PROPOSAL FOR PRELIMINARY EXPLORATION (G-3)

OF GRAPHITE IN PATIMAL BLOCK (4.00 SQ. KM AREA)

DISTRICT- BALANGIR, ODISHA

COMMODITY: GRAPHITE

BY

MINERAL EXPLORATION AND CONSULTANCY LIMITED

DR. BABASAHAB AMBEDKAR BHAWAN

SEMINARY HILLS

NAGPUR (MH)

PLACE: NAGPUR

DATE: July, 2024

Summary of the Block for Preliminary Exploration (G-3)

	Features	Details
	Block ID	**Patimal Block**
	Exploration Agency	Mineral Exploration and Consultancy Limited (MECL)
	Commodity	**Graphite**
	Mineral Belt	Eastern Ghat Mobile Belt, Odisha
	Budget & Time schedule to complete the project	353.57 Lakhs & 12 months
	Objectives	The present exploration program (G3) has been formulated on the basis of the outcomes of previous work and recent field traverses to fulfill the following objectives: i. Geological mapping on 1:2000 scale to delineate graphite bands and other lithounits in the area. ii. Topographical Contouring on 1:2000 scale, by means of surface contouring at 2 m interval. iii. Delineation of the potential subsurface mineralized zones by Geophysical Surveys (Self Potential). iv. Trenching will be carried out at suitable interval in the anomalous zone marked by geophysical survey to establish the continuity of the mineralization along strike direction, which is covered by soil. v. After the positive outcomes of the above activities drilling will be carried out to intersect the graphite mineralization at 30m vertical depth with 200m strike interval. vi. Assessment of quality and quantity of the resources (333) if any as per UNFC norms & Minerals (Evidence of Mineral Contents) Rules- 2015.
	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, Survey)	Geologist Party days: Field -150 days & HQ-45 days Geophysicist Party days: Field -60 days & HQ-30 days
		Survey Party days: 60 days(Geophysical Survey) & 30 days (for Topographical Survey)

<table>
<tr><td></td><td></td><td>Sampling Party days: 50 days</td></tr>
<tr><td>1.</td><td>Location</td><td>The proposed Patimal Block comprises of 4.00 sq km area and lies in Patnagar Taluk of Balangir District (Toposheet No: 64L/13), Odisha. Patimal, Dhandamunda, Burhibahal, Gundurupali and Shantipur villages fall around the proposed area. The district headquarter Balangir is 60.00 km east of the block. All the villages in the area are well connected to each other and to the highways by motorable roads and tracks.</td></tr>
<tr><td></td><td>Latitude and Longitude</td><td>
<table>
<tr><th rowspan="2">SL</th><th rowspan="2">POINT</th><th colspan="2">GCS-WGS 1984 (DMS)</th><th colspan="2">UTM (m)</th></tr>
<tr><th>LATITUDE</th><th>LONGITUDE</th><th>NORTHING</th><th>EASTING</th></tr>
<tr><td>1</td><td>A</td><td>20° 47' 22.896" N</td><td>82° 55' 59.950" E</td><td>2300078.092</td><td>701236.4591</td></tr>
<tr><td>2</td><td>B</td><td>20° 47' 1.522" N</td><td>82° 56' 37.511" E</td><td>2299433.785</td><td>702330.7143</td></tr>
<tr><td>3</td><td>C</td><td>20° 46' 29.417" N</td><td>82° 55' 54.920" E</td><td>2298431.615</td><td>701110.6666</td></tr>
<tr><td>4</td><td>D</td><td>20° 46' 22.244" N</td><td>82° 55' 3.124" E</td><td>2298193.16</td><td>699615.1208</td></tr>
<tr><td>5</td><td>E</td><td>20° 45' 53.467" N</td><td>82° 54' 40.136" E</td><td>2297300.257</td><td>698960.6741</td></tr>
<tr><td>6</td><td>F</td><td>20° 46' 22.184" N</td><td>82° 54' 16.284" E</td><td>2298175.269</td><td>698260.3139</td></tr>
</table>
</td></tr>
<tr><td></td><td>Villages</td><td>Patimal, Dhandamunda, Burhibahal, Gundurupali and Shantipur villages</td></tr>
<tr><td></td><td>Tehsil/Taluk</td><td>Patnagar Taluk</td></tr>
<tr><td></td><td>District</td><td>Balangir</td></tr>
<tr><td></td><td>State</td><td>Odisha</td></tr>
<tr><td>2.</td><td>Area (hectares/ square kilometres)</td><td></td></tr>
<tr><td></td><td>Block Area</td><td>4.00 sq.km</td></tr>
<tr><td></td><td>Forest Area</td><td>Mostly Non-Forest area.</td></tr>
<tr><td></td><td>Government Land Area (Bilanam)</td><td>Data not available</td></tr>
<tr><td></td><td>Charagaha</td><td>Data not available</td></tr>
<tr><td></td><td>Private Land Area</td><td>Data not available</td></tr>
<tr><td>3.</td><td>Accessibility</td><td></td></tr>
<tr><td></td><td>Nearest Rail Head</td><td>The nearest Railway Stations is at Nuapada (South Eastern Railway) which is 60 km south-west of the proposed block.</td></tr>
<tr><td></td><td>Road</td><td>The State Highway-42 connecting Patnagar to Padmapur passes about 18.00 km east of the block and the State Highway-03 connecting Nuapada to Sohela Passes 40 km south-west of the block.</td></tr>
<tr><td></td><td>Airport</td><td>The nearest airport is at Raipur, which is about 215 km west of the block.</td></tr>
<tr><td>4.</td><td>Hydrography</td><td></td></tr>
<tr><td></td><td>Local Surface Drainage Pattern (Channels)</td><td>The area falls to the south western foothills of the Gandhamardan range and the adjacent pediplain. There are several high points in the Gandhamardan range. The tributaries of Suktel River forms the main drainage fed by tributaries descending from the Gandhamardan range. The northwestern part of the block has maximum elevation of 330 m. The elevation of the block ranges between 300 m to 330 m.</td></tr>
<tr><td></td><td>Rivers/ Streams</td><td>Tributaries of Sukhtel River</td></tr>
<tr><td>5.</td><td>Climate</td><td></td></tr>
</table>

<table>
<tr><td></td><td>Mean Annual Rainfall</td><td>Average annual rainfall is 100 cm</td></tr>
<tr><td></td><td>Temperature</td><td>Minimum temperatures: 10°C (Dec-Feb),
Maximum temperatures: up to 46°C (March-June)</td></tr>
<tr><td>6.</td><td>Topography</td><td></td></tr>
<tr><td></td><td>Toposheet Number</td><td>64L/13</td></tr>
<tr><td></td><td>Morphology of the Area</td><td>The area comprises of mostly gently undulating plane. The average elevation of the block is 315 m above MSL. Thick alluvium accumulated due to the network of drainage has helped the area to form cultivable land.</td></tr>
<tr><td>7.</td><td>Availability of baseline geoscience data</td><td></td></tr>
<tr><td></td><td>Geological Map (1:50K/25K)</td><td>Bhukosh Map (1:50000), Plate-III: Geological Map of Paikmal-Khaparakhol Area, Sambalpur and Balangir, Odisha based on aerial photo-interpretation with limited field checks (F.S.1987-88, GSI)</td></tr>
<tr><td></td><td>Geochemical Map</td><td>NGCM data available in Bhukosh</td></tr>
<tr><td></td><td>Geophysical Map (Aeromagnetic, ground geophysical, Regional as well as local scale GP maps)</td><td>NGPM Gravity and Magnetic data available in Bhukosh</td></tr>
<tr><td>8.</td><td>Justification for taking up Preliminary Exploration</td><td>a. The proposed block has been carved out by amalgamating 10A 2(b) leases/ taken over leases for further exploration by the State Technical Committee (JWG) on 06.02.2023 and allotted to MECL for necessary action.

b. During the preliminary field visit conducted by MECL the graphite mineralization observed on ground had was confirmed by many abandoned graphite quarries. The graphite mineralization in the strike extension was covered by thick soil cover. Hence, exploration activities like geophysical survey and trenching will help to delineate the subsurface mineralized zone and augment the graphite resources in the proposed block. 02 numbers of bedrock samples of graphite have been collected from the proposed block area. The analysis results of bedrock samples are given below.
<table>
<tr><th>Sl. No.</th><th>Sample No.</th><th>Moisture%</th><th>Ash%</th><th>VM%</th><th>FC%</th></tr>
<tr><td>1</td><td>P-02</td><td>2.18</td><td>83.34</td><td>5.52</td><td>8.90</td></tr>
<tr><td>2</td><td>P-03</td><td>1.80</td><td>82.05</td><td>9.04</td><td>6.23</td></tr>
</table>
</td></tr>
</table>

		c. GSI during the field season 1971-72 carried out detailed investigation of graphite deposit in Sargipalli-Bardhapalli Belt, Sambalpur and Bolangir District, Odisha. From the observations during the investigation and thick soil cover in the area, it was recommended that close spaced geophysical prospecting by SP and IP methods must be carried out to ascertain the strike extension of graphite deposits. d. GSI 1978-79 carried out investigation for graphite in Bolangir, Sambalpur and Kalahandi Districts, Odisha. In 20 sq km area between Sapmund and Telenpali, one abandoned quarry and two graphite occurrences were observed. The graphite in the quarry was reported to be of 65% grade and maximum 5 m width at the middle of the quarry at 26 m depth. A 35cm wide graphite body associated with a small calc-granulite band was exposed within porphyroblastic granite gneiss with 7.4 m strike length at N50°E-S50°W and 35° southerly dip. The Proposed Block lies 7 km east of this area, thus the same geological setup is extended upto the proposed block. Regional evaluation of the graphite resources, detailed geological mapping, exploratory excavation, geophysical survey and sampling in selected zones to assess additional resource was recommended. e. No previous exploration data of the leases are available with the State Government. Hence the proposed exploration will help to generate data and make the block feasible for auction. f. At present graphite is a critical mineral for the nation. The previous exploration in the surrounding area has established occurrences of graphite. Hence, the Preliminary Exploration (G-3) will help to establish the vertical and lateral extension of graphite in the current block, which will definitely augment the graphite resource and make the block auctionable.

