PROPOSAL FOR PRELIMINARY EXPLORATION (G3 STAGE) OF GRAPHITE IN SAHARHA BLOCK, RAYAGADA DISTRICT, ODISHA UNDER NMET

Commodity: Graphite

BY

MMPL PRIVATE LIMITED
FR 07 SHILPANGAN, PLOT NO – LB 1,
SECTOR III, SALT LAKE, KOLKATA-700091

Place: Kolkata
Date: July, 2025

Summary of the Block G3 Stage Exploration

Table 1. Summary of the block		
Sl.no	**Features**	**Details**
A.	Block ID	Saharha Block
B.	Current Exploration Agency	MMPL Private Limited (Formerly Maheshwari Mining Private Limited)
C.	Previous Exploration Agency	MMPL Private Limited (Formerly Maheshwari Mining Private Limited)
D.	G4 stage Geological Report (Previous stage Geological Report)	RECONNAISSANCE SURVEY (G-4 STAGE) FOR GRAPHITE IN DARUKONA BLOCK, RAYAGADA DISTRICT, ODISHA (F.NO. 23/411/NMET-2023/389)
E.	Commodity	Graphite
F.	Mineral Belt	Tumudibandh Shear Belt (Eastern Ghats Mobile Belt)
G.	Completion Period with entire Time schedule to complete the project	12 months
H.	Objectives	The present exploration program (G3) has been formulated on the basis of the outcomes of previous work to fulfil the following objectives: • Geological mapping on 1:2000 scale to delineate graphite bands and other lithological units in the area. • Topographical Contouring on 1:2000 scales, by means of surface contouring at 2 m interval. • Delineation of the potential subsurface mineralized zones by Geophysical Surveys (SP survey). • Trenching will be carried out to expose the graphite bands. • Exploratory drilling with 100-200 m strike spacing for 1st level (30 m vertical depth of intersection) and 2nd level (60 m vertical depth of intersection). • Assessment of quality of the resources (333) as per UNFC norms & Minerals (Evidence of Mineral Contents) Rules- 2015.
I.	Whether the work will be carried out by the proposed agency or through out-sourcing and details thereof. Components to be outsourced and name of the out-source agency	The work will be carried out by proposed agency.
J.	Name/Number of Geoscientists	Field Geologist: Two numbers HQ Geologist: Two numbers Geophysicists

<table>
<tr><td>K.</td><td>Expected Field days (Geology)
Geological Party Days</td><td>150</td></tr>
<tr><td>1.</td><td>Location</td><td>
<table>
<tr><th>Corner Poins</th><th>Longitude</th><th>Latitude</th></tr>
<tr><td>A</td><td>83.6022</td><td>19.4306</td></tr>
<tr><td>B</td><td>83.6147</td><td>19.4381</td></tr>
<tr><td>C</td><td>83.6082</td><td>19.4491</td></tr>
<tr><td>D</td><td>83.5963</td><td>19.4418</td></tr>
</table>
</td></tr>
<tr><td></td><td>Villages</td><td>Saharha, Budni</td></tr>
<tr><td></td><td>Tehsil/Taluk</td><td>Bissamcuttack</td></tr>
<tr><td></td><td>District</td><td>Rayagada</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>2.10 sq km</td></tr>
<tr><td></td><td>Forest Area</td><td></td></tr>
<tr><td></td><td>Government Land Area</td><td></td></tr>
<tr><td></td><td>Private Land Area</td><td></td></tr>
<tr><td>3.</td><td>Accessibility</td><td></td></tr>
<tr><td></td><td>Nearest Rail Head</td><td>Muniguda Railway station</td></tr>
<tr><td></td><td>Road</td><td>SH-46</td></tr>
<tr><td></td><td>Airport</td><td>Jharsuguda</td></tr>
<tr><td>4.</td><td>Hydrography</td><td></td></tr>
<tr><td></td><td>Local Surface Drainage Pattern (Channels)</td><td>Dendritic pattern</td></tr>
<tr><td></td><td>Rivers/Streams</td><td></td></tr>
<tr><td>5.</td><td>Climate</td><td></td></tr>
<tr><td></td><td>Mean Annual Rainfall</td><td>1,340.3 mm</td></tr>
<tr><td rowspan="2"></td><td>Temperatures (December)(Minimum)</td><td>15°C (59°F)</td></tr>
<tr><td>Temperatures (June)(Maximum)</td><td>32.6°C (90.7°F)</td></tr>
<tr><td>6.</td><td>Topography</td><td></td></tr>
<tr><td></td><td>Toposheet Number</td><td>65M/11</td></tr>
<tr><td></td><td>Morphology of the Area</td><td>The area consists of small hillocks, nala sections and agricultural flat land.</td></tr>
</table>

7.	**Availability of base line geoscience data**	
	Geological Map (1:50000/1:12500)	Available
	Geochemical Map	Available
	Geophysical Map (Aeromagnetic, ground geophysical, Regional as well as local scale GP maps)	Gravity data Available
8.	**Justification for taking up preliminary exploration (G3)**	Justification for taking up the investigation in G3 stage: • In the western part of the proposed block, four numbers of graphite bands were interpreted by MMPL based on the surface and subsurface geological evidences where the average true thickness of the bands varies from 1.9 m to 12.6 m and the average fixed carbon content (FC) varies from 3.42% to 9.08%. • In the eastern part of the proposed block two numbers of graphite bands of average true thickness of 5 m and 3.20 m with average FC% of 3.48 % and 3.52% respectively were interpreted by MMPL based on the surface and sub-surface geological evidences. A resource of 0.116 million tonne has been estimated by MMPL at 4.5 % average weighted FC in G4 stage of investigation. • MMPL recommends for upgrading the block area of 2.10 sq.km into G-3 stage of investigation. • The precise location, extent (Strike, dip and depth persistence) and Resource of the graphite mineralization of the prospect need to be verified in G-3 stage of investigation.

Detailed description on the following titles to be made in the proposal.

1 Block Summary

1.1 Physiography

The area is a rugged terrain, the general ground level being 380 m. and hills rising to as much as 910 m. above M.S.L. There are hill ranges in the central, eastern and southern part of the block. The central hill range continues from northern boundary of the block to the southern boundary. The area exhibits dendritic pattern of drainage. Kumbikada nala in the eastern part and Burhabandha in the western part are the two perennial streams which flow towards northern side of the block.

The general slope as indicated from the drainage is from southern side to northern side. The hill ranges and the drainage in general controlled by the lithology and the structure of the formations. Higher altitudes are occupied by Khondalite while other lithological units are restricted to lower altitude.

1.2 Background Geology

1.2.1 Regional Geology

The rugged country with discontinuous hill ranges occurring along the coast of the Bay of Bengal is known as the Eastern Ghats. The average altitude is 610 m and the tallest peak Mahendragiri is 1501 m high. The highly deformed rocks that experienced ultrahigh-temperature granulite facies metamorphism and several generations of magmas of varied compositional types are recognized as the **Eastern Ghats Mobile Belt** (EGMB) which is extending from Brahmani River in Odisha to Ongole in south-eastern Andhra Pradesh. The 1000-km-long terrain is nearly 300 km wide in the northern part (Mahalik 1996), but tapers to merely 30 km in the south, the average width being 100 km. The Gondwana in two Phanerozoic rift valleys, the Mahanadi Graben in the north and the Godavari Graben in the south, break the continuity. It is a Mesoproterozoic terrain that has a very long history of tectono-thermal evolution including migmatization and charnockitization of supra-crustal rocks.

