

Proposal for Thapen – Bazargarh Graphite Block (116.498
Sq.Km) , Kalahandi District, Odisha State for Reconnaissance
Survey (G4 Stage) under NMET

(Basemetals/Ferrous/Non-Ferrous/Industrial/Strategic &
Critical/Precious metals etc.)

By
Odisha Mineral Exploration Corporation Limited (OMECL)
Bhubaneswar, Odisha

Place: Bhubaneswar
Date: 24th June, 2022

Summary of the Block for Reconnaissance Survey (G4 Stage)

General Information about the Block

	Features	Details
	Block ID	Thapen - Bazargarh Graphite Block
	Exploration Agency	Odisha Mineral Exploration Corporation Limited (OMECL), Bhubaneswar, Odisha
	Commodity	Graphite
	Mineral Belt	Eastern Ghat Mobile Belt (EGMB)
	Completion Period with entire Time schedule to complete the project	The total duration of the project shall be completed in 18 months from the date of commencement of the project.
	Objectives	Based on the evaluation of available geological data, the present Proposed Reconnaissance Survey (G-4) has been expressed to fulfill the following objectives. 1. To carry out the geological mapping 1:12,500 scale for delineation of the litho units of Graphite bearing formations (host rock) with the structural features i.e., strike, dip, lineation/foliation and to identify lateral disposition of the mineralized zones etc. 2. Ground geophysical survey to identify anomalous zones for occurrence of graphite and sub-surface mineralization zone of concealed ore body for further exploration to establish the potentiality of the area. 3. Collection of grab (Bedrock/Soil) and pit samples of graphite and analysis of the same. 4. A total of 10 nos. of scout boreholes shall be drilled (50mts/borehole) over the anomalous zone basing on the findings of geophysical survey. The future course of Exploration program will be decided after reconnaissance survey (G-4). 5. To estimate reconnaissance resources of Graphite mineral as per UNFC norms and Minerals (Evidence of Mineral Contents) Rules-2015 & Amendment MEMC Rule-2021 at G-4 level.
	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	1. The Geological Mapping, core logging and report writing will be carried out by OMECL. 2. Survey, Geophysical survey, Pitting, Trenching, Scout drilling, and Laboratory studies will be outsourced through tender process by the proposed agency.
	Name/Number of Geoscientists	Mr. Bikash Chandra Sahoo Dr. Prasanta Kumar Nayak Dr. Lingaraj Sahoo Mr. Subrat Kumar Sahoo /04 nos
	Expected Field Days (Geology)	Geologist Party days 240 days

1.	Location				
	Latitude / Longitude		PILLAR ID	LATITUDE	LONGITUDE
			1	20°15'00.0000"	83°20'00.0000"
			2	20°16'17.9045"	83°19'59.9983"
			3	20°16'17.6033"	83°20'42.4807"
			4	20°16'48.5266"	83°20'42.8990"
			5	20°16'48.8585"	83°19'59.9979"
			6	20°18'24.4231"	83°19'59.9820"
			7	20°18'24.5976"	83°25'00.0416"
			8	20°15'00.0000"	83°25'00.0000"
			9	20°15'00.0175"	83°22'09.0347"
			10	20°15'51.2955"	83°22'10.2086"
			11	20°15'51.2222"	83°21'27.7175"
			12	20°15'00.7309"	83°21'28.4108"
			13	20°11'10.0703"	83°21'29.9814"
			14	20°11'13.7037"	83°16'02.8853"
			15	20°14'35.7013"	83°16'03.8612"
			16	20°14'35.3692"	83°17'17.0606"
			17	20°15'00.0284"	83°17'16.4500"
	Villages	Thapen, Tundla, Bandhpada, Kendubahali, Khairamal, Hatikhoj, Palam, Belsaparha, Bhaludunguri, Turlakhaman, Khajurparha, Karsaada & Salebhata etc.			
	Tehsil/Taluk	Kesinga, Narla & Madanpur Rampur			
	District	Kalahandi			
	State	Odisha			
2.	Area (hectares/square kilometers)				
	Block Area	116.498 Sq. km			
	Forest Area	Land details of the block to be collected			
	Government Land Area	-do-			
	Private Land Area	-do-			
3.	Accessibility				
	Nearest Rail Head	Kesinga (20 to 25 kms)			
	Road	NH-59 (Khariar to Brahmapur via Titilagarh-Madanpur Rampur-Baliguda-Hinjilicut) is running from SE to NW across the Thapen - Bazargarh Graphite block & it meets NH-26 (Raipur to Rajapulova via Bolangir-Kesinga-Bhawanipatna) at Amath Chowk which is approximately 4 kms from the block area. Location map is placed on Plate-II.			
	Airport	Utkela Airport, Kesinga (33 kms.) & VSS Airport Jharsuguda (245 kms)			

