

**PROPOSAL FOR PRILIMINARY EXPLORATION (G-3)
FOR GRAPHITE AND MANGANESE IN
SALEPALI BLOCK
(12.19 SQ. KM AREA)
DISTRICT- BALANGIR, ODISHA**

COMMODITY: GRAPHITE AND MANGANESE

**BY
MINERAL EXPLORATION AND CONSULTANCY LIMITED
DR. BABASAHAB AMBEDKAR BHAWAN
SEMINARY HILLS**

PLACE: NAGPUR

DATE: 23rd June 2022

**Summary of the Block for Preliminary Exploration (G-3)
GENERAL INFORMATION ABOUT THE BLOCK**

Features	Details
Block ID	Salepali Block
Exploration Agency	Mineral Exploration and Consultancy Limited (MECL)
Commodity	Graphite and Manganese
Mineral Belt	Eastern Ghats Mobile Belt, Balangir District, Odisha
Budget & Time schedule to complete the project	165.55 lakhs & 12 months
Objectives	<p>The present exploration programme (G-3) has been formulated on the basis of previous geological and geophysical data available to fulfil the following objectives:</p> <p>i) To validate the geophysical anomaly and sub surface extension of the ore body by drilling boreholes at the 200m strike/section interval considering geological and geophysical work carried out by GSI.</p> <p>ii) To drill boreholes to prove sub surface continuity of graphite and manganese ore zones up to 35m vertical depth from the surface.</p> <p>iii) To estimate graphite and manganese ore resources (333) in the block as per UNFC norms & Minerals (Evidence of Mineral Contents) Rules- 2015.</p>
Whether the work will be carried out by the proposed agency or through outsourcing and details thereof. Components to be outsourced and name of the outsource agency	Work will be carried out by the proposed agency
Name/Number of Geoscientists	
Expected Field days (Geology, Geophysics, Surveyor)	Geologist Party days: Field -150 days & HQ-60 days
	Survey Party days: 45 days
	Sampling Party days: 45 days

1. Location	The block proposed for exploration lies in the parts of Survey of India Toposheet No 64 P/02 and is bounded by latitude 20° 39' 18.23" N to 20° 42' 33.11" N and longitude 83° 00' 34.57" E to 83° 04' 32.69" E (Plate No I). The area is connected by fair weather road from the Patnagarh Tehsil. The nearest railhead is Balangir and nearest airport is Raipur, Chattisgarh.																					
Latitude and Longitude	<table border="1"> <thead> <tr> <th colspan="3">DATUM-WGS-84</th> </tr> <tr> <th>POINTS</th> <th>LATITUDE</th> <th>LONGITUDE</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>20° 41' 13.63" N</td> <td>83° 01' 12.90" E</td> </tr> <tr> <td>B</td> <td>20° 41' 35.47" N</td> <td>83° 03' 44.62" E</td> </tr> <tr> <td>C</td> <td>20° 40' 44.69" N</td> <td>83° 03' 58.03" E</td> </tr> <tr> <td>D</td> <td>20° 39' 31.74" N</td> <td>83° 01' 04.49" E</td> </tr> <tr> <td>E</td> <td>20° 40' 11.92" N</td> <td>83° 00' 44.95" E</td> </tr> </tbody> </table>	DATUM-WGS-84			POINTS	LATITUDE	LONGITUDE	A	20° 41' 13.63" N	83° 01' 12.90" E	B	20° 41' 35.47" N	83° 03' 44.62" E	C	20° 40' 44.69" N	83° 03' 58.03" E	D	20° 39' 31.74" N	83° 01' 04.49" E	E	20° 40' 11.92" N	83° 00' 44.95" E
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Villages	Salepali, Rahenmal, Karlamal, Guhiramunda, Chakamal, Turlamal, Kalangapali, Chakamal, Kalangapali, Phudkiupadha, Chuladarh, Bichhilipali, Balipata, Bilaisathi, Banjari, Batarla, Salabandha, Jhulenbar, Niljibahal, Khghapani, Dungurihurha, Mandodar, etc.																					
Tehsil/Taluk	Patnagarh																					
District	Balangir																					
State	Odisha																					
2. Area (hectares/ square kilometres)																						
Block Area	12.19 sq.km																					
Forest Area	Mostly Non-Forest area.																					
Government Land Area (Bilanam)	Data not available																					
Charagaha	Data not available																					
Private Land Area	Data not available																					
3. Accessibility																						
Nearest Rail Head	Balangir (280 km from Raipur and 310 Km from Bhubaneswar),																					
Road	The intermittent villages in the area are connected by fair weather jeepable metalled / unmetalled roads. The nearest railhead is Balangir.																					
Airport	Raipur (225 km)																					
4. Hydrography																						
Local Surface Drainage Pattern (Channels)	The general slope of the area is towards southerly and northerly showing dendritic drainage pattern. The southerly flowing drainage collected by Sauten Jor nala and ultimately draining into Lant River.																					

		However, the southerly flowing drainage collected by Kukurchhoba Jor nala and ultimately draining into Mayabati River.
	Rivers/ Streams	Mayabati River and Lant River
5.	Climate	
	Mean Annual Rainfall	Average annual rainfall is 100 cm
	Temperature:	Minimum temperatures: 10°C (Dec-Feb), Maximum temperatures: up to 46°C (March-June)
6.	Topography	
	Toposheet Number	64P/01
	Morphology of the Area	The area is almost flat terrain and covered with agriculture land. The average height of the area is 280m above MSL.
7.	Availability of baseline geoscience data	
	Geological Map (1:50K/25K)	Regional Geological map of Geological Survey of India available at (1:10,000 scale)
	Geochemical Map	Not available.
	Geophysical Map (Aeromagnetic, ground geophysical, Regional as well as local scale GP maps)	Available.
8.	Justification for taking up Reconnaissance Survey/ Regional Exploration	<ol style="list-style-type: none"> 1. Considering the potentiality of the area for graphite and manganese based on the available historic exploration data of the block explored by GSI during field season 1984-85 and 1986-87. MECL proposed G-3 stage exploration work for graphite and manganese in Salepali Block in Balangir District of Odisha through NMET funding. Salepali Block may be the prospective graphite and manganese blocks identified for auction. 2. During the field season 1968-69, Bhattacharya A. of GSI has carried out investigation for graphite in the area of Titlagarh, Sadar, and Patnagarh Sub-Division, Balangir District, Odisha and reported manganese occurrences in the east of Salepali village. They have reported flaky nature of graphite and flakes size varies from 1cm to 0.5cm. 3. Mohanty S. D. of GSI has carried out investigation for graphite in parts of Balangir, Sambalpur and Kalahandi districts of Odisha during the field season 1981-82. He has reported occurrences of graphite in the area. He has also reported the occurrence of Manganese in water-logged pit (14 m x 5 m) located 2 km west of Salepali within khondalite and Mn content around 25 to 30% on visual estimate.

		<p>4. Mohanty et al. (1986) has carried out investigation for graphite in Salepali and Turekela area in Balangir districts of Odisha during the field season 1984-85. They have carried out geological mapping and auger drilling for proving of strike extension of shallow graphite bodies in the area and recommended for trenching and geophysical survey, followed by drilling in positive locations.</p> <p>5. During the field season 1986-87, Rao et al. of GSI has carried out geophysical investigation for regional assessment of graphite resources and suggested drilling in the Salepali Block.</p> <p>6. During December 2021, MECL has collected 1 bedrock sample from wall of water-logged pit, west of Salepali and analysed for manganese and graphite. The value of graphite and manganese are 3.17% FC and 13.24% Mn respectively.</p> <p>7. The exploration will be helpful in estimation of inferred Category (333) Resources and will help in planning G2 level of exploration programme which in turn will lead to estimation of indicated (332) category resources and will facilitate the State Govt. Odisha for auctioning of blocks.</p>
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**PROPOSAL FOR PRELIMINARY EXPLORATION (G-3) FOR
GRAPHITE AND MANGANESE ORE IN
SALEPALI BLOCK, DISTRICT-BALANGIR, ODISHA**

1.0.0 INTRODUCTION

1.1.0 Preamble:

1.1.1 Graphite, also known as plumbago or black lead or mineral carbon, is a stable form of naturally occurring carbon. Structurally, graphite is known to crystallise in hexagonal system and occurs in layered & lamellar form with grey-to-black metallic lustre and a greasy feel. Natural graphite is categorised into two commercial varieties (i) crystalline (flaky) graphite and (ii) amorphous graphite. Both flaky and amorphous varieties of graphite are produced in India. Besides natural graphite, there is synthetic or artificial graphite which is manufactured on a large-scale in electric furnaces, using anthracite or petroleum coke as raw feed.

1.1.2 Worldwide demand for graphite is expected to rise with the development of non-carbon energy applications such as batteries used in electric vehicles, electric devices and energy storage devices that use graphite. Such emerging & high growth applications of graphite are certainly causing noticeable impacts on the demand & consumption patterns within the country & globally as well. Demand for graphite in lithium-ion batteries for application in electric/hybrid vehicles, laptops, smart phones, home/business applications and traditional uses for expanded graphite foils, are the potential areas that are expected to be major drivers in the market. It represents 23% of global flake graphite demand. (Manganese: Vision 2020 and Beyond, IBM, 2014).

1.1.3 The world resources of graphite are believed to exceed 800 million tonnes of recoverable reserves. However, world reserves of graphite have been placed at 300 million tonnes of which Turkey accounts for 30% followed by China & Brazil 24%, Mozambique 8%, Tanzania 6%, India & Vietnam (3% each) and Mexico, Dem. P. R. of Korea & Madagascar (1% each). World production of graphite was 1.0 million tonnes in 2018

same as in the preceding year. China continued to be the leading producer, with a share of about 63% which is followed by Mozambique (11%), Brazil (10%) and India & Dem. P.R of Korea (4% each) (IBM, Mineral Year Book-2019).

