

GEOLOGICAL REPORT ON PRELIMINARY EXPLORATION (G3) FOR LIMESTONE IN

JAHARITOLA AND MUNDATOLA BLOCK DISTRICT: SUNDARGARH, ODISHA

**Report submitted under the Mineral (Evidence of Mineral Content) Rules-2015
(Amended up to 2021)**

TEXT, ANNEXURE



MINERAL EXPLORATION AND CONSULTANCY LIMITED
(Formerly known as Mineral Exploration Corporation Limited)

A Government of India Enterprises
CORPORATE OFFICE, NAGPUR

JUNE-2025

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जहरीटोला और मुंडाटोला ब्लॉकों में चूना पत्थर के लिए प्रारंभिक अन्वेषण (G3) पर भूवैज्ञानिक रिपोर्ट जिला: सुंदरगढ़, ओडिशा

कार्यकारी सारांश

सुंदरगढ़ जिला, ओडिशा में स्थित जहरीटोला (3.34 वर्ग किमी) और मुंडाटोला (4.34 वर्ग किमी) ब्लॉक, जो मूल रूप से एमएमआरडी अधिनियम 2015 की धारा 10A(2)(b) के अंतर्गत पट्टों में आते थे, को उनके भूवैज्ञानिक गठन के आधार पर ओडिशा राज्य तकनीकी समिति द्वारा आगे की अन्वेषण के लिए चयनित किया गया और MECL को आवंटित किया गया। प्रारंभिक फील्ड विज़िट में पुराने चूना पत्थर की खदानों की उपस्थिति की पुष्टि हुई, और सीमित सतही सैंपलिंग की गई।

परियोजना को सितंबर 2024 में स्वीकृति मिलने के बाद, दिसंबर 2024 में G3 स्तर का अन्वेषण कार्य शुरू हुआ, जिसमें भूवैज्ञानिक मानचित्रण (1:4000 पैमाने पर), स्थलाकृतिक आंकड़े और सैंपलिंग शामिल थे। ये ब्लॉक भौगोलिक रूप से समतल हैं और क्वार्ट्जाइट तथा मेटाबेसिक चट्टानों की पहाड़ी श्रृंखलाओं से घिरे हुए हैं। ये ब्लॉक सर्वे ऑफ इंडिया के टोपोशीट संख्या 73B15 के अंतर्गत आते हैं, जिनका भू-स्थानांक 22°21'48.57"N से 22°23'34.14"N अक्षांश और 84°52'13.63"E से 84°55'49.55"E देशांतर के बीच है।

मुख्य सतही अनावेषण में डोलोमिटिक शेल, फेरुजिनस क्वार्ट्जाइट और क्वार्ट्ज वेन शामिल हैं, जिसमें डोलोमाइट मुख्य रूप से मुंडाटोला ब्लॉक के पूर्वी हिस्से में दिखाई देता है। जहरीटोला ब्लॉक पूरी तरह से मिट्टी से ढका हुआ है। इस क्षेत्र में पाई जाने वाली चट्टानें गंगपुर समूह से संबंधित हैं, जो भूवैज्ञानिक दृष्टि से जटिल प्रोटरोजोइक मीटासेडीमेंटरी अनुक्रम के अंतर्गत आती हैं, जिनमें महत्वपूर्ण कैल्केरियस और क्लास्टिक इकाइयाँ शामिल हैं। ब्लॉक से लिए गए पाँच प्रतिनिधि नमूनों के पेट्रोग्राफिक विश्लेषण से शेलयुक्त डोलोस्टोन/डोलोमिटिक शेल और कार्बोनेट युक्त शेल की पहचान हुई।

कुल 40 सतही नमूने एकत्र किए गए और विश्लेषण किया गया; इनमें से केवल चार (MML-13, 16, 17, 18, 38) में डोलोमाइट के सीमांत रूप से स्वीकार्य मान पाए गए — जिनमें से दो SMS (O.H.) ग्रेड के मानदंडों को पूरा करते हैं और दो को NMI-2018 में प्रकाशित विनिर्देशों के आधार पर परिशोधन योग्य (Beneficiable) माना गया। हालांकि, ये उपस्थिति बिखरी हुई हैं और निरंतरता का अभाव है।

जहरीटोला ब्लॉक से कोई नमूना एकत्र नहीं किया गया क्योंकि यह पूरी तरह मिट्टी से ढका हुआ है। दोनों ब्लॉकों में चूना पत्थर/डोलोमाइट के लिए कोई संभावित खनिजीकृत क्षेत्र चिह्नित नहीं किया गया, और विश्लेषणात्मक परिणामों को नीलामी योग्य संसाधनों की स्थापना के लिए अपर्याप्त माना गया।

इसके बाद अन्वेषण कार्यक्रम को TCC, NMET की सिफारिश पर पूर्व-समाप्त कर दिया गया। हालांकि, कुछ डोलोमाइट पॉकेट स्थानीय/कैप्टिव औद्योगिक आवश्यकताओं को पूरा कर सकते हैं, लेकिन वर्तमान खनिजीकरण साक्ष्यों के आधार पर इन ब्लॉकों में नीलामी योग्य वाणिज्यिक संभावनाएँ नहीं हैं।

**GEOLOGICAL REPORT ON PRELIMINARY EXPLORATION (G3) FOR
LIMESTONE IN JAHARITOLA AND MUNDATOLA BLOCKS
DISTRICT: SUNDARGARH, ODISHA**

EXECUTIVE SUMMARY

The Jaharitola (3.34 sq km) and Mundatola (4.34 sq km) blocks in Sundargarh district, Odisha, originally was falling under Section 10A(2)(b) leases of MMRD Act 2015, were selected by the State Technical Committee, Odisha for further exploration based on the geological setup and allotted to MECL. A preliminary field visit confirmed the presence of old limestone quarries, and limited surface sampling was carried out.

Following project approval in September 2024, exploration at G3 level commenced in December 2024, including geological mapping (1:4000 scale), topographical contouring, and sampling. The blocks are physiographically flat, flanked by hill ranges of quartzites and metabasic rocks, and lie between latitudes 22°21'48.57"N and 22°23'34.14"N and longitudes 84°52'13.63"E and 84°55'49.55"E, within Survey of India Toposheet No. 73B15. Key surface exposures include dolomitic shale, ferruginous quartzite, and quartz veins, with dolomite exposed mainly in the eastern part of Mundatola block. Jaharitola block remains entirely soil-covered. Rocks exposed in the area belong to the Gangpur Group characterised by geologically complex, proterozoic metasedimentary sequence with significant calcareous and clastic units. Petrographic analysis of five representative samples from the block revealed shaly dolostone/dolomitic shale and carbonate-rich shale.

A total of 40 surface samples were collected and analyzed; only four (MML-13, 16, 17, 18, 38) showed marginally acceptable values of dolomite—two meeting SMS (O.H.) grade and two considered beneficiable based on the specification published in the NMI-2018. However, these occurrences are scattered and lack continuity.

No samples were collected from Jaharitoal block due to soil cover. No potential mineralized zones for limestone/dolomite were delineated in either block, and analytical results were deemed inadequate for establishing auctionable resources.

The exploration program was subsequently pre-closed on recommendation of the TCC, NMET. Although some dolomite pockets may cater to local/captive industrial needs, the blocks lack commercial viability for auction under current mineralization evidence.

CHAPTER-1

1.0.0 INTRODUCTION

- 1.0.1 Limestone, a sedimentary rock, originated mainly by chemical/biochemical precipitation of carbonate minerals in a variety of depositional environments, ranging from marine to terrestrial. The marine system is either neritic (shelf) or pelagic (open-ocean) (James and Jones, 2016). Most of the limestone in geological history is deposited in neritic system. On the other hand, evidences show that pelagic limestones are in the operation since Jurassic time. Each of these depositional environments is controlled by differences in temperature, salinity, depth of photic zone, siliciclastic input and sediment supply. Warm water with normal salinity and low siliciclastic input favours the formation of limestone within the agitated part of the photic zone (the depth of water to which light penetrates) (James and Jones, 2016). This indicates that most of the limestones are deposited in tropical-subtropical belt, within 30° north and south of Equator (Tucker, 2001). In terrestrial setting carbonates are usually formed in lakes, springs, caves depending upon water temperature and local climate.
- 1.0.2 Calcium carbonate (CaCO_3) in the form of calcite is the predominant mineral constituent of limestone. It also contains some amount of magnesium carbonate (MgCO_3) and/or dolomite ($\text{Ca Mg} (\text{CO}_3)_2$). Variable amount of terrigenous quartz, clay, pyrite, haematite, chert etc., present as non-carbonate minerals, control the quality/grade of limestone.
- 1.0.3 Limestone is a crucial and versatile mineral commodity. There are evidences that it has been in use as construction material from the early days of human civilization. From the Great Pyramids of Giza to the Golden fort of Jaisalmer, many of the world's most beautiful and historical buildings are made up of limestone. In the modern time, limestone is primarily used to manufacture cement. However, the uses of limestone, now a days, have not been confined only to construction material; rather the versatility in its uses in different industries made it a valuable mineral. In Iron & Steel Industry, limestone is used both in blast furnace and steel melting shop as a flux. In chemical industry, limestone is consumed to produce bleaching powder, toothpaste, calcium carbide etc. It is used as a purifier in the sugar industry. Limestone is also consumed by industries like paper, fertilizer and foundry etc.

