

**RECONNAISSANCE SURVEY (G-4 STAGE) FOR GRAPHITE
IN DARUKONA BLOCK, RAYAGADA DISTRICT, ODISHA**
(F.No. 23/411/NMET-2023/389)



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दारुकोना ब्लॉक, रायगड़ा जिला, ओडिशा में ग्रेफाइट के लिए टोही सर्वेक्षण .जी-4 चरण) आर. रॉय, बी. कुंडू और टी. के. गिरी (भूवैज्ञानिक) अध्याय-1: सारांश

ओडिशा के रायगढ़ जिले के दारुकोना ब्लॉक में एफ. संख्या 23/411/23-एनएमईटी/389 के अंतर्गत ग्रेफाइट के लिए एक सर्वेक्षण (जी-4 चरण) किया गया। यह क्षेत्र पूर्वी घाट मोबाइल बेल्ट के पश्चिमी खोंडालाइट क्षेत्र के अंतर्गत आता है। 65 एम/एल1 के उत्तर पश्चिमी भाग का गठन करने वाले 119 वर्ग किमी के क्षेत्र को ग्रेफाइट की उपस्थिति को समझने के लिए 1:12500 पैमाने पर मैप किया गया है। ग्रेफाइट के ग्रेड का पता लगाने के लिए 100 बेड रॉक नमूने एकत्र किए गए, एसपी सर्वेक्षण के 5 लाइन किमी और ग्रेफाइट निकाय के विस्तार का पता लगाने के लिए 100 क्यूबिक मीटर की पिटिंग और ट्रेंचिंग पूरी की गई और संसाधन आकलन के लिए 500 मीटर ड्रिलिंग पूरी की गई। खोंडालाइट, ग्रेनाइट गनीस और चार्नोकाइट प्रमुख लिथोलॉजिकल इकाइयाँ हैं, साथ ही कुछ स्थानों पर लेप्टीनाइट, कैल्क-ग्रेनुलिट, मैफ़िक ग्रेनुलाइट, क्वार्ट्जाइट और पेग्माटाइट के आउटक्रॉप पाए गए। अधिकांश चट्टानें सामान्य रूप से परिणित हैं - NNW-SSE दक्षिण-पश्चिम की ओर 50° झुकी हुई हैं। चट्टानों में खनिज संयोजन यानी सिलिमेनाइट-गार्नेट-ऑर्थोक्लेज़-प्लेगियोक्लेज़-क्वार्ट्ज, ऑर्थोपायरोक्सीन-क्लिनोपायरोक्सीन-प्लेगियोक्लेज़ और क्वार्ट्ज-प्लेगियोक्लेज़-पाइरोक्सीन-गार्नेट कायापलट के ग्रेनुलाइट स्वरूपों के संकेत हैं। इस क्षेत्र में पाए जाने वाले ग्रेफाइट जमा प्रसार और शिस्ट प्रकार के हैं। छोटे प्रसार वाले ग्रेफाइट के गुच्छे आम तौर पर खोंडालाइट और ग्रेनाइट गनीस में पाए जाते हैं, जो कि पर्णन के समानांतर उन्मुख होते हैं जो कि अलाभकारी है। आर्थिक ग्रेफाइट जमा खोंडालाइट और ग्रेनाइट गनीस के बीच सीमा भाग में शिस्ट प्रकार के रूप में पाए जाते हैं।

सतह और उपसतह भूवैज्ञानिक डेटा के एकीकृत विश्लेषण के आधार पर तीन ग्रेफाइट युक्त क्षेत्रों को जोन ए, जोन बी और जोन सी के रूप में नामित किया गया है।

जोन ए में, 0.7 मीटर से 5.0 मीटर तक की मोटाई वाले आठ व्याख्या किए गए ग्रेफाइट बैंड की पहचान की गई है। ये बैंड 2% से अधिक निश्चित कार्बन (एफसी) सामग्री प्रदर्शित करते हैं, जिनका मान 2.14% से 4.97% एफसी तक है। इस क्षेत्र के लिए अनुमानित कुल ग्रेफाइट संसाधन लगभग 0.079 मिलियन टन है।

जोन बी में चार व्याख्या किए गए ग्रेफाइट बैंड शामिल हैं, जिनकी मोटाई 1.9 मीटर और 12.6 मीटर के बीच है। इस क्षेत्र में ग्रेफाइट में 2% से अधिक एफसी भी है, जिसका मान 3.42% से 5.16% एफसी तक है। जोन बी के लिए अनुमानित संसाधन 0.031 मिलियन टन है।

जोन सी में, दो ग्रेफाइट बैंड को चित्रित किया गया है, जो 2.23 मीटर और 8.23 मीटर के बीच मोटाई प्रदर्शित करते हैं। इन बैंड में 2.89% से 3.52% तक FC सामग्री वाला ग्रेफाइट होता है। जोन सी के लिए अनुमानित कुल संसाधन लगभग 0.085 मिलियन टन है।

