P-1844

Maheshwari Mining Private Limited
Corporate Office : 21, C.L.M. Lane,
P.O.-Raniganj-713347, Dist.-Burdwan, W.B., India
Phone : 0341-2445446 / 5210, Fax : 0341-2446477
CIN No. : U14294WB1994PTC062325

Ref: MMPL/KOL-NMET/2023-16

Date: 01/09/2023

To,
The Director,
Directorate of Mines & Geology
Govt. of Odisha

**Sub: Submission of Detailed Project Report for G4 stage investigations on identified areas of Odisha State**

Respected Sir,

Maheshwari Mining Pvt. Ltd, has been accredited as a Private Notified Exploration Agency under Ministry of Mines vide certificate no. NABET/AEA/004.

We are hereby submitting our Detailed Project Report of Graphite to the State DGM & NMET.

It is requested to you kindly consider these detailed proposal .The details of the blocks along with the attachments enclosed are as follows:

| PROPOSED BLOCK | COMMODITY | DISTRICT | TOPOSHEET NO |
|---|---|---|---|
| Kanapulisi Block | Graphite | Raygada | 65M/11 |

Looking forward to have a positive response from your end.

Yours Faithfully

Anusrita Thakur
Senior-Geologist

MAHESHWARI MINING PVT. LTD. Kolkata

**For & On Behalf of Maheshwari Mining Pvt. Ltd.**
Date: 01.09.2023

Maheshwari
Global Technologies. Ecological Mining

Maheshwari Mining Private Limited
Head Office: 21, C.L.M. Lane, P.O.-
Raniganj-713347, Dist.-Paschim Bardhaman, W.B., India
Phone: 0341-2445446/5210, Fax :0341-2446477
CIN No.: U14294WB1994PTC062325

To
The Director & HoD
National Mineral Exploration Trust (NMET)
Ministry of Mines
F-114, Shastri Bhavan
New Delhi-110001

It is certified that:

1. Project titled "PROPOSAL FOR KANAPULIGI BLOCK, RAYAGADA DISTRICT, ODISHA STATE FOR RECONNAISSANCE SURVEY (G4 STAGE) UNDER NMET" along with estimated cost Rs. 2,52,95,831.50 Crores is submitted for consideration of NMET funding.
2. The project proposal is prepared following the guidelines prescribed in Minerals (Evidence of Mineral Contents) Rules, 2015 in case of mineral exploration project proposals.
3. The proposal has been duly examined and concurred by associate finance in accordance with canons of financial propriety.
4. The same project proposal or project proposal with similar objectives has not been submitted to any other funding agency by this organisation and the project proposal bears no duplication with existing work/ ongoing project undertaken by this agency.

Yours faithfully,

Signature

[Name & designation of Head of the Organisation]
[DG/Principal Secretary/Secretary (Geology & Mining)/CMD/CEO/MD]

Date 01.09.2023
Place KOLKATA

**Estimated cost of different work components of Graphite investigation of Kanapulisi area (G4 Stage)**

**Total area: 79 sq km, Period Of Completion: 12months**

| Sl. Nos. | Item of work | Unit | Rates as per NMET SoC 2020-21 | | Estimated Cost of the Proposal | |
|---|---|---|---|---|---|---|
| | | | SoC-Item-Sl No | Quantity | Rates as per SoC | Total |
| 1 | **Geological Mapping (on 1:12,500) (79 sq km)** | | | | | |
| | (a) Charges for 2 Geologists in field (without labourer) | per day per Geologist | 1.2. b | 120 | 11,000 | 1320000 |
| | (b) Charges for 2 Geologists at Headquarters | per day per Geologist | 1.2. a | 60 | 9,000 | 540000 |
| | (c) Wages for 4 labourers for geologist | per day | 5.7 | 240 | 345 | 82800 |
| 2 | **Land/Crop compensation** | per borehole | 5.6 | 10 | 2000 | 20000 |
| 3 | **Geochemical sampling (Bedrock sampling)** | 100nos | | | | |
| 4 | **Geophysical survey (Gravity survey, Magnetic survey and SP survey) (4.5 L.km)** | 4.5 L.km | | | | |
| | (a) Charges for 1 Geophysicist in field (without labourer) | per day | 3.18b | 60 | 11000 | 660000 |
| | (b) Charges for 1 Geophysicist at Headquarters | per day | 3.18a | 45 | 9000 | 405000 |
| | (c) Wages for 4 labourers in field with geophysicist | per day | 5.7 | 240 | 345 | 82800 |
| | (d) Charge for Gravity survey | per station | 3.1a.i | 350 | 3800 | 1330000 |
| | (e) Charge for Magnetic survey | per station | 3.2a.i | 350 | 1800 | 630000 |
| | (f) Charge for SP survey | per L.km | 3.3a | 4.5 | 29600 | 133200 |
| 5 | **Survey work** | | | | | |
| | (a) Surveyor Charges (without labourer) | per day | 1.6.1a | 45 | 8300 | 373500 |
| | (b) Labour(4nos) charges for survey work | per day | 5.7 | 180 | 345 | 62100 |
| 6 | **Technological Survey** | | | | | |
| | (a) Trenching | per cu m | 2.1.1 | 100 | 3330 | 333000 |
| | (b) Drilling | per m in soft rock | 2.2.1.4a | 1000 | 11500 | 11500000 |
| | (c) Borehole pillaring (construction of concrete pillar) 12 inches x12 inches x 30 inches | per borehole | 2.2.7a | 10 | 2000 | 20000 |
| | (d) Transportation of Drill Rig and truck(to and from Headquarter s or Previous drill site) | per km | 2.2.8 | 480 | 36 | 17280 |
| | (e) Drilling camp setting cost | per drill | 2.2.9a | 1 | 250000 | 250000 |
| | (f) Drilling camp winding cost | per drill | 2.2.9a | 1 | 250000 | 250000 |
| | (g) Monthly accommodation charges for drilling camp | per month | 2.2.9 | 2 | 50000 | 100000 |
| | (h) Approach road making to drill site | per km | 2.2.10 | 5 | 22020 | 110100 |
| 7 | **Laboratory Studies** | | | | | |
| | (a) Proximate analysis for graphite | per sample | 4.1.16 | 430 | 3000 | 1290000 |
| | (b) Analysis for associated trace element (Vanadium) | per sample | 4.1.15b | 430 | 421 | 181030 |
| | (c) Analysis for associated REE | per sample | 4.1.13 | 10 | 5380 | 53800 |
| | (d) Petrochemical studies (PCS) | per sample | 4.1.15a | 10 | 4200 | 42000 |
| 8 | **Petrographic studies** | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | (a) Preparation of thin sections | per sample | 4.3.1 | 10 | 2353 | 23530 |
| | (b) Study of thin sections | per sample | 4.3.4 | 10 | 4232 | 42320 |
| 9 | **Bulk Density/specific gravity Determination** | per sample | 4.8.1 | 3 | 1605 | 4815 |
| 10 | **Drill core preservation** | per m | 5.3 | 250 | 1590 | 397500 |
| 11 | **Geological Report preparation (5 hard copies with a soft copy)** | cost per 5 hard copies along with soft copy | 5.2 | | As the exploration cost is exceeding 50 lakhs but less than 150 lakhs. | 750000 |
| 12 | **Peer Review** | lumpsump | as per EC decision | 1 | 10000 | 10000 |
| 13 | **Preparation of exploration proposal (5 hard copies with a soft copy)** | one number (5 hard copies) along with soft copies | 5.1 | 1 | 2% of approved project cost or 3.8 lakh, whichever is lower | 380000 |
| | Grand Total of estimated cost: | | | | | **₹ 2,13,94,775.00** |
| | Grand Total including 18%GST | | | | | **₹ 2,52,45,834.50** |
| **Grand Total= Two Crore Fifty-Two Lakhs Forty-Five Thousand Eight Hundred Thirty-four only** | | | | | | |

# Proposal for Kanapulisi Block, Rayagada District, Odisha State for Reconnaissance Survey (G4 stage) under NMET.

**Commodity : Graphite**

**By**

**Maheshwari Mining Pvt. Ltd.**

Place:Kolkata
Date: 31-08-23

## Summary of the Block for Reconnaissance Survey (G4 Stage)

GENERAL INFORMATION ABOUT THE BLOCK

| | Features | Details |
|---|---|---|
| | Block ID | Kanapulisi Graphite Block |
| | Exploration Agency | Maheswari Mining Pvt. Ltd. |
| | Commodity | Graphite |
| | Mineral Belt | Eastern Ghats Mobile Belt, Rayagada District, Odisha |
| | Completion Period with entire Time schedule to complete the project | 1 year |
| | Objectives | |
| | 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 | By proposed agency |
| | Name/Number of Geoscientists | |
| | Expected Fielddays (Geology) Geological Party Days | |
| 1. | **Location** | |
| | Latitude | 19° 15' 00.00"N to 19° 20' 00.00"N |
| | Longitude | 83°35' 00.00"N to 83°40' 00.00"E |
| | Villages | Kanapulisi |
| | Tehsil/Taluk | Bissamcuttack |
| | District | Rayagada |
| | State | Odisha |
| 2. | **Area(hectares/squarekilometres)** | |
| | Block Area | 7900 Ha or 79 Sq kms |
| | Forest Area | NA |
| | Government Land Area | NA |
| | Private Land Area | NA |
| 3. | **Accessibility** | |
| | Nearest Rail Head | Chatikona which is on East Coast Railway 43 kms from Kanapulisi. |
| | Road | The distance from the district headquarters Rayagada is about 42kms. |
| | Airport | Visakhapatnam is the nearest Airport is at 246 kms. |
| 4. | **Hydrography** | |
| | Local Surface Drainage Pattern(Channels) | Surface pattern is subdendritic |
| | Rivers/Streams | The drainage system of the area is controlled by Pedda Nala and Balandeli Nala flowing from the north to south and NE to SW respectively alongwith their first order and second order nalas which finally feed to the river Vanshadhara in down stream. |
| 5. | **Climate** | |
| | Mean Annual Rainfall | 1280mm |