- 1.0.4 The total reserves/resource of limestone of all categories and grades as per NMI (National Mineral Inventory) data based on UNFC (United Nations Framework Classification) system as on 1.4.2015 (Mineral Year Book 2020) have been estimated at 203,224 million tonnes, of which 16,336 million tonnes (8%) are placed under reserves category and 1,86,889 million tonnes (92%) are under resource category. Karnataka is the leading state having 27% of the total resource followed by Andhra Pradesh and Rajasthan (12% each), Gujarat (10%), Meghalaya (9%), Telangana (8%), Chhattisgarh and Madhya Pradesh (5% each) and remaining 12% by other states. Grade wise, Cement Grade (Portland) has leading share of about 70% followed by Unclassified Grades (12%) and BF Grade (7%). Remaining (11%) are different Grades.
- 1.0.5 The production of limestone in 2019-20 was 359 million tonnes, decreased marginally by about 5.43% as compared to that of the previous year. There were 659 reporting mines in 2019-20 as against 725 during the previous year. Thirty mines each producing more than 3 million tonnes per annum contributed 42% of the total production of limestone in 2019-20. The share of 26 mines each in the production range of 2 to 3 million tonnes was 17% of the total production. About 19% of the total production was contributed by 51 mines each producing 1 to 2 million tonnes annually. The remaining 22% of the total production was reported by 552 mines and three associated mines during the year. Ten principal producers contributed about 54% of the total production. About 2.82% of the production was reported by public sector mines as against 2.88% in the previous year. About 97% of the total production of limestone during 2019-20 was of cement grade, 2% of iron & steel grade and the rest 1% of chemical grade (As per Mineral Year Book 2020 by Indian Bureau of Mines).
- 1.0.6 Rajasthan was the leading producing state accounting for 20% of the total production of limestone, followed by Madhya Pradesh (13%), Andhra Pradesh & Chhattisgarh (12% each), & Karnataka (10%), Tamil Nadu & Telangana (7% each), Gujarat (6%) and the remaining 13% was contributed by Assam, Bihar, Himachal Pradesh, Uttarakhand of Jammu and Kashmir, Jharkhand, Kerala, Maharashtra, Meghalaya, Odisha and Uttar Pradesh. (As per Mineral Year Book 2020 by Indian Bureau of Mines)
- 1.0.7 India was the second largest cement producing country in the world after China. In 2019-20, the total consumption of limestone, as reported by different industries was

328.62 million tonnes registering negative growth of 0.87% over that of preceding year. Cement was the major consuming industry accounting for 308.66 million tonnes (94%) consumption, followed by iron & steel 12.68 million tonnes (4%) and chemical 5.29 million tonnes (2%). The remaining consumption was reported by aluminium, alloy steel, sugar, paper, fertilizer, glass, metallurgy, foundry, etc. (As per Mineral Year Book 2020 by Indian Bureau of Mines)

- 1.0.8 Exports of limestone decreased marginally by 3%, i.e., 3.76 million tonnes in 2019-20 from 3.88 million tonnes in the previous year. Limestone was mainly exported to Bangladesh (97%) & United Kingdom (1%). In 2019-20 the import of limestone increased marginally by 5% to 25.64 million tonnes. Limestone was mainly imported from UAE (80%), Oman (12%), Vietnam (4%), Malaysia (3%), & other countries (1%). (As per Mineral Year Book 2020 by Indian Bureau of Mines)

CHAPTER-2

2.0.0 DETAILS OF THE QUALIFIED PERSON(S) / EXPLORATION AGENCY

2.1.0 INVESTIGATING AGENCY

2.1.1 The block was explored by Mineral Exploration And Consultancy Limited (formerly Mineral Exploration Corporation Limited)-MECL during field execution from December 2024 to March 2025 and the exploration programme was funded by National Mineral Exploration Trust (NMET). MECL was established as an autonomous Public Sector Company in October 1972, under the administrative control of Ministry of Mines, Government of India for systematic exploration of minerals, to bridge the gap between the initial discovery of a prospect and its eventual exploitation.

2.1.2 Experience: MECL has completed over 1717 projects/reports and established 212 billion tonnes of ores / mineral reserves of minerals like Coal, Lignite, Bauxite, Copper, Gold, Lead-Zinc, Iron Ore, Limestone, Manganese, Magnesite, Chromite, Fluorspar, graphite and other critical minerals and several other Industrial Minerals since inception (Ason March 2025).

2.1.3 MECL's registered address is:

Mineral Exploration And Consultancy Limited
(Formerly Known as Mineral Exploration Corporation Limited)
(A PSE under Ministry of Mines, Govt. of India)
Dr. Babasaheb Ambedkar Bhawan, Highland drive road, Seminary Hills,
Nagpur- 440006, Maharashtra, India.

2.2.0 QUALIFIED PERSONS

Exploration agency: Mineral Exploration and Consultancy Limited

Experience: 52 Years, Since 1972

Email: cmd@mecl.gov.in; gm-exploration@mecl.gov.in

List of qualified persons involved in the project are tabulated below:

Table 2.1
List of qualified persons involved in exploration in the Jaharitoal and Mundatola Blocks
Sundargarh District, Odisha.

Sl No.	Name
1	Shri P. Ravindran, Ex. GM (Exploration)
2	Shri S. K. Satpathy, Sr. Manager (Geology)
3	Shri Rajesh Patel, Manager (Geology), Project Management.
4	Shri Deepak Kumar Behera, Sr. Geologist
5	Shri Rajat Kumar Patra, Geologist
6	Smt. Rajanya Roy, Sr. Geologist
7	Shri Rohit Sharma, Manager (Chemical Lab.)
8	Shri Sayantan Pal, Manager (Geology), Petrology Lab.

CHAPTER-3

3.0.0 TITLE AND OWNERSHIP

3.1.0 TITLE OF THE REPORT

“GEOLOGICAL REPORT ON PRELIMINARY EXPLORATION (G-3 STAGE) FOR LIMESTONE IN JAHARITOAL AND MUNDATOLA BLOCKS DISTRICT-SUNDARGARH, ODISHA”

3.1.1 Ownership: Government of Odisha

3.1.2 Name of Prospector: MINERAL EXPLORATION AND CONSULTANCY LIMITED
(Formerly Mineral Exploration Corporation Limited)
A Govt. of India Enterprise; A Miniratna-I CPSE
Ministry of Mines, Govt. of India.

3.1.3 Address of Prospector: Mineral Exploration And Consultancy Limited
(Formerly Known as Mineral Exploration Corporation Limited)
(A PSE under Ministry of Mines, Govt. of India)
Dr. Babasaheb Ambedkar Bhawan, Highland drive road,
Seminary Hills, Nagpur- 440006, Maharashtra, India.

3.1.4 E-mail of Prospector: cmd@mecl.gov.in; gm-exploration@mecl.gov.in

3.1.5 Telephone numbers of Prospector: 0712-2510289; 0712-2511829

3.2.0 DETAILS ABOUT PERIOD OF PROSPECTING

3.2.1 The proposed block is a cluster of 10A 2(b) leases/ taken over leases selected for further exploration by the State Technical Committee (JWG) on 06.02.2023. State government allotted the blocks to MECL for necessary actions. MECL has carried out preliminary field visit where limestone quarries were observed. MECL collected few samples for limestone from the surface exposures.

3.2.2 In light of preliminary field visit and requirement of DoMG Odisha proposal for preliminary exploration of limestone in Jaharitola (3.34 sq km), Mundatola (4.34 sq km) Blocks is prepared and submitted for discussion.

3.2.3 Preliminary exploration (G3) for Limestone in Jaharitoal and Mundatola blocks, Sundargarh district, Odisha was discussed and recommended in 68th Technical-Cum-

Cost Committee (TCC), NMET held on 28th – 30th August 2024. The project was approved in the 37th Executive Committee (EC), NMET meeting held on 23rd September 2024 and approval issued vide. letter no. F.No. 23/501/2024-NMET/446, dated 23.10.2024 with designated time duration of 12 months. Project approval order is attached as Annexure I. Field operation was initiated by MECL in December 2024 with the commencement of geological mapping on 1:4000 scale followed by topographical contouring and collection of bedrock samples. Jaharitola and Mundatola are separate blocks. However, they are adjacent to each other hence it is recommended to execute under one project and a single report. The project was reviewed for technical and others by the TCC, NMET in its 75th after completion of 1st phase of work like geological mapping, surface contouring, collection of bedrock samples and analysis of samples. Analytical values are not encouraging in terms of limestone occurrences. Hence, it was directed to pre-close the blocks and submit a report based on the works carried out in the blocks. Draft geological report was prepared and reviewed by Dr. Prabodha Ranjan Sahoo, Associate Professor, Department of Applied Geology, IIT(ISM) Dhanbad. After attending the comments final geological report has been prepared. Peer reviewer comment is attached as Annexure V and response to the comments is attached as Annexure VI.

CHAPTER-4

4.0.0 DETAILS OF THE AREA

4.1.0 LOCATION AND ACCESSIBILITY OF THE BLOCK

4.1.1 Jaharitola and Mundatola blocks fall in Sundargarh district, Odisha. It lies between latitudes 22°21'48.57"N and 22°23'34.14"N and longitudes 84°52'13.63"E and 84°55'49.55"E. The Jaharitola and Mundatola blocks cover an area of 3.37 sq km and 4.33 sq km respectively. They fall within the Survey of India Toposheet No 73B15. Location map of the block is provided in the Plate-I and google earth image showing the location of the blocks with respect to major cities in the surroundings as Text Figure 4.1.

4.1.2 The block is well connected with the National Highway 143 which connects Gumla in Jharkhand to Barkote in Odisha via Rourkela which passes west of the blocks. The block is located north of Rourkela steel city at distance of 55km. Biramitrapur Tehsil which is located 15km from the block in the northwest direction.