RECONNAISSANCE SURVEY (G-4 STAGE) FOR GRAPHITE IN DARUKONA BLOCK, RAYAGADA DISTRICT, ODISHA

CHAPTER-1: SUMMARY

A reconnaissance survey (G-4 stage) was carried out for Graphite in Darukona block of Rayagada district in Odisha, under F.No. 23/411/23-NMET/389. This area belongs to the western khondalite zone of Eastern Ghats Mobile Belt. An area of 119 sq km constituting the northwestern part of 65 M/11 was mapped on 1:12,500 scale to decipher graphite occurrences. 100 nos of bedrock samples were collected for ascertaining the grade of graphite, 5-line km of SP surveys and 100 cubic meters of pitting and trenching completed to study the continuity of graphite bearing zones along strike and subsequently 500 meter drilling completed to study the depth continuity of graphite bearing zones.

Khondalite, granite gneiss and charnockite are the major lithological units together with few outcrops of leptynite, calc-granulite, mafic granulite, quartzite and pegmatite encountered in the mapped area. Most of the rocks are foliated with general trend of foliation -NNW-SSE dipping 50° southwesterly. Mineral assemblages i.e. sillimanite-garnet-orthoclase-plagioclase-quartz, orthopyroxene-clinopyroxene-plagioclase and quartz-plagioclase-pyroxene-garnet in the rocks are indicative of granulite facies of metamorphism. Graphite occurrences found in this area are of dissemination and schist type. The small-disseminated graphite flakes are generally found in khondalite and granite gneiss, oriented parallel to foliation are insignificant. Good prospects of graphite occur as schist along the boundary between khondalite and granite gneiss.

Three graphite-bearing zones, designated as Zone A, Zone B, and Zone C, delineated based on an integrated analysis of surface and subsurface geological data.

In Zone A, eight interpreted graphite bands with thicknesses ranging from 0.7 m to 5.0 m identified. These bands exhibit fixed carbon (FC) content exceeding 2%, with values ranging from 2.14% to 4.97% FC. The total graphite resource estimated for this zone is approximately 0.079 million tonnes.

Zone B comprises four interpreted graphite bands, with thicknesses varying between 1.9 m and 12.6 m. The graphite in this zone also contains more than 2% FC, with values ranging from 3.42% to 5.16% FC. The estimated resource for Zone B stands at 0.031 million tonnes.

In Zone C, two graphite bands delineated, exhibiting thicknesses between 2.23 m and 8.23 m. These bands contain graphite with FC content ranging from 2.89% to 3.52%. The total resource estimated for Zone C is approximately 0.085 million tonnes.

CHAPTER-2: INTRODUCTION

Graphite also known as plumbago or blacked or mineral carbon is a stable form of naturally occurring carbon. Structurally graphite crystallizes in hexagonal system and occurs in layersed and lamellar form with grey to black metallic luster and a greasy feel. Natural graphite categorized into two commercial varieties – crystalline graphite and flaky graphite. As per NMI database, based on UNFC system total resources of graphite as on 01.04.2020 was placed at about 211.62 million tonnes, out of that 8.56 million tonnes are reserve categories and 203.6 million tonnes are placed in resource category. Arunachal Pradesh accounts for 36% resources followed by Jammu and Kashmir (29%), Jharkhand (9%), Odisha (9%), Madhya pradesh (5%), Tamil nadu (4%). Production of graphite at about 30168 tonnes (in 2020-21) decreased by 13% as compared to that in the preceding year. Odisha was leading producer contributing 42% of the total output during 2020-21. Graphite listed as critical mineral in the list of 30 critical minerals for India issued by Ministry of Mines, Govt. of India in June, 2023.

In pursuance of NMET-mineral exploration project F. No. 23/375/2023-NMET/389, Reconnaissance Survey (G4 Stage) for graphite was carried out by the team of geologists of Maheshwari Mining Private Limited in parts of Rayagada district falling in toposheet No. 65M/11 during the period from 15.12.2023 to 01.05.2025. An area of 119 sq km was mapped on 1:12,500 scale alongwith 100 cu.m trenching, 30 cu.m pitting, 5 line kilometer of SP survey and proximate analysis of 100 nos. of groove sampling (BRS), 144 nos. core samples, 13 nos. of PT samples were done during the investigation. 6 nos. of borehole with a total metreage of 500 m were planned to intersect the graphite bearing zones at a 30 m vertical depth of intersection.

2.1. Acknowledgement

During the project, constant support from Mr. Sanjeev Ganeriwala, Joint Managing Director of Maheshwari Mining Private Limited, is gratefully acknowledged. I also extend my thanks to Maheshwari Mining Private Limited for providing necessary resources and environment to carry out the work.