| | | |
|---|---|---|
| | Temperatures (December)(Minimum)<br>Temperatures (June)(Maximum) | December:7°C to 8°C<br>May: 46°C |
| **6.** | **Topography** | |
| | Topo sheet Number | E44F11 (65M/11) |
| | Morphology of the Area | The area represents highly rugged terrain with undulated topography characterized by lofty hill ranges intervened by intermontanee valleys. A prominent NS valley dissects the block in central part. |
| **7** | **Availability of baseline geosciences data** | |
| | Geological Map(1:50K/25K) | 1:50K map of GSI |
| | Regional structural set up map | Published Literature (Tectonophysics) |
| | DRM of Rayagada District | Published by GSI |
| | Geochemical Map | Not available |
| | Geophysical Map (Aeromagnetic, ground geophysical,Regional as well as local scale GP maps) | Not available |
| **8.** | **Justification for taking up Reconnaissance Survey/ Regional Exploration** | Graphite bodies of economic importance occur in the Eastern Ghats migmatite complex of Odisha, India, which consists of sillimanite-rich gneiss (khondalite), calc-silicate granulite, basic (pyroxene) granulite and gneissic palaeosomes and a variety of quartzofeldspathic neosomes and pegmatite veins. More graphites are concentrated in migmatised khondalite and calc-silicate granulite than in their unmigmatised counterparts and it is common at pegmatite-country rock margins. Lodes of graphite are structurally controlled and they occur along fold hinge zones, necks of boudins and along the dominant foliation in rocks that show the effects of polyphase deformation. Faults, fractures and joints also act as locales of graphite mineralisation. The richest lodes are located where there is the coincidence of several lithological and structural features.<br>The graphite occurs in graphite-rich schists and gneisses, as veins and as disseminated flakes along grain boundaries and in microfractures and cleavages. It is present in all rock types except pegmatites. Most of the bodies of graphite are lenticular and show pinch and swell characters.<br>The present area hosts pelitic and psammopelitic meta sediments often migmatised to varibale degree with the characteristic mineral assemblages like graphite and silimanite. The area is in close proximaty to the famous Tumudibandh Graphite belt controlled by the Tumudibandh Shear Zone. |

| | | |
|---|---|---|
| | | During reconnoitary traverses, exposures of graphite bearing khondalites and calcgranulites have been noticed around village Barangapadar, Rangamati, Durgi, Kanapulisi of variable dimensions in which graphite occurs as disseminations and minor veinlets. Analyses of few grab samples collected during reconnoitary traverses by the geologists of Maheswari Mining Private Ltd. indicate FC content varying from 4.24 to 15.23%. State Directorate of Geology had also located few pockets without any detailed assessment.<br>In order to assess the geospatial disposition and to study the grade and resource potential of the graphite incidences a G4 stage of exploration is proposed. |

## Detailed description

Block Summary

In view of the auction policy of the Government and demand of more explored blocks Govt. of India amended the MM(D&R)Act, 1957 in 2021 allowing Private Agencies to be stake holders in explorations of major minerals in a time bound manner in which the funds will be provided by the NMET instituted by Govt. of India (Notification, NPEA, 2021).

India is a major global producer of flaky graphite. The country has been ranked amongst the top five graphite producers by the USGS. Graphite occurrences are reported from different states including Jammu and Kashmir, Arunachal Pradesh, Gujarat, Jharkhand, Maharashtra, Karnataka, Kerala, Tamil Nadu, Odisha, Chattisgarh and Rajasthan. However, the deposits of economic importance are located in Tamil Nadu, Andhra Pradesh, Chattisgarh and Arunachal Pradesh, some of which are yet to be exploited. As far as mining and processing of graphite is concerned, Jharkhand, Odisha and Tamil Nadu are the only states where operations are being conducted. The worldwide as well as in the country, demand for graphite is increasing with the development of non-carbon energy applications such as batteries used in electric vehicles, electric devices and energy storage devices that use graphite. To fulfil demand and to keep a balance between demand and production, it is essential to develop the resources of graphite in country.

In view of the auction policy of the Government and demand of graphite in the domestic industries, emphasis for assessment of graphite is warranted. In order to carve out an auctionable block, Government of Odisha accorded "in Principle Approval" for the agency vide L.No. 7664 Dt.- 05.06.2023 to undertake geological prospecting at G4 level to identify potential graphite bearing areas in T.S.No E44F11 (65M/11) where the agency M/s Maheswari Mining Private Ltd. recorded some observations with the help of limited field traverses with the background geology available and identified potential graphite prospects which can be taken up for detailed assessment from reconnaissance to exploration at different levels so as to support the State Govt. for putting potential blocks for auction with our effort to contribute for mineral development of the State.

### B. Physiography and Drainage:

The area represents highly rugged terrain with undulated topography characterized by lofty hill ranges intervened by intermontane valleys. A prominent NS valley dissects the block in central part. The hill ranges seems to be structurally controlled and aligned in NNW- SSE to NS in the central and western part in compliance to the regional Tumudibandh shear. Besides, few conical hills with steep scarp faces in central and southern part are noteworthy. Robarhi PF, Kankubarhi RF and Debala RF form the prominent hill ranges. The highest elevation is 930m above MSL in north eastern part while 382m is the lowest elevation in the valley around village Kanapulisi.

The drainage system of the area is controlled by Pedda Nala and Balandeli Nala flowing from the N to S and NE to SW respectively along with their first order and second order streams which finally feed to the river Vanshadhara in downstream and few spring points are also noticed around village Kanapulisi,Tenupulisi, Rangamati, Barhapulisi etc.

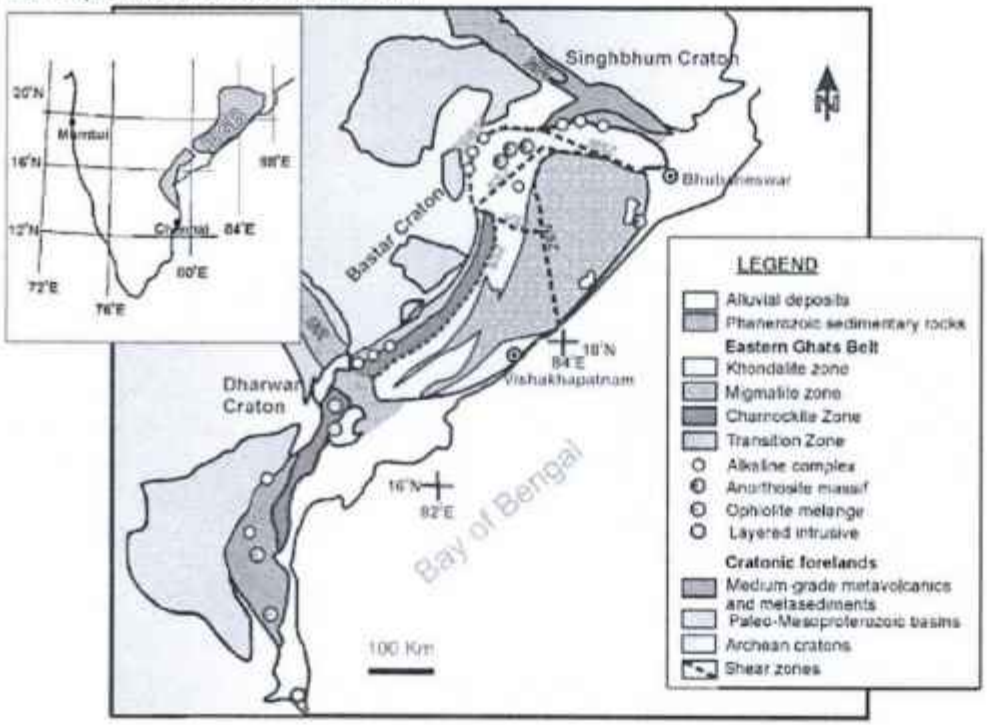
### 1.1. Climate:

The area experiences sub-tropical climate with heavy monsoon downpours, extreme cold during winter and hot summer months. The temperature exceeds in summer up to $46^0$and falls to $7^0$to $8^0$ during winter. The average annual rainfall in the area is approximately 1280 mm.

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

### Regional Geology of the area:

The area of exploration forms a part of Eastern Ghats Mobile Belt which skirts the eastern fringe of Dharwar and Bastar Cratons and the southern fringe of Singhbhum Craton. This belt has been sliced off along eastern continental margin of India. In western and northern part, this belt has been thrusted over the respective Cratons. The Eastern




Ghats Mobile Belt is also cut across by Gondwana grabens of the Mahanadi and the Godavari. It consists of a typical litho assemblages of charnockites, supracrustals of khondalite group (dominated by garnet-sillimanite gneiss with sub-ordinate quartzite, marble and calc-silicate), migmatised gneisses (leptynite and orthogneiss) and granitoids. All have been metamorphosed in upper amphibolite to granulite facies. Younger intrusions of anorthosites, alkaline rocks and granites are also conspicuous in this belt (Ramakrishnan et.al. 1998). Retrograde metamorphism has been reported in this belt (Sen et. al. 1995). In general, the Eastern Ghats Mobile Belt is tightly folded into isoclinal and recline folds, the axial plane of which plunges south-easterly due to strong forces of compression directed from south-east (Chetty et. al. 1998). Nanda (1995) divided the Eastern Ghats Mobile Belt into four longitudinal litho zones depending on the predominance of litho types. These are western Charnockite Zone (WCZ), Western Khondalite Zone (WKZ), Central Migmatite Zone (CMZ) and Eastern Khondalite Zone (EKZ). The present area of exploration lies in the Western Khondalite Zone.

Mahalik (1998) has divided Odisha into three geological sectors. Present area of exploration lies in the south Odisha sector. Rocks of the region have been affected by two typical tectonic trends; the NE-SW trend, commonly known as the Eastern Ghats trend (oldest) and NW-SE trend, known as Nagavalli-Vansadhara trend. The NW-SE trend has been off-set by two major faults, the Eastern Ghats Boundary Fault and Tel River Shear. The NW-SE trend between Koraput and Bhawanipatna gets deflected to north-south orientation and continues up to Gandhamardan hill where it again deflected to NE-SW trend forming an arcuate belt. Faults and shear zones of south Odisha sector have genetically related either to the Eastern Ghats trend (NE-SW) or Nagavalli-Vansadhara trend (NW-SE).