4.1.3 Small villages Girijatola, Lodatola, Lathigarha and Banrae are located within the Mundatola block where as Kapartola, Ganjutola and Jaharitola are located in Jaharitola block.

4.1.4 Details of the boundary corner points of the block are given in the table below:

Table 4.1
DGPS co-ordinates (WGS-84) of the boundary corner points of Jaharitola and Limestone Block (G3), Sundargarh District, Odisha.

Sl No.	DMS Co-ordinates		UTM Co-ordinates		Description of Corner Points
	Latitude (N)	Longitude (E)	Northing (m)	Easting (m)	
1	22° 23' 34.14"	84° 52' 57.22"	2477842.17	282007.84	JT 01
2	22° 23' 21.72"	84° 54' 32.35"	2477421.99	284723.72	JT 02
3	22° 22' 18.13"	84° 54' 45.55"	2475460.64	285074.24	JT 03
4	22° 23' 22.61"	84° 52' 50.5"	2477490.45	281810.64	JT 04

Table 4.2
DGPS co-ordinates (WGS-84) of the boundary corner points of Mundatola Limestone Block (G3), Sundargarh District, Odisha.

Sl No.	DMS Co-ordinates		UTM Co-ordinates		Description of Corner Points
	Latitude (N)	Longitude (E)	Northing (m)	Easting (m)	
1	22° 23' 12.63"	84° 52' 44.8"	2477185.56	281643.10	MT 01
2	22° 22' 21.48"	84° 53' 41.58"	2475589.18	283245.58	MT 02
3	22° 22' 1.66"	84° 55' 44.82"	2474930.74	286763.12	MT 03
4	22° 21' 48.57"	84° 55' 49.55"	2474525.97	286892.68	MT 04
5	22° 22' 16.42"	84° 52' 13.63"	2475468.97	280726.99	MT 05

4.2.0 DETAILS OF THE AREA WITH LAND USE

4.2.1 Mostly the block is occupied by agricultural lands.

4.3.0 MINERAL (S) UNDER INVESTIGATION OR GRANTED UNDER LICENSE OR LEASE APPLIED FOR

4.3.1 Limestone



JAHARITOLA AND MUNDATOLA BLOCL LOCATION

Text Figure: 4.1 Google image showing location of the Jaharitola and Mundatola Blocks (G3), Sundargarh District, Odisha.

CHAPTER-5

5.0.0 PHYSIOGRAPHY AND ENVIRONMENT

5.1.0 RELIEF OF THE AREA WITH MINIMUM AND MAXIMUM ELEVATION, DRAINAGE PATTERN, NATURAL WATER COURSES, RESERVOIRS, ETC.

5.1.1 Physiographically the block area is flat. Surrounding area is characterized by flat terrain with encircling hill ranges made up of distinct lithological units. Generally, the quartzites and metabasic rocks forms the hills, whereas the schists, phyllite and limestone/dolomite form the flat grounds. Average elevation in the block is around 243 mRL. Maximum elevation recorded in northern part of the blocks is around 218 mRL whereas minimum elevation recorded in the eastern part of the block i.e 196mRL. In between the two blocks Khatma Nadi flows which is a tributary of Deo River. Deo river meets Keol river near Rourkela. Generally the block area falls in the catchment area of Keol River. The drainage pattern is dendritic. Most of the area is occupied by thick soil.

5.2.0 ROADS, RAILWAY TRACK, ELECTRIC TRANSMISSION LINE, TELEPHONE LINE, ETC.

5.2.1 The blocks are well connected with the National Highway 143 which passes in the west of the blocks. District and other roads are available within the blocks which connect villages in and around the blocks.

5.2.2 No railway tracks are within the blocks. The nearest railhead is Biramitrapur of Southeastern Railway which is 15km from the blocks in the northwest direction. Rourkela railway station is 33km from Biramitrapur.

5.2.3 Nearest port is Paradip Port which is 420km southeast of the block.

5.2.4 The Rourkela Domestic Airport at Rourkela is the nearest airport which is 40km south of the blocks while Biju Patnaik International Airport at Bhubaneswar, state capital is 350 km away in the southeast direction.

5.3.0 SOCIO DEMOGRAPHIC PROFILE OF THE AREA AND NEARBY

- 5.3.1 Jaharitola and Mundatola blocks are in Sundargarh district. Hence, information provided here for the district based on the last census (2011) data.
- 5.3.2 The total population of the district as per 2011 Census is 2093437. Of the total population, 1061147 are males and 1032290 are females. It is the 2nd district in terms of size and 6th in terms of population. The population of the district is further distributed as 1355340 living in rural areas and 738097 in urban areas, constituting 64.74 and 35.26 per cent of rural and urban population respectively. In terms of population per Sq. Km. Sundargarh is 19th densely populated district in the state.
- 5.3.3 Sundargarh district has a sex ratio of 973 females for every 1,000 males. The literacy rate of the district was 73.34%. Total Scheduled Castes (SCs) population reported in the district is 191660 persons, constituting about 9.16 per cent of total population of the district. Total Scheduled Tribes (STs) population reported in the district is 1062349 persons, constituting about 50.75 per cent of total population of the district.
- 5.3.4 The Collector and District Magistrate is the administrative head of the district. For smooth running of administration, he is assisted by Additional District Magistrate, Sub-Collector, Block Development Officers, Tahasildars, Deputy Collectors, and other Officers. Sundargarh consists of three Sub-Divisions viz. Sundargarh, Panposh and Banei. One Sub-Collector is in charge of each Sub-Division. For the convenience of revenue administration, the district is divided into 18 tahasils namely Sundargarh, Hemgiri, Lephripa, Balisankara, Rajagangapur, Biramitrapur, Panposh, Raurkela, Banei, Tangarpali, Subdega, Baragaon, Kutra, Lathikata, Bisra, Koida, Gurundia and Lahunipara with one Tahasildar in charge of each tahasil. For development of rural areas consisting of 1779 villages in 262 Gram Panchayats, the district is divided into 17 Community Development Blocks with one Block Development Officer in charge of each Block.

5.4.0 HISTORICAL SITES AND ARCHAEOLOGICAL MONUMENTS, PLACES OF WORSHIP, PUBLIC UTILITIES ETC.

5.4.1 No historical sites, archaeological monuments are located within the block.

5.5.0 FORESTS, SANCTUARIES, NATIONAL PARK AND WILD LIFE SANCTUARIES ETC.

5.5.1 No sanctuaries, national park and wild life sanctuaries are existed within the block and the surrounding area.

5.6.0 FLORA AND FAUNA WITHIN AND NEARBY

5.6.1 As per Champion's classification, Sundargarh district falls under Penincular Sal type and dry deciduous mixed forest. The forests of Sundargarh district are mostly of Northern Tropical Dry Deciduous Type. The crop is a mixed one with Sal (*Shorea robusta*) as the dominant species. The eastern half of Bonai and the Rajgangpur range of Sundargarh division contain better quality of vegetation. The Sal which is the principal timber tree and more or less gregarious in these forests varies from a fairly pure to a mixed crop and occurs throughout the area. The Koira forests and some portions of Toda Reserve contain best quality of Sal. The other associates of Sal are Asan or Sahaj (*Terminalia tomentosa*), Kurum (*Adina cordifolia*), Bija or Piasal (*Pterocarpus marsupium*), etc. The steep slopes of the hills are covered with a dense forest mixed with many climbers. Sal (*Shorea robusta*) is gregarious and among the other noteworthy trees are species of *Buchanania semecarpus*, *Terminalia cedrela*, *Cassia*, *Butea*, *Bauhinia*, *Acacia* and *Adina*, which are found also on the lower Himalayan slopes. Mixed with these, however, are a number of trees and shrubs, such as *Cochlospermum*, *Soymida*, *Boswellia*, *Hardarickia* and *Bassia*. The surface of the plateau land between the valleys, where undulating, is usually clothed with a dense scrub jungle in which *Dendrocalamus strictus* is prominent. In keeping with the extensive and splendid forests, the district is rich in varieties of animal lives. The elephant, *Elephas maximus indicus* (Hati) is fairly numerous. They are mostly seen in the east and west portion of Bonai. The Bison, *Bos gaurus* (Gayal), a very retiring animal is generally seen in the denser and remoter forests. The wild buffalo, *Bubalus bubalis* (*Sana mainshi*) was at one time quite plentiful, but today there is not a single specimen left in Sundargarh.

Among the principal carnivora, the tiger, panther, hyaena, wild dog, jackal and fox are seen. The jungle cats, *Felis claus* and *Felis bengalensis* are fairly common in the forests. The common grey mongoose, *Herpestes edwardsi* is occasionally found in rocky hills in Sundargarh. It is usually larger in size and more yellow in colour than the common mongoose and has the tail tipped with black. The jackal, *Canis aureus* (Bilua) is found all over the district usually in scrub jungle near the villages and avoids dense forests.