The authors express their sincere guidance to National Mineral Exploration Trust, Ministry of mines, Government of India for approving the project and funding it. The Directorate of Geology and mining (DGM, Odisha and DGM Koraput) is thankfully acknowledged for monitoring the programme.

Support from the District collectorate Office (Rayagada, Odisha), Divisonal Forest Office (Rayagada, Odisha), SP office (Rayagada, Odisha), Tahsil office (Bissamcuttack, Odisha), Range office (Muniguda, Odisha), concerned RI offices and local police station (Bissamcuttack, Odisha) are being thankfully acknowledged.

2.2. Details of the project

The project approved by National Mineral Exploration Trust under F.No. 23/411/23-NMET/389 for reconnaissance survey (G4 stage) for Graphite in Darukona graphite block in Rayagada district of Odisha.

2.3. Investigating agency

Maheshwari Mining Private Limited was conducted this exploration program in pursuance of F.No. 23/411/23-NMET/389 approved by NMET on 15th December, 2023.

2.4. Objectives of investigation

The major objectives of the project are as follow-

- To carry out geological mapping of Graphite bearing outcrops and other associated lithological units.
- Assessment of resource and grade of Graphite in G4 stage of exploration.
- Attempt to delineate a block or more than one block to upgrade the investigation in G3 stage.

The first objective involves mapping the distribution of graphite occurrences within the study area on 1:12500 scale. It also involves identifying and delineating the lithological units (rock types) associated with these graphite bearing zones. This could include identifying the geological formations or rock units where graphite and lateritic graphite occur.

The second objective is to assess the tentative resource of graphite and determine its grade. Tentative resource assessment involves estimating the quantity of graphite present in the identified areas based on geological data and sampling. Determining the grade of graphite involves analysing the quality and composition of the graphite, including proximate analysis (fixed carbon content, ash content, sulphur content, volatile content and moisture content) together with analysis of 14 elements by ICPMS.

The third objective involves identifying geologically and geochemically potential areas or blocks within the study area for further exploration and assessment of graphite prospects.

2.5. Basis for taking up investigation

B.C Achariya and B. Dash (1984) confirmed the occurrence of graphite in Rayagada district. After that occurrence of graphite was reported by J.K Nanda and U.C. Pati (1988-89) in the mineralogy of khondalite in the area. Then Dr. S. Pasayat and K. N. Adhikari (1988) describe location wise (Berapadar, Panugurha, Saharha etc.) graphite mineralization together with fixed carbon content (2% to 10%) based on visual estimation, which are adjacent or within the area of the block. Based on the above information the team of geologist of Maheshwari Mining Private Limited took geological traverses and collect grabs samples from

different location. Chemical analysis of most of the samples show encouraging FC%.

2.6. Nature and quantum of the work

Table no. 2.1: Nature and quantum of work				
Sl. no	Item of work	Unit	Quantum approved	Quantum achieved
1	Geological mapping (on 1:12500)	Sq. Km	119	119
2	Geochemical sampling (Bedrock sampling)	Nos.	100	100
3	Magnetic survey	Points	350	350
4	SP survey	L.km	5	5
5	Pitting (where BRS is not available)	Cubic meter	30	30
6	Trenching	Cubic meter	100	100
7	Drilling (6 number of borehole)	Meter	500	500
8	Proximate analysis for graphite	Nos.	330	257
9	Proximate analysis for graphite 10% external check	Nos.	33	24
10	Analysis for associated REE + Vanadium (ICPMS 14 elements)	Nos.	150	148
11	Petrochemical studies (pcs)	Nos.	10	10
12	Petrographic studies	Nos.	10	10
13	Preparation of thin sections	Nos.	10	10
14	Study of thin section	Nos.	10	10
15	Bulk density/ specific gravity determination	Nos.	5	5
16	Drill core preservation	Meter	200	184.7

2.7. Personnel involved

Table 2.2 List of the personnel involved	
Responsibility Assigned	Personnel of MMPL Involved
President & CEO (Exploration)	Mr. Ambika Prasad Samantaray, President and CEO, MMPL
Advisor Geology	Mr. Pradipta Tarafdar
Overall Co-ordination	Mr. Sourabh Sarkar, DGM, MMPL
Geological Report Preparation & Documentation	Mr. Rupan Roy
Field Geologist	Mr. Rupan Roy, Geologist, MMPL
	Mr. Biswajit Kundu, Geologist, MMPL
	Mr. Tushar Kant Giri, Geologist, MMPL
Office Geologist	Mrs. Anusrita Thakur, Manager Geology, MMPL
	Mr. Balkrishnan Viswakarma, Manager Geology, MMPL
	Mr. Promit Roy, Geologist, MMPL,
Petrographic study	Ms. Medha Sarkar, Geologist, MMPL
Field Co-ordinator	Mr. Rupan Roy, Geologist, MMPL
SURPAC Modeling	Ms. Moulipriya Bhakta, Deputy Manager Geology, MMPL
Field Geophysicist	Mr. Abhishek Deori, Geophysicist, MMPL
	Mr. Manas Pritam Pukhan, Geophysicist, MMPL
Office Geophysicist	Dr. Suvendu Mondal, DGM, MMPL
DGPS Survey	Mr. Pintu Roy, Surveyor, MMPL
Drilling co-ordinator	Mr. Sujan Karmakar
Draftsman	Ms. Gargi Roychowdhury
Technical Support	Mr. Sudipta Bhowmik , IT specialist and Admin, MMPL
ArcGIS and Autocad	Mr. Rupan Roy, Geologist, MMPL
	Mr. Biswajit Kundu, Geologist, MMPL
	Mr. Tushar Kant Giri, Geologist, MMPL

