4 Exploration & Development

GOVERNMENT'S POLICY

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

* To judiciously exploit and utilise the country's mineral potentialities, systematic regional and detailed exploration will be carried out using state-of-the-art techniques in a time bound manner. Zero-waste mining will be the national goal and mining technology will be upgraded to ensure exploration and utilisation of entire run-of-the-mine.

* To make regulatory environment conducive to private investment, procedures for grant of mineral concessions, such as Reconnaissance Permits, Prospecting Licences and Mining Leases shall be transparent and seamless with security of tenure guaranteed. Prospecting and mining shall be recognised as independent activities with transferability of concessions playing a key role in mineral development.

* To attract large investments and high technology, a new concession, namely, Large Area Prospecting Licence (LAPL) will be introduced. Duration of all concessions will be rationalised and areas of operations enlarged suitably within each State.

* IBM will maintain a digitised database comprising a Resource Inventory and a Tenement Registry. The Tenement Registry will give information of leasehold and freehold areas in terms of greenfield, brownfield and relinquished areas, etc. Data filing will be rigorously applied and concession holders will be monitored. Lock-in arrangement will be assured and the data will be released to prospectors after integration.

* Prospecting being a high-risk venture, access to risk funds from capital markets will be facilitated.

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

The High-Level Committee constituted by the Government of India which brought out the National Mineral Policy, 2008 has recommended amendments to the MMDR Act, 1957 with the purpose of providing necessary initiatives to attract investment and participation of private and public sectors in areas of exploration and exploitation of minerals. In a latest development, the Government of India has uploaded the updated drafts of MMDR Act, 2011 on its website for suggestions and comments, before it is placed in the Parliament for deliberations and accordance of assent.

ORGANISATIONS INVOLVED

GSI, AMD, DGMs of various states, public sector companies like NMDC, MECL, MOIL, etc. continued their efforts in respect of surveying, mapping and exploration of new deposits and reassessment of old deposits/mines during 2009-10.

In oil sector, ONGC, OIL and a few joint ventures and private companies were engaged in exploration of onshore and offshore areas.

IBM

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

During 2009-10, IBM prepared 100 multimineral leasehold maps, with forest overlays on 1:50,000 scale, in respect of Gujarat and parts of Rajasthan. Forest overlays are prepared in collaboration with Forest Survey of India.

During 2009-10, IBM conducted 66 ore dressing investigations, 50,519 chemical analyses, 2,383 mineralogical studies and 6 in-plant studies.

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

GSI

GSI pursued its systematic geological mapping in 2009-10 and had completed 1,659 sq km large-scale mapping, 35.75 sq km detailed mapping and 55,988 m drilling as against preceding year's achievement of 1,109 sq km large-scale mapping, 25.31 sq km detailed mapping and 63,078 m drilling. Out of the total mappable areas of 3.146 million sq km of the country, 3.093 million sq km has been covered so far by systematic mapping bringing the total coverage to 98.31%.

Reserves Established

Reserves/resources established in the course of mineral exploration during 2009-10 are furnished below:

i) About 3,421 million tonnes resources of coal in various coalfields of Chhattisgarh and Jharkhand were estimated.

ii) In Rajasthan, about 34.73 million tonnes of gold ore resources containing 1.87 g/t Au and 1.932 million tonnes gold ore resources with 3.978 g/t Au were estimated in Delwara West Block and Gundelapara Block, respectively in Bhukia gold prospect, Banswara district. In Bharkundi Block, Dungarpur district, 4.5 million tonnes gold ore resources with 0.25 g/t Au have been estimated.

iii) About 4.61 million tonnes of indicated iron ore resources with an average grade of 61.97% Fe, 3.01% SiO_2 and 4.37% Al_2O_3 at a cut-off grade of 55% Fe have been estimated in Ghoraburhani Block, Sundargarh district, Odisha. So far 13.71 million tonnes of indicated iron ore resources were estimated in the block.

iv) In Damurda South Block, Keonjhar district, Odisha 0.07 million tonnes of manganese ore resources were estimated with an average grade of 30.44% Mn, 24.32% Fe and 0.25% P at 20% Mn cut-off grade. Thus in Lasarda-Pacheri-Bolani and Damurda area till date 14.84 million tonnes of manganese ore resources have been estimated.

v) In Miniyun-ki-Dhani area, Jaisalmer district, Rajasthan, a resource of 235.28 million tonnes of SMS grade limestone and 336.07 million tonnes of cement grade limestone were estimated.

Survey

Marine Survey

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

During 2009-10, a total of eighteen cruises were undertaken using three vessels.

The following marine geoscientific surveys were carried out during 2009-10 Field Season:

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

a) & b) Studies on geomorphological configuration of the swath of No Ground in Upper Bengal Fan along with acquaintance of Multibeam Echosounder (SM 208 & SM 209).

c) Study of possible changes in the seabed morphology and magnetic anomaly pattern across the arc-trench gap south of Great Nicobar Island in view of Sumatra earthquake and monitoring of changes of Curie Isotherm around Barren Island (SM-210).

d) Study of possible changes in the seabed morphology and magnetic anomaly pattern across the arc-trench gap south of Great Nicobar Island in view of Sumatra earthquake (SM-212).

e) Magnetic and Bathymetric surveys off Visakhapatnam, Kakinada, Ongole and Chennai (SM-211).

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

2. Seven cruises aboard R.V. Samudra Kaustubh within the TW off the East Coast conducted:

a) Geotechnical appraisal of River Subarnrekha outflow sector and Parametric (magnetic) Survey off Chilka, Odisha (ST-202).

b) Mapping of seabed off Ganga Delta (ST-204).

c) Study of submarine valley in the upper continental slope off Chilka mouth, Odisha by Multibeam Bathymetry (ST-205).

d) Evaluation of coastal process and monitoring of shoreline changes off Mahanadi Delta, Odisha (ST-206).

e) Placer mineral resource evaluation in the Territorial Waters off north of Bhimunipatnam, Andhra Pradesh (ST-203).

f) Parametric Survey within Territorial Waters off Porto Novo and South of Karaikal, Tamil Nadu (ST-207).

g) Mapping of seabed within Territorial Waters off south of Nagapattinam, Tamil Nadu (ST-208).

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

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

b) Geotechnical appraisal off Chitrapu, Karnataka (SP-226)

c) Swath bathymetric survey of part of Gulf of Cambay, off Valsad, Gujarat (SDF-227).

d) Parametric (seismic and magnetic) survey within Territorial Waters in the shelf area off Thiruvananthapuram-Kolachal, Kerala Coast (SD-228).

e) Preliminary evaluation of construction sand resources in the area beyond Territorial Waters off Alleppey, Kerala (SD-229).

Airborne Survey

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

During 2009-10, aerogeophysical multisensor data was acquired surveying over an area of 30,975 sq km involving 14,761 line km in Hosadurg-Vengurla aeas over Western offshore falling between 12^{0} N-16^{0}-N latitude using Twin Otter Airborne Survey System (TOASS) by GSI.

Since the acquisition and induction of TOASS, a total of 490,923 line km over an area of

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

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

MECL

The highlights of exploration carried out by MECL during 2009-10 are given below:

i) A total of 33,103 m of promotional drilling on behalf of Ministry of Coal in the states of Andhra Pradesh, Maharashtra and Chhattisgarh was carried out. Similarly, a total of 125,101 m contractual drilling on behalf of NTPC, CMPDI, CMDCL, WBMDTC, NMDC and APMDC-OMC was carried out in Chhattisgarh, Jharkhand, West Bengal, Madhya Pradesh and Odisha. About 1,691 million tonnes of coal resources were estimated.

ii) A total of 55,127 m of promotional drilling on behalf of Ministry of Coal for lignite was carried out in the states of Rajasthan and Tamil Nadu. Similarly, 2,716 m contractual drilling was also carried out in Gujarat. About 458 million tonnes, 241 million tonnes and 1,574 million tonnes lignite resources were established in Gujarat, Rajasthan and Tamil Nadu, respectively.

iii) Exploration for base metals was carried out in promising areas of Ajmer and Chittorgarh, districts, Rajasthan. A total of 4,226 m drilling was carried out in 18 boreholes. Resource estimation in various areas were – 1.241 million tonnes with 0.70% Cu, 0.35% Pb and 0.56% Zn at Bajta North block (Phase-I) in Ajmer district, Rajasthan; 0.973 million tonnes with 1.33% Pb and 1.44% Zn at Ganeshpura block in Ajmer district, Rajasthan and 2.65 million tonnes with 3.42% Pb, 0.66% Zn and 0.38% Cu at Rewara block, Chittorgarh district, Rajasthan.

iv) Exploration for gold was carried out in Parasi Central (Phase-I & II) blocks in Ranchi district, Jharkhand. In Parasi Central (Phase-I) block 3.486 million tonnes and 1.67 million tonnes of resources were estimated with 1.05 g/t Au and 1.72 g/t Au, respectively. Similarly in Parasi Central (Phase-II) block 7.467 million tonnes and 3.714 million tonnes of resources were estimated with 0.995 g/t Au and 1.65 g/t Au, respectively.

MINERALWISE EXPLORATION ACTIVITIES

PETROLEUM AND NATURAL GAS

The Government of India has formulated a New Exploration Licensing Policy (NELP) to accelerate and expand exploration of oil and gas in the country. A total of 235 blocks have been awarded so far in eight rounds of NELP during 2000-2009. Exploration under NELP has shown positive results, in both inland and offshore areas.

ONGC

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

During 2009-10, ONGC acquired a total of 24,993 GLK/LK of 2D seismic data which included 4,621 GLK inland and 20,372 LK offshore data. During the same period, 21,741 sq km of 3D seismic data was also acquired which included 4,133 sq km inland and 17,608 sq km offshore areas. ONGC's 128 exploratory wells comprised 93 wells to a total depth of 240,045 m inland areas and 35 wells to a total depth of 128,624 in offshore areas.

During 2009-10, ONGC reported 21 new hydrocarbons discoveries, namely, North Kural-1(DBBH), Karvan-1 (KVAA), Ahmedabad-124 (AMBC) and South Kadi-155 (SKFY) in Cambay; North Geleki-1, (HGAA), Kasomarigaon-2 (KSAB) and Sundulbari (SDAC) in Assam & Assam-Arakan; Pengonda-1A (PGAB), South Mahadevapatanam-1 (SMAA-AA), Kammapalem-1 (KMP-AA), East Rangapuram-3 (ERA-AA) and Kesanapalli West-30 (KWDP) in Krishna-Godavari Onland; Nannilam-3, Cauvery Onland; GS-69-1 (GS-69-AA), GD-7-1 (GD-7-AA) and GS-KW-6 (GS-KW-AF) Krishna-Godavari Offshore and PER-1 (PER-A), GK-28-1 (GK-28-A), SD-1-5(SD-B), B-121--7 (B-121-B) and BF-1 in Western offshore. As a result of these exploratory efforts, ONGC accreted 82.98 million tonnes reserves during 2009-10, leading to 2511.36 million tonnes ultimate reserves of oil and oil-equivalent gas (O+OEG) at the end of the year in areas under its operations.

OIL

Significant discoveries of oil/gas struck by OIL at various districts in Assam during 2009-10 are as below :

i) The Well South Tinali-2 (Loc. DGN) was drilled to probe the prospectivity within Tipam Formation in Dibrugarh district, Assam. The Well encountered a few hydrocarbon bearing sands within Tipam Formation. On testing the 3,195 m Lower Tipam Sand through perforation in the range of 3,210-3,222 m, the Well produced at the rate of 60 klpd oil through 4 mm bean with FTHP:60 kg/cm^2.

ii) The Well Disaijan-1(Loc. BGB) located in the north-east of Baghjan area in Tinsukia district, Assam when drilled encountered a few prospective sands within Narpuh, Lakadong & Therria and Langpar Formation. On testing 4,106 m Narpuh Sand through perforation in the range of 4,110-4,115 m the Well displaced oil mixed with water at a sluggish rate.

iii) The Well NHK-583 (Loc.NKV) located towards north-west of Jaipur structure of Nahorkotiya Extension PML in Dibrugarh district, Assam was drilled to delineate the limit of extension of lower Tipam Formation. The Well encountered a few hydrocarbon bearing sands within Lower and Barail Formation. On testing the 2,730 m Barail Sand through perforation in the range of 2,735.5-2,738.5 m, the Well produced 10 klpd on gas lift through 12 mm bean.

iv) The Well Hapjan-55 (Loc. HRU) located in Hugrijan PML in Tinsukia district, Assam, encountered a number of hydrocarbon bearing sands within Tipam & Barail formations. On testing 3,146 m Barail 4th & 5th Sands through perforations in the range 3,153-3,159 m, the Well produced 80 klpd (oil:78 klpd) through 6 mm bean with FTHP:89 kg/cm^2 (Casing : 21 kg/cm^2).

v) The exploratory Well Umatara-1 (Loc. DGG) drilled in Umatara structure in Dibrugarh district, Assam, encountered a few hydrocarbon bearing sands within Barail Formation. On testing the 4,287 m Barail Sand through perforations/ reperforations in the range of 4,291.5-4,294.5/4,287 - 4,293 m, the Well produced 38 klpd oil through 5 mm bean with FTHP:25 kg/cm^2.

vi) Location of Dhulijan (NHK-581) lies in Dhulijan structure in Hugrijan PML in Tinsukia district, Assam. The Well encountered a gas bearing sand within Tipam Formation.

The physical achievements of exploration activities pursued by ONGC and OIL during 2009-10 are detailed in Table-1.

Table – 1 : Exploration for Petroleum & Natural Gas by ONGC and OIL, 2009-10

Agency/location/State	Seismic Survey		Drilling			
			Exploratory		Development	
	2D(GLKM)	3D(SQKM)	Wells	Meterage	Wells	Meterage
ONGC: Total	**24993**	**21741**	**128**	**368669**	**249**	**509078**
Inland: Total	**4621**	**4133**	**93**	**240045**	**201**	**385847**
Andhra Pradesh	–	889	9	38182	14	32878
Assam	_	322	23	67444	13	57975
Bihar	90	401	–	–	–	–
Gujarat	895	893	38	70441	161	264640
Himachal Pradesh	_	_	1	1244	_	_
Madhya Pradesh	_	_	1	5366	_	_
Rajasthan	950	385	1	927	_	_
Tamil Nadu	–	1015	14	34842	12	27598
Tripura	627	146	6	17063	1	2756
Uttar Pradesh	667	22	_	_	–	–
West Bengal	1392	60	_	4536	_	_
Offshore: Total	**20372**	**17608**	**35**	**128624**	**48**	**123231**
East Coast Offshore	16104	9612	13	45606	–	–
West Coast Offshore	4268	7996	22	83018	48	123231
OIL						
Inland: Total	**1308**	**984**	–	_	–	_
Andhra Pradesh	_	38	_	–	–	–
Assam & Arunachal Pradesh	905	744	–	–	–	–
Mizoram	403	_	–	–	–	–
Rajasthan	–	202	–	–	–	–

RELIANCE INDUSTRIES LIMITED

Reliance Industries Limited (RIL) has successfully drilled 4 appraisal Wells in the southern and deeper parts of the NEC-25 block. Results of these are being incorporated to generate an integrated development plan for all discoveries to maximise capital efficiency. Appraisal activities are currently underway in KG-D4, CY-D5, KG-III-5, KG-III-6, KG-V-D3 and GS-01 blocks. Currently, RIL's portfolio consists of 29 exploration blocks. The compay has submitted a proposal for commercial utility of the discoveries made in KG-III-5, CY-D5,NEC-25 and KG-D6 blocks.

In the South West Panna (SWP)development project, new 3D survey indicated a significant reduction in 2P reserves at 1.76 MMBO from about 11 MMBO in place. The Government has accorded approval to abandon the project. Separately, it has approved installing the SWP jacket and deck with minor modifications at Palla L (PL) to advance production by around 12 months and improve the final hydrocarabaon recovery from PL.

The development plan of the PL area has been approved by the Director General of Hydrocarbons (DGH) in June, 2009 for completion in 2011. However, with the Government approving the installation of SWP facilities at PL, the project is now expected to be completed in 2010. Initial anticipated total production from PL is approximately 4,000 BOPD from 6 Wells.

To arrest the declining trend in gas production in Tapti, 3 infill Wells (2 in South Tapti and 1 in Mid Tapti) have been approved for drilling in Q3/Q4 2009-10 by the Management Committee. MTA-6 Well has been already drilled and is currently producing around 35-40 MMSCFD gas. STA-7 Well has also been drilled and is currently producing 35 MMSCFD of gas. The STC Well is currently being drilled and

after the drilling of this well, gas production from Tapti is expected to be ramped up from the current level of around 315 MMSCFD to around 330 MMSCFD. A development plan for Mukta (MB area) is under consideration for submission to the Government of India for approval. The proposal, however, will depend on the results of a pre-drilled Well that will be undertaken in 2010-11.