4.	Hydrography	
	Local Surface Drainage Pattern (Channels)	The south-western part of the block consists of hilly tract whereas north-eastern part mostly covered with soil/alluvium. There is no perennial nallah passing within the block area.
	Rivers/Streams	Tel River flows outside the block along north-west direction.
5.	Climate	
	Mean Annual Rainfall	Average annual rainfall is 1378.20mm (Source: District rainfall data)
	Temperatures (December) (Minimum) Temperatures (June)(Maximum)	Minimum temperatures 040C (December) Maximum temperatures up to 450C (May) (Source: District rainfall data)
6.	Topography	
	Toposheet Number	F44X7 (64P/7) & F44X8 (64P/8)
	Morphology of the Area	Most of the area show flat topography covered with soil / alluvium except few hillocks exposed at the south & south-western part of the block comprising of metamorphosed rocks.
7.	Availability of baseline geosciences data	
	Geological Map (1:50K/25K)	1:50,000 Scale Geological Map (Geological Survey of India)
	Geochemical Map	Not Available
	Geophysical Map (Aeromagnetic, ground geophysical, Regional as well as local scale)	Not Available
		1. The block is located within the favorable geological domain, where numbers of graphite occurrences have been reported by GSI & Directorate of Geology (DGO) in adjacent areas. 2. Based on the evaluation of geological data obtained from Thapen - Bazargarh block during the field visit to

8.	Justification for taking up Reconnaissance Survey/ Regional Exploration	the area, the present exploration program at G4 level has been prepared. 3. Considering the primary investigation for graphite, some graphite samples have been collected from four different locations where graphite is noticed within khondalite & calc-silicate rocks. Graphite occurs as veins and disseminated flakes within the weak planes like micro fracture, cleavage and along the foliation plane. Graphite occurrences are also noticed at the contact zones of khondalite and granite gneiss. The chemical analysis of 7 samples shows FC % ranging from 10.33 to 35.98% which is encouraging. With this backdrop it is justified to carry out reconnaissance survey in this block for delineation of mineralized zone and to study the potentiality of the area. 4. The Geophysical Survey combined with Geological Mapping, scout drilling, excavation and sampling will be helpful in assessing the disposition of the mineralized zones, structural features if any. 5. The Reconnaissance Survey will be helpful in estimation of reconnaissance resources (334) of Graphite, and it may lead for further planning of detailed exploration program in the block basing upon the findings of G4 level exploration, which in turn will facilitate the state Government for auction of block.
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Detailed description on the following titles to be made in the proposal

1. Block Summary

1.1 Physiography

In general, the study area forms a flat land along the north & north-eastern part and a hilly undulated terrain along the south & south-western part of the Block. The vegetation around the southern and eastern part is mixed open shrubs. The area has got dendritic pattern of drainage. The block area is mostly consisting of Agricultural lands. There is no perennial nallah passing within the block area.

The climate of the Kalahandi District is of extreme type. It is dry except during monsoon. The maximum temperature of the district is 45⁰ + Celsius, whereas the minimum temperature recorded is 4⁰ Celsius. The district experiences the average annual rainfall as 1378. 20mm. The monsoon starts late in June and generally lasts up to September.

1.2 Background Geology (Regional Geology, Geology of the Block).

1.2.1 Regional Geology

The proposed exploration area lies in the western part of the Eastern Ghats Super Group of rocks and also known as Eastern Ghats Mobile Belt (EGMB) which extends from Brahmani River in Odisha to Ongole in Andhra Pradesh over a stretch of 900kms with a width varying from 30 to 300km, the maximum width being in Odisha. The area forms geologically a part of the Archaean complex of the peninsular shield comprising highly metamorphosed sedimentary and igneous rocks belonging to khondalite and charnockite

formations of the Eastern Ghats Group along with the ubiquitous granite-gneisses. The khondalite formation is represented by the quartz feldspathic garnetiferous sillimanite, graphite bearing schists and gneisses, calc-silicate granulites and garnet ferrous quartzites. They occur intimately inter-banded with each other suggesting inter-bedded nature of the pelitic, psammitic and calcareous members of the sedimentary formation, although their relative position is obscure.

The well foliated rocks show marked variation in attitude due to poly-phase deformation. Migmatization has affected almost all these rock types sometimes obliterating their original lithology and field relationships. There are also folds and shear zones which trend NW-SE to WNW-ESE. Based on their spatial distribution and mutual relationship enumerated above the rock types of the area can be fitted in the following tentative geological succession.

Stratigraphic succession of the Area (after GSI)

	Recent	Laterite and Soil /alluvium
	Later intrusive	Pegmatite and quartz veins
		Granite-gneisses
ARCHAEOAN		Meta-dolerite
	Eastern Ghats Group	Charnockite formation:
		Charnockites (intermediate & basic type)
		Khondalite Formation:
		Khondalite, Calc-silicate rocks and Quartzite

1.2.2 Geology of the block

The Thapen - Bazargarh area has been considered for preliminary investigation for graphite deposits. The block demarcated for preliminary investigation has an area of 116.498 sq km and located in Narla and Kesinga block of Kalahandi district and the block falls in toposheet no. F44X7 (64P/7) & F44X8 (64P/8).

During investigation in this block, it has been found that the southern and south-western part of the block comprise of four hillocks, which are generally consists of khondalite suit of rocks dissected by quartz veins at places. Foliations have been observed in outcrops of country rocks, which have a general trend of NE-SW, dipping 50° to 80° towards NW direction. Small scale folding is seen indicating the migmatisation at the contact zone of Granite gneiss and Khondalites. This migmatisation has been taken place at the contact of pegmatite-khondalite margins. The graphite occurs as small veins and disseminated flakes along the weak planes like foliation plane and micro fractures within migmatised khondalites. Graphite also occurs at the contact of khondalite and granite gneiss as small veins being conformably along the foliation planes of host rock. They appear to be formed from the disseminated flakes of graphite, an essential constituent of khondalite by the process of remobilisation, controlled by shearing and subsequent migmatisation by the granite- gneiss and their related pegmatites and quartz veins.

