e. for Geophysics Exploration, Petrological, Palaeontological, Geochronological, Laboratories come under the purview. Assistance is provided in procurement of new instruments by finalizing the specifications of such instruments needed.
Chemistry	Undertake chemical analysis of rocks, water, soil, etc for utilization in the field of mineral investigation, basic data generation, fundamental research, environmental impact assessment, agriculture, health problems, land use, etc.
Mineral Physics*	Its functions are to carry out analysis and provide information for the identification of mineral phases and their semi-quantitative proportions, using X-ray techniques like XRD, DTA systems, etc. It provides inputs to petro-physical studies.
Drilling**	Its functions are basically to provide drill cores for mineral exploration and stratigraphic studies, mostly using conventional wet and dry drilling methods.

Engineering & ** Repairs/maintenance of all kinds of major/minor vehicles & drilling machineries & Transport and equipments in HQ & fields. Makes provision for transport facilities to geological/geophysical & drilling field investigations as per needs. Partially provides support in making available diamond bits.

* The Vth Pay Commission had recommended merger of the work of these streams with Geophysics. The matter is at a final stage

** The Vth Pay Commission have recommended merger of these streams. The matter is at a final stage.

2.7.5. The overview of the sanctioned and filled in posts in GSI are given in Table - II.3:

Table – II.3

Sanctioned / Filled in Posts in GSI (Updated)

		Group A	Group B	Group C	Group D
1	Director General	1(1)			
2	Scientific Stream	2428 (1227)	72(1)		
	i) Geology	306 (141)	18(-)		
	ii) Geophysics	64 (32)			
	iii) Geophysics (Instt.)	40 (9)	22 (14)		
	iv) Mineral Physics	328 (140)	-(-)	*3100	2000
	v) Geochemistry	3 (1)	72 (21)	(3275)	(2459)
	vi) Others		21 (15)		
3	Technical Stream				
	i) Drilling + Mech. Engg.	90(60)	60(41)		
	ii) Others	1(-)	15(10)		
4	Administration				
	i) Personnel	53(27)	133(101)	*2500	
	ii) Finance	6(3)	13(4)	(1910)	
	iii) Material Management	8(7)	67(42)		
5	Total	3327(1646)	493(249)	5600 (5185)	2000 (2459)
6	Grand Total		11,420 (9539)		

Note: Figures in parenthesis indicate 'Filled in Strength' of GSI as on 30.06.2008

*Includes Group B (Non – Gazetted) Officers

The sanctioned strength was determined in the year 2002 as a result of the recommendation of the Varma Committee.

2.7.6. Distribution of Scientific Officers, Scheme wise and Region/Wing wise is given in Table -II.4. The distribution is in accordance with the items approved for taking up during field season 2008-09.

