Proposal for Preliminary exploration in Dhourakhaman Graphite Block (Area – 37.0 Sq. Km), Tehsil : Belpara, Bolangir District, Odisha G3 stage

Commodity: Graphite

Exploration agency

Odisha Mining Corporation Limited

Gopabandhu Marg, Unit 4, Keshari Nagar, Bhubaneswar, Odisha 751001

Submitted to

68th meeting of NMET Technical-cum-cost Committee.

Place : Bhubaneshwar

Date : 15-08-2024

Summary of the Turekela Graphite Block (G3 Stage)

GENERAL INFORMATION ABOUT THE BLOCK

1.	Features	Details
	Block ID	Dhourakhaman Graphite Block
	Exploration Agency	Odisha Mining Corporation Limited
	Commodity	Graphite
	Mineral Belt	Sargipalli Graphite belt
	Completion Period with entire Time schedule to complete the project	16 Months
	Objectives	• Identification of basic litho-units and structural fabric of the area through geological mapping to establish graphite mineralization. • To conduct geophysical survey to ascertain the trend of graphite mineralization within graphite schist and the associated Migmatites and Khondalites. • Study of the behaviour of existing graphite veins and its lateral and depth continuity through drilling and sampling. • To understand the mode of occurrence and genesis of graphite in the study area. • Estimation of resources in accordance with UNFC classification in G3 category.
	Whether the work will be carried out by the proposed agency or through outsourcing and details thereof.	The current exploration work will be carried out by OMC Limited.

	Components to be outsourced and name of the outsource agency	
	Name/ Number of Geoscientists	Geologist: 01 HQ (60 days) Geologist: 02 Field (90 days)
	Expected Field days (Geology) Geological Party Days	90 days
1.	**Location**	
	Latitude	20° 33' 45 " N to 20° 37' 49.48" N
	Longitude	82° 46' 45 02.58" E to 82° 51' 28.26" E
	Villages	Dhourakhaman, Dudukamal, Kendagarh, Malikdar
	Tehsil/ Taluk	Belpara
	District	Bolangir
	State	Odisha
2.	**Area (hectares/ square kilometres)**	
	Block Area	37.0 Sq. Km
	Forest Area	Parts of Bender I RF, Lami RF and Ganjaudhar RF
	Government Land Area	Information not available
	Private Land Area	Information not available
3.	**Accessibility**	
	Nearest Rail Head	Nearest Rail Head: Harishankar Road Railway station near Lathor on the Vizianagaram-Raipur Section of the S.E. Railway is about4.5 km N-W from the area.
	Road	National Highway No. 42 passes 11 kms SE of the block
	Airport	Bhubaneshwar Airport is around 312.90 Km from the area aerially.
4.	**Hydrography**	
	Local Surface Drainage Pattern (Channels)	Radial/Joint trellis drainage pattern

	Rivers/ Streams	Lant River at around 6.0 km north east of the area flowing eastwards to join Tel River.
5.	**Climate**	
	Mean Annual Rainfall	126 cm/annum
	Temperatures (December) (Minimum)	23.52° C
	Temperatures (June) (Maximum)	50° C
6.	**Topography**	
	Toposheet Number	Part of Toposheet No. 64 L/14
	Morphology of the Area	The northern part of the area is occupied by the northeast-southwest trending strike ridge of Gandhamardhan Parbat and Bender. The northwestern part of the area forms the Ganjador hill range. The topography in the forest is subdued and are remnants of the older Khondalite ridges. However the proposed area has a patchy soil cover with sporadic outcrops,
7.	**Availability of baseline geoscience data**	
	Geological Map (1:50K/ 25K)	Geological Map (based on works of GSI) derived from Bhukosh website on scale 1:50,000
	Geochemical Map	**Not Available**
	Geophysical Map (Aeromagnetic, ground geophysical, Regional as well as local scale GP maps)	Aeromagnetic survey data available (Sourced from Directorate of Geology, Odisha. Aeromagnetic Survey was carried out in the year 1993 to 1997)
8.	**Justification for taking up Reconnaissance Survey / Regional Exploration**	The thirty critical minerals for India have been identified on the basis of their high supply risk, economic importance, or both, are: Antimony, Beryllium, Bismuth, Cobalt, Copper, Gallium, Germanium, Graphite, Hafnium, Indium, Lithium, Molybdenum, Niobium, Nickel, PGE

		(Platinum Group Elements), Phosphorus, Potash, Rare Earth Elements (REE), Rhenium, Silicon, Strontium, Tantalum, Tellurium, Tin, Titanium, Tungsten, Vanadium, Zirconium, Selenium, and Cadmium. In view of this, the Odisha Mining Corporation has intensified its efforts to discover and exploit new resources of graphite along with rejuvenating the existing OGP areas of graphite occurrences in eastern Odisha. Further, 15 legacy studies by GSI including exploratory mapping at scales from 1: 63360 to 1: 50000 have been conducted in the proposed block. Therefore, large scale mapping is required to establish continuity of the graphite schist horizon that is observed to be consistent with local structures and quarries of graphite. Some trenching across major graphite ore bodies has also been conducted. 09 studies by DoMG have been conducted in the area, inventorying the various leases, and working mines in that period. Detailed geo-referenced geological maps exist, hence ground truthing of the legacy data is required. Other exploratory activities such as Trenching, Pitting and geophysical surveys mainly through SP and VES

		have been conducted 1975-1988 as per legacy data however since the surveys were conducted in 80's, precise co-ordinates or locations cannot be pin-pointed due to the usage of local reference points. Therefore, only the continuity of graphite schist in contact with Khondalite/Granite Gneiss and Pegmatites needs to be established by exploratory drilling/contact mapping/EM/SP surveys. The Dhourakhaman block falls on the western limb of the regional fold having graphite mineralization dominantly but not to limited migmatised khondalites. Minor graphite occurrences in associated granites and pegmatite bodies are also recorded. The samples taken from the flaky form graphite showed FC range from 1.49 to 45.23 %.

1. Block Summary

Physiography

The physiography is dominantly structurally controlled and falls south of the arcuate Gandhamardhan range forming a water divide. The different hill ranges in the area have NE-SW to ENE-WSW trends in the northern part which swerves to the general N-S direction in the southern part. The Gandhamardhan range is table land having the highest elevation of about 1000m above MSL. To the SW lies the Chandil range known as the Patpani range in the southern extension. The drainage of the area is mostly controlled by joints. In the northern part, the Sukhajhor (also known as katanginala) flows north-easterly and joins the Suktel River. In N-E of the study area, the Lant River forms the major drainage and flows to the N-E to join ultimately Tel River, further SE. In the Southernmost part of the area, the Arjuna Nala flows SE and joins the Udanti River.

Figure 1 : Map showing location of the proposed block

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

The study area in eastern India is located within the Sargipalli graphite belt. The area represents parts of the Eastern Ghat Supergroup comprising strongly metamorphosed rocks Viz, khondalites (and their migmatitic derivatives) calc-granulite and garnetiferous quartzite associated with granite gneisses, pegmatites, and quartz veins. The Eastern Ghat Mobile Belt (EGMB) extends from Brahmani River in Odisha to Ongone in Andra Pradesh over a stretch of 900 km with a width Varying from 30 to 300 km, the maximum width of Odisha. Graphite occurs either sporadically or locally concentrated in the rock units.

Table 1 : Stratigraphic succession in the study area (Derived from GSI)

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

Geological setup of Dhourakhaman block

The Dhourakhaman block falls on the western limb of the regional fold having graphite mineralization dominantly, but not limited to migmatised khondalites. Minor graphite occurrences in associated granite and pegmatite bodies are also recorded. This portion of the limb is exposed. Two faults have been reported in the northern and southern parts of the study area and these faults have been verified by the presence of fault breccia. Most of the mineralization of graphite is present near the convergence zone of faults and shear zone. A detailed description of the lithology is provided as below.

1. **Khondalites**

The Khondalites are visibly represented by quartz-garnet-sillimanite-graphite gneiss and often grading into Granitic Gneisses that may host garnets. The contacts are not clearly demarcated. The Khondalites generally forms low mounds and subdued topography in the area as against of the NE-SW ridges in the west of region. The outcrops present themselves as grayish to reddish brown in Colour, medium grained and foliated. The constituting minerals are quartz, garnet, sillimanite, granite with some biotite and feldspar. The Khondalite occurrences along the Laul river are highly enriched in Iron probably through hydrothermal fluids circulating along the fault separating Calc-silicate rocks in contact with Khondalites.

2. **Calc Silicates**

The calc-silicates (Including Calc-granulites and Calc-schists) occur as linear bands whose lateral extension cannot be determined due to the soil cover. The available outcrops of calc-silicates are found intricately folded. The calc-silicate rocks are much more exposed in the Ganjaudhar, Turekela area. In the Ganjaudhar area, which falls west to the study area, contact between Khondalites and Calc silicates is

observed to be transitional as outcrops of the Khondalites start showing typical ribbed texture along with development of calcareous mineral assemblage. This could be interpreted as transition from deep marine carbonate facies to fresh water alluvium facies. North of Belpara town, Calc-silicate rocks are being quarried for aggregates. The Calc-silicates in these quarries are dominated by Calc-granulites accompanied by minor bands of dolomitic limestones that are now metamorphosed into enclaves of para-amphibolites, Hornblendites and cluster of acicular Actinolite crystals. Further, evidence of emplacement of anorthosites are found within the Calc silicates with minor amounts of Biotite. The Anorthosites are fine grained and compact. The outcrops show large grains of Anorthite (or oligoclase?) in the hand specimen.