The eastern, north-eastern & central parts of the block are exposed with Granite gneiss which shows same trend of foliations as khondalites. The north-west and other parts of the block are generally covered with soil/alluvium.

Two numbers of Pits have been discerned near the Thapen village, where graphite veins are noticed within the migmatised khondalites. Weathered products of calc-silicate granulite and some quartzite pebbles have been observed at the surface near the pits. Graphite samples have been collected from opened pits from in-situ of khondalite. Graphite mineralization has also been noticed within the excavated materials of khondalite suit of rocks of the pond & bore wells near Thapen village.

Description of various rock formations in the Area:

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

Khondalite (quartz- feldspar- garnet- sillimanite + graphite schist/gneiss):

It occurs typically in bouldery outcrops (highly weathered) on narrow, steep hill ranges and low lying mounds and in valley inter-banded with quartzite and calc-silicate rocks. This is coarse grained, brownish yellow to reddish grey coloured, foliated and highly weathered rock. Due to varying degree of weathering its colour changes to pinkish/purplish at places, when highly kaolinised, it becomes very light. It is highly sheared and mylonitised at places. The rock is intimately associated with quartzite and both grade into each other along as well as across the foliation. They are highly migmatised and the quartzo-feldspathic neosome bands that have traversed the rock along the regional foliation plane of the rocks.

Granite Gneiss: This is medium to coarse grained rock occupying in low-lying areas with migmatite, consisting mainly of quartz, orthoclase, plagioclase, feldspar, biotite, garnet and opaque minerals. The whole sequence has been metamorphosed to granulite facies. The alkali-feldspar gneiss is fine to coarse grained and contains porphyro-blastic texture.

Quartzite: The quartzite is medium to coarse-grained, white to buff coloured, granular to faintly schistose in nature and is invariably garnetiferous. Pegmatite and quartz veins traverse the rock along foliation planes. Quartzite grades laterally to khondalite.

Calc-silicate rocks: The calc-silicate rocks occur as bands and lenses within khondalite. Their trend generally confirms the regional foliation direction and the contact of these rocks with khondalite and granite is sharp. The calc-silicate rocks are highly weathered. The calc-silicate rock is usually a dark grey to greenish, fine to medium grained, hard and massive to foliate. It contains green diopside, hornblende, plagioclase, garnet and quartz. Accessories include zircon, calcite, apatite and epidote.

Charnockite: It is mainly orthopyroxene-bearing quartz-feldspar rock formed at high temperature and pressure, commonly found in granulite facies metamorphic regions. This is a medium to coarse grained, massive porphyro blastic rock with large rounded to oval shaped porphyro blasts of potash feldspar. It is moderately foliated, gneissose and generally it has the typical greasy luster and greenish black colour.

Pegmatite and quartz veins: Pegmatite and quartz veins traverse the country rocks both along and across the foliation. At places pegmatite contains few crystals of beryl and tourmaline which are of less significance.

Soil/Alluvium: Soil is found mainly over khondalite and granite gneiss and is very common in areas.

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

Occurrences of graphite have been noticed within the block which forms a part of Eastern Ghats Mobile Belt. As graphite samples have been collected from different locations within the khondalite suit of rocks where Fixed Carbon (FC) content varies from 10.33% to 35.98%. With this background the area can be put into G-4 level of exploration for assessment of Graphite within the block.

Geophysical Survey will be carried out to assess the continuity of surface manifestations of mineralized zones. Self-potential (SP) Survey / Charged Potential (CP) Survey for 40 line kms as well as Induced Polarization (IP) Resistivity Survey shall be carried out over 40 line kms.

During Geological Mapping the bed rock samples shall be collected from the outcrops along with soil. Geochemical samples will be analyzed.

1.4 Scope for proposed exploration:

The Reconnaissance Survey at G-4 stage proposed exploration program comprises of study of historical airborne geophysical data (Magnetic & Radiometric), Geological Mapping (1:12,500 scale), Sampling (Bedrock, Core & soil), Pitting, Trenching, Self Potential

(SP) Survey / Charged Potential (CP) Survey), IP Resistivity (dipole – dipole) survey, drilling of 10 nos of scout boreholes involving about 500m drilling with associated survey, chemical analysis, laboratory studies and report preparation.

1.5 Observations and Recommendations of previous work:

The block area forms a part of Eastern Ghats Mobile Belt (EGMB). Incidence of Graphite at some places is noticed within khondalite & calc-silicate rock present within the block. So, it is worthwhile to explore the area with G4 level to delineate the disposition of ore body for the further exploration work. Since the present exploration work is of reconnaissance (G4) level of exploration, the possibility of any other mineralization will also be ascertained.