The development plan for Sohagpur Coal Bed Methane (CBM) blocks has been approved by the Government and development activities have been scheduled for commencement in Fiscal Year 2010-11 by drilling and completion of additional Wells. Prolonged production testing was undertaken in the Wells drilled in Sohagpur CBM blocks which produced favourable results. During 2009-10, two CBM blocks BS-1 and BS-2 were relinquished. With this RIL currently holds a total of 3 CBM blocks.

Foreign Collaboration in Hydrocarbon Exploration

Under Production Sharing Contract (PSC), exploration blocks and producing fields have been awarded through international competitive bidding to private, foreign and National Oil Companies. Currently 33 foreign companies (20 as operators and 13 as non-operator consortium partners), including a few major Exploration and Production companies are operating under the PSC regime. The following benefits have been accrued due to participation of foreign companies in Exploration & Production Sector, under the PSC regime.

i) Cumulative investment of US$ 5.6 billion have been made so far by foreign companies for carrying out exploration and development activities in awarded blocks.

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

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

iv) One of the largest oil discoveries has been made in Mangala Field of Rajasthan by Cairn India Ltd., a foreign company and presently oil at the rate of 1,25,000 bopd is being produced.

COAL

The agencies engaged in exploration for coal during 2009-10 were mainly GSI, CMPDI, MECL and State Directorates of Geology & Mining.

GSI

The GSI continued its operations for search and assessment of coal resources in the country through regional exploration in coalfields of Andhra Pradesh, Chhattisgarh, Madhya Pradesh, Maharashtra, Odisha and West Bengal. An additional resources of 3420.98 million tonnes of coal have been assessed from the data generated from regional exploration during 2009-10.

Andhra Pradesh regional exploration (UNFC G-4 stage) in Godavari Valley Coalfield (Khammam and West Godavari districts) was pursued by GSI to explore and evaluate coal potentiality. In Naryanapuram- Pattyyagudem area, two prominent Lower Kamthi coal-carbonaceous shale zones (Seam zone- B and C) with individual coal section varying in thickness from 0.40 m to 1.65 m were intersected between 203.35 m and 524.50 m depths.

In Chhattisgarh, regional exploration (UNFC G-3 & 2 stage) for locating additional resources of power-grade coal was continued in three coalfields viz., Mand-Raigarh, Hasdo-Arand and Tatapani-Ramkola. In Chainpur block of Mand-Raigarh Coalfield, out of ten regional Barakar seams developed in this area, two bottom seams viz. Seam I and II were intersected between 466.65 m and 724.87 m depths during the period. Cumulative thickness of Seam I ranges from 6.70 m to 8.28 m while Seam II was 3.27 m thick. Continuity of the coal seams was traced over 2 km along up-dip direction. Investigation was completed. In Saraipali block of Mand-Raigarh Coalfield, ten regional Barakar coal seams (III to XII in ascending order) varying in cumulative thickness from 0.50 m to 5.62 m were intersected between 187.70 m and 509.97 m depths. The

important seams are Seam no V, VI, XI and XII. The continuity of the coal seams was established over 1 km along strike and 1.5 km along dip direction. In Nawagaon block of Mand-Raigarh Coalfield, twelve regional Barakar coal seams (Seam no I to X, XII and XIII in ascending order) with thickness ranging from 0.53 m to 11.09 m were intersected between 24.43 m and 585.60 m depths. The important seams are Seam no I, II, IV, VI, VII and VIII. The thickest seam, seam-IV with cumulative thickness ranging from 4.30 m to 11.09 m was intersected between 24.43 m and 425.04 m depths. In Parogia (West) block of Hasdo-Arand Coalfield, four regional Barakar coal seams (II, IV, V & VI in ascending order) varying in thickness from 0.81 m to 9.07 m were intersected between 161.30 m and 272.48 m depths. The thickest seam, Seam IV (Dhajag) attained maximum thickness of 9.07 m. Seam-V (Morga seam) with maximum cumulative thickness of 8.35 m occurs at a shallower depth between 178.80 m and 195.60 m. The continuity of the coal seams has been established for about 1 km along strikeand 1 km along dip direction. In Reonti (West) block (promotional), Tatapani-Ramkola Coalfield,five regional Barakar coal seams (Seam no II to VII) varying in thickness from 2.30 m to 13.52 m (cumulative thickness) was intersected between 689.71 m and 821.93 m depths.

In Madhya Pradesh, regional exploration (UNFC G-2 & 3 stage) for locating superior grade coal as well as coal with coking propensity was continued in Singrauli, Sohagpur and Pench Valley Coalfields. In Hatta-Dudhmania area of Singrauli Coalfield five Raniganj coal seams (Seam no. III to VII in ascending order) varying in thickness from 1.05 m to 1.80 m was intersected between 243.30 m and 497.05 m depths. Maximum of five Barakar coal seams varying in thickness from 0.50 m to 5.60 m were intersected between 522.10 m and 627.20 m depths. In Merkhi block of Sohagpur Coalfield, four regional Barakar coal seams (Seam no. I to IV) varying in thickness from 0.35 m to 4.68 m were intersected at 418.72 m depth. Three local coal seams varying in thickness from 0.25 m to 1.52 m were intersected between 327.64 m and 482.40 m depths. In Devanitola block of Sohagpur Coalfield (promotional), four regional Barakar coal seams (I to IV) varying in thickness from 0.77 m to 6.50 m were intersected between 129.45 m and 260.02 m depths. The thickest seam, Seam III, occurring as composite seam varies in thickness from 4.92 m to 6.50 m. In Amiliha block of Sohagpur Coalfield (promotional), four regional Barakar coal seams (I to IV) varying in individual seam thickness from 0.20 m to 2.70 m were intersected between 159.44 m and 327.35 m depths. The thickest seam, Seam no. III (2.25 m to 2.70m) was intersected between 229.60 m and 285.80 m depths. In Pachri block of Sohagpur Coalfield, four regional Barakar coal seams varying in individual seam thickness from 0.75 m to 12.30 m (Seam III) were intersected between 113.95 m and 301.50 m depths. In Naurazabad (North) area of Johilla Coalfield, the first borehole encountered Lameta, Parsora, Pali and Raniganj Formations. The contact between Parsora Formation and Pali Formation was intersected at 261.15 m depth. The second borehole through Raniganj Formation was under progress. In Bagbardiya sector of Pench Valley Coalfield, a maximum of 217.70 m of Motur Formation was drilled during the period and the two boreholes were closed within Motur Formation. In Payalidhana sector of Pench Valley Coalfield, nine coal horizons of Barakar Formation ranging in thickness from 0.65 m to 3.95 m were intersected between 313.15 m and 356.95 m depths in the first borehole drilled in the sector.

In Maharashtra, regional exploration (UNFC G-3 stage) in Wardha Valley Coalfield (Yavatmal district) to assess the coal resource potentiality of the area was continued. In Dewala-Mangli block of Wardha Valley Coalfield, the first borehole was closed within Motur Formation and the second borehole was in progress through Motur Formation below Deccan Traps cover.

In Odisha, regional exploration (UNFC G-2 & 3 stage) in Angul and Jharsuguda districts, the storehouse of power grade coal , had been given due priority by GSI where exploratory efforts helped in identifying potential blocks for future developmental activities. In Simlisahi Kujabiharipur block of Talcher field (promotional), ten regional Barakar coal seams zones (Seam zones II to XI) with cumulative coal thickness ranging from 2.46 m to 42.93 m were intersected between

296.44 m and 641.80 m depths. Coal zone III is the thickest seam zone having a maximum of 6 split sections with cumulative coal thickness varying from 24.87 m to 42.93 m. Continuation of the coal seams has been established for about 4 km along strike and 1 km along dip direction. In Kudanali North East block of Talcher Coalfield (promotional), four regional coal seam zones of Barakar Formation (Seam zones III and VI to VIII, combined) were intersected within the depth range of 277.20 m to 417.71 m. Coal seam zone III (27.19 m) is thickest with a maximum of 7 split sections. Persistence of coal seams has been established for about 0.5 km along dip direction in the western part of the block. In Harichandanapur block of Talcher Coalfield (promotional), so far one borehole has been drilled. Ten regional coal seam zones of Barakar Formation (Seam zone II to XI) with cumulative coal thickness ranging from 1.90 m to 71.78 m (Seam zone III) were intersected between 104.36 m and 502.40m depths. Coal seam zone III is thickest with a maximum of 7 split sections. In Piplimal-Khairkuni block of Ib-River Coalfield (promotional), five regional Barakar coal seam zones namely Belpahar, Parkhani, Lajkura,Rampur and Ib with cumulative coal thickness varying from 1.39 m to 41.67 m were intersected between 14.34 m and 513.88 m depths. Lajkura is the thickest coal seam zone with 9 split sections. Continuity of the coal seams has been established for about 0.5 km along strike and 1 km along dip direction.

In West Bengal, regional exploration (UNFC G-3 stage) in Raniganj and Birbhum Coalfields (Birbhum district) has established significant coal zones. In Binodpur-Bhabaniganj block of Raniganj Coalfield, Salanpur 'A' Group of Barakar seams with maximum cumulative thickness of 11.00 m (including a single thick seam of 9.95 m) were intersected between 69.75 m and 463.00 m depths. In East of Bhabaniganj area of Raniganj Coalfield, a maximum of 97.50 m of Barakar Formation was intersected with a coal seam of 5m thickness at 169.25 m depth. In Mahallah area of Birbhum Coalfield, the last borehole intersected Rajmahal Formation, Infratrappeans, Barakar Formation and the borehole was closed within metamorphics. In Makhdumnagar area of Birbhum Coalfield, the lastborehole intersected about 597 m thick coal-bearing Barakar Formation below younger cover of Tertiaries, Rajmahal Formation, Infratrappeans and Dubrajpur Formation. Twenty-one coal sections ranging in thickness from 0.50 m to 6.30 m were intersected between 548.55 m and 836.75 m depths. In Gazipur area of Birbhum Coalfield, the first borehole intersected about 241 m thick Barakar Formation below younger cover of Tertiaries and Rajmahal Formation. Four coal sections ranging in thickness from 0.50 m to 1.50 m were intersected between 639.90 m and 717.10 m depths. In Dhobbanpur area of Birbhum Coalfield, the first borehole so far intersected 168 m of Rajmahal Formation below younger cover of Tertiary sediments.

Additional resources estimated by GSI in various coalfields during 2009-10 are given in Table - 2.

Table – 2 : Additional Resources Estimated by GSI in Various Coalfields 2009-10 (Up to June, 2010)

(In million tonnes)

State/Coalfield/Block	Additional resources
Chhattisgarh	
(A) Mand-Raigarh Coalfield	
(i) Sithra-Kurekela	707.24
(ii) Kesarchuan-Lamdand	300.98
(B) Tatapani-Ramkola Coalfield	
(i) Odari	229.45
(ii) Bartikhurd	44.46
(iii) Garhauli	161.74
C) Hasdo Arand Coalfield	
(i) Chakeri	28.23
D) East of Bisrampur Coalfield	
Ulia-Gamardih	164.82
Jharkhand	
(A) Brahmani Coalfield	
(i) Pokharia-Paharpur	584.25
(ii) Gosaipahari-Siulibana	1199.81
Total	**3420.98**

CMPDI

CMPDI continued its coal exploration activities in 2009-10, mainly in CIL and Non-CIL/ Captive Mining Blocks. Exploration in CIL blocks was taken up to cater to the project planning/ production support needs of subsidiaries of CIL whereas exploration in Non-CIL/Captive Mining Blocks was undertaken to facilitate allotment of coal blocks to prospective entrepreneurs for captive mining. A total of 122 to 138 drills were deployed in 2009-10, out of which 55 were departmental drills.

CMPDI deployed its departmental resources for exploration of CIL/Non-CIL/Promotional blocks. Besides, four contractual agencies have deployed its own resources for detailed drilling/ exploration in 19 blocks. Resources of Directorates of Geology & Mining of Madhya Pradesh and Odisha were utilised for nominal amount of production support drilling.

In 2009-10, CMPDI and its contractual agencies took up exploratory drilling in 104 blocks/mines spread over 25 coalfields. These coalfields with no. of blocks/mines are: Raniganj (9), Jharia (4), West Bokaro (1), North Karanpura (1), Ramgarh (2), Auranga (1), Tawa Valley/Patharkhera (3), Pench-Kanhan (6), Kamptee (3),Nand-Bander (2), Wardha (10), Singrauli (8), Sohagpur (15), Mand Raigarh (8), Rajmahal (1), Sendurgarh (1), Johilla (1), Korba (6), Hasdo-Arand (1), Bisrampur (5), Lakhanpur (1), Talcher (8), Ib Valley (3), Sonhat (1) and Makum (3). Out of 104 blocks/mines, 16 were Non-CIL/Captive blocks, 1 promotional block and 87 CIL blocks/mines. Departmental drills of CMPDI took up exploration in 76 blocks/mines, contractual agencies selected through tendering commenced drilling in 19 blocks and State Governments carried out production support drilling in 9 block areas.

A total of 265,133 m of exploratory drilling was carried out by CMPDI in 2009-10 through departmental drills and it includes 1,992 m in Promotional blocks, 183,637 m in CIL blocks and 79,504 m in Non-CIL/Captive Mining blocks. Similarly, 205,128 m of drilling was carried out through outsourcing.

During 2009-10, against a target of 117,000 m drilling (departmental 57,600 m and outsourcing 59,400 m), the departmental drills of CMPDI have carried out 79,504 m of exploratory drilling whereas contractual parties have carried out 140,102 m of drilling. The block-wise achievement of drilling in 2009-10 was as follows:

Exploratory Drilling by CMPDI (Departmental and Outsourcing) in 2009-10

Sl. No.	Agency	Target (m)	Exploratory drilling achieved (m)	Achieved (%)
1.	Departmental	210,000	265,133	126
2.	Outsourcing			
i)	State Govts	5,000	9,101	182
ii)	MECL (MoU)	50,000	24,145	48
iii)	Tendering(CIL Blocks)	35,600	31,780	89
iv)	Tendering(Non-CIL Blocks)	59,400	140,102	236
	Total	**360,000**	**470,261**	**131**

Drilling in Non-CIL Blocks in 2009-10

Agency/command area	Coalfield	Block	Drilling (m)
A. CMPDI (Departmental)			
ECL	Raniganj	Tamla	1,509
CCL	Auranga	Rajbar ABC	14,372
WCL	Kamptee	Bharatwada	5,396
	Nand-Bander	Mandwa	5,010
SECL	Sohagpur	Malachua	3,280
		Panwari	5,878
MCL	Talcher	Bankui	19,219
		Mahanadi	2,568
	Ib Valley	Prajapara	22,272
	Sub-total : A (Departmental)		**79,504**
B. Outsourcing through open tendering			
ECL	Rajmahal	Kayda-Chaudhar-Gariapani	19,443
SECL	Mand-Raigarh	Syang Central 'A'	20,517
		Syang East 'B'	16,737
		Syang North West	21,718
		Syang South	21,465
		Chirra North	26,673
	Hasdo-Arand	Morga South	13,549
	Sub-total B (Outsourcing)		**140,102**
	Grand Total of Drilling in Non-CIL Blocks		**219,606**

The achievement of drilling in 2009-10 also includes Promotional (regional) drilling by departmental drills. CMPDI continued the promotional drilling in Chimri block of Tawa Valley Coalfield and a total of 1,992 m has been drilled in this block in 2009-10.

CMPDI has also carried out technical supervision of Promotional Exploration carried out by MECL in Coal Sector (7 blocks) and monitored Promotional Exploration conducted by GSI in 9 blocks.

MECL

During 2009-10, MECL carried out regional exploration for coal on promotional as well as contractual basis in different parts of the country. For Ministry of Coal, promotional work for coal was carried out in areas in Andhra Pradesh, Chhattisgarh, and Maharashtra. About 33,103 m promotional and 125,101 m contractual drilling was carried out during 2009-10. The details are given in Table-3.

MECL estimated 1,691 million tonnes resources of coal in various coalfields as per the geological reports submitted during 2009-10. The details are given in Table-4.

Table – 3 : Exploratory Drilling for Coal by MECL, 2009-10

State/District	Block/Coalfield	Drilling (m)
A. Promotional-on Behalf of Ministry of Coal		
Andhra Pradesh	Tadikalaipudi Godavari Valley Coalfield	222
-do-	Somavaram Godavari Valley Coalfield	363
-do-	Dip side of Venkatapuram Godavari Valley Coalfield	11719
Chhattisgarh	Gare Pelma/Bhalumura, Mand-Raigarh Coalfield	8017
-do-	Dolesara Mand-Raigarh Coalfield	5296
Maharashtra		
	Khapri Umrer Coalfield	992
-do-	Gumgaon Umrer Coalfield	3532
-do-	Sukhli Umrer Coalfield	2962
B. Contractual-on Behalf of CMDCL		
Chhattisgarh	Gare Pelma Mand-Raigarh Coalfield	27706
C. Contractual-on Behalf of CMPDI		
Chhattisgarh	Sayang (C) Mand-Raigarh Coalfield	20517
	Boro-Sayang (E) Mand-Raigarh Coalfield	20517
	Ghugra Bisrampur Coalfield	4721

(Contd.)