The EGMB was referred to as a convergent orogeny that evolved under NW–SE-directed sub horizontal compression resulting from oblique collision of continental plates (Chetty and Murthy 1994; Ramakrishnan et al. 1998; Bhattacharya 2002). Gravity modelling constrained by seismic information suggests that the eastward-inclined 38 to 40km-thick column of cratonic crust lies 35 km below this mobile belt (Kumar et al. 2004). It will be apparent that the EGMB displays high-gravity anomaly compared to the cratons, implying denser rocks underlying it (Subramanyam and Verma 1986). Building the bulk of the EGMB, the exposed charnockite–khondalite succession represents the thrust-up lower crustal material. The basement archaean rocks are seen nowhere, but the material forming them occurs in the framework of the mobile belt in a drastically remobilized and reconstituted forms.

Four lithological zones were recognized in the EGMB on the basis of ages of protoliths and constituent minerals (Ramakrishnan et al. 1998). The fifth unit is the zone of transition. The brief descriptions are as follow-

The **Western Charnockite Zone** comprises dominant charnockites and enderbites with lenses of basic and ultrabasic rocks and minor intercalations of metapelite (khondalite) and basic granulites. There are several generations of charnockites, the oldest being deformed and gneissose, garnet bearing and concordant in disposition with the khondalite.

The Western Khondalite Zone is dominated by metapelitic khondalite with intercalations of quartzite, calc silicate gneiss, marble and minor though very significant high Mg–Al granulite characterized by sapphirine. Intrusive bodies of charnockites and massif-type anorthosite, as seen at Bolangir, Turrkel and Jugsaipatna are also present. Metamorphosed basic sills and lava flows are represented by concordant bodies of basic granulites within the khondalite succession. In many cases, there are plutonic intrusives.

The Central Migmatite Zone is made up of dominant migmatites, garnet-bearing diatexites with leptynites, high Mg–Al granulite and calc silicate rock intruded by charnockites and porphyritic granites. There are bodies of massif-type anorthosite within the zone. The migmatites owe their origin to high-grade metamorphism with differential melting of siliceous granulites, like the khondalite. The charnockites also show a composition that reveals affinity to tholeiitic to calc-alkaline basalts of the protoliths (Rao et al. 1995). There are patches of charnockite developed incipiently on the granulitic gneisses and migmatites. They were supposed to have formed as a result of activity of CO_2-rich fluids and/or through a process of charnockitization of metasediments of appropriate bulk composition (Nanda and Pati 1989; Paul et al. 1990; Rajesham et al. 1992; Mohan et al. 2003).

The **Eastern Khondalite Zone** consists of a lithology not different from that of the Western Khondalite Zone, but is devoid of anorthosite bodies. The leptynites that are interlayered with khondalites in the Chilka Lake area represent the granitoids produced by dehydration melting in the metapelites of different composition (Sen and Bhattacharya 1997). The presence of sillimanite trails within garnets suggests that the khondalites were indeed subjected to partial melting. In the Rengali domain in the northern part of the EGMB, the multiple shear zones seem to have not only served as places for intrusion of alkaline rocks but also provided pathways to fluids that brought about charnockitization and migmatization of granulitic rocks (Mahalik 1994). Understandably, the ultrabasic intrusives occur as boundinaged bodies in the highly deformed masses of khondalites of shear zones. Closely associated in space, the co-magmatic anorthosite occurs as metamorphosed and tectonized layers in the EGMB.

Transition Zone is present on the western and south-western margins of the EGMB. It consists of a mixture of litho-types belonging to the craton and the Western Charnockite Zone. The granulites show retrogression to amphibolite facies of metamorphism along the shear zone.

On the basis of different geological investigation and evidences tentative stratigraphic column (Table2) was proposed by Ramakrishnan et al., (1994).

Table 2: Stratigraphic Sequence of Eastern Ghats [Ramakrishnan et al., (1994)]

Age	Lithological Units
800-900 Ma	Alkaline rocks, granitoids
1000-1100 Ma	-------Eastern Ghats orogeny--------
	Development of eastern Ghats front of upgraded cratonic rocks.
	Incipient and massive charnockite and garnetiferous gneiss with biotite and sillimanite
1300-1400 Ma	Emplacement of alkaline rocks (Feldspathoid gneiss and anorthosite)
Khondalite Group (WKZ, CMZ, EKZ)	Garnet-sillimanite-Quartzo-feldspathic graphite gneiss
	Cordierite-sapphirine-spinel rocks
	Calc silicate rocks and rare marbles
	Quartzite rich in garnet
1600-1800 Ma (WCZ)	Evolution of purana basin
2600-2800 Ma	Charnockite with enclaves of basic granulite, high grade schists including BIF and layered basic complexes, representing original cratonic basement (?) in migmatitic amphibolite facies
3000 Ma	Vestigial events (?)

1.2.2 Geology of the area covered under G-4 stage

An area of 119 sq.km was covered through Large Scale Mapping, on 1:12,500 scale, in and around Darukona-Saharha-Dukum-Kiribiri-Jagannathpur-Rambu-Kanumani area for the investigation of graphite.The area of present investigation falls to the north eastern part (Fig 3.3) of Survey of India toposheet no 65 M/11 bounded by latitudes 19°25'00"-19°30'00"N and longitudes 86°30'00"- 86°37'00"E, lying in Rayagada District of Odisha.

Description of the lithological units

Khondalite

Khondalite is the dominant lithological unit and covers an area of 39.810 sq.km which is the 33.453 % of the proposed area. Outcrops of khondalite are exposed along the hills (central, eastern and southern side of the area). In hand specimens khondalite is reddish brown colored, medium to coarse grained, very hard and foliated and contains garnet, sillimanite, quartz and feldspar with graphite and opaque as accessory minerals. The mineral assemblage evidenced that it underwent granulite facies of metamorphism. There are three varieties of khondalite units encountered in the area. They are, khondalite proper, migmatised khondalite and granite like khondalite. The khondalite proper is reddish in color with very rough and foliated in appearance. The migmatised khondalite contains leucosomes of quartz feldspar rich bands alternates with garnet rich bands. In the gradational contact zone between khondalite and granite gneiss, the khondalite shows the granite like appearance due to less proportion of garnet. In this situation, the presence of sillimanite used to differ as khondalite from the granite gneiss.

Graphite flakes were noticed in the mineralogy of khondalite near Darukona, Bandhugurha, Kakarmaska, Gaganmati villages etc.

The general trend of foliation measured in khondalite trends NW-SE dipping 50° to 60° southwesterly.