The broad stratigraphic framework of Eastern Ghats Super Group postulated by Ramakrishnan et al (1998) is as follows.

| | |
|---|---|
| 800-900 Ma | Alkaline rocks, granitoids |
| | -------Eastern Ghats Orogeny------- |
| 1000-1100 Ma | Development of Eastern Ghats 'Front' of upgraded cratonic rocks<br>Incipient and massive charnockite and garnet-hornblende-biotite gneisses and garnetiferous gneiss with biotite and sillimanite |
| 1300-1400 Ma | Emplacements of alkaline rocks (feldspathoidal gneisses) and anorthosites |
| Khondalite Group (WKZ,CMZ&EKZ) | Garnet-sillimanite-graphite gneisses<br>Cordierite-sapphirine-spinel rocks<br>Calc-silicate rocks and rare marbles<br>Quartzite rich in garnet (and some sillimanite)<br>(The whole suite interleaved with charnockites) |
| 1600-1800 Ma | Evolution of Purana basins |
| 2600-2800Ma | Charnockites with enclaves of basic granulites, high grade (WCZ) schists including BIF, and layered basic complexes, representing original cratonic basement (?) in 'migmatitic' amphibolite facies |
| 3000 Ma | Vestigial events (?) |

The area under exploration forms a part of Eastern Ghats Super Group of rocks of Archaean age comprising pelitic and psammopelitic schists and gneisses viz: khondalite suite of gneisses, charnockite, quartzo-feldspathic gneiss and pegmatite overlain by recent soil and alluvium. The litho units form more or less banded assemblages with permeations of neosomes, pegmatites and vein quartz. The litho units exhibit foliations varying from N40$^0$-60$^0$W dipping at 50$^0$ to 75$^0$southwesterly. Pegmatites occur as intrusives within the migmatised khondalite. Based on the field studies and earlier works of various eminent geoscientists (Ramakrishna etal, 1998), the regional stratigraphy surrounding this region can be enumerated as follows:

| | |
|---|---|
| Recent to sub recent | Soil/Alluvium |
| | Laterite |
| Intrusive | Pegmatite/vein quartz |
| | Porphyroblastic granite gneiss |
| | Garnetiferous granite gneiss |
| | Charnockite |
| | Pyroxene Granulite |
| Archaean | Khondalite suite : Quartzite,Migmatised Khondalite, calc granulites (± Graphite) |

**Local Geology and Stratigraphy:**

Geological traverses over the area revealed that area is occupied by para and ortho metamorphites of EGMB forming high rising hillocks and mounds with intervening valleys which mostly soil covered with scanty exposures of khondalite and its variants, quartzo-feldspathic gneiss, charnockite, granite gneisses and pegmatites forming more or less banded assemblage with variable degree of alteration.

The rock formation exposed in the investigation area belong to the Eastern Ghats Super Group comprising mostly quartz-feldspar- garnet- sillimanite graphite schist gneiss (khondalite), quartzite, granite gneiss, migmatite, pegmatite and quartz veins, khondalite and granite gneiss represent the predominant member among the above litho units and alternate in the entire terrain with an approximate NNE-SSW trending hills and ridge with the development of migmatite at their margins. The migmatised zones are variously folded

and impregnated by quartz-feldspar veins. These migmatised zones are sporadically enriched with graphite mineralization. One such graphite mineralized zone of approximately 2.5kms length has been traced between Barangapadar in the north and Barhapulisi in the south. Low grade disseminated type of graphite occurs intermittently within the mineralized zone at the contact of migmatised khondalite and/ calc granulite granite gneiss.

The foliation in the khondalite and granite gneiss is the most pervasive structural element. Besides, lineation, slickenside surface, cleavage and local folds are the associated structural features marked in the area.

The metasediments have foliation trend varying between NNE- SSE to NW-SE which persist almost over the entire terrain excepting a few local variations. The foliation in the metasediments dips towards west with varying angles from sub vertical to near vertical. Two sets of joints are very prominent in this terrain. The hills and nalas of this area seem to be joint controlled.

Based on their mutual field relation relationships, the following stratigraphic succession is suggested in order of their increasing antiquity.

| | |
|---|---|
| Recent to sub recent | Soil/Alluvium |
| Intrusive | Pegmatite/VQ |
| | Quartzo-feldspathic gneiss (±graphite) |
| Archaean | Charnockite (migmatised) |
| | Khondalite suite of rocks (migmatised/kaolinised/±graphite) |

**Khondalite:**

Khondalite is the oldest rock unit occurring in the area which are migmatised and altered to variable extent. It is exposed in the Nala cuttings & wall sections only and also in the scarp section of hills. It forms a banded assemblage with quartzites, quartzo-feldspathic gneiss, granite gneiss& often silicified. Because of close proximity to perennial streams, the lithounits have undergone higher degree of alterationand at places kaolinised. It is reddish brown to buff in colour, medium grained, inequigranular consisting essentially of quartz, plagioclase, sillimanite&/or graphite, garnet and opaque minerals which are scattered throughout the rock mass. Quartz and orthoclase are abundant; plagioclase, sillimanite are common and garnet isnoticed as an accessory. Secondary growth is noticed in most of the quartz grains. Under microscope plagioclases are highly saussuritised. Iron solution leached out from the garnet imparts a reddish look to the rock mass. Flakes of graphite occur as dissemination within the khondalite. The trend of foliation in khondalite varies from NNE-SSW to N40$^0$-60$^0$W to S40$^0$-S60$^0$Edipping 55$^0$ to 70$^0$ westerly & southwesterly. Intense weathering and alteration of the constituent minerals rendered the litho units moderately fissile at places with kaolinisation of the plagioclageporphyroblasts. Hard and fresh khondalites are rare.

**Charnockite:**

Charnockites are exposed in bouldery form in the slopes and often migmatised with granite gneiss in southwestern part of the area on the Nala banks. Megascopically, it is hard, massive, mesocratic and medium grained rock showing a distinct gneissic trend and exfoliation weathering features. Crude gneissosity is developed due to dimensional orientation of quartz and feldspar along a definite direction. Granulated prisms of hypersthene and flakes of biotite constitute the melanocratic bands whereas felsic bands are represented by quartz and feldspar. Mineralogically, it is composed of plagioclase, orthoclase, hypersthenes and quartz as major and biotite are found as accessory mineral. Equidimensional quartz and feldspar form a mosaic texture. Exfoliation weathering is also noticed.

**Granite gneisses:**

Granitic suite of gneisses and their migmatised equivalents are another predominant litho units in the area which occur in the mid contours and foothill regions of hill ranges and valleys with xenoliths of pelites and pyroxene granulites & charnockite. Both mesocratic and leucocratic medium to coarse grained granite gneisses have been observed in the area. In the valley portions porphyroblastic granite gneisses are also noticed.The trend of foliation in granite gneisses varies from NNE-SSW to N40$^0$W to S40$^0$E dipping 55$^0$ to 70$^0$westerly.Granite suite of rocks have significantly migmatised the para-metamorphites giving rise to migmatites where graphite mineralizations are noticed.

**Quartzo-feldspathic gneiss:**

Quartzo-feldspathic gneiss is the second most predominant unit exposed in the valleys that occur in close association with granitic gneisses. It occurs as sheet rocks and highly weathered and altered enclosing enclaves of mesocratic gneissesin bouldery form on the surface and closely associated with migmatised khondalite exhibiting crude foliation andexfoliationweathering and is encountered in the nala cuttings. It is a medium to coarse grained highly altered and weathered rock showing a distinct gneissic trend. Both quartz and feldspar show dimensional orientation along the folial plane. Garnets are highly altered with leaching out of iron solution. Secondary over-growth in most of the quartz grains indicates a sedimentary parentage. It is essentially composed of quartz, orthoclase, plagioclase and graphite and garnets are found as accessory minerals. Opaque are scattered throughout the rock mass. Graphite flakes occur as disseminations along the foliation of quartzo-feldspathic gneiss.

**Pegmatite:**

Small veinlets ofpegmatite/pegmatoids are exposed on the valleys both in northern and southern part of the area. These are mainly composed of megacrysts of quartz and feldspar where micaconstitutes a very less percentage showing concordant relationship with the country rock. The permeations are mostly foliation guided.

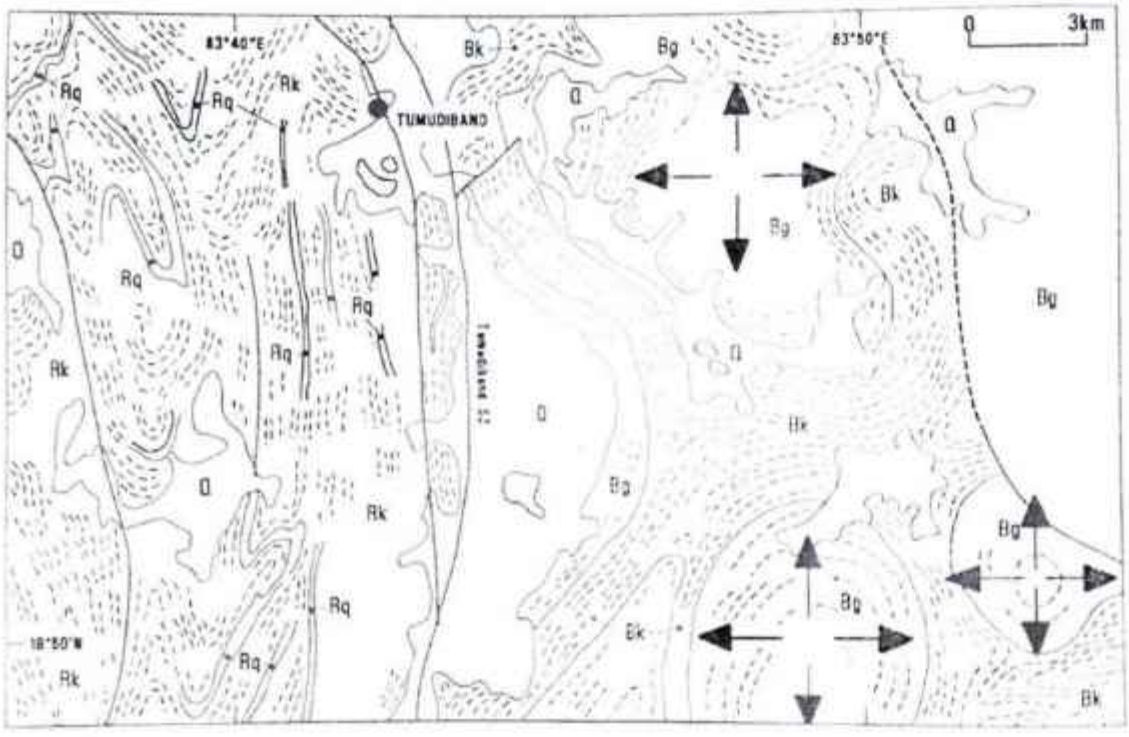
**Soil and alluvium**:

The valley parts of the area is covered with soil and alluvium with average thickness of 4m. Residual soil is formed by weathering of the in-situ country rocks. The alluvium is encountered in the narrow tracts which support the vegetation and agriculture of area. The soil is grayish in look and plastic. Both vertisols, transported soil and alluvium occupy the valleys and flood plains of ephemeral and perennial nalas.