Table - 3 (Concld.)

State/District	Block/Coalfield	Drilling (m)
Jharkhand	Kapuriya Jharia Coalfield	9808
	Singra Jharia Coalfield	7895
	Production Support Jharia Coalfield	2047
Madhya Pradesh	Dongrital Singrauli Coalfield	13301
	Patpaharia Singrauli Coalfield	4077
D. Contractual-on Behalf of NTPC		
Chhattisgarh	Chandrasekharpara Mand-Raigarh Coalfield	578
Jharkhand	Pakri-Burwadi Jharia Coalfield	641
E. Contractual-on Behalf of NMDC		
Madhya Pradesh	Shahpur (E) & (W) Sohagpur Coalfield	67
F. Contractual-on Behalf of WBMDTC		
West Bengal	Sitarampur Raniganj Coalfield	426
	Raniganj Raniganj Coalfield	63
G. Contractual-on Behalf of APMDC-OMC		
Odisha	Nuagaon-Teleshahi Talchir Coalfield	12738
	Total	**158205**

Table – 4 : Additional Resources Estimated by MECL in Various Coalfields, 2009-10

(In million tonnes)

State/Coalfield/Block	Additional resources
Andhra Pradesh	
Godavari Valley Coalfield	
Jangareddygudem block	81.65
Tadikalapudi block	24.23
Somavaram block	745.94
Chhattisgarh	
Mand-Raigarh Coalfield	
Gare-Pelma Sec-1	377.43
Madhya Pradesh	
Sohagpur Coalfield	
Shahpur East block	56.61
Shahpur West block	38.38
Arjuni block	164.72
Pathora block	202.18
Total	**1691.14**

Singareni Collieries Company Ltd (SCCL)

During 2009-10, SCCL carried out detailed explorations in Godavari Valley coalfield, Andhra Pradesh. A total of 92,314 m drilling was achieved against a target of 100,000 m and coal reserves of the order of 74.57 million tonnes were proved in Gudala block-II in 2009-10. The total proved geological reserves of Godavari Valley Coalfield are placed at 9435.78 million tonnes as on 31.3.2010.

West Bengal Mineral Development & Trading Corporation Ltd (WBMDTCL)

In 2009-10, WBMDTCL carried out exploration for coal in three blocks-Kulti, Sitarampur and Ichhapur, all in Bardhaman district. In total 14.75 sq km area were mapped on 1:2,000 scale with 488.5 m drilling in three boreholes and 237 samples were collected for analysis.

State Directorates

The details of exploration for coal carried out by the State Directorate of Geology & Mining of various states during 2009-10 are given in Table-5.

LIGNITE

GSI, MECL, DMG, Rajasthan and GMDC conducted investigation for lignite during 2009-10.

GSI

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

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

In Tamil Nadu, lignite exploration was carried out in the Ramnad sub-basin in Ramanathapuram district. In Bogalur block, during the period, one 4.00 m thick lignite seam was intersected at 315.60 m depth and the investigation that concluded established two regionally persistent lignite seams with strike extension of about 6 km and dip extension of about 3 km in the block. In Bogalur East block (promotional), development of the regional lignite seams (maximum cumulative thickness 15.20 m) was recorded between 332 m and 386 m depths. Regional persistence of these seams has been established over a strike length of about 4 km with down-dip continuity of about 1 km in the block.

In Rajasthan, lignite exploration has been carried out in the Palana basin in Bikaner district.

In Hadda North and West area (promotional), lignite horizons varying in thickness from 0.70 m to 3.00 m were intersected between 83.00 m and 128.00 m depths.

Table – 5 : Exploration for Coal by Various State Directorates of Geology & Mining, 2009-10

State/ District	Location	Geological mapping		Drilling		Remarks
		Area (sq km)	Scale	Boreholes	Meterage	
Chhattisgarh						
Korba	Saila block, Saila-Pali area	–	–	06	748.50	Of the total 14 coal seams that exist in the block nine are workable seams.
Raigarh	Dhaurabhata, Gare Sector 1/A	100	1:50,000	05	1722.50	A total of 20 million tonnes resources of coal are estimated in this block.
Surguja	Sondhdia block	505	1:50,000	06	880.30	Eleven coal seams have been intersected. Out of which six seams have attained workable thickness.
Maharashtra						
Chandrapur	Nandori	–	–	–	1450.50	About 155.96 million tonnes proved reserves of coal were estimated out of 180 million tonnes of in situ resources.
-do-	Takli	3.00	1:25,000	–	1989.80	So far 36.16 million tonnes coal reserves have been proved.
-do-	Wislon block	–	–	–	896.55	So far 4.92 million tonnes proved reserves were estimated out of 21.30 million tonnes of in situ coal resources.
-do-	Panewadala block	–	–	–	718.50	So far 13.63 million tonnes proved reserves were estimated out of 39 million tonnes of resources.
Nagpur	Makardhokda block-V (Dawa-Phukeshwar)	4.00	1:25,000	–	823.50	So far 7.74 million tonnes coal reserves were proved.
-do-	Nand-Panjrepar	2.00	1:25,000	–	2411.20	So far 19.62 million tonnes of coal reserves were proved.
Wardha	Shekapur block	5.00	1:25,000	–	1072.00	So far 8.16 million tonnes of coal reserves were proved.
Yavatmal	Adkoli-Pawnar	2.00	1:25,000	–	716.35	Exploration completed and 21.76 million tonnes coal resources were estimated.
-do-	Dara-Parsoda	12.00	1:25,000	–	830.75	So far 8.06 million tonnes of coal resources were assessed.
Nagaland						
Mokokchung	Northern Mongchen Coalfield	–	–	01	300.00	–
Odisha						
Angul	Ananta/Lingaraj/ Bhubaneswari blocks of Talcher Coalfield	–	–	09	2052.45	–
Jharsuguda	Madhupur block Ib Valley Coal-field	–	–	14	3296.50	–

Table – 6 : Exploratory Drilling for Lignite by MECL, 2009-10

Lignite field/Block	Drilling (m)
A. Promotional-on Behalf of Ministry of Coal	
Neyveli Lignite Field	
Sattanur	4106
Ramnad (Rajsingamangalam)	10955
Barmer Lignite Field	
East of Kurla	14992
Bayatu	966
Bikaner Lignite Field	
Deshnok-Ramsar-Sinthal	649
Pyau	944
Kolasar Gravity Block	1197
Diyatra	6823
Bangarsar-Jaimalsar	11308
Jaisalmer Lignite Field	
Jaisalmer	3187
B. Contractual-on Behalf of NLC	
Surat Lignite Field	
Valia	2716
Total	**57843**

Table – 7 : Exploration for Lignite by State DMG and State Undertaking, 2009-10

Agency/State/ District/Location	Mapping		Drilling		Sampling (No.)	Result
	Area (sq km)	Scale	No. of boreholes	Meterage		
DMG, Rajasthan						
Bikaner						
Naion-ki-Basti, Saroopdesar	170	1:50,000	05	750	8	Lignitic shale and gery clay zones of thickness varying from 1 to 2 m were intersected in three boreholes at depth range of 90 to 127 m.
Surpura	200	1:5,000	06	810	36	No lignite was encountered in boreholes.
Khari-Charnan	225 10 2	1:50,000 1:10,000 1:2,000	–	–	–	Due to non-availability of drilling machine exploration for lignite could not be emphasized.
GMDC, Gujarat						
Bhavnagar	–	–	32	3933.50	144	–
Surka (North)						
Kachchh	–	–	20	700	–	One million tonnes resources of lignite were estimated.
Mata-No-Madh						
Panandhro	–	1:50,000	–	–	–	Total geological reserves of 15 million tonnes of lignite were estimated.
Surat	–	1:5,000	–	–	30	–
Tadkeshwar	–	1:3,000				

MECL

MECL carried out exploration for lignite in Rajasthan and Tamil Nadu and established 2,273 million tonnes of resources during 2009-10 with CV (calorific value) varying from 1356 to 2745 kcal/kg. Promotional and contractual drilling was carried out in Tamil Nadu, Gujarat and Rajasthan. The details of exploratory drilling during 2009-10 are given in Table - 6.

State Directorates

Particulars of exploration carried out by State Directorate of Geology & Mining, Rajasthan during 2009-10 are given in Table - 7.

GMDC

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

NON-FERROUS METALS

BASE METALS

GSI, MECL, HCL, HZL and State Directorates conducted investigations for copper, lead and zinc ores in different parts of the country during 2009-10 .

GSI

The details of exploration activities carried out by GSI during 2009-10 are given in Table-8.

MECL

MECL carried out detailed exploration for base metals in promising areas in the state of Rajasthan. Details of exploration carried out by MECL during 2009-10 are given in Table - 9.

HCL

HCL carried out about 735 m exploratory sub level mine development work for confirmation of surface boreholes results in Chapri area and a total 1226.20 m mine development like driving, raising, cross cutting etc. in Surda mine, both in ICC, East Singhbhum district, Jharkhand. HCL has also conducted exploration of Khetri mine (undertook drilling of 122.50 m in 2 boreholes and 97 samples were collected) and at Kolihan mine (undertook drilling to a total 319.20 m in 4 boreholes and 305 samples were collected), in Jhunjhunu district, Rajasthan.

HZL

HZL carried out exploration in Rampura-Agucha mines, Bhilwara district, Rajasthan by drilling 5096.15 m in six boreholes. About 311 samples were collected and estimated 120.36 million tonnes of ore resources with 1.92 to 2.17% Pb and 11.80 to 14.67% Zn were established. In Rajpura-Dariba mines, Rajsamand district, Rajasthan, HZL conducted underground mapping in 877 linear m on 1:200 scale; 21,502.45 m drilling in 47 boreholes; undertook collection of 3096 samples and estimated 42.20 million tonnes of ore resources with 1.40 to 2.30% Pb and 6.30 to 8.10% Zn. A total of 2,997 m underground mapping on 1:200 scale; 18,363 m drilling in 409 boreholes and collection of 16,254 samples were carried out by HZL in Zawar Group of Mines (Mochia, Balaria, Zawarmala and Baroi), Udaipur district, Rajasthan. In addition, in Mochia mine, 8 sq km of surface geological mapping, 18 linear km geophysical mapping and 41 samples were collected and in Balaria mine 1,341 samples were collected and 16,021 m of surface drilling in 16 boreholes were carried out.

State Directorates

Investigation of base metals as carried out by State Directorates of Geology & Mining of Nagaland, Madhya Pradesh and Rajasthan during 2009-10 are given in Table - 10.

Table – 8 : Exploration for Base Metals by GSI, 2009-10

State/District	Name of block	Details of exploration	Results
Gujarat			
COPPER			
Banaskantha	Southeast of Ambamata and Data-Bhanpur	Rock Sampling	A limonitised calc-silicate band of dimension 400 m x 60 m was identified to the west of Godha. It contains specks of pyrite, chalcopyrite and magnetite. Well dumps from Khokhariya show pyrite & chalcopyrite in calc-silicate rocks.
Haryana			
COPPER			
Mahendragarh	North of Gangutana	Exploration by drilling	Two boreholes (GGBH-11 and GGBH-12) were drilled at 200 m strike interval to intersect the mineralised zone at 60 m vertical depth. GGBH-11 intersected two mineralised zones having average copper content of 0.27% x 4.0 m and 0.24% x 4.0 m along the borehole. Borehole GGBH-10 which was drilled last year to intersect the mineralised zone (0.38% Cu x 4.00 m) was delineated while borehole GGBH-3 at deeper level (at 200 m vertical depth) intersected copper mineralised zone of an average width of 6.5 m having average copper content of 0.32%.
-do-	South of Faizabad ki-Dhani	Channel sampling and drilling	A 100 m long and 12 m wide zone of sulphide mineralisation having mostly pyrrhotite and pyrite with specks of chalcopyrite in graphite-biotite-amphibolite schist and associated calc silicate rocks was identified in a quarry section of Faizabad-ki-Dhani hill. The channel samples indicated copper values in the range of 200 ppm to 660 ppm. Drilling of borehole (FDBH-1)was taken up in the western part of the main Faizabad-ki-Dhani hill to see the extension of mineralisation in the soil covered area by intersecting the geophysical anomaly due to suspected sulphide mineralisation zone at 60 m vertical depth.

(Contd.)

Table - 8 (Contd.)

State/District	Name of block	Details of exploration	Results
Himachal Pradesh			
LEAD-ZINC			
Sirmaur	Ambota area Tons Valley	Channel Sampling and drilling	Ambota Block is found to host three lead-zinc lenses. The strike lengths of first & second lenses are 500 m each and that of third one is 260 m. The values of Zn in first lens varied from 0.1% to 4.08% and Pb from 125 ppm to 0.83%, while in the second lens the values of Zn varied from 500 ppm to 1.22% and Pb from 100 ppm to 1.7%. From the third lens the value of Zn was recorded as 1.70%. On the basis of surface analytical results five boreholes were proposed initially to test the subsurface behaviour of those lenses and out of them two boreholes (AS-1 & 2) have intersected more than one mineralised zones at depth. Further boreholes were under progress and channel samples were collected from the gap zones.
Solan	Motipur-Narag	Drilling and chemical analysis	Geophysical and geochemical anomaly was delineated over a strike length of 1.1 km within the shear zone. The lower part of Sanjauli quartzite is marked by a shear for a strike length of 2.10 km from Padhan in the northwest to Narag in the southeast. Out of five boreholes proposed, two boreholes (MNS-1 & MNS-2) have been completed. The analytical results of MNS-1 indicated five prominent zones of Pb+Zn mineralisation viz. (1) 2.10 m x 1.47% (2) 1.80 m × 3.85% (3) 2.10 m x 1.03% (4) 2.10 m x 0.74% and (5) 1.90 m × 0.50%. Analytical results of MNS-2 was awaited. Borehole MNS-3 was reportedly under progress.
Jammu & Kashmir			
LEAD-ZINC			
Baramulla	Buniyar area	Grab sampling	Comenced as collaborative programme with DGM, Jammu & Kashmir. One selected grab sample from the richest zone of ore analysed 20% Pb and 17% Zn with traces of copper (Cu).
Reasi	Bakkal-Sersandhu-Khairikot area	Rock sampling	Surface indications of mineralisation have been noted in the form of minor disseminations of pyrite in quartzite and ferruginisation at places. Five old workings have also been recorded in the area. Analytical results of the surface bedrock samples were awaited.
Maharashtra			
COPPER			
Gadchiroli	Ghanpur-Mudholi	Drilling and sample analysis	Surface analytical results of 10 samples of this area indicated Cu values that varied from 20 ppm to 1.9%, Pb from 10 ppm to 30 ppm, Zn Zn from 10 ppm to 75 ppm, Co from <10 ppm to 20 ppm, Ni from <10 ppm to 100 ppm and Cr from 10 ppm to 0.1%. First borehole was under progress.

(Contd.)

Table - 8 (Contd.)

State/District	Name of block	Details of exploration	Results
Meghalaya			
BASE METAL			
East Khasi Hills	Umphyrnai area	Channel sampling	The channel samples from the adjoining area i.e. east of Pomlakrai reveals that there is a segment with high value of copper i.e. 310 ppm to 950 ppm. Occurrences of secondary uranium-lead and high value of REE and thorium have also been reported. Specks of primary oxidised sulphides were noticed along thinly banded acid metavolcanics. Analytical results of the samples were awaited.
Rajasthan			
BASE METAL			
Alwar	Deota-Kishangarh Bas area	Channel sampling and geochemical analysis	Evidences of mineralisation are manifested by old workings along with mine dumps and disseminations of primary sulphides and malachite stains confined to a prominent shear zone trending N 60^0 W-S 60^0 E and having a variable width of 5 m to 65 m. Geochemical samples were collected from three channels (CH-1, CH-2 & CH-3). The analytical results of samples from CH-1 indicated copper values ranging from 0.1% to 0.9% along a zone of 13 m width.
Bhilwara	Kalalikhera block	Exploration by drilling	Exploration by drilling was taken up to test the sub-surface persistence of mineralisation in a zone of over 500 m strike length delineated on the surface based on favourable geological milieu, interesting aerogeophysical anomaly signatures and encouraging analytical results of surface samples. The first borehole (KKR-1) drilled up to a depth of 235.30 m intersected intermittent zones of sulphide mineralisation with visual estimate of 2-10% total sulphide (pyrite+/- pyrrhotite +/- chalcopyrite). Second borehole (KKR-2) was under progress.
- do -	Rampuriya and Gadariyakhera villages	Mapping and sampling	The area indicates a linear zone of AEM anomaly with significant magnetic signature, ferruginisation and is in strike continuity of favourabale host rocks having mineralisation on either end of the area. Detailed mapping on 1:5000 scale, geochemical sampling in grid pattern (100m x 50 m) and trenching were carried out to expose BIF and ferruginised bands. Analytical results of 57 out of 331 pedogeochemical samples show Pb between 10 ppm and 460 ppm and Zn between 20 ppm and 1100 ppm.
- do -	Karoi-Rajpura area Pur-Banera belt	Mapping and sampling	Five random grab samples indicated copper values between 0.93% and 1.57%. An area of 1 sq km has been covered for Detailed Mapping (scale 1:2000) in the southwest of Village Rajpura where the primary copper.