2. Previous Work

2.1 Previous Exploration in adjoining area (Regional area):

Geological investigation, comprising geological mapping and pitting was undertaken in 1972-73 by Geological Survey of India, along the Titilagarh- Muribahal sector of the Titilagarh graphite Belt, Bolangir district, Orissa, for the detailed appraisal of the graphite resources and to study the controls of localization. The Titilagarh graphite belt is a vast, mineral bearing area (about 55 km long and 40 km wide) covering parts of Bolangir and Kalahandi districts of Orissa, in Survey of India's topo-sheet nos.64 P/3, 4, 7, 8 & 11. As per their view, the area exposes with highly metamorphosed khondalite and charnockite formations of Eastern Ghats Super Group and the granite-gneisses. The survey resulted in finding of a number of small and scattered occurrences of graphite of which a few seem promising. Commercially exploitable graphite deposits of this sector are located at the sheared and migmatized contacts of khondalite and medium-fine grained gneiss with wide-spread feldspathisation. They are structurally controlled by the foliation of the host rock. Only, lens and vein type of graphite deposits with sizeable dimensions are economically paying. He had recommended more geophysical prospecting, Pitting, Drilling, Geochemical Sampling etc. over the area.

Investigation for graphite was carried out in the Eastern Ghats' by Geological Survey of India during 1968-69 through geological mapping, pitting and trenching in the Titilagarh, Bolangir, and Patnagarh Sub-Division of Bolangir district. It was observed that graphite is found along certain zones, where concentration is higher. Pitting and trenching have not been sufficient to find the zone of maximum concentration. Geophysical prospecting and drilling were recommended to study the exact nature of the deposits.

As many as twenty new graphite occurrences have been located during the course of geological mapping of about 600 sq km area in parts of Koraput district on 1:15,840 scale by Geological Survey of India in 1983-84. Graphite occurs mainly in the form of vein, veinlets, pockets and dissemination in quartz-feldspar-garnet-sillimanite $\pm$ graphite gneiss and schist, which are generally associated with garnetiferous granite/quartzo-feldspathic injections. Graphite is noticed in leptynite. It is generally noticed along foliation and joint planes and shear zones.

2.2 Previous Exploration in the proposed block area:

The proposed block area has not been explored previously by any other agencies. However, this area has been mapped by GSI in 1:50,000 scale. The geological maps placed in Plate-III.

3. Block Description

The Thapen - Bazargarh Graphite Block area falls in Survey of India Toposheet No. F44X7(64P/7) & F44X8 (64P/8). And covers an area of 116.498 sq.km in and around villages Thapen, Tundla, Bandhpada, Kendubahali, Khairamal, Hatikhoj, Palam, Belsaparha, Bhaludunguri, Turlakhaman, Khajurparha, Karsalpada & Salebhata etc. of Kesiinga, Narla & Madanpur Rampur Block/Tehsil of Kalahandi District, State Odisha. The block location in toposheet is given in Plate-I. The Co-ordinates of all the corner points of the block area are given in the following table.

Co-ordinates of the pillar points of the block

THAPEN-BAZARGARH BLOCK CORNER POINT		
PILLAR ID	LATITUDE	LONGITUDE
1	20°15'00.0000"	83°20'00.0000"
2	20°16'17.9045"	83°19'59.9983"
3	20°16'17.6033"	83°20'42.4807"
4	20°16'48.5266"	83°20'42.8990"
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16	20°14'35.3692"	83°17'17.0606"
17	20°15'00.0284"	83°17'16.4500"

4. Planned Methodology

In accordance with the objective set for the block, the exploration programme is proposed. The exploration shall be carried out as per Minerals Evidence of Mineral Content (MEMC) Rule-2015 & Amendment MEMC Rule-2021. Accordingly, the following scheme of exploration is formulated to achieve the objectives.

4.1 Geological Mapping

Geological Mapping will be done over the entire of 116.498 sq.km in 1:12,500 scale. During the geological mapping different lithounits will be delineated along with their contact and structural features. Surface manifestations of the ore bodies available alongwith their surface disposition will be marked on the map.

4.2 Surface Sampling

During course of geological mapping the bed rock samples shall be collected from the outcrops along with soil samples. A total 100 nos. of Surface Samples (Bed Rock & Soil) from different location which will be analyzed for graphite mineralization (FC, Ash, Moisture and VM).

4.3 Geophysical Survey

The area of the block is 116.498 sq kms. and in general, is plain land with some undulations and majority of the area is covered by local shrubs and cultivated land except some isolated hillocks at places. In view of presence of vegetation and soil cover the ground Geophysical Survey is required to know the anomalous zone of graphite and its depth persistency. On interpretation of data of geological mapping, geochemical sampling (Bedrock & Soil sampling), Geophysical Survey ten boreholes will be drilled to assess the continuity of surface manifestations of mineralized zones. In this context, surface Geophysical Survey i.e. Self-Potential (SP) survey for 40 line km as well as Induced Polarisation (IP) Resistivity Survey / Charged Potential survey over the anomalous zone shall be carried out.

- (i) Ground Self Potential (SP) / Charged Potential (CP) Survey: 40 line kilometers.
- (ii) Ground Induced Polarization (IP) - Resistivity Survey (Dipole – Dipole): 40 line kilometers.

Charged Potential and Self Potential methods

Charged Potential (CP) measurements are acquired by connecting a current electrode directly to the conductive body and locate the other remote electrode at a considerable distance to ensure that its effect is virtually non-existent in the survey area. The current can be injected through a surface outcrop or a borehole if no outcrops are available. The potential between two non-polarizable electrodes is then measured on the surface around the conductive body in a sequence of connected measurement-points. As long as the electric conductivity of the mineralisation is more than 1000 times higher than that in the surrounding host rock, the electrical potential will, in practice, stay constant above the mineralisation, and then drop down when the measurements are outside the ore- body (Figure 1). By measuring the potential around a known graphite ore-body, the body's length, dip and size can be mapped. In addition, an outline of unknown ore-bodies can be mapped. A practical way of interpreting depth extend of nearly vertical electric conductive bodies from CP data is presented by Kihle & Eidsvig (1978).