PROPOSAL FOR PRELIMINARY EXPLORATION (G-3)
OF GRAPHITE IN PATIMAL BLOCK (4.00 SQ. KM AREA)
DISTRICT- BALANGIR, ODISHA

1.0.0 INTRODUCTION

1.1.0 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.

1.2.0 The world resources of graphite are believed to exceed 800 million tonnes of recoverable graphite. However, world reserves of graphite have been placed at 320 million tonnes of which Turkey accounts for 28% followed by China (23%), Brazil (22%), Madagascar & Mozambique (8% each), Tanzania 5%, India &Uzbekisthan (2% each) and Mexico & Dem. P. R. of Korea (1% each). (IBM, Mineral Year Book-2021).

1.3.0 World graphite production has fluctuated slightly in recent years. In 2022, the total worldwide production of graphite amounted to 1.3 million metric tons, an increase from the 1.13 million metric tons produced in the previous year. In the past decade, China has consistently been the leading global graphite producer. In 2022, China produced an estimated 850,000 metric tons of graphite. Following China, was Mozambique in a distant second place, with a production volume estimated at 170,000 metric tons that year. India ranks 10th position in the top graphite producing countries.

1.4.0 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 36% of the total resources which is followed by Jammu & Kashmir (29%), Jharkhand (9%) Madhya Pradesh (5%) Odisha (9%), and Tamil Nadu (4%). However, in terms of reserves, Tamil Nadu has the leading share of about 36% followed by Jharkhand (30%) and Odisha (33%) of the total reserves (Mineral Year Book-2021). 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.

1.5.0 The Ministry of Mines has recently listed out 30 critical minerals that are essential for economic development and national security, graphite is one of them. The use of digital technologies depends on minerals such as lithium, graphite, cobalt, titanium

and rare earth elements. Graphite is mainly required in clean technology industries having major application in Batteries, Lubricants, fuel cells for EVs, Electric Vehicle. Based on the Report on Critical minerals for India, June 2023 India has 9 million tones of graphite reserve (Production reported from 12 mines). The net import reliance for graphite in India is 60% which is mostly imported from China, Madagascar, Mozambique, Vietnam and Tanzania. Graphite has been categorized as a mineral having high economic importance and well as high supply risk. To meet the demand new area suitable for graphite mineralization needs to be explored. The proposed block is an attempt for the search of graphite.

1.2.0 BACKGROUND

1.2.1 In view of the enactment of the MMDR Amendment Act, 2015 and Mineral Auction Rule, 2015 by the Govt. of India, the State administration of Odisha desired that some mineral prospects of the State be explored on priority basis through National Mineral Exploration Trust (NMET) fund so that those could be auctioned and thereby earn revenue for the state along with the augmentation of reserve and resource of the country. Graphite occurrences in Balangir district in Odisha are among them.

1.2.2 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 in the block and graphite quarries were observed in the area. MECL collected few samples for graphite from the surface exposures and the analysis values are given below:

Sl. No.	Sample No.	Moisture%	Ash%	VM%	FC%	Rocktype
1	P-02	2.18	83.34	5.52	8.90	Khondalite
2	P-03	1.80	82.05	9.04	6.23	Khondalite

1.2.3 In light of the above proposal for Preliminary Exploration for graphite in Patimal Block over an extent of 4.00 sq km is prepared and submitted for discussion. The details of the proposal are described in the following paragraphs.

2.1.0 LOCATION AND ACCESSIBILITY

2.1.1 The proposed Patimal Block comprises of 4.00 sq km area and lies in Patnagar Taluk of Balangir District (Toposheet No: 64L/13), Odisha. Patimal, Dhandamunda, Burhibahal, Gundurupali and Shantipur villages fall around the proposed area. The State Highway-42 connecting Patnagar to Padmapur passes about 18.00 km east of the block and the State Highway-03 connecting Nuapada to Sohela Passes 40 km south-west of the block. The district headquarter Balangir is 60.00 km east of the block. All the villages in the area are well connected to each other and to the highways by motorable roads and tracks. The nearest airport is at Raipur, which is about 215 km west of the block. All the villages in the area are well connected to

each other and to the highways by motorable roads and tracks. The nearest Railway Stations is at Nuapada (South Eastern Railway) which is 60 km south-west of the proposed block. The block proposed is bounded by latitude 20° 45' 59" N to 20° 47' 26" N and longitude 82° 54' 21" E to 82° 56' 38" E (Plate No I).

Table 2.1
Coordinates of Corner Points of Proposed Patimal Block, Patnagar Tehsil, Balangir District, Odisha

SL	POINT	GCS-WGS 1984 (DMS)		UTM (m)	
		LATITUDE	LONGITUDE	NORTHING	EASTING
1	A	20° 47' 22.896" N	82° 55' 59.950" E	2300078.092	701236.4591
2	B	20° 47' 1.522" N	82° 56' 37.511" E	2299433.785	702330.7143
3	C	20° 46' 29.417" N	82° 55' 54.920" E	2298431.615	701110.6666
4	D	20° 46' 22.244" N	82° 55' 3.124" E	2298193.16	699615.1208
5	E	20° 45' 53.467" N	82° 54' 40.136" E	2297300.257	698960.6741
6	F	20° 46' 22.184" N	82° 54' 16.284" E	2298175.269	698260.3139

2.2.0 PHYSIOGRAPHY AND DRAINAGE

2.2.1 The area falls to the south western foothills of the Gandhamardan range and the adjacent pediplain. There are several high points in the Gandhamardan range. The tributaries of Suktel River forms the main drainage fed by tributaries descending from the Gandhamardan range. The northwestern part of the block has maximum elevation of 330 m. The elevation of the block ranges between 300 m to 330 m. The area comprises of mostly gently undulating plane. The average elevation of the block is 315 m above MSL. Thick alluvium accumulated due to the network of drainage has helped the area to form cultivable land.

2.3.0 CLIMATE

2.3.1 The area has a sub-tropical climate with torrential rainfall between June and September. The temperature ranges between 10^0 C in winter and 46^0 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.

2.4.0 FLORA AND FAUNA

2.4.1 The areas under exploration are sparse to densely vegetate. The floral assemblage includes Sal (Shorearobusta), Shishu (Dalbergialatifolia), Neem (Nekuaindica), Tamarind (Tamarindusindica), Jackfruit (Autocarpusintergrifolia), Kendu (Diaspyrosmelanxylon), 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.

3.1.0 REGIONAL GEOLOGY

3.1.1 The exploration area lies in the northern part of the Eastern Ghat 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 structure.

3.1.2 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:

Table: 3.1

Regional Stratigraphic succession (After GSI)

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

3.2.0 GEOLOGY OF THE BLOCK

3.2.1 The proposed area is mainly covered by Granite Gneiss, Khondalite of Eastern Ghat Super Group and Quartzite. The details of lithologies present in the block are described in the successive paragraphs. The generalized stratigraphy of the proposed area (After GSI) is given in **Table No 3.2.**

Table No 3.2

Geology of the Block (After GSI)

AGE	SUPERGROUP	FORMATION	LTHOLOGY
			Alluvium and soil Pegmatite and quartz veins Granite gneiss, Migmatites
Archaean	**Eastern GhatSupergroup**	Charnockite Formation	Charnockite
		Khondalite Formation	Khondalite, calc-granulites Garnetiferous quartzite

3.2.1.1 **Khondalite:** Quartz-garnet-sillimanite gneisses and schists (with or without graphite), garnetiferous quartzite and calc-granulite constitute this formation.The quartz rich variants of the khondalites are resistant to erosion and stand out asconical hills, ridges with thick vegetation in the Gandhamardan Range.The schists and gneisses of the khondalite formation are grayish brownish in colour, medium grained and contains quartz, garnet, sillimanite with or without graphite and a little biotite.The sillimanite needles are arranged in a linear fashion imparting schistosity. Garnet is limonitised along cracks. Biotite forms after the garnet. Graphite flakes, when present, are normally arranged parallel or sub-parallel to schistosity.

3.2.1.2 **Calc-granulite:** It is a medium grained rock, greenish white in colour, The mineral assemblage are diopside, scapolite, quartz, calcitewith a little feldspar. In some cases presence of garnet is noted in minor amounts.

3.2.1.3 **Granite gneiss:** The granite gneiss is of two types i.e. garnetiferous granite gneiss and porphyroblasticgarnetiferous granite gneiss. The nonporphyroblastic type is the older as evidenced by xenoliths of this rock found in porphyroblastic granite gneiss. Bands of this rocks are concordant with migmatisedkhondalite. The porphyroblasticgarnetiferous granite gneiss is the most predominant and occupies extensive areas. The rock is very coarse grained with porphyroblasts of feldspar in a groundmass of quartz, feldspar, garnet.

3.2.1.4 **Pegmatite and quartz veins:** Pegmatite and quartz veins are very common within the migmatite zone. Most of the veins are aligned parallel to the foliation of the migmatite host rock. Three combination of minerals are noted in the pegmatite i) quartz and feldspar, ii) quartz-feldspar-muscovite-biotite, iii) feldspar, quartz-biotite-tourmaline. Quartz veins of variable thickness occupy the joint planes. Sometimes it contains graphite flakes and clots.

3.2.2 **STRUCTURE**: Well developed foliation due to parallel arrangement of sillimanite needles, graphite and biotite flakes is displayed by the rocks of the khondalite formation. Banding displayed by concentration of garnet quartzo-feldspathic matters is prominent in the gneissic variety of the khondalites. In the non-porphyroblastic granite gneiss, flattened quartz and biotite rich bands impart the gneissosity. An indistinct gneissosity is observed in porphyroblastic granite gneiss by a rough alignment of feldspar porphyroblasts.

The strike of foliation is dominantly NW-SE to NE-SW with steep south easterly dips. The general steep dip (70° to 80°) of foliation is a common feature in the whole area.