(Contd.)

Table - 8 (Contd.)

State/District	Name of block	Details of exploration	Results
			minerals like chalcopyrite, bornite, covelite and chalcocite in calcareous biotite gneiss were noticed in the pit excavated for road materials. Surface indication of mineralisation is manifested by malachite stains in biotite gneiss in different places. Bed-rock samples have been collected from the area.
Churu	Biramsar-ki-Dungri	Bedrock sampling	The indications of mineralisation in this area are malachite and azurite staining, box work, old working and slag dumps. Bedrock samples were collected from different pits made in ultramafic rocks for dimension stone and sent for analysis of PGE, Cr, Ni, Co and base metals. Samples have also been collected from well-dumps, well-section and from channels across the Biramsar-ki-Dungri area. In a well-section, massive sulphide mineralisation has been recorded.
Dausa & Alwar	North of Dhani Basri Prospect	Geophysical surveys	Geophysical surveys that comprised IP, Magnetic (V.F). Self Potential and Resistivity methods were carried out in the area. IP survey has brought out three charageability zones. Zone-I trending north-south falls in the southern part of the area has moderate order of anomaly, zone-II trending NW-SE and zone-III trending N-S have feeble order of anomaly.
Jaipur	Dholpura area	Bedrock sampling	Mineralisation is manifested in the form of malachite staining, presence of old working and mine dumps. Occurrences of fresh sulphides including chalcopyrite were observed confined to quartz veins (SW of Dhula) and brecciated magnetite quartzite (west of Dholpura).
Jhunjhunu	Dhanota area	Exploration by drilling	The analytical results of 45 grid geochemical samples indicate Cu ranging from 14 ppm to 6700 ppm. Co < 25 ppm to 730 ppm, Zn 8 ppm to 47 ppm and Pb < 50 ppm to 95 ppm. Presence of 0.5 ppm and 0.12 ppm Au content in two samples was indicated. A wide and persistent gossan zone trending in NE-SW direction dipping steeply towards NW was traced for a distance of 700 m with width varying up to 240 m. Extensive old workings and huge slag dumps are present within gossan zone. The first borehole (DNBH-1) was under progress. Disseminations and clusters of coarse crystals of pyrite along with minor pyrrhotite, smears and occasional stringers of chalcopyrite have been noticed along the borehole cores, but the borehole was yet to intersect the expected zone of mineralisation.

(Contd.)

Table - 8 (Concld.)

State/District	Name of block	Details of exploration	Results
Sikar	Mahawa block	Channel sampling and drilling	The analytical results of surface channel samples indicated Cu values ranging from 10 ppm to 6400 ppm. So far a strike length of 470 m mineralised zone has been explored by drilling 3 boreholes (MBH- 1, MBH-2 & MBH-3). The first borehole intersected one 3.40 m (along borehole) mineralised zone and the second borehole intersected three mineralised zones of 12.40 m, 18.60 m and 4.00 m thickness. The third borehole which was under progress has so far intersected four mineralised zones of 8.30 m, 5.00 m,1.70 m and 4.50 m thickness.
Sirohi	Danva Block	Deep drilling	Two deeper boreholes (DAN-1 & DAN-2) were planned so as to intersect the mineralisation delineated in shallow borehole (60 m vertical depth) at 300 m vertical depth. But the borehole DAN-1 did not intersect massive sulphide mineralised zone at desired depth and was closed at 425.25 m. Borehole DAN-2 was under progress.
Udaipur	Bara Block	Detailed mapping and soil sampling	The evidence of sulphide mineralisation in the area includes malachite stains and old workings. The area has been covered for Detailed Mapping (1:2500) and systematic soil sampling on the grid 100 m x 25m.
Sikkim			
BASE METAL			
West Sikkim	Chakung-Jugdum area	Sampling	The copper mineralisation is mainly confined to the quartz veins occurring in fractures and shears in chloritic phyllite of Gorubathan Formation of Daling Group. Presently systematic sampling is being carried out for a strike length of more than 1 km in Jugdum block covering all the three old workings reported earlier.

Table – 9 : Exploration for Base Metals by MECL, 2009-10

State/ District	Block	Mapping		Samples collected	Drilling		Remarks
		Scale	Area (sq km)		Bore-holes	Mete-rage	
Rajasthan							
Ajmer	Bajta North Block (Phase-1)	-	1	166	5	859	About 1.241 million tonnes of resources with 0.70% Cu, 0.35% Pb and 0.56% Zn (at 0.50% Cu cut-off) were estimated.
- do -	Ganeshpura Block	-	0.50	200	5	1067	About 0.973 million tonnes of resources with 1.33% Pb and 1.44% Zn (2.77% Total Metal Content) at 2.00 Total Metal Content (TMC) cut-off were estimated.
Chittorgarh	Rewara Block	-	1	298	8	2300	About 2.65 million tonnes of resources with 3.42% Pb, 0.66% Zn and 0.38% Cu (4.4% TMC) at 2% TMC were estimated.

Table – 10 : Exploration for Base Metals by State Directorates of Geology & Mining, 2009-10

State/ District	Block	Mapping		Samples collected	Drilling		Remarks
		Scale	Area (sq km)		Bore-holes	Mete-rage	
DGM, Nagaland							
Phek	Meluri	–	–	–	–	150	Core logging and sampling were carried out.
DGM, Madhya Pradesh							
Katni-Jabalpur	Badwara, Sleemnababad and Bahoriband areas	–	–	47	–	–	About 273 sq km area has been reconnoitered.
DMG, Rajasthan							
Ajmer	N/v Nayagaon, Jiwana, Chainpura etc.	1:50,000 1:10,000 1:2,000	100 10 1	15	–	–	Gossan zone was located at the contact of limestone and quartzite in about 1 km x 5-70 m area.
Bhilwara	N/v Thadia	1:2,000	1	10	_	–	An area extending for a strike length of 1150 m with width 30 to 40 m is indicative of base metal occurrences.
Pali	N/v Jadan Kharadi, etc.	1:50,000 1:10,000 1:2,000	100 10 2	–	–	–	–
Rajsamand	N/V Sunarkui	1:2,000	1	38	2	329	Indication of base metal mineralisation is revealed along a thin ferruginous sheared gossan zone within dolomite exposed for more than 1500 m strike length near Village Sunarkui.
Sirohi	Anua and Chotila blocks	1:50,000 1:10,000 1:2,000	150 10 1.5	17	–	–	Malachite staining, gossan areas, old trenches, old slag debris sulphide mineralisation in the form of stringers in calc silicate and pyroxinites have been marked in the area.
Udaipur	N/v Kun, Balicha, Kodarwadia, etc.	–	–	-	6	739.50	Old workings show plenty of malachite encrustations and staining.

BAUXITE

State Directorates

During 2009-10, Directorate of Geology & Mining, Chhattisgarh carried out prospecting for bauxite in Darai area in Kabirdham district by reconnaissance geological survey on 1:50,000 scale in 356 sq km area; detailed geological mapping on 1:4,000 scale in 2.03 sq km area; drilling 532.95 m in 47 boreholes; and 526 nos of sampling. In total 0.22 million tonnes of bauxite resources were estimated. In Sarbhanja area, Mainpet Plateau, Surguja district, the Directorate has conducted prospecting for bauxite by reconnaissance geological survey on 1:50,000 in 300 sq km area; detailed geological mapping on 1:4,000 scale in 2.34 sq km area; pitting 112 cu m; 1480.30 m drilling in 133 boreholes and 273 no of sampling. About 0.2 million tonnes of bauxite was estimated with average 47% Al_2O_3.

In 2009-10, Directorate of Geology & Mining, Maharashtra conducted exploration for bauxite in Ghungur area, Kolhapur district by mapping on 1:25,000 in 15 sq km area; detailed geological mapping in 0.27 sq km area and by undertaking 213 m of drilling. In Patan Jawali Teh, Satara district, exploration for bauxite was carried out by mapping on 1:25,000 scale in 50 sq km area; detailed geological mapping in 0.65 sq km area and by undertaking 114 m of drilling. The Directorate also conducted general survey for bauxite in Guhaghar area, Ratnagiri district by mapping on 1:25,000 scale in 40 sq km area and by carrying out surface sampling.

During 2009-10, Directorate of Geology, Odisha carried out exploration for bauxite around Gunapur area (Sambarmali), Kalahandi district by geological mapping on 1:25,000 scale in 60 sq km area; on 1:2,000 scale in 0.15 sq km area ; taking up trial excavation of 27 cu m and collecting 292 grab and channel samples. In Kadalikhol, Munda, Murka, Bagbilmali area, Koraput district the Directorate has conducted investigation for bauxite by geological mapping on 1:50,000 scale in 125 sq km area and collected 230 rock and bauxite (grab/channel) samples. Eleven bauxite bearing plateaux were delineated. The Directorate also carried out exploration for bauxite in Nariniguda, Pancharha and Baldigurha areas in Koraput district by geological mapping on 1:50,000 scale in 150 sq km area and collecting 235 rock, grab and channel samples. Bauxite bearing plateaux were also located in the area.

FERROUS MINERALS

CHROMITE

GSI

In Odisha, reconnaissance (G-4) stage investigation has been carried out during 2009-10 for chromite around Maulabhanj and Tangeria areas in Dhenkanal district to assess the potentiality of chromite mineralisation along the transition zone of Eastern Ghat Mobile Belt (EGMB) and Iron Ore Super Group (IOSG), south of Sukinda ultramafic complex. The presence of chromiferous ultramafic zone for a linear stretch of more than 1 km has been established through large scale mapping (1: 10,000 scale) supplemented by pitting/ trenching. In the identified favourable area (0.35 sq km) within ultramafic clan of rocks for chromite mineralisation, detailed mapping on 1: 2000 scale has been carried out. The visual estimate of Cr_2O_3 is about 20-25% (chemical analytical results were yet to be received). However, bedrock samples collected from old pits in the area during 2004-05 analysed Cr_2O_3 ranging from 29.17 to 49.43% and Fe_2O_3 from 17.72% to 34.33%.

FACOR

During 2009-10, M/s. FACOR carried out exploration in Boula chromite mine, Keonjhar district, Odisha by 417.8 m drilling in 19 boreholes; in Kathpal chromite mine, Dhenkanal district, Odisha by 2606.4 m drilling in 55 boreholes and collecting 276 sample and in Ostapal chromite mine, Jajpur district, Odisha by 4,441.10 m drilling in 31 boreholes and collecting 196 samples.

IRON ORE

GSI

In Andhra Pradesh, reconnaissance (G-4) stage investigation was carried out during 2009-10 for iron ore in Bayyaram-Nilvancha-Sitanagar and surrounding areas in Khammam district as a request item of Andhra Pradesh DGM for preliminary assessment of iron ore resources. An area of 60 sq km was covered by large-scale mapping on 1: 12,500 scale along with pitting/ trenching of 60 cu m and collection of 110 pit/trench samples along with 375 bedrock and groove samples. Based on sampling and mapping, five iron ore bands have been delineated and potential blocks were identified for systematic assessment of iron ore mineralisation. Iron ore occurs in the area in two geological domains, one being associated with BMQ belonging to Khammam Group and the other associated with quartzite of Bollapalli Formation of Pakhal Supergroup. Iron ore occurs as 10 m to 40 m wide

magnetite–haematite quartzite bands extending discontinuously from Imababanagar to Sitanagaram in Warangal district. In Pakhals, it occurs as sedimentary hematitic ore associated with ferruginous and feldspathic sandstones of Bollapalli Formation of Pakhal Supergroup. A 5-10 m thick massive iron ore (haematite) band with 200 m strike length in association with ferruginous sandstone has been traced in Irsulapuram area. The lower part of the ferruginous sandstone unit which is gritty in nature hosts iron ore rich pockets. This gritty sandstone unit represents basal unit of Pakhal Supergroup. BMQ bands have also been traced along the flanks of the Papameda Gutta hill. In addition to these, BMQ bands are delineated in Mudumukala Gutta, Kucherla Bodu and Kucherla Gutta. The BMQ bands at Kucherla Gutta are rich in magnetite.

In Chhattisgarh**,** M/s. Chhattisgarh Mineral Development Corporation (CMDC) sponsored item for prospecting (G-3) stage investigation was continued during 2009-10 in Aridongri area, Kanker district with the objective to delineate potential iron ore bodies and estimation of ore reserves. This item was initiated during field season 2006-07 and had to be suspended for want of forest clearance. The investigation is scheduled to be supplemented by 800 m of drilling in 11 boreholes. The leasehold area of CMDC lies in the southern part of the Aridongri hillock and is around 3.5 km long and 2 km wide. During the course of mapping and sampling in an area of 5 sq km in 2006-08, three iron ore bands of lenticular nature have been delineated which have a cumulative strike length of 2.373 km. The strike length of the northern most iron ore band is about 1.383 km with width ranging from 3 to15 m. The central iron ore band has a strike length of about 130 m with width of about 15 m. The southernmost iron ore band has a strike length of around 880 m with a maximum width of about 25 m in the northern part. Analytical results have shown encouraging values with Fe varying from 57.2% to 69.6%. Drilling operation has commenced in 2009-10. Four boreholes CKAr-1 to 4 have been planned to intersect the ore zone at 60 m vertical depth. The borehole CKAr-1 has intersected an ore zone of 7.7 m. The prospecting (G-3) stage investigation was continued during 2009-10 for iron ore in Parwi area, Kanker district to assess the iron ore resources in Parwi area. During 2008-09, LSM on 1: 12,500 scale along with channel sampling had been carried out to delineate potential magnetite and specularite-bearing iron ore bands in BMQ. The BMQ and specularite-magnetite bearing ore bands occur as enclaves with Bengpal gneiss of Archaean Age. BMQ with iron ore bands occur as discontinuous bodies and pockets trending N-S and NNW-SSE between Khora in the north and Jalhur in the south. Four massive iron ore bands (Band-I to IV) have been delineated which have strike lengths of 300 m, 150 m, 200 m and 85 m, respectively. The true outcrop width ranged from 5 m to 18 m. Analytical results of channel samples of Band-III have shown a maximum value of 67% Fe.

In Karnataka, during 2009-10 reconnaissance (G-4) stage was carried out for iron ore resources in selected freehold areas in Taranagar and Rajpura blocks in Bellary district as a collaborative item with DGM, Karnataka State for preliminary assessment of iron ore resources. The investigated area forms a part of highly folded meta-sedimentary sequence of Sandur schist belt which exposes a spectra of the meta-volcano sedimentary units of the Donimalai Formation belonging to Sandur Group. The BIF and bedded chert are associated with the meta-volcanic unit. The iron ore is mostly hematitic with occasional magnetite. Large-scale mapping (1:12,500 scale) along with systematic bed rock and pit/trench sampling has been carried out in two identified blocks (Block-A & Block-B) in the Taranagar area and potential BIF bands have been delineated. BIF is represented by Banded Haematite Jasper (BHJ), Banded Hematite Chert (BHC) & Banded Haematite Quartzite (BHQ). In Block-A, two BIF bands have been delineated in the Gungadi hill range, one along the northern portion and the other in the south eastern corner of the block. The north- eastern BIF band is 1.00 km in strike length with width ranging from 30-70 m. The south-western BIF band is more than 2 km in strike length with width ranging from 80-100 m. Fe content is about 60% (visual estimation). In Block-B, seven BIF bands have been traced along north of Timmappanagudi area. The strike length varies from 1 km to more than 2 km with width ranging from 10 m to 50 m. The Fe content is about 60% (visual estimation). Chemical assay results were awaited.

In Meghalaya, reconnaissance (G-4) stage investigation was carried out during 2009-10 for assessment of iron ore potentiality in the northern part of East Garo Hills district. Large-scale mapping (1: 10,000) covering an area of 15 sq km along with 30 cu m of pitting/trenching and collection of 25 bed rock samples have been accomplished in Athiabari area in toposheet no: 73K/13 till April, 2010. The BMQ bands trending NE-SW is exposed as discontinuous bands over a strike length of about 2 km with width ranging from 10 to 85 m. These bands continue further towards north. Two trenches and six pits were excavated in the unexposed portions of the area to establish the strike continuity of the potential BMQ bands and also to study the contact relationship between the gneissic rocks and the BMQ. The depth persistence of the iron ore bands seems to be limited. In many portions of the area the iron ore also occur as floats.