3. Graphite Schist

The Graphite schist is a hybrid product mainly developed within Khondalites/Migmatites mainly due to faulting activity that has then been intruded by acidic intrusive such as Pegmatites and Quartz veins. The Pegmatites associated with Graphite Schists are often garnetiferous indicating continued syntectonic movement during graphite mineralization. The structural trend of the graphite schist is often dictated by localized structures such as fault planes and shear zones. During the field visit to the locality, pinkish and translucent Pyrope garnets were also found to be concentrated within the pegmatites. The Graphite schists also show displacement along major planes and often show the development of Limonite along such planes.

Figure 2 Highly sheared and limonitized outcrop of Khondalites in direct contact with Calc silicates near Laul River

Figure 3 Different outcrops of calc silicate rocks found in vicinity of the study area.

Figure 4 Outcrop of Graphite Schist in Larki abandoned quarry.

Figure 5 Migmatised Khondalites near Maguri Pahar (Bender II RF)

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

The block forms a part of the Sargipalli Graphite belt that conforms to the "Western Zone" (Acharya and Dash, 1984). The structural fabric of the area consists of NNE-SSW/NE-SW trending ridges in the western portion of the study area. The block is in strike continuity of Khondalite is observable for a distance of approximately 36 Sq. Km. The occurrence of thin alternating bands of calc silicate rocks, notably Calc-granulite is often observed with all the graphite deposits, however Calc-gneisses with complex folding patterns are also available.. The mineralogical and structural changes at the contact of calc-silicates and Khondalites is also a favored site for graphite mineralization as seen in Khairmal Graphite block falling east to the now proposed Turekela block.

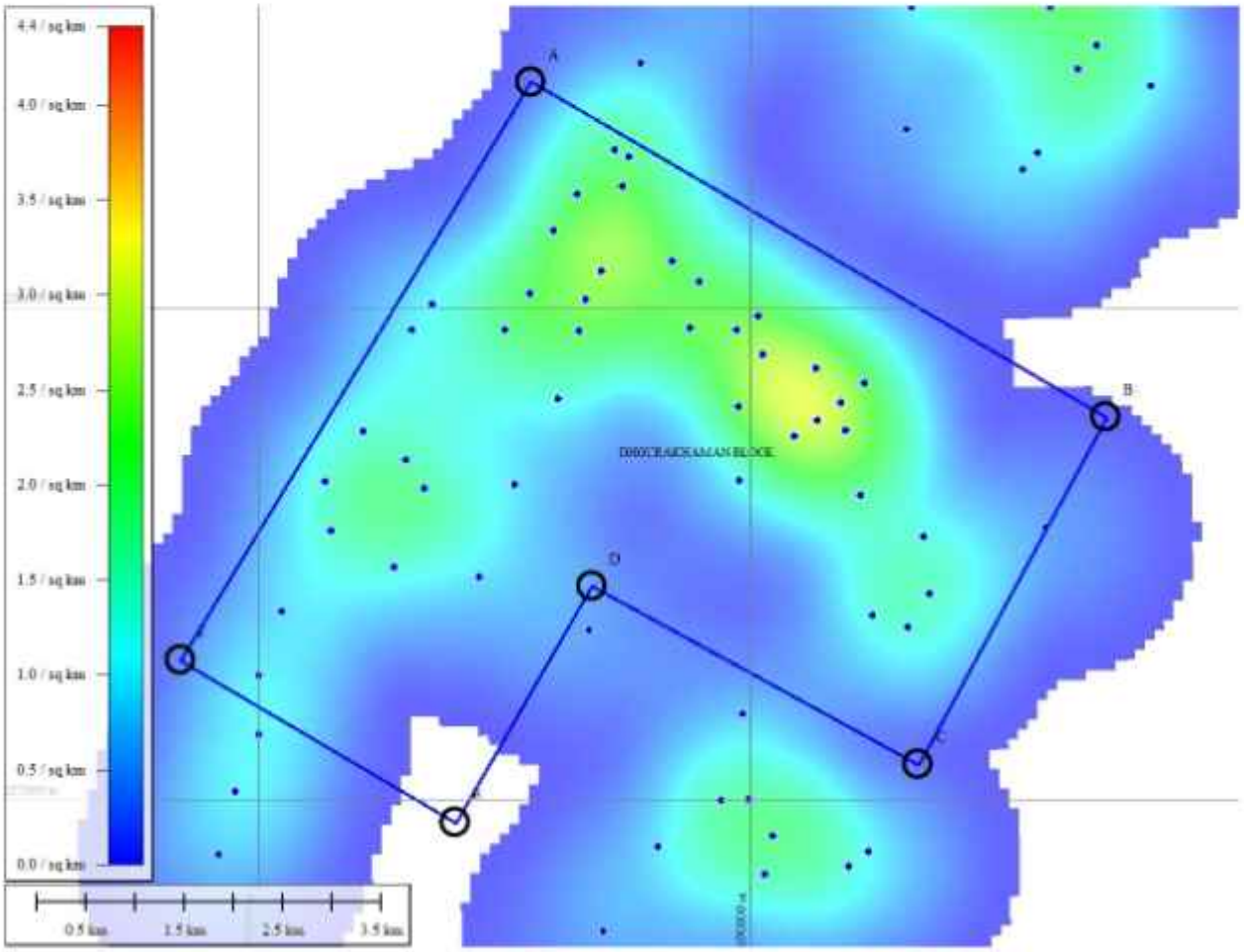
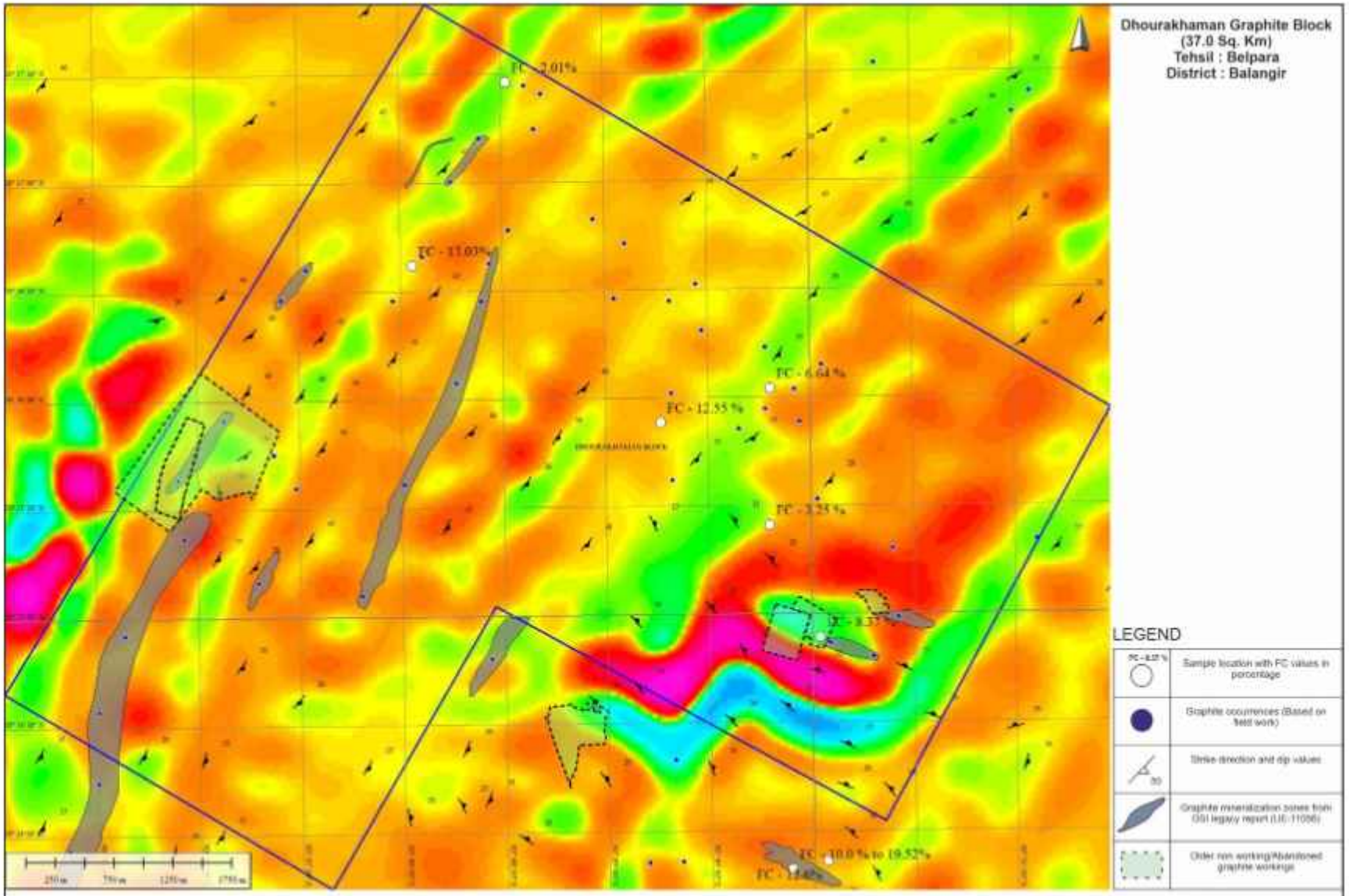


Figure 6 Distribution of graphite occurrences in the Balangir district (derived from Field observations and GSI legacy reports)



Layout showing the proposed graphite block over 2nd Vertical Derivative along with locations of the collected samples (with FC values in %)

Figure 7

As observed, the major domain of the foliation/schistosity planes is NE-SW in the Western portion of the Bolangir. This portion of the Bolangir area has profuse outcrops of Khondalites and migmatites with intrusions of granite gneisses. The trend of the foliation plane in the north then turns NW-SW and N-S in the eastern portion, thus mimicking a fold. The WNW-ESE lineations conform to the Mahanadi trend and often manifest on the surface as fault breccia.