3.2.3 **MINERALIZATION:** The graphite deposit of the area fall in the Sargipali graphite belt. Most of the deposits are under soil cover. Quarrying was started from the outcrops that were available. Graphite in a disseminated form is noted mostly in khondalite and less commonly in quartzite and granite gneisses in the areas. The graphite in khondalite constitutes 1 to 2% of the khondalite rocks and the parallel arrangement of the graphite flakes defines the foliation of khondalites. At places, the graphite

concentration in migmatised khondalites increases sufficiently in bands which become economically exploitable. These bands might have long strike continuity (more than 100m) and low grade varying from 5% to 10% F.C. Other important form of graphite bodies are the lensoid and vein types. These bodies are smaller but the grade is normally higher (more than 30% F.C.). Generally, these bodies contain lumpy graphite. Graphites of least significance occur as clots, pockets in pegmatite/quartz veins. The gangue minerals associated with graphite bodies are quartz, feldspar, garnet, sillimanite, biotite, calcite and sericite.

In 20 sq km area between Sapmund and Telenpali, one quarry with 65% grade and maximum 5 m width and two graphite occurrences were observed. 0.5 km west of Telenpali, a 35 cm wide graphite body associated with a small calc-granulite band was exposed having strike length of 7.4m and trend N50°E-S50°W towards 35° south. The Proposed Block lies 7 east of Telenpali area, thus the same geological setup is extended upto the proposed block.

In Lachimal- Damaipali area, at 0.5 km west of Lachimal 50 cm thick lumpy graphite band was observed. 0.5 km ENE of Dameipali an abandoned graphite quarry was observed having 1.5m wide graphite body exposed (with F.C. 40%) on the footwall over a- strike length of 5m in migmatised khondalite. The strike was N70° W-S70° E with 75° southerly dip. Another graphite band, 28 cm thick is located within migmatised khondalite at the contact with biotite granite gneiss in a well about 1 km NW of Damaipali. The proposed block falls 3 km south of the Lachimal Damipali area having the same geological setup favourable for graphite mineralization.

During the preliminary field visit carried out by MECL, few abandoned pits were observed in the block where graphite was associated with khondalite along the direction of foliation. The area to the strike extension of graphite pits were soil covered. Two samples were collected from the area where graphite was associated with khondalite.

3.3.0 PREVIOUS WORK AND RECOMMENDATION

3.3.1 Tak, M.W. carried out geological mapping in 650 sq km area in 1:63,360 scale during the field season 1961-62. Graphite was observed to be the only mineral of economic importance with concentration of workable deposits of graphite in form of pockets, veins and lenses. Intrusion of pegmatite veins, sometimes apperared to control the mineralisation and subsequent concentration. The disposition of graphite belts and isolated pocket and lenses prevailed along the geological strike and dip direction of the host rocks. The graphite in this area appeared to be of inorganic origin.

3.3.2 Chakrabarti P. during the field season 1971-72 carried out detailed investigation of graphite deposit in Sargipalli-Bardhapalli Belt, Sambalpur and Bolangir District, Odisha. The major graphite deposits in the Sargipalli-Bardhapalli Graphite Belt were restricted to the narrow zones of leptynites. The economically workable graphite bodies were observed to be associated with pegmatites and appear to be

hydrothermal in origin. The detailed surface mapping revealed that the local mining activities had exhausted almost all the surface shows of graphite, thus no new graphite deposits can be seen on surface. It was recommended to carry out close spaced geophysical prospecting by SP and IP methods along the leptinite zones and strike extension of graphite deposits.

3.3.3 Mohanty, S.D. and Joshi O.P. during the field season 1978-79 carried out investigation for graphite in Bolangir, Sambalpur and Kalahandi Districts, Odisha. 123 sq km area was mapped in 1:63,360 scale, 11.25 cubic meter of test pitting was carried out and four quarries were examined. Graphite bands, veins and lenses were observed confined to linear zones within migmatised khondalite. In 20 sq km between Sapmund and Telenpali, one quarry and two graphite occurrences were observed. The graphite in the quarry was reported to be of 65% grade and maximum 5 m width at the middle of the quarry at 26 m depth. Association of pegmatite with graphite is noticed on the eastern face of the quarry. 0.5km west of Telenpali, a 35cm wide graphite body associated with a small calc-granulite band was exposed within porphyroblastic granite gneiss. The measured strike length of the body is 7.4m with a trend of N50°E-S50°W and 35° southerly dip. The Proposed Block lies 7 km east of Telenpali area, thus the same geological setup is extended upto the proposed block. Thick soil cover was observed in the graphite bearing areas, thus geophysical methods to probe concealed bodies in probable graphite bearing zones were recommended. Regional evaluation of the graphite resources, detailed geological mapping, exploratory excavation and sampling in selected zones to assess additional resource was recommended.

3.3.4 Mohanty S.D. during the field season 1981-82 carried out investigation for graphite in Bolangir, Sambalpur and Kalahandi Districts, Odisha. Reconnaissance study of 665 sq km area, 56.65 cubic meter pitting and trenching and collection of 28 channel samples were carried out. Graphite bands, veins and lenses occur mostly parallel to the foliation within the migmatised khondalite. A reserve of 57415 tonnes in possible category with 5.93% to 7.25% FC was estimated. In Lachimal- Damaipali area, at 0.5 km west of Lachimal 0.5 m thick lumpy graphite band was observed. 0.5 km ENE of Dameipali an abandoned graphite quarry was observed. The quarry with two direction of excavation i.e. N-S and E-W was observed, a 1.5m wide graphite body is exposed on the footwall over a- strike length of 5m in a host rock of migmatised khondalite. The strike was N70° W-S70° E with 75° southerly dip. The graphite body appeared to be synformally folded with the axis plunging to SE. The F.C. is about 40% (V.E.). Another graphite band, 28 cm thick is located within migmatised khondalite at the contact with biotite granite gneiss in a well about 1 km NW of Damaipali. The proposed block falls 3 km south of the Lachimal Damipali area having the same geological setup favourable for graphite mineralization.It was recommended that Exploratory trenching, sampling in already identified promising deposits may be

taken up. It was also recommended that geophysical investigation in soil covered areas may be undertaken to delineate graphite bearing zones followed by drilling to prove depth extension of graphite mineraization.

3.3.5 Satapathy U.N. during the field season 1987-88 carried out Photogeological Studies on the assessment of graphite resources in Titlagarh- Sargipalli Belts in parts of Bolangir and Sambalpur Districts, Odisha. An area of 2100 sq km was covered with the aid of aerial photographs on 1:60,000 (approx) scale. It was observed that the structure and migmatisation majorly controls the graphite localization. Three graphite bearing zones were demarcated in the area by the photo geological studies. The proposed block falls in north eastern of Zone-2. The zone-2 is a 28 km long and 6km wide area between Rengali in the southwest and Thutibhata in the northeast which was observed to be promising with a number of graphite mines. The proposed block falls 4 km south of Zone-II, where an abandoned graphie mine is present within the proposed block. Further geological and geophysical survey was recommended to be carried out in the area.

4.0.0 OBJECTIVE OF THE PROPOSED PRELIMINARY EXPLORATION (G-3 STAGE):

4.1.0 The present exploration program (G3) has been formulated on the basis of the outcomes of previous work and recent field traverses to fulfill the following objectives:

i. Geological mapping on 1:2000 scale to delineate graphite bands and other lithounits in the area.

ii. Topographical Contouring on 1:2000 scale, by means of surface contouring at 2 m interval.

iii. Delineation of the potential subsurface mineralized zones by Geophysical Surveys (Self Potential).

iv. Trenching will be carried out at suitable interval in the anomalous zone marked by geophysical survey to establish the continuity of the mineralization along strike direction, which is covered by soil.

v. After the positive outcomes of the above activities drilling will be carried out to intersect the graphite mineralization at 30m vertical depth with 400m strike interval.

vi. Assessment of quality and quantity of the resources (333) if any as per UNFC norms & Minerals (Evidence of Mineral Contents) Rules- 2015.

5.0.0 PLANNED METHODOLOGY

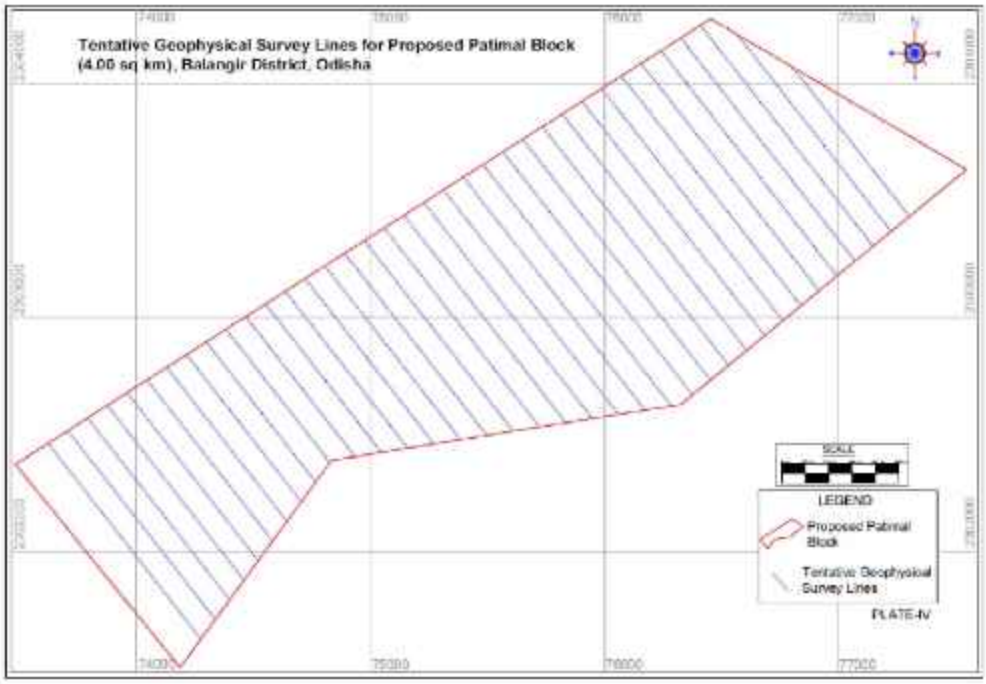
5.0.1 In accordance to the objective set for Preliminary Exploration (G-3) of the block, the exploration programme is proposed. The Exploration shall be carried out as per Minerals (Evidence of Mineral Contents) Rule-2015. Accordingly, the following scheme of exploration is formulated in order to achieve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

5.1.0 GEOLOGICAL MAPPING

5.1.1 Geological mapping will be carried out in the 4.00 sq.km area on 1:2,000 scale. Rock types, their contact, structural features will be mapped. Surface manifestations of the graphite mineralisation along with their surface disposition will be marked on map. 10 numbers of surface samples of various lithounits will be studied for petrography and minerography.