In Odisha, General exploration (G-2) stage investigation was continued during 2009-10 in Ghoraburhani- Sagasahi area, Sundargarh district. The iron ore bodies occur on low isolated ridges and are confined in the valley portions of "horse shoe-shaped" synclinorium. The litho units of the area comprise ferruginous shale, iron ore and laterite. The iron ore bands occur as lenses and bands with ENE-WSW trend and low to moderate dip north west. The cumulative strike length of ore bodies in Ghoraburhani area is 1.95 km. The surface width varies from 40 to 250 m. The ore is mainly powdery to soft laminated with minor hard laminated ore, lateritised at places. Exploratory drilling was initiated in the Ghoraburhani block during 2007-08 and was continued in 2009-10 by extending it to Sagasahi block. A total of fifteen boreholes has so far been completed. During 2009-10, two boreholes, one in Ghoraburhani block (SBH-11) and the other in Sagasahi block (SSB-4) have been drilled. The borehole (SBH-11) in the Ghoraburhani block intersected spectacular ore zone with cumulative thickness of 70.20 m comprising hard, soft laminated and powdery ore and another zone of cumulative thickness of 9.80 m comprised low-grade shaly ore. The low- grade shaly ore occurs as intercalations within the high-grade ore. The borehole SSB-4 drilled in Sagasahi block intersected a cumulative thickness of 36.00 m ore zone comprising soft laminated and powdery ore with minor hard laminated variety and 35.45 m cumulative thickness of low-grade shaly ore zone. The iron content varied from 48.64 to 69.16% (Average grade: 61.66%), SiO_2 varied from 0.05 to 6.68 % and Al_2O_3 from 1.53 to 15.93%. During 2009-10, with the available chemical analysis data, 4.61 million tonnes of indicated iron ore resource (332) with an average grade of 61.97% Fe, 3.01% of SiO_2 and 4.37% of Al_2O_3 at cut-off grade of 55% Fe were estimated. Thus in Ghoraburhani block so far a total of 13.71 million tonnes of indicated iron ore resource (332) has been estimated. Reconnaissance (G-4) stage investigation was carried out during 2009-10 as a sponsored project of M/s. OMC Ltd to demarcate the iron ore bearing zones in the Daitari-Sindurimundi leasehold areas of M/s. OMC Ltd in Keonjhar district. An interbanded sequence of soft laminated ferruginous shale and brown chert overlain by massive and hard laminated iron ore band was delineated during mapping in Sindurimundi hill. The iron ore band has been traced over a strike length of 1300 m with approximate width of 20 m. The massive and hard laminated iron ore mostly consists of haematite with some goethite and is occasionally limonitised. Southwest of Talsa, an iron ore band locally bouldary in nature has been traced over a strike length of 1000 m width of 10 m.

In Rajasthan, reconnaissance (G-4) stage investigation was carried out for ferrous and associated metallic minerals in the extension zone of known iron ore deposits during 2009-10 as one year item to evaluate the potentiality of iron ore in central Rajasthan. Airborne survey under OHR carried out earlier in central Rajasthan including Jahazpur belt had picked up several linear/elongated magnetic zones with more than 780 gammas over several kilometers. During this field season reconnoitory traverse mapping (1: 25,000 scale) for an area of 450 sq km and large-scale mapping (1: 10,000 scale) covering an area of 2 sq km have been carried out along with collection of 60 bedrock and channel samples. Several impersistent iron ore bands with width varying from 5m to 20 m were demarcated in Bijethi-Darga-Soguria-Manohargarh, Jhinkli, Tola, Mataji-ka-Khera and Amargarh areas. These iron ore bands are present within dolomite and along the contact of dolomite and quartzite units belonging to Proterozoic sedimentaries of Jahazpur Group and are composed mainly of hematite and limonite. Significant development of boxwork structures and botryoidal growth indicate secondary enrichment. The depth persistence of the bands is presumbly of limited extent. Presence of old workings is noted near Soguria, Darga, Biletha and Bijeti areas. Thick slag heaps are also present near Samiya-ka-Jhopra and Biletha areas. Prospecting (G-3) stage investigation has been carried out during 2009-10 for ferrous and associated metallic minerals to explore the potential of iron ore deposits in the extension zone of Bagholi-Papra iron ore deposits of northern Rajasthan.The iron ore prospects occur within Pre-Delhi rocks in association with albitites. Strong aeromagnetic signatures with peak values of 9,770 and 9,910 gammas are recorded which corroborate well with the known iron ore occurrences. Drilling was carried out to probe the causative source of the ground magnetic anomaly in the earlier (2007-08) delineated three shallow magnetic anomaly zones below the soil cover in strike continuation of the exposed iron ore band. Fourteen boreholes are planned to intersect the magnetic zones at about 40-45 m depth below the ground. The boreholes were in progress and it intersected albitised calc gneiss and minor disseminations of iron ore.

State Directorates

DGM, Chhattisgarh, in 2009-10 conducted exploration for iron ore in Raoghat area, Narayanpur and Kanker districts by

reconnaissance geological survey on 1:50,000 scale in 415 sq km area and 32 samples were collected. Five million tonnes of iron ore resources were inferred with an iron content of +60%.

The Department of Mines & Geology, Karnataka, in 2009-10 carried out exploration for low-grade iron ore in Ambarkoppa, Tumbinakatte & Veerpura villages in Shimoga district by mapping 300 sq km area on 1:50,000 scale and collected 20 samples. About 6.2 million tonnes of iron ore (38-50%) resources were inferred to a workable depth of 20 m.

During 2009-10, DGM, Madhya Pradesh, carried out demarcation of iron ore in Hirapur area, Sagar and Chhattarpur districts. A total of 931 sq km area have been covered by reconnaissance survey. Some of the prominent localities of discontinuous mineralised pockets of iron ore are Sarwa, Raipura, Maheri Pahar and Indora areas. The Directorate has also taken up survey and demarcation of iron ore in Mandsaur and Neemuch districts. Reconnaissance survey of 2,209 sq km and 32.5 cu m of pitting were accomplished.

In 2009-10, Directorate of Geology, Odisha carried out exploration for iron ore by geological mapping on 1:25,000 scale in 29 sq km area and 27 ore samples were collected in an area west of Baneikala. Further geological mapping on 1:2,000 scale in 0.3 sq km area; 39.5 cu m trial excavation in two pits; and collection of 72 ore samples in Brahmanijhori area both in Keonjhar district were also carried out. The Directorate has also conducted exploration for iron ore in Kusumdihi, Roladihi, Bandhala areas (by geological mapping on 1:25,000 scale in 32 sq km area and collecting 18 samples); in Randa, Damaru, Dangichuan, Rajabasa areas (by geological mapping on 1:25,000 scale in 27 sq km area and collecting 9 samples), both in Sundergarh district.

DMG, Rajasthan in 2009-10, conducted detailed geological mapping on 1:2000 scale in one sq km area and collected 10 spot samples from areas near Village Thadiya in Bhilwara district as part of its iron ore exploration activities.

NMDC

During 2009-10, NMDC carried out exploration in Bailadila iron ore deposit nos 11B, 14 and 11C in Dantewada district, Chhattisgarh by undertaking 1601 m core drilling in 23 boreholes in 50 m grid pattern. Similarly, in deposit nos 10 and 11A too, 593 m core drilling were carried out in eight boreholes. In Donimalai Iron Ore Mine, Bellary district, Karnataka, 1,005 m drilling in 22 boreholes and collection of 440 samples were carried out in 2009-10.

SAIL

During 2009-10, SAIL carried out exploration for iron ore in Rajahara, Jharandalli and Dali (Manual &Mechanised) mines, Durg district, Chhattisgarh by carrying out 3061.10 m of drilling in 81 boreholes and collecting 2,526 samples for analysis. A total 74.02 million tonnes of iron ore resources were estimated in these mines. Besides, SAIL also conducted exploration in its various iron ore mines in Singhbhum district, Jharkhand such as Meghahatuburu wherein 2000 m drilling in 44 boreholes along with collection of 1,250 samples were carried out in Kiriburu, 1,570 m drilling in 22 boreholes with 1,570 samples collected; in Sukri lease, - 17.20 m drilling in one borehole and in Dhobil lease341.5 m drilling were conducted. In Bolani Iron Ore Mines, Keonjhar district, Odisha, SAIL carried out 375 m drilling in seven boreholes with collection of 375 samples .

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

During 2009-10, the company carried out detailed mapping on 1:2,000 scale in their leasehold areas at Velguem/Surla mine, Sancordem Malpona mine and Sigao mine, Goa. During exploration, a total of 150.84 hectares area was mapped, 2506.30 m drilling was done in 42 boreholes and 429 samples were collected. As on 1.4.2010, total iron ore reserves estimated were 11.04 million tonnes in Velguem/Surla mine, 10.37 million tonnes in Sancordem-Malpona mine and 7.5 million tonnes in Sigao mine.

MANGANESE ORE

GSI

In Maharashtra, the prospecting (G-3) stage investigation was carried out during 2009-10 as a collaborative programme with Maharashtra State DGM to establish manganese ore horizons in Parseoni extension area, west of Parseoni mine in Nagpur district. Exposures of intricately folded and faulted sequence of manganese bearing Sausar metasediments associated with Tirodi gneiss of Archaean age were reported in the study area. The overall trend of manganese ore bodies is east-west. The host rock of manganese mineralization is pink and white marbles. Manganese ore occurs within the marbles as irregular bands and lenses varying in thickness from 0.5 to 1 m. Potential blocks for follow up assessment of manganese ore mineralisation have been identified in the area through

large-scale mapping. Two potential manganese ore bands are located in Salavi and Mohagaon blocks. Systematic pitting/trenching and bedrock sampling has been carried out in Salavi and Mohagaon blocks to assess the continuity of manganese ore horizons. The dominant manganese ore mineral is braunite with subordinate psilomelane / pyrolusite.

In Odisha, prospecting (G-3) stage investigation was carried out during 2009-10 for manganese ore in Damurda South block, Bonai- Kendujhar belt, Keonjhar district. The investigation involved drilling and sampling in the identified block lying in the north western part of the Precambrian Bonai-Kendujhar belt of North Odisha. The present investigation in Damurda South block is in continuation of the work of exploration that was carried out during 2006-09 in the block . Drilling in Damurda North Block was completed in 2008-2009. This is a two year item commencing in 2009-10. The area is covered by ferruginous as well as manganiferous laterite along with massive and brecciated chert. A number of abandoned quarries and pits are noted in the area. The manganese mineralisation is mostly pocket type and occurs as lensoidal bodies in the laterite profile. Mineralisation along joint and fracture planes within brecciated chert are also recorded. The mineralisation is supergene enrichment type and is controlled by both lithology and structure. Manganese ore minerals are mostly pyrolusite and psilomelane. Nine boreholes involving a total meterage of 537.75 m have so far been drilled in the area. Out of these nine boreholes, seven boreholes have intersected manganese ore zones. A total cumulative thickness of 60.45 m of manganese ore zone has been intersected. Individual ore zones vary from 0.20 m to 11.20 m. The available chemical assay results indicate that manganese (Mn) content ranged from 9.09% to 45.24%, iron (Fe) content varied from 11.35% - 40.15% and phosphorus (P) ranged from 0.04% - 0.70%. The visual estimation (VE) of the intersected ore zones is from 10% to more than 20% Mn (the analytical results were yet to be received). On the basis of available chemical analysis data an inferred resource of 0.07 million tonnes (333) of manganese ore with an average grade of 30.44% Mn, 24.32% Fe and 0.25% P has been estimated at 20% Mn cut-off grade. Thus in Lasarda-Pacheri-Bolani and Damurda area till date 14.84 million tonnes (333) of manganese ore have been estimated at 20% Mn cut-off grade. Reconnaissance (G-4) stage investigation was carried out during 2009-10 for manganese ore in the Balagorha-Champuasahi area belonging to Precambrian Bonai-Kendujhar belt (BKB), Keonjhar district. This is a two year programme along the northern strike continuity of Damurda North Block. Exposures of ferruginous as well as manganiferous chert relicts within the manganiferous and ferruginous laterite were seen in the area. Manganese ore bodies are associated with chert bands. The chert bands are both massive and brecciated. A number of abandoned manganese quarries with visible good grade of manganese have been recorded in the area. Two manganese ore bodies have been delineated during detailed mapping on 1: 2000 scale. The manganese ore is of both hard and soft in nature and visual estimate (VE) of Mn is 30-35%. Manganese also occurs as fracture and cavity fillings within brecciated chert and within porous and cavernous laterite.

State Directorates

DGM, Maharashtra conducted general survey for manganese ore in Parseoni area, Nagpur district. Large-scale mapping (1:25,000) of 37 sq km area was carried out. Manganese ore exposures are noticed near Savali and Mohgaon villages.

Directorate of Geology, Odisha carried out exploration for manganese ore around Unchabali, Baneikala, Kundumpani, etc areas (Geological mapping on 1:25,000 scale in 29 sq km area and 41 rock and 27 ore samples were collected) and in Brahmanjhor area (Geological mapping on 1:2000 scale in 0.3 sq km area; trial excavation of 39.5 cu m; 7 rock and 72 ore samples were collected) both in Keonjhar district. Five discontinuous manganese ore bodies in first area and a thin zone of manganese mineralisation was located in the second area. The Directorate also conducted exploration for manganese ore around Rangua area, Sundargarh district by carrying out geological mapping on 1:25,000 scale in 32 sq km area; 6 cu m of trial excavation and collecting 12 samples. Three manganese ore occurrences around Rangua were located.

DMG, Rajasthan conducted exploration for manganese ore near Chhota Pandwal area, Banswara district by mapping on 1:50,000 scale in 150 sq km area; on 1:10,000 scale in 10 sq km; on 1:2,000 scale in one sq km area and collecting 15 samples.

MOIL

During 2009-10, MOIL carried out 4,925 m exploratory drilling involving 17 boreholes in two mines –Tirodi and Bharweli situated in Balaghat district, Madhya Pradesh; five mines Dongri Buzurg & Chikla in Bhandara district and Gumgaon, Kandri & Munsar in Nagpur district, all in Maharashtra. The reported reserves as on 1.4.2010 in Tirodi, Bharweli, Dongri Buzurg and Chikla mines were at 1.77 million tonnes,

21.53 million tonnes, 11.13 million tonnes and 4.33 million tonnes, respectively.

STRATEGIC METALS

MOLYBDENUM

GSI

A reconnaissance (G-4) stage concept oriented exploration for molybdenum was continued during 2009-10 in the Velampatti South Block (VSB), Harur-Uttangarai Belt (HUB), Dharmapuri district, Tamil Nadu by drilling with an objective to test the strike and depth extensions of molybdenum mineralisation within the shear zone as per the new concept of molybdenum mineral disposition in the shear zone. This block is located in the southern tip of Harur-Uttangarai Belt, in the eastern part of Alkali-Carbonatite Province (ACP), North Tamil Nadu. GSI carried out extensive exploration in this belt between 1989 and 2003 and based on the exploration work it was established that in a shallow to moderately easterly dipping shear zone a lode was presumed to occur as a tabular body dipping along the shear zone. Exploration by drilling boreholes at 100 m strike interval was carried out to intersect the shear zone at two levels, i.e. 50 m and 100 m below ground level and ore resource was computed accordingly. Present studies and re-examination of the exposures of the shear zone on the surface have revealed that the prominent narrow quartz reefs in the HUB, the carriers of the molybdenum mineralisation, ran for hundreds of meters at a stretch along the strike, as sub-horizontal to low easternly dipping raft like bodies that did not occurr as a tabular body dipping along the shear zone. These mineralised quartz veins are disposed as sub-horizontal to low easternly dipping lensoidal or sigmoidal bodies. Boreholes were drilled to confirm the new concept and the result of these boreholes also confirmed the new concept. With the present concept the resources of the lodes may go up after re-calculation. Similarly, a reconnaissance (G-4) stage investigation for molybdenum was also carried out in Kanavaypudur-Toppur area, Dharmapuri district during 2009-10. A number of prominent NNE-SSW trending sub-parallel shear zones with proto to ultramylonite fabric were exposed around Toppur and Kanavaypudur. Within the shear zones quartz veins, quartz ankerite veins with clusters of limonitised sulphides and occasional specks of molybdenite were recorded. Soil samples have been collected systematically from this area and from Vellakkal-Kilburikkal area.

TUNGSTEN

GSI

During 2009-10, GSI carried out prospecting (G-3) stage of investigation for tungsten mineralisation in quartz veins in Mahakoshal Group of rocks around Wyndhamganj area, Sonbhadra district, Uttar Pradesh. During 2008-09, three scheelite bearing mineralised zones were identified by UV Lamp in Wyndhamganj area. The northern zone was traced for a strike length of 200 m, central zone was traced discontinuously for 1 km and southern zone was also traced for 1 km. The analytical results of the samples of southern mineralised zone vary from 490 ppm to 5,038 ppm tungsten (W). In the adjoining western part between Wyndhamganj and Chakdurma scheelite bearing zone was delineated which have shown tungsten values up to 1,327 ppm. Presently the area has been covered by mapping and sampling.