2.8. Modes of operation of different work component and associated agencies

Large Scale Mapping (Reconnaissance survey) on 1:12,500 scale, surface & sub-surface sampling (BRS and core sampling), petrographic studies, Geophysical Survey, Pitting and Trenching, DGPS survey, sub-surface exploration (drilling) work were conducted by the in-house strength of Maheshwari Mining Private Limited. Geochemical analyses (Proximate analysis of graphite and analysis of 14 elements by ICPMS and determination of proximate analysis of core samples and bulk density were carried out by NMCI Shree Coal Laboratory. Check sample analysis was done by Shiva analyticals (India) Private Limited.

CHAPTER-3: PROPERTY DESCRIPTION

3.1. Village, district and state details

The area of investigation is part of the Rayagada district, Odisha (Fig.3.1). The main localities are Saharha, Dukum, Dedipadar, Beidipadar, Rambu, Lakhabhata, Darukona, kiribiri, Gaganamati.

3.2. Concerned toposheet

The area of investigation falls to the northeastern part of the survey of India toposheet no. **65M/11** (Fig.3.3).

3.3. Geo-coordinates of the corner points of the investigated area

Table 3.1: Geo-coordinates of the corner points of the investigated area		
Point Corners	Latitude	Longitude
A	19°25'00"N	83°30'00"E
B	19°25'00"N	83°37'30"E
C	19°30'00"N	83°30'00"E
D	19°30'00"N	83°37'30"E

3.4. Land use/cover

The designated area's land cover includes high hill ranges in the central, eastern and southern side together with agricultural lands, nalas and forestlands.

3.5. Forest type

The southern, central & eastern part of the area are densely covered with vegetation, which can be classified under tropical dry, deciduous, and mixed forests.

3.6. Free hold details

The total area of the proposed block is freehold.



Figure 3.1: Location map of the study area in and around Darukona-Saharha-Dukum-Kanumani, Rayagada District, Odisha