Granite gneiss

Granite gneiss is the second dominant lithological unit and covers an area 13.436 sq km which is 11.291 % of the area. Outcrops of granite gneiss are restricted to lower altitudes especially along the foothills and valley portion of the block. Two types of granite gneiss encountered in the area i.e. porphyritic granite gneiss and foliated granite gneiss. The porphyritic granite gneiss occurs along small oval shaped hillocks near Kumbhia and Patapadar villages and on the other hand the foliated granite gneisses encountered along the foothills near the Bandichua, Jugapadar, Buragurha, Burni and Kankubari villages.

In hand specimens the granite gneisses are pinkish white colored, coarse grained, and crudely foliated and contains garnet, quartz and feldspar with opaque as accessory minerals.

Graphite flakes has also encountered in the mineralogy of granite gneiss along the foliation plane near the Ankulpadar and Jagannathpur villages.

The general trend of foliation in granite gneiss is NW-SE dipping 40° to 73° towards southwest.

Charnockite

Charnockite is the third dominant lithological unit and covers an area 2.572 sq km which is 2.161 % of the explored area. Bouldery outcrops of charnockite encountered near Jambagurha, Bandhugurha, Madua and Lakhabhata villages showing gradational contact with khondalite. In hand specimen charnockite is leucocratic to melanocratic, medium to coarse grained, massive rock which contains quartz, feldspar and pyroxene.

Calc silicate granulite

Calc- silicate granulite has limited distribution and covers an area 0.011 sq km which is 0.009 % of the proposed area. It was recorded along south-eastern side of Jambagurha and western side of Kiribiri village. Megascopically the rock is greenish white in colour and shows ridge and furrow structure due to differential weathering of alternate compositional banding. The essential mineral constituents of the rock are plagioclase, quartz, diopside, wollastonite and sphene. The rock shows disharmonic folds generated due to the competent contrast between quartz feldspar rich layers and diopside, wollastonite rich layers.

Quartzite

A narrow band of quartzite is found in the eastern side of Ranigurha village within granite gneiss. It is composed of quartz and garnet.

Basic granulite

Basic granulite is a dark grey, medium to coarse grained massive granulitic rock containing Pyroxene and plagioclase. Basic granulite occurs mostly as narrow bands within migmatites and migmatised khondalites. Xenoliths of basic granulite occur within granite gneiss.

Leptynite

Leptynite is a leucocratic, medium to coarse grained foliated metamorphic rock which is composed of quartz, feldspar and garnet and characterized by the presence of platy quartz. Outcrops of leptynite are encountered along the foothills and valley portions within the khondalites. This is found near Naringigurha, Dombakuppa, Naringipanga and Bandichhua villages.

Pegmatite

Pegmatite veins intruded into granite gneiss recorded from the north western part of Kiribiri village. It is milky white colored, crystalline and composed of large crystals of plagioclase, well developed crystals of garnet, (almandine?) suspected tourmaline and small quantum of quartz.

1.2.3 Geology of the proposed block (G3)

Khondalite

Outcrops of khondalite are exposed along the. In hand specimens khondalite is reddish brown colored, medium to coarse grained, very hard and foliated and contains garnet, sillimanite, quartz and feldspar with graphite and opaque as accessory minerals. The mineral assemblage evidenced that it underwent granulite facies of metamorphism. The general trend of foliation measured in khondalite trends NW-SE dipping 50° to 60° southwesterly.

Granite gneiss

In hand specimens the granite gneisses are pinkish white colored, coarse grained, and crudely foliated and contains garnet, quartz and feldspar with opaque as accessory minerals. The general trend of foliation in granite gneiss is NW-SE dipping 40° to 73° towards southwest.

Leptynite

Leptynite is a leucocratic, medium to coarse grained foliated metamorphic rock which is composed of quartz, feldspar and garnet and characterized by the presence of platy quartz.

Quartzo-feldspathic graphite gneiss

The quartzo-feldspathic graphite gneiss occurs along the nala sections and characterized by alternative bands of quart-feldspar rich band and graphite rich bands. The graphite flakes are parallel to the plane of gneissosity.

1.3 Mineral potentiality based on geology, geophysics, ground geochemistry etc.

In the western side of the proposed area, four numbers of graphite bands were interpreted by MMPL based on the surface and subsurface geological evidences where the average true thickness of the bands varies from 1.9 m to 12.6 m and the average fixed carbon content varies from 3.42% to 9.08%.

In the eastern side of the proposed area two numbers of graphite bands of average true thickness of 5 m and 3.20 m with average FC% of 3.48 % and 3.52% respectively were interpreted by MMPL based on the surface and sub-surface geological evidences.

A resource of 0.116 million tonne has been estimated by MMPL at 4.5 % average weighted FC in G4 stage of investigation. The detailed description of the graphite bands interpreted at G4 stage are as follow-

Sl. No	Graphite band	True thickness × Avg. weighted FC	Interpreted strike length
1	B-9	6.14×3.56% FC	53
2	B-10	1.91×3.43% FC	53
3	B-11	4.5×5.16% FC	53
4	B-12	12.62×9.09%FC	45
5	B-13	5×3.48% FC	284
6	B-14	3.20×3.52% FC	86

1.4 Recommendations of previous G4 stage mineral exploration report

The recommendations of previous G4 stage mineral exploration report are as follow-

- The graphite mineralisations in the block occur as elongated lensoidal bodies.
- The graphite mineralisation in the area is structurally controlled, predominantly occurring along lithological contacts that are parallel to the regional foliation trend. Field observations indicate that graphite is commonly present along nala sections and hillocks aligned with the foliation direction, particularly at the interfaces between contrasting lithological units. This spatial association suggests a strong structural and lithological control on the distribution of graphite mineralisation.
- The zone-B and zone-C can be upgraded to G-3 to investigate the resource of both graphite ore.
- As there is an upper primary high school nearby Zone -A, it is not be advisable for further exploration in future.
- Although the initial tungsten (W) concentration values appeared promising, subsequent chemical analyses of duplicate samples—specifically from the four samples exhibiting the highest W concentrations—revealed results that were not encouraging. As a result, tungsten has not been considered for resource estimation in this study.

1.5 Objectives

The present exploration program (G3) has been formulated on the basis of the outcomes of previous work to fulfil the following objectives:

- Geological mapping on 1:2000 scale to delineate graphite bands and other lithological units in the area.
- Topographical Contouring on 1:2000 scales, by means of surface contouring at 2 m interval.
- Delineation of the potential subsurface mineralized zones by Geophysical Surveys (SP survey).
- Trenching will be carried out to expose the graphite bands.
- Exploratory drilling up to second level at 100-200 m interval between the 1st level boreholes in order to investigate the graphite mineralization up to 60 m vertical depth of intersection.
- Assessment of quality and quantity of the resources (333) if any as per UNFC norms & Minerals (Evidence of Mineral Contents) Rules- 2015.

2 Previous Work:

MMPL has submitted the geological report of G4 stage of investigation for graphite with resource categorized under UNFC class 334. The entire geological report is attached

3 Block description

The detailed co-ordinate of the proposed block is given below-

Table 3. Coordinate of the cardinal points		
Corner Points	**Longitude**	**Latitude**
A	**83.6022**	**19.4306**
B	**83.6147**	**19.4381**
C	**83.6082**	**19.4491**
D	**83.5963**	**19.4418**

4 Planned Methodology

In accordance with the objectives set for preliminary exploration (G3 level) in saharha block, Rayagada District of Odisha geological mapping in 1:2000 scale, trenching, geophysical SP survey, two phases exploratory drilling, chemical analysis of the samples (BRS, PT and core samples), petrological and mineralogical studies are proposed in the block. The exploration will be carried out as per Minerals (Evidence of Mineral contents) Rules-Ammended in 2021. Accordingly, the details of different activities to be carried out are presented in subsequent columns.