5.2.0 GROUND GEOPHYSICAL SURVEY:

5.3.1 Ground Geophysical Self Potential Survey would be carried out in the proposed block to delineate the target mineralization. The survey will be planned in a grid pattern of 100m traverse interval across the trend of mineralization and 20 m station interval. A total of tentative 30 Line Km SP survey is planned to delineate the subsurface mineralized graphite zones. The tentative geophysical plan attached below is prepared based on the graphite mineralization observed during field visit.

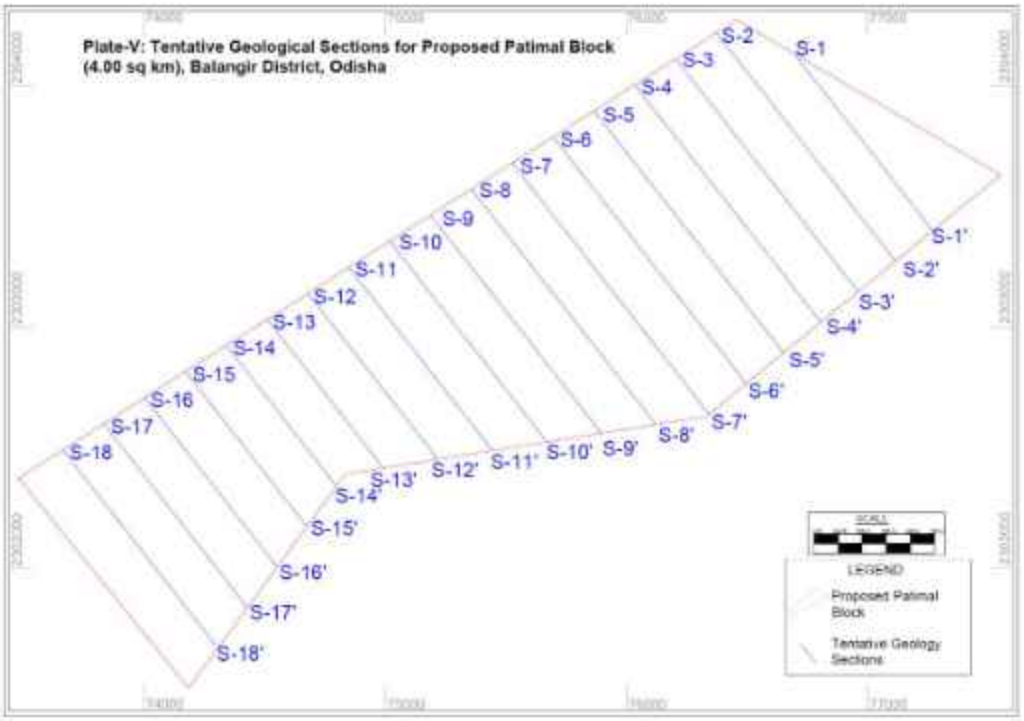


5.4.0 TRENCHING

5.4.1 09 trenches (270 cubic m) have been proposed in the area to ascertain the continuity of graphite mineralization identified during the geophysical survey. A mineralized length of maximum 10 m, is estimated to be intersected in the trenches. The maximum numbers of samples collected from each trench is 15 including the mineralized zone, hanging wall and footwall. A total of 135 Nos of primary would be collected from 09 trenches & 10% of Primary samples i.e. 13 samples will be sent to NABL External Labs for proximate analysis of graphite (i.e. Fixed Carbon (FC), Ash (A), Moisture (M) and Volatile Matter (VM)).

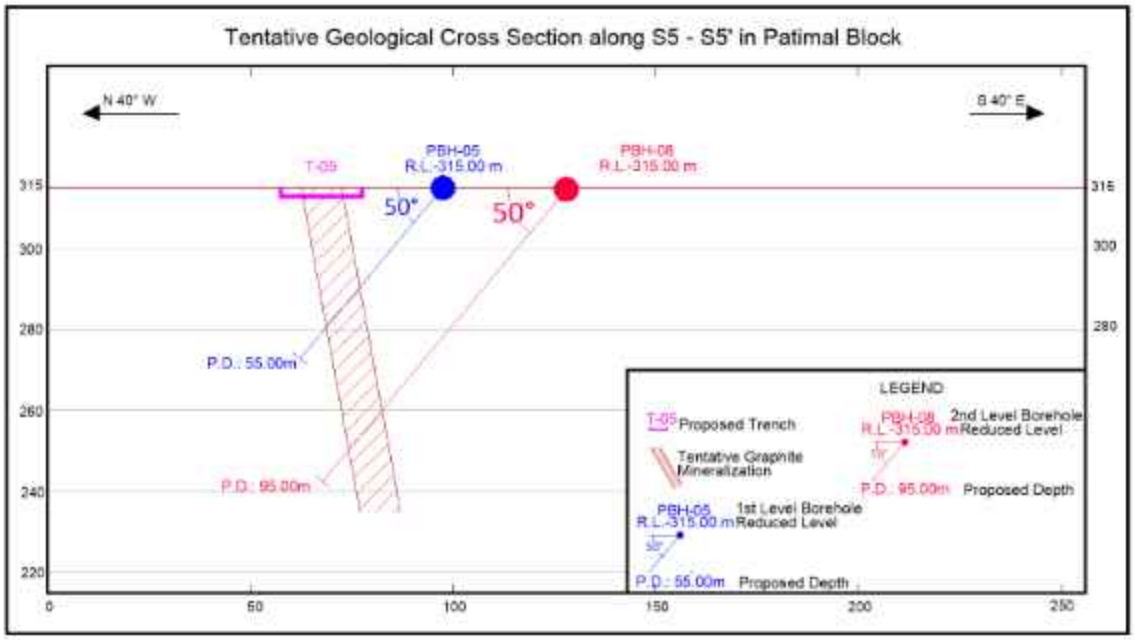
5.5.0 EXPLORATORY DRILLING

5.5.1 Based on the positive outcomes of geophysical survey and trenching, boreholes will be planned to establish subsurface continuity of mineralization. 18 boreholes have been planned at 200 m strike interval to intersect the graphite mineralization at 30 m vertical depth (1st level) from the surface. The total drilling for 1st level borehole is 990 m. 05 boreholes have been planned at 800 m strike interval to intersect the graphite mineralization at 60 m vertical depth (2nd level) from the surface. The total drilling meterage for 2nd level borehole is 475 m. The total estimated mineralization to be intersected in each borehole is 10 m. 15 nos of samples from each borehole (mineralized zone, hanging wall and footwall) will be collected for primary sampling. 1465 m of drilling will be carried out to explore the total strike length of mineralization for 1st level and 2nd level intersection.



5.6.0 CORE LOGGING

5.6.1 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 ore type would be recorded.



5.7.0 CORE SAMPLING

5.7.1 The mineralized graphite along with hanging wall and foot wall 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 zone and its physical character. 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). The cores of rocks 3 m immediate on footwall and 3 m immediate on hanging wall of mineralized zones would be sampled at 1.0 m interval, depending upon the intensity of mineralization, change in lithology and core recovery etc.

15 nos of samples from each borehole (mineralized zone, hanging wall and footwall) will be generated as primary samples. A total 345 numbers of primary core samples will be analyzed for graphite mineralization (FC: Non-carbonate, Ash, Moisture and VM). Around 10% of Primary samples i.e. 35 numbers of sample for Graphite will be sent to NABL External Labs for analysis of graphite mineralization (FC: Non-carbonate, Ash, Moisture and VM) as external check samples.

05 samples are kept for Raman Spectroscopy is proposed to assess the physical properties of graphite.

5.8.0 XRF Analysis:

5.8.1 50 nos of sample with 5 external will be carried out for oxides.

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 BULK DENSITY

5.10.1 A provision of 5 samples for bulk density determination has been kept.

6.1.0 QUANTUM OF WORK:

6.1.1 The quantum of work proposed by MECL in Patimal Block (G-3 Stage of Exploration) is given in Table 6.1.

Table: 6.1
Proposed Quantum of Exploratory Work in Patimal Block, District- Balangir, Odisha.

Sl. No.	Item of Work	Unit	Proposed Quantum of work
1	Geological Mapping (1:2000)	sq. km	4.00
2	Topography Survey (1:2000)	sq. km	4.00
3	Geophysical Survey (SP Survey)	Line Km	40
4	Trenching (1m x 2m x15m) x 09 trenches	Cu. m	270
5	Exploratory Drilling	m.	1465
6	Sample Preparation & Chemical Analysis		
	i) Proximate Analysis of Primary samples for Graphite for 4 parameters i.e. Fixed Carbon (FC), Ash (A), Moisture (M) and Volatile Matter (VM) (135 Trench + 345 Borehole)	Nos.	480
	ii) External Check sample (10 % of Primary samples) for Graphite for 4 parameters (13 Trench + 35 Borehole)	Nos.	48
	iii) XRF analysis for oxides (SiO_2, Al_2O_3, Fe_2O_3, CaO, MgO, Na_2O, K_2O, LOI and V_2O_5)	Nos.	50
	iv) External (10%) Check samples from NABL Lab for XRF analysis for oxides (SiO_2, Al_2O_3, Fe_2O_3, CaO, MgO, Na_2O, K_2O, LOI and V_2O_5)	Nos.	5
8	Raman Spectroscopy	Nos.	5
9	Petrographic Studies	Nos	10
10	Mineragraphic Studies	Nos	10
11	Bulk Density studies	Nos	5
12	Report Preparation (Digital format)	Nos.	1

6.2.0 MANPOWER DEPLOYMENT

6.2.1 Manpower deployment List may be provided later.

6.3.0 TIMELINE AND BREAK-UP OF EXPENDITURE

6.3.1 The proposed exploration programme is planned for Preliminary Exploration (G-3). The work activities like camp setting, geological work, geophysical survey, drilling & laboratory work, report writing will be completed within 12 months' time. The bar chart showing activities wise time schedule is placed at **Table-6.2.**

Table-6.2.