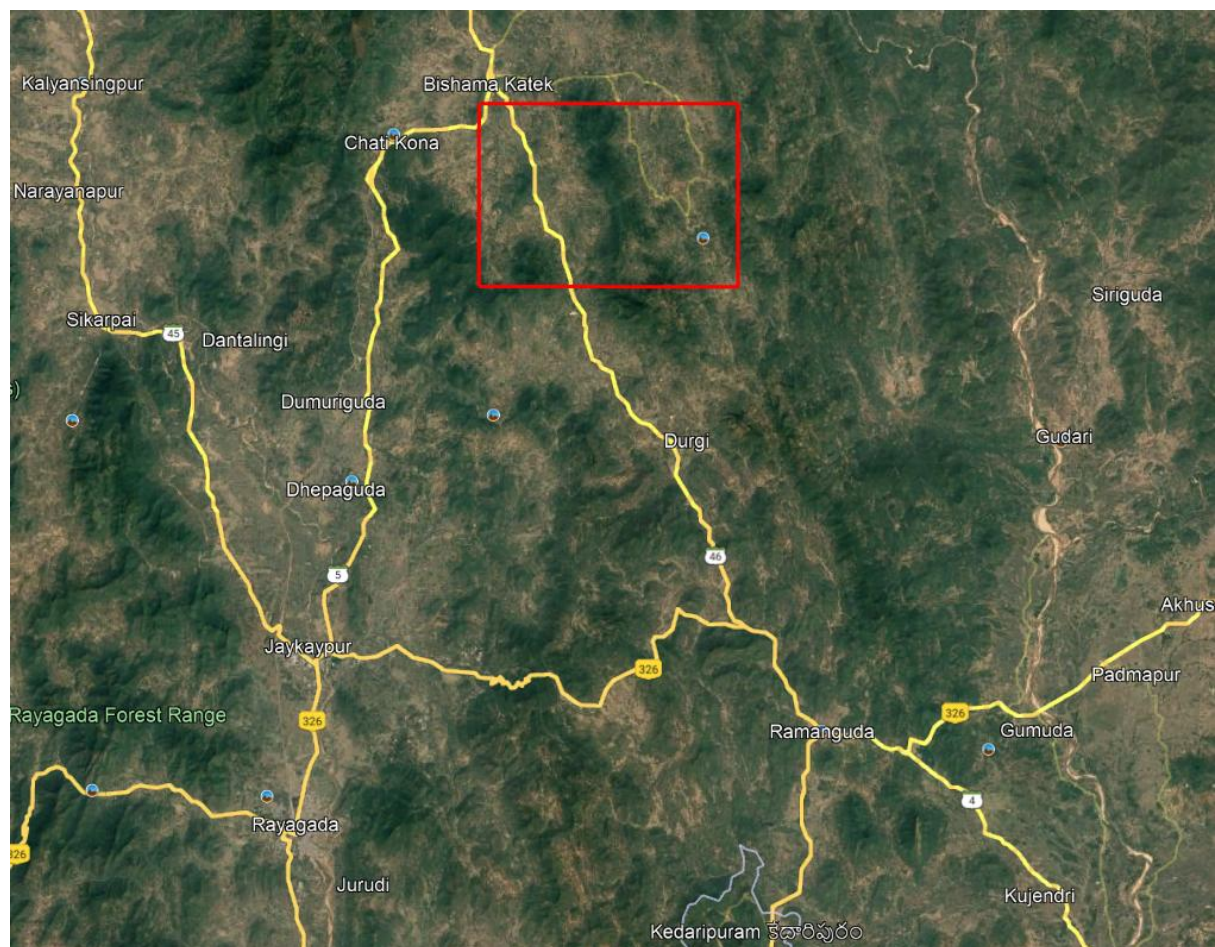


Figure 3.2: Large Scale Mapping (LSM) area, in and around Darukona-Saharha-Dukum-Kanumani, Rayagada District, Odisha, shown on Google Earth imagery