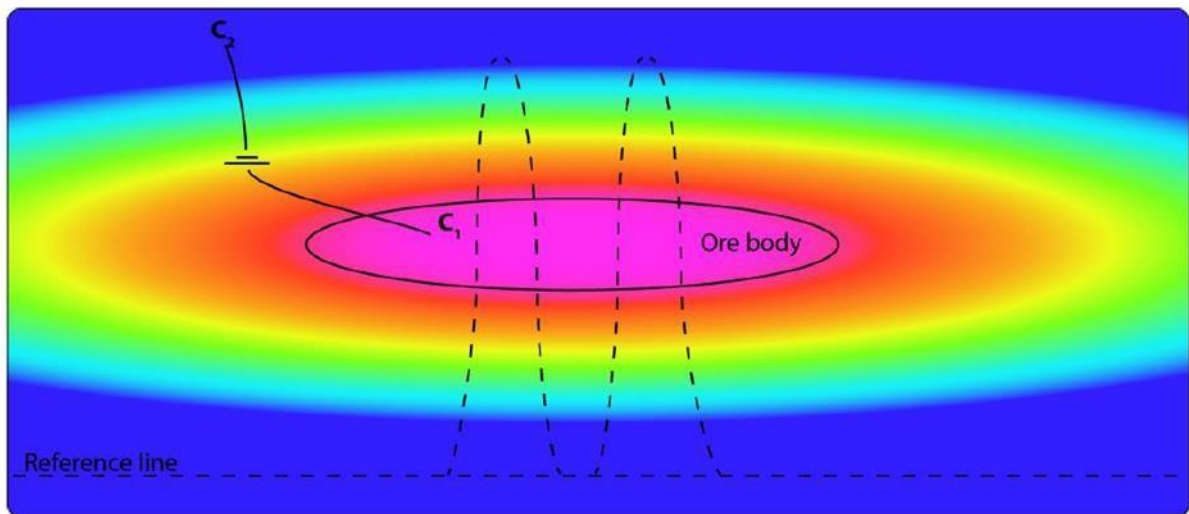
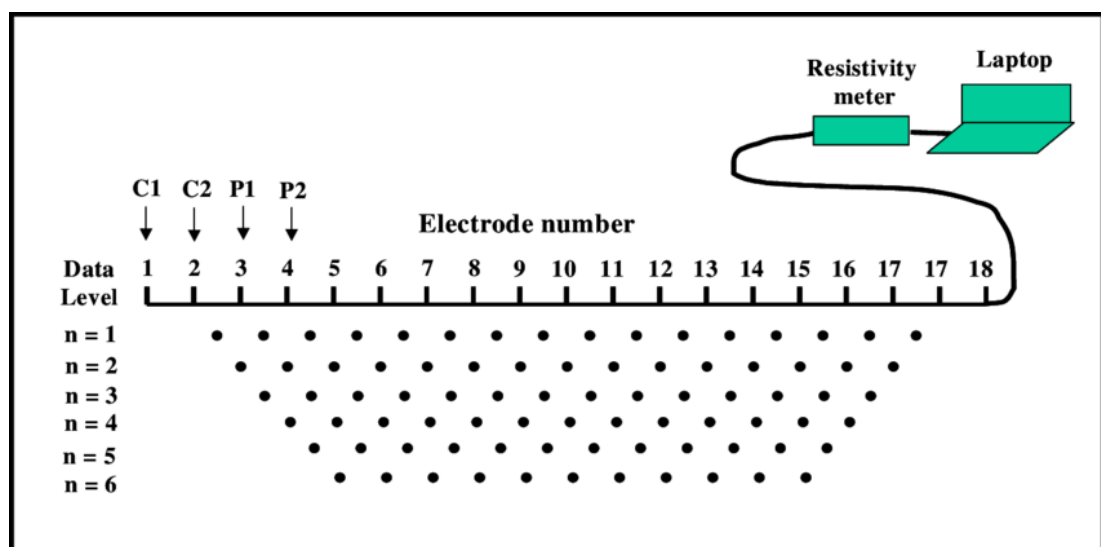


Figure 1: Conceptual illustration of the CP- method. The current electrode (C1) is connected to the ore body and the remote electrode (C2) is placed far outside the survey area. The color indicates the strength of the charged potential above an ore-body. The dashed line shows the survey path along which the entire body will eventually be covered.

SP may give negative potential values of 1000 mV or even more above graphite mineralisations. Measured SP signals less than 100 mV are not regarded as anomalies in mineral prospecting. A total of 40 line km work planned at target zones.

2D Resistivity and Induced Polarization (IP)

To be able to calculate the size of graphite bodies, it is necessary to know the resistivity of the host rock. Using 2D resistivity measurements, also called ERT (Electrical Resistivity Tomography), the thickness of an ore-body can be evaluated and the true resistivity (electric conductivity) of EM anomalies may be calculated. Induced Polarization (IP) responds to electronic conducting minerals which are not in electric contact. This means that massive graphite deposits should not give an IP effect. However, IP effects are often seen in the contacts between graphite bodies and surrounding host rock where graphite grains are not connected. A dipole dipole survey using 10m dipole spacing and $n = 8$ shall be used for acquiring data. A total of 40 line kilometers survey planned at target areas derived after data integration.