4.1 Topographic Surveying

Topography survey will be carried in the area (2.10 sq. km) and all the surface features will be marked in the 1:2000 scale. The block boundary will be surveyed by DGPS / total station in WGS-84 Datum and demarcation of the boundary pillars to enable the block auctionable. The reduced level and coordinate of the boreholes would be surveyed by DGPS/ total station.

4.2 Geological Mapping

Detailed geological mapping on 1:2000 scale in the area (2.10 sq. km) will be carried out by taking geological traverses. The contacts of different lithounits, surficial lithology, structural features, etc. will be noted in detail. The detailed geological map on 1:2000 scale will be generated based on the details gathered during the field visit.

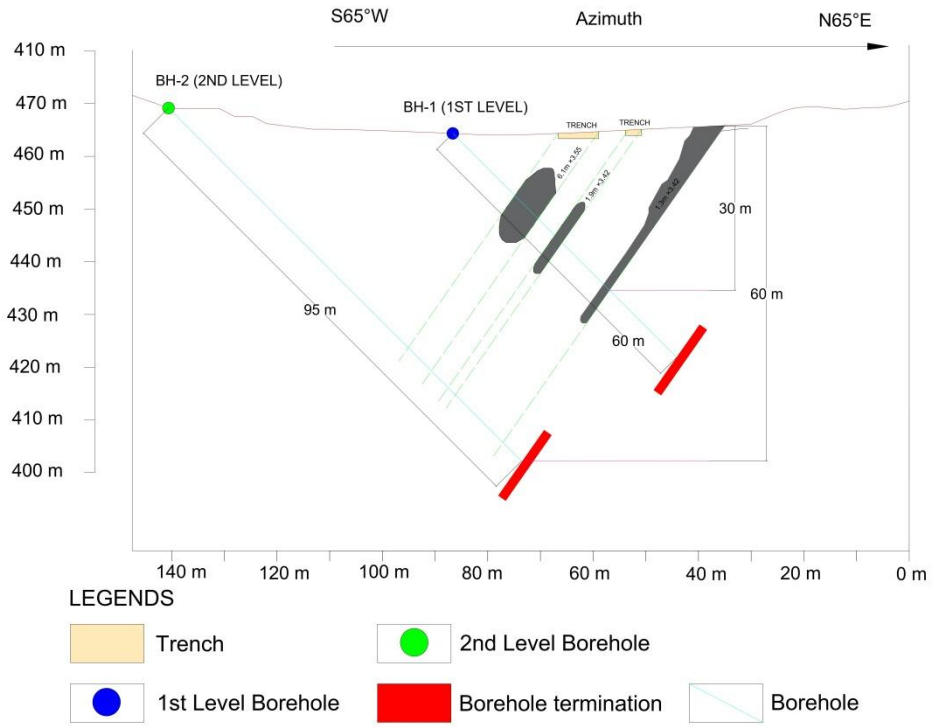
4.3 Core Drilling

4.3.1 Borehole plan:

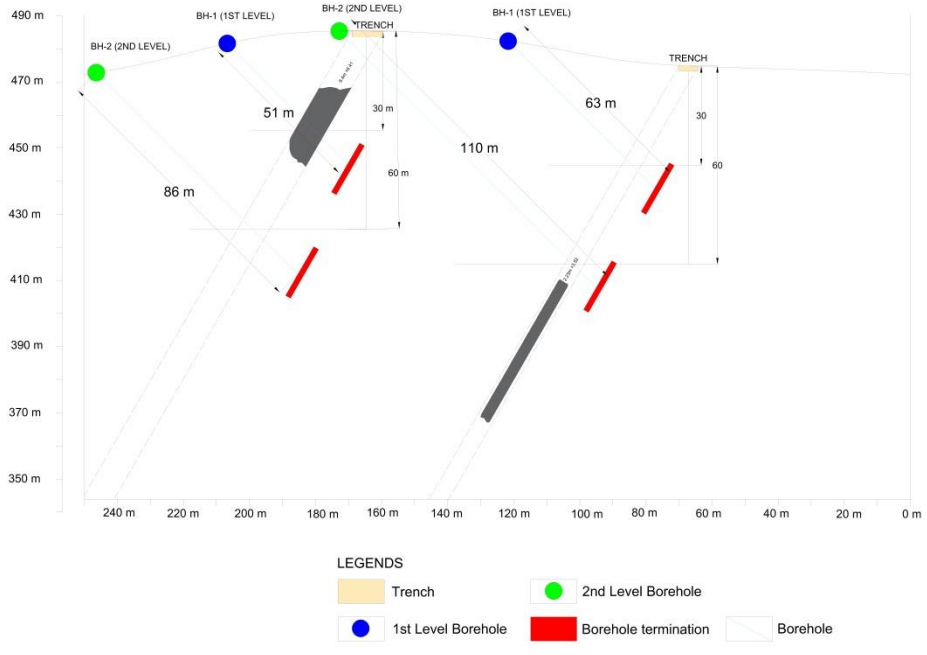
In phase I, 1st level boreholes will be planned to investigate the depth persistence of graphite mineralization up to 30 m vertical depths of intersection. The borehole spacing will be 100 m to 150 m.

In phase II, 2nd level boreholes will be planned based on the reference of 1st level boreholes with positive outcome to investigate the depth persistence of the graphite mineralization at 60 m vertical depth of intersection.

Tentative cross sectional view for western zone



Tentative cross sectional view for eastern zone



4.3.2 Core Logging

The drill cores would be logged systematically viz. details of litho-units, colour, structural feature, texture, mineralization, beside the recovery, rock quality designation and type of ore deposit and core photography would be recorded.

4.3.3 Core Sampling

The drill core will be split into two equal halves and one part would be preserved in the core box. The other half will be powdered to 70 micron (200 mesh size) and the same would be divided into four parts (250 g each) through coning and quartering. One part of sample will be sent to chemical laboratory for proximate analysis, second part to be preserved in the camp as duplicate sample, third part to be sent for chemical analysis of minor and trace elements by ICPMS and the fourth part would keep as either check sample or sample to be used for any other specific purpose.

The length of each sample will be kept 0.50 m-1.0 m depending upon the width of the graphite mineralizations. 10 nos. of samples would be analyzed by ICPMS to ascertain the presence of any uncommon minerals.

4.4 Petrographic and petrochemical Studies

Thin and polished section studies of the outcrop samples and the core samples will be studied for detailed petrographic and mineralogical characteristics. These samples will be collected from ore zones and associated rocks. A provision of 10 nos. specimens for petrographic studies are kept for the proposed area.

4.5 Bulk Density Determination

In addition, bulk density determination of 3 nos. of samples will be carried out for the proposed block.