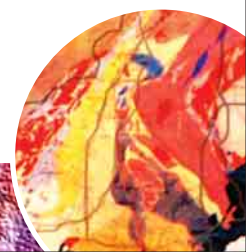


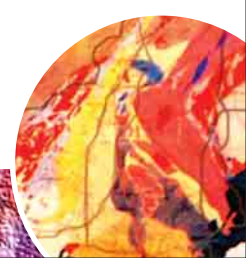
Table – II.4

**Distribution and Deployment of
Scientific Officers, Region/Wing Wise, and Activity Wise During Field Season 2008-09**

	Items of work	NER	ER	NR	CR	SR	WR	CHQ	Coal	AMSE	MW	Total
		Pers.	Pers.	Pers.	Pers.	Pers.	Pers.	Pers.	Pers.	Pers.	Pers.	Pers.
1.	Mineral investigation	6G	15G	7G	10G+4 ½S	22½G	13G+2 GP	-	22½G	4½G	15G+4 GPI+4C	115½G +2GP+4 GPI+4C
2.	Geophysical Survey (GPS)	-	-	-	-	-	1 GP	-	-	-	-	1GP
3.	Systematic Geological Mapping	1G	-	-	-	-	-	-	-	-	-	1G
4.	Aerogeophysical Surveys including ASGE	-	-	-	-	-	-	-	-	14G+ 7GP	-	14G+ 7GP
5.	Geophysical Mapping (GPM)	2GP	1GP	9GP	1GP	7GP	-	3½GP+ 1GPI	-	-	-	23½G+ 1GPI
6.	Geochemical Mapping	4½G+2C	9G+3½C	6½G+2C 4½C	9G 1½C	16G+	9G+	-	-	-	-	54G+ 13½C
7.	Systematic and parametric survey within EEZ	-	-	-	-	-	-	-	-	-	5G+2C	5G+2C
8.	Systematic & parametric survey within TW	-	-	-	-	-	-	-	-	-	7G+5GP +2GPI+ 2C	7G+5G P+2GPI +2C
9.	Specialised Thematic Studies	11½G	10G	13G	5½G	12G	7G	-	-	-	-	59G
10.	Geotechnical studies	4½G	7½G	23G	7½G	8G	3G	-	-	-	6G+3GP +1C	59½G+3 GP+1C
11.	Geotechnical Service	-	-	4G	1½G	2G	1G	-	-	-	-	8½G
12.	Environ.Geol. investigation	½G+½C	6G+½C	1G	2½G	-	1G	-	½G+½C	-	8G+1C	19½G+ 2½C
13.	Seismotectonics	2½G	2G	4½G+ 1GP	1G	3½G+1½ GP	1½G+ 1GP	2GP	-	-	-	15G+5½ GP
14.	Seismotectonic Services	1½G	-	2G	2G+1GP	1G	½G	-	-	-	-	7G+1 GP
15.	Landslide Hazard Zonation Studies	2 G	½G	3½G	2G	6½G	-	-	-	-	-	14½G
16.	Landslide Hazard Zonation Service	1 G	½G	½G	-	-	-	5G	-	-	-	7G
17.	Studies	-	-	5G	-	-	-	-	-	-	-	5G
18.	Geothermal Service	-	-	½G	-	-	-	-	-	-	-	½G
19.	Geodata	-	10½G+ 5½GP	3½GP	-	8½G+ 1GP	3G+1GP	4G+1GP	6½G	-	2G+1GP	34½G+ 13GP

	Items of work	NER	ER	NR	CR	SR	WR	CHQ	Coal	AMSE	MW	Total
		Pers.	Pers.	Pers.	Pers.	Pers.	Pers.	Pers.	Pers.	Pers.	Pers.	Pers.
20.	Geodata Service	½G	3G	10½G	6G+½GP	8½G+½GP	2G+½GPI	1½G	1½G	1½G	-	35G+1GP+½GPI
21.	Antarctic Research	-	-	-	-	-	-	6G	-	-	-	6G
22.	Antarctic Service	-	-	-	-	-	-	3G	-	-	-	3G
23.	Research	2G+1GPI	12½G+½GPI	6½G+½GP+½C	5G+1GP	4G	3½G	9G	3G+½C	2G+3GP	6G+3GP	53½G+7½GP+1½GPI+1C
24.	Laboratory Service	2½G	3G	10½G+1GPI	3½G	9G+½GP+1GPI	3½G	10G+1GP	2½G	5G+1GPI	-	49½G+1½GP+3GPI
25.	P.G.R.S.	-	-	-	-	2G	-	1G	-	3½G	-	6½G
26.	P.G.R.S. Service	-	5G	3G	½G	2G	½G	1G	1G	-	-	13G
27.	M.C. and Printing	2½G	2½G	8G	9½G	8G	2½G	6G	-	-	-	39G
28.	Map Service	-	9G	2G	1½G	13½G	1½G	6½G	1G	1G	1G	37G
29.	Publication	2G	4G	4G	2G	4G	4G	6G	4G	2G	1G	33G
30.	Technical Consultancy Services	1G	3½G	2G	1G	2G	1G	3G	2G	1G	1G	17½G
31.	Technical co-ordination	3½G+½GPI	9½G	8G	14G	12G+2GP	6½G	26G+1GP	6½G	3½G+1S	1G	90½G+3GP+½GPI+1S
32.	Core Library	-	2G	-	-	-	-	-	-	-	-	2G
33.	Curatorial	-	-	1G	1G	-	-	4G	-	-	-	6G
34.	Geophysical Support Service	1½GPI	1½GP+½GPI	7GP+3GPI	1½GP+5GPI	½GP+2GPI	3GP+1½GPI	3½GP+1GPI	4GP+1GPI	2GP+4GPI	-	23GP+19½GPI
35.	Chemical Support Service	1½C	14C	25½C	13C	7½C	16½C	12C	-	6C	-	96C
36.	Mineralogical Support Service	1M	-	2M	2M	1G+1GP+2M	3M	3M	-	3M	-	16M+1G+1GPI
37.	In service training faculty/ deputation/ leave etc	-	-	-	-	-	-	-	-	-	-	96G+1GP+1GPI+1C
	Total	49G+2GP+3GPI+4C+1M	115G+8GP+1GPI+18C	126G+21GP+4GPI+28C+2M	85G+5GP+13C+2M+4½S	145G+13GP+4GPI+12C+2M	64G+8GP+2GPI+18C+3M	92G+12GP+2GPI+12C+3M	51G+4GP+1GPI+1C	38G+12GP+5GPI+6C+3M+1S	53G+12GP+6GPI+10C	915G+98GP+33GPI+12C+16M+5½S