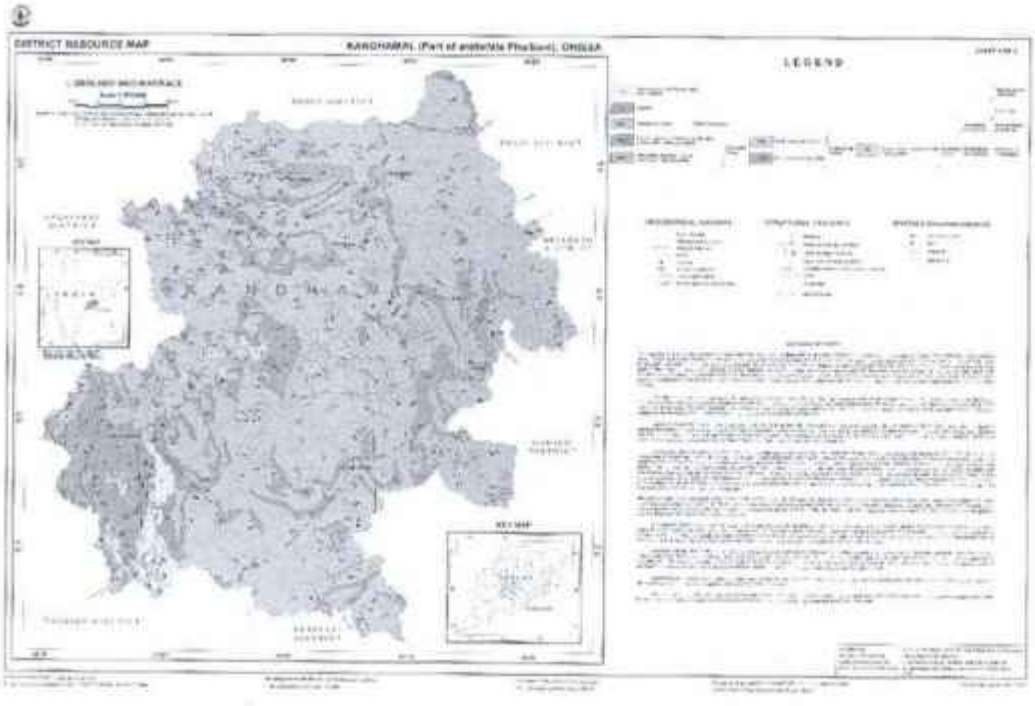
**Structure:**

Both diastrophic and non-diastrophic structures are found within the litho assemblages. The diastrophic structures include foliation, shears, folds and faults and non-diastrophic structure include joint and impersistent mineral lineation. As revealed from the surface data, graphite mineralization is litho structurally controlled as it is confined to the foliation plane of quartzo-feldspathic gneiss and migmatised khondalite. The area is affected by granitic activity as a result of which meta-sediments are sheared. Drags and kinks are well marked in the migmatised khondalite. Secondary structural features are noticed in the litho units that include kinks and joints.

Study of satellite imagery revealed that the area lies in close proximity to the west of Tumudibandh Shear Zone (N-S running) and a N-S sympathetic shear passes through the area of proposal.




**Tumudibandha shear zone map after Nash et.al. 1993**




Similarly asymmetric minor shears of Tel shear (ENE-WSW) also cross cuts the Tumudibandha shear in WNW-ESE direction where the intersection of lineament offered suitable avenues for emplacement of granitic melt resulting in remobilization of graphite along the structural weak planes i.e. foliation in this case.

**Foliation:**

Foliations are well developed in khondalite, granite gneisses and quartzo-feldspathic gneiss. The general trend of the foliation of lithounits varies from NNE-SSW to N40$^0$W-S40$^0$E dipping 50$^0$- 70$^0$ southwesterly.

**Joints:**

Two set of joints are well developed in khondalite and quartzo-feldspathic gneiss. One set of joint trends in N45$^0$ E-S45$^0$ W dipping 74$^0$ northwesterly and other set is parallel to the foliation plane.

**Metamorphism:**

Petrographical studies of the lithounits revealed the following mineral assemblage signifies the metamorphic episodes the area has witnessed:

a. Quartz + Orthoclase+Plagioclase+Sillimanite+Garnet+ graphite

b. Quartz +Plagioclase+ Orthoclase + Hypersthene+Biotite

c. Quartz+ Orthoclase+ Plagioclase+Garnet+Zircon

The above mineralogical assemblages& their mutual textural characteristicsare suggestive of high temperature– high pressure phenomena characteristic of granulite facies of regional metamorphism. Occurrence of biotite in the fracture planes of garnet and saussuritisation of feldspar are indicative of retrogression.

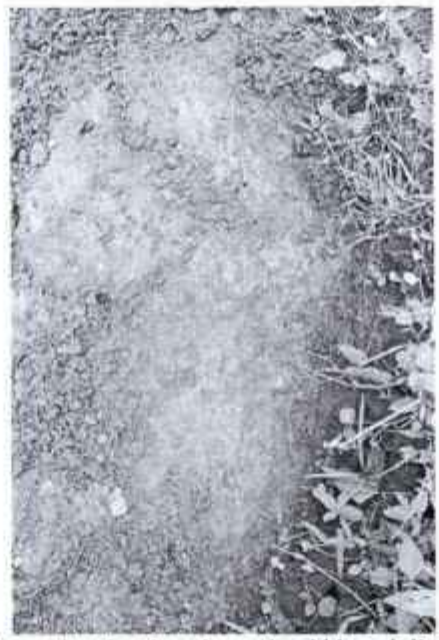
**Mineralisation Details:**

The reconnaissance traverses under taken in the area and background information collected from theagenda volume of SGPB it is inferred that the area is a potential graphite prospects in which nine occurrences of graphite have been reported and well within the influence of Tumudibandha shear zones in its western part. It is expected that out of 79 sq km area 10-15 sq.km. area (Cumulative) would be potential for geophysical survey. Migmatisedkhondalite&quartzo feldspathicgneiss occur concomitantly & graphite mineralisation is restricted only to the contact zones (more pronounced in the hanging wall side of quartzo - feldspathic gneiss & less often in the foot wall. Graphite chiefly occur as dessiminations and veinlets along foliation of host rocks in conformity to the migmatised foliations and at places in the sympathetic lineaments.It is inferred that numerous sporadic pockets of graphitemineralised zone persists within the area.

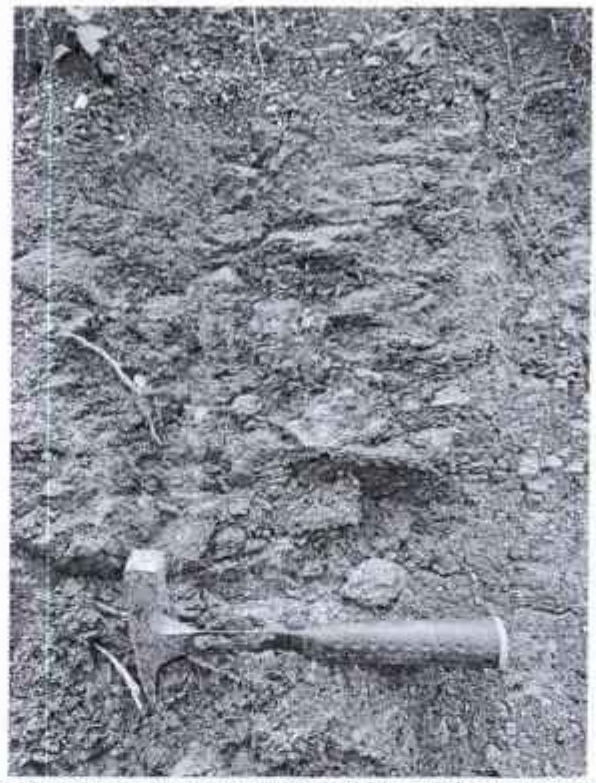
During reconnaissance traverse within the proposed block few occurrence of graphite mineralization have been noticed and grab samples have been collected for chemical assay. It is noticed that graphite disseminations are foliation controlled within the migmatised Khondalites and Granite-gneiss.

Graphite schist near Barangapadar.

Vein type graphite at the contact of migmatised khondalite and quartzo-feldspathic gneiss near Rangamati.



Graphite dissemination in migmatised khondalite near Durgi



**Graphite dissemination in migmatised khondalite near Kanapulisi**

Graphite mineralization is litho-structurally controlled &mineralisation has been facilitated by quartzo-feldspathic gneiss which seems to act like a scavenger and graphite is a remobilized product follows emplacement of quartzo feldspathic gneiss &migmatisation. As a whole mineralisation within the area, has been proved to be restricted within valleys and lower contours.Graphite being a constituent mineral of migmatised khondalite occurs as disseminations within the host rock as flakes and fibers. Size of graphite tiny flakes & fibers varies from 1 to 8mm are randomly distributed exhibiting a preferred orientation in conformity to the foliation.