1.1.4 The total graphite reserves/resources in the country as on 1.04.2015 have been placed at about 194.89 million tonnes as per NMI database, based on UNFC system (IBM, Mineral Year Book-2019). Out of these, 7.96 million tonnes are categorised as reserves and the balance 186.92 million tonnes are in the remaining resource category. The total graphite resources above 40% fixed carbon are about 2.91 million tonnes, however, the resources having 10- 40% fixed carbon constitute 40.65 million tonnes. Besides, the balance 151.31 million tonnes fall under 'Others', 'Unclassified' and 'Not-known' grades (IBM, Mineral Year Book-2019).

1.1.5 Graphite occurrences are reported from various States but the deposits of economic importance are located in Arunachal Pradesh, Chhattisgarh, Jharkhand, Odisha and Tamil Nadu. Arunachal Pradesh accounts for 37% of the total resources which is followed by Jammu & Kashmir (32%), Odisha (9.7%), Jharkhand (9%) and Tamil Nadu (4%). However, in terms of reserves, Jharkhand has the leading share of about (52%) followed by Tamil Nadu (42%) and Odisha (6%) (Mineral Year Book-2019). The graphite reserves having +40% Fixed Carbon is rather limited in the country. In view of this, detailed exploration of graphite deposits in Odisha, Jharkhand, Jammu & Kashmir and Kerala should be carried out.

1.1.6 Manganese is one of the most common elements in the Earth's crust and is widely distributed across the planet's surface. It is very hard, brittle, gray-white transition metal that is found in variety of minerals, but never as free element in nature; is it often found in minerals in combination with iron. Manganese ore is the basic source to provide manganese as indispensable input in making of iron and all types of steels. So far there is no technology which can substitute manganese in steel making. Manganese combines the twin benefits of relatively low price with outstanding technical usage.

- 1.1.7 In order to sustain the current level of production of Mn ores and to meet the future demands, the exploration of Manganese ore is the need of the hour.
- 1.1.8 In India the Manganese Ore deposits mainly occurs as metamorphosed bedded sedimentary deposits associated with Gondite Series (Archaean) of Madhya Pradesh (Balaghat, Chhindwara & Jabua districts), Maharashtra (Bhandara & Nagpur districts), Gujarat (Panchmahal district), Odisha (Sundargarh district) and Kodurite Series (Archaean) of Odisha (Ganjam & Koraput districts) and Andhra Pradesh (Srikakulam & Vishakhapatnam districts).
- 1.1.9 The total reserves/resources of manganese ore in the country as on 1.04.2015 have been placed at 495.87 million tonnes as per NMI database, based on UNFC system (Mineral Year Book-2019). Out of these, 93.47 million tonnes are categorised as reserves and the balance 402.40 million tonnes are in the remaining resource category. Grade-wise, Ferromanganese grade accounts for 7%, Medium grade 11%, BF grade 28% and the remaining 54% are of Mixed, Low, Others, Unclassified, and Not-known grades including 0.17 million tonnes of battery/chemical grade. The overall grade of the manganese ore reserve in the country is in the range of 30-35% Mn (IBM Mineral Year Book 2019).
- 1.1.10 The total state-wise distribution of the manganese resources in the country indicates that Odisha tops with 44% share followed by Karnataka 22%, Madhya Pradesh 12%, Maharashtra & Goa 7% each, Andhra Pradesh 4% and Jharkhand 2% each. Rajasthan, Gujarat, Telangana and West Bengal together shared the remaining about 2% resources.
- 1.1.11 The Govt. of India enacted the MMDR Amendment Act, 2015 duly introducing the system of auction for allocation of Mineral Concessions. Manganese has been categorized in the Fourth Schedule which needs prospecting and exploration by the State Govt. before auctioning of blocks

- 1.1.12 On the basis of previous data available in Salepali Block, MECL requested consent from Directorate of Mines, Government of Odisha to take up exploration work for graphite and manganese in Salepali Block in Balangir District of Odisha through NMET funding.
- 1.1.13 Subsequently, after receipt of consent from Directorate of Mines, Govt. of Odisha, MECL prepared a proposal for Reconnaissance Survey (G-4) for graphite and manganese in Salepali Block, district -Balangir, Odisha and submitted to 39th meeting of Technical cum Cost Committee (TCC) of National Mineral Exploration Trust (NMET), held on 29th March 2022. The committee has suggested to put up the proposal to take up G-3 stage exploration in the area. Subsequently, proposal for Preliminary Exploration (G-3) for graphite and manganese in Salepali Block, district -Balangir, Odisha has been prepared and will be submitted to NMET for taking up for discussion in the upcoming TCC.

1.2.0 Background:

- 1.2.1 During the field season 1968-69, Bhattacharya A. of GSI has carried out investigation for graphite in the area of Titlagarh, Sadar, and Patnagarh Sub-Division, Balangir District, Odisha and reported manganese occurrences in the east of Salepali village. They have reported flaky nature of graphite and flakes size varies from 1cm to 0.5cm.
- 1.2.2 Mohanty S. D. of GSI has carried out investigation for graphite in parts of Balangir, Sambalpur and Kalahandi districts of Odisha during the field season 1981-82. He has reported occurrences of graphite in the area. He has also reported the occurrence of Manganese in water-logged pit (14 m x 5 m) located 2 km west of Salepali within khondalite and Mn content around 25 to 30% on visual estimate.
- 1.2.3 Mohanty et al. (1986) has carried out investigation for graphite in Salepali area during the field season 1984-85 and recommended for trenching and geophysical survey, followed by drilling in positive locations.

- 1.2.3 During the field season 1986-87, Rao et al. of GSI has carried out geophysical investigation for regional assessment of graphite resources and suggested drilling in the Salepali Block.
- 1.2.4 During December 2021, MECL has collected 1 bedrock sample from wall of water-logged pit, west of Salepali and analysed for manganese and graphite. The value of graphite and manganese are 3.17% FC and 13.24% Mn respectively.
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1.3.0 Location & Accessibility of the Area

The block proposed for exploration lies in the parts of Survey of India Toposheet No 64 P/02 and is bounded by latitude 20° 39' 18.23" N to 20° 42' 33.11" N and longitude 83° 00' 34.57" E to 83° 04' 32.69" E (Plate No I).

The coordinate of cardinal points of block boundary are as follows:

CARDINAL POINTS	DATUM-WGS-84; ZONE-44(NORTH)			
	UTM (M)		DMS	
	NORTHING	EASTING	LATITUDE	LONGITUDE
A	2288833.025	710429.466	20° 41' 13.63" N	83° 01' 12.90" E
B	2289560.339	714812.079	20° 41' 35.47" N	83° 03' 44.62" E
C	2288003.436	715220.132	20° 40' 44.69" N	83° 03' 58.03" E
D	2285696.481	710225.214	20° 39' 31.74" N	83° 01' 04.49" E
E	2286925.059	709644.194	20° 40' 11.92" N	83° 00' 44.95" E

The area is connected by fair weather road from the Patnagarh Tehsil. The nearest railhead is Balangir and nearest airport is Raipur, Chattisgarh.

1.4.0 Physiography, Drainage and Vegetation

1.4.1 The area comprises of wide spread plain land, folded ridges, hillocks and mounds. The maximum height of the ridge is 372m and minimum height of the valley is 194m above MSL. Rain-fed easterly flowing Suktel River with network of streams drains the area. The drainage is sub-parallel to sub-dendritic controlled by ridges and lineaments. Thick alluvium accumulated due to the Suktel River has helped extreme cultivation in the area.

1.4.2 The area has a sub-tropical climate with torrential rainfall between June and September. The temperature ranges between 10⁰ C in winter and 46⁰ C in summer season and the average annual rainfall is around 100 cm. This part of Odisha is very hot in summer with occasional extreme hotness in comparison to other parts of the state.

1.4.3 The areas under exploration are sparse to densely vegetated. The floral assemblage includes Sal (*Shorea robusta*), Shishu (*Dalbergia latifolia*), Neem (*Nekua indica*), Tamarind (*Tamarindus indica*), Jackfruit (*Autocarpus intergrifolia*), Kendu (*Diaspyros melanxylon*), Mango, Amla, Harida, Bahada, Boula, Simili, Berries and Bel etc. Wild animals are scarcely observed in this area. The faunal assemblages include bears, rabbits, snakes, wild boars, jackals, peacocks, wild hens and host of birds.

1.5.0 Previous Work

- 1.5.1 B.C. Roy (1940) first reported the manganese ore deposits in Balangir district. He observed that: (i) the manganese ore deposits occupy summits and plains (ii) the manganese ore bodies have definite strike and dip (iii) the manganese ore comprises mainly of pyrolusite and psilomelane as ore minerals with chert, limonite and wad, (iv) the ore bands are associated with calc-granulites and garnetiferous gneisses.
- 1.5.2 Later on, Jhingran (1947) investigated and Krishnaswamy (1950) estimated the ore reserve to the tune of 650 thousand tonnes up to 1.5 m depth. Later on, host of workers from Geological Survey of India have carried out field work from 1962-65 and onwards. Finally, investigation aided by drilling was taken up in 1994-95. The average grade of ores from Balangir district range from 19-39% Mn, 10-28% Fe, 4-46% SiO₂ and 0.12-0.48% P.
- 1.5.3 A.G. Jhingran (1947) envisaged that the Dunguripalli manganese ore deposit (T. S. No. 64 P/5) was of considerable magnitude. Shri S. Krishnaswamy (1950) observed numerous occurrences of Mn ore mainly as lenses and pockets in calc-silicates, being parallel to regional foliation trend and assessed a reserve of 6,60,000 tonnes up to a depth of 15 m in T.S. P/1 & 5. M.W. Tak (1964-65), P. Bose (1965-66) and D. Mitra (1964-65) had mapped on 1:63,360 scale in Toposheet No. 64 P/5 & 9, 64 P/5, and 64 P/1 & 5 respectively.
- 1.5.4 M.W. Tak carried out mapping in the northern part of the present area and found that Mn mineralisation is associated with calc-gneiss, diopside granulite and highly weathered khondalite. P. Bose (1967) observed numerous lensoidal and pocket type deposits within khondalite and partly in calc-silicate rocks. D. Mitra observed the occurrences of Mn ore within khondalite suite of rocks. He envisaged that the presence of quartz-garnet-rhodonite association in deposits indicate probably a gonditic rock and closeness of calc-

silicate within ore deposits suggest a calc-magnesian association common in sedimentary environment.