5.7.0 WATER BODIES SUCH AS RIVER, NALA, STREAM, RESERVOIR, ETC

5.7.1 No Major water bodies such as river, nala reservoirs are located within the block.

5.8.0 CLIMATIC CONDITIONS

5.8.1 The climate of this district is characterized by a hot dry summer and well-distributed rainfall in the South-West monsoon season. The hot season starts with the beginning of March and continues till May which is usually the hottest month of the year with the mean daily maximum temperature of 41°C and the mean daily minimum temperature of 27°C. The onset of rain brings relief although when the spells of rain cease, the weather reverts to oppressive character which is due to the high moisture content in the air. The nights become cooler from the month of October and in November, there is a drop in temperature both at day and at night. The district being a hilly region shows such extremities in climate. December is the coldest month of the year with the mean daily maximum temperature of 27°C and the mean daily minimum temperature of 12°C. The average annual rainfall in the district is 1647.6 mm. The rainfall is fairly uniform in the whole district. About 86% of the annual rainfall is received during the monsoon months from June to September, July being the month with the heaviest shower. Relative humidities are high in the South-West monsoon season. Storms and depressions from the Bay of Bengal during the monsoon season pass across the district, causing heavy rainfall and strong winds. Thunder-storms frequently occur throughout the year, the frequency

CHAPTER 06

6.0.0 INFRASTRUCTURE AND CONSUMER INDUSTRIES

- 6.0.1 The exploration blocks lie near to the Biramitrapur tahsil which is boarder to Jharkhand. Its proximity to Rourkela positions it advantageously for economic and infrastructural spillovers, especially in transportation and industrial sectors. Biramitrapur's economy is bolstered by its rich mineral resources, particularly limestone and dolomite. The presence of industries such as Bisra Stone Lime (BSL) and various sponge iron factories underscores its industrial significance. Several sponge iron factories are situated here, contributing to the local economy. Biramitrapur hosts several educational institutions, including St. Mary's Convent School (ICSE), Sri Aurobindo Integral Education and Research Center (CBSE), and Don Bosco School, among others. Higher education is catered to by institutions like Shrama Shakti College (offering Arts & Commerce) and Nirmal Munda Science College. Public and private healthcare facilities providing general medical services to the residents of Biramitrapur and the surrounding area.

CHAPTER 07

7.0.0 GEOLOGY OF THE AREA

7.1.0 REGIONAL GEOLOGY

7.1.1 The geological background described here for the sake of clarity in local geology, is taken from earlier workers and from traverses made in the areas. Location of the block on the regional geological map is provided as Plate II.

7.1.2 A group of argillaceous, arenaceous and calcareous metasediments and sometimes sediments of carbonaceous nature form the main rock types of the areas. In general the mapped areas comprise mainly of the assemblages of conglomerate, schist and phyllite, quartzite, metabasic rocks, limestone-dolomite/calc silicates and carbonaceous phyllite associated with granites. The persistent E-W trending Raghunathpali conglomerate forms the major lineament in the area which divides the northerly lying Gangpur Group of rocks from the rock assemblages to its south.

7.1.3 The rocks of Gangpur basin extend nearly up to the Bihar-Orissa border and show complex structural history. In contrast, the rock assemblages lying south of Raghunathpalli conglomerate offers different lithological and structural set-up. Stratigraphy of the area based on the works of Das and Bhattacharya (1979-80) is given below.

Table 7.1
Regional Stratigraphy of the area (After GSI, 1980)

Age	Group/ Stage	Lithology
Quaternary to Recent		Soil and alluvium Laterite Tourmaline bearing vein quartz Granite (Pegmatitic)
Lower Proterozoic	Gangpur Group	Carbon quartzite
		Dolomite
		Phyllite with bands of cross bedded quartzite
		Limestone
		Metabasic rock
		Carbonaceous phyllite
		Phyllite and garnetiferous mica schist with thin bands of calcareous rocks
		Sheared conglomerate
Archean to Lower	Iron Ore Group	Granite and granite gneiss
		Carbonophyllite

Age	Group/ Stage	Lithology
Proterozoic		Calc-silicate rock
		Quartzite and silicified cherty quartzite
		Metabasic rock
		Phyllite and quartz mica schist
		Quartzite and quartz schist (locally magnetite bearing)
		Conglomerate

7.1.4 The rocks belonging to the Gangpur Group are sheared conglomerate, phyllite, mica schist with bands of calcareous rock, carbonaceous phyllite, metabasic, limestone, dolomite, pegmatoid/granite, quartz veins and quartz-tourmaline rock, laterite. The group has a persistent conglomerate zone at the base and is characterized by proliferation of calcareous facies. The major part of low lying terrains is covered by a very light coloured soil. It mostly contains clay and silt. The soil appears to have been primarily derived from mica schist and phyllite. described in the following paragraphs.

7.2.0 REGIONAL STRUCTURE

7.2.1 Some of the locations in parts of toposheets no. 73B15 and 73F03 offer good rock exposures which preserve interesting mesoscopic structural features. As compared to Krishnan's (1937) easterly closing anticlinorium concept, the structural data as described below favors Banerji's (1968) idea of low easterly plunging antiform which has refolded the earlier reclined to steep angle overturned synclinal fold. Being limited to the extreme eastern part of the Gangpur Group of rocks the area under report deals only with the upper most tectonic level of the structural Domain-I described by Banerji (1968). The different structural features as observed by earlier workers are described below:

7.2.2 **Primary structures S0:** Compositional banding in dolomite, colour banding in carbon phyllite and cross bedding features in quartzite are the important primary features noted in the area. It is interesting to note that the reversal of truncated top direction of the cross bedding in quartzite between the Koel River in the South and Luaram in the north gives the indication of centrally younging sequence of the original sedimentary beds.

7.2.3 **S1 plane:** This is major E-W trending foliation plane developed in almost all rock types of the area. It is considered as the axial plane schistosity of F1 reclined to

overturned fold in schist as found near Sankulagoja. The plane dips in moderately high angle (40° - 60°) due south.

- 7.2.4 **S2 plane:** This is the second generation superposed foliation over S1 plane and has the similar E-W trend as the latter. It is generally represented by fracture plane schistosity. But, as a mark of distance, S2, in general, dips at comparatively low angle than S1 planes. Thus, generally, in the fold it is difficult to differentiate S2 from S1 planes.
- 7.2.5 **S3 plane:** This is observed at some places with N-S strike and sub-vertical (70° - 80°) easterly dip. It is represented by crenulation cleavage or fracture cleavage schistosity and is interpreted to be parallel to the axial plane of F3 fold.
- 7.2.6 **Lineation:** Some illustrative fold axis plunge and a few surface striation features are recorded as major linear structures found in schist and quartzite of the mapped area. Lineations as a result of intersection between S0, S1 and S2 are also observed in the area.
- 7.2.7 **Folded structures:** A number of minor and mesoscopic folds are recorded at different places. These are discussed below in sequence according to their style, geometry and superposition. The behavior of the marker horizons like carbonphyllite and lateritised quartzite also helps to establish the regional picture of fold geometry. **F1 fold:** It is tight isoclinal, steep overturned to inclined fold. Plenty of such minor and mesoscopic folds are observed in limestone and dolomite near Jhariatoli on Katepur Jharianala. Limbra near Gatitanger on Deonala, in low grade schists near Sankulagoja and in carbonphyllite near Sorda village respectively. It shows high angle plunge (60° to 70°) in $S20^{\circ}E$. The amplitude wave length ratio of such folds varies as 2:1. The regional manifestation of F1 fold geometry is represented by carbonphyllite near SE of Sukra and NE of Luaram. **F2 fold:** It is a moderately tight low angle overturned fold which plunges at low angle (15° to 20°) in $N65^{\circ}E$ to easterly direction. At a few places, the westerly plunge is also recorded which might be due to the effect of third folding. Besides, a number of such minor folds in schist, carbonphyllite and limestone-dolomite near Sankulagoja, the regional expression of this fold is also clearly displayed by the marker bands, i.e. carbonphyllite and lateritised quartzite. The superposition of F2 fold over F1 is clearly observed at a place east of Ganihutoli. Here the southerly plunging

reclined F1 fold is refolded by the gentle easterly plunging F2. This phenomenon of refolding is also corroborated by the four times repetition of carbonphyllite in the SW of Sankulagoja. **F3 fold:** It is broad open type of fold, plunging at low angle (30° to 40°) towards north to N15°E directions. Amplitude wave length ratio of this fold varies from 1:1 to 1:4.

7.2.8 **Shear zone:** The narrow (width varying from 100m to 500m) strip of laterite over schist, quartzite and carbonphyllite possible indicates a zone of shearing. The disconnected linear (length varying from 2km to 3km) patches of this lateritic rock show fold geometry, which is akin to F2 fold geometry. The repetition of this laterite band with excessive ferrugination and silicification indicates the shearing as synkinematic with F1 fold and subsequently affected by the second phase of folding.

7.2.9 **Faults:** Some transverse types of faults marked near Masrikudar between Sankulagoja and Lindidhir and north-east of Luaram. These have laterally shifted the quartzite bands in NE-SW direction with the amount of throw ranging from about 100m near Luaram to 2km along Koel river near Masrikudar. The associated evidences of ferrugination, silicification and striation lineation (slicken-sides) etc. are also found along this fault zone.

7.3.0 METAMORPHISM IN THE REGION

7.3.1 Based on the petrographic studies and field evidences suggest that the rocks have also suffered a retrograde effect of metamorphism. The conclusions derived by the earlier workers can be tentatively correlated with the results obtained by Mahalik and Kanungo (1972) and are summarized in the Table 7.2.

7.4.0 REGIONAL MINERALISATION:

Gangpur group of rocks well known for its limestone, dolomite, pyrite.