However, mineralogical studies indicate that graphite occurs as disseminated flakes and fibers along the folial plane of migmatisedkhondalite and quartzo feldspathic gneiss and is of erratic nature. The deleterious elements present are quartz, plagioclase, orthoclase, biotite and opaques. Quartz grains showing secondary overgrowths occur as oval to lensoidal grains with sutured outline. Orthoclases are mostly perthitic and altered significantly to kaolin while plagioclases occur as platy crystals suffering from saussuritisation. The mineralisation is believed to be remobilized product of carbon during contact regional metamorphism facilitated during emplacement of quartzo-felspathic gneiss. Disseminated graphite bearing rocks occur as narrow tongues or ribbons and more often as lensoidal bodies. The chemical assay data of few grab samples collected by the agency from different localities analyses following assay for FC content which signifies its potentiality.

| Sl. No. | Sample No. | Location of the graphite body | FC | Ash | Moisture | LOI |
|---|---|---|---|---|---|---|
| 1 | 4 | 19° 20' 20.10"-83° 36' 47.13" Village Barangapadar | 10.33 | 87.36 | 1.22 | 12.64 |
| 2 | 5 | 19°18'09.24"-83° 36'35.67" Village Rangmati | 15.23 | 70.14 | 5.10 | 29.86 |
| 3 | 6 | 19°20'55.90"-83° 36'16.76" Village Durgi | 10.97 | 86.29 | 1.26 | 13.71 |
| 4 | 7 | 19°18'6.18"-83° 37'12.58" Village Kanapulisi | 4.24 | 90.21 | 1.89 | 9.79 |

**1.3 Mineral potentiality:**

Based on the above discussed background of the area, and drilling operations undertaken by the agency for State Directorate in the adjoining Khalpadar block in Rayagada district where extensive graphite mineralization in migmatised khondalites& quartzo-felspathic gneisses are noticed, it is imperative that the south &eastern blocks of Muniguda area is a potential target for Graphite mineralisation, where benicifiable grade ( F.C.>2%) Graphite ore can be established and assessed, so as to prepare auctionable blocks. The depth of the mineralisation may be gone up to 70 m by inclined borehole to identify the 2nd and 3rdlevelmineralised zones. The depth of the mineralization may be extended upto 2nd& 3rd level mineralized zone.

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

This zone includes the well-known Tumudibandh graphite deposit and the ones located in the Kandhamal, Rayagada and Gajapati districts. The strike of the litho-units varies from NNE-SSW in conformity to bounding shear. This zone is separated from the western zone by faults. Khondalite, calc-silicate granulite and associated quartzo-felspathic intrusions are of widespread occurrence. Charnockites are more in this zone compared to western zone. The important graphite mines include those at Madaguda, Lakhajorna, Raisil, Ambaguda and Bandhamundi. State department has also successfully established significant graphite deposits around Naringapanga, Khalpadar, Jugapadar, Khalpadar, Naringpanga and Jagadalpur with similar litho structural setup and two blocks have been successfully auctioned as ML by the State in which dessiminatedgraphiteflakes within the host migmatites.

**Scope for proposed exploration.**

**1.Geological Mapping**

The target area of 79 sq km in toposheet no E44F11 will be scanned through geological mapping in 1:12500

scale through geological traverses at 100- 150m interval with help of GPS and brunton to locate the graphite bearing horizons and validation of the available geological and litho structural data. The contacts of different formations, identification of different rock formation, structural features, etc. will be recorded in detail.

**Geophysical Survey**

The potential graphite bearing mineralized zones identified through large scale geological mapping will be taken up for geophysical survey. Geophysical techniques to be adopted are magnetic survey, self-potential survey, resistivity survey and IP survey. As per available information and the cursory field works done by the agency, it is revealed that graphite bearing pockets, lenses and disseminations occur in the area which are of variable dimension and litho structurally controlled. In absence of detailed geometrical data of the mineralized zone it is proposed to take up SP survey at 50m X 40m grid interval and the potential SP anomalous zone will be subject to IP and magnetic surveys supported by resistivity sounding at least 50 X 20 points in the mineralized zone.

**Pitting/ Trenching**

Trail pitting and trenching will be done to expose the mineralized zone and to study the behavior of the ore body. It is proposed to take up pitting over the identified graphite mineralized zones at 50m interval along the strike and dip with each dimension 1m X 1m X 1m. Subsequently the pits will be converted to trenches (10m X 1m X 1m) wherever necessary to delineate the spatial disposition of the host rock and mineralized zone. As such about 30 pits and 10 trenches are expected to be driven during course of prospecting in apprehension of locating about 10 pockets or bands in the area based on surface mapping and geophysical survey to expose the ore body.

**Scout drilling/ Systematic drilling**

Based on the outcome of geological mapping & geophysical survey and trail excavation along with analytical results of surface, grab samples, pit samples and delineation of graphite ore body, few scout bore holes are proposed to be given to prove the existence of mineralized zone at depth and in strike continuity. A total drilling of 1000m is proposed with a total number of ten nos. boreholes.

**Sampling (Grab and Chip)**

During course of mapping, 50 BRS samples will be collected from the surface exposures & pit wall/floor sections to examine the grade of ore, petrographic and mineralogical characterisations. The representative samples shall be prepared in field in triplicate. One shall be forwarded to NABL accredited laboratory for analysis. About 30 pit samples, 100 trench samples, 100 bed rock samples and 200 borehole core samples will be generated during course of exploration for primary analysis. The borehole cores would be logged systematically. Viz. details of the litho units, colour, structural feature, texture, mineralization, core recovery and graphite ore type would be recorded.

The mineralized part of drill core will be sampled as primary sample. The individual sample will be split into two equal halves and one part will be preserved in the core box for future reference and will be stored in core library, after completion of the project. The whole samples shall be split through coning and quartering in field. One part will be sent to the NABL accredited Laboratory for analysis, second part will be preserved in the camp as duplicate sample, third part will be utilized for preparing composite sample for individual ore band and the fourth part will be kept as either check sample or sample to be used for any other specific purpose. The length of each sample will be kept 1m within the ore zone depending upon the width of particular type of graphite ore and its physical character.

All primary, internal check and external check samples will be analysed for 5 radicals i.e. ($Al_2O_3$, $SiO_2$, Ash, FC and LOI).Mineralized zones will be delineated at cut-off grade FC: 2% based on the chemical results of primary samples.

**Observation and Recommendations of previous work.**

J. K. Nanda U. C. Pati, Geologists (Sr.) 1988 of GSI had reported occurrence of peliticand psammopelitic meta sedimenaries with or without graphite in the area along with charnockite and granite suite of rocks.

This strip of area is about 40 km long and 5 km wide, between Gumuda in the east and Lekapai in the west. Ramanaguda, Mukundpur, Bankili and Robarhi are major villages of the area. Further the geological map available in Bhukosh also depicts a banded assemblage of acid and basic charnockite, granite gneiss and calc granulite. Further state department also recorded an extensive mineralized zone from Barangapadar and Barhapolisi. Occurrences of graphite as disseminations, narrow ribbons and bands, stringers and lenses have been reported in association with migmatised khondalite, granite gneiss and quartzite around Kanapulisi, Barhapolisi, Durgi, Panugurha and Barangpadar etc.

PreviousWork

**Previous Exploration in adjoining area (Regional area);**

J. K. Nanda U. C. Pati, Geologists (Sr.) August, 1988 of GSI had reported occurrence of pelitic and psammopelitic meta sedimenaries with or without graphite in the area along with charnockite and granite suite of rocks.

B.C. Mohanty & P.C. Vajani(1982-83) of Directorate of Geology, Odisha first reported the graphite occurrences around Sollagudi, Narigapanga, Khallupadar, Mudra, Bongna, Berli and Sabinala villages ofRayagada District. Preliminary investigation was carried out and found Graphite occurrences occur under a thick soil cover. Analysis shows F.C. content varying from 7 to 49%. It was observed thatGraphite occurs as within migmatised khondalite and are of stratiform type. The ore bodies exhibit concordant relationships with the host rocks indicating structural control of mineralization.
S. N. Parida& D. N. Pani (1983-84) of DG (O) carried out mapping in nearby areas of Narigapanga block and found 7 occurrences of Graphite. Out of these the graphite deposit near Bandhamandi is of low grade with F.C. content varying from 4.56 to 21.38%. The deposit occurs in two isolated patches.

Later on, S.P. Nanda & B.S. Rauta (2015-16) of DG (O)carried out investigation at G-4 level aroundPanchubai village RayagadaDsitrictand estimated a total reconnaissance resource of 0.032 mt for 10 graphite bodies. Out of 10 graphite bodies, Narigapanga has the highest graphite resource of 0.029 mt.
D. K. Sahoo, B.S. Rauta (2016-17) of DG (O) carried out Exploration around Naringpanga of Rayagada district during the Field Season 2016-17 by DG (O) to assess the resource and grade of graphite around Naringpanga to carve out an auctionable block. The Block has been successfully auctioned.
DoMG Odisha has recently completed a G2 level exploration in Jagdalpurblock (Toposheet no.- E44F10) and established a mineralized zone of about 1km length and 300m width having optimum vertical depth of mineralization upto 132m and drilling was done by the agency through outsource by the state department
DoMG Odisha has recently completed a G2 level exploration in Khalpadar block (Toposheet no.- E44F10) and established a mineralized zone of about 1km length and 300m width having optimum vertical depth of mineralization upto 132m and drilling was done by the agency out source by the state department.

**Previous Exploration in the proposed block area:**

Mohanty and Pattanaik (1989-90) of state DOMG have covered the area for investigation around Durgi through geological mapping , trail excavation and sampling. The investigation has reported ten incidence of graphite which have been explored through pitting and trenching to tune of 324cum. Systematic excavation was done in five out of ten incidences which intercepted disseminated zones, series of stringers and veins ranging in thickness 10cm to 30m up to a maximum depth of 30m about 30 channels samples, 6 chip samples were analyzed for F.C, ash and volatile matter. The F.C content in Barangpadar graphite occurrence, ranges

between 4.5 to 17.0%,the Rangamati incidences analyzed F.C contents 25.7 to 46.3%, the Durgi incidences analyzed F.C contents 4.6 to 6.5% while Kanapulisi occurrences analyzed F. C contents ranging from 12.3 to 19.5%, besides numerous pegmatites and one calc- tufa have also been reported.
The above findings merit for detail prospecting through systematic geological mapping, geophysical mapping, trail excavation, exploratory drilling and sampling.