- 1.5.5. During the field season 1968-69, Bhattacharya A. of GSI has carried out investigation for graphite in the area of Titlagarh, Sadar, and Patnagarh Sub-Division, Balangir District, Odisha and reported manganese occurrences in the east of Salepali village. They have reported flaky nature of graphite and flakes size varies from 1cm to 0.5cm.
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- 1.5.8 During the field season 1986-87, Rao et al. of GSI has carried out geophysical investigation for regional assessment of graphite resources and suggested drilling in the Salepali Block.

1.6.0 Regional Geology

- 1.6.1 The exploration area lies in the northern part of the Eastern Ghats Super Group of rocks belonging to the meta-sedimentary sequence of Precambrian khondalite. The sequence of para-metamorphic is made up of pelitic, psammitic and calcareous formations, which are represented by khondalite, quartzite and calc-silicate rocks. These have been intruded by granites. All the hill ranges in this area are composed of either khondalite or garnetiferous quartzite or both. Calc-silicate bands adjoining to the ore horizons form denudational

hillocks or mounds and are 1 to 2m thick. Granite gneiss occupies the valleys. The whole sequence has been metamorphosed to granulite facies. Structurally the area exhibits a complex picture.

1.6.2 On the basis of contact relationship, presence of xenoliths/caught up patches of one particular unit within the other & structural and stratigraphical relationship, the tentative stratigraphic succession of the area (After GSI) may be given as follows:

Age	Formation	Lithology
Quaternary	-	Alluvium, soil and latsol
Tertiary	-	Laterite
Precambrian (Eastern Ghat Supergroup)	-	Aplite, Pegmatite and Quartz veins
	Granitoids	Equigranular, non-garnetiferous granite gneiss, garnetiferous granite gneiss and granulite, leptinitic gneiss Migmatite
	Charnockite Suite	Hypersthene bearing gneisses and granulites (mostly acid to intermediate charnockitic type)
	Khondalite Suite	Pyroxene granulite, quartzite, Khondalite with manganiferous horizons Calc-silicate rocks with manganese ore
Base Not Seen		

1.6.3 Description of various rock formations in the Area

The rock types exposed in the area are calc-silicate, quartzite (Mn bearing), granite gneiss, amphibolite and quartz and pegmatite vein. From the disposition of individual members of khondalite it is difficult to ascertain the stratigraphy, as the units have been subjected to different cycles of sedimentation as well as deformation. Description of different litho units is given below.

Calc-silicate rocks: The calc-silicate rocks occur as bands and lenses within khondalite and also with Mn-ore bearing silicate-carbonate rock in the form of denudational hillocks and mounds and are intricately folded and exhibit rib and furrow weathering structure and crude layering. Their trend generally confirms the regional foliation direction and the contact of these rocks with khondalite and granite is sharp. The calc-silicate bands are 100m to 1km in length and 20 to 50 m in width. The calc-silicate rock

is usually a dark grey to greenish, fine to medium grained, hard and massive to foliated. It contains green diopside, hornblende, plagioclase (andesine), garnet (grossularite), scapolite, sphene and quartz. Accessories include zircon, calcite, apatite and epidote.

Khondalite (quartz- feldspar- garnet- sillimanite + graphite schist/gneiss): It occurs typically in bouldery outcrops (highly weathered) on narrow, steep hill ranges and low lying mounds and in valley interbanded with quartzite and calc-silicate rocks. This is coarse grained, brownish yellow to reddish grey coloured, foliated and highly weathered rock. Due to varying degree of weathering its colour changes to pinkish/purplish at places, when highly kaolinised, it becomes very light. It is highly sheared and mylonitised at places. The rock is manganiferous and secondary manganese minerals occur along the foliation, fracture and joints planes. The rock is intimately associated with quartzite and both grade into each other along as well as across the foliation. They are highly migmatized and the quartzofeldspathic neosome bands that have traversed the rock along the regional foliation plane of the rocks.

Quartzite: The quartzites is medium to coarse grained, white to buff coloured, granular to faintly schistose in nature and are invariably garnetiferous. Pegmatite and quartz veins traverse the rock along foliation planes. Quartzite grades laterally to khondalite. It is predominantly made up of large xenoblastic grains of quartz with pale pink garnet and clusters of sillimanite. Quartzite is highly brecciated in a number of places such as in Dandapani block. Brecciated quartzite, in general contains ore bodies. Manganese mineralisation is noticed within brecciated and feldspathised quartzite at places. Manganiferous quartzite is exposed in Dandapani and Dunguripalli (south) blocks.

Granulite: It is coarse grained black massive rock and occurs as small lenticular inclusions parallel to foliation within granite gneiss and at places occur in boulder form along small ridges in association with khondalite and quartzite. It is mainly a plagioclase (andesine-labradorite)-pyroxene rock with subordinate amount of amphibole, biotite, garnet, perthite and quartz and accessories include sphene, ilmenite, zircon and apatite.

Migmatite: Migmatite occupy the low lying areas in the east of Bijapati and around Dunguripalli. It exhibits gneissose structure and the palaeosome includes hypersthene, diopside and biotite and the neosome comprises of K-feldspar and plagioclase.

Granite Gneiss: This is medium to coarse grained rock occupying low-lying areas with migmatite, consisting mainly of quartz, plagioclase, K-feldspar, biotite, garnet, epidote and few opaques. The whole sequence has been metamorphosed to granulite facies. The alkali-feldspar gneiss is fine to coarse grained and contains porphyroblasts of microcline and perthite within quartz-feldspar-garnet aggregates.

Pegmatite and quartz veins: Pegmatite and quartz veins traverse the rocks at a number of places close to manganese mineralisation in all the rock types both along and across the foliation. At places pegmatite contains few crystals of beryl which are of less significance.

Laterite: Laterite is developed mainly over khondalite and granite gneiss and is very common in areas close to manganese mineralised zones as in Dunguripalli (south) Block. Extensive development of laterite has been developed in northeast of Rengali.

1.6.4 Regional Structure

The entire area covered by large scale/detailed mapping exhibits a complex structural fabric as the whole sequence has been subjected to multiple cycles of deformation. As a result, the existing structural elements are completely altered rendering it difficult to decipher the complete structural geometry. However, the secondary planar structural elements like, foliation and gneissosity and joints are well preserved in the rock types of the area. The different structural features as observed are described below:

Primary structures: The primary structures have been mostly obliterated due to granulite facies metamorphism. However, relict bedding is observed along the contact between khondalite, quartzite and calc-silicates. Interbanding of different litho units within the Khondalite Group is seen clearly in many outcrops.

Secondary structures: The secondary planar structures such as foliation, gneissosity, schistosity, joint and cleavages are well preserved in rocks. S1 is defined by compositional banding, preferred orientation of prismatic, acicular and flaky minerals in the rock.

i) Foliations: Foliation (S1) is most pervasive and trends in NNW-SSE to NE-SW direction with moderate to steep easterly to south-easterly dip. Planar arrangement of minerals like garnet, biotite, sillimanite, graphite, quartz and feldspar mark the foliation plane in khondalite, quartzite, calc-silicate rocks and granite.

ii) Joints: Altogether, two sets of joints are observed in the surrounding area. These are E-W dipping 70° to 80° to south and N 65° E-S 65° W dipping 60° - 80° to southeast.

iii) Lineations: Two types of lineations are noted in the area:

(a) slickenside lineation: This is observed in manganiferous quartzite and calc-silicate rocks.

(b) Mineral lineation: The mineral lineation is defined by minerals like sillimanite, biotite and garnet.

iv) Folding: The area exhibits at least three generations of folding. The first generation of folds (F1) is tight isoclinal, intrafolial, upright and reclined in nature. The F1 folds are developed conspicuously in calc-silicate rocks and to a lesser extent in quartzite. The axial planes of F1 folds have a general trend in NNW-SSE direction. The second generation of folds (F2) is moderate to steeply plunging, open and broad type on NE-SW axis and third generation fold (F3) is characterised by upright, open to broad warps with E-W trend.

v) Faults and Shear: Faulting and shearing are evidenced by brecciation, silicification, vug filling, slickensides and mylonitisation in quartzite and khondalite. Quartzite and khondalites are intensely silicified and brecciated resembling chert breccia in the vicinity of manganese ore bands in a number of places such as west of Bijapali village in Dunguripalli south block. Shifting and missing of ore bands are due to local fault and pinching and swelling nature of ore bodies in the area.

1.6.5 Metamorphism

High grade metamorphism under granulite facies conditions characterise the Eastern Ghats Super Group of rocks. The mineral assemblages of khondalite (quartz-feldspar-garnet-sillimanite+graphite), granulite (plagioclase-hypersthene-diopside) and calc-silicate (diopside-plagioclase-calcite-quartz-scapolite) indicate pyroxene granulite sub-facies under granulite facies of Eskola.

1.6.6 Mineralization (Surface manifestation)

Graphite mineralisation is restricted to Khondalite suite and its migmatized equivalents. The graphite is crystalline and flaky and occurs in disseminated state with varying proportion especially in quartz-feldspar-garnet-sillimanite-graphite schist. Workable concentration results through the process of remobilisation and epigenetic enrichment in migmatized khondalite. The deposits are in the form of bands, en-echelon veins and lenses usually disposed conformably to the foliation planes of the host rocks and at places, in shear zones and hinge zones of folds suggesting both lithological and structural controls of localisation. The lensoidal bodies have limited extension both along and across the strike. The graphite deposits occur invariably at shallow depth, within 30m from the surface, just below the soil and laterite cover. The ore zone is often intercalated with grey clay partings.

On the surface the Mn ore mineralization presents a rugged bouldery outlook. In general, oxide minerals show granoblastic to granulitic fabric. Gravity filling, stalactitic, botryoidal, box work and colloform structures are commonly observed within the ore. The ore is in general steel grey to dull grey in colour and is soft or powdery in nature. Pyrolusite, psilomelane and cryptomelane are seen replacing each other. Silica in rhodonite is seen replaced by the manganese oxides.