Rare Metals & Rare Earths

AMD

Reconnaissance and detailed survey (210 and 4.66 sq km) for Rare Metals and Rare Earths investigation resulted in locating columbite-tantalite and beryl bearing pegmatites at Gaurpura and Gurlabahal in Jharsuguda district, Odisha. Reserves of columbite-tantalite were established at Sukopara and Kotwalpara pegmatites in Bastar district, Chhattisgarh. Recovery of columbite-tantalite mineral concentrate was continued from the pegmatites of Pandikimal, Jharsuguda district and Bodenar, Bastar district areas where the Recovery Units are in operation. Beryl was also collected from these pegmatites as by-product.

BEACH SAND MINERALS

AMD

Reconnaissance survey (230 sq km) was carried out under Beach Sand Off Shore investigations and delineated potential heavy mineral concentrations along the coastal tracts between :

i) Machiwada and Onjal in Tapi-Par river, Valsad and Navsari districts, Gujarat. Heavy mineral concentration of 12% was recorded.

ii) Nechanpur and Bagda in Nunia and Panchpara nadi, Balasore district, Odisha. Heavy mineral concentration of up to 20% was recorded.

iii) Nileswaram and Chandragiri river mouth, Kasargod district, Kerala. Heavy mineral concentration of 8-10% in some zones up to 3 m depth from surface was recorded along 21 km long coastal area.

iv) Bordi and Dahanu coast, Thane district, Maharashtra, and

v) In lake sediments of Namakal district, Tamil Nadu. The Lacustrine sediments of downstreams and plains of Kollimalai-Pachamalai hills recorded 20-50% heavy mineral concentration predominantly with garnet.

GSI

Preliminary survey for placer mineral resources evaluation in the territorial waters off north of Bhimunipatnam, Andhra Pradesh, was carried out during the 2009-10. The samples were collected on 1 km x 1 km grid pattern within the water depths of 10.77 m to 19.97 m. Surface sediments comprised brown grey fine sand from 12 to 20 m water depths with patches of brown medium to fine sands. The bottom sediments are generally grey coarse sand with shells and shell fragments and rock pieces at places. Heavy mineral (HM) studies of sediment samples from vibro cores have indicated that the HM wt% varies from 1.14 to 5.86 with an average value of 3.14. HM concentration is more (1.6%) in – 60 +120 ASTM. The HM suit comprised ilmenite, garnet, sillimanite, zircon, monazite and rutile with pyroxenes, amphiboles, apatite etc. The surface temperature, salinity, conductivity, pH and DO values of sea water varied from 25.2^0 – 25.3^0C, 22.7-24.5 ppt, 36.4-29 (ms/cm), 7.9-8.20 and 7.8-8.0 mg/l, respectively.

Reconnaissance (G-4) stage investigation for placer mineral occurrence near Honnavara town, Uttar Kannad district, Karnataka was carried out during 2009-10 as a request item from Karnataka State DGM to evaluate the nature and extent of placer minerals occurring in the coastal area between Apsarakonda hill and Village Kasarkod . The area is occupied by geomorphic landforms of marine origin which include active beach, beach ridge, swale and sand dunes etc. The landforms are dominantly made up of sand beds with placer mineral bands deposited by the depositional activity of the sea all along the coast. Samples have been collected for panning to identify the heavies including gold and for petromineralogical study. Results of samples so far received indicated that beach sediment comprises 11-20% heavy minerals.

Preliminary survey for placer mineral resource evaluation in the territorial water off Uni Paravur, Kollam district, Kerala, was carried out during 2009-10. Bathymetry study carried out over the area indicated a gently sloping topography with minor undulation. Vibro core sampling on 1 km x 1 km grid at 64 locations indicated that sand is largely coarse to medium in nature and the heavies are confined to finer fractions. Brownish ferruginous mud patches are seen at places close to the shore. The concentration of heavies is less in the middle part in comparison to the southern part. A conspicuous shelly zone beneath 1.97 m column of medium-grained sand is encountered in one of the locations. The northern part has relatively a considerable amount of heavies in finer fraction. Heavy mineral study report of sediments was awaited.

During 2009-10, Directorate of Geology, Odisha carried out investigation for heavy minerals (ilmenite, rutile, zircon, garnet, monazite, etc.) in beach sand in three sectors (T.S. No. 74E/6, NE of Puri, T.S. No. 74 E/13 and SW of Konark T.S. No. 74 1/1) along Puri coast. The investigation included 1.9 sq km geomorphological mapping/land use/land cover mapping on 1:2000 scale, 3,328 m drilling and collection of 3,328 samples in T.S. No. 74 E/6; 5.2 sq km geomorphological/land use/land cover mapping on 1:2000 scale, 2,013 m drilling, collection of 2,013 samples, 26.05 km line survey and R.L. of 243 boreholes in NE of Puri T.S. No. 74 E/13 and 7.9 sq km geomorphological mapping/land use/land cover mapping on 1:2000 scale, 3045 m drilling and collection of 3,045 samples in SW of Konark T.S. No. 74 1/1. Reserves and grades of the deposits will be assessed after detailed analysis of the samples.

PLATINUM GROUP OF METALS

GSI

Reconnaissance (G-4) stage investigation for assessing the potentiality of PGE mineralisation in ultramafic and mafic rocks of Betul belt in Betul and Chhindwara districts, Madhya Pradesh was carried out during 2009-10.The mapped area around Bordehi exposed bimodal volcanics and tuffs which are intruded by bodies of hornblendite and hornblende gabbros. Patches of schistose talc-serpentinite exposed near Bamla, Bijori and Riyatwadi villages analysed higher content of Ni (about 600 ppm) and Cr (0.11% to 0.24%). Besides, talc-serpentinite from Bordehi area and pyroxenite from Padhar areas contained Ni from 375 ppm to 600 ppm and Cr from 0.10% to 0.24% ppm. PGE analysis received so far indicated 111 ppb PGE content.

Reconnaissance (G-4) stage investigation for nickel, cobalt and platinoid group of elements in the basic ultrabasic intrusives around Gondpipri area, Chandrapur district, Maharashtra was continued during 2009-10. Detailed mapping in Chek-Vitalwada and Heti area demarcated the oxidised and sulphide zones in the pyroxinite and gabbro and also delineated the mineralisation zone of maximum width of 3 m for a strike length of 500 m. Bedrock samples from Heti area indicated Ni value up to 800 ppm and PGE value up to 1,037 ppb. Ore microscopic study revealed the presence of fair concentration of pentlandite, pyrrholite, bravoite, pyrite, chalcopyrite, magnetite and Cr-magnetite in

silicate gangue of pyroxenites and gabbro. The SEM-EDX and EPMA studies revealed the presence of five to six discrete grains of Pt and Pd-Te in association with sulphide and oxide in pyroxenite and gabbros. The item has been upgraded to G3 and extended for one more year i.e. 2010-11.

Reconnaissance (G-4) stage investigation for PGE in ophiolite belt was carried out in Manipur during 2009-10.The ophiolite suit comprised serpentinised peridotite, peridotite, pyroxenite with minor plagiogranite which has a general trend of N-S to NNE-SSW and shows varying degree of tectonic alteration and serpentinisation.Three discontinuous lenses (3 m x 1 m) of massive chromite have been observed within serpentinised ultramafic. The ophiolite suits are emplaced into the pelagic sediments of Tertiary age. The contact between sediments and ophiolite is sharp, sheared and shows intense brecciation (1-3m) Cr_2O_3 with content of chromite varying from 44-59%.

Reconnaissance (G-4) investigation for PGE mineraisation in the ultramafic-mafic rocks of Sulthan Bathery-ananthavadi area of Wayanad district, Kerala was carrid out during 2009-10. Pitting –trenching and channel sapling were carried out in three WNW-ESE trending sub-parallel bands of 2 km length and 10-30 m wide ultramafic bodies exposed at Vakeri. Samples have been collected for petrography, whole rock and trace element analysis, ore microscopy, EPMA and SEM-EDX studies.

Prospecting (G3) stage investigation for PGE in Bangur and Baniapank in Kendujhar district, Odisha was underaken during 2009-10 under an MoU with OMC Ltd to assess the extension of chrome bearing ultramafic in leasehold area of Bangur mine area of OMC Ltd that represents a litho-melange in which two narrow zones of 5 and 8 m width contain chromitite clasts in pegmatoid gabbro matrix. Depth persistence of these zones is confirmed in underground mine. Stray analysis of matrix from these zones yielded anomalous PGE value (29 ppm). This zone is taken as the target for detailed sampling and petrochemical study for delineating PGE mineralisation. Geochemical samples 240 in number were collected of which 50 samples were analysed by AAS for Cr & Ni. The result indicates gradual depletion in Cr in brown clay soil from 380 ppm in the north to 117 ppm in the south. Nickel show positive correlation with Cr. Drilling is proposed at places where Ni and Cr show anomalous values.

Three items for PGE investigations were taken up in Sittampundi layered complex, ultramafic of Sathyamangalam group and Mettuppalaiyam mafic-ultramafic complex, Tamil Nadu. Reconnaissance (G-3) stage investigation for platinum group of elements by scout drilling in Tasampalaiyam block, Sittampundi layered maficultramafic complex was initiated in 2009-10 to prove the depth persistence of PGE mineralised chromitite bodies. The block has been divided into 4 sectors (T1 to T4). Four boreholes (TBH-1 to 4) have been completed in T1 sector which were drilled along the positive trench section that has given high Pt + Pd values. All the boreholes intersected the chromitite/chromiferous meta-pyroxinite bands showing rich to sporadic disseminations of pyrite and chalcopyrite. In TBH-1 the main chromite band of 0.55 m width was intersected at 51.87 m depth which has a 40-50% chromite and sparse pyrite disposition. Besides, 10 more bands of chromitite with 20-60% chromite were intersected between 51.96 and 72.28 m depth whose width varied from 0.05 m to 0.67 m. In TBH-2, a total of 11 chromitite bands were intersected from 38.29 to 49.03 m having width of 0.05 m to 0.70 m that comprised 15-25% chromite. In TBH-3, there are 11 bands of chromitite intersected between 30 and 47.96 m depth with width varying from 0.13 to 0.90 m along boreholes. In TBH-4, three bands of chromitite were intersected viz. i) Band 1 of 0.12 m width was intersected between 41.30-42.18 m depth; ii) Band 2 of 0.42 m width was intersected between 41.21 and 41.63 m depth and iii) Band 3 of 0.19 m width was intersected between 41.96 and 42.15 m depth. The fifth borehole TBH-5 was in progress which has so far intersected thin layers of metapyroxinite rich in pyrite. The closed spaced trenching carried out in T2& T3 sectors has resulted in delineation of a number of chromitite and chromiferous meta-pyroxinite bands. The petrographic study of borehole samples of TBH-1 has revealed the presence of major sulphide minerals like pyrite, chalcopyrite, pentlandite and millenite occurring in the form of fine dissemination, stringers and pods mainly along the grain boundaries, fracture within the oxide (chromite) as well as in silicate (amphibolites). SEM study of the same samples indicated various PGM phases identified as native platinum grain as well as telluride, sulphide and arsenide forms. The largest grain of 27micrometre size of Pd telluride is reported for the first time in Sittampundi complex. Analysis of remaining samples was under progress. The investigation extended for one year. Reconnaissance (G-4) stage preliminary investigation for platinum group of elements in the meta-ultramafic rocks of Sathyamangalam Group was carried out during 2009-10. At Siviyarpalaiyam, four ultramafic (meta pyroxenite/talc tremolite schist) bands extending to about 850 m length have been delineated in the eastern zone and in the western zone two bands of meta-pyroxenite extending to about 250 m length have been delineated. Samples have been collected from meta-

pyroxenite bands and processed for chemical analysis. Reconnaissance (G-4) stage investigation for platinum group of elements by scout drilling in Solavanur and Karappadi blocks and detailed mapping in Mallanayakanpalaiyam block, Mettuppalaiyam mafic-ultramafic complex was carried out during 2009-10. In Solavanur block, a total of two boreholes (SBH-1 & 2) have been completed and the third borehole (SBH-3) was under progress. The first borehole (SBH-1) intersected meta-pyroxenite band between 29.40 m and 34.30 m depth and shows an average grade of 801 ppb Pt and 1,124 Pd over a width of 3 m. Besides, four additional meta-pyroxenite bands having width varying from 0.60 m to 4.90 m have been intersected between 17.83 m and 52.20 m depth. The borehole SBH-2 intersected the meta-pyroxenite band which analysed 279 ppb Pt and 859 ppb of Pd over a width 2-5 m from 46.25 to 55.25 m depth. Apart from this, five more bands having width ranging from 1.15 m to 8.00 m have been intersected between 19.40 m and 62.20 m depth. The third borehole (SBH-3), which was in progress intersected a meta-pyroxenite band that analysed an average grade of 208 ppb Pt and 437 ppb Pd over a width of 6.5 m between 40.95 m and 43.15 m depth. Besides, nine more meta-pyroxenite bands varying in width from 0.15 m to 3.20 m have been intersected between 18.35 m and 43.15 m depth.

DIAMOND

GSI, and Directorate of Geology, Odisha continued with their engagement in exploration for diamond in 2009-10.

GSI

In Andhra Pradesh during 2009-10 GSI carried two investigations in search of kimberlite clan of rocks (KCR bodies) in Mahaboobnagar district. Reconnaissance (G-4) stage investigation was continued during 2009-10 to identify KCR bodies in Buthpur and Achampet block in Mahbubnagar district. Systematic stream sediment samples were collected from suitable trap site from 4th and 5th order streams. The heavy minerals so far identified includes magnetite, epidote, garnet, tourmaline, zircon, sphene, amphibole, ilmenite, hematite, cassiterite, rutile and iron hydroxide diagnostive of crustal lithologies. Reconnaissance (G-4) stage investigation was continued during 2009-10 in search of KCR bodies in Kalwakurtyand Charakunda Block in Mahaboobnagar district. Systematic stream sediment samples were collected from suitable trap site from 4th and 5th order stream. The major heavy minerals, population so far identified comprised magnetite, epidote, garnet, tourmaline, zircon, sphene, amphibole, ilmenite, hematite, cassiterity netile and iron hydroxide indicating crystal lithologies.

Reconnaissance (G-4) stage investigation in search of KCR bodies in parts of Raichur district, Karnataka was carried out during 2009-10. The area forms a part of the Dharwar craton exposing the metavolcanic associated with metasedimentary rocks of the Eastern Greenstone belts. Mapping of the area revealed a suspected ultramafic body located near Village Gunjehalli. Two kimberlite bodies were discovered about 300 m south of Turkandoni (Toposheet No. 57E/5) through indicator mineral survey, geological traverse and pitting.

State Directorate

In 2009-10, Directorate of Geology, Odisha continued exploration for assessment of diamond from primary source around Kalmidadar, Arkholi and Kathiwadi areas in Nuapada district by mapping on 1:50,000 scale in 20 sq km area, 501.45 m drilling, 100 cu m excavation and sampling (core - 500 nos, rock -27 nos, loam - 3 nos and 120 tonnes of bulk). Bulk sample processing indicated that olivine lamproite body of Kalmidadar area is diamond bearing that could yield good recovery of diamond. The Directorate has also carried out geophysical study to locate source rock of diamond around Nangalbod areas of Nuapada district by 1.1 sq km survey, 12.76 line km magnetic traverse, 3 nos resistivity sounding and 432 nos of data related to resistivity profiling.

GOLD

The GSI, MECL, HGML and State Directorates were engaged in the exploration for gold during 2009-10. An account of exploration work done by GSI is given in Table-11. The details of exploration carried out by MECL, State Directorates and HGML are given in Table - 12.

INDUSRTRIAL MINERALS

The details of exploration work carried out for industrial minerals by GSI and State Governments during 2009-10 is given in Table - 13.

DECORATIVE DIMENSION STONES

State Directorates

The details of exploration work carried out for marble, granite, sandstone and decorative dimension stones by State DGMs during 2009-10 are furnished in Table - 14.