G = Geologist; GP = Geophysicist; GPI = Geophysicist (Instrumentation); C = Chemists; M = Mineral Physicist; S = Officer Surveyor (½ indicates – Officer attached with more than one activity)



2.8.0. Training & HRD:

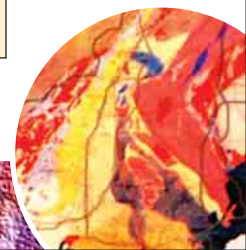
2.8.1. The Geological Survey of India Training institute (GSI TI) is the premier Institute in the country imparting state-of-the-art training in various disciplines of Earth science. The GSI TI with its headquarters at Hyderabad conducts various training programmes including field training through five field centres located at Lucknow (Uttar Pradesh), Zavar (Rajasthan), Ranchi (Jharkhand), Raipur (Chhattisgarh), Chitradurga (Karnataka) and specialized Divisions viz. Photogeology and Remote Sensing (PGRS), Geophysics and Centre for Geoinformation Management & Training (CGMT) also located at Hyderabad. Since its inception in 1976, the GSI TI has conducted over 700 training programmes (up to September 2008) and trained 12,089 geoscientists of GSI, other Earth science organizations and universities of the country and also geoscientists from ESCAP and SAARC countries. The training programmes are focused on fundamentals and applied aspects of geosciences viz. geology, geophysics, geochemistry, natural hazards, remote sensing, drilling and surveying. The Institute regularly conducts DST (Department of Science & Technology) supported programmes, ISRO (Department of Space) supported Remote Sensing (NNRMS) programmes, customized courses for other agencies and administrative courses for the departmental personnel. For strengthening the application of digital techniques in geoscientific Data processing, a collaborative venture named Project INDIGEO between the Geological Survey of India, International Institute for Geo-information and Earth Observation (ITC) and Maastricht School of Management (MSM), the Netherlands and Association of Exploration Geophysicists (AEG), India; was launched in 1999.

Training Courses Conducted During F.S. 2007-08

Table – II.5

Sl. No.	Title of the Course	No. of courses	Eligibility	Duration	No. of Participants			
					GSI	States	Others	International
Discipline - GEOLOGY								
SCIENTIFIC COURSES								
1.	Orientation Course for Geologists	1	Newly recruited geologists	9 months	11		9	
2.	Refresher Course on STM in Granite-Greenstone Terrain	1	Geologists engaged in STM mapping	3 weeks	7			
3	Advance Course in processing of Geophysical data	1	Geophysicists with 8 to 10 years of field experience	3 week	18			
4	Field Workshop on the Ultramafic rocks of Sukinda – Boula – Nausahi area, Orissa with special emphasis on the Orthomagmatic Ore mineralization	1	Geologists from GSI and other organizations	1 weeks	17	1	3	
5	Field Workshop on Active Fault Studies in Yamuna Tear Zone, Uttaranchal and Himachal Pradesh and analysis of Seismological data	1	Geologists, Geophysicists	5 Days	10		2	
6	Advance Course in HG-AAS, GF-AAS and Microwave digestion system	1	Chemists at least with 5 years experience	2 weeks	20			
7	3 rd Course on the Application of High Resolution Imagery for landslide inventory, hazard and risk assessment	1	Geoscientists of GSI officers from Govt. organizations such as BRTF and University staff/research scholars.	3 week	18			