Manganese ore bodies occur as bands, lenses, pockets, veins, tabular bodies and disseminations within the khondalite group of rocks. The ore is more enriched at the central part. The lensoidal/discontinuous ore bodies are arranged in an en-echelon pattern. These are lateritic and have been weathered to a considerable depth along with the enclosing rocks.

The ore bodies are conformably interstratified with and enclosed in different stratigraphic levels with calc-granulite at its contact with khondalite. Detailed mapping and available subsurface data suggest that the ore is concentrated along the fold axes of minor and mesoscopic folds. Intense brecciation, shearing, fracture form the important loci for mineralisation and the granitic intrusion have influenced the depth persistence of the ore. The lensoidal discontinuous ores owe their origin to the flowage or drag folds. Hence it may be concluded that manganese ores are both lithologically and structurally controlled.

1.7.0 Scope of Proposed Exploration

1.7.1 The proposed Preliminary Exploration (G-3 stage) program comprises topographical survey and drilling of boreholes at 200m strike interval with associated laboratory work and geological report preparation.

1.8.0 Observation and Recommendations of previous work

1.8.1 During the field season 1968-69, Bhattacharya A. of GSI has carried out investigation for graphite in the area of Titlagarh, Sadar, and Patnagarh Sub-Division, Balangir District, Odisha and reported manganese occurrences in the east of Salepali village. Mohanty S. D. of GSI has carried out investigation for graphite in parts of Balangir, Sambalpur and Kalahandi districts of Odisha during the field season 1981-82. Mohanty et al. (1986) has carried out investigation for graphite in Salepali area during the field season 1984-85 and recommended for trenching and geophysical survey, followed by drilling in positive locations. During the field season 1986-87, Rao et al. of GSI has carried out geophysical investigation for regional assessment of graphite resources and suggested drilling in the Salepali Block.

2.0.0 Previous Work / Background information

2.0.1 The background information and previous works have been described in para 1.2.0 and 1.5.0 respectively.

3.0.0 Block description

The proposed block details are given in para 1.3.0.

4.0.0 Objective of the proposed Preliminary Exploration (G-3 stage):

4.0.1 The present exploration programme (G3) has been formulated on the basis of previous regional data available to fulfil the following objectives:

4.1.0 Objective of the proposed Reconnaissance Survey (G3):

- i) To validate the geophysical anomaly and sub surface extension of the ore body by drilling boreholes at the 200m/400m strike/section interval considering geological and geophysical work carried out by GSI.
- ii) To drill boreholes to prove sub surface continuity of graphite and manganese ore zones up to 35m vertical depth from the surface.
- iii) To estimate graphite and manganese ore resources (333) in the block as per UNFC norms & Minerals (Evidence of Mineral Contents) Rules- 2015.

5.0.0 Planned Methodology

5.1.0 In accordance to the objective set for Preliminary Exploration (G-3) of the block, the exploration programme is proposed. The Exploration shall be carried out as per Minerals (Evidence of Mineral Contents) Rule-2015. Accordingly, the following scheme of exploration is formulated in order to achieve the objectives. The details of different activities to be carried out are presented in subsequent paragraphs.

5.2.0 Topographic Surveying

5.2.1 The prospect area would be tied up with the triangulation network and contouring/topographical survey will be carried out in the block area and the surface features will be picked up and marked on a map on 1:10,000 scale. The reduced levels

and co-ordinates of boreholes would be determined. The contouring will be done at 2m interval.

5.3.0 Geological Mapping

5.3.1 Geological map already available at 1:12,500 scale, which can be utilized for the exploration work.

5.4.0 Trenching:

5.4.1 During the exploration, trenching work will be carried out by cutting trenches of 1m width and 2 m depth directly on the fresh outcrop/rock exposures across the Mn ore/graphite bearing formation involving 300 cubic meter excavation.

5.5.0 Channel Sampling:

5.5.1 During the exploration, trenching work will be carried out by cutting trenches of 1m width and 2 m depth directly on the fresh outcrop/rock exposures across the Mn ore/graphite body involving 300 cubic meter excavation. The channel of 5cm x 2cm dimension will be cut on the floor of the trenches to collect the channel samples. The length of each channel sample will be kept as 1.00m uniformly in the same type of lithology, whereas, the length of the sample may be adjusted with variation/change in lithology. The representative powdered samples of (-) 200 # size will be obtained by stage wise grinding of the chips collected from the channels and by reducing the weight of sample by repeated coning and quartering. A final finished sample of 500 gram (-200 mesh) will thus be prepared. One part around 100gm sample will be sent to chemical laboratory for analysis, second part will be preserved in the camp as duplicate sample, the third part will be utilized for preparing composite sample for individual ore band and the fourth part will be kept as either check sample or sample to be used for any other specific purpose. Thus total 150 no of primary channel samples will be generated. 5% of primary channel samples (8 no samples) will be analyzed as internal check samples. Around 10% of primary samples (15 no samples) will be analyzed as external check samples from any NABL accredited External Laboratory. A total of 150 no of primary, 8 no of internal check and 15 no of external check channel samples will be analyzed for manganese mineralization i.e. Mn, SiO₂, P₂O₅, Fe₂O₃, MnO₂ and Acid Insolubles. Similarly, 150 no of primary, 8 no of internal check and 15 no of external check channel samples will be analyzed for graphite mineralization i.e. Fixed Carbon (FC: Non-carbonate), Ash (A), Moisture (M) and Volatile Matter (VM).

5.6.0 Exploratory Drilling:

5.6.1 Based on the available geological and geophysical work carried out by GSI, MECL proposed to drill 8 shallow / first level boreholes involving 480m of drilling meterage upto a vertical depth of 30m at the 200m strike/section interval. Initially, 2 nos of boreholes, PBH-2 along section line S-2 and PBH-7 along section line S-7 will be drilled at the anomaly suggested by geophysical survey and geological mapping respectively. On the basis of results of these 2 boreholes, remaining 6 boreholes will be drilled on either side of the boreholes at 200m strike/section interval. The details of the boreholes are as given below:

Proposed Borehole No.	Section Line	Proposed Depth (m)	Azimuth	Angle of Inclination
PBH-01*	S1	60.00	S45°E	45°
PBH-02	S2	60.00	S45°E	45°
PBH-03*	S3	60.00	S45°E	45°
PBH-04*	S4	60.00	S45°E	45°
PBH-05*	S5	60.00	S45°E	45°
PBH-06*	S6	60.00	S45°E	45°
PBH-07	S7	60.00	S45°E	45°
PBH-08*	S8	60.00	S45°E	45°
Total		1080.00		
* Conditional Boreholes				

5.7.0 Core Logging

5.7.1 The borehole cores would be logged systematically. Viz. details of the litho units, colour, structural feature, texture, mineralization, besides the recovery, rock quality designation (RQD) and graphite and manganese ore type would be recorded.

5.8.0 Core Sampling

5.8.1 The mineralized (graphite & manganese) part of drill core will be sampled as Primary sample. The length of each sample will be kept 1.00 m within the ore zone depending

upon the thickness of particular type of graphite and manganese ore, its physical character, intensity of mineralization, change in lithology and core recovery etc. The primary core samples for manganese mineralisation will be analysed for 6 radicals' i.e. Mn, SiO₂, P₂O₅ Fe₂O₃, MnO₂ and Acid insolubles. The primary core samples for graphite mineralisation will be analysed for Fixed Carbon (FC: Non-carbonate), Ash, Moisture and Volatile Matter (VM) (Proximate Analysis for 4 parameters).

- a) Around 100 no of primary core samples shall be generated from the mineralized zones intersected in the boreholes of the all four blocks and will be analyzed for graphite mineralization (FC, Ash, Moisture and VM).
- b) Around 5% (5 no) samples will be analyzed in Chemical Laboratory of MECL as Internal check samples and 10% of Primary samples (10 no) will be sent to NABL External Labs for analysis of graphite mineralization (FC, Ash, Moisture and VM) as external check samples.
- c) Around 100 nos of core samples might be generated from the mineralized zone intersected in the boreholes. All the primary and internal check samples for manganese mineralisation will be analysed for 6 radicals' i.e. Mn, SiO₂, P₂O₅ Fe₂O₃, MnO₂ and Acid Insolubles.
- d) Around 5% of primary samples (5 nos) will be analysed as internal check sample for manganese mineralization i.e. Mn, SiO₂, P₂O₅ Fe₂O₃, MnO₂ and Acid Insolubles. Around 10% of primary samples (10 nos) will be sent to NABL External Labs for analysis of manganese mineralization i.e. Mn, SiO₂, P₂O₅ Fe₂O₃, MnO₂ and Acid Insolubles.
- e) Composite samples would be prepared from the mineralized zones of primary drill core samples of each borehole by mixing the primary samples in length proportion. Around 20 nos. of composite sample would be generated from drill cores and be analyzed for manganese mineralization i.e. Mn, SiO₂, P₂O₅ Fe₂O₃, MnO₂ and Acid Insolubles by XRF technique. Similarly, around 20 nos. of composite samples for graphite would be

generated from drill cores and be analyzed for graphite mineralization (FC, Ash, Moisture and VM).

5.9.0 Petrological and Mineragraphic Studies

5.9.1 Thin and polished section studies on drill cores samples would be done for ascertaining the petrographic and mineragraphic characteristics. These samples would be drawn from ore zones and host rocks. A provision of 10 specimens for petrographic and 10 specimens for mineragraphic studies has been kept in the block.

5.10.0 Specific Gravity Determination:

5.10.1 To derive the tonnage factors, 10 nos. of samples for mineralised zones are proposed to be subjected for specific gravity determination. The samples are to be drawn from ore zones/ mineralised zones.

5.11.0 Quantum of work:

5.11.1 The quantum of work proposed by MECL in Rengali Graphite Block (G-3 Stage of Exploration) is given in Table 5.1.

Table: 5.1 Proposed Quantum of Exploratory Work in Salepali Block, District-Balangir, Odisha.