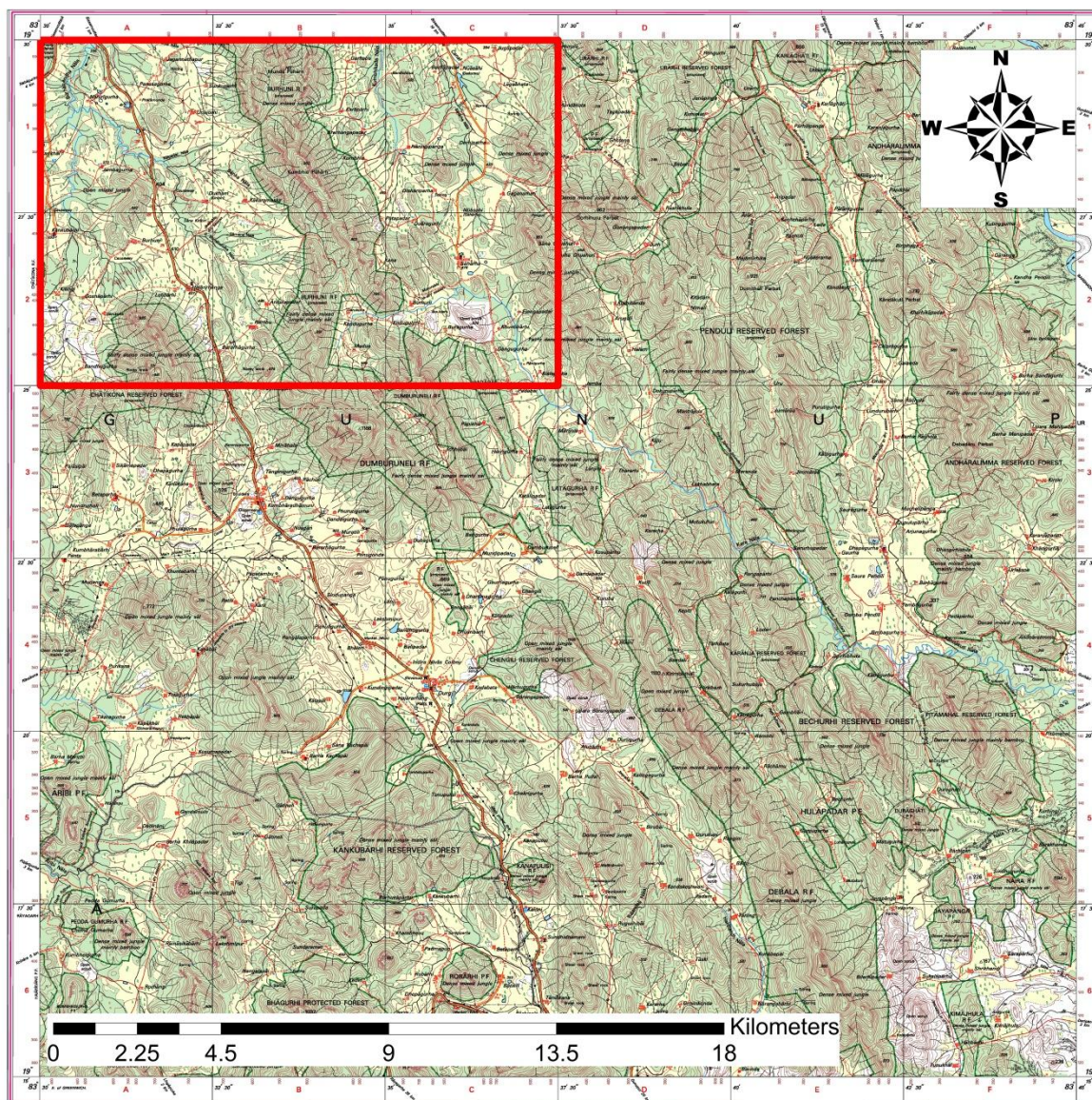


Figure 3.3: Block boundary of the study area superimposed on survey India toposheet number 65M/11

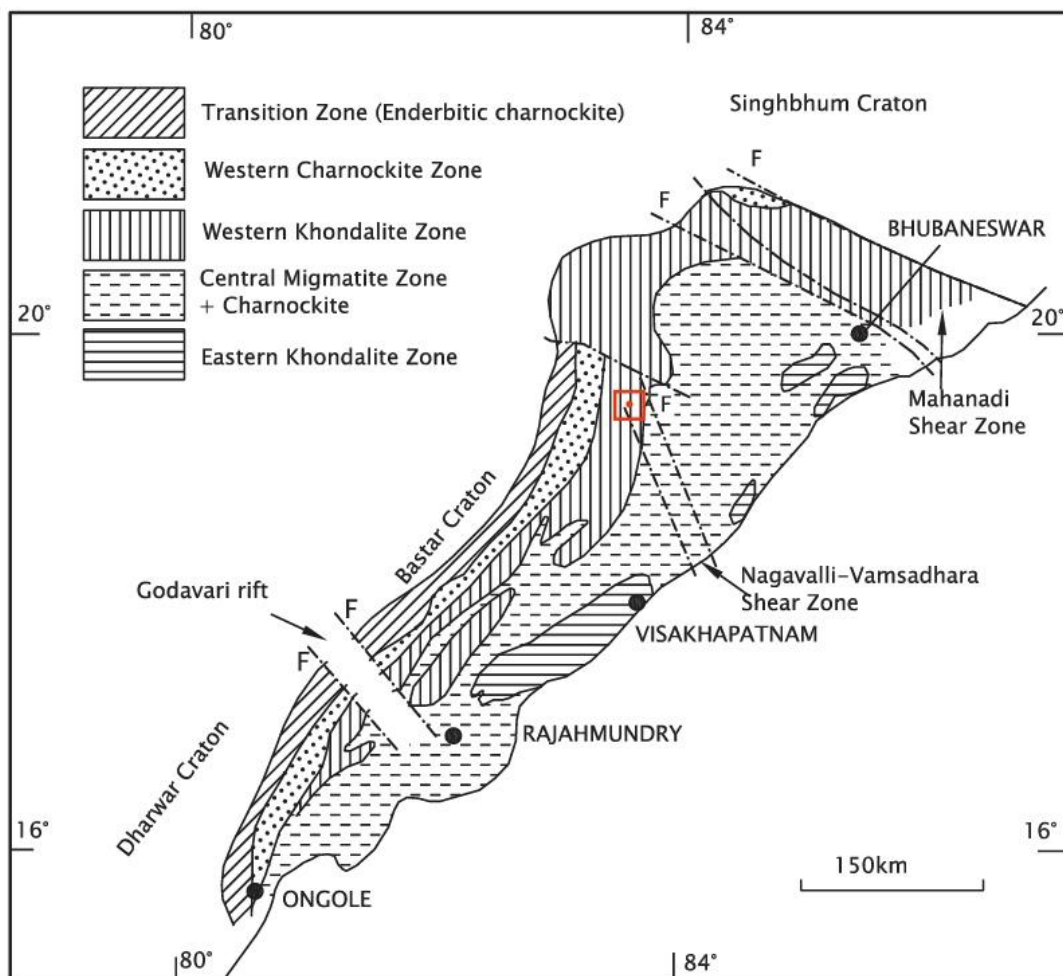


Figure 3.4: Location map of study area superimposed on map of five lithological zones of Eastern Ghats Mobile Belt (Based on Ramkrishna et al.1998; Dasgupta and Sengupta 2002; Biswal and Sinha 2003)

3.7. Location

Geographically the area belongs to the Rayagada district of Odisha. The area, enclosed between latitudes: 19°-25' N- 19°30'N and longitude: 83°30'00"E-83°37'30"E, located to the north western part of toposheet No. 65 M/11 (Fig.3.3).