5 Nature Quantum and Target for G3 stage

Table no. 4. Nature and quantum of work for Preliminary Exploration (G3 Stage) of graphite in Kodabata, Rayagada District, Odisha

Sl. no	Item of work	Unit	Quantum
1	Geological mapping (on 1:2000)	Sq. Km	2.10
2	Trench samples	Nos.	100
4	SP survey / Resistivity survey	L.km	3
6	Trenching	Cubic meter	200
7	Drilling (number of 1st level borehole = 10, number of 2nd level borehole = 10)	Meter	1600
8	Proximate analysis for graphite (Trench samples- 100; core samples - 350)	Nos.	450
9	Proximate analysis for graphite 10% external check	Nos.	45
10	Analysis for associated REE + Vanadium (ICPMS 14 elements)	Nos.	10
11	Petrographic studies	Nos.	10
12	Preparation of thin sections	Nos.	10
13	Study of thin section	Nos.	10
14	Bulk density/ specific gravity determination	Nos.	3
15	Total graphitic carbon	Nos.	20

6 Manpower deployment

Two geologists, two geophysicists, one surveyor with required laborers and two drilling rig with drilling crew will be deployed as per the requirement of the time schedule chart (Table: 4).

Time Schedule/Action Plan for preliminary exploration (G3 stage) in Sahada block, Rayagada district, Odisha under NMET															
S.No	Nature of Work	Months													
		1	2	3	4	REVIEW	5	6	7	REVIEW	8	9	10	11	12
1	Camp Set up														
2	Geological mapping on 1:2000 scale (DM) (sq km)														
3	Topographic survey- DGPS/ Total station/Drone														
4	Geophysical survey (SP survey) (L.km)														
5	Surface exploration- Trenching (cu. m)														
6	Chemical analysis of surface samples														
8	DGPS survey for fixation of borehole and cardinal points														
9	Drilling of 1st level boreholes														
10	Drilling of 2nd level boreholes														
11	Chemical analysis of subsurface samples														
12	Geological report preparation														

7 Break up of expenditure

Annexure 17A

Estimated Cost for Preliminary Exploration (G3) For Graphite In Saharha Block, Rayagada District, Odisha

Total area - 2.10 Sq.km; Borehole 20 [10 first level, after 1st review (04 in Western and 06 in Eastern zone) + 10 second level, after 2nd review] , Meterage - 1600 (600 m first level+ 1000 m second level), Period of completion - 12 months, Review -1st review after 3 months (after Geological mapping, Trenching and GP Survey); 2nd review after 6 months (after completion of 1st level of drilling); 3rd review after 8 months (after completion of 2nd level of drilling)

SL.No	Item Of Work*	Unit*	Rate As Per NMET SOC 2020-21		Estimated Cost of the Proposal		
			SOC. Item No	Rate As Per SOC* (a)	Qty. (b)	Total Amount (Rs) (a*b)	Remarks
A	**Detailed Geological Mapping Other Geological Work & Surveying**						
	Geological mapping (1:2000), Trenching & Drilling work						
i	a. Charges for 2 Geologist per day (Field) for Geological mapping & Trenching work, drilling activity (without labour)	day	1.3.b	₹ 11,000.00	150	₹ 16,50,000.00	
ii	b. Labours charges; Base rate (for 2 labours per geologists)	day	5.7	₹ 541.00	300	₹ 1,62,300.00	Amount will be reimbursed as per the notified rates by the Central Labour Commissioner or respective State Govt. whichever is higher.
iii	c. Charges for Geologist per	day	1.3.a	₹ 9,000.00	30	₹ 2,70,000.00	

	day (HQ)						
	Sub Total- A					**₹ 20,82,300.00**	
B	**Trenching/Pitting**						
i	Trenching	per cu.m	2.1.1	₹ 3,330.00	200	₹ 6,66,000.00	Trenching to be done on each and every profile
	Sub Total- B					**₹ 6,66,000.00**	
C	**Survey work**						
i	Toposurvey Charges for one qualified surveyor	day	1.6.1a	₹ 8,300.00	30	₹ 2,49,000.00	Topographic survey, surface contouring at specific interval
ii	DGPS Survey for BH fixation & RL determination	Per Point of observation of observation	1.6.2	₹ 19,200.00	24	₹ 4,60,800.00	20 BH + 4 Cardinal points
iii	Labours Charges for survey work; Base rate	day	5.7	₹ 541.00	120	₹ 64,920.00	
	Sub Total- C					**₹ 7,74,720.00**	
D	**Ground Geophysical Survey (in- house)**						
i	Charge for SP survey	Line km	3.3a	₹ 29,600.00	3	₹ 88,800.00	
	Sub Total- D					**₹ 88,800.00**	
E	**Drilling (after review) (in-house)**						
i	Systematic Drilling (Hard rock) (HQ) in first Level	per m	2.2.1.4a	₹ 11,500.00	600	₹ 69,00,000.00	10 BH 1st level @30 m vertical depth of intersection (BH depth 60-70 m)
ii	Systematic Drilling up to 1550 m (Hard rock) (HQ) in second Level	per m	2.2.1.4a	₹ 11,500.00	1000	₹ 1,15,00,000.00	10 BH 2nd level @60m vertical depth of intersection (BH Depth 100-110 m)

							(Subject to successful intersection in first level BH and subsequent approval of NMET-TCC)
iii	Borehole deviation by multi shot camera	per m	2.2.6	₹ 330.00	500	₹ 1,65,000.00	2nd level BH Staggering
iv	Land / Crop Compansation (in case the BH falls in agricultural Land)	per borehole	5.6	₹ 20,000.00	20	₹ 4,00,000.00	As per actuals as certified by local authorities subject to a maximum of 20000 per borehole
v	Construction of concrete Pillar (12"x12"x30")	per borehole	2.2.7a	₹ 2,000.00	20	₹ 40,000.00	
vi	Transportation of Drill Rig & Truck associated per drill (2 rig)	Km	2.2.8	₹ 36.00	3,440	₹ 1,23,840.00	Raniganj to Rayagada to and fro (860 Km) =860*2*2
vii	Monthly Accomodation Charges for drilling Camp (up to 2 Rigs)	month	2.2.9	₹ 50,000.00	6	₹ 3,00,000.00	2 rig 3 month each
viii	Drilling Camp Setting Cost	Nos	2.2.9a	₹ 2,50,000.00	2	₹ 5,00,000.00	
ix	Drilling Camp Winding up Cost	Nos	2.2.9a	₹ 2,50,000.00	2	₹ 5,00,000.00	
x	Road Making (Flat Terrain)	Km	2.2.10a	₹ 22,020.00	6	₹ 1,32,120.00	
xi	Drill Core Preservation	per m	5.3	₹ 1,590.00	500	₹ 7,95,000.00	
xii	Charges for one Sampler per day (1 Party)	one sampler per day	1.5.2	₹ 5,100.00	70	₹ 3,57,000.00	
xiii	Charges for Labour	day	5.7	₹ 541.00	280	₹ 1,51,480.00	
	Sub Total- E					**₹ 2,18,64,440.00**	
F	**Laboratory Studies**						
1	**Chemical Analysis**						