Table: 5.1 Proposed Quantum of Work in Salepali Block, District-Balangir, Odisha			
Sl. No.	Item of Work	Unit	Proposed Quantum of work
1	Topographical Survey (on 1:10,000 Scale)	Sq. Km.	12.19
3	Trenching (1m x 2m x150m)	Cu. m	300
3	Core Drilling	m.	480 (8 BHs)
4	Sample Preparation & Laboratory Studies		
A.	Primary samples (Core + Channel)		
	i) Primary samples for Proximate Analysis of Graphite (Ash, Moisture, V.M. and F.C.)	Nos.	250 (100+150)
	ii) Internal Check samples for Proximate Analysis of Graphite (Ash, Moisture, V.M. and F.C.)	Nos.	13

	iii) External Check sample Proximate Analysis of Graphite (Ash, Moisture, V.M. and F.C.)	Nos.	25
	iv) Chemical Analysis: Primary for 6 radicals i.e., Mn, SiO ₂ , P ₂ O ₅ , Fe ₂ O ₃ , MnO ₂ and Acid Insolubles	Nos.	250 (100+150)
	v) Internal Check samples (5% of Primary samples) for analysis of 6 radicals i.e., Mn, SiO ₂ , P ₂ O ₅ , Fe ₂ O ₃ , MnO ₂ and Acid Insolubles	Nos.	13
	vi) External Check sample (10 % of Primary samples) for analysis of 6 radicals i.e., Mn, SiO ₂ , P ₂ O ₅ , Fe ₂ O ₃ , MnO ₂ and Acid Insolubles	Nos.	25
B.	Composite Samples (Core Samples)		
	i) Composite samples will be analyzed for 6 radicals i.e., Mn, SiO ₂ , P ₂ O ₅ , Fe ₂ O ₃ , MnO ₂ and Acid Insolubles by XRF technique	Nos.	20
	ii) Proximate Analysis of Graphite (Ash, Moisture, V.M. and F.C.)	Nos.	20
5	Petrographic Studies	Nos	10
6	Mineragraphic Studies	Nos	10
7	Specific Gravity Determinations	Nos	10
8	Report Preparation (Digital format)	Nos.	1

6.0.0 Manpower Deployment

6.0.1 Manpower deployment List may be provided later.

7.0.0 Break-up of Expenditure

7.1.0 The proposed exploration programme is planned for Preliminary Exploration (G-3). The work activities like camp setting, survey and associated geological work, drilling & laboratory work at G-2 level will be completed within 10 months' time. Report writing will take another 4 months' time with overlapping of 2 months of laboratory studies. Thus the total duration of the project shall be 12 months from the date of commencement of the project. The bar chart showing activities wise time schedule is placed at Table-7.1

7.2.0 The Project cost with provisional escalation is estimated at **Rs. 165.55 (Say)**. The details of item wise cost estimate as per Schedule of Charges (SoC) of NMET have been considered for geological and laboratory studies and is given in Table No. 7.2 and the summary is given below:

Sl. No.	Item	Total
1	Geological Work	3238980.00
2	Pitting/ Trenching	999000.00
3	Exploratory Drilling	6883740.00
4	Laboratory Studies	1968597.50
	Sub total	13090317.50
5	Report	654515.88
6	Peer Review	10000.00
7	Proposal Prepration	275096.67
	Total	14029930.04
8	GST (18%)	2525387.41
	Total cost including 18% GST	16555317.45
	SAY, in Lakhs	165.55

8.0.0 Justification:

- 8.0.1. Considering the potentiality of the area for graphite and manganese based on the available historic exploration data of the block explored by GSI during field season 1984-85 and 1986-87, MECL proposed G-3 stage exploration work for graphite and manganese in Salepali Block in Balangir District of Odisha through NMET funding. Salepali Block may be the prospective graphite and manganese blocks identified for auction.
- 8.0.2. During the field season 1968-69, Bhattacharya A. of GSI has carried out investigation for graphite in the area of Titlagarh, Sadar, and Patnagarh Sub-Division, Balangir District, Odisha and reported manganese occurrences in the east of Salepali village. They have reported flaky nature of graphite and flakes size varies from 1cm to 0.5cm.
- 8.0.3. Mohanty S. D. of GSI has carried out investigation for graphite in parts of Balangir, Sambalpur and Kalahandi districts of Odisha during the field season 1981-82. He has reported occurrences of graphite in the area. He has also reported the occurrence of Manganese in water-logged pit (14 m x 5 m) located 2 km west of Salepali within khondalite and Mn content around 25 to 30% on visual estimate.
- 8.0.4. Mohanty et al. (1986) has carried out investigation for graphite in Salepali and Turekela area in Balangir districts of Odisha during the field season 1984-85. They have carried out geological mapping and auger drilling for proving of strike extension of shallow

graphite bodies in the area and recommended for trenching and geophysical survey, followed by drilling in positive locations.

- 8.0.5. During the field season 1986-87, Rao et al. of GSI has carried out geophysical investigation for regional assessment of graphite resources and suggested drilling in the Salepali Block.
- 8.0.6. During December 2021, MECL has collected 1 bedrock sample from wall of water-logged pit, west of Salepali and analysed for manganese and graphite. The value of graphite and manganese are 3.17% FC and 13.24% Mn respectively.
- 8.0.7. The exploration will be helpful in estimation of inferred Category (333) Resources and will help in planning G2 level of exploration programme which in turn will lead to estimation of indicated (332) category resources and will facilitate the State Govt. Odisha for auctioning of blocks.

9.0.0 References:

Bhattacharya, A. (1969)	Report on the graphite investigation in the Eastern Ghats in the Titlagarh, Sadar, and Patnagarh Sub-Division in the Bolangir district, Orissa, Unpubl. G.S.I. report (F.S. 1968-69).
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Jhingran, A.G. (1947)	Rec. G.S.I. V.81, Pt-I.
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Mohanty, S. D. (1986)	Report on the investigation for Graphite in parts of Balangir, Sambalpur and Kalahandi Districts, Orissa, Unpubl. G.S.I. report (F.S. 1981-82).
Mohanty, S. D., Rath, S. C., and Kanungo, S. C., (1986)	Report on the investigation for Graphite in Salepali and Turekela areas, Bolangir (Balangir) District, Orissa, Unpubl. G.S.I. report (F.S. 1984-85).
Rao, G. K., Saha, K. and Kapoor, R. N. (1986)	Report on the geophysical investigation for Regional assessment of graphite resources, Bolangir Division, Orissa, Unpubl. G.S.I. report (F. S. 1986-87)

List of Plates:

1. Plate-I: Block Location Map of Salepali Block in Toposheet no. 64P/01, Balangir District, Odisha State.
2. Plate-II: Geological Map with Geophysical Layout and proposed borehole plan of the block (Scale 1:12,500).
3. Plate-III: Representative Geological Cross Section (Scale 1:500).

			1	2	3	4	REVIEW	5	6	7	8	9	10	11	12		
1	Camp Setting	Month															1 month
2	Survey Party days (1 Party)	Party days															45 Days
	Exploratory Pitting/ Trenching	Party days															90 Days
3	Surface Drilling (2 rig)	m.															480m in 8 Bhs
4	Geologist Party days (1Party)	Party days															150 Days
5	Sampling Party days, Core Sampling (1 party)	Party days															45 Days
6	Camp Winding	Months															1 month
7	Laboratory Studies	Months															4 months (500 samples)
8	Geologist Party days, HQ (1Party)	Party days															60 days
9	Report Writing with Peer Review	Months														4 months	

S.N	Item of Work	Unit	Rates as per NMET SoC 2020-21		Estimated Cost of the Proposal		Remarks
			SoC-Item - SI No.	Rates as per SoC	Qty.	Total Amount (Rs)	
A	GEOLOGICAL WORK						
1	Survey (on 1:1000 Scale)						
a	Bore Hole Fixation and determination of coordinates & Reduced Level of the boreholes by DGPS	Per Point of observation	1.6.2	19,200	8	1,53,600	
b	Charges of one Surveyor (1 Party)	one surveyor per day	1.6.1a	8,300	45	3,73,500	
c	Labours (4 Nos) Base rate - Rs. 443/-	day	5.7	443	180	79,740	Amount will be reimburse as per the notified rates by the Central Labour Commissioner or respective State Govt. whichever is higher
d	Charges for one Sampler per day (1 Party)	one sampler per day	1.5.2	5,100	45	2,29,500	
e	Labours (4 Nos) Base rate - Rs. 443/-	day	5.7	443	180	79,740	Amount will be reimburse as per the notified rates by the Central Labour Commissioner or respective State Govt. whichever is higher
2	Borehole logging & sampling & report writing						
a	Charges for one Geologist per day at HQ	day	1.3	9,000	60	5,40,000	
b	Charges for one Geologist per day at field	day	1.3	11,000	150	16,50,000	
c	Labour (2 Nos) Base rate - Rs.443/-	day	5.7	443	300	1,32,900	Amount will be reimburse as per the notified rates by the Central Labour Commissioner or respective State Govt. whichever is higher
	Sub-Total A					32,38,980	
B	PITTING/ TRENCHING						
	Exploratory Trenching	cu.m.	2.1.1	3330	300	999000	
C	DRILLING						
1	Drilling up to 300m (Hard Rock) (2 Bhs: 120 m, 16 Conditional Bhs: 960 m)	m	2.2.1.4a	11,500	480	55,20,000	
2	Borehole deviation Survey by Multishot Camera	m	2.2.6	330	480	1,58,400	
3	Land / Crop Compensation (in case the BH falls in agricultural Land)	per BH	5.6	20,000	8	1,60,000	Amount will be reimburse as per actuals or max. Rs. 20000 per BH with certification from local authorities
4	Construction of concrete Pillar (12"x12"x30")	per borehole	2.2.7a	2,000	8	16,000	
5	Transportation of Drill Rig & Truck associated per drill (2 rigs)	Km	2.2.8	36	1,300	46,800	2600km to & fro from Nagpur/ Rig
6	Monthly Accommodation Charges for drilling Camp (up to 2 Rigs)	month	2.2.9	50,000	4	2,00,000	
7	Drilling Camp Setting Cost	Nos	2.2.9a	2,50,000	1	2,50,000	