Geologically the area belongs to the western khondalite zone of Eastern Ghats Mobile Belt (Fig 3.4). According to the classification of graphite zone of Odisha, it is in the part of southern graphite zone occurring in the south-western side of Tumudibandh shear belt.

3.8. Accessibility

The area is well connected by a network of rail and road. Bissamcuttack, Muniguda and Rayagada are the nearby railway stations. On the other hand the SH-46 is connecting the area to the NH-326 (Fig.3.2).

3.9. Climate and vegetation

The area experiences humid and tropical climate. During summer the mercury rises to as high as 48°C. Rainy season starts from the middle of June lasting up to the end of October. Average rainfall in the area is 120 cm winter months are cold and-pleasant.

Typical tropical forests occupy the hill slopes constituted particularly of khondalite due to its susceptibility to weathering. The deciduous trees growing in these forests include Shorearousta, Modhucalatifolia, Sal, tamarind, Mahul and Bamboo, in the lower slopes and the vegetation includes economic plants such as Jackfruit, Kendu, Mango, Banana etc. The soil and alluvium covered plains are utilized for the cultivation of paddy, wheat, pulses. Along the hill slop cashew and cotton cultivation are very popular in this area. Bushes of Chromolaena Odorata are common in this area.

3.10. Flora and fauna

The common flora include Mahul (*Bauhinia vahlii*), Tamarind (*Tamarindus indica*), and Bamboo (*Bambusa vulgaris*), Jackfruit (*Artocarpus heterophyllus*), Kendu (*Diospyros melanoxylon*), Mango (*Mangifera indica*), Banana (*Musa Paradisiaca linn*) etc.

The common fauna include Chameleon (*Chamaeleo chamaeleon*), Gliding snake, Mongoose, Peacock, Wild buffalo, Snakes etc.

3.11. Geomorphology

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

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

3.12. Local infrastructure

Being the part of Eastern Ghats Mobile Belt, the area is characterised by undulated topography consisting of high hill ranges and valleys together with nala sections and agricultural land, with several villages including Saharha, Dukum, Dedipadar, Beidipadar, Rambu, Lakhabhata, Darukona, kiribiri, Gaganamati, Kankubadi etc. In spite of such undulatory topography, it is well connected by metaled roads and electric power supplies

for domestic use. The Kankubadi Lake is located near the Kankubari village.

3.13. Environment

Rayagada was conferred the status of district in the early part of 1992, when erstwhile Koraput district was divided into four new districts. About 94% of the population live on rural areas and depends for their livelihood largely on irrigation. It is located to the southwestern part of Odisha lying between latitude $18^{\circ}54'$ to $20^{\circ}00'$ and longitude $82^{\circ}54'$ to $82^{\circ}02'$ covering an area of 7073 sq.km.

Mineral is one of the important components for making industry in the district. The minerals are graphite, manganese, bauxite, chinaclay, limestone, quartz and gemstone.

The economy of the Rayagada district is mainly driven by the industrial & agricultural sector and tourism. Among these, the agricultural sector and industrial are the backbone of the economy of the district. Tourism of Rayagada recounted through the wealth of its natural and cultural heritage.

CHAPTER-4: PREVIOUS WORK

- ❖ Parts of the area and the surroundings were covered by systematic geological mapping earlier by Dey (1940-41), Dey and Chakraborty (GSI, 1944-45) and Muktinath (GSI, 1941-42). Then, Chaudhury and Acharya (GSI, 1977-78), Malviya and Mathur (GSI, 1980-81) and Dasgupta (GSI, 1981-82) have studied parts of it and gave a general geological account of the area comprising field relationships and basic petrography of the lithological units. They have grouped the lithological units under Eastern Ghats Super Group (Complex).
- ❖ Officers of the Directorate of Geology, Odisha first reported graphite occurrences around Sollagudi, Naringapanga, Khallupadar, Mudra, Bongna, Berli and Sabinala villages of Rayagada district in 1982-83. Preliminary investigation was carried out and found graphite occurrences under thick soil cover. Analysis of FC% varying up to 49%. It was observed that graphite occurrences are found within the migmatised khondalite. The ore bodies show concordant relationship with the host rock.
- ❖ In 1983-84 Directorate of Geology, Odisha carried out mapping and found seven graphite occurrences in nearby areas of Naringapanaga village. The F.C % varying from 4.56 to 21.38%.
- ❖ In recent years, J.K Nanda and U.C. Pati (GSI, 1988-89), have reported occurrences of pelitic and psammopelitic meta-sedimentaries with or without graphite in the area along with charnockite and granite suit of rocks.
- ❖ Dr. S. Pasayat and K. N. Adhikari (GSI, 1988) reported occurrences of graphite in different villages of Rayagada district.