Sl. No.	Title of the Course	No. of courses	Eligibility	Duration	No. of Participants			
					GSI	States	Others	International
8	3 rd Course on Geochemical Data Handling and preparation of Geochemical maps	1	Geologists engaged in geochemical mapping	2week	20			
9	Advance Course on Conceptual Ore Deposit Modelling and Mineral Exploration	1	Geologists engaged in mineral exploration	2 Days	6		11	
10	Refresher Course on Airborne Geophysical Data interpretation	1	Geologists & Geophysicists	2 weeks				
11	4 th Refresher Course in Ore Microscopy	1	Geologists	2 weeks	12			
12	Integration of expert knowledge in developing a quantitative prediction for medium scale landslide hazard and risk- A case study from Darjeeling Himalaya, India	1	Scientific collaboration GSI, NRSA, ITC	In progress				
13	Landslide probability and risk quantification along communication corridors from historical data: A case study from Nilgiri hills, Tamil Nadu, India	1	Scientific collaboration GSI, NRSA, ITC	In progress				
14	9 th Refresher Course in Structural Geology	1	Geologists		2 weeks	Dropped		
TECHNICAL COURSES								
15	11 th Course in Digitization and data Entry for Draughtsman	1	Draughts men	2 weeks	16	1	2	
16	3 rd Basic Course on Mud Technology	1	Drilling Engineers	1 week	16		2	
17	21 st Basic course on Drilling for Junior Drilling technicians	2	Technical Operators (D) and Drilling Assistants.	5 weeks	29			
18	Application of RS & GIS in earth sciences using FOSS GIS and Image processing software	2	Geoscientists	2 weeks	40			
19	1 st Basic Course on introduction to Chemical Analytical Techniques of geological samples for Geologists	1	Geologists	2 weeks	15			
20	6 th Refresher Course in Surveying techniques	1	Surveyors (JTA/STA)	3 weeks	15			
21	Refresher Course on Map & Cartography (Workshop on Portal readiness of 50K maps)	1	Geoscientists	5 Days	25			
ADMINISTRATIVE COURSES								
22	Workshop on Project Management and Administration for JAG level officers	1	JAG level officers	2 weeks	25			
23	4 th Refresher Course on Material Management for Stores Personnel	1	Store Superintendents/ Store keepers	5 Days	20			



Sl. No.	Title of the Course	No. of courses	Eligibility	Duration	No. of Participants			
					GSI	States	Others	International
24	Refresher Course on Vigilance Administration for Group 'C' Ministerial Staff	1	Group 'C' Ministerial Staff	3 Days	24			
25	Workshop on Vigilance related matters for JAG-STIS level officers	1	JAG/ Senior STS level officers	4 Days	24			
26	Refresher course on Accounts related matters for Group 'C' Ministerial Staff	1	Group 'C' Ministerial Staff	5 Days	21			
27	Basic Course on Roster Maintenance for Group 'C' Ministerial Staff	1	Group 'C' Ministerial Staff	3 Days	21			
28	27 th Workshop on Enhancing Managerial Skills and Personal Competence for STS/JTS officers	1	STS/JTS level officers	3 Days	31			
SPONSORED COURSES								
29	7 th Course on Application of Remote Sensing and GIS for Mineral Exploration under NNRMS Programme (ISRO Sponsored)	1	Faculty from Universities/Colleges and geologists from govt. organizations	10 weeks			12	
30	4 th Course on Application of Geoinformatics in Disaster Management (ISRO Sponsored)	1	Faculty from Universities/ Colleges and geologists from govt. organizations	4 weeks			20	
31	Contact Course on Application of RS & GIS in earth sciences (DST Sponsored)	1	Faculty from Universities/Colleges and geologists from govt. organizations	4 weeks			20	
32	Contact Course on Mineral Exploration in collaboration with Indian School of Mines and IITs (DST Sponsored)	1	Faculty from Universities / Colleges and geologists from govt. organizations	3 weeks	Dropped			
OUTSIDE FSP PROGRAMMES								
1	Application of RS & GIS in earth sciences using Free and Open Source GIS & Image processing software.	3	Geoscientists from AMSE, Northern Region, Op; Karnataka & Goa	2 weeks	56			
2	2 nd & 3 rd Special Course in Engineering Geology for the officers of Northern Railway- using Free and Open Source GIS & Image processing software.	2	officers of Northern Railway	1 week			20	
3	Special Course in Mapping & Mineral Exploration for the officers of DMG, Karnataka – using Free and Open Source GIS & Image processing software.	1	officers of DMG, Karnataka	4 weeks		20		