After familiarizing with the local geological fabric of the area, the abandoned quarries of falling within the block were examined. Since the pits are waterlogged and have been in the waterlogged condition since 90's, only the walls of the pits and surrounding excavation was available for first hand observation. The first abandoned quarry to be visited was the Malikdar Quarry located near NE corner of the proposed block. The Malikdar Quarry consists of a cluster of 07 pits. The Malikdar cluster of quarries is bounded by a high magnetic anomalous zone (Refer figure 7) which appears to be a fold within the Leptynites. The quarries are water-logged at present and since these pits are aligned to regional structural lineaments, chronic seepage along fault planes at greater depth can be expected. The host rock here is Khondalite, which is highly jointed and shows occasional folding. However, it was not possible to measure the structural attributes due to extreme weathering of excavated surfaces.
The following salient observations can be made ;

- The pegmatitic activity is very apparent in the area. The pegmatites are emplaced concordantly within the foliation planes of the Khondalite. The graphite mineralization is found to be along these planes and away from these zones of emplacement, the Khondalite is barren.

- The occurrence of Graphite Schist is of importance here, as all the graphite

mineralization occurs within a thin horizon of Graphite Schist where the flaky graphite interlaths with Quartz, Biotite, and occasional Garnet. The graphite schist follows the major deformation plane and pinches/swells according to its host lithology. It is estimated that at the depth of 20-25 meters, the estimated thickness of graphite schist exceeds 8 to 10 meters and gradually tapers off to form a lensoidal body.

- The section of the pit shows minor mineralization that confirms the graphite association with Khondalite, Pegmatite and shearing activity. The Pegmatite bodies show rough zoning where Pyrope Garnets are dominantly found in pegmatites near the graphite mineralization.

- Rock chip samples collected from Bender I and Bender II forest provide FC values of 2.01% to 13.03%.

- Rock chip samples derived from exposures of some abandoned graphite mines within and in vicinity of the proposed block

Location	Fixed carbon (%)
Malikdar	**8.37**
Turekela	**45.23**
Rautmunda quarry I	**10.68**
Rautmunda quarry-II	**1.49**

Figure 8 View of the Malikdar cluster of graphite quarries (abandoned)

Figure 9 View of Ganjaudhar Graphite quarry (Abandoned)

Geophysical data available over the area

Aeromagnetic data available of the area combined with foliation planes show distinct NE-SW trending magnetic pattern in the western portion of the study area. The trend is conformable with Khondalite outcrops that form synformal structure. The 'hinge' portion of this structure is deformed by cataclastic deformation brought upon by a fault or shear zone as observed by development of fault breccia near Amabanji. Two distinct ENE-WSW trending linear structures conforming to the Mahanadi trend are also observed that are thought to be deep seated dykes or faults, however their manifestations on the surface are to be confirmed based on further field work.

Some discrete packages trending NNW – SSE of low magnetic areas are observed near the study area, field observations indicate low magnetic bodies such as acidic dykes or calc granulites (as near Belpara quarries).

Figure 10 Leptynites overlying the Bengpal Gneisses south of Malikdar cluster of quarries (Ref : Figure7)

Scope for proposed exploration.

1. **Geological Mapping**

It is proposed to conduct geological mapping at 1: 12,500 scale to identify soil type, lithology and structural fabric that would be important in identifying the controls of mineralization of graphite in the study area. The mapping in the area was initiated by GSI through Sh. S. C Chakrabarti in FS 1948-49, followed by Sh. M.W Tak in FS 1958-59 and 1961-62 along with Sh. S. Roy Choudhury. Later works of tracing graphite quarries was inventoried by Sh. S.D Mohanty in 1980-81. The scale of the mapping was 1 : 63360. Therefore, a LSM programme is warranted for seeking continuity of graphite bearing horizons in the area.

2. **Pitting/Trenching**

The graphite schist dips at gentle to moderately high angles and is influenced by the contact and nature of both Khondalites and pegmatites. However due to development of sandy soil over the khondalites and changed land use over the decades, trenching may be required to establish the continuity of the graphite schist between the intermediate areas between the SP survey lines.

The total quantum of excavation is proposed to be 150 Cu.M.

3. **Ground geophysical Survey**

As noted by the earliest GSI workers, the self-potential methods and Induced Polarization methods of ground geophysical survey are the best tools to delineate graphite deposits. The trend of the graphite veins or graphite bearing schist have often been picked up as SP anomalies in the legacy reports. Coverage of the geophysical surveys conducted by GSI in various field seasons is provided in figure 7.

It is proposed to conduct 32 Line Kms of SP Survey in the area.

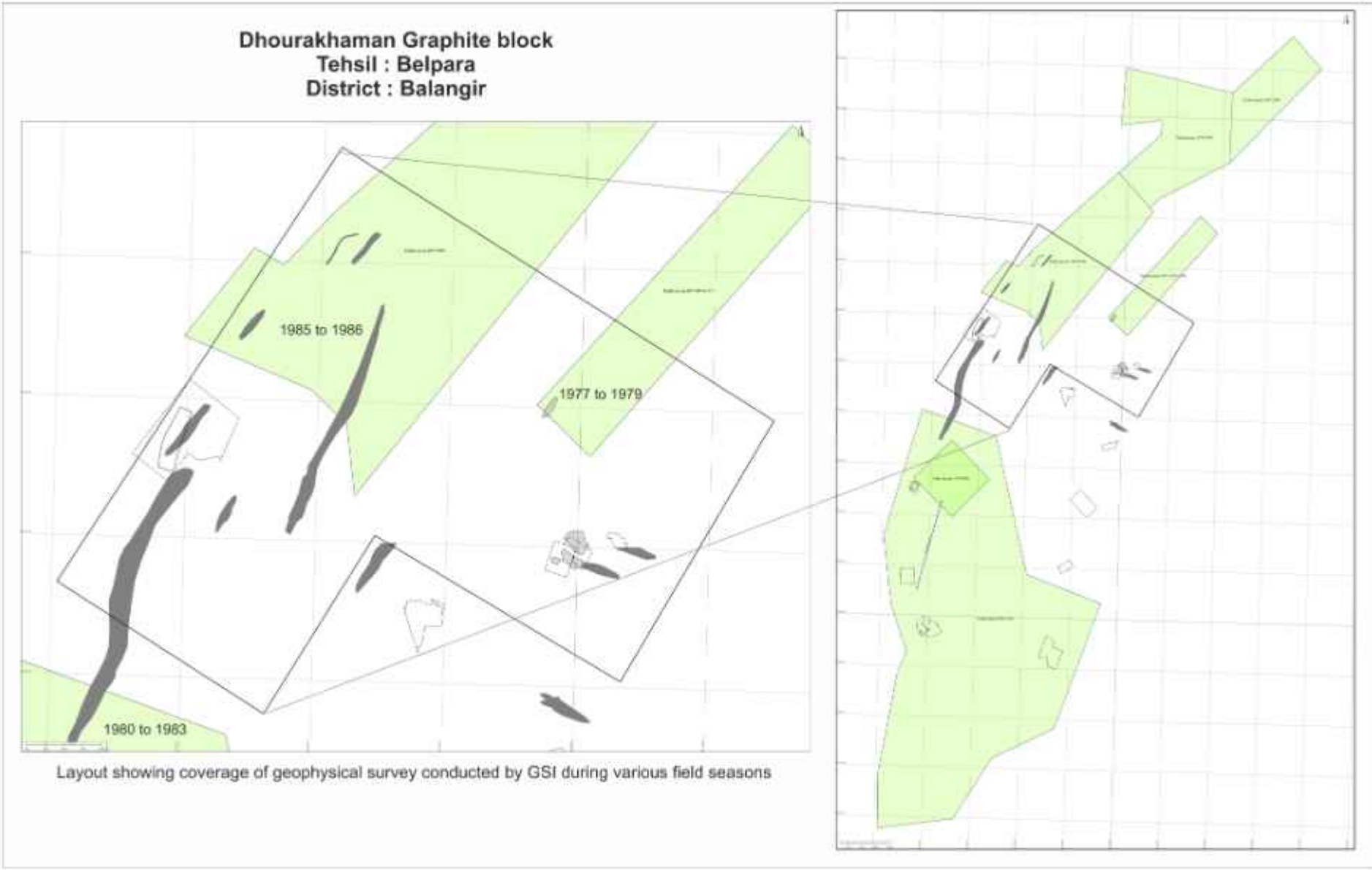


Figure 11 : Layout showing coverage of earlier geophysical surveys in legacy reports of GSI (UE- 10438)