Table 7.2

Comparison of Views by different workers regarding metamorphism in the Gangpur basin

Sequence of metamorphism suggested both by Kaunungo & Mahalik (1972) and Das & Bhattacharya 1979)	Related deformation suggested by Kanungo & Mahalik (1972)	Related deformation suggested by Das & Bhattacharya 1979) the present authors
M ₃ Retrograde metamorphism with development chlorite crystals blasts as neocrystalised or pseudomorphs after biotite and garnet		The granite intrusion which has caused the 3rd phase of broad open crenulation fold, whose axial trace is disposed in N_S direction
M ₂ Metamorphism belonging to low amphibolite facies with development of garnet and staurolite as related porphyroblasts, superposed on E W foliation plane	Crenulation movement F ₂	The easterly closing low angle overturned antiformal F ₂ fold, the axial plane of which also is in E_W directional tend
M ₁ Metamorphism belonging to greenschist facies, with development of sericite-chlorite biotite. The long axis of the minerals are arranged in SW foliation plane.	Granitic intrusion Main fold movement F ₁	The reclined to steeply overturned F ₁ fold, the axial plane of which extends in EW direction

7.5.0 GEOLOGY OF THE BLOCK

7.5.1 Details provided in the following paragraphs are on the basis of the traverses made in the blocks. Generally, topography is flat and gentle slope mostly covered by thick soil cover. Prominent litho-units exposed particularly in the low lying areas (eastern part of Mundatola block) are dolomitic shale, ferruginous quartzite and quartz vein. Exploitation of dolomite were carried out in the area which is evident from the two mining pits in the eastern part of the Mundatola block where dolomite/dolomitic shale have been well exposed. Based on the design of the pit, it is observed that selective

mining was carried out which may be due to quality parameter. Geological map of the area is provided as Plate IV.

7.6.0 DESCRIPTION OF ROCK TYPES

- 7.6.1 **Top soil:** More than 80% of the block area is covered with thick soil cover, which is extensively cultivated in Mundatola block. In Jaharitola block 100% of the area is under soil cover. The colour of soil varies from earthy brown to greyish brown and light to reddish brown, with a fine to medium grain size. It is friable when dry and sticky when wet. The average thickness of the soil horizon is between 5 to 7 meters.



Field Photograph 7.1: Soil profile near Jaharitola village in Jaharitola block.

- 7.6.2 **Ferruginous Quartzite:** Ferruginous quartzite outcrops are exposed as a small mound surrounded by floats of iron rich boulders and pebbles south of Mundatola village. These rocks typically appear in shades of dark brown, purple, brick-red to cherry red, and at some places, exhibit limonitic staining due to intense weathering. Chemical weathering, particularly oxidation, has led to the transformation of iron-rich minerals within the quartzite into goethite and limonite. This goethitisation and limonitisation primarily occur along fracture planes, where iron silicates are more exposed to oxidizing fluids. The oxidation process involves the conversion of ferrous iron (Fe^{2+}) to ferric iron (Fe^{3+}) in the presence of oxygen and water, facilitating the precipitation of

goethite $[\text{FeO}(\text{OH})]$. As weathering progresses, iron-rich lumps and boulders are dislodged from the parent ferruginous quartzite and transported short distances. These fragments accumulate around the outcrop or migrate to nearby low-lying areas, where they form a float horizon composed of boulders and pebbles. These float materials are generally angular, indicating minimal transport and suggesting an in-situ origin. The surface of the surrounding area has developed a reddish-brown coloration, a result of ongoing oxidation and the spread of iron oxides such as goethite and limonite.



Field Photograph 7.2: Ferruginous quartzite exposed south of Mundatola Village.



Field Photograph 7.3: Float ore horizon south of Mundatola Village.

7.6.3 Dolomite: Dolomite is the most abundant litho unit exposed on the surface in the Jaharitola & Mundatola (G-3) Blocks. It primarily occurs as both massive and bedded deposits with a regular habit. The rock is fine to medium-grained and exhibits colours ranging from light grey, white, pink, to yellow. They generally associated with mica. The general trend of the dolomite is along an east-west direction, with dips varying from 20° to 65° towards the north. At many places thin quartz veins cut across. Thickness of quartz veins varies from 5 cm to 15 cm cutting across the foliation of dolomite. Megascopically, this vein is consisting of mainly quartz and mostly fracture related and has clear contacts with the dolomite. The petrographic study shows that Dolomite occurs as very fine anhedral to subhedral grains. Quartz and feldspar are showing bimodal grain size distribution, occurring as very fine subangular grains and as well as fine to medium subhedral clasts. Sericite and biotite/ phlogopite are present as very fine flaky aggregates showing parallel alignment. The surface of the dolomite is weathered and altered due to rain, surface runoff water, and wind. In areas where dolomite is not exposed, it is concealed beneath soil and alluvium cover. Field photographs of Dolomitic shale/Dolomite are presented in the following field photographs.



Field Photograph 7.4: Dolomitic shale/Dolomite exposed in the central part of the Mundatola block with quartz veins cut across.



Field Photograph 7.5: Left- Channel marking on the Dolomite for sampleing. Right- Dolomitic shale/Dolomite exposed in the mining pit in the eastern part of Mundatola block.

CHAPTER-8

8.0.0 PREVIOUS WORK

8.1.0 DETAILS OF PREVIOUS EXPLORATION CARRIED OUT BY OTHER AGENCIES/PARTIES

- 8.1.1 Krishnan (1937) mapped the area including the erstwhile Gangpur State in 1:253,440 scale during the field seasons from 1927-28 to 1931-32. He classified the rocks into Gangpur series and Iron Ore series on the basis of occurrence of a long narrow and thin conglomerate band (Raghunathpali Conglomerate) between the two. According to him, the Gangpur Series forms an easterly closing anticlinorium and is older than the Iron Ore Series of rocks with non-depositional and erosional break on a regional scale along the Raghunathpali Conglomerate.
- 8.1.2 Banerjee (1968) remapped, during 1960-61, a major part of the above area on 1:63360 scale. On the basis of underformed cross-laminations and a comprehensive study on structure and metamorphism, he identified the Gangpur Formations as younger than the Iron Ore group of rocks. But the major consideration on refolded antiform and two phases of synkinematic metamorphism were upheld.
- 8.1.3 Later, Kanungo and Mahalik (1972) on the basis of detailed study on primary and secondary structures, proposed that the Gangpur group rocks were folded into a major isoclinal synclinorium, which plunges due west at a gentle angle. But the stratigraphic sequence suggested by them fairly agrees with that of Banerjee.
- 8.1.4 Besides, detailed structural, petrological and mineral investigation work were carried out in smaller and isolated parts within the area by Mukherjee (1961), Sengupta (1959), Sarkar and Dutta (1958) and Narayanaswami et al (1957). Prasad Rao et al (1964) considered the group of rocks occurring between Raghunathpalli Conglomerate and Tamra rocks between Iron Ore and Gangpur Groups.
- 8.1.5 During systematic geological mapping in the adjoining area to the east, Ramachandran and Raju (1973) included this group of rocks under Dhanjhor. According to them, these rocks are younger than the Iron Ore Group and Older than Gangpur Group of rocks.

8.1.6 G.C. Das A.K. Bhattacharya, A. Bhattacharya and P.K. Panda (1979-80) carried out systematic geological mapping on 1: 50,000 in parts of toposheets No.73B/12, 73B/11, 73B/15, and 73F/03 covering an area of 945 sq km falling in parts of Sundargarh district, Orissa. Their opinion was sheared Raghunathpali conglomerate horizon as a major break in sedimentation between the Gangpur Group of rocks in the north and the underlying metamorphites in the south. The metamorphites are described previously as Iron Ore Series rocks (Krishnan 1937, Prasad Rao et al 1964, Banerji 1967) whereas Ramachandran and Raju in their unpublished G.S.I. report (1937) mentioned this rock as a possible equivalent of Dhanjhora Group. In the course of their work preponderance of quartzite within the Raghunathpali conglomerate horizon the progressive change in composition of the schist from argillaceous to arenaceous components with local patches of conglomerates (as found near Bhalulata in T.S. No. 73F/03) have been observed. These features suggest that the influx of mature clastic material continued in pulses during the depositions. Further the availability of sedimentary heavies like magnetite, ilmenite and rutile from the quartzite of Sirgida Pahar and south of Bhainsamunda Pahar indicate the responsibility of Paleobeach environment. Structurally, the sharp change of dip direction of rock units occurring to the north and south, the line joining Jaraikela and Rutkupuri (toposheet No. 73B/12) along with the occurrence of metabasic rock and emplacement of granite plutons in the south indicate the existence of a possible lineament.

CHAPTER-9

9.0.0 GEOPHYSICAL SURVEY

- 9.1.0** In the recent exploration programme no geophysical survey has been carried out. However, the area was covered under NGPM programme where gravity survey only carried out.

CHAPTER-10

10.0.0 EXPLORATION UNDERTAKEN DURING CURRENT INVESTIGATION

10.1.0 INTRODUCTION

10.1.1 Gangpur Group of rocks known for their limestone and dolomite occurrences. Many mining industries are existed near and around the Biramitrapur area. One of them is the Bisra Stone Lime Company Limited (BSLC). Further, reconnaissance permits (RP) or prospecting licenses (PL) were granted earlier for limestone/dolomite. After enactment of the amendment in Mines and Minerals (Development and Regulation) Act, 1957 (MMDR Act) such RP/PL areas have been cancelled as per law. Those areas in and around the Biramitrapur, Hatibari were given to the MECL by the State Govt. of Odisha for further investigation and carved out auctionable blocks. After scrutinizing the available exploration data, two blocks carved out for exploration i.e Jaharitola and Mundatola under NMET funding at G3 stage.

10.2.0 OBJECTIVES OF INVESTIGATION

10.2.1 The present exploration program at G3 stage had been formulated on the basis of the outcomes of previous work to fulfill the following objectives:

- i. Geological mapping on 1:4000 scale to record the lithological and structural features present within the proposed block
- ii. Topographical contouring on 1:4000 scale to generate the topography of the area.
- iii. Exploratory drilling will be carried out at 800 m grid interval to prove the limestone occurrences up to 50 m vertical depth.
- iv. To establish the various grades of limestone along with the estimation of resources (333) as per the UNFC norms & Minerals (Evidence of Mineral Contents) Rules- 2015.
- v. To assess the feasibility of the block for auction purpose.