Table – 11 : Exploration for Gold by GSI, 2009-10

State/District	Location	Details of work done	Results obtained/Remarks
Andhra Pradesh			
Anantapur	East of Kanganapalle, northern part of Ramagiri-Penakacherla	Mapping and geochemical analysis	The mapping indicated wall rock alterations like silicification, epidotisation and sericitisation in the area. Amphibolites are often silicified with stringers of quartz along foliation plane and dissemination of sulphide (mostly pyrite and pyrrhotite) at places. Analytical result so far received did not indicate any significant gold value. The silicified amphibolite indicated Cu values up to 0.73% and Zn values upto 0.21%.
Mahaboobnagar	North of Krishna river, Gadwal Schist belt	Trenching and sampling	About 184 geochemical soil and bed rock samples were collected for gold analysis in Nandimalla and Patharchad blocks. Trenching and sampling were carried out in SW and of Patharchad to delineate the strike length of mineralised zone where anomalous gold values of 40, 80 and 160 ppb were recorded from soil and bedrock samples. Mineralisation is manifested by the presence of silicification, brecciation and limonitisation. Out of 519 geochemical samples collected during 2008-09 only 13 samples indicated gold value ranging from 25 ppb to 165 ppb and the rest of the samples showed <25 ppb Au value.
Bihar			
Nalanda	Munger-Rajgir Group of rocks	Geochemical analysis	Sulphide mineralisation has been noted at contact zone of quartzite and upper phyllite over 4 km strike length from the closure of F_1 fold near Giriak. Analytical result of bedrock samples indicated anomalous gold value in 17 samples ranging from 28 ppb to 200 ppb. Analytical results from the trench samples so far received showed anomalous Au value ranging from 26 ppb to 272 ppb. No significant silver value has so far been recorded in the area.
Jharkhand			
East & West Singhbhum	Tilaitanr-Sobhapur	Trenching and sampling	Mineralisation in the form of discontinuous exposures of grey quartz veins containing disseminated grains of pyrite were delineated over a distance of about 150 m with thickness varying from 10-30 cm. In the mineralised zone dissemination of chalcopyrite, pyrite, arsenopyrite and suspected native gold is noted mostly in quartz/quartz carbonate veins traversing the massive ultramafic host rock in the southern part of the area. Old workings were seen at about a km west of Village Bhitar Dari. Analytical results of trench samples are awaited.

(Contd.)

Contd.

Table - 11 (Contd.)

State/District	Location	Details of work done	Results obtained/Remarks
Ranchi	Sindauri East Block	Exploration by drilling	To assess the gold potentiality of the six mineralised zones extending into this block from the adjacent Kotadih-Sindauri block. Five boreholes (SEB-1, 2, 3, 4 and 5) at 100 m intervals were completed. The borehole SEB-1 intersected 12 significant zones of gold mineralisation between 44.50 m and 189.25 m depth, which indicated gold value ranging from 0.160 g/t to 8.95 g/t. Borehole SEB-2 also intersected 12 mineralised zones between the depth of 68.85 m and 87.35 m which indicated gold values ranging from 0.17 g/t to 20.10 g/t Au. In borehole SEB-3, five mineralised zones having cumulative width of 2.05 m with 1.18g/t Au down to the depth of 118.25 m have been intersected. In SEB-4 and 5, significant zones of sulphide mineralization in the form of stringers of pyrite and arsenopyrite with suspected grains of gold have been intersected at various depths ranging between 32.55 m and 181.50 m. With the available assay data a total inferred resource of 3.10 million tonnes (333) having an average grade of 1.81 g/t Au at 05 g/t cut off has been estimated.
Karnataka			
Chitradurga	Belaghatta Block	Bedrock, trench and stream sediments sampling	Three sheared alteration/carbonatised zones and one sheared silicified zone were delineated along N-S to NNW-SSE direction having width varying from 8 m to 14 m. Out of the three zones, the central one (Zone II) is prominent with sulphide mineralisation. Bedrock samples from the silicified zone have yielded anomalous Au value ranging from 35-345 ppb. Trench samples from carbonated Zone-II have analysed gold value of 0.56 g/t over 4m width. Stream sediment samples from the same zone have analysed Au value up to 235 ppb. The mineralisation in the form of disseminated pyrite has been observed in trenches. Analytical results of trench samples were awaited. The stream sediment samples from the zone have analysed Au values up to 250 ppb.
Gulbarga	Northern part of Mangalur schist belt	Analysis of bedrock, trench, stream sediment and soil samples	Gold mineralisation in the form of disseminated sulphide is structurally controlled and is confined to quartz veins in schistose amphibolite. Analytical result of bedrock, trench, stream sediment and soil samples so far received did not indicate any significant gold values. However, a few samples of bedrock yielded anomalous gold value ranging from 25 ppb to 55 ppb and that of trench samples from 25 to 88 ppb. Chemical analysis results for the remaining samples were awaited.

(Contd.)

Table - 11 (Contd.)

State/District	Location	Details of work done	Results obtained/Remarks
Tumkur	Ajjanahalli block-D	Drilling, trenching and bedrock sampling	Prospecting (G-3) stage investigation for gold in Ajjanahalli bock-D, Tumkur district was initiated during 2009-10 to assess the gold potentiality of the eight mineralised zone delineated earlier. The mineralisation is noted in highly sheared BIF traversed by quartz/ quartz-carbonate veins having profuse dissemination of pyrite, pyrrohotite and arsenopyrite. During the year mineralized zones 5 & 6 were proved by drilling to study the subsurface nature of mineralisation whereas zones 7 and 8 were assessed by trenching and bedrock sampling. Analytical results of bedrock samples, so far received indicated a maximum gold value of 0.65 g/t whereas trench samples indicated gold value ranging from 0.10 to 1.20 g/t over a width of 1 m. Trenching and bedrock sampling have established mineralised zone of 500 m on Band 7 and 1050 m on Band 8. Drilling in Bands 5 & 6 indicated that borehole AGD-1 has intersected Band 5 at 80.90 m-82.15 m and Band 6 at 121.70-128.65 m, 131.25-148.85 m and 201.55-213.55 m depths. Borehole AGD-2 has intersected Band 5 at 54.75-61.80 m and Band-6 at 125.30-128.60 m and 133.10-149.80 m depths. Analytical results of core samples are awaited. Based on the work carried out during 2008-09 resources of gold ore estimated in Block-C is 0.9946 million tonne with average grade 2.17 g/t (cut-off 1 g/t) and 0.213524 million tonne with average grade 1.45 g/t (cut-off 0.5g/t).
Rajasthan			
Banswara	Delwara West Block	Exploration by drilling	Prospecting (G-3) stage exploration for gold-copper mineralisation in Delwara West block, Bhukia Gold Belt which was initiated in 2005-06 was continued during 2009-10 to test the southern continuity of gold mineralisation of southern block, Bhukia area and to test the depth continuity of mineralised zones I, II, III, IV & V. Altogether 25 boreholes (DWB-1 to 24 & 27) have been drilled & DWB-28 and 25 were under progress. First 11 boreholes (DWB-1 to 7, 9,11, 13 &15) intersected 4 to 24 sulphide zones (1.00 m to 56.80 m wide) corresponding to surface zones of mineralisation and confirmed the strike continuity for a strike length of 100 m. DWB-10, 12, 14 & 16 intersected 9-23 sulphide zones with 1.00-55.25 m width. The DWB-17 to 22 have intersected 1.00 m-7.00 m thick 3-8 sulphide zones. DWB-23 & 24 have intersectred 1.00 m to 16.90 m thick 8 and 6 sulphide zones, respectively. DWB-27 has intersected 1.00m to 37.20 m thick 15 sulphide zones corresponding to surface mineralisation I, II & III. Results of core samples collected from DWB-1 to 18 have been received. To understand the geometry and correlation of the lodes and zones of mineralisation, level plans or all the gold lodes-I to V at 160 m RL have been separately prepared at 0.2 g/t and 0.5 g/t Au cut-off.

(Contd.)

Table - 11 (Concld.)

State/District	Location	Details of work done	Results obtained/Remarks
			Most of the lodes are correlatable with adjacent boreholes. On the basis of analytical results received so far resource estimation has been attempted by cross section method at cut-off grade of 0.2 and 0.5 g/t and 1.0 m stoping width. A resource of 1.62 million tonnes of gold ore has been augmented during 2009-10. Thus in the Delwara West Block the total gold ore inferred resource is 34.73 million tonnes with average grade of 1. 87g/t Au. The resource has been categorised as UNFC 333.
Banswara	Gundelapara NW Block	Reconnaissance stage investigation	Surface evidences of mineralisation are in the form of small old workings, gossans, malachite stains, pyrite mineralisation, presence of ore grinding implements and stop heap in and nearby area. Gossans are ochre red, reddish to yellowish brown and black in colour showing presence of limonite and goethite with box work structure. Sulphides are brown to black bluish in colour and contain mainly copper minerals such as chalcopyrite and bornite.
- do -	Gundelapara Block	Resource estimation	In Gundelapara block, Bhukia gold prospect, Banswara district, Rajasthan, where prospecting (G-3) stage investigation was carried out during 2006-08, an inferred resource of 1.932 million tonnes of gold ore with an average grade of 3.978 g/t Au has been estimated during 2009-10. The resource has been categorised as UNFC 333.
Dungarpur	Bharkundi Block	Reconnaissance stage investigation	A total of reconnaissance resource of 4.5 million tonnes gold ore with average grade of 0.25 g/t Au has been estimated during 2009-10. The resource has been categorised as UNFC 334.
Uttarakhand			
Pithoragarh and Chamoli	Martoli-Milam area and Niti area	Reconnaissance stage investigation	Reconnaissance (G-4) stage investigation in search of more gold and associated mineralisation in Martoli- Milam area and Niti area, Pithoragarh and Chamoli districts has been initiated during 2009-10. Reconnaissance (G-4) stage investigation for gold mineralisation in basal conglomerate of Ralam Formation around Malari, Chamoli district was completed during 2008-09. Two auriferous lenses have been delineated on the basis of available analytical results. (i) Lens-1: auriferous lens extends for 90 m and has two zones viz 0.65 g/t Au x 10 m over a strike length of 90 m and 0.48 g/t Au × 8-13 m over a strike of 60 m. (ii) Lense-2: extends for 135m strike length and has two zones viz 0.4 g/t Au × 3-5 m over a strike of 135 m and 0.5 g/t Au × 4 m for a strike of 40 m. Analytical values of channel samples from walls of old working show a zone for copper in Khimkharak area (NE of Malari) which shows Cu content of 2.88% over a width of 16 m for a strike of 20 m which grades down to 1.9% × 3 m in another old working. One of the old workings in Tamakhani area shows Cu value of 0.73% over 4.5 m width. Results of other elements are: Pb <20-620 ppm, Zn 7-0.18%, Ni <10 ppm-0.23% and Co <10 -710 ppm.

Table – 12 : Exploration for Gold by MECL, HGML and State Directorates, 2009-10

State / District	Location	Agency	Details of work done	Results obtained
Jharkhand				
Ranchi	Parasi Central Block (Phase - II)	MECL	Mapping 1.25 sq km, drilling 1962.90 m in 8 boreholes and collection of 1,823 samples.	Resources estimated are 7.467 million tonnes with 0.995 g/t Au and 3.714 million tonnes with 1.65 g/t Au.
Ranchi	Parasi Central Block (Phase - I)	MECL	Mapping 1.25 sq km, drilling 2806 m in 17 boreholes and collection of 2,937 samples.	About3.486 million tonnes resources with 1.05 g/t Au av grade and 1.67 million tonnes with 1.72 g/t Au.
Karnataka				
Davanagere	N/v Kudrekonda	DGM	Mapping in 300 sq km area on 1:50,000 scale and collection of 15 samples.	After result from chemical analysis is obtained, detailed investigations will be carried out.
Raichur	Hutti	HGML	Surface drilling 450 m, underground drilling 696.40 m and collection of 12,421 samples.	A total of 9.18 million tonnes of resources of gold ore were estimated @ 5.68g/t Au.
- do -	Hira-Buddini	HGML	Exploratory Mining - 567.10 m and collection of 2,340 samples were carried out.	About 0.75 million tonnes resources of gold ore with 3.26 g/t Au were computed.
- do -	Uti	HGML	Mapping in 3 sq km area on 1:2,000 scale, exploratory mining 294.60 m and 1,538 samples were collected.	Open pit and exploratory mining will be continued.
Madhya Pradesh				
Katni & Jabalpur	Badwara, Sleemnabad and Bahoribad areas	DGM	About 273 sq km area has been reconnoitered with collection of 47 stream sediment samples.	Detailed investigations is taken up for precious metal and base metal.
Rajasthan				
Jaipur	N/V Pachhapur, Gol, etc.	DMG	Mapping in 10.5 sq km area on 1:10,000 scale and collection of 229 samples.	Noble metal indications were found over a strike length of about 20 km through the villages of Pachhapur, Gol, Dhavla, Matasula, etc.
Rajsamand	N/V Sunarkui	DMG	Mapping in 1 sq km area on 1:2,000 scale, 329 m drilling in two boreholes, and collection of 20 spot and 18 core samples were carried out.	The project is under progress and is to be prospected by mapping and drilling.
Udaipur	N/v Kun, Balicha, and Kodarwadia	DMG	About 739.50 m drilling in six boreholes were carried out.	Investigation is associated with base metal. Reserves to be computed after receipt of chemical analysis.

Table – 13 : Exploration for Industrial Minerals by GSI, DGMs and Central/State Undertakings, 2009-10

Agency/ Mineral/ State/District	Location	Geological mapping		Drilling		Sampling	Remarks
		Scale	Area (sq km)	Boreh-oles	Meter-age		
Geological Survey of India							
APATITE AND ASSOCIATED MINERALS							
Jharkhand & West Bengal							
Dhanbad & Purulia	Cholwari & adjoining areas	–	–	–	–	–	Analysis of bed-rock samples of apatite-magnetite bearing rock in holwari area showed an average P_2O_5 value of 7.76% and the channel samples indicated average value of 6.77% P_2O_5. In Belaidih block by exploratory drilling apatite-magnetite body was established up to a vertical depth of 30 m where surface samples assayed values ranging from 22.13 to 23.67% P_2O_5.
GLASS SAND							
Assam							
Nagaon	Jiyajuri Chapanala	–	–	–	–	–	The quartzite that occurs within Pulibagan to west and Parkup to the east appears to be suitable for glass industry and the block between Jiyajuri and Champavati will attract immediate interest.
Himachal Pradesh							
Shimla & Kullu	Rampur group of rocks	–	–	–	–	–	Huge exposures of pure white quartzite were recorded from Manikaran Formation of Rampur Group. Some of these may be suitable for glass industry particularly for optical glass.
LIMESTONE							
Andhra Pradesh Kurnool	West of Nandi-kotur	–	–	–	–	–	The sub-horizontally dipping Narji limestone extends for 25 km with its width varying from 1.5 to 2 km. Based on dug wells and tube well inventory the thickness of massive limestone is estimated to be 15 to 20 m Bedrock samples were collected in a grid pattern of 250 m x 200 m for analysis.
Gujarat							
Junagadh & Amreli	Una,Kodinar and Sutrapada Tq	–	–	–	–	–	Bed-rock and borehole sample results of Gaj andMiliolite formations indicate thin vertically discontinous bands of limestone with >40% CaO. The chemical results indicate that none of these limestones are suitable for LD, chemical, SMS and BF grades. The high Al percentage makes the utility of these limestones even doubtful for Cement Industry.

(Contd.)

Table - 13 (Contd.)

Agency/ Mineral/ State/District	Location	Geological mapping		Drilling		Sampling	Remarks
		Scale	Area (sq km)	Boreholes	Meterage		
Rajasthan							
Jaisalmer	Miniyun-ki Dhani (East)	–	–	–	–	–	The area has been drilled by five boreholes. Hard, massive and crystalline (Khuiala) limestone has been intersected in all the boreholes. The thickness of the limestone band varies from 0.24 to 10.93 m. The Khuiala limestone was proved to be of SMS grade. A resource of 235.28 million tonnes SMS grade limestone and 336.07 million tonnes cement grade limestone have been estimated.
Tamil Nadu							
Cuddalore	Senkurichi prospect	–	–	–	–	–	The cretaceous limestone extends for 6.5 km in length and 500 m width. Sampling has been carried out by drilling boreholes which intersected limestone up to its contact with its Archean basement.
PHOSPHATIC SEDIMENTS							
Kerala							
Outer shelf and upper continental margin of Kollam	–	–	–	–	–	–	During the cruise calcareous concretions and some small worm tubes found in the slope between 100 and 200 m water depth revealed indications of phosphate when tested with ammonium molybdate solution.
PHOSPHORITE							
Chhattisgarh							
Durg	Kharenadih-Bhargaon-Sambalpur	–	–	–	–	–	An area of 30 sq km extending both sides of Kharkhara nala has been taken up for assessment of phosphorite. Phosphatic clay band samples were collected in grid pattern by putting augur drill up to a depth of 20 m.
Gujarat							
Dahod	Bombela-Tanda area	–	–	–	–	252	A total of 252 samples were collected for chemical analysis out of which 184 showed positive results when tested with Sapiro's solution.

(Contd.)

Table - 13 (Contd.)