8	Drilling Camp Winding up Cost	Nos	2.2.9b	2,50,000	1	2,50,000	
9	Road Making (Flat Terrain)	Km	2.2.10a	22,020	2	44,040	Road Making will be considered as per the requirement and Road Making Charges will be reimbursed accordingly.
10	DGPS Survey for Block Boundary	per point	1.6.2	19,200	-	-	
11	Drill Core Preservation (17 x 15 + 60)	per m	5.3	1,590	150	2,38,500	
	Sub Total C					68,83,740	
D	LABORATORY STUDIES						
1	Chemical Analysis						
i)	Primary samples						
	b. Proximate Analysis of Graphite (Ash, Moisture, V.M. and F.C.) for Primary samples	Nos	4.1.16	3,000	250	7,50,000	
	b. For 6 radical (Mn, SiO ₂ , P ₂ O ₅ , Fe ₂ O ₃ , MnO ₂ and Insolubles)	Nos	4.1.7a + 7b	2,841	250	7,10,250	
ii)	Check samples Internal (5%)						
	a. Proximate Analysis of Graphite (Ash, Moisture, V.M. and F.C.) for Primary samples	Nos	4.1.16	3,000	13	37,500	
	b. For 6 radical (Mn, SiO ₂ , P ₂ O ₅ , Fe ₂ O ₃ , MnO ₂ and Insolubles)	Nos	4.1.7a + 7b	2,841	13	35,513	
iii)	Check samples Extrnal (10%)						
	a. Proximate Analysis of Graphite (Ash, Moisture, V.M. and F.C.) for Primary samples	Nos	4.1.16	3,000	25	75,000	
	b. For 6 radical (Mn, SiO ₂ , P ₂ O ₅ , Fe ₂ O ₃ , MnO ₂ and Insolubles)	Nos	4.1.7a + 7b	2,841	25	71,025	
iii)	Composite Samples						
	a. For 6 radical (Mn, SiO ₂ , P ₂ O ₅ , Fe ₂ O ₃ , MnO ₂ and Insolubles) by XRF technique	Nos	4.1.15a	4,200	20	84,000	
	b. Proximate Analysis (Ash, Moisture, V.M. and F.C.) for Primary samples	Nos	4.1.16	3,000	20	60,000	
	b. Total Sulphur (S)	Nos	4.2.14	1,900	-	-	
	c. ICP-MS (34 Elements)	Nos	4.1.14	7,731	-	-	
II	Petrological samples (Surface & Bh Core Samples)						
i	Preparation of thin section	Nos	4.3.1	2,353	10	23,530	
ii	b) Study of Thin Section	Nos	4.3.4	4,232	10	42,320	
III	Mineragraphic Studies (Surface & Bh Core Samples)						
a	Preparation of polished section	Nos	4.3.2	1,549	10	15,490	
b	Study of Polished Section	Nos	4.3.4	4,232	10	42,320	
c	Digital Photographs	Nos	4.3.7	280	20	5,600	
IV	Specific Gravity Determination						
	Specific Gravity Determination	No.	4.8.1	1,605	10	16,050	
	Sub Total D					19,68,598	
E	Total A to D					1,30,90,318	
F	Geological Report Preparation	5 Hard copies with a soft copy	5.2	For the projects having cost more than Rs. 50 lakhs but less than 150 lakhs- A minimum of Rs. 2.5 lakhs or 5% of the value of work whichever is more.		6,54,516	
G	Peer review Charges		As per EC decision			10,000	
H	Preparation of Exploration Proposal (5 Hard copies with a soft copy)	5 Hard copies with a soft copy	5.1	2% of the Cost or Rs. 3.8 Lakhs whichever is lower		2,75,097	EA has to submit the Hard Copies and the soft copy of the final proposal along with Maps and Plan as suggested by the TCC-NMET in its meeting while clearing the proposal.
I	Total Estimated Cost without GST					1,40,29,930	
J	Provision for GST (18% of L)	%				25,25,387	GST will be reimburse as per actual and as per notified prescribed rate
K	Total Estimated Cost with GST					1,65,55,317	
						165.55	

or Say Rs. , In Lakhs:

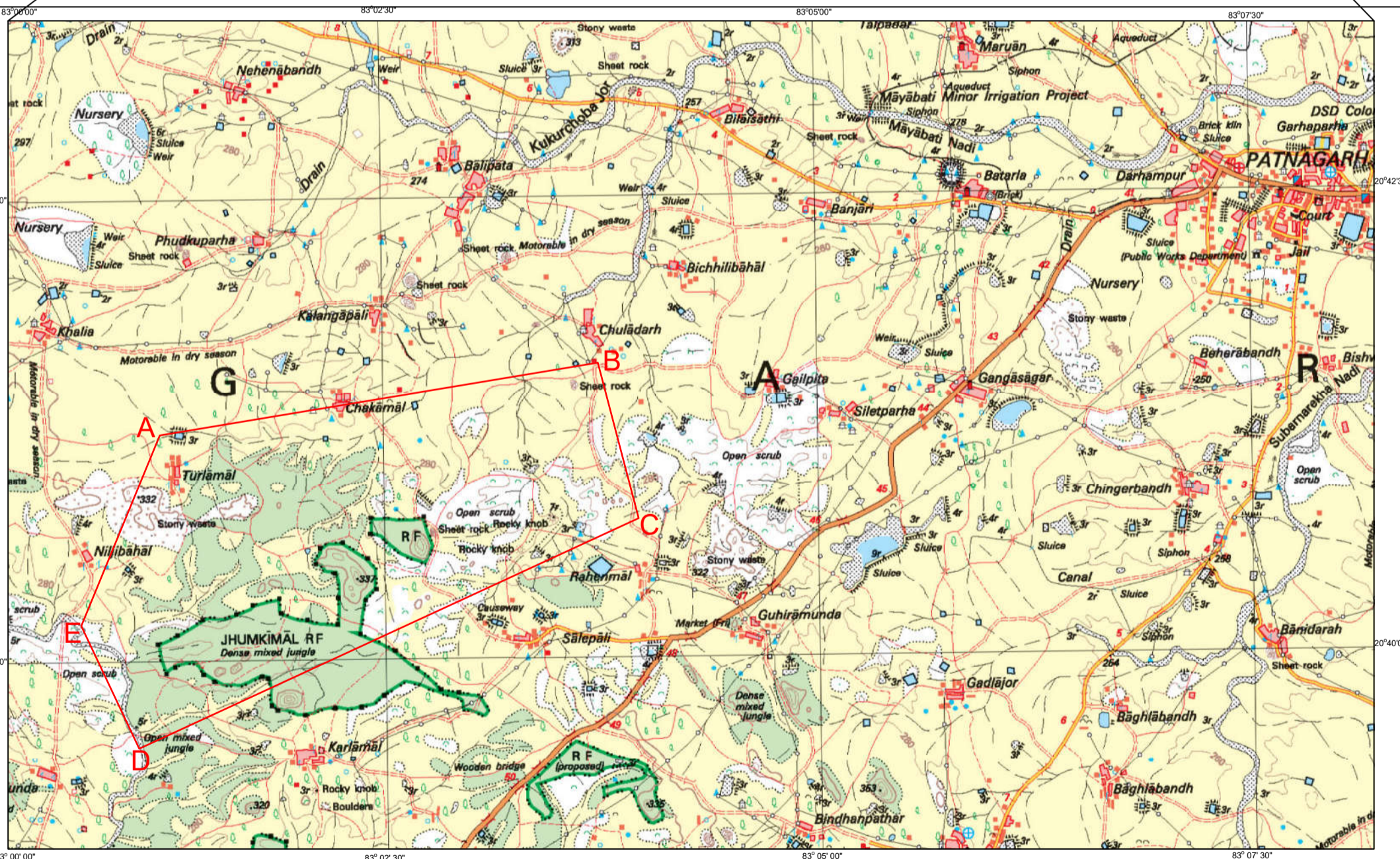
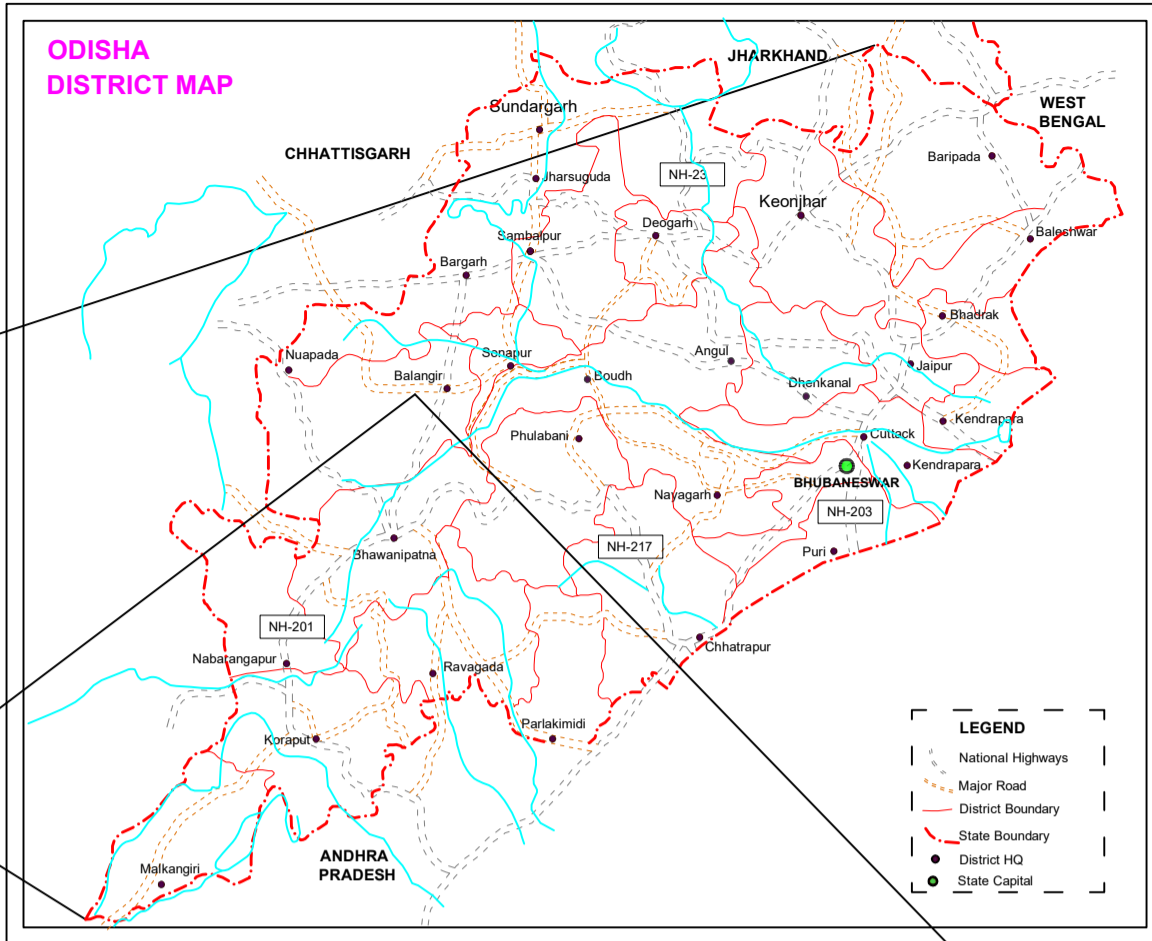
**Summary of the Block for Preliminary Exploration (G-3)
GENERAL INFORMATION ABOUT THE BLOCK**