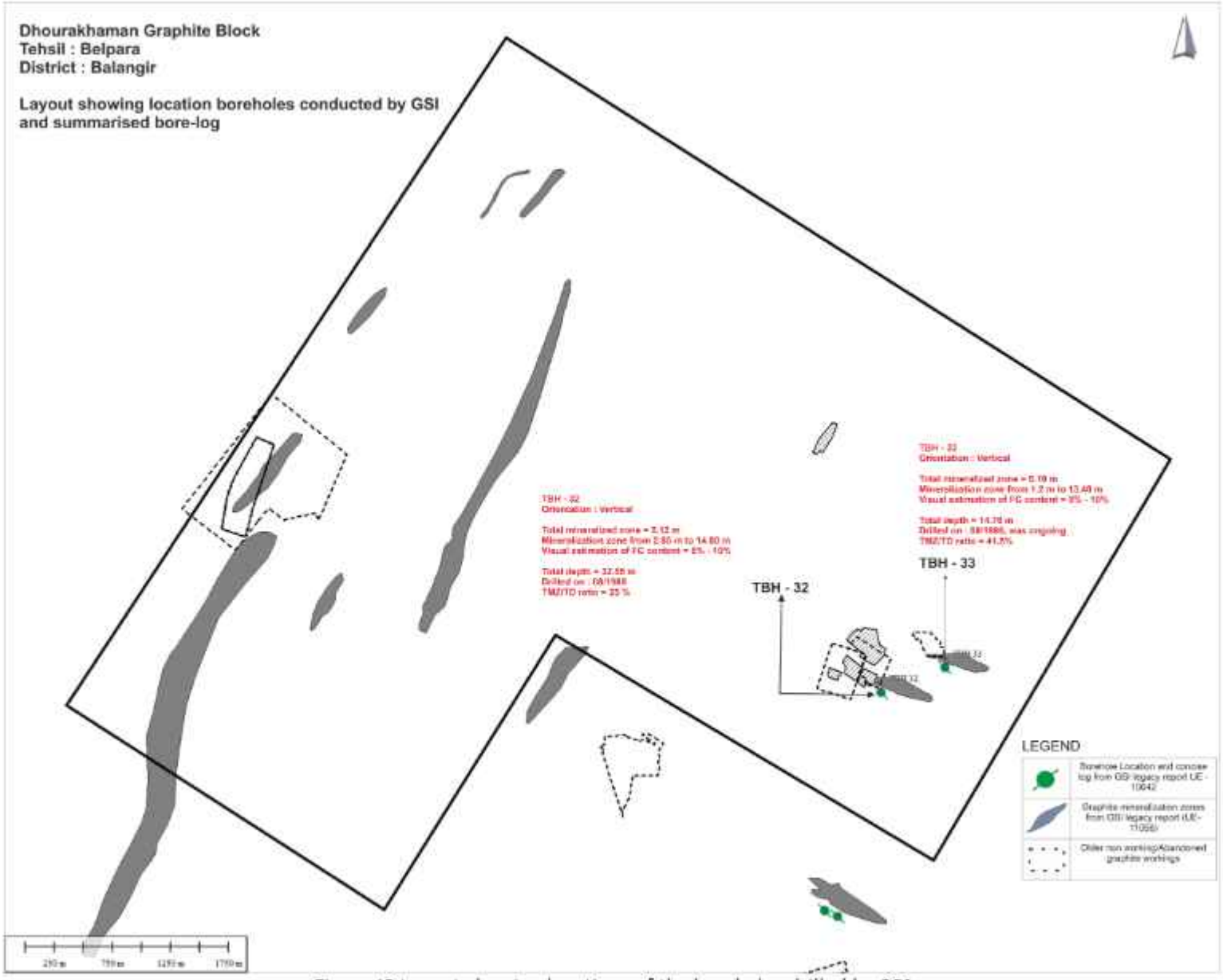


Figure 12 Layout showing locations of the boreholes drilled by GSI

4. Exploratory drilling and core sampling

The identified key target areas identified through geophysical survey, and pitting including the extension of existing flaky form graphite are to be drilled and core-sampled to get the samples for determination of Fixed carbon, Moisture, Volatile matter, and Ash content.

A total number of 15 exploratory holes of 70 meters depth have been proposed with a total meterage of 1,050 meters.

Observation and Recommendations of previous work.

GSI. PUB. UE 9862

Report On the Investigation For Graphite in parts of Bolangir And Kalahandi Districts, Orissa

(Progress Report for the field season 1980-81 by Sh. S. D. Mohanty)

General observations and recommendations made by the author in the report

- The workable graphite concentrations are located within the porphyro-blastic granite gneiss. The migmatisation has, therefore, a great role to play in the formation of the graphite deposits and the localization of which has often been controlled by structures.

- Hydrothermal activity is responsible for the growth of good graphite flakes.

- The band type graphite bodies have greater strike and depth continuity, though low in grade.

- The inventory work should be continued in the rest of the quarries of the two belts to complete assessment of the minimum available graphite resources.

- Reconnaissance along with intensive scanning supported by pitting and trenching wherever necessary should be conducted in other areas further south and SE of present area to test the new finds and demarcate promising graphite zones.

- The different types of graphite body vary in strike length and depth continuity. Normally, the band type of bodies extend along strike for more than 400 m (e.g., Dhourakhaman), but smaller bodies as short as 80m in strike length (e.g., Dohalagarh) have also been noted. Depth persistence beyond 30 m (e.g., Mahanilaha) is noted in some quarries while it is around 10 m in others. The lensoid and lenticular bodies on the other hand may go deeper depending upon the disposition of the longer axes of the bodies.

- The high grade graphite bodies, in the form of lenses and veins, are found along structurally weak zones. Such weak zones are joints, parallel or subparallel to foliation, shear, fault planes and hinges of folds. Concentration of graphite as veins along foliation joints is seen at Hakadunari and Bijeka hill occurrences. Similar concentration is also noted in Dhourakhaman, Rengali, Mahanilaha and Ganjaodar quarries. Graphite mineralisation is evidenced in these quarries alone shear planes developed parallel or sub-parallel to the host rock foliation. This is also observed in quartz veins in which graphite flakes are aligned along fracture planes sub-parallel to the host rock foliation. Graphite concentration in the hinge zones of both tight and open folds is observed at Lohakhan and Dhourakhaman the resultant bodies have lensoid appearance. In Ganjaodar quarry, graphite mineralisation is noted along north -westerly trending minor faults.

2. Previous Work

Previous Exploration in adjoining area

Report No	Report Title/Authors	Year	Work undertaken
UE 5772	A Report On The Detailed Investigation On Graphite By Drilling In Sambalpur And Bolangir-Patna Districts, Orissa. Prateek Bose	FS 1966 - 1967	Exploratory drilling over geophysical anomalies.
UE 6364	Progress Report On Graphite Investigation In Sargipalli Belt, Bolangir District, Orissa S.D.Mohanty and B Sarangi	FS 1976-1977	Geological mapping
UE 7268	Progress Report On Investigation For Graphite In Sargipali And Titlagarh Graphite Belt Bolangir District, Orissa S. C. Kanungo & S. D. Mohanty	FS 1975-1976	Geological mapping at 1 : 63,360, Pitting and trenching near Malisira
UE 7310	Report On Geophysical Investigations For Graphite In Turekela Block, Bolangir Dist., Orissa N. Kar, A. P. Das & O. N. Tarafder	FS 1980-1981	Geophysical survey
UE 7421	Report On The Investigation For Graphite Occurrences In Sargipali Graphite Belt, Bolangir District, Orissa	FS 1977-1978	Geological mapping of graphite bearing areas and possible reserve estimation of

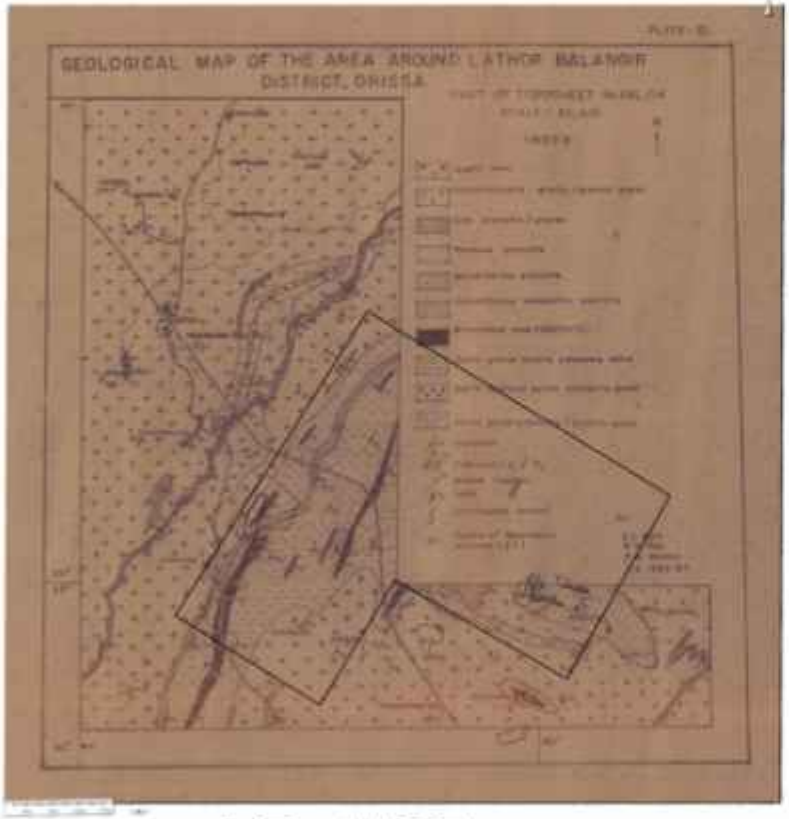
	S. D. Mohanty		some of the quarries
UE 7767	Report on the Investigation For Graphite in parts of Sambalpur, Bolangir and kalahandi District, Orissa. S.D. Mohanty and B.Sarangi	FS 1979-1980	Geological mapping
UE 8094	Report On The Investigation For Graphite In Bolangir, Sambalpur And Kalahandi Districts, Orissa S.D. Mohanty & O.P. Joshi	FS 1978-1979	Geological mapping of graphite bearing areas at 1 : 63,360 and 1 : 15,840 and test pitting
UE 8985	Report on Regional Geophysical Surveys for Graphite in Turekela Block,Bolangir District. H.Das and O.N.Tarafder	FS 1983-1984	Geophysical survey
UE 9862	Report On The Investigation For Graphite In Parts Of Bolangir And Kalahandi Districts, Orissa S. D. Mohanty	FS 1981-1982	Geological mapping, inventory and channel sampling
UE 9883	Report on Regional Geophysical Surveys for Graphite in Turekela Block, Bolangir District. H.Das and O.N.Tarafder	FS 1983-1984	Geophysical survey
UE 9099	Report On Geophysical Investigation For Graphite Mineralisation In Turekela Block Of	FS 1982-1983	Geophysical survey