10.2.2 After completion of first phase of work it was observed that analytical results of surface samples taken from the exposed limestone/dolomite bodies are not encouraging in context with the limestone/dolomite. Hence, the exploration programme was pre-closed after the recommendation of the TCC, NMET. Also, the results are not indicating any

possibilities for further activities in the blocks and for make it auctionable block for limestone.

10.3.0 DETAILS OF EXPLORATION ACTIVITIES TAKEN UP

10.3.1 To meet the above objectives, activities mentioned in the following table were planned. The table also shows a comparison between approved and achieved quantum in the block.

Table 10.1
Quantum of work approved vs achieved in Jaharitoal and Mundatola Block (G3),
Sundargarh district, Odisha

Sl. No.	Item of Work	Unit	Approved	Achieved
1	Geological Mapping (on 1:4000 Scale)	Sq Km.	Jaharitoal (3.34) Mundatola (4.34)	Jaharitoal (3.37) Mundatola (4.33)
2	Topographical Survey (1:4000 Scale)	Sq Km	Jaharitoal (3.34) Mundatola (4.34)	Jaharitoal (3.37) Mundatola (4.33)
3	DGPS survey of Boreholes and Block Boundary	Nos.	30 (21 BH + 9 BP)	09 BP (Boundary Points)
4	Pitting	Cu m	200	0
5	Core Drilling	m	1200	0
6	Construction of Pillar	Nos.	21	0
7	Core preservation	m	1100	0
8	Sample Preparation & Chemical Analysis			
A.	Primary samples (Bedrock/Pit/Borehole)			
	i) Primary samples for 6 radicals i.e. Mn, SiO ₂ , P ₂ O ₅ , Fe ₂ O ₃ , MnO ₂ and Acid Insoluble	Nos.	1200	40
	ii) External Check sample (10% of Primary samples) for 6 radicals	Nos.	120	0
9	Petrographic Studies	Nos	10	5
10	Digital Photography	Nos.	10	5
11	Bulk Density	Nos.	4	0
12	Report Preparation	Nos.	1	1

10.4.0 SURVEY

- 10.4.1 The entire survey work has been carried out with the help of Differential Global Positioning System (DGPS) and Total Station (Trimble Make, Model R8s). The topographical survey i.e., leveling/contouring was carried out on 2m contour interval in the entire block area of Jaharitoal (3.37 sq km) and Mundatola (4.33 sq km). The coordinates and reduced levels of all the base stations and cardinal points of the block boundary have been recorded by DGPS. Surface features in the block i.e. roads, village boundaries, temples/mosque, ponds, river/nalas etc. were also surveyed and presented on the Topographical Map which is provided as Plate III.
- 10.4.2 The survey work was carried out by using (DGPS) and total stations of Tremble make having accuracy of 0.10m and with WGS 1984 datum. At first, base stations was fixed with coordinates N22°23'00.973"- E84°52'55.580" and RL 213.417. Reduced levels and coordinates of all data points were recorded with DGPS and Total stations in WGS-84 datum in UTM (m) Zone-44N.
- 10.4.3 In the initial part network of stations were also established all around the block for contouring and borehole fixation with the help of DGPS. List of major stations established in the area has been provided in Annexure-II
- 10.4.4 Co-ordinates of Boundary corner points were also fixed by DGPS which is provided in the Table 4.1. During proposal block boundary corner points were based on the GPS co-ordinates. However, after DGPS survey the corner points have changed marginally which is obvious. After DGPS survey the extent of the blocks are 3.37 and 4.33 sq km for Jaharitola and Mundatola respectively. DGPS co-ordinates to be considered in future reference.

10.5.0 GEOLOGICAL MAPPING

- 10.5.1 MECL carried out detailed geological mapping on 1:4000 scale, by taking traverses for both the blocks. Lithological units and litho-contacts have been mapped with the help of total station. Attitude and structural features of rocks like bedding, foliation and joints were recorded by Brunton Compass. The geological map was prepared by plotting the different litho units and structural features i.e., strike & dip of foliations. Geological map of the area is provided as Plate IV.

10.6.0 BEDROCK SAMPLE

10.6.1 A total of 40 samples collected from the exposed dolomite bodies to assess the quality. Dolomite is exposed as inclined bodies. Hence, samples were collected by making channels across the strike of the dolomites. Length of the channels are 1-2m based on the width of the exposures. In Jaharitola block no samples have been collected as the whole area is covered by soil. In Mundatola dolomite is exposed in low lying areas especially in the eastern part or in old mining pits. All samples collected belong to the Mundatola block only. Samples collected were subjected to analysis of CaO%, MgO%, SiO₂%, Fe₂O₃%, Al₂O₃%, SO₃%, P₂O₅%, K₂O%, Na₂O%, LOI%. Analytical results are provided in the Annexure II and locations of samples are plotted on the geological map of the blocks (Plate IV). Analytical results indicate that no samples are qualified to be either limestone or dolomite except 04 samples (MML-13, 16, 17, 18, 38). Samples MML 13 and 38 are Steel Melting Shop (Open Hearth), [SMS (O.H)] and remaining are beneficial grade (can be upgraded through processing) as per specification provided by the IBM in their National Mineral Inventory (NMI), 2018. These said dolomitic samples are distributed randomly over the eastern part of the block. No consistency in the sample values to be qualified for the dolomite have been observed. Hence, no potential zones have been marked/established.

Table 10.2

Summary of the Chemical Analysis of surface samples in Jaharitola and Mundatola blocks, Sundargarh, Odisha

	CaO %	MgO %	SiO₂ %	Fe₂O₃ %	Al₂O₃ %	SO₃ %	P₂O₅ %	K₂O %	Na₂O %	LOI %
Min.	0.39	0.73	1.37	1.01	0.33	0.01	0.01	0.10	0.01	1.56
Max.	31.78	18.57	81.61	7.48	17.70	0.05	0.12	8.88	4.46	45.63
Avg.	19.72	12.30	26.29	2.97	7.34	0.02	0.05	3.03	0.40	27.62

10.7.0 TRENCHING/PITTING

10.7.1 No pitting and trenching work has been carried out during the current exploration.

10.8.0 DRILLING

Based on the results of the surface samples, no drilling work had been recommended in the blocks.

10.9.0 PETROGRAPHIC STUDIES

10.9.1 A total of 5 nos of samples of various litho-units exposed on the surface were subjected to petrographic studies at Petrology Laboratory, MECL Nagpur. Thin sections were prepared and petrographic studies of the same were carried out using Leitz and Ortholux II microscopes to know the mineral composition, texture, characteristics of individual minerals and the rock type. Litho-units identified by petrographic studies are shaly dolostone/ dolomitic shale and carbonate rich shale. Details of the petrographic study of samples are provided in Annexure IV and in the following Table.

Table 10.3
Details of the Petrographic Samples in Jaharitoal and Mundatola Blocks, Sundargarh District, Odisha.

Sl. No.	Sample No.	Northing (m)	Easting (m)	Remarks
1	MMLP-01	2474733	286202	Shaly dolostone/ dolomitic shale
2	MMLP-02	2474709	286210	Shaly dolostone/ dolomitic shale
3	MMLP-03	2474795	285559	Shaly dolostone/ dolomitic shale
4	MMLP-04	2474753	285721	Shaly dolostone/ dolomitic shale
5	MMLP-05	2475982	282522	Carbonate rich shale

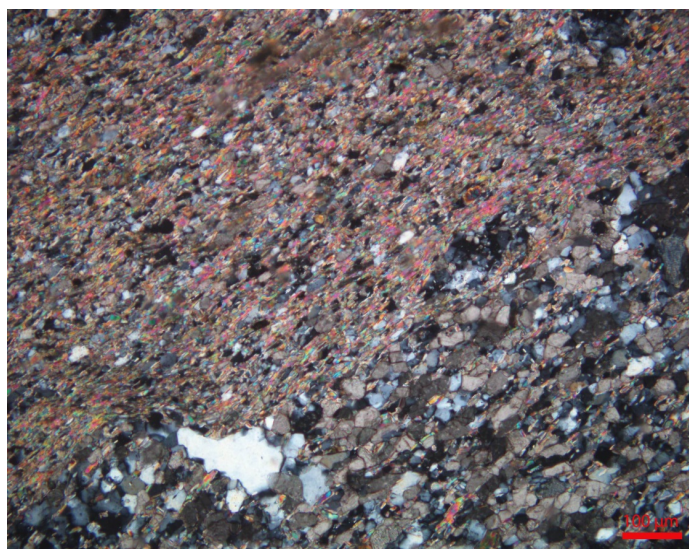
10.9.3 Descriptions of the litho units identified by petrographic studies are as follows:

Shaly dolostone/ dolomitic shale: Dolomite occurs as very fine anhedral to subhedral grains. Quartz occurs as very fine to fine subangular to subrounded clasts. Sericite and biotite/ phlogopite are present as very fine disseminated flakes showing parallel alignment. At places Feldspar is noted as very fine to fine subhedral to anhedral grains, often clustering in pockets. Opaques are noted as very fine specks in accessories. Chlorite occurs as very fine flakes and patches in pockets. Tourmaline is noted as very

fine subhedral prismatic grains in accessories. Photomicrographs of the samples are provided in the following figures.