Estimated time schedule for Preliminary Exploration (G-3) for Graphite in Patimal Block, Districts: Balangir, State: Odisha [Block area- 4.00 sq. km; Schedule timeline- 12 months]

Sl. No.	Particulars	Months	1	2	3	4	5	REVIEW	6	7	8	9	10	11	12
1	Camp Setting/ mobilization	Months													
2	Geologist days	days													
3	Geophysist days	days													
4	Survey Days (2 party)	days													
5	Trenching	days													
6	Drilling (1 rig)	m													
7	Sampling days	days													
8	Camp winding	Months													
9	Laboratory Studies	days													
10	Geologist days, HQ	days													
11	Report Writing with Peer Review	days													

6.3.2 Tentative cost has been estimated based on Schedule of Charges (SoC) of projects funded by National Mineral Exploration Trust (NMET) w.e.f. 01/04/2020 and the total estimated cost is **Rs. 352.18 Lakh.** The summary of tentative cost estimates for Preliminary Exploration is given in **Table No.-6.3** and details of tentative cost estimates are given as Annexure-I.

Table No.-6.3

Summary of Tentative cost estimates for Preliminary Exploration in Patimal Block

Sl. No.	Item	Total
1	Geological Work	3,554,448
2	Geophysical Work	2,737,280
3	Trenching	899,100
4	Drilling	19,411,350
5	Laboratory Studies	1,974,485
	Sub total	**28,576,663**
6	Report	857,300
7	Peer Review	30,000

Sl. No.	Item	Total
8	Proposal Prepration	500,000.00
	Total	**29,963,963**
9	GST (18%)	5,393,513.32
Total cost including 18% GST		**35,357,476**
SAY, in Lakhs		**353.57**

7.0.0 JUSTIFICATION

7.1.0 The proposed block has been carved out by amalgamating 10A 2(b) leases/ taken over leases for further exploration by the State Technical Committee (JWG) on 06.02.2023 and allotted to MECL for necessary action.

7.2.0 During the preliminary field visit conducted by MECL the graphite mineralization observed on ground had was confirmed by many abandoned graphite quarries. The graphite mineralization in the strike extension was covered by thick soil cover. Hence, exploration activities like geophysical survey and trenching will help to delineate the subsurface mineralized zone and augment the graphite resources in the proposed block. 02 numbers of bedrock samples of graphite have been collected from the proposed block area. The analysis results of bedrock samples are given below.

Sl. No.	Sample No.	Moisture%	Ash%	VM%	FC%	Rocktype
1	P-02	2.18	83.34	5.52	8.90	Khondalite
2	P-03	1.80	82.05	9.04	6.23	Khondalite

7.3.0 GSI during the field season 1971-72 carried out detailed investigation of graphite deposit in Sargipalli-Bardhapalli Belt, Sambalpur and Bolangir District, Odisha. From the observations during the investigation and thick soil cover in the area, it was recommended that close spaced geophysical prospecting by SP and IP methods must be carried out to ascertain the strike extension of graphite deposits.

7.4.0 GSI 1978-79 carried out investigation for graphite in Bolangir, Sambalpur and Kalahandi Districts, Odisha. In 20 sq km area between Sapmund and Telenpali, one abandoned quarry and two graphite occurrences were observed. The graphite in the quarry was reported to be of 65% grade and maximum 5 m width at the middle of the quarry at 26 m depth. A 35cm wide graphite body associated with a small calc-granulite band was exposed within porphyroblastic granite gneiss with 7.4 m strike length at N50°E-S50°W and 35° southerly dip. The Proposed Block lies 7 km east of this area, thus the same geological setup is extended upto the proposed block. Regional evaluation of the graphite resources, detailed geological mapping, exploratory excavation, geophysical survey and sampling in selected zones to assess additional resource was recommended.

7.5.0 No previous exploration data of the leases are available with the State Government. Hence the proposed exploration will help to generate data and make the block feasible for auction.

7.6.0 At present graphite is a critical mineral for the nation. The previous exploration in the surrounding area has established occurrences of graphite. Hence, the Preliminary Exploration (G-3) will help to establish the vertical and lateral extension of graphite in the current block, which will definitely augment the graphite resource and make the block auctionable.

8.0.0 References:

- Tak, M.W., F.S. 1961-62, GSI, Progress Report (Mapping) for the Field-Season 1961-62
- Chakrabarti P., F.S. 1971-72, GSI, Detailed investigation of graphite deposit in Sargipalli-Bardhapalli Belt, Sambalpur and Bolangir District, Odisha.
- Mohanty, S.D. and Joshi O.P., F.S. 1978-79, GSI, Report on investigation for graphite in Bolangir, Sambalpur and Kalahandi Districts, Odisha.
- Mohanty S.D., F.S. 1981-82, GSI, Report on investigation for graphite in Bolangir, Sambalpur and Kalahandi Districts, Odisha.
- Satapathy U.N. F.S. 1987-88, GSI, Photogeological Studies on the assessment of graphite resources in Titlagarh- Sargipalli Belts in parts of Bolangir and Sambalpur Districts, Odisha.

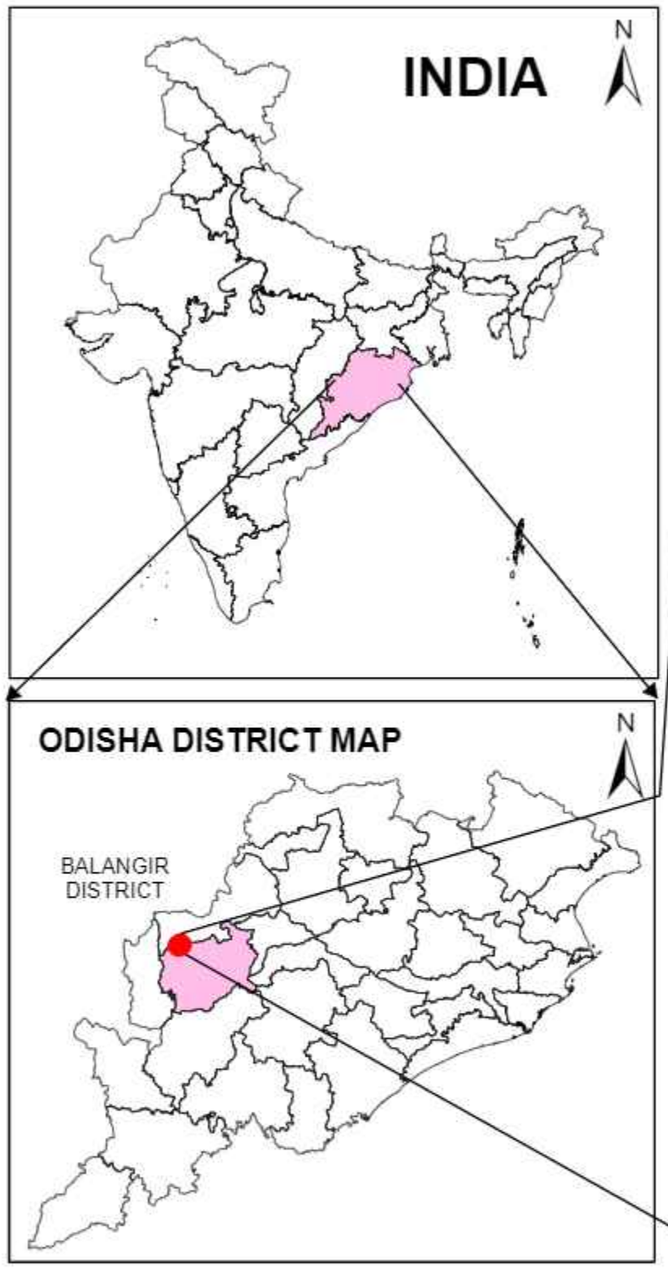
9.0.0 List of Plates:

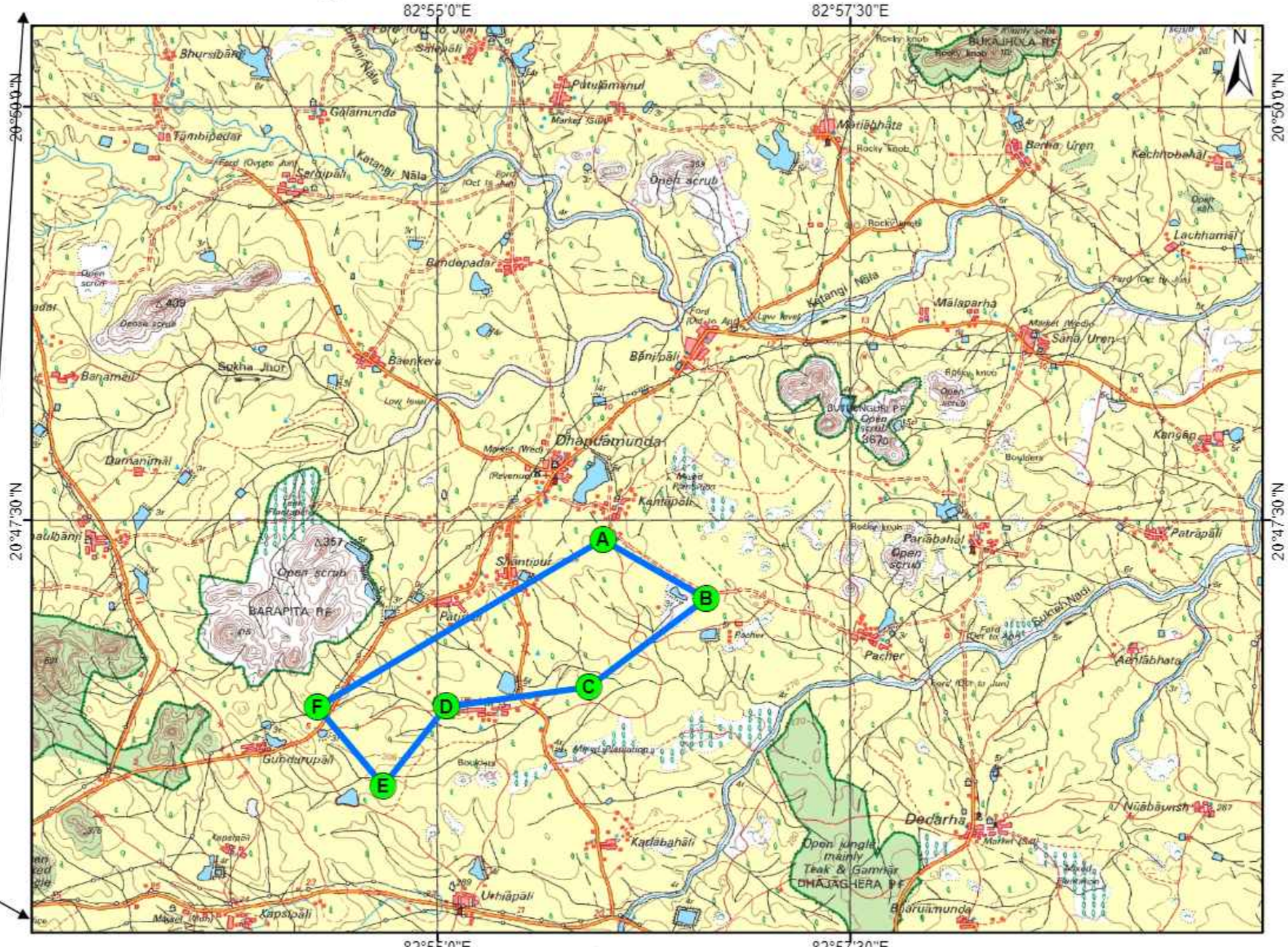
i. Plate-I: Location Map of Patimal Block in Toposheet no. 64L/13, Balangir District, Odisha.
ii. Plate-II: Regional Geological Map showing Patimal Block (Source: Bhukosh, GSI).
iii. Plate-III: Geological map of Patimal Block.
iv. Plate-IV: Tentative Geophysical Layout Plan for Preliminary Exploration (G3) of Graphite in Patimal Block (Geophysical Survey Line Spacing of 100 m and Station Interval of 20 m), Balangir District, Odisha
v. Plate-V: Geological Section Lines for Preliminary Exploration (G3) of Graphite in Patimal Block (Section Line Spacing of 400 m), Balangir District, Odisha
vi. Plate-VI: Tentative Geological Cross Section along Section Line S5 – S5' in PatimalBlock, Balangir District, Odisha

10.0.0 List of Annexures:

i) Estimated Time Schedule and Details of Tenative Cost for Preliminary Exploration (G-3) for Graphite in Patimal Block (Area- 4.00 sq. Km), Districts: Balangir, State: Odisha

Location Map showing Proposed Patimal Block (4.00 sq km) for Preliminary Exploration of Graphite, Balangir District, Odisha





Co-ordinates of Corner Points of Proposed Patimal Block (4.00 sq km), Patnagar Tehsil, Balangir District, Odisha					
SL	POINT	GCS-WGS 1984 (DMS)		UTM (m)	
		LATITUDE	LONGITUDE	NORTHING	EASTING
1	A	20° 47' 22.896" N	82° 55' 59.950" E	2300078.092	701236.4591
2	B	20° 47' 1.522" N	82° 56' 37.511" E	2299433.785	702330.7143
3	C	20° 46' 29.417" N	82° 55' 54.920" E	2298431.615	701110.6666
4	D	20° 46' 22.244" N	82° 55' 3.124" E	2298193.16	699615.1208
5	E	20° 45' 53.467" N	82° 54' 40.136" E	2297300.257	698960.6741
6	F	20° 46' 22.184" N	82° 54' 16.284" E	2298175.269	698260.3139

1:50,000

0 0.375 0.75 1.5 2.25 3 Kilometers

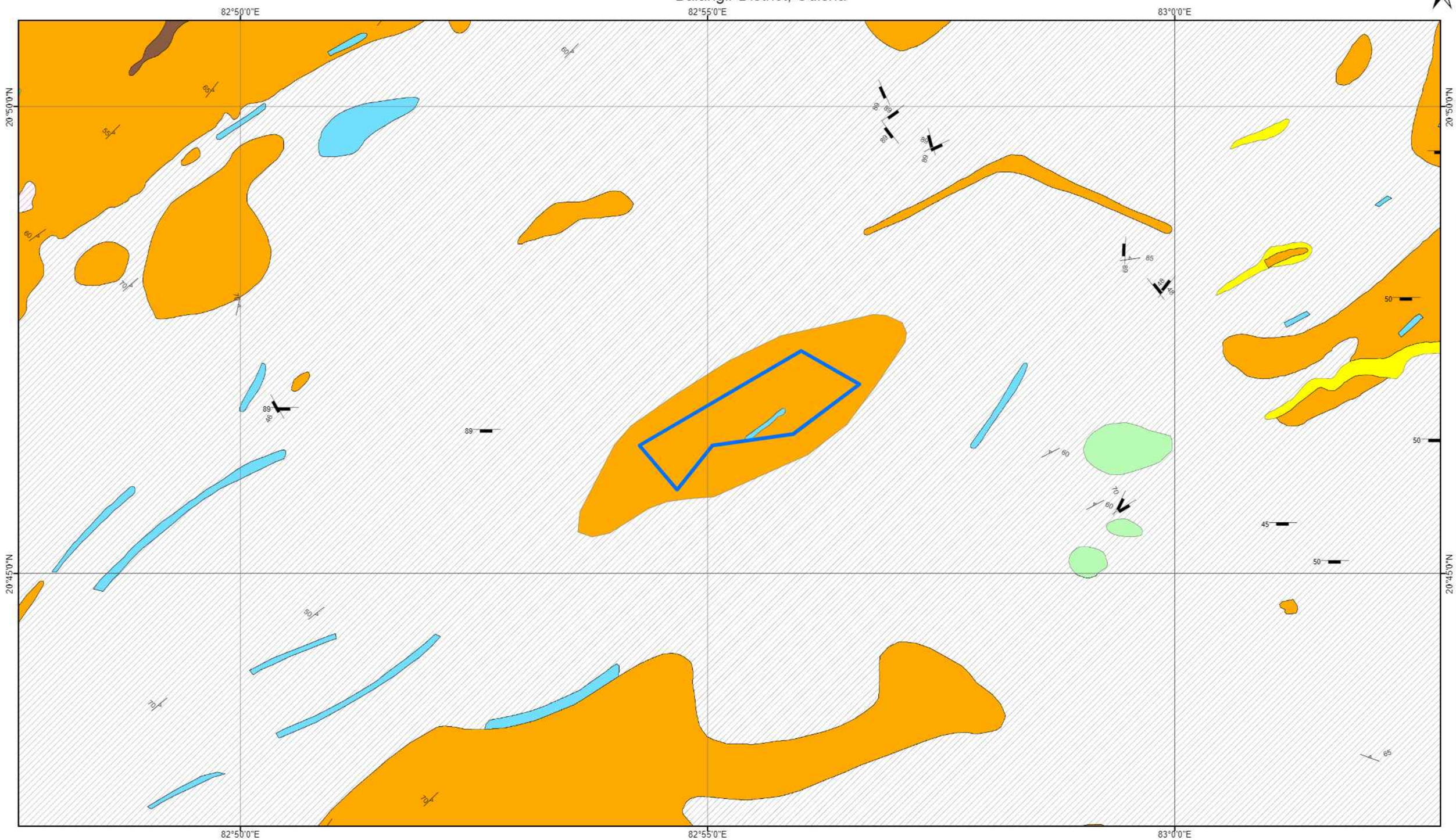
Legend

- Corner Points of Proposed Patimal Block
- Proposed Patimal Block

Scale: Not to Scale

Source: Part of Survey of India Toposheet No. 64L/13

Regional Geology Map showing Proposed Patimal Block (4.00 sq km), Eastern Ghat Mobile Belt
Balangir District, Odisha