	Titlagarh Subdivision, Bolangir District, Orissa H. Das & O. N. Tarafder		
UE 9999	Report on Large scale Geological Mapping for Graphite Occurrences in Parts of Koraput District, Orissa A.K.Lal & K.P.Singh	FS 1982-83	Geological mapping
UE 10171	Report On The Investigation For Graphite In Turekela And Bakbera Areas Of Bolangir And Kalahandi Districts. Orissa S. D. Mohanty, P.Chakrabarti & V.Ankanna,	FS 1982-83	Geological mapping
UE 10305	Report On The Investigation For Graphite In Salepali And Turekela Areas, Bolangir (Balangir) District, Orissa. S. D. Mohanty, S. C. Rath and S. C. Kanungo	FS 1984-1985	Geological mapping
UE 10375	Report On The Graphite Investigation In Parts Of Bolangir, Kalahandi And Phulbani Districts Of Orissa S. C. Kanungo, S. D. Mohanty, K. N. Nanda and V. Ankanna	FS 1983-84	Geological mapping
UE 10438	Report On Geophysical Investigation For Regional Assessment Of Graphite In The	FS 1985-1986	Geophysical survey

	West Of Talbhata & Pandikimal Areas, Bolangir District, Orissa H.Das, S. Chakaraborty and O.N.Tarafder		
UE 10642	Interim Report On Regional Assessment Of Graphite Resources In Sargipali Graphite Belt Covering Parts Of Balangir District, Orissa S. C. Kanungo, R. M. Khuntia, S. D. Mohanty & S. C. Rath	FS 1985-86	Photogeological study
UE 11150	Photogeological Studies On The Assessment Of Graphite Resources In Titlagarh - Sargipali Belts In Parts Of Balangir And Sambalpur Districts, Orissa. U. N. Satapathy	FS 1987-1988	Photogeological study
UE 11254	Report On The Geophysical Investigation For Regional Assessment Of Graphite Resources In Parts Of Titlagarh Area, Bolangir District, Orissa G. Kameshwara Rao, R.N. Kapoor and Dr H.K. Kundu	FS 1988-1989	Geophysical survey

Dhourakhaman Graphite Block
Tehsil : Belpara
District : Balangir

Layout showing the location of the proposed block over earlier works of Geological Survey of India



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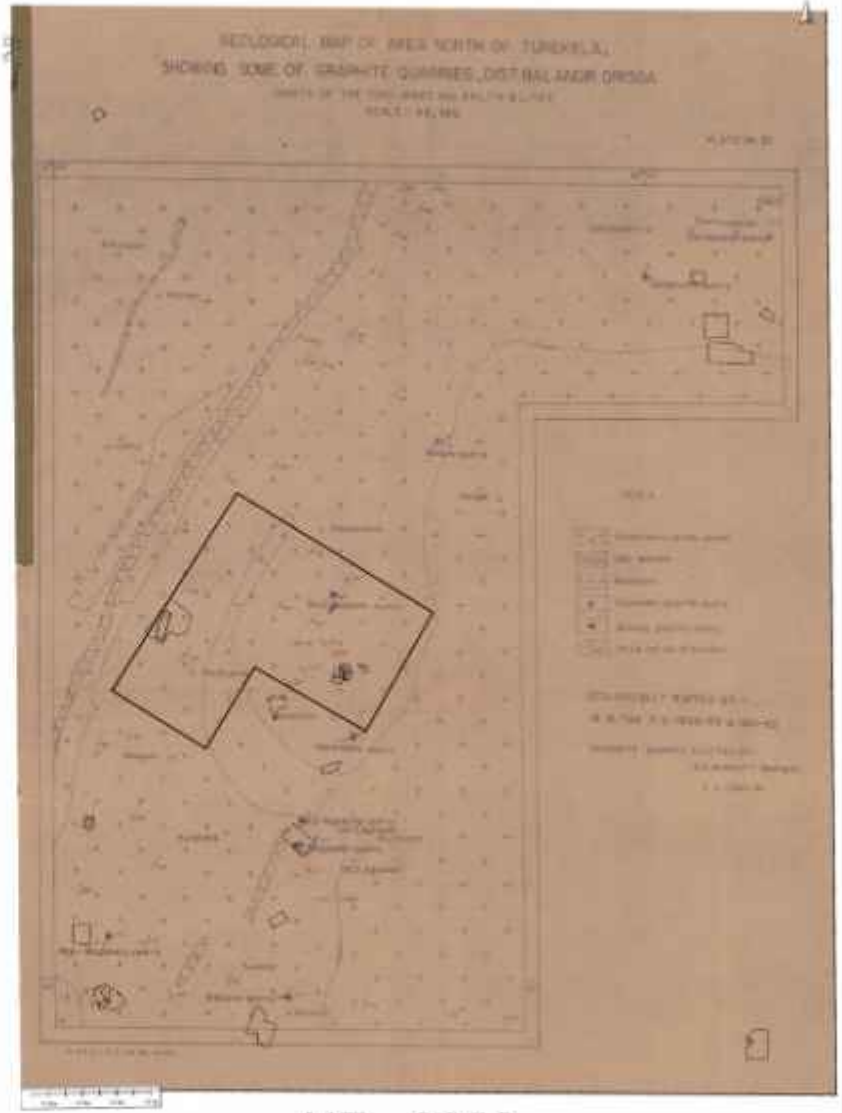

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Figure 13

Previous Exploration in the proposed block area:

The above mentioned table consists of works of GSI and DoMG in the proposed block area and the adjoining areas.

Regional geological map adapted from GSI (1:50,000 scale)

Available and attached as annexure

3. Block description

Corner	Longitude	Latitude	Area of the block
1	82.802	20.63	37.0 Sq. Km
2	82.767	20.578	
3	82.794	20.562	
4	82.808	20.584	
5	82.839	20.567	
6	82.858	20.599	

4. Planned Methodology

a. Work allocation

The on-site team shall consist of one senior geologist along with a team of field geologists and field assistants. Based on the initial field observations regarding the fabric of the area, the work will be further allotted primarily by scouting the available outcrops over the soil-covered area and indications of graphite mineralization.

b. Geological mapping and fieldwork

Geological mapping at a scale of 1:12,500 has been proposed for an area of 37.0 Sq. km, further infilling of observed mineralized zones can be considered for mapping at 1 : 2000. This will include tracing of the existing graphite schist observable in the

abandoned pits in the strike of the contact. From the available outcrops, rock chip sampling will be conducted. While all the samples bearing visible graphite will be subjected to analysis for FC, Ash, Moisture and Volatile matter, some samples will be subjected to whole rock analysis and petrological analysis to get further insight into the local geology. Some key samples will be examined for major oxides, petrological analysis, and rest of samples will be analysed proximate analysis for FC content as default.

c. Geophysical survey

Since graphite mineralization responds particularly well to SP survey, the self-potential method (SP) has been found to be instrumental in bringing out anomalies of graphite in the Bolangir region. However, the results of the SP survey must be rigorously verified by excavation or by drilling.

A total of 32.0 Line kilometers is envisaged to cover the areal extension satisfactorily. The spacing between the traverses is kept being 100.0 meters to anticipate any change in trend of the graphite bearing graphite schist..

d. Trenching

Since the graphite-bearing vein is concealed under a mantle of soil, trenching would be needed to verify the results of SP survey that is being conducted to test the extension of the existing graphite vein in the area.

A cumulative of 150.0 Cu.M of excavation is proposed for this area.

e. Exploratory drilling/Scouting holes

15 Nos of boreholes with a tentative depth of 70.0 meters are being proposed for the area, with targets defined by both the large-scale geological mapping and SP survey. Therefore, total meterage is expected to be at 1050.0 meters.

5. Nature, Quantum, and Target

Sr. no	Item	Description	Qty	Unit
1	Geological mapping and collection of surface samples.	1 : 12500	37	Sq. km
3	Surveying of boundary pillars (06 Nos), borehole locations (15 Nos) and SP survey (1 Nos TBM)	By DGPS	22	Observation points
4	Excavation		150	Cu.M
5	S.P Survey		32	Line Km.
6	Drilling	Medium rock 15 BH – 70 m each	1050	Metres
7	Bore hole plugging and construction of concrete pillars		15	Nos
8	Sample analysis (including RC samples, Trench bulk samples and borehole samples) BRC = 80 samples + 10% QC samples, Core samples 110 + 10% QC samples, Excavation = 20 Bulk samples + 10 % QC samples		231	Nos
9	20 Nos whole rock analysis by IC-OES/ICP – MS and 30 Nos samples for major oxides		10	Nos
10	Petrography, digital microphotograph and Thin section preparation		25	Nos

6. Time schedule of the project

Time-line for G3 level exploration in Dhourakhaman Graphite block, Balangir, Odisha (Area : 37 Sq. Km)

ODISHA MINING CORPORATION

Presented to 68th NMET TCC meeting

Phase	Activity	2024				2025											
		Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12	Month 13	Month 14	Month 15	Month 16
		September	October	November	December	January	February	March	April	May	June	July	August	September	October	November	December
Phase 1	Geological mapping and surveying											MONSOON					
	Chemical analysis of BRS samples																
	Petrological and mineralogical studies																
	Geophysical survey (Self Potential survey, including tendering process)																
MID TERM REVIEW		MID REVIEW AFTER 6 MONTHS															
Phase 2	Excavation (Trenching or pitting as appropriate based on field experience																
	Drilling of 15 boreholes (time period includes mobilization and tendering process)																
	Chemical analysis of trench and core samples													BUFFER PERIOD			
	Interpretation of results and buffer period																
	Preparation of Geological report according to MEMC																
	NMET Presentation and project closure																
		2024				2025											

Project duration : 16 months

Field days = 90

7. Tentative budget of the project

Estimated cost of Prospecting exploration (G3) for Graphite in Dhourakhaman Block (37.0 Sq. Km), District : Bolangir, Odisha
Name of the Exploration Agency - Odisha Mining Corporation Limited
Total area : 37 Sq. Km, Completion Time - 16 months, Review - 6 months, 12 months