Features	Details
Block ID	Salepali Block
Exploration Agency	Mineral Exploration and Consultancy Limited (MECL)
Commodity	Graphite and Manganese
Mineral Belt	Eastern Ghats Mobile Belt, Balangir District, Odisha
Budget & Time schedule to complete the project	165.55 lakhs & 12 months
Objectives	<p>The present exploration programme (G-3) has been formulated on the basis of previous geological and geophysical data available to fulfil the following objectives:</p> <p>i) To validate the geophysical anomaly and sub surface extension of the ore body by drilling boreholes at the 200m strike/section interval considering geological and geophysical work carried out by GSI.</p> <p>ii) To drill boreholes to prove sub surface continuity of graphite and manganese ore zones up to 35m vertical depth from the surface.</p> <p>iii) To estimate graphite and manganese ore resources (333) in the block as per UNFC norms & Minerals (Evidence of Mineral Contents) Rules- 2015.</p>
Whether the work will be carried out by the proposed agency or through outsourcing and details thereof. Components to be outsourced and name of the outsource agency	Work will be carried out by the proposed agency
Name/Number of Geoscientists	
Expected Field days (Geology, Geophysics, Surveyor)	Geologist Party days: Field -150 days & HQ-60 days
	Survey Party days: 45 days
	Sampling Party days: 45 days

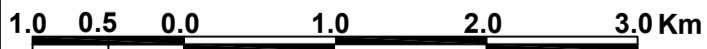
1. Location	The block proposed for exploration lies in the parts of Survey of India Toposheet No 64 P/02 and is bounded by latitude 20° 39' 18.23" N to 20° 42' 33.11" N and longitude 83° 00' 34.57" E to 83° 04' 32.69" E (Plate No I). The area is connected by fair weather road from the Patnagarh Tehsil. The nearest railhead is Balangir and nearest airport is Raipur, Chattisgarh.																					
Latitude and Longitude	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th colspan="3">DATUM-WGS-84</th> </tr> <tr> <th>POINTS</th> <th>LATITUDE</th> <th>LONGITUDE</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>20° 41' 13.63" N</td> <td>83° 01' 12.90" E</td> </tr> <tr> <td>B</td> <td>20° 41' 35.47" N</td> <td>83° 03' 44.62" E</td> </tr> <tr> <td>C</td> <td>20° 40' 44.69" N</td> <td>83° 03' 58.03" E</td> </tr> <tr> <td>D</td> <td>20° 39' 31.74" N</td> <td>83° 01' 04.49" E</td> </tr> <tr> <td>E</td> <td>20° 40' 11.92" N</td> <td>83° 00' 44.95" E</td> </tr> </tbody> </table>	DATUM-WGS-84			POINTS	LATITUDE	LONGITUDE	A	20° 41' 13.63" N	83° 01' 12.90" E	B	20° 41' 35.47" N	83° 03' 44.62" E	C	20° 40' 44.69" N	83° 03' 58.03" E	D	20° 39' 31.74" N	83° 01' 04.49" E	E	20° 40' 11.92" N	83° 00' 44.95" E
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Villages	Salepali, Rahenmal, Karlamal, Guhiramunda, Chakamal, Turlamal, Kalangapali, Chakamal, Kalangapali, Phudkiupadha, Chuladarh, Bichhilipali, Balipata, Bilaisathi, Banjari, Batarla, Salabandha, Jhulenbar, Niljibahal, Khghapani, Dungurihurha, Mandodar, etc.																					
Tehsil/Taluk	Patnagarh																					
District	Balangir																					
State	Odisha																					
2. Area (hectares/ square kilometres)																						
Block Area	12.19 sq.km																					
Forest Area	Mostly Non-Forest area.																					
Government Land Area (Bilanam)	Data not available																					
Charagaha	Data not available																					
Private Land Area	Data not available																					
3. Accessibility																						
Nearest Rail Head	Balangir (280 km from Raipur and 310 Km from Bhubaneswar),																					
Road	The intermittent villages in the area are connected by fair weather jeepable metalled / unmetalled roads. The nearest railhead is Balangir.																					
Airport	Raipur (225 km)																					
4. Hydrography																						
Local Surface Drainage Pattern (Channels)	The general slope of the area is towards southerly and northerly showing dendritic drainage pattern. The southerly flowing drainage collected by Sauten Jor nala and ultimately draining into Lant River.																					

		However, the southerly flowing drainage collected by Kukurchhoba Jor nala and ultimately draining into Mayabati River.
	Rivers/ Streams	Mayabati River and Lant River
5.	Climate	
	Mean Annual Rainfall	Average annual rainfall is 100 cm
	Temperature:	Minimum temperatures: 10°C (Dec-Feb), Maximum temperatures: up to 46°C (March-June)
6.	Topography	
	Toposheet Number	64P/01
	Morphology of the Area	The area is almost flat terrain and covered with agriculture land. The average height of the area is 280m above MSL.
7.	Availability of baseline geoscience data	
	Geological Map (1:50K/25K)	Regional Geological map of Geological Survey of India available at (1:10,000 scale)
	Geochemical Map	Not available.
	Geophysical Map (Aeromagnetic, ground geophysical, Regional as well as local scale GP maps)	Available.
8.	Justification for taking up Reconnaissance Survey/ Regional Exploration	<ol style="list-style-type: none"> 1. Considering the potentiality of the area for graphite and manganese based on the available historic exploration data of the block explored by GSI during field season 1984-85 and 1986-87. MECL proposed G-3 stage exploration work for graphite and manganese in Salepali Block in Balangir District of Odisha through NMET funding. Salepali Block may be the prospective graphite and manganese blocks identified for auction. 2. During the field season 1968-69, Bhattacharya A. of GSI has carried out investigation for graphite in the area of Titlagarh, Sadar, and Patnagarh Sub-Division, Balangir District, Odisha and reported manganese occurrences in the east of Salepali village. They have reported flaky nature of graphite and flakes size varies from 1cm to 0.5cm. 3. Mohanty S. D. of GSI has carried out investigation for graphite in parts of Balangir, Sambalpur and Kalahandi districts of Odisha during the field season 1981-82. He has reported occurrences of graphite in the area. He has also reported the occurrence of Manganese in water-logged pit (14 m x 5 m) located 2 km west of Salepali within khondalite and Mn content around 25 to 30% on visual estimate.

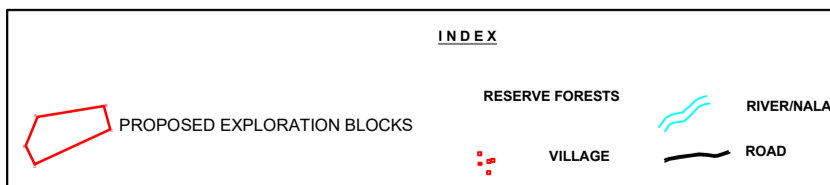
		<ol style="list-style-type: none">4. Mohanty et al. (1986) has carried out investigation for graphite in Salepali and Turekela area in Balangir districts of Odisha during the field season 1984-85. They have carried out geological mapping and auger drilling for proving of strike extension of shallow graphite bodies in the area and recommended for trenching and geophysical survey, followed by drilling in positive locations.5. During the field season 1986-87, Rao et al. of GSI has carried out geophysical investigation for regional assessment of graphite resources and suggested drilling in the Salepali Block.6. During December 2021, MECL has collected 1 bedrock sample from wall of water-logged pit, west of Salepali and analysed for manganese and graphite. The value of graphite and manganese are 3.17% FC and 13.24% Mn respectively.7. The exploration will be helpful in estimation of inferred Category (333) Resources and will help in planning G2 level of exploration programme which in turn will lead to estimation of indicated (332) category resources and will facilitate the State Govt. Odisha for auctioning of blocks.
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Scale