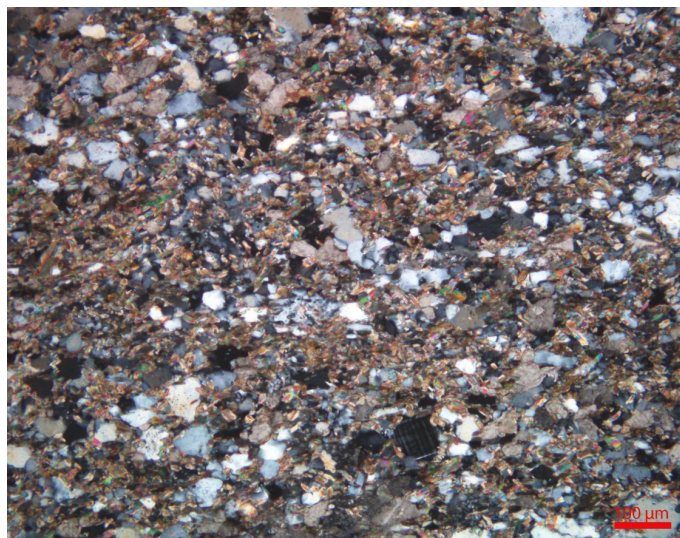
Pmg – 1: Photomicrograph showing association of dolomite, quartz and micaceous minerals in shaly dolostone/ dolomitic shale as seen under crossed nicols. Sample No.: MMLP02 Magnification: 100X



Pmg – 2: Photomicrograph showing micaceous segregation zone in shaly dolostone/ dolomitic shale as seen under crossed nicols. Specimen No.: MMLP04, Magnification : 100X

Carbonate rich shale: Quartz and feldspar occur as very fine to fine anhedral grains, feldspar grains are mostly microcline in nature. Biotite/ phlogopite are present as very fine flaky aggregates showing parallel alignment. Calcite/ dolomite occur as very fine to fine grains, medium to moderately coarse patches showing inclusions of very fine quartz within it and also occur as fine rhombs in dissemination. Opaques are noted as

very fine specks in accessories. Tourmaline is found present as very fine subhedral prismatic grains in areas.



Pmg – 3: Photomicrograph showing association of quartz, micaceous minerals, carbonates and feldspar in carbonate rich shale as seen under crossed nicols. Sample No.: MMLP05, Magnification: 100X

10.10.0 OUTCOME OF THE INVESTIGATION TAKEN UP

10.10.1 On the basis of geological mapping and samples collected, no mineralized area has been established in context with the limestone/dolomite in Mundatola block. Also, Jaharitola block is fully covered by thick soil. Further activities like pitting and drilling had not been recommended to explore the possibilities of limestone occurrences in the area.

CHAPTER-11

11.0.0 LOCATION OF DATA POINTS

11.1.0 ACCURACY AND QUALITY OF SURVEY USED TO LOCATE BLOCK BOUNDARY AND DRILL HOLES

11.1.1 The entire survey work has been carried out with the help of DGPS (Make-Trimble GNSS System, Model-R8s). With the help of DGPS, co-ordinates of surface features i.e., roads, village boundaries, water bodies, base station and co-ordinates of block boundary cardinal points with R.L. has been determined (Annexure II) and accordingly the topographical map is presented (Plate-III). Contour interval in topographical map is taken as 2 m. The topographic survey was done in PPK (Post Precision Kinematics) mode. Positional (horizontal) accuracy of the survey is 10mm while the elevation accuracy is 20mm in PPK mode.

11.1.2 TECHNICAL SPECIFICATION OF DGPS

MAKE	TRIMBLE DGPS
MODEL	R8-S
YEAR	2017

a) MEASUREMENT ACCURACY:

Static Mode

Horizontal – 10 mm +0.1 ppm or better.

Vertical – 20 mm +0.4 ppm or better.

b) BASE LINE ACCURACY:

- i. Accuracy Horizontal shall not be more than 4 mm for 10 km baseline with occupation line of 10 minutes or less.
- ii. Accuracy vertical shall not be more than 7.5 mm for 10 km baseline for with occupation of 10 minutes or less.

c) FAST STATIC:

- i. Horizontal – 3mm +0.5 ppm
- ii. Vertical – 5 mm +0.5 ppm

d) GNSS RECEIVER:

- Trimble R8s Multiple frequency GNSS Receiver has internal on-board memory via SD card or internal memory.

- Trimble R8s has 440 channels (GPS + GLONASS +GAGAN) and should be capable of tracking.
- GPS: LIC/A, L2C, L1C, L2E, L5
- GLONASS: LIC/A, L2C/A, L1P, L2P, & L3
- Beidou: B 1 complete with (phase 2) & B2
- SBAS: LIC/A, L5
- Galileo: E1, E5A, E5B
- Systems: EGNOS, QZSS, SBAS, WAAS, GAGAN, (MUST take correction from GAGAN) etc.
- R8s is water proof, shock proof, dust proof, humidity proof, and condensation proof.
- IP 67 with temporary submersion in water up to 1 m.
-

e) **SOFTWARE & COMMUNICATION:** Fully functional and Trimble business centre office post processing software.

f) **CONTROLLER:**

- Trimble TSC 3 windows-based controller for base and 02 nos. Rovers should be provided.
- Alpha numeric hard QWERTY keyboard for Base and 02 no's Rover should be provided.
- Internal Memory – 256 MB RAM & 8 GB Non-Volatile memories should be provided.
- Integrated camera for Geo Tagging Must with inbuilt GPS, Compass and Accelerometer should be provided.

11.1.3 **CO-ORDINATE SYSTEM MANAGER:** Should have datum and projection support & should support Grid coordinates.

- **COGO:** support COGO functionality & able to Key in lines, Sub-divide lines and creating parallel lines for staking out purpose.
- **TRANSFER DATA BETWEEN FIELD AND OFFICE:** Should be capable of e-mail data collected in the field, should be able import and export DXF files in the field for effective GIS support.
- **BACKGROUND MAP:** Able to accept background maps in CAD format.
- **OPERATING SYSTEMS:** Windows 6.5 should be provided.
- **EXPORT:** Able to exporting the data in RINEX format as well in CAD format.
- **REPORTING:** Software should be capable of generating reports directly from the surveyed data.

- POST PROCESSING SOFTWARE ADVANCE CAPABILITY: Trimble Business Centre Post Processing software capable of processing Base line with IGS station and processing drawing including engineering application such as contouring, Cross section & L section etc. All software shall be same OEM make.

11.2.0 QUALITY AND ADEQUACY OF TOPOGRAPHIC CONTROL

- 11.2.1 Block boundary co-ordinates, the surface features, contour points were surveyed by DGPS). The topographic survey was done in PPK (Post Precision Kinematics) mode. Positional (horizontal) accuracy of the survey is 10mm while the elevation accuracy is 20mm in PPK mode. The detailed topographical map of the blocks has been prepared on 1:4,000 scale and provided as Plate III.

CHAPTER-12

12.0.0 SAMPLING TECHNIQUE

12.1.0 NATURE AND QUALITY OF SAMPLING AND MEASURES TAKEN TO ENSURE SAMPLE REPRESENTATIVITY

12.1.1 During geological mapping 40 nos of samples as channel were collected from exposed limestone/dolomite. To ensure sample quality, the initial step involves removing weathered portions, opting for sampling from the fresh sections of the channels. For unbiased representation, samples were systematically taken from channels, exercising caution to prevent contamination and mixing with other rock types. Approximately 2 to 3 kg samples were carefully selected for each sample and packed in high-quality cotton bags.

12.1.2 First, each BRS sample of 2-3 kgs collected from the field was crushed. After crushing, the crushed samples were mixed thoroughly and reduced the sample size to 500 gm by coning and quartering. This representative samples were powdered and completely passed through (-) 200 mesh size sieves from which 100 gm sample packed in polythene sample pouch and submitted for chemical analysis for required analysis from MECL Laboratory, Nagpur. The remaining 400 gm sample has been preserved for future reference.

CHAPTER-13

13.0.0 SUB SAMPLING TECHNIQUES AND SAMPLE PREPARATION

13.1.0 SAMPLE PROCESSING FOR CHEMICAL ANALYSIS

- 13.1.1 During sample preparation, adherence to standard operating procedures is paramount. Samples are powdered to -200 mesh size using sample crusher, Pulveriser, mortar and pestle. Rigorous cleaning procedures for all the instruments used in sample processing including sample tray, brush, and all tools, are implemented after each sample is processed, maintaining a contamination-free environment.
- 13.1.2 Standard sampling procedure adopted and the samples were prepared at centralized sampling unit.
- 13.1.3 Following the initial crushing, representative samples of around 100 grams are drawn through successive reduction using coning and quartering method. The remaining powdered samples are carefully stored for future reference, with preventive measures in place to avoid sample mixing. This technique involves pouring the bulk sample onto a flat surface, forming a cone, and systematically dividing it into four quadrants. Two opposite quadrants are selected for further processing, and the method is repeated, reducing the sample size while preserving representatives. Thorough cleaning of all tools used in the sampling, drawing, and packaging processes further ensures the integrity of the collected samples.
- 13.1.4 In accordance with the standard sampling procedures, it has been observed that smaller particle size leads to higher homogeneity of samples as well as higher dissolvability during chemical analysis. As a result, samples have been reduced to -200 mesh size for chemical analysis.

CHAPTER-14

14.0.0 QUALITY OF ASSAY DATA AND LABORATORY TESTS

14.1.0 THE NATURE, QUALITY AND APPROPRIATENESS OF THE ASSAYING AND LABORATORY PROCEDURES

14.1.1 Laboratory Procedure for samples: The chemical analyses of primary samples have been carried out in MECL's Chemical laboratory for determining CaO%, MgO%, SiO₂%, Fe₂O₃%, Al₂O₃%, SO₃%, P₂O₅%, K₂O%, Na₂O%, LOI%.