Annexure - 11A

Sr.no	Item of work	Unit	Rates as per NMET SoC		Estimated cost of the proposal		Remark
			SoC Item (Sr. no)	Rates as per SoC	Qty.	Total amount (INR)	
1	**Geological Work**						
a	Geological mapping at 1:12,500 and BRS sampling						
b	Charges for one geologist per day at HQ	Charges for one geologist per day	*1.2*	9,000.0	60	**5,40,000.0**	60 man-days at HQ
c	Charges for one geologist per day at field	Charges for one geologist per day	*1.3*	11,000.0	180	**19,80,000.0**	2 geologists x 90 days
d	Charges of one sampler per day	Charges for one sampler per day	*1.5.3*	5,100.0	40	**2,04,000.0**	1 Sampler x 40 days
e	Demarcation of lease boundary, Fixation of borehole and determination of co-ordinates & Reduced Level (RL) of the boreholes by DGPS (including charges for labours deployed for the work) through DGPS	Per point of observation	*1.6.2*	19,200.0	22	**4,22,400.0**	Outsourced component
2	**Mineral Investigation**						
a	Excavation of pits upto 2 m depth	Per Cu. M	*2.2.1*	3,800.0	150	**5,70,000.0**	Outsourced component
b	Drilling for NQ size borehole (Diamond core drilling) - Medium hard rock upto depth of 300 m (Normal rate)	Per M	*2.1.3a*	10,100.0	1050	**1,06,05,000.0**	15 Nos BH of 70 m each (Outsourced component)
c	Construction of concrete pillar (12" x 12" x 30")	Per borehole	*2.7a*	2,000.0	15	**30,000.0**	Outsourced component
d	Tendering process cost	One time	*2.3*		1	**1,44,956.0**	2 % or 5 Lacs which ever is lower
3	**Geophysical survey**						
a	Self potential method	Line Km	*3.3a*	29,600.0	32	**9,47,200.0**	Outsourced component
b.	Expert charges for Geophysicist	Charges per day	*3.18*	9,000.0	2	**18,000.0**	Charges for QA/QC of geophysical data based at HQ, Outsourced component

4	**Laboratory studies**						
a	Analysis of one rock/soil sample for determination of apackage of 34 elements by ICP-AES/ICP MS	Per sample	*4.1.14*	7,731.0	5	**38,655.0**	Outsourced component
b	Major oxides	Per sample	*4.1.15*	4,200.0	5	**21,000.0**	Outsourced component
c	Proximate analysis of Graphite	Per sample	*4.1.16*	3,000.0	231	**6,93,000.0**	BRC = 80 samples + 10% QC samples, Core samples 110 + 10% QC samples, Excavation = 20 Bulk samples + 10 % QC samples (Outsourced component)
4.3	**Petrological studies**						
a	Preparation of standard thin section of the rocks	Per sample	*4.3.1*	2,353.0	10	**23,530.0**	Outsourced component
b	Completed petrographic/ore microscopic study/mineragraphic report of the rock samples	Per sample	*4.3.4*	4,232.0	5	**21,160.0**	Outsourced component
c	Digital photomicrograph of the thin sections	Per sample	*4.3.7*	2,380.0	10	**23,800.0**	Outsourced component
5	**Miscellaneous Charges**						
a	Preparation of exploration proposal	One number (5 hard copies along with soft copy)	*5.1*			**1,23,733.0**	2 % or 3.8 Lacs whichever is lower
b	Geological report preparation	Cost per 5 Hard copies of report along with soft copy	*5.2*			**7,50,000.0**	econnaissance Survey/ Preliminary exploration/General exploration/Detailed exploration exceeding ₹150 lakh but less than 300 lakh: A Minimum of ₹7.5 lakh or 3% of the work whichever is more and ₹3000/- per each additional copy.
c	Drill core preservation	Per M	*5.3*	1,590.0	200	**3,18,000.0**	Outsourced component
d	Charges for engaging skilled, semi skilled and unskilled workers attending work associated with mineral exploration project in the field/camp/HQ.		*5.7*	522.0	360	**1,87,920.0**	(4 Nos x 90 days) As per Central Govt. rules
6	**Peer review charges**		*LS*	30,000.0	1	**30,000.0**	

	Sub-Total (A)				1,76,92,354.0	
	Total of outsourced items				1,41,23,665.0	
	Operational charges based on the amount of total amount of outsourced items		ii		10,81,183.0	Flat 8.5 lacs + 5% on the balance
	Sub-Total (B) including the Operational charges				1,87,73,537.0	
	GST @ 18 %				33,79,236.7	
	Total (incl. of GST)				2,21,52,773.7	
	Total in Cr.				2.215	

List of Plates

List of Annexures

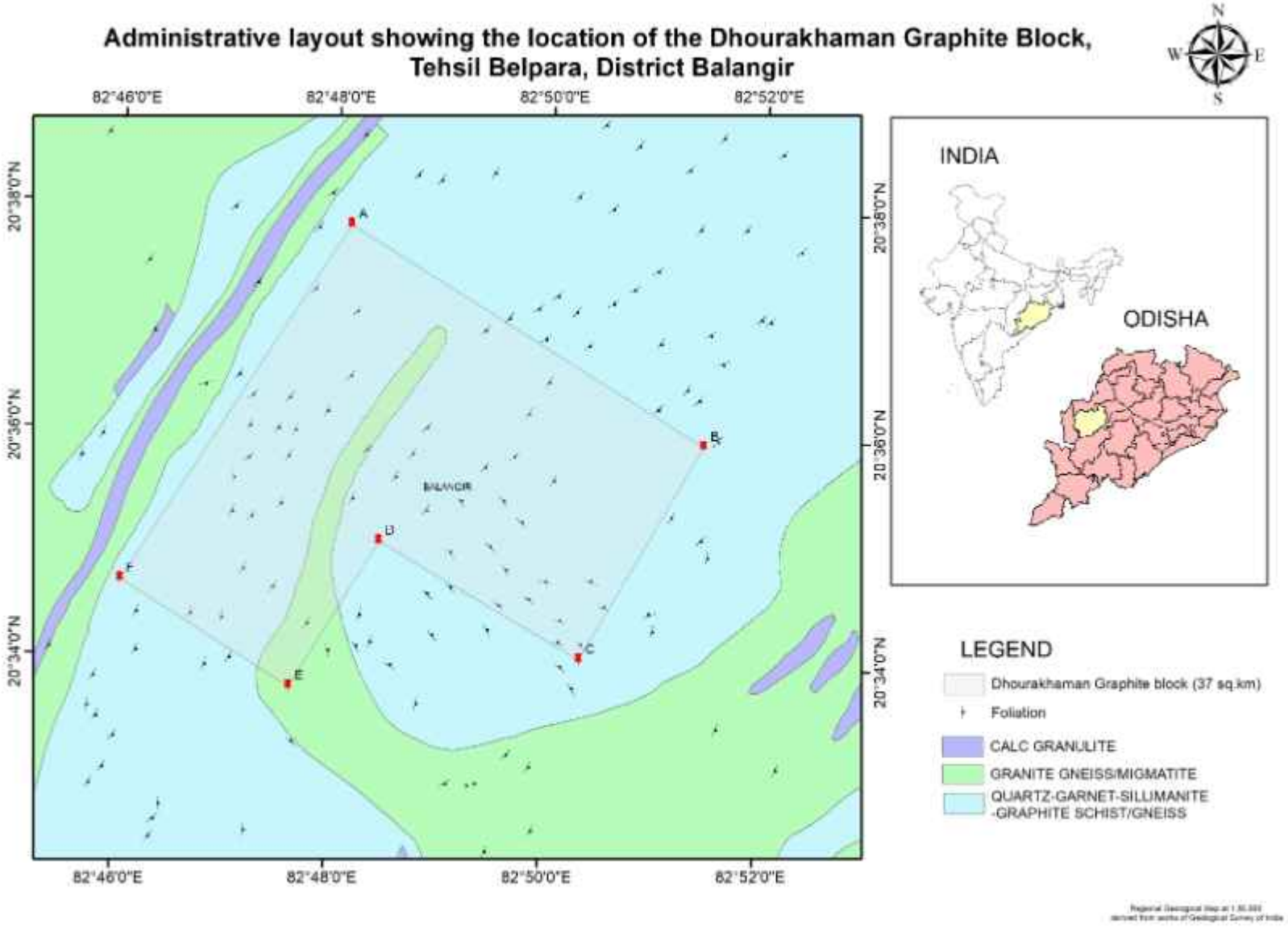

Plate 1 : Geological map at 1 : 50,000 (derived from GSI)