4.4 Pitting & Trenching

The channel samples shall be collected from the mineralized zones of Pit/Trench. The dimension of pit and trench shall be (2m x 2m x 2m) and (2m x 2m x 10m) respectively. The representative samples shall be prepared in field in duplicate. Total 10 nos. of pit and 5 nos. of trenches over different mineralized horizons shall be proposed within the block. 5 bulk samples will be collected from mineralized zones of pit & trenches for the determination of bulk density.

4.5 Drilling and Core Logging

Ten nos. of scout boreholes shall be drilled over the anomalous zone confirmed by geophysical survey. The borehole cores would be logged systematically. Viz. details of the litho units, colour, structural feature, texture, grain size, mineralization, core recovery and Graphite ore type would be recorded.

4.6 Core Sampling

The graphite mineralized part of drill core will be sampled as Primary sample. The length of each sample will be kept 1.00m within the ore zone depending upon the thickness of graphite and its physical character. The primary core samples for graphite mineralization will be analyzed for Fixed Carbon, Ash, Moisture and Volatile Matter (Proximate Analysis for 4 radicals).

- a) Around 330 nos. of primary core samples (300 nos. Primary & 30 nos. Check samples) shall be generated from the mineralized zones intersected in the boreholes of the block and will be analyzed for graphite mineralization (FC, Ash, Moisture and VM).
- b) Around 10% (30 nos.) samples will be sent to NABL Chemical laboratory for analysis of graphite mineralization (FC, Ash, Moisture and VM) as external check samples.
- c) Composite samples would be prepared from the mineralized zones of primary drill core samples of each borehole. A total of 10 nos. of composite samples for graphite would be generated from drill cores and be analyzed for graphite mineralization (FC, Ash, Moisture and VM).

4.7 Petrological & Mineragraphic Studies

Thin section studies on surface and drill cores samples would be done for ascertaining the petrographic & mineragraphic characteristics. These samples would be drawn from ore zones only. A provision of 60 specimens (30 specimens are for petrographic studies & 30 specimens are for mineragraphic studies) has been kept.

4.8 Specific Gravity Determination

To derive the tonnage factors, 5 nos. of sample are proposed to be subjected for specific gravity determination. The samples are to be drawn from ore zones/ mineralized zones.

4.9 Bulk Density Determination

A total 10 nos. of graphite sample shall be analyzed for bulk density for estimation of resource.

5. Nature Quantum and Target

The quantum of work proposed by OMECL in Thapen - Bazragarh Graphite block is given in table below:

Envisaged Quantum of proposed work in Thapen - Bazargarh Block

Sl. No.	Item of Work	Unit	Quantity
A	GEOLOGICAL WORK		
1	Geological Mapping (1:12500)	Sq. km	116.498
2	Core Logging	m	500
3	Demarcation of lease boundary, Fixation of Borehole and determination of coordinates & Reduced Level (RL)of the boreholes by DGPS	Point	10
B	DRILLING		
1	Surface Drilling	m	500
2	Tender preparation, publishing & finalisation	No.	1
3	Land/Crop compensation	Bore hole	10
4	Construction of concrete pillar(12"x12"x30")	Bore hole	10
5	Camp setting	drill	1

6	Camp winding	Per drill	1
7	Approach road making	km	40
8	Drill core preservation	m	500
C	PITTING		
1	Pitting	Cu.m	80
2	Trenching	Cu.m	200
D	GROUND GEOPHYSICAL SURVEY		
1	Self-potential / Charged Potential	Line Km	100
2	Induced Polarization – Resistivity (Dipole - Dipole)	Line Km	50
3	Survey	Sq. km	10
E	LABORATORY STUDIES		
1	Chemical Analysis		
	i) Primary samples and Check samples for Graphite (Core Samples)		
	a) Primary samples for Proximate Analysis (Ash, Moisture, V.M. and F.C.)	Nos	500
	b) Check sample Proximate Analysis (Ash, Moisture, V.M. and F.C.)	Nos	50
	c) REE	Nos	20
	ii) Composite Samples for Graphite (Core Samples)		
	a) Proximate Analysis (Ash, Moisture, V.M. and F.C.)	Nos	10
	b) Total Sulphur (S)	Nos	10
2	Physical Analysis		
i)	a) X-RD Studies	Nos	20
ii)	b) ICP -MS studies (34 trace elements)	Nos	20
iii)	Preparation of thin section	Nos	30
iv)	Petrographic studies	Nos	30
v)	Preparation of polished section	Nos	30
vi)	Mineralographic studies	Nos	30

vii)	Specific gravity	Nos	5
viii)	Bulk density	Nos	10
F	GEOLOGICAL REPORT PREPARATION	Nos	1
G	PEER REVIEW	Nos	1
H	PREPARATION OF EXPLORATIONPROPOSAL	Nos	1

6. Manpower deployment

Manpower deployment List will be provided later.

7. Break-up of expenditure

Cost has been estimated based on actual schedule of charges mandated in the circular OM No. 61/1/2018-NMET dated 31st March 2020 for promotional projects of MOM.

The total estimated cost is Rs. **294.7134 Lakhs**. The cost estimates for reconnaissance survey (G4 Level) are given in Table below.