i)	**Trench Samples**						
a	Proximate analysis for graphite	Nos	4.1.16	₹ 3,000.00	100	₹ 3,00,000.00	
ii)	**Trench Check samples (10% External)**						
a	Proximate analysis for graphite	Nos	4.1.16	₹ 3,000.00	10	₹ 30,000.00	
iii)	**BH Core samples (first level BH)**						
a	Proximate analysis for graphite	Nos	4.1.16	₹ 3,000.00	150	₹ 4,50,000.00	
iv)	**BH Core samples (10%External) (first level BH)**						
a	Proximate analysis for graphite	Nos	4.1.16	₹ 3,000.00	15	₹ 45,000.00	
v)	**BH Core samples (Second level BH)**						
a	Proximate analysis for graphite	Nos	4.1.16	₹ 3,000.00	250	₹ 7,50,000.00	
c	Analysis of one rock/ soil sample for determination of a package by 34 elements by ICP-AES / ICPMS (34 elements along with Cu, Pb, Zn, Fe, Ni, Co, Cr, Al, S, Bi etc.)	Nos	4.1.14	₹ 7,731.00	10	₹ 77,310.00	
vi)	**BH Core samples (10%External) (Second level BH)**						
a	Proximate analysis for graphite	Nos	4.1.16	₹ 3,000.00	25	₹ 75,000.00	
c	Analysis of one rock/ soil sample for determination of a package by 34 elements by ICP-AES / ICPMS (34 elements along with Cu, Pb, Zn, Fe, Ni, Co, Cr, Al, S, Bi etc.)	Nos	4.1.14	₹ 7,731.00	1	₹ 7,731.00	
2	**Physical & Petrological**						

	Studies						
i	Preparation of Standard thin section of rock	Nos	4.3.1	₹ 2,353.00	10	₹ 23,530.00	
ii	Complete petrographic/ ore microscopic study/ mineragraphic report of rock sample	Nos	4.3.4	₹ 4,232.00	10	₹ 42,320.00	
iii	Digital Photomicrograph of thin polished section	Nos	4.3.7	₹ 280.00	10	₹ 2,800.00	
iv	Bulk density analysis	Nos	4.8.1	₹ 1,605.00	3	₹ 4,815.00	
v	Total graphitic carbon	Nos	-	₹ 2,500.00	20	₹ 50,000.00	As per actuals . The coast is given based on market research
	Sub Total- F					**₹ 18,58,506.00**	
G	**Total A to F**					**₹ 2,73,34,766.00**	
H	**Geological Report Preparation**	**5 Hard copies with a soft copy**	**5.2**			**₹ 8,20,042.98**	**Reimbursement will be made after submission of the Final Geological Report in Hard Copies (5 Nos) and the soft copy to NMET.**
I	**Peer review Charges**	**As per EC decision**		**₹ 30,000.00**	**1**	**₹ 30,000.00**	

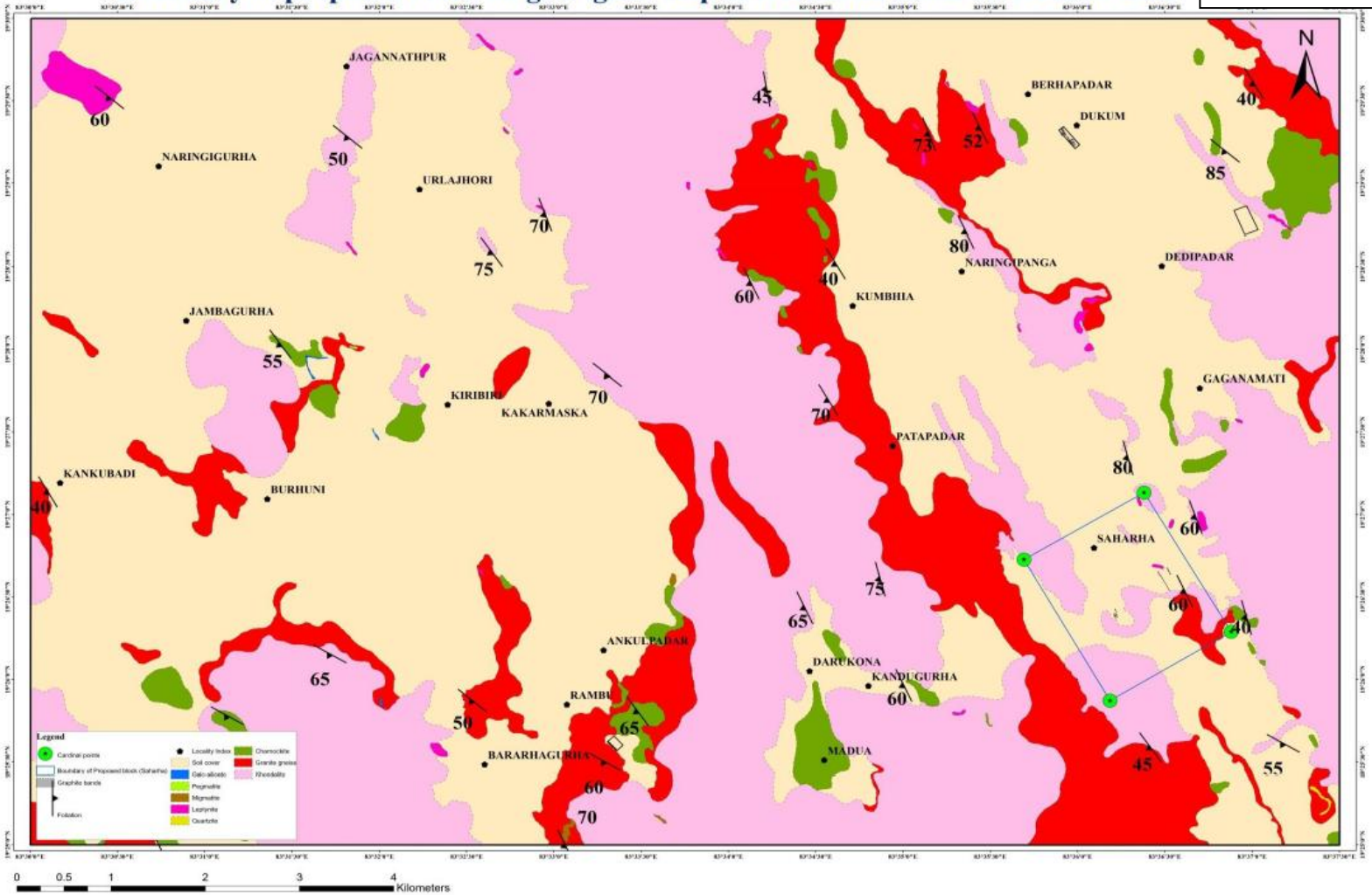
J	**Preparation of Exploration Proposal (5 Hard copies with a soft copy)**	**5 Hard copies with a soft copy**	**5.1**	**2% of the Cost or Rs. 5.0 Lakhs whichever is less**		**₹ 5,00,000.00**	**EA will be reimbursed after submission of the Hard Copies and the soft copy of the final proposal along with Maps and Plan as suggested by the TCC-NMET in its meeting while clearing the proposal.**
L	**Total Estimated Cost without GST**					**₹ 2,86,84,808.98**	
M	**Provision for GST (18% of L)**					**₹ 51,63,265.62**	**GST will be reimbursed as per actual and as per notified prescribed rate**
N	***Total Estimated Cost with GST***					***₹ 3,38,48,074.60***	
	Rs. In Lakhs					***₹ 338.48***	
Note:							
1	**Strict adherence to the Ministry of Finance's and GFR guidelines is mandatory. Every transaction must adhere to GFR rule 21.**						
2	**In case of delay/non- performance, the appropriate action will be taken by competent authority against delinquent agency as per prevailing govt. of India rules/guidelines on procurement**						
3	**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 execution of the project by NEA on its own, a Certificate regarding non outsourcing of any component/project is required.**						
4	**Necessary efforts should be made to minimize any adverse impact on the environment during exploration activities.**						
5	**Any item of work not mentioned above shall be added as per SoC.**						
6	**All the Geological Reports and data are to be uploaded on NGDR as per MERT template by the agency**						