14.2.0 STANDARD OPERATING PROCEDURE (SoP) FOR THE ANALYSIS BY MECL LAB, NAGPUR

14.2.1 SOP OF ANALYSIS BY XRF

Sample Particle Size:

The Sample is ground to a particle size <75µm, but <50µm is ideal.

Sample preparation: Pellets preparation

The process of making pressed pellets for XRF analysis includes grinding the sample to fine particle size and pressing the sample at pressure of between 15 to 35 ton.

Instrumentation:

1. X-ray irradiates the sample.
2. Sample emits secondary X-ray characteristic of a particular element.
3. Analyzing sample rotates to accurately diffract each wavelength and satisfy Bragg's Law.
4. Detector measures position and intensity of XRF peaks

14.2.2 Photograph of WD-XRF instrument (Rigaku, Japan) at Chemical Lab, MECL, Nagpur have been represented in the following Photo 14.1.



Photo 14.1: Photograph showing WD-XRF instrument (Rigaku, Japan) at Chemical Lab, MECL, Nagpur

14.3.0 STANDARD OPERATING PROCEDURE (SoP) FOR THE DETERMINATION OF LOSS ON IGNITION (L.O.I.) AT MECL LAB

Procedure

1. Weigh 1 g of dry sample in silica or platinum crucible.
2. Place this crucible in muffle furnace at a temperature below 300°C. Raise the temperature of the furnace to 1000°C. Keep this at this temperature for about 30 minutes.
3. Cool the crucible in desiccators and weigh the crucible.
4. Find the loss in weight.
5. $\% \text{ Loss on Ignition (LOI)} = \frac{\text{Loss in weight} \times 100}{\text{Weight of the sample}}$

14.4.0 Accuracy of Sampling Procedure: The grade estimates of the deposit are based on the results of samples. Each sample undergoes the process of sample preparation and analysis. Since, sampling and analysis are two complimentary links of quality estimation chain, the possible source of errors, if any, could be from the bias in sample preparation and inaccuracies in assaying or both. The sampling was carried out by

observing prevailing standard procedure. Thus, the reliability of the sampling process is very high and has not been compromised at any stage.

14.5.0 SECURITY AND CHAIN OF CONTROL OF SAMPLES

14.5.1 The security and chain of control of samples from the field unit to sampling unit and finally to the chemical laboratory undergoes through a meticulous and well-organized process. The samples were prepared at centralized mechanized sampling unit under the supervision of qualified sampling technician. The samples were meticulously labeled and tagged before being sent to the chemical laboratory under the direct supervision of the technician. During transportation, the samples were securely sealed in bags, and the integrity of the seals was verified at the sampling unit before the bags were opened. Adhering to standard procedures, the sampling unit implemented robust precautionary measures to prevent any potential contamination, ensuring the reliability of the sample analysis. Additionally, the remaining samples were appropriately preserved and tagged for future reference, highlighting a commitment to maintaining a secure and traceable chain of control under the company's custody. At the sampling unit, standard procedure is followed and all the precautionary measures are taken to avoid contamination. The sampling unit is separate from the chemical laboratory, so there is no chance of contamination.

CHAPTER-15

15.0.0 SUMMARY AND RECOMMENDATIONS

15.1.0 SUMMARY

- 15.1.1 Jaharitola and Mundatola blocks fall in Sundargarh district, Odisha. It lies between latitudes 22°21'48.57"N and 22°23'34.14"N and longitudes 84°52'13.63"E and 84°55'49.55"E. The Jaharitola and Mundatola blocks cover an area of 3.37 sq km and 4.33 sq km respectively. They fall within the Survey of India Toposheet No 73B15
- 15.1.2 The block is well connected with the National Highway 143 which connects Gumla in Jharkhand to Barkote in Odisha via Rourkela which passes west of the blocks. The nearest railhead is Biramitrapur of Southeastern Railway which is 15km from the blocks in the northwest direction.
- 15.1.3 Physiographically the block area is flat and 80% of the area is under soil cover. Generally, the block area falls in the catchment area of Keol River. The drainage pattern is dendritic. Most of the area is occupied by thick soil.
- 15.1.4 Regionally, the lithounits exposed in the blocks are part of the Gangpur Group characterized by argillaceous, arenaceous and calcareous metasediments and sometimes sediments of carbonaceous nature. Rock assemblages of conglomerate, schist and phyllite, quartzite, metabasic rocks, limestone-dolomite/calc silicates and carbonaceous phyllite. Field evidences suggest that the rocks have suffered a retrograde effect of metamorphism.
- 15.1.5 Prominent litho-units exposed in the blocks are dolomitic shale, ferruginous quartzite and quartz vein. Dolomitic shale generally associated with mica. The general trend of the dolomite is along an east-west direction, with dips varying from 20° to 65° towards the north. At many places thin quartz veins cut across the dolomitic shale.
- 15.1.6 During current exploration geological mapping, topographical survey and collection of bed rock samples have been carried out.

15.1.7 Forty (40) nos. of bed rock samples have been collected from the exposed dolomitic shale. All samples collected belong to the Mundatola block only. Samples collected were subjected to analysis of CaO%, MgO%, SiO₂%, Fe₂O₃%, Al₂O₃%, SO₃%, P₂O₅%, K₂O%, Na₂O%, LOI%. Analytical results indicate that no samples are qualified to be either limestone or dolomite except 04 samples (MML-13, 16, 17, 18, 38). Samples MML 13 and 38 are Steel Melting Shop (Open Hearth), [SMS (O.H)] and remaining are beneficial grade (can be upgraded through processing) as per specification provided by the IBM in their National Mineral Inventory (NMI), 2018. These said dolomitic samples are distributed randomly over the eastern part of the block. No consistency in the sample values to be qualified for the dolomite have been observed. Hence, no potential zones have been marked/established.

15.1.8 In view of the outcomes of the value of bedrock samples the project has been pre-closed due to blocks are not feasible in context with limestone for auction.

15.2.0 RECOMMENDATIONS

15.2.1 Based on the findings from the Jaharitola and Mundatola blocks in Sundargarh district, Odisha, the current exploration project has not identified sufficient quality or continuity of limestone/dolomite mineralization for auction purposes. However, based on the previous mining small dolomite pockets exist, especially SMS (O.H.) or beneficiable grade, they may not support large auction blocks but can serve local industries or captive plants.

CHAPTER-16

16.0.0 PLATES AND MAPS

- 16.1.0 Location Map of the block showing various topographic and physiographic features on SoI toposheet is given as Plate-I on 1:50,000 Scale.
- 16.1.2 Regional Geological Map on 1: 2,00,000as Plate-II
- 16.1.3 Topographical Map on 1:4000 is given as Plate-III
- 16.1.4 Geological Map of blocks on 1:4000 is given as Plate-IV.

CHAPTER-17

17.0.0 ANNEXURE / ENCLOSURES TO THE REPORT

- 17.1.0 The report includes all the relevant annexure and maps, plans, sections, photographs & photomicrograph etc. List of annexures, tables, maps/plans/sections, photographs, Text figures & photomicrograph etc are provided before the start of the text part of the Geological Report.

CHAPTER-18

CERTIFICATE FROM THE QUALIFIED PERSON WITH NAME, DATE AND SIGNATURE

This is to certify that geological report has been prepared on preliminary exploration (G-3) for Limestone/dolomite in Jaharitola and Mundatola Blocks, Sundargarh district, Odisha by Mineral Exploration and Consultancy Limited (MECL) on behalf of National Mineral Exploration Trust. The report has been prepared in accordance with the Minerals (Evidence of Mineral Contents) Rule 2015 specified under Mineral Auction Rule, 2015 and amended up to 2021.

NAME: **SHRIKANT SHARMA**

DESIGNATION: **HEAD (EXPLORATION)**

DATE: 30.06.2025

**LIST OF PERSONNEL ASSOCIATED WITH JAHARITOLA AND MUNDATOLA
BLOCKS, DISTRICT- SUNDARGARH, ODISHA**

Overall guidance	Shri P. Ravindran, GM (Exploration)
Overall Planning, Co-ordination & Supervision	Shri S. K. Satapathy, Sr. Manager (Geology)
Project Management	Shri Rajesh Patel, Manager (Geology) / Project Manager
Physical Execution of work	
a) Geology	Shri Deepak Kumar Behera, Sr. Geologist
	Shri Rajat Kumar Patra, Geologist
b) Survey	Shri N.K.N. Choudhari, Survey & Map Officer
Sample Processing	Mrs Shikha Pradeep Pandey, Sr. Technician (Sampling)
	Shri Ankush Haridas Wagh, Sr. Technician (Sampling)
	Shri Satish Kumar Inaparthi, Sr. Technician (Sampling)
Chemical Laboratory	Shri Rohit Sharma, Manager (Chemical Lab)
	Dr. Deepti Rahangdale, Manager (Chemical Lab)
Petrographic Studies	Shri Sayantan Pal, Manager (Geology)
Documentation	Shri S. K. Satapathy, Sr. Manager (Geology)
Non-Coal Geological Report Cell	Ms. Rajanya Roy, Sr. Geologist
	Shri Uday Patil, Sr. Computer Operator
	Shri Shivanand, Sr. Computer Operator
Reprography and Printing	Shri Durgesh Devarshee, Assistant Survey & Map Officer
Hindi Translation	Shri Shreekant Rai, Hindi Officer

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