Estimated cost for reconnaissance survey (G4) for Graphite in Thapen-Bazargarh Block, District - Kalahandi, Odisha (Block area: 116.498 sq.km, Nos. of Borehole - 10 Nos., Borehole depth range - 50m, schedule timeline - 18 months)							
Sl. No.	Item of Work	Unit	Rate as per NMET SoC 2020-21		Estimated cost of proposal		Remarks
			SoC item Sl. No.	Rate as per SoC(in Rs)	Quantum of Work	Total Amount (Rs.)	
A	GEOLOGICAL WORK						
1	Charges for One Geologist - Field	per day	1.3	11,000	300	33,00,000	
2	Charges for One Geologist - HQ	per day	1.3	9,000	50	4,50,000	
3	Labour Charges for Geological mapping (2 Nos.) Base rate- 443/-	per day	5.7	443	600	2,65,800	(Amount will be reimbursed as per notified rates by central labour Commission rates or respective State Govt. Whichever is higher)
4	Charges for one Sampler	per day	1.5.2	5,100	180	9,18,000	
5	Labour Charges for sampling work (4 Nos.) Base rate- 443/-	per day	5.7	443	720	3,18,960	(Amount will be reimbursed as per notified rates by central labour Commission rates or respective State Govt. Whichever is higher)
Sub Total-A						52,52,760	
B	DRILLING						
1	Surface Drilling	per m	2.2.1.4	11,500	500	57,50,000	

2	Land/Crop compensastion	Per Bore hole	5.6	20,000	10	2,00,000	As per actuals as certified by local authorities subject to a maximum of 20,000 per borehole
3	Demarcation of lease boundary, Fixation of Borehole and determination of coordinates & Reduced Level (RL)of the boreholes by DGPS	Per point observation	1.6.2	19,200	10	1,92,000	
4	Construction of concrete pillar(12"x12"x30")	Per Bore hole	2.2.7a	2,000	10	20,000	
5	Monthly Accomodation charges for drilling camp(up to 2 rigs)	Per Months	2.2.9	50,000	3	1,50,000	
6	Camp setting	Per drill	2.2.9a	2,50,000	1	2,50,000	
7	Camp winding	Per drill	2.2.9b	2,50,000	1	2,50,000	
8	Approach road making	Per km	2.2.10b	32,200	40	12,88,000	
9	Drill core preservation	Per m	5.3	1,590	500	7,95,000	
Sub Total-B						88,95,000	
C	PITTING						
1	Pitting	Cu.m	2.1.2	3,800	80	3,04,000	10 pits 2*2*2
2	Trenching	Cu.m	2.1.1	3,330	200	6,66,000	5 trenches 2*2*10
Sub Total-C						9,70,000	
D	GROUND GEOPHYSICAL SURVEY						
1	Self-potential / Charged Potential	LineKm	3.3a	29,600	40	11,84,000	
2	Induced Polarization – Resistivity (Dipole - Dipole)	LineKm	3.4a	69,950	40	27,98,000	
3	Survey Party days	Per days	1.6.1a	8,300	180	14,94,000	

4	Labour charges for survey work (4 Nos.) Base rate- 443/-	Per days	5.7	443	720	3,18,960	(As per rates prescribed by central labour Commission rates or respective State Govt. Whichever is higher)
Sub Total-D						57,94,960	
E	LABORATORY STUDIES						
1	Chemical Analysis						
	i) Primary samples and Check samples for Graphite (Core Samples)						
	a) Primary samples for Proximate Analysis (Ash, Moisture, V.M. and F.C.)	Nos	4.1.16	3,000	500	15,00,000	60% of core sample (500m) + 100 grab sample + 50 pit sample + 50 trench sample
	b) Check sample Proximate Analysis (Ash, Moisture, V.M. and F.C.)	Nos	4.1.16	3,000	50	1,50,000	
	c) REE	Nos	4.1.13	5,380	20	1,07,600	
	ii) Composite Samples for Graphite (Core Samples)						
	a) Proximate Analysis (Ash, Moisture, V.M. and F.C.)	Nos	4.1.16	3,000	10	30,000	
	b) Total Sulphur (S)	Nos	4.2.14	1,900	10	19,000	
2	Physical Analysis						
i)	X-RD Studies	Nos	4.5.1	4,000	20	80,000	10 core samples + 10 grab samples
ii)	ICP -MS studies (34 trace elements)	Nos	4.1.14	7,731	20	1,54,620	
iii)	Preparation of thin section	Nos	4.3.1	2,353	30	70,590	
iv)	Petrographic studies	Nos	4.3.4	4,232	30	1,26,960	
v)	Preparation of polished section	Nos	4.3.2	1,549	30	46,470	
vi)	Mineralographic studies	Nos	4.3.4	4,232	30	1,26,960	

vii)	Specific gravity	Nos	4.8.1	1,605	5	8,025	
viii)	Bulk density	Nos	4.10	3,540	10	35,400	
3	Rock powdering	Nos	4.3.12	2,520	560	14,11,200	
Sub Total-E						24,55,625	
Total A+B+C+D+E						2,33,68,345	
F	Tender preparation, publishing & finalisation	one time	2.3			4,67,367	2% of the approved project cost or 5 lakh whichever is lower will be paid one time to exploration agency.
G	GEOLOGICAL REPORT PREPARATION	One Number (5 Hard copies) along with soft copy	5.2			7,50,000	Project cost exceeding 150 Lakh but less than 300 Lakh: A minimum of Rs 7.5 lakh of 3% of the work which ever is more and Rs 3000/- per each additional copy
H	PEER REVIEW		As per EC decision			10,000	
I	PREPARATION OF EXPLORATION PROPOSAL	One Number (5 Hard copies) along with soft copy	5.1			3,80,000	2% of approved project cost or 3.8 lakh whichever is lower
Total F+G+H+I						16,07,367	
Total A+B+C+D+E+F+G+H+I						2,49,75,712	
GST 18%						44,95,628	
Grand Total(A+B+C+D+E+F +G+H+I+18% GST)						2,94,71,340	