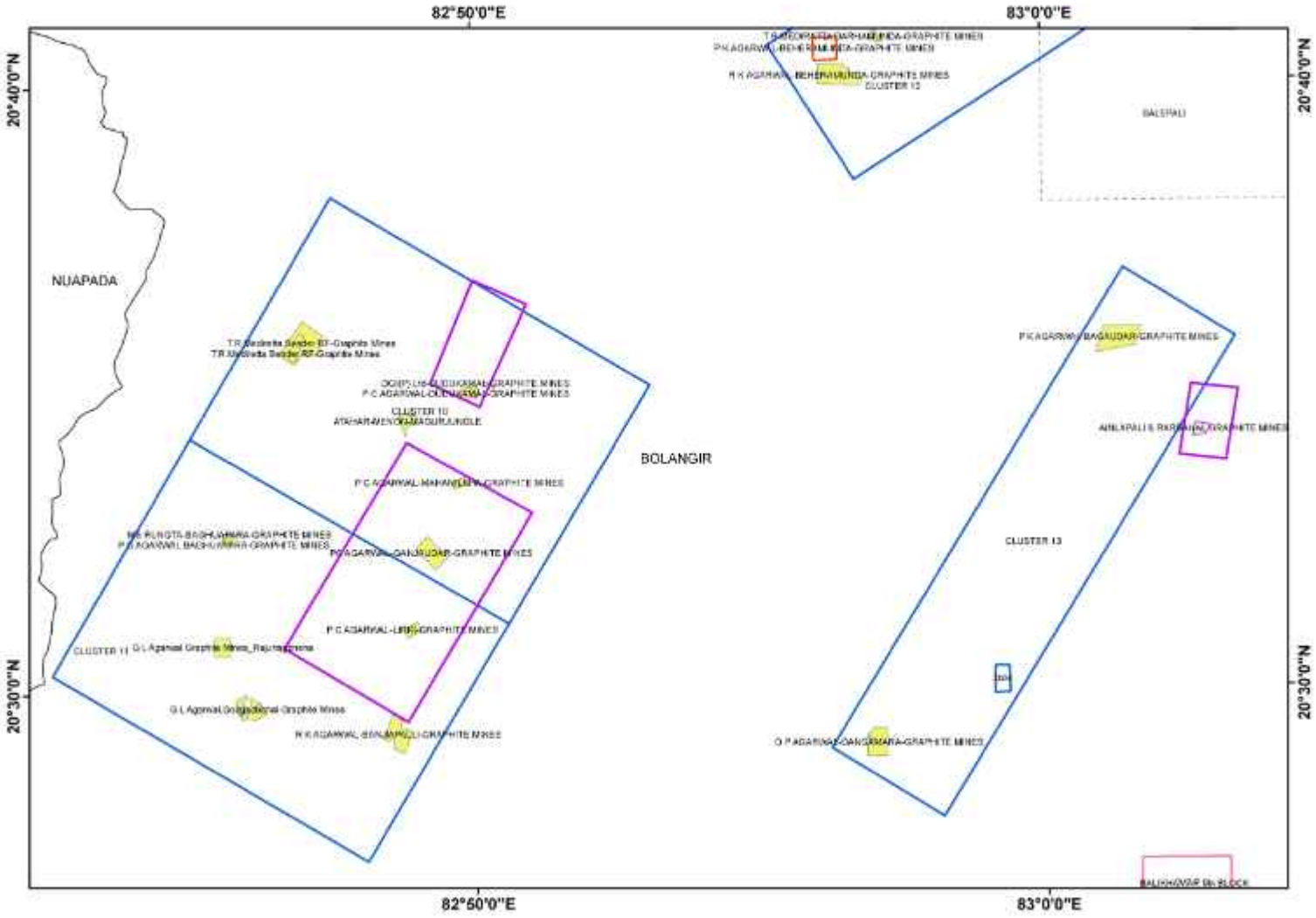

Plate 2 : Map sourced from DoMG Odisha showing location of expired/taken over graphite leases in vicinity of the block

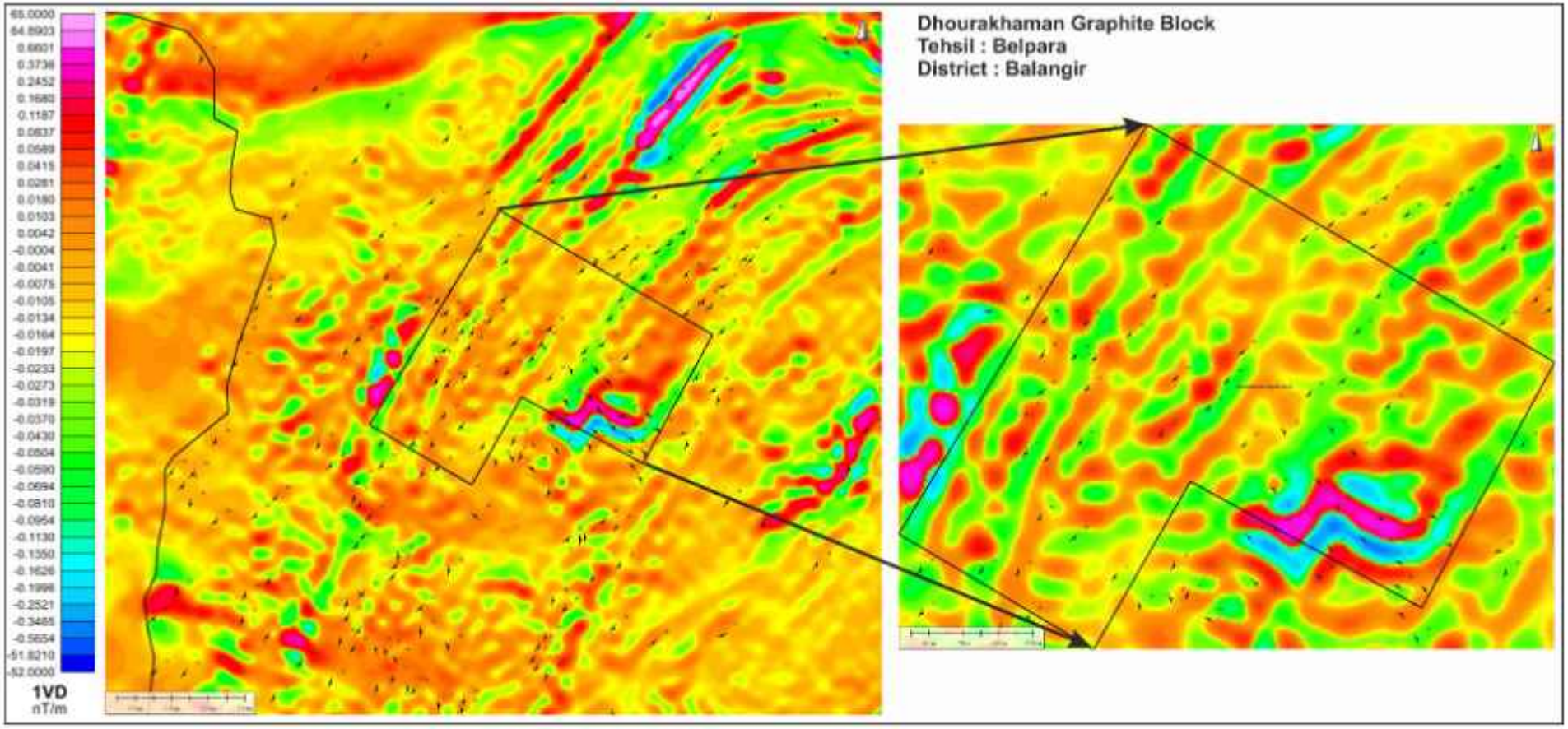

Plate 3 : Aeromagnetic data over the block showing prominent magnetic features

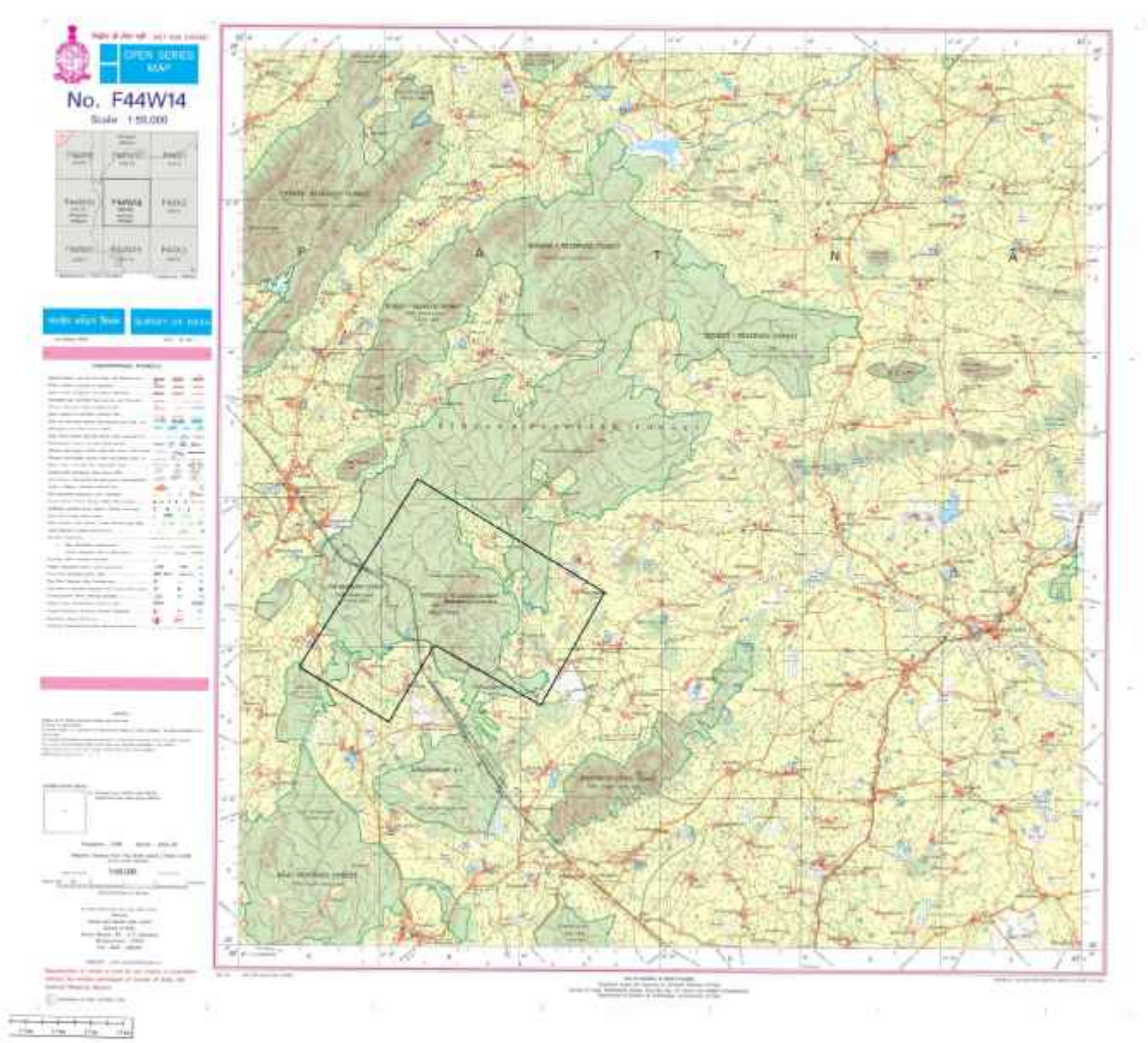

Plate no. 4 : Location of the block superimposed on Survey of India toposheet no. 64 L/14