Agency/ Mineral/ State/District	Location	Geological mapping		Drilling		Sampling	Remarks
		Scale	Area (sq km)	Boreholes	Meterage		
Madhya Pradesh							
Jhabua	In parts of Jhabua district	–	–	–	–	–	To locate the new phosphorite deposits, work input was carried out mainly by Remote Sensing techniques with limited and critical field checks. Systematic sampling was carried out all along the length of the dolomite bands.
POTASH							
Gujarat							
Kachchh	Little Rann	–	–	–	–	–	In salt works of Little Rann, brine was collected from dug-cum-borewells/ tubewells. The litho units encountered in the dug wells are generally clay, sand and silt. Sixty samples of brine were collected for potash analysis from various dug-cum-borewells/tubewells located in seven blocks of Little Rann.
SAND							
Kerala							
Pathanamthitta, Alappuzha, Kottayam & Ernakulam	Achenkovil, Manimala, Meenachil & Muvattupuzha river basins	–	–	–	–	–	The photogeological work supported by field checks in the area indicated that in Achenkovil river basin, channel fills, flood plains and river terraces constitute major sand bearing geomorphic units. Extensive development of channel fills and terraces has been observed in full course of River Manimala.
TALC-STEATITE							
West Bengal							
Darjeeling	Gok-Karmi area	–	–	–	–	–	Pockets of talc-steatite were identified along the western slope of Tiruk Khola (river) and along the eastern slope of Ramsuk Khola. The strike length of talc-steatite in Ramsuk Khola has been established for more than 60 m with the help of trenching/ pitting and sampling.
State Directorate of Geology & Mining							
APATITE							
West Bengal							
Purulia	Kutni	1:500	0.09	–	–	25	Resources are yet to be established.

(Contd.)

Table - 13 (Contd.)

Agency/ Mineral/ State/District	Location	Geological mapping		Drilling		Sampling	Remarks
		Scale	Area (sq km)	Boreholes	Meterage		
BARYTES, RED OCHRE & SILICA SAND							
Rajasthan							
Bharatpur	Raipur, Bhondagaon, and Gathri	1:10,000 1:1,000	10 1	–	–	33	About 0.23 million tonnes silica sand and about 0.27 million tonnes of red ochre resources have been estimated.
CHINA CLAY							
West Bengal							
Bankura	N/V Kalyani, Onda area	1:12,500	2	–	–	–	Pitting (15 nos) have been carried out.
CLAY & SILICA SAND							
Rajasthan							
Jaisalmer	N/v Modha & Jasuwala Nada (Gaj Singh-ki-Dhani)	1:50,000 1:10,000 1:2,000	150 10 1	–	–	14	Occurrences of off-white coloured, siliceous white clay were observed in about 0.50 sq km and 0.35 sq km area near Modha (Gaj Singh-ki-Dhani) and Jasuwala Nada villages.
DOLOMITE							
Madhya Pradesh							
Chhatarpur	N/V Banja	–	–	27	660.90	–	About 361 sq km area has been geologically reconnoitered and a total resource of 9.39 million tonnes of dolomite has been estimated.
DOLOMITIC LIMESTONE							
Rajasthan							
Jaisalmer	N/v Askandra	1:50,000 1:10,000 1:2,000	150 10 1	–	–	10	About 1.5 to 2 sq km area near Village Askandra comprises outcrop of pinkish to creamish white coloured boulders of dolomitic limestone overlain by limekanker (0.5 to 1.0 m).
FLUORITE, CALCITE & BARYTES							
Rajasthan							
Jalore	N/v Padavi and Baretha	1:10,000 1:2,000	10 0.5	–	–	8	Presence of calcite were seen in wells near Village Padavi with thickness up to 0.5 m and as vugs ranging in diameter up to 20 cm and a veinlet of size up to 10 m x 3 cm.

(Contd.)

Table - 13 (Contd.)

Agency/ Mineral/ State/District	Location	Geological mapping		Drilling		Sampling	Remarks
		Scale	Area (sq km)	Boreholes	Meterage		
GYPSUM							
Rajasthan							
Bikaner	Areas in Khajuwala Pugal & Kolayat Teh.	1:50,000 1:10,000 1:2,000	500 20 5	–	–	22	On the basis of detailed geological mapping 1.5 million tonnes of gypsum resources were estimated.
LATERITE							
Madhya Pradesh							
Mandsaur & Neemuch	–	–	–	–	–	–	A total of 2209 sq km area has been reconnoitered, 32.50 cu m pitting carried out and 47.25 million tonnes laterite resources have been estimated.
Rajasthan							
Jhalawar	N/V Dag, Girdharpura, Goshala, etc.	–	–	–	–	8	The inferred resources of laterite in the area were estimated at 43.51 million tonnes.
LIMESTONE							
Chhattisgarh							
Bastar	Bastar area	1:50,000 1:4,000	780 1	–	–	135	About 6.30 million tonnes resources of cementgrade limestone were inferred from the area.
Raipur	Deogam-Kurra area	1:50,000 1:4,000	440	29 2.36	806.40	856	Total proved limestone reserves of the area are 5.925 million tonnes of cement grade, 3.076 million tonnes of blendable grade and 18.587 million tonnes of low-grade.
Himaachal Pradaesh							
Shimla	N/v. Gumma Rohana	–	–	2	218.41	–	–
Mandi	N/V Karla	–	–	–	–	–	Drilling yet to commence.
Karnataka							
Gulbarga	Malkhed, Jewragi area	–	–	3	304	300	Gridwise exploratory drilling work has been taken up, core logging and sample collection for chemical analysis are being done.
Madhya Pradesh							
Satna	Tala Bandarkhan area	–	–	32	1055	–	A 500 sq km area has been reconnoitered geologically and 45 million tonnes of limestone resources so far have been estimated.

(Contd.)

Table - 13 (Contd.)

Agency/ Mineral/ State/District	Location	Geological mapping		Drilling		Sampling	Remarks
		Scale	Area (sq km)	Boreholes	Meterage		
Nagaland							
Phek	Meluri	–	–	–	–	–	Mapping of limestone deposits at Satuza in scale of 1:5,000, drilling 300 m, core logging and sampling have been carried out.
Rajasthan							
Bikaner	Sarunda-Mandeliya area	–	–	–	–	–	About 200 sq km regional mineral survey was covered and concealed dolomite and cement grade limestone deposits were found.
Chittorgarh	Satkhanda-Sindvari block	– 1:2,000	–	4 2	200 150	252 188	Limestone of various colours have been intersected in the boreholes.
	Barolimadhu-singh Bansa block						
	Gilund block						- do -
Jaipur	N/V Bithloda, Jaton-ki-Dhani, Mandla, etc.	1:50,000 1:10,000 1:4,000	100 16 3.5	–	–	30	Concealed limestone bands spread over 1000 x 400-600 m area and in 800 x 250 -400 m area were observed near villages Jaton-ki-Dhani and Torda Bamnan, respectively.
Jaisalmer	N/V Sam	1:10,000 1:2,000	15 0.5	37	1478	776	Resources of 116 million tonnes of SMS grade limestone and 181 million tonnes of cement grade limestone were estimated.
Jhalawar	N/V Chhatrapur to Karanpura	1:50,000 1:10,000 1:4,000	200 20 2	–	–	6	Due to erratic occurrences, resources of limestone were not calculated.
Nagaur	N/V Gandwana and Kherwad	1:10,000 1:2,000	20 2	26	1217	697	Average thickness of limestone in borehole is 10 m About 68 million tonnes resources of cement/chemical grade limestone were assessed tentatively.
- do -	N/V Madpura-Bher	1:50,000 1:10,000 1:2,000	150 10 2	11	401	–	About 37.5 million tonnes resources of limestone are tentatively assessed.
Sikar & Jhunjhunu	N/V Chhajna, Kairpura, Kotri, etc	1:10,000 1:4,000	10 5	–	–	140	Two limestone bands (1100 x 200-250 m & 900 x 100-350 m) near Village Chhajna, three limestone bands (800 x 50-200 m, 500 x 50-150 m & 550 x 50-150 m) near Village Bodola & Kairpura and 1000 x 50-250 m limestone bearing areas were noted near Village Karoi.

(Contd.)

Table - 13 (Contd.)

Agency/ Mineral/ State/District	Location	Geological mapping		Drilling		Sampling	Remarks
		Scale	Area (sq km)	Boreholes	Meterage		
LIMESTONE & DOLOMITE							
Karnataka							
Tumkur	N/V Melanahalli	–	–	5	426	150	–
Rajasthan							
Ajmer	N/V Garhi-Arjunpura, Bhagwanpura,	1:50,000 1:10,000 1:2000	50 10 2	–	–	25	Dolomitic limestonebands are exposed intermittently in an area of 3 km x 20-100 m near Village Garhi Arjunpura.
Banswara	N/V Karji, Jagta, Rawat-ka-Padla, etc.	–	–	–	–	–	About 0.10 million tonnes resources of cement grade limestone were estimated,
LIMESTONE, FLUORITE & BASE METAL							
Rajasthan							
Sikar & Jhunjhunu	N/V Raghunathpura, Baseri, Chhapoli, etc.	1:50,000 1:10,000	415 16	–	–	30	Granite 3000 x 100 - 400 m and seven gossan zones of various length and width were noted in the area.
PHOSPHORITE							
Rajasthan							
Udaipur & Banswara	Parts of Girwa Teh, Udaipur and Kushalgarh Teh, Banswara	1:50,000 1:10,000 1:2,000	150 1.5 1.5	–	–	–	Resources to be computed after the completion of chemical analysis.
PYROPHYLLITE							
West Bengal							
Purulia	N/V Jinamonipur	1:12,500	9.8	–	–	28	–
PYROPHYLLITE/SILLIMANITE							
Maharashtra							
Chandrapur	N/V Walni-Khatgaon	1:25,000	40	–	535.50	–	About 0.16 million tonne resources of pyrophyllite-sillimanite have been estimated.
QUARTZ							
Karnataka							
Mandya	N/V Katteri Hagganahalli, etc.	1:50,000	80	–	–	20	About 15,000 tonnes of quartz resources have been inferred.
QUARTZ & FELSPAR							
Rajasthan							
Tonk	N/V Jhalra, Nayagaon, etc.	1:50,000 1:10,000 1:2,000	200 12 1.2	–	–	–	–
Udaipur	N/V Nimri, Shid, Kerpura, Jhunjpura, etc.,	1:50,000 1:10,000 1:2,000	2000 20 2	–	–	–	NE of Village Kerpura pegmatite rich in quartz was mapped and near Village Jhunjpura five quartz veins were mapped.
SILICA SAND							
Rajasthan							
Karauli	N/V Pator, Pura Ata, etc.	1:50,000 1:10,000 1:2,000	105 10 1	–	–	6	Whitish brown coloured silica sand was observed at two places (250 m x 50 m and 200 m x 50 m) near Village Pator and in an area of 200 m x 50 m near Village Pura Ata.

(Contd.)

Table - 13 (Concld.)

Agency/ Mineral/ State/District	Location	Geological mapping		Drilling		Sampling	Remarks
		Scale	Area (sq km)	Boreholes	Meterage		
SILICEOUS EARTH, SILICA SAND, CLAY AND BENTONITE							
Rajasthan							
Barmer	N/V Gunga, Pushad and Bisu	1:50,000 1:10,000 1:2,000	305 22 4	–	–	–	Bentonite up to 2.25 m or more thickness, silicious earth up to 1.75 m thickness and white clay up to 2 m thickness were located in the area.
SOAPSTONE AND DOLOMITIC LIMESTONE							
Rajasthan							
Alwar	N/V Berla (Gothri)	1:50,000 1:10,000 1:2,000	160 10 2	–	–	25	DDT grade soapstone in 120 x 140 m and dolomitic limestone in 80 x 60 m areas were marked near Berla (Gothri).
TALC/STEATITE							
Karnataka							
Davanagere	Near Reddy camp and Village Kabbala	1:50,000	100	–	–	30	Reserves inferred were 0.20 million tonnes to a workable depth of 20 m.
West Bengal							
Darjeeling	N/V Takdiya (Gok)	1:25,000	10	–	–	18	One pit (1.2 m x 1.2 m x 1m) and two trenches (7.30 m x 0.5 m x 1.25 m & 10.40 m x 0.6 m x 1.4 m) were made.
Mineral Exploration Corporation Ltd							
FRIABLE QUARTZITE/GLASS SAND							
ASSAM							
Nagaon	Jiajuri block	–	2.5	9	655	657	About 320.53 million tonnes resources with SiO_2- 88.42%, Fe_2O_3- 0.93%, Al_2O_3-5.12%, CaO-0.13% and MgO-0.11% were estimated.
Gujarat Mineral Development Corpn. Ltd							
LIMESTONE							
Gujarat							
Kachchh	N/V Panandhro	1:50,000	–	–	–	–	About 41 million tonnes of geological resources of limestone were estimated.
Surat	N/V Tadkeshwar	1:5,000 1:3,000	2.64	90	1811	588	Proved reserves of limestone were computed at 69 million tonnes.

Table – 14 : Exploration for Granite, Marble and Other Dimension Stones by State Directorates in 2009-10

Agency/ Mineral/ State/District	Location	Geological mapping		Drilling		Sampling	Remarks
		Scale	Area (sq km)	Boreholes	Meterage		
DMG, Rajasthan							
BAJRI AND GRAVEL							
Jalore	Parts of Sukri, Jawai, and Khari rivers	1:50,000 1:10,000	105 10	– –	– –	19	About 15 million tonnes resources of Bajri in Sukri, Jawai and its tributaries were assessed.
DMG, Karnataka							
GRANITE, GRANITIC GNEISSES AND DOLERITE							
Chitradurga	N/V Dasarahalli, Lambanihatti and Kanave	1:50,000	500	–	–	15	Reserves inferred 1.58 million cu m to a workable depth of 20 m.
DTE OF GEOLOGY, Odisha							
GRANITE & GNEISS							
Keonjhar and Mayurbhanj	East of Village Kalika-Prasad	1:50,000	250	–	–	46	A part of dolerite dyke located in east of Village Kalika-Prasad is found to contain 500 cu m of dark grey dimension stone block of size 0.5 m x 0.5 m x 0.5 m.
DMG, Rajasthan							
GRANITE							
Barmer and Jaisalmer	N/V Dhavi	1:50,000 1:10,000 1:2,000	305 22 4	– – –	– – –	15	Exposures of granite is wide spread in an area more than 2-2.5 sq km.
Jaisalmer	N/V Rampura (Chowk), Khetsar, Guddika-Tala, etc.	1:50,000 1:10,000 1:2,000	50	–	–	10	About 0.5 to 0.75 sq km granite bearing area near Village Rampura (Chowk) was observed. Medium grained, light reddish coloured granite is partially blockable.
Jalore	Parts of Raniwara Teh	1:10,000 1:2,000	5 1	–	–	1	Isolated exposures of granite are in the form of sheet rock which are hard, compact and blockable.
MARBLE							
Rajasthan							
Bhilwara	N/V Koshithal, Amota etc.	1:10,000 1:2,000	40 3	–	–	60	Exploration by drilling is warranted.
MASONRY STONE							
Rajasthan							
Alwar	N/V. Hazipur, Khor and Nagli	1:50,000 1:10,000 1:4,000	100 10 2	–	–	20	Hard and compact quartzite identified in the area could find application as masonry stone.

(Contd.)

Table - 14 (Concld.)

Agency/ Mineral/ State/District	Location	Geological mapping		Drilling		Sampling	Remarks
		Scale	Area (sq km)	Boreholes	Meterage		
Dhaulpur	N/V Khanpura	1:50,000 1:10,000 1:3,600	170 10 2	–	–	15	The area comprises light grey, spotted red and creamish coloured masonry stone and is marked in 900 x 250-700 m area. About 21.60 million tonnes resources have been estimated.
QUARTZITE (MILL STONE)							
Rajasthan							
Alwar	N/VBerla (Gothri)	1:50,000 1:10,000 1 :4,000	160 10 2	–	–	25	Felspathic quartzite which can be used as mill stone is marked in 2000 x 200 m area near Berla and Chimravali villages.
SANDSTONE							
Rajasthan							
Dhaulpur	N/V Subhanpura-Raitonti, Dompura, etc.	1:50,000 1:10,000 1:3,600	100 12 2.5	–	–	21	About 25.64 million tonnes resources of sandstone were assessed in the area.
Jodhpur	N/V Mindoli, Lavera Khurd, etc.	1:50,000 1:10,000 1:2,000	150 20 2	–	–	–	Buff/white coloured sand stone were located.
Karauli	N/V Kalyani	1:50,000 1:10,000 1:2,000	105 10 1	–	–	10	Sandstone was observed in 1000 m x 150-500 m x 1 m area located near Village Kalyani .
SANDSTONE AND MASONRY STONE							
Rajasthan							
Bundi	N/V Prempura, Loicha, Dulhapura, etc.	1:50,000 1:10,000 1:3,072	100 10 1	–	–	10	Inferred resources of sand stone for masonry purposes were calculated at 180 million tonnes.
Kota	N/V Mandliya, Mandana, Ramgarh, etc.	1:50,000 1:10,000 1 :4,000	125 12 1.20	–	–	6	Inferred resources of sandstone for masonry purposes were calculated at 123.5 million tonnes.