8 List of plates

Sl. No	Description
I	Boundary of the proposed block on the geological map of Darukona block
II	Boundary of proposed block on toposheet number 65M/11
III	Proposed tentative borehole location map for the proposed block
IV & V	SP anomaly map for eastern and western zone of proposed block area

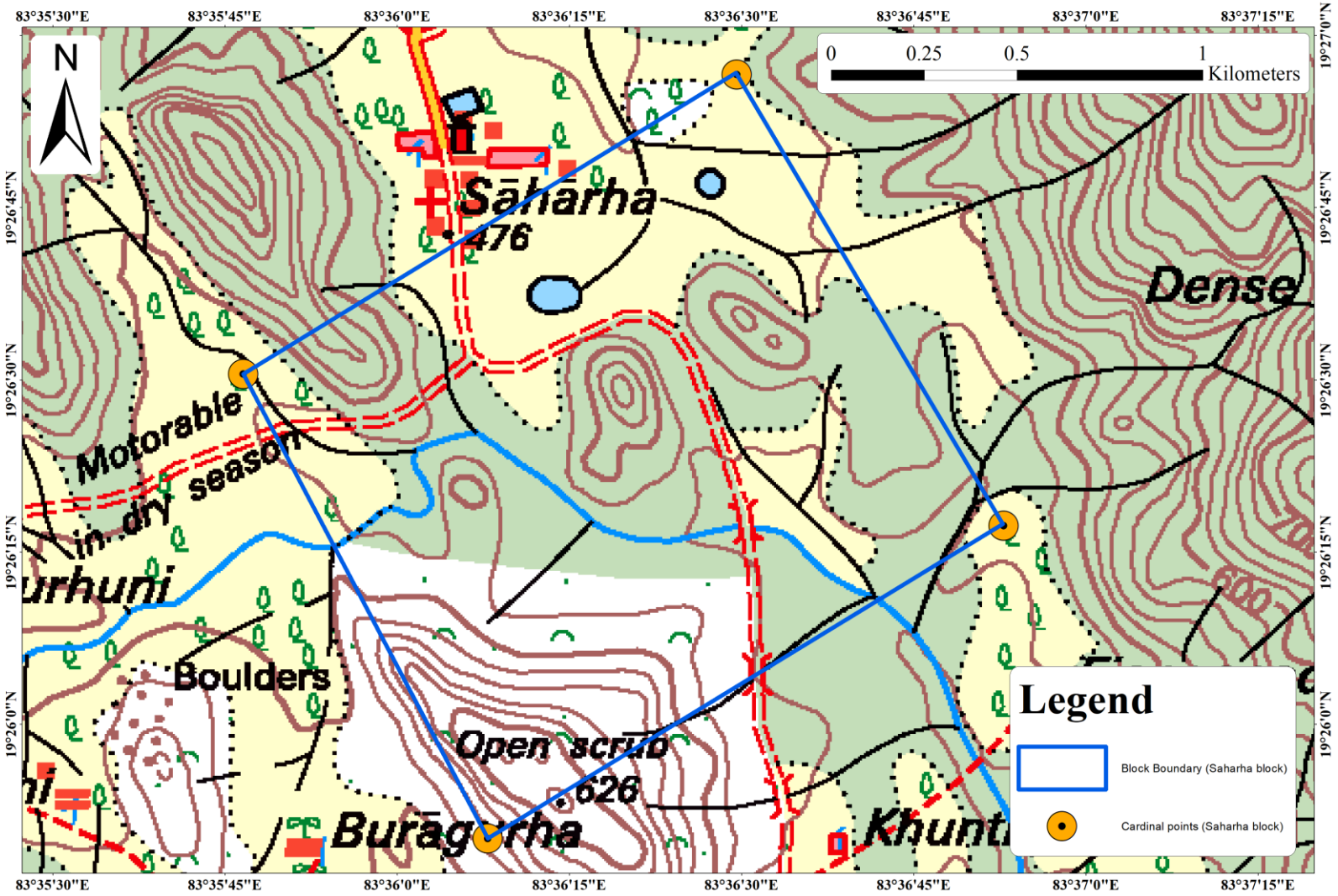
PLATE-I

Boundary of proposed block on geological map of Darukona block on 1:12500 scale



Proposed block boundary of Saharha block on Survey of India toposheet number 65M/11