**Block description**

| Block Corner points Cardinal Points | Latitude | Longitude |
|---|---|---|
| A | 19°20'0.00" | 83° 35°0.00" |
| B | 19°20'0.00" | 83° 36°5.95" |
| C | 19°21'4.22" | 83° 36°5.95" |
| D | 19°21'4.22" | 83° 36°55.31" |
| E | 19°20'0.00" | 83° 36°55.31" |
| F | 19°20'0.00" | 83°40°0.00" |
| G | 19°15'0.00" | 83°40°0.00" |
| H | 19°15'0.00" | 83°38°26.90" |
| I | 19°15'23.46" | 83°38°26.90" |
| J | 19°15'23.46" | 83°36°11.81" |
| K | 19°15'0.00" | 83°36°11.81" |
| L | 19°15'0.00" | 83° 35°0.00" |

**Planned Methodology**

In accordance to the objectives set for reconnaissance exploration (G-4) around Kanapulisi, Rayagada District, Odisha, large scale geological mapping, geophysical survey, excavations and drilling programme associated with other geological sampling and analytical work are proposed in the block. The exploration shall be carried out as per Mineral (Evidence of Mineral Contents) Rule-2015& 2021.
Accordingly, the details of different activities to be carried out are presented in subsequent paragraphs.

**Geological Mapping:**

The detailed geological mappings on 1:12,500 scale will be carried out to study the contacts of different formations, identification of different rock formations, structural elements etc., in detail. The map will be prepared and interpreted for targeting the graphite prospects for detailed mapping and geophysical survey as a follow up programme.

**Geophysical Survey**

The potential graphite bearing mineralized zone identified through large scale geological mapping will be taken up for geophysical survey like magnetic survey, self-potential survey, resistivity survey and IP survey. The mineralized zone is proposed to be covered by SP survey at 50m X 20m grid interval and the potential SP anomalous zone will be subject to IP survey support by resistivity sounding at least 20 points in the mineralized zone. It is expected that out of 79 sq km area 10-15 sq km area would be potential for geophysical survey. The geophysical map will be generated based on the SP/ IP values recorded in the block and location of sounding values. Depth wise interpretation will be interpreted.

**Topographic Surveying:**

The reduced levels and co-ordinates of boreholes would be determined. The locations of the trenches and pits will be surveyed. The block boundary will be surveyed by DGPS & total station in WGS-84 Datum for demarcation of Block Boundary.

**Pitting/ Trenching**

Trail pitting and trenching will be done to expose the mineralized zone and to study the behavior of the ore body. It is proposed to take up pitting over the graphite mineralized zones at 50m interval along the strike and dip with each dimension 1m X 1m X 1m. Subsequently the pits will be converted to trenches (10m X 1m X 1m) wherever necessary to delineate the spatial disposition of the host rock and mineralized zone. As such about 30 shallow pits and 10 trenches are expected to be driven during course of prospecting.

**Exploratory Drilling:**

Based on the outcome of geological mapping& geophysical survey, analytical results of surface, grab samples and delineation of graphite ore body, the scout drilling will be taken up over the anomalous zone to prove the mineralization up to 30m vertical level. The location of boreholes will be decided after pitting, trenching and geological survey. About 10 boreholes are suggested to be drilled in this G4 level of investigation.

**Sampling (Grab, Chip& core)**

During the course of mapping, grab samples will be collected from the surface exposures & pit wall/floor sections to examine the grade of ore. The representative samples shall be prepared in field in triplicate. One shall be forwarded to NABL accredited laboratory for analysis. About 30 pit samples, 100 trench samples, 100 bed rock samples and 200 borehole core samples will be generated during the course of exploration. The borehole cores would be logged systematically, viz. details of the litho units, colour, structural feature, texture, mineralization, core recovery and graphite ore types would be recorded.

The mineralized part of drill core will be sampled as primary sample at one meter interval. The individual sample will be split into two equal halves and one part will be preserved in the core box for future reference and will be stored in core library, after completion of the project. One part of split sample will be sent to the NABL accredited/ State Laboratory, Bhubaneswar for analysis, second part will be preserved in the camp as duplicate sample, third part will be utilized for preparing composite sample for individual ore band and the fourth part will be kept as either check sample or sample to be used for any other specific purpose. The length of each sample will be kept 1m within the ore zone depending upon the width of particular type of Graphite ore and its physical characters.

All primary, internal check and external check channel samples will be analysed for 5 radicals i.e. ($Al_2O_3$,$SiO_2$, Ash, FC and LOI).Mineralized zones will be delineated at cut-off grade i.e 2% FC based on the assay results of primary samples. The check samples will also be analysed for 5 radicals. Besides, one sample from each prospects will be subjected to trace element studies particularly to know the vanadium and tungsten components Nature, Quantum and Target.

**The quantum of work proposed by the agency in Kanapulisi (G-4 Level of Exploration) is given in Table below.**

| Components | G4-stage |
|---|---|
| Aerial reconnaissance | Nil |
| GeologicalSurvey | 1:12,500scale for 79 sq km area.<br>Identification of lithology, structure, surface mineralization, borehole core studies and old history of mining, if any. |
| GeophysicalSurvey | Regional ground geophysical survey: 3 L km, 300stns.( 200 m – 400 m traverse interval, 10-20 m station interval)<br>Gravity survey, (ii) Magnetic surveyd (iii) SP Survey |
| GeochemicalSurvey | Bedrock samples:100nos<br>Pit samples: 30 nos<br>Trench samples: 100 nos |
| Pitting/Trenching | 30 nos. Pits (1m X 1m X 1m): 30 cu m<br>10 nos. Trench (10m X 1m X 1m): 100 cu m |
| Scout drilling /Systematic drilling | Ten boreholes with a total of 1,000m of drilling target. |
| Grab and Chip sampling for Petrographic and mineragraphic studies | (10PS+10PCS) representative samples from all bed rocks to carry out petrographic studies(PS) and petro-chemistry(PCS). |
| Core sample | 200 borehole core samples from graphite bearing zones.Sample length 1m. |
| Analyses of samples | BRS+Pit samples+Trench samples+Core samples=100+30+100+200=430 nos |
| Synthesis of all available data | Integration of regional geophysical, geological, and geochemical data.<br>Synthesis of all available data and Report writing |

| Estimated cost of different work components of Graphite investigation of Kanapulisi area (G4 Stage) | | | | | | |
|---|---|---|---|---|---|---|
| Total area: 79 sq km, Period Of Completion: 12months | | | | | | |
| Sl. Nos. | Item of work | Unit | Rates as per NMET SoC 2020-21 | | Estimated Cost of the Proposal | |
| | | | SoC-Item-Sl No | Quantity | Rates as per SoC | Total |
| 1 | **Geological Mapping (on 1:12,500) (79 sq km)** | | | | | |
| | (a) Charges for 2 Geologists in field (without labourer) | per day per Geologist | 1.2. b | 120 | 11,000 | 1320000 |
| | (b) Charges for 2 Geologists at Headquarters | per day per Geologist | 1.2. a | 60 | 9,000 | 540000 |
| | (c) Wages for 4 labourers for geologist | per day | 5.7 | 240 | 345 | 82800 |
| 2 | **Land/Crop compensation** | per borehole | 5.6 | 10 | 2000 | 20000 |
| 3 | **Geochemical sampling (Bedrock sampling)** | 100nos | | | | |
| 4 | **Geophysical survey (Gravity survey, Magnetic survey and SP survey) (4.5 L.km)** | 4.5 L.km | | | | |
| | (a) Charges for 1 Geophysicist in field (without labourer) | per day | 3.18b | 60 | 11000 | 660000 |
| | (b) Charges for 1 Geophysicist at Headquarters | per day | 3.18a | 45 | 9000 | 405000 |
| | (c) Wages for 4 labourers in field with geophysicist | per day | 5.7 | 240 | 345 | 82800 |
| | (d) Charge for Gravity survey | per station | 3.1a.i | 350 | 3800 | 1330000 |
| | (e) Charge for Magnetic survey | per station | 3.2a.i | 350 | 1800 | 630000 |
| | (f) Charge for SP survey | per L.km | 3.3a | 4.5 | 29600 | 133200 |
| 5 | **Survey work** | | | | | |
| | (a) Surveyor | per day | 1.6.1a | 45 | 8300 | 373500 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Charges (without labourer) | | | | | |
| | (b) Labour(4nos) charges for survey work | per day | 5.7 | 180 | 345 | 62100 |
| 6 | **Technological Survey** | | | | | |
| | (a) Trenching | per cu m | 2.1.1 | 100 | 3330 | 333000 |
| | (b) Drilling | per m in soft rock | 2.2.1.4 a | 1000 | 11500 | 11500000 |
| | (c) Borehole pillaring (construction of concrete pillar) 12 inches x12 inches x 30 inches | per borehol e | 2.2.7a | 10 | 2000 | 20000 |
| | (d) Transportation of Drill Rig and truck(to and from Headquarter s or Previous drill site) | per km | 2.2.8 | 480 | 36 | 17280 |
| | (e) Drilling camp setting cost | per drill | 2.2.9a | 1 | 250000 | 250000 |
| | (f) Drilling camp winding cost | per drill | 2.2.9a | 1 | 250000 | 250000 |
| | (g) Monthly accommodation charges for drilling camp | per month | 2.2.9 | 2 | 50000 | 100000 |
| | (h) Approach road making to drill site | per km | 2.2.10 | 5 | 22020 | 110100 |
| 7 | **Laboratory Studies** | | | | | |
| | (a) Proximate analysis for graphite | per sample | 4.1.16 | 430 | 3000 | 1290000 |
| | (b) Analysis for associated trace element (Vanadium) | per sample | 4.1.15b | 430 | 421 | 181030 |
| | (c) Analysis for associated REE | per sample | 4.1.13 | 10 | 5380 | 53800 |
| | (d) Petrochemical studies (PCS) | per sample | 4.1.15a | 10 | 4200 | 42000 |
| 8 | **Petrographic studies** | | | | | |
| | (a) Preparation of thin sections | per sample | 4.3.1 | 10 | 2353 | 23530 |
| | (b) Study of thin sections | per sample | 4.3.4 | 10 | 4232 | 42320 |
| 9 | **Bulk** | per | 4.8.1 | 3 | 1605 | 4815 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Density/specific gravity Determination** | sample | | | | |
| 10 | **Drill core preservation** | per m | 5.3 | 250 | 1590 | 397500 |
| 11 | **Geological Report preparation (5 hard copies with a soft copy)** | cost per 5 hard copies along with soft copy | 5.2 | | As the exploration cost is exceeding 50 lakhs but less than 150 lakhs. | 750000 |
| 12 | **Peer Review** | lumpsu mp | as per EC decisio n | 1 | 10000 | 10000 |
| 13 | **Preparation of exploration proposal (5 hard copies with a soft copy)** | one number (5 hard copies) along with soft copies | 5.1 | 1 | 2% of approved project cost or 3.8 lakh, whichever is lower | 380000 |
| | Grand Total of estimated cost: | | | | | **₹ 2,13,94,775.00** |
| | Grand Total including 18%GST | | | | | **₹ 2,52,45,834.50** |
| **Grand Total= Two Crore Fifty-Two Lakhs Forty-Five Thousand Eight Hundred Thirty-four only** | | | | | | |