Legend

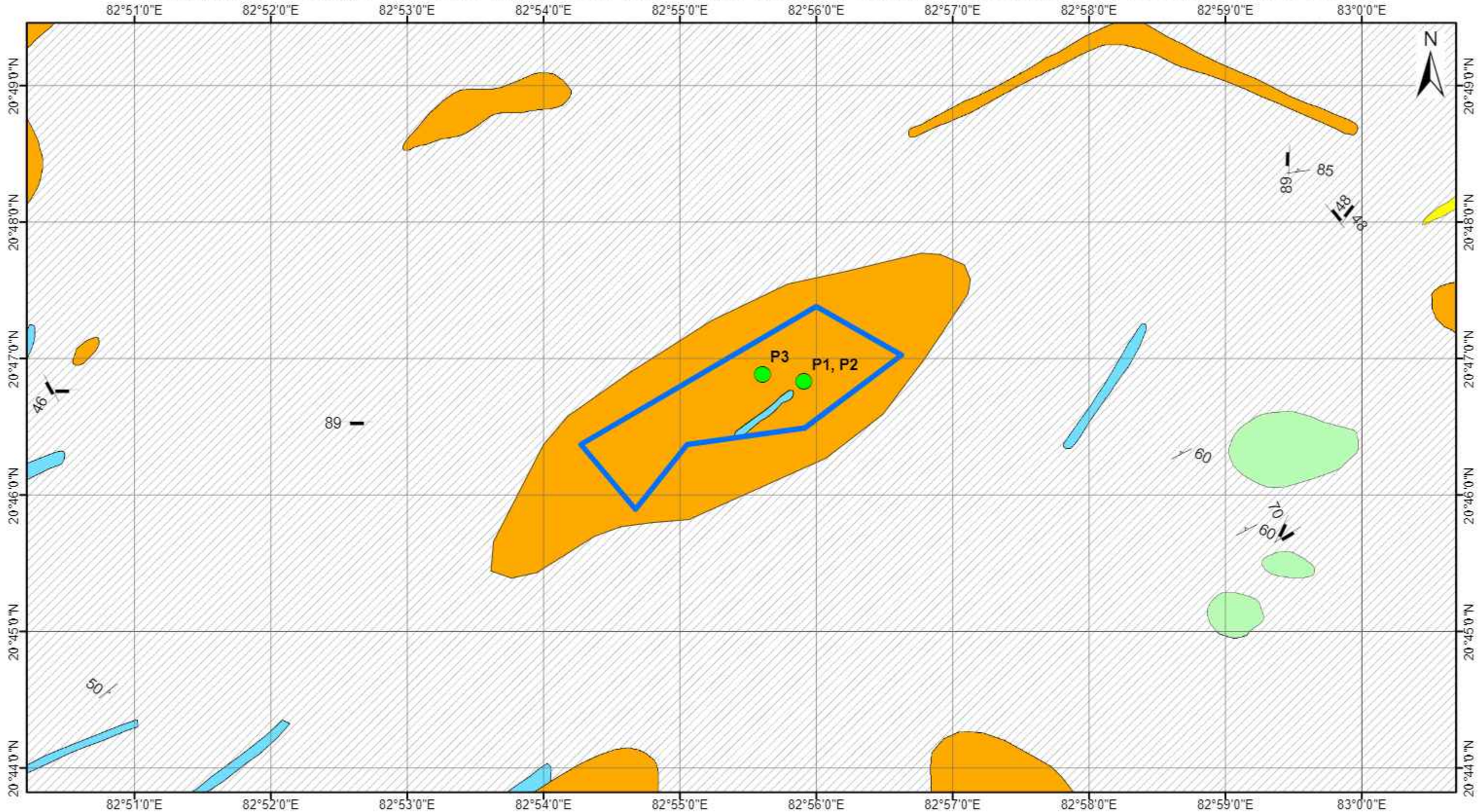
- PROPOSED PATIMAL BLOCK
- ACID TO INTERMEDIATE CHARNOCKITE
- CALC GRANULITE
- DOLERITE
- GRANITE GNEISS
- GRANITE GNEISS/MIGMATITE
- LATERITE
- QUARTZ-GARNET-SILLIMANITE-GRAPHITE SCHIST/GNEISS
- QUARTZITE
- CLEAVAGE/FOLIATION/SCHISTOSITY (S1)
- JOINT

Source: Bhukosh, GSI

1:50,000

0 0.4 0.8 1.6 2.4 3.2 Kilometers

Geology Map showing Proposed Patimal Block with Sample Location, Eastern Ghat Mobile Belt, Balangir District, Odisha



Legend

- PROPOSED PATIMAL BLOCK
- ACID TO INTERMEDIATE CHARNOCKITE
- CALC GRANULITE
- GRANITE GNEISS/ MIGMATITE
- QUARTZ-GARNET-SILLIMANITE-GRAPHITE SCHIST/GNEISS
- QUARTZITE
- CLEAVAGE/FOLIATION/SCHISTOSITY (S1)
- JOINT

Field Sample Location

- P1, P2
- P3

Source: Bhukosh, GSI

1:50,000

0 0.4 0.8 1.6 2.4 3.2 Kilometers

Tentative Geophysical Survey Lines for Proposed Patimal Block (4.00 sq km), Balangir District, Odisha