Annexure 1 : Minutes of meeting from initial TEC meeting (state level)

DIRECTORATE OF MINES & GEOLOGY
STEEL AND MINES DEPARTMENT, GOVT. OF ODISHA,
BHUBANESWAR
Heads of Department Building, Unit-V, Pin-751001
Tel No.: 0674-2391537, Fax No.: 0674-2391684
Email ID: dirmines_odisha@rediffmail.com

No. GXVII(h) -8/22 14568 **/DoMG., Dt.** 06-12-2023

From

Sri Rajat kumar Kar,
Additional Director (Geology),

To

The Director/Sr.Geologist,GSI,Bhubaneswar
The Director (Project & Planning)/
G.M(Expolration)/DGM (Geology)OMC Ltd.
The Project Director/Project Manager/
Sr.Professional Geolgst/Jr.Professional Geolgst,STC
The Project Co-ordinator, IDPeX

Sub: Proceedings of the Technical Evaluation meeting held on 07.11.2023 for discussion on further level of Explorations on Graphite Blocks recommended by STC

Sir,

In reference to the captioned subject, I am directed to send herewith the proceedings of the Technical Evaluation meeting held on 07.11.2023 under the Chairmanship of the Director of Mines & Geology, Odisha for information and necessary action.

Encl: As above

Yours faithfully,

ADDITIONAL DIRECTOR (GEOLOGY)

Proceedings of the Technical Evaluation meeting held on 07.11.2023 under the Chairmanship of the Director of Mines & Geology, Odisha for discussion on Graphite blocks recommended by Strategic Technical Consultant (STC) for further level of exploration

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A Technical Evaluation meeting was held on 07.11.2023 at 4.00 PM in the Conference Hall of the Directorate of Mines & Geology, Odisha under the Chairmanship of the Director of Mines & Geology, Odisha with the agenda to discuss the graphite blocks identified by STC and finalise the blocks for a further level of exploration as a part of MRM. The list of participants present in the meeting is in ***Annexure -I***.

The Director of Mines & Geology, in his welcome address appraised the objective of the Committee Meeting & asked the Director (Project & Planning), OMC to summarise the findings of the STC where three Graphite Blocks have been identified after integration of the legacy data of different exploring agencies.

The Representatives of STC made a PPT presentation of the target graphite blocks of Balangir District as detailed below

SLNo	Name of the Block	District	Area in sq km	Proposed Level of Exploration
1	Kharmal Graphite Block	Balangir	3.119	G3
2	Magurjungal Graphite Block	Balangir	5.909	G3
3	Turekela Graphite Block	Balangir	32.194	G3

After the deliberation, it is observed from the background information available with DoMG that

- Turekela & Mangurjungal Graphite Blocks are 300m apart and included within two Cluster blocks (Cluster 10 & 11) identified by DoMG for future exploration which encompasses twelve number of Taken over Leases as briefed below.
- Similarly, Kharmal Graphite Block which includes Anilapali & Rarbahal Graphite Mines of Sri Antaryami Mishra over an area of 14.959 Ha which is a working mines having validity upto 2027. The proposed block is flanked by another Cluster -13 in its western margin, where two Taken Over Leases and one 10 A (2) (b) cases are also included within the Cluster Block.

Details of the Cluster Blocks

Name of the Cluster	Lessee Name	Status of Lease	Area in sq km
Cluster-10	T.R.Mediretta Bender RF-Graphite Mines	Taken Over Leases	188.911
	Atahar-Menon-Magurjungle		
	P C Agarwal-Dudukamal-Graphite Mines		
	DGI(P)LTD-Dudukamal-Graphite Mines		
	R K Agarwal-Dudukamal-Graphite Mines		
	P C Agarwal-Mahanilaha-Graphite Mines		
	PC Agarwal-Ganjaudar-Graphite Mines		
Cluster-11	P C Agarwal-Lirki-Graphite Mines	Taken Over Leases	
	R K Agarwal-Banjiapalli-Graphite Mines		
	G L Agarwal,Godgadbahal-Graphite Mines		
	GL Agarwal Graphite Mines_Rajunagphena		

	Ms Rungta-Baghuapara-Graphite Mines		
Cluster-13	P K Agarwal-Bagaudar-Graphite Mines	Taken Over Leases	68.459
	O P Agarwal-Dangamara-Graphite Mines		
	Gidhmal_Mundapala Graphite_Prabhas ch Agarwal	10 A(2) (b)	

After threadbare discussion, the following decisions were taken by the Committee.

- The G3 level of exploration will be taken up by OMC in Magurjungal & Turekela Graphite Blocks for mineral targeting while, the Cluster -10 & 11 may be taken as a whole from which 151.03sq km area will be covered at G4 level by OMC through Geological & Geophysical prospecting to delineate the mineralised zone and potentiality of Taken over Leases.
- Kharmal Graphite Block will be explored at G3 level by OMC excluding the ML area. The Committee recommended to allot the adjoining Cluster 13 covering an area of 68.459 sq km to OMC for exploration at G4 level.
- The available information on Taken Over Leases, 10 A (2) (b) case & ML area with DoMG need to be incorporate in the exploration plan by OMC.
- Representatives from GSI opined to conduct Geophysical Exploration over the target blocks at G3 level/ G4 level and the regional geophysical study by Heliborn Survey taking the back ground geophysical data of GSI covered areas where number of graphite incidences had already been reported.

The meeting ended with a vote of thanks to the Chair and other participants.

DIRECTOR OF MINES & GEOLOGY

Annexure-I

List of Participants

Sl. No.	Name	Designation	Signature
1	Shri G. Rajesh	I.F.S, Director of Mines & Geology, Odisha	
2	Shri K.C.Das	Director, GSI, Bhubaneswar	
3	Shri Rajat Kumar Kar	Addl. Director, Directorate of Mines & Geology, Odisha	
4	Dr. P.C. Mishra	Joint Director, Directorate of Mines & Geology, Odisha	
5	Dr. Kshirod Ch Brahma	Director, Project & Planning, OMC	
6	Shri Biswajeet Lenka	Senior Geologist, GSI	
7	Shri B.C.Sahoo	General Manager (Exploration), OMC	
8	Shri Mihir Ku Malla	Deputy General Manager (Geology), OMC	
9	Dr. R. Mohanty	Project Director, STC	
10	Shri Asim Chatterjee	Program Manager, STC	
11	Shri Navneet Sharma	Sr. Professional Geologist, STC	
12	Mr. Nadim Mohd	Jr. Professional Geologist, STC	
13	Ms Ipsita	Project Coordinator, IDPeX	

Annexure 2 : Notification of the graphite blocks for exploration under Rule 67 – MCR in favour of OMC Ltd.

Government of Odisha

Department of Steel & Mines

*****

No 2033 /S&M, Bhubaneswar dated the 07/03/2024

SM-AE-ME-0012-2022

NOTIFICATION

Sub: Notification of two mineral blocks under Rule 67 of MC Rules'2016 in favour of Odisha Mining Corporation for carrying out exploration.

Whereas, the Director of Mines and Geology has identified 2 (two) graphite blocks of Bolangir district namely Kahirmal Block and Magurjungal-Turkela block to be notified under Rule 67 of Mineral (Other than Atomic & Hydro Carbons Energy Minerals) Concession Rules'2016 for Geological exploration to be carried out by Odisha Mining Corporation Ltd.

Now, therefore, after careful consideration, the State Government has been pleased to notify aforesaid two blocks of Bolangir district under Rule 67 of MC Rules'2016 to be under taken for Geological exploration up to G2 level of UNFC by OMC Ltd. The time period for exploration shall be 2 (two) years from the date of issue of this notification. The block details is given below.

Sl. No	Name of the block	Mineral	T.S. No	Area in Sq. Km.	Block Coordinates		
					Pillar ID	Longitude	Latitude
1	Khairmal Block	Graphite	F44X2	83.494	1	82°26'13.37916"	20°29'01.10320"
					2	83°01'24.14346"	20°36'53.59263"
					3	83°03'21.66494"	20°35'44.98173"
					4	83°03'24.17529"	20°34'52.04414"
					5	83°03'11.10581"	20°33'42.15014"
					6	82°58'10.84970"	20°27'52.55501"
					7	83°02'39.33615"	20°34'06.21480"
					8	83°02'39.31078"	20°34'06.33200"
					9	83°02'39.64683"	20°34'06.24240"
					10	83°02'40.14387"	20°34'06.56221"
					11	83°02'40.07758"	20°34'06.29237"
					12	83°02'48.82514"	20°34'07.05699"
					13	83°02'53.82463"	20°34'13.85407"
					14	83°02'53.58636"	20°34'16.48476"
					15	83°02'44.69651"	20°34'18.19050"
					16	83°02'38.86862"	20°34'19.30466"
					17	83°02'37.69898"	20°34'13.94459"
					18	83°02'35.93938"	20°34'05.97910"

					Pillar ID	Longitude	Latitude
2	Magurjungal-Turkela	Graphite	F44W2	188.959	1	82°42'34.421"	20°30'19.124"
					2	82°47'31.268"	20°38'10.109"
					3	82°53'5.394"	20°35'1.806"
					4	82°48'4.979"	20°27'12.915"

By order of the Governor

01/03/2024.

(D. K. Singh)

Additional Chief Secretary to Government

Steel and Mines Department

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