## References


- Chakraborty, A. K. & Lal, N.: Report on the geophysical investigation for regional assessment of graphite resources, koraput district, GSI, Odisha
- Chetty, T.R.K and Murthy,D.S.N (1998): Regional tectonic framework of the Eastern Ghats mobile Belt: A new interpretation. GSI spl. Publication No.44, pp 39-50.
- Mahalik, N.K (1995): Geology of the contact between Eastern Ghats Belt and North Orissa Craton, India jour. Geol. Soc. India Vol-44, pp.41-52.
- Nanda, J.K. (1995): Boundary relation of Eastern Ghats Mobile belt. Symposium on India and
- Antarctica during the Precambrian and granulite and crustal processes in East Gondwana, Visakhapatnam, pp. 34-35 (abs).
- Nanda, J.K, Pati U.C (1988): Report on the geo-traverse across Eastern Ghat in Orissa sector, FS-1987-88, GSI report, ERO_UE12170_1987_1988 report.
- Nash C.R, Rankin L. R, Leeming P.M, Harris L. B(1960): Delimeation of lithostructural domains in
- northern Orissa (India) from Landsat Thematic Mapper imagery, Tectonophysics vol. 260, pp 245- 257.
- Pasayat, S. & Adhikari, K. N. (1986-87): Report on the assessment of graphite resources in parts of koraput and phulbani districts, GSI, Odisha.
- RamakrishanM.,NandaJ.K.,Augustine P.F.(1998): Geological evolution of the Proterozoic and Eastern Ghats Mobile Belt, GSI, special Publ. No. 44.
- SGPB agenda volume 1987 and 1989.


## List of Plates

Plate 1: Index map on 1:50,000.
Plate2: Location map
Plate3: Geological map on 1:50,000.

| Proposed Timeline for different work components of Graphite investigation in Kanapulisi Block, Rayagada District, Odisha State | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Months | | | | | | | | | | | | |
| **Item of work** | **1** | **2** | **3** | **4** | **5** | **6** | | **7** | **8** | **9** | **10** | **11** | **12** |
| Large Scale Mapping (1:12,500) | | | | | | | | | | | | | |
| Bed rock sampling | | | | | | | | | | | | | |
| Geophysical survey by Geophysicist | | | | | | | | | | | | | |
| Laying of Geophysical survey lines & location of Boreholes by surveyors | | | | | | | | | | | | | |
| Trenching & Sampling | | | | | | | | | | | | | |
| Chemical analysis of surface samples | | | | | | | | | | | | | |
| Drilling | | | | | | | | | | | | | |
| Core Sampling & its preparation | | | | | | | | | | | | | |
| Chemical analysis of core samples | | | | | | | | | | | | | |
| Processing of Analytical data | | | | | | | | | | | | | |
| Preparation of Geological report | | | | | | | | | | | | | |

REVIEW

**DIRECTORATE OF MINES AND 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.** R1-176 **/DoMG., Dt.** 07-08-2023

From,

Dr. Sukanta Mishra
Joint Director (C.A)
Directorate of Mines and Geology
Odisha, Bhubaneswar

To,

Maheshwari Mining Private Ltd.
PO-Kaliapani, Kaliapani Main Road
C/O- IMFA Ltd, Mahagiri Mines (Chromite)
Kaliapani, Jajpur, Odisha-755047

Sub: Issue of analysis report of Graphite sample.

Ref: Your letter dtd.28.07.2023.

Sir,

I am enclosing herewith the analysis report of 07 (Seven) nos. of Graphite Sample submitted to this Laboratory vide your letter dtd. under reference above for favour of your information and necessary action.

**Yours faithfully,**

7-8-23

**JOINT DIRECTOR (C.A)**

DIRECTORATE OF MINES AND 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

## ANALYSIS REPORT

**Name of the Sample: Graphite Sample.**

**Received from : Maheshwari Mining Private Ltd.**

| Sl. No. | Sample No. | Lab. No. | LOI % at (950°)C | Ash % | M % | F.C % |
|---|---|---|---|---|---|---|
| 1 | DUG - 1 | 524-C/23 | 8.57 | 91.43 | 2.64 | 2.34 |
| 2 | DKG - 2 | 525-C/23 | 9.47 | 90.53 | 1.05 | 6.17 |
| 3 | HAZDG - 3 | 526-C/23 | 11.74 | 88.26 | 1.90 | 6.78 |
| 4 | BRPG - 4 | 527-C/23 | 12.64 | 87.36 | 1.22 | 10.33 |
| 5 | RAMG - 5 | 528-C/23 | 29.86 | 70.14 | 5.10 | 15.23 |
| 6 | DURG - 6 | 529-C/23 | 13.71 | 86.29 | 1.26 | 10.97 |
| 7 | KPG - 7 | 530-C/23 | 9.79 | 90.21 | 1.89 | 4.24 |

*N.B.* (1) The above mineral samples are not drawn by the Government Laboratory.

(2) Samples will be destroyed after 15 days from the date of issue of analysis report to the party.

4-8-23

**JOINT DIRECTOR (C.A)**

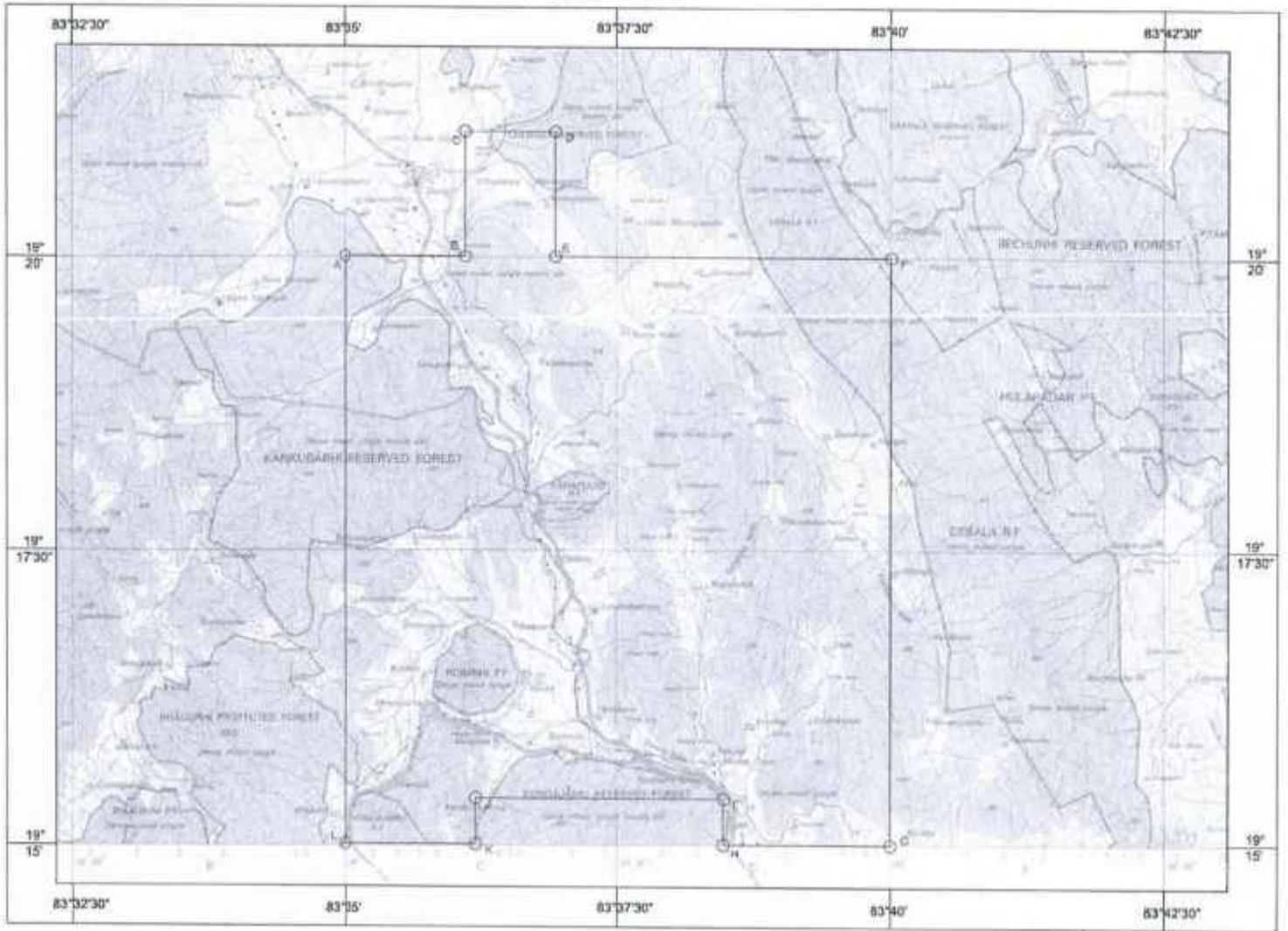
Joint Director (C.A)
Directorate of Mines and Geology
Odisha, Bhubaneswar