PLATE-II



Tentative borehole location on geological map of Sahada block on 1:3000 scale

PLATE-III

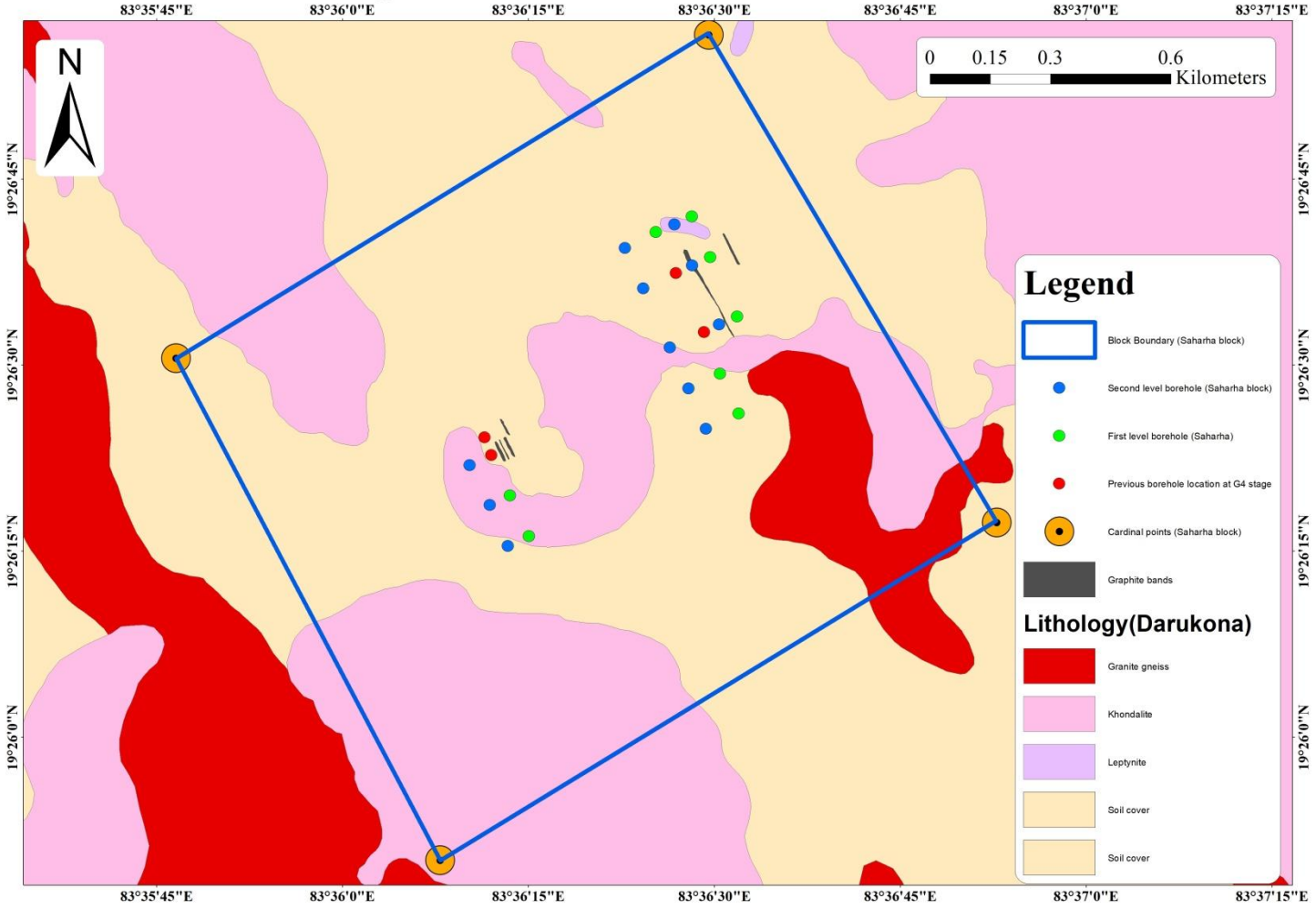


PLATE-IV

SP anomaly map of western zone of Saharha block on 1:300 scale

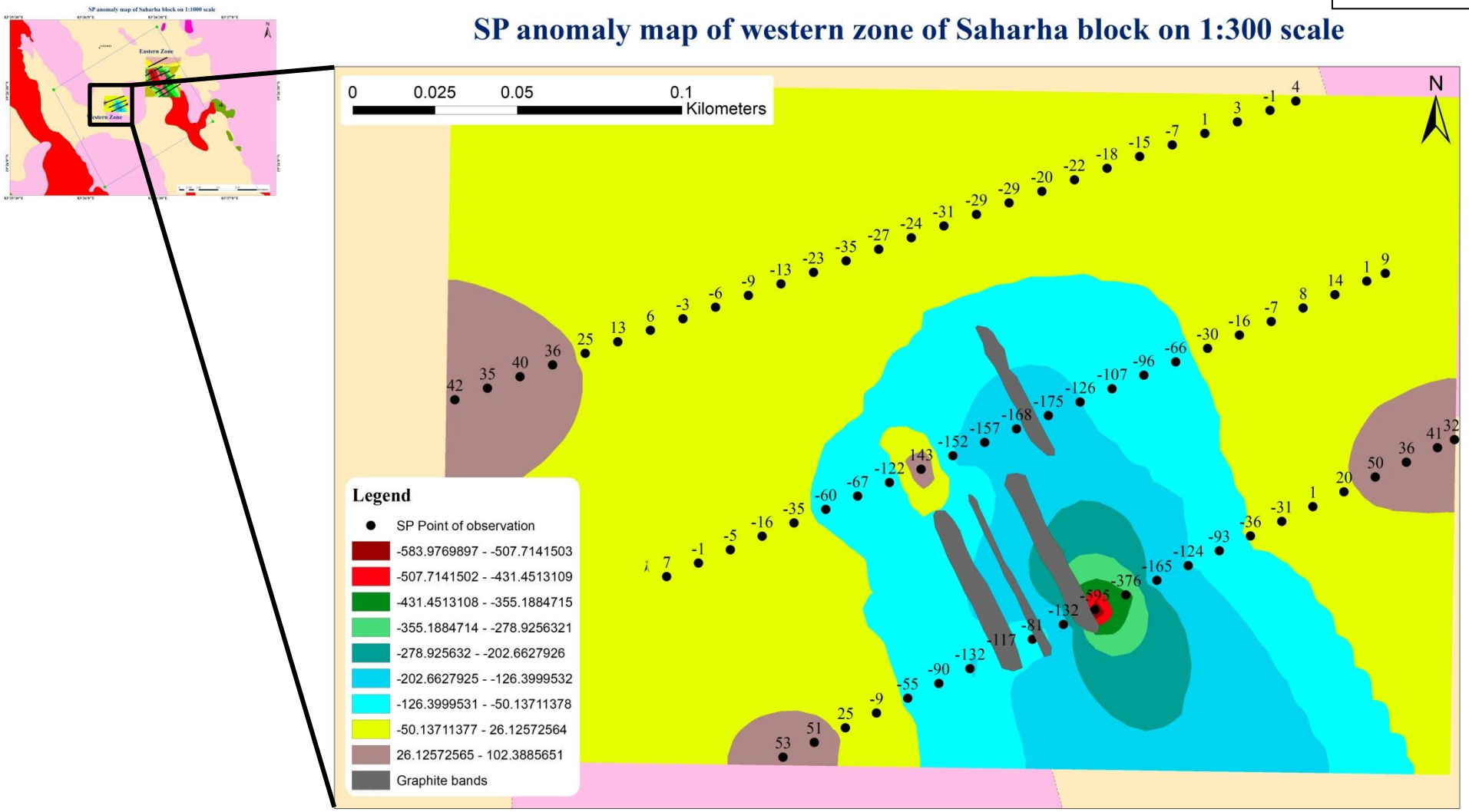
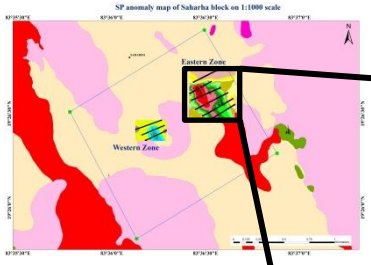


PLATE-V

SP anomaly map of eastern zone of Saharha block on 1:700 scale



83°36'30"E

0 0.05 0.1 0.2 Kilometers

N

Legend

- SP Point of observation
- -205.9757843 - -151.0310676
- -151.0310675 - -110.3195207
- -110.3195206 - -80.15410796
- -80.15410795 - -57.80290314
- -57.80290313 - -41.24167252
- -41.24167251 - -24.68044189
- -24.68044188 - -2.329237075
- -2.329237074 - 27.83617564
- 27.83617565 - 68.54772259
- 68.5477226 - 123.4924393
- Graphite bands

19°26'30"N

83°36'30"E