R:F = 1:50,000

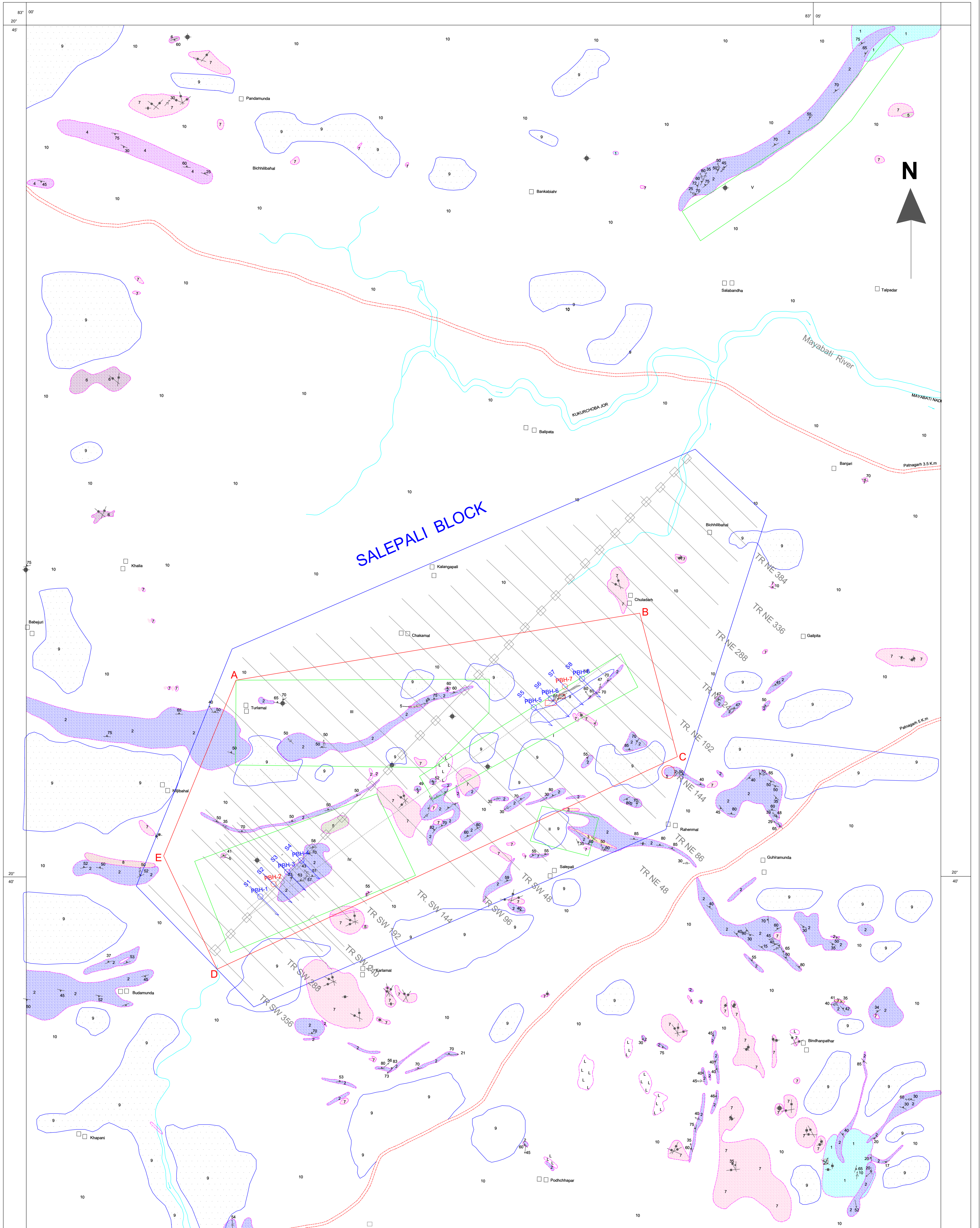


MINERAL EXPLORATION CORPORATION LIMITED	
LOCATION MAP	
SALEPALI BLOCK	
(PART OF TOPOSHEET NO. 64P(02))	
DISTRICT : BALANGIR	STATE : ODISHA
Prepared by : Exploration Division, MECL, Nagpur.	Processed at : Non-Coal Geological Report Cell MECL, Nagpur.
MECL / EXPLORATION / JUNE-2022	PLATE - I
	1

GEOLOGICAL MAP OF AREA AROUND SALEPALI DIST. BALANGIR, ODISHA (AFTER GSI)

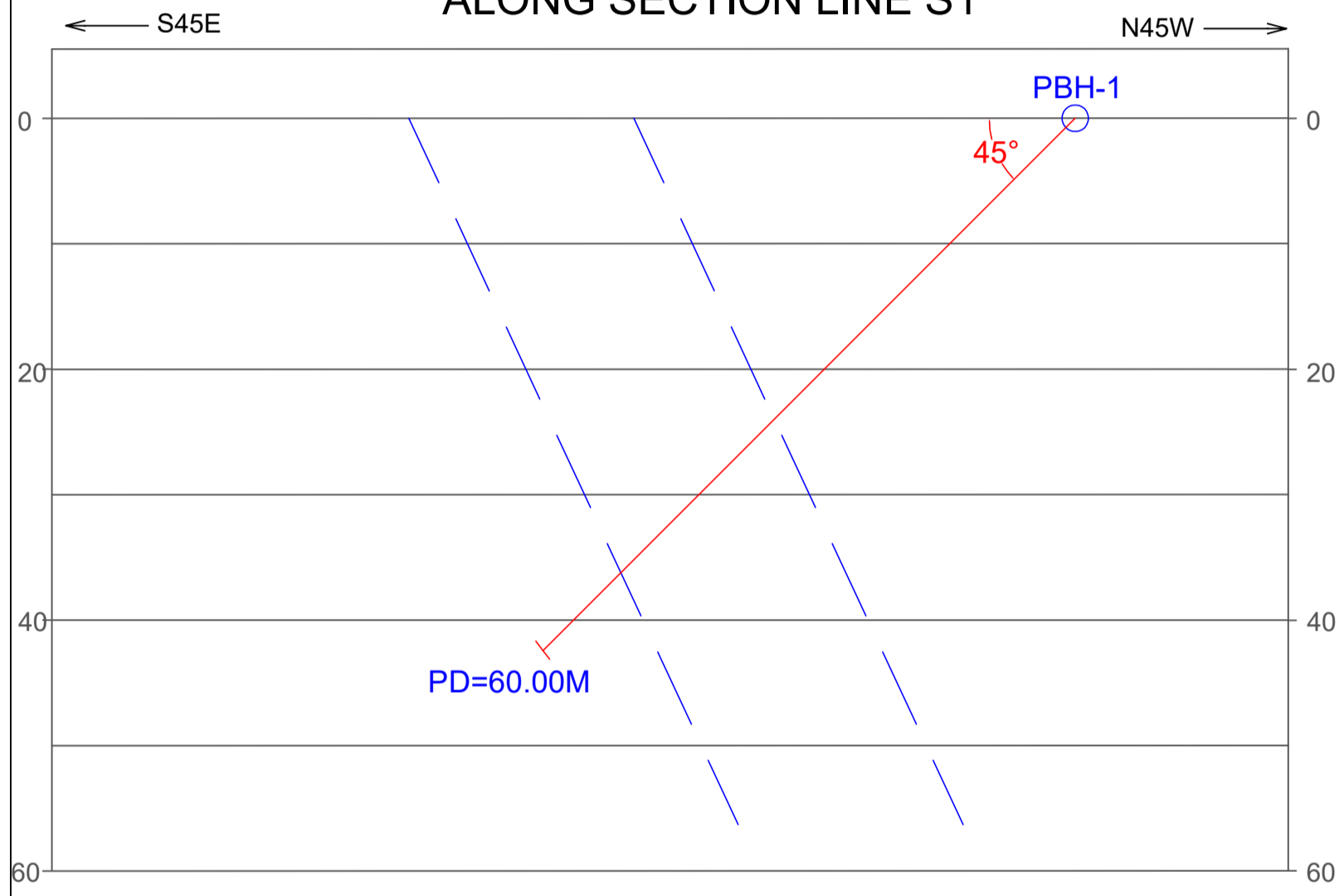
(PART OF TOPOSHEET NO. 64 P/2)

SCALE 1:12,500



INDEX			
	YELLOWISH GREY SOIL / REDDISH BROWN SOIL / LATERITE		STRIKE AND VERTICAL / INCLINED DIP OF FOLIATION
	PEGMATITE / QUARTZ VEIN		JOINTS VERTICAL / INCLINED
	PORPHYROBLASTIC GARNETIFEROUS GRANITE GNEISS		MINOR FOLDS SHOWING PLUNGE OF AXIS
	GARNETIFEROUS GRANITE GNEISS		MINOR ANTIFORM SHOWING PLUNGE
	RHONDALITE - MIGMATITE (QUARTZ-FELDSPAR-GARNET, SILLIMANITE-GRAPHITE GNEISS/SCHIST)		MINOR SYNFORM SHOWING PLUNGE
	CHARNOCKITE		MINERAL LINEATIONS
	CALC GRANULITE/CRYSTALLINE LIMESTONE		INFERRED OUTCROP BOUNDARIES
	QUARTZ-GARNET-SILLIMANITE +/- GRAPHITE GNEISS/SCHIST (RHONDALITE)		GRAPHITE OCCURRENCES
			OVERTURNED FOLD SHOWING DIRECTION OF PLUNGE
			GRAPHITE QUARRIES SUSPENDED
			POTENTIAL GRAPHITE ZONE
			GRAPHITE ZONE BASED ON AUGER DRILLING
			TR. SW 240 NW 50, SE 100 GEOPHYSICAL TRAV.
			STN. NO. SURVEY PILLAR
			BLOCK BOUNDARY FOR GEOPHYSICAL SURVEY
			BLOCK BOUNDARY FOR G3 STAGE EXPLORATION
			PBH-1 PROPOSED BOREHOLE (CONDITIONAL)
			PBH-2 PROPOSED BOREHOLE (TO BE DRILLED)

REPRESENTATIVE GEOLOGICAL CROSS SECTION ALONG SECTION LINE S1



INDEX

- PBH-1 PROPOSED BOREHOLE
●
- P.D PROPOSED DEPTH
—
- 45° INCLINATION OF BOREHOLE FROM HORIZONTAL
/

MINERAL EXPLORATION CORPORATION LIMITED

REPRESENTATIVE GEOLOGICAL CROSS SECTION
ALONG SECTION LINE S1

SALEPALI BLOCK

DISTRICT : BALANGIR

STATE : ODISHA

R.F. - 1 : 500

PLATE-III