Time Schedule/Action plan

TIME SCHEDULE FOR EXPLORATION PROPOSAL FOR GRAPHITE ORE IN THAPEN-BAZARGARH BLOCK (G4 Stage), KALAHANDI DISTRICT, ODISHA																							
		unit	1	2	3	4	5	6	7	8	9	REVIEW	10	11	12	13	14	15	16	17	18	Quantity	
1	Camp Setting	Month																					1
2	Geological Party days	Party days																					300
3	Survey Party days	Party days																					180
4	Geophysical Work	Month																					
	i)Self-potential / Charged Potential	Line Km																					40
	ii)Induced Polarization – Resistivity	Line Km																					40
5	Geophysical Report Preparation	Month																					2
	Pitting & Trenching (10 Pits & 5 Trenches)	Cu. M																					280
6	Surface Drilling	m																					500
7	Sampling Party days	Party days																					180
8	Laboratory Studies	Nos.																					1325
9	Camp Winding	Months																				1	
10	Report Writing with Peer Review	Months																				3	
Note 1: Commencement of project may be reckoned from the day the exploration acreage is available along with all statutory clearance.																							
2: Timeloss on account of monsoon/ agricultural activities/forest clearance/local law and order problem/lockdown etc. will be additional to above timeline.																							

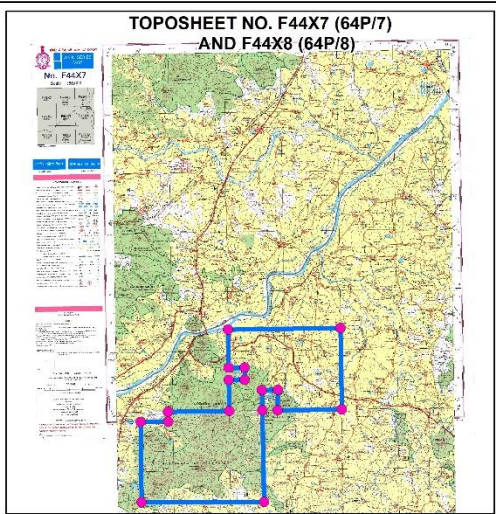
8. References:

- Geological Investigation for Graphite In The Titlagarh Graphite Belt, Bolangir District, Orissa in 1972-73 By Shri S.C.Kanungo, Geologist, Geological Survey of India.
- Graphite Investigation in the Eastern Ghats in 1968-69 by Shri Animesh Bhattacharya, Geologist, Geological Survey of India.
- Report on Assessment of Graphite Resources in Parts of Koraput District, Odisha in 1983-84 by A.K. Lal, R.N. Patra, A.K. Saxena & V.K. Mathur, Geologists, Geological Survey of India
- District Resource Map Kalahandi district, Odisha, Geological Survey of India

List of Plates

- Plate I: Toposheet map with proposed block boundary on 1:50,000 scale.
- Plate II: Google Earth Map of Thapen – Bazargarh graphite block.
- Plate III: Geological map of Thapen - Bazargarh Graphite block by GSI in 1:50,000 scale.

MAP SHOWING PROPOSED THAPEN-BAZARGARH GRAPHITE BLOCK OVER AN AREA OF 116.498 sq.km. ON PART OF TOPOSHEET NO. F44X7 (64P/7) AND F44X8 (64P/8) FOR EXPLORATION IN KALAHANDI DISTRICT, ODISHA



THAPEN-BAZARGARH BLOCK CORNER POINT		
PILLAR ID	LATITUDE	LONGITUDE
1	20°15'00.0000"	83°20'00.0000"
2	20°16'17.9045"	83°19'59.9983"
3	20°16'17.6033"	83°20'42.4807"
4	20°16'48.5266"	83°20'42.8990"
5	20°16'48.8585"	83°19'59.9979"
6	20°18'24.4231"	83°19'59.9820"
7	20°18'24.5976"	83°25'00.0416"
8	20°15'00.0000"	83°25'00.0000"
9	20°15'00.0175"	83°22'09.0347"
10	20°15'51.2955"	83°22'10.2086"
11	20°15'51.2222"	83°21'27.7175"
12	20°15'00.7309"	83°21'28.4108"
13	20°11'10.0703"	83°21'29.9814"
14	20°11'13.7037"	83°16'02.8853"
15	20°14'35.7013"	83°16'03.8612"
16	20°14'35.3692"	83°17'17.0606"
17	20°15'00.0284"	83°17'16.4500"

Legend

- Thapen-Bazargarh Block Corner Point
- Proposed Thapen-Bazargarh Block Boundary
- Graphite Sample Location

SCALE = 1:50,000