74000 75000 76000 77000

2304000 2303000 2302000

N W E S

SCALE

0 m 100 m 200 m 300 m 400 m 500 m

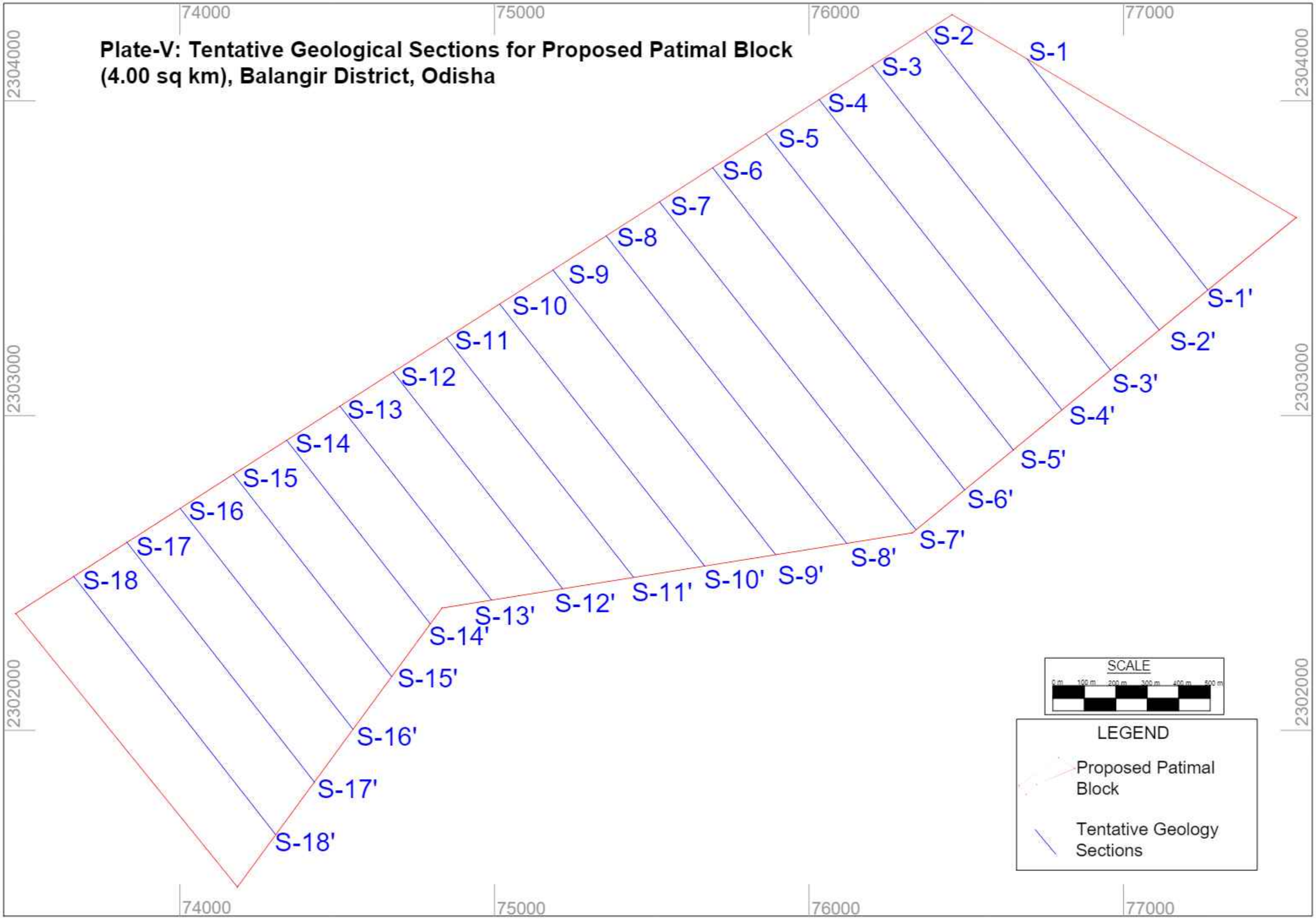
LEGEND

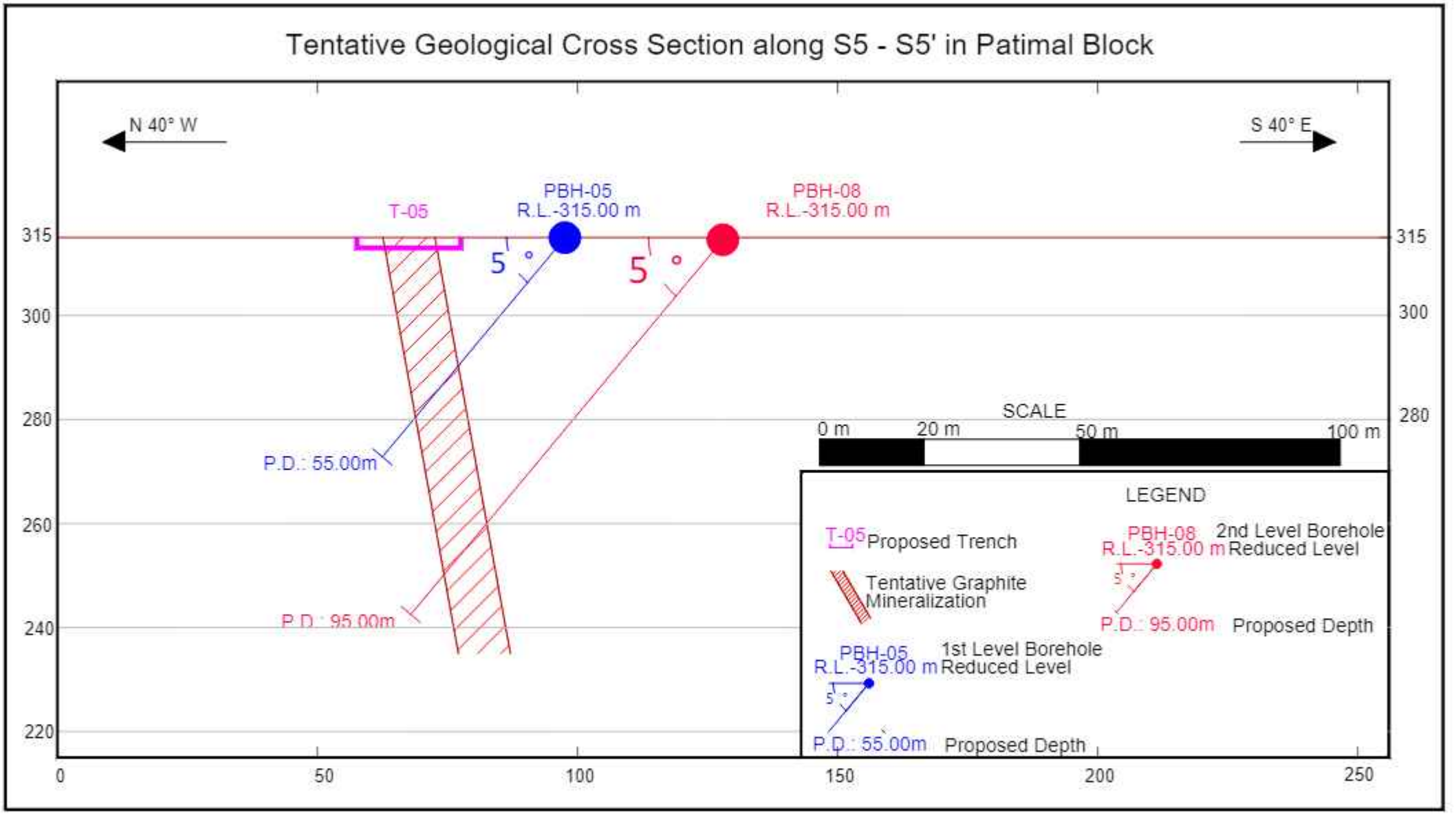
Proposed Patimal Block

Tentative Geophysical Survey Lines

PLATE-IV

Plate-V: Tentative Geological Sections for Proposed Patimal Block (4.00 sq km), Balangir District, Odisha




Tentative Geological Cross Section along S5 - S5' in Patimal Block
N 40° W
S 40° E
T-05
PBH-05
R.L.-315.00 m
PBH-08
R.L.-315.00 m
5°
5°
P.D.: 55.00m
P.D.: 95.00m
315
300
280
260
240
220
0
50
100
150
200
250
SCALE
0 m
20 m
50 m
100 m
LEGEND
T-05 Proposed Trench
Tentative Graphite Mineralization
PBH-08 2nd Level Borehole
R.L.-315.00 m Reduced Level
P.D.: 95.00m Proposed Depth
PBH-05 1st Level Borehole
R.L.-315.00 m Reduced Level
P.D.: 55.00m Proposed Depth

Estimated cost for Preliminary Exploration (G-3) for Graphite in Patimal Block, District: Balangir, Odisha. [Block area- 4.00 sq. km; Nos. of Borehole- 23; Borehole depth range: 55-95m; Schedule timeline- 12 months]							
S. No.	Item of Work	Unit	Rates as per NMET SoC 2020-		Estimated Cost of the Proposal		Remarks
			SoC-Item -Sl No.	Rates as per SoC	Qty.	Amount (Rs)	
A	GEOLOGICAL WORK						
1	Geological Mapping (1:2000), Borehole logging, sampling & Report writing						
I	Charges for one Geologist- Field	day	1.2	11,000	150	16,50,000	
II	Charges for one Geologist - HQ	day	1.2	9,000	45	4,05,000	
III	2 labours/ party (Rs 522/day/labour) (As per rates of Central Labour Commissioner)	day	5.7	522	300	1,56,600	Amount will be reimbursed as per the notified rates by the Central Labour Commissioner or respective State Govt. whichever is higher
IV	Core Sampling -1 Samplers Labour charge not included	day	1.5.2	5,100	66	3,36,600	
V	4 labours/ party (Rs 522/day/labour) (As per rates of Central Labour Commissioner)	day	5.7	522	264	1,37,808	Amount will be reimburse as per the notified rates by the Central Labour Commissioner or respective State Govt. whichever is higher
2	Survey						
I	Topographical Survey	day	1.6.1a	8300	30	249000	Topographical Survey on 1:2000 (2 m contour interval)
II	4 labours/ party (Rs 522/day/labour) (As per rates of Central Labour Commissioner)	day	5.7	522	120	62,640	
III	Bore Hole Fixation and determination of co-ordinates & Reduced Level of the boreholes by DGPS and boundary coordinates	Per Point of observation	1.6.2	19,200	29	5,56,800	23 BHs and 6 boundary coordinates
					Sub Total- A	35,54,448	
B	GEOPHYSICAL SURVEY						
I	Self Potential	Line Km	3.3b	29600	40	11,84,000	Tentative 3.20 sq km area for Geophysical Survey at 100 m traverse interval i.e. 30Line Km.
II	Charges for one Geophysicist- Field	day	3.18	11000	60	6,60,000	
III	Charges for one Geophysicist - HQ	day	3.18	9000	30	2,70,000	
IV	Surveyor Work	day	1.6.1a	8300	60	4,98,000	
V	4 labours/ party (Rs 522/day/labour) (As per rates of Central Labour Commissioner)	day	5.7	522	240	1,25,280	
					Sub Total- B	27,37,280	
C	TRENCHING						
	Trenching (1m x 2m x15m): 09 trenches	Cu. M.	2.1.1	3330	270	8,99,100	
					Sub Total- C	8,99,100	
D	DRILLING						
I	Drilling upto 300m (Hard Rock) (1 rig)	m	2.2.1.4a	11,500	1,465	1,68,47,500	
II	Land / Crop Compansation	per BH	5.6	20,000	23	4,60,000	Amount will be reimburse as per actuals or max. Rs. 20000 per BH with certification from local authorities
III	Construction of concrete Pillar (12"x12"x30")	per borehole	2.2.7a	2,000	23	46,000	
IV	Transportation of Drill Rig & Truck associated per drill	Km	2.2.8	36	2,000	72,000	Certification in this regard is required to be provided
V	Monthly Accomodation Charges for drilling Camp (up to 2 Rigs)	month	2.2.9	50,000	4	2,00,000	
VI	Drilling Camp Setting Cost	Nos	2.2.9a	2,50,000	2	5,00,000	2 rigs
VII	Drilling Camp Winding up Cost	Nos	2.2.9b	2,50,000	2	5,00,000	2 rigs
VIII	Approach Road Making (Flat Terrain)	Km	2.2.10a	22,020	5	1,10,100	Road Making will be considered as per the requirement and Road Making Charges will be reimbursed later
IX	Core Preservation: One complete borehole plus mineralised cores of all the remaining Bhs	m	5.3	1,590	425	6,75,750	This amount will be reimbursed after successful delivery of the cores to concerned libraries/authorities
					Sub Total- D	1,94,11,350	
E	LABORATORY STUDIES						
1	Chemical Analysis						
i	Primary & Check samples for Graphite						
	a. Primary Samples for Proximate Analysis of Graphite: Fixed Carbon (FC), Ash (A), Moisture (M) and Volatile Matter (VM)	Nos	4.1.16	3,000	480	14,40,000	Trench-135, BH-345
	b-External(10%) Check samples from NABL Lab for Proximate Analysis of Graphite: Fixed Carbon (FC), Ash (A), Moisture (M) and Volatile Matter (VM)	Nos	4.1.16	3,000	48	1,44,000	
	c-XRF analysis for oxides (SiO2, Al2O3, Fe2O3, CaO, MgO, Na2O, K2O, LOI and V2O5)	Nos	4.1.15a	4,200	50	2,10,000	
	d-External(10%) Check samples from NABL Lab for XRF analysis for oxides (SiO2, Al2O3, Fe2O3, CaO, MgO, Na2O, K2O, LOI and V2O5)	Nos	4.1.15a	4,200	5	21,000	
2	Physical & Petrological Stusies						
I	Preparation of thin section	Nos	4.3.1	2,353	10	23,530	
II	Complete petrographic study report	Nos	4.3.4	4,232	10	42,320	
III	Preparation of polished section	Nos	4.3.2	1,549	10	15,490	
IV	Complete mineragraphic study report	Nos	4.3.4	4,232	10	42,320	

S. No.	Item of Work	Unit	Rates as per NMET SoC 2020- SoC-Item -Sl No.	Rates as per SoC	Estimated Cost of the Proposal Qty.	Amount (Rs)	Remarks
v	Digital Photographs	Nos	4.3.7	280	10	2,800	
vi	Bulk Density studies	Nos	4.8.1	1,605	5	8,025	
vii	Raman Spectroscopy	Nos		5,000	5	25,000	Price not available in SoC, NMET. Will be reimbursed as per actual cost through outsourcing.
					Sub Total- E	19,74,485	
D					Total A to E	2,85,76,663	
E	Geological Report Preparation		5.2	For the projects having cost exceeding Rs. 150 lakhs and less than Rs. 300 lakhs - A minimum of Rs. 7.5 lakhs or 3% of the value of work whichever is more		8,57,300	Reimbursement will be made after submission of the final Geological Report in Hard Copies (5 Nos) and the soft copy to NMET.
F	Peer review Charges		As per EC decision			30,000	
G	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. 5 Lakhs whichever is lower		5,00,000	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.
H	Total Estimated Cost without GST					2,99,63,963	
I	Provision for GST (18% of I)					53,93,513	GST will be reimburse as per actual and as per notified prescribed rate
J	Total Estimated Cost with GST					3,53,57,476	*or Say Rs. 353.57 Lakh*
Note:							
1	If any part of the project is outsourced, the amount will be reimbursed as per the Paragraph 3 of NMET SoC and Item no. 6 of NMET SoC. In case of execusion of the project by NEA on its own, a Certifiate regarding non outsourcing of any component/project is required.						