2.9.0. Information Technology:

2.9.1. **Overview** of current GeoInformation Management activities in GSI: GSI has taken up the GSI Net and Portal Project during the X Plan period and the GSI portal has gone live since November 2007. The Net and Portal Project envisages a nationwide intranet supported by an Enterprise Integrated Portal (EIP). Commensurate with the GSI information infrastructure development and NSDI movement, a holistic approach has been adopted in developing and consolidating digital data and metadata holdings. Accordingly, strong emphasis has been put to generate, update and fine-tune databases and metadata bases for different thematic domains and products. Fine tuning and integration of the existing geoscientific database domains (geological Map (1:50,000), drilling, mining & geochemical exploration, coal, geophysics, remote sensing, natural hazard and environmental geology) into the Spatial Data Warehouse (SDW) of the Enterprise GIS module of the Portal has been prioritized. Glaciology and geothermal domains are being directly incorporated in the centralized SDW. Soft copy conversion of unpublished reports, published paper maps, historical maps, drawings etc has commenced and GSI has also started to collect data directly in digital format, albeit in a small scale.

2.9.2. The X Plan project 'Digital Archive' resulted in generating toposheet-based digital files in various format for geological maps on 1:50000 scale. Migration/conversion of this varied digital data into Geoinformatics/SDW format, with concurrent input of attribute data into the respective thematic domains through the standardized web-enabled forms is a thrust area during the XI Plan.

2.9.3. With completion of Local Area Networks (LAN) in all offices of GSI, the stage is set for the commissioning of the Wide Area Network (WAN) and GSI Intranet by the end of 2008. It is expected that the process of digital capture, storage processing and use of geoscience data will reach international standards once the project is completed.

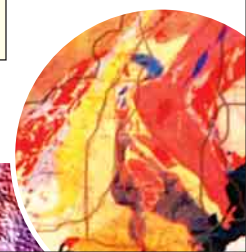
2.10.0. International/Multinational Cooperation:

2.10.1. Geological Survey of India (GSI) commenced its international activities by the close of 19th century. In 1965 International Wing (named as International Division) was set up to discharge multifarious responsibilities of the Department in matters pertaining to the domain of international activity. The following bilateral agreements are in operation (Table -II.6):

Table – II.6

Bilateral Agreements with Foreign Surveys

S.No.	Country	Date of MoU	Subjects
1	France	Late 1980s	<ul style="list-style-type: none"> • Collaborative ventures in mineral exploration and development. • GSI-BRGM Joint venture in Uganda Mapping Project.
2.	Canada	April 2004	<ul style="list-style-type: none"> • Development of a mitigation strategy to manage risk from arsenic toxicity in groundwater of West Bengal, India. • Landslide Mitigation Project.
3.	Netherlands	July, 2007	<ul style="list-style-type: none"> • Project INDIGEO-3 concerning “Collaboration in strengthening capabilities in the application of digital methods in geological, geophysical, geo-chemical mapping and geo-hazard assessment”. The MoU is for 5 years. • The MoU was signed among GSI, NRSA and ITC for the Ph.D Programme (partly in India and partly in the Netherlands) for 3½ to 4 years on ‘Use of New Earth Observation Techniques for Landslide Hazard and Risk Assessment’ in Himalaya and Nilgiri areas.