PLATE - I

# INDEX MAP OF THE PROPOSED EXPLORATION FOR GRAPHITE AROUND KANAPULISI, RAYAGADA DISTRICT

Toposheet no.- E44F11

Scale -1:50,000




## LEGEND

- CORNER POINT
- BLOCK BOUNDARY

| CORNER POINTS | LONGITUDE | LATITUDE |
|---|---|---|
| A | 83°35'0.00" | 19°20'00.00" |
| B | 83°36'05.95" | 19°20'00.00" |
| C | 83°36'05.95" | 19°21'04.22" |
| D | 83°36'55.31" | 19°21'04.22" |
| E | 83°36'55.31" | 19°20'00.00" |
| F | 83°40'00.00" | 19°20'00.00" |

| CORNER POINTS | LONGITUDE | LATITUDE |
|---|---|---|
| G | 83°40'0.00" | 19°15'00.00" |
| H | 83°38'26.90" | 19°15'00.00" |
| I | 83°38'26.90" | 19°15'23.46" |
| J | 83°36'11.81" | 19°15'23.46" |
| K | 83°36'11.81" | 19°15'00.00" |
| L | 83°35'0.00" | 19°15'00.00" |

Block Area- 79sq km

0 1km 2km 10km

PLATE - II

## LOCATION MAP OF THE PROPOSED AREA AROUND KANAPULISI, RAYAGADA DISTRICT

Not In Scale

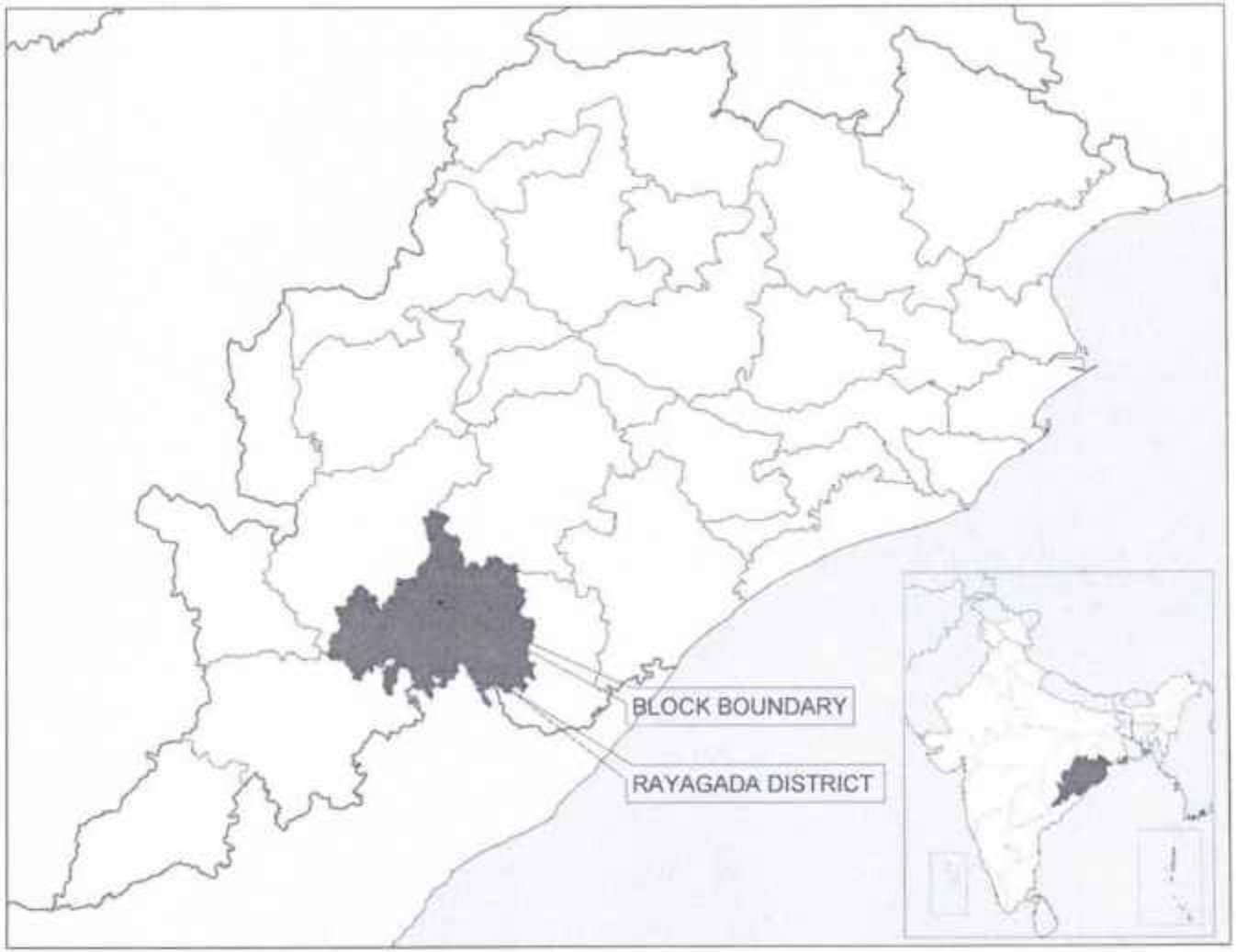
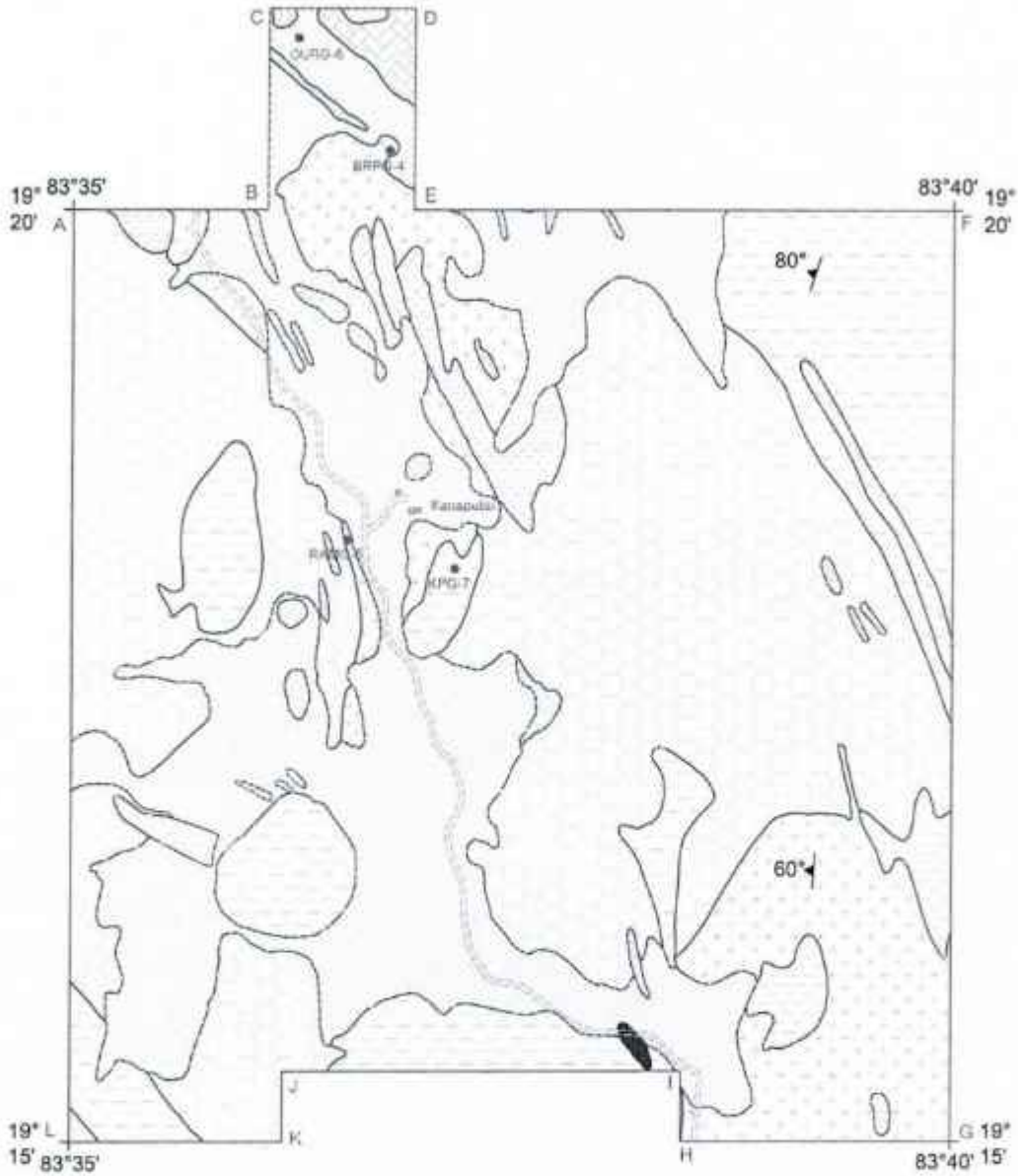


PLATE - III

# GEOLOGICAL PLAN OF THE PROPOSED AREA AROUND KANAPULISI, RAYAGADA DISTRICT (AFTER GSI)

Toposheet no.- E44F11

Scale -1:50,000




## LEGEND

- BLOCK BOUNDARY
- ROAD
- GRAB SAMPLE LOCATION (KPG7)
- VILLAGE
- LATERITIC SOIL
- QUARTZ- GARNET- SILIMINITE GNEISS WITH OR WITHOUT GRAPHITE
- ACID CHARNOCKITE
- QUARTZITE
- GRANITE GNEISS

| CORNER POINTS | LONGITUDE | LATITUDE |
|---|---|---|
| A | 83°35'0.00" | 19°20'00.00" |
| B | 83°36'05.95" | 19°20'00.00" |
| C | 83°36'05.95" | 19°21'04.22" |
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