S.No.	Country	Date of MoU	Subjects
4.	Australia	May, 2005	<ul style="list-style-type: none"> Cooperative staff development related to environmental governance and mine rehabilitation'
5.	Russia	-	<ul style="list-style-type: none"> Collaboration between India and Russia has been continued under the Integrated Long Term Programme (ILTP) of cooperation in science and technology
6.	China	January, 2008	<ul style="list-style-type: none"> Dating of Indian Khondalites for provenance Characterization and correlation with similar rocks in other parts of the world. Palaeo-climatic and palaeo-environmental changes in Asian Continent through speleological studies with the aid of TIMS-U Dating and stable isotope studies. Technology exchange on sampling and laboratory methodologies used in geochemical mapping for mineral resources.
7.	Nepal	-	<ul style="list-style-type: none"> An MOU has been finalized for providing consultancy services to carry out geological/ geotechnical investigations for the Sapta Kosi and Sun Kosi projects, Nepal.
8.	Bhutan	-	<ul style="list-style-type: none"> The MoU between GSI and Water and Power Consultancies Services (India) Ltd. (WAPCOS) concerning preparation of detailed project report for Punatsangchhu Hydro Electric Power Project - II, Bhutan was signed on 1st February 2008 and the work is continuing. GSI – CWC : GSI nominated an expert member for the Design Expert Team for the Dam Safety Inspection of Chhukha Dam, Bhutan on the request of Central Water Commission (CWC), Bhutan Investigation Division, Phuentsholing, Bhutan.
<p>Bilateral cooperation with Uzbekistan, Syria, Guyana, Surinam, Burkina Faso, Ghana, Ukraine, Mozambique, Lesotho, Mongolia and Democratic Republic of Congo, Belarus, Argentina, Gabon is under consideration by the Govt. of India.</p>			

2.10.2. In addition GSI participates in large number of international programmes, symposia and workshops as given in Table - II.7

Table – II.7

International Programmes, Symposia and Workshops

Sl. No.	Programme	Nature of GSI's participation
1.	International Geological Correlation Programme (IGCP)	GSI is the accredited nodal agency for IGCP activity in India and so far India participated in 81 IGCP Projects out of which 11 are ongoing. The various IGCP Projects deal with geological problems of global as well as regional significance taking into consideration the various geological, geochemical and geophysical parameters, tectonism, metallogeny, environment, etc. in order to obtain in depth understanding of the process involved in a regional perspective.
2.	Commission for the Geological Map of the World	GSI has been identified as Coordinator of South Asian part of the project. This project is regarding compilation of the international geological map of Asia on a scale of 1:1.5 million.

S. No.	Programme	Nature of GSI's participation
3.	Geoscientific study of Antarctica	Since 1981, GSI as a lead agency has made valuable contribution to the geology of Antarctica region - being the coldest and the most inaccessible continent of the earth. The Indian Scientific Expeditions to Antarctica for conducting fundamental research in several fields of earth, atmosphere and biological sciences, commenced with launching of – MV Polar Circle on 6th December 1981 have since created an unique example of inter-disciplinary endeavour in science and logistics in one of the most hostile parts of the Earth where average thickness of ice cover is about 1.6 km. The first landing team and the second expedition in the Antarctica were led by GSI Geologists. There after several expeditions were led by GSI geologist. The International Division monitors the activities of GSI in Antarctica which include regional geological studies, glaciological studies and logistic assistance to National Antarctica Programme. GSI geologists. Thereafter several expeditions were led by GSI geologists. The International Division monitors the activities of GSI in Antarctica which include regional geological studies, glaciological studies and logistic assistance to National Antarctica Programme.
4.	Expedition to Arctic	Two members from GSI participated in the 1 st Indian Arctic Expedition held in March 2008.

2.10.3. Apart from above programmes Geological Survey of India participates regularly in PDAC – International Convention, Trade Show, and Investors Exchange, Canada; World Mining Conference and is participating in the International Project – ONE GEOLOGY.