CHAPTER-5: GEOLOGY OF THE AREA

5.1 Regional Geology

The rugged terrain with discontinuous hill ranges facing the Bay of Bengal is known as the Eastern Ghats where the average altitude is 610 m, and the tallest peak Mahendragiri is 1501 m high. Extending from Brahmani River in Odisha to Ongole in south-eastern Andhra Pradesh, the terrain of highly deformed rocks that experienced ultrahigh-temperature granulite facies metamorphism and several generations of magmas of varied compositional types is recognized as the **Eastern Ghats Mobile Belt (EGMB)**. The 1000-km-long terrain is nearly 300 km wide in the northern part (Mahalik 1996), but tapers to merely 30 km in the south, the average width being 100 km (Fig. 6.1). Two Phanerozoic rift valleys, Mahanadi and Godabari graben in the south, break the continuity by hosting Gondwana sediments. It is a Mesoproterozoic terrain that has a very long history of tectono-thermal activities including migmatization and charnockitization of supra-crustal rocks.

The EGMB was referred to as a convergent orogeny that evolved under NW–SE-directed sub horizontal compression resulting from oblique collision of continental plates (Chetty and Murthy 1994; Ramakrishnan et al. 1998; Bhattacharya 2002). Gravity modelling constrained by seismic information suggests that the eastward-inclined 38- to 40-km-thick column of cratonic crust lies 35 km below this mobile belt (Kumar et al. 2004). It is apparent that the EGMB displays high-gravity anomaly compared to the cratons, implying denser rocks underlying it (Subramanyam and Verma 1986).

Four lithological zones constitute in the EGMB (Fig. 3.4) on the basis of ages of protoliths and constituent minerals (Ramakrishnan et al. 1998). The fifth unit is the zone of transition.

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

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

The Central Migmatite–Charnockite Zone is made up of dominant migmatites, garnet-bearing diatexites with leptynites, high Mg–Al granulite and calc silicate rock intruded by charnockites and porphyritic granites. There are bodies of massif-type anorthosite within the zone. The migmatites owe their origin to high-grade metamorphism with attendant differential melting of siliceous granulites, like the khondalite. The charnockites also show a

composition that reveals affinity to tholeiitic to calc-alkaline basalts of the protoliths (Rao et al. 1995). There are patches of charnockite developed incipiently on the granulitic gneisses and migmatites. They were supposed to have formed as a result of activity of CO₂-rich fluids and/or through a process of charnockitization of metasediments of appropriate bulk composition (Nanda and Pati 1989; Paul et al. 1990; Rajesham et al. 1992; Mohan et al. 2003).

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

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

5.2 Stratigraphic Column

On the basis different geological investigations and evidences a tentative stratigraphic column (Table no 5.1) was proposed by Ramakrishnan et al., (1994).

Table no.5.1: Stratigraphic Sequence of Eastern Ghats [Ramakrishnan et al., (1994)]	
Age	Lithological Units
800-900 Ma	Alkaline rocks, granitoids
1000-1100 Ma	-----Eastern Ghats orogeny-----
	Development of eastern Ghats front of upgraded cratonic rocks.
	Incipient and massive charnockite and garnetiferous gneiss with biotite and sillimanite
1300-1400 Ma	Emplacement of alkaline rocks (Feldspathoid gneiss and anorthosite)
Khondalite Group (WKZ, CMZ, EKZ)	Garnet-sillimanite-Quartz-feldspathic graphite gneiss
	Cordierite-sapphirine-spinel rocks
	Calc silicate rocks and rare marbles
	Quartzite rich in garnet
1600-1800 Ma (WCZ)	Evolution of purana basin
2600-2800 Ma	Charnockite with enclaves of basic granulite, high grade gneiss including BIF and layered basic complexes, representing original cratonic basement (?) in migmatitic amphibolite facies
3000 Ma	Vestigial events (?)

5.3 Structure

The Eastern Ghats in the Peninsular India trends NE-SW and form detached hill ranges that stretch from Cuttack to the Nilgiris. Presently, the Eastern Ghats Mobile Belt is distinguished from the southern granulite terrain by differences in lithological polarity, presence of manganese, marble, the ubiquitous garnetiferous gneiss, structural alignment and

age (Ramakrishnan, 1988). The Eastern Ghats Complex in Odisha comprises dominantly metasediments like khondalite, quartzite, acid gneiss and calc-silicate granulite intimately associated with basic granulite (two pyroxene), charnockite, porphyroblastic acid gneiss and leptynite. More or less these rock types form banded assemblage and are permeated by quartz-feldspar neosomes and pegmatites giving rise to migmatites depicting palaeosome-neosome mixtures of different degrees at different places which is typical of migmatite complex of Eastern Ghats (Halden et al., 1982).

These lithological layering exhibit complex structural patterns. Parallel bands of more or less foliated graphite in Eastern Ghats Complex of Odisha rock units are oriented diversely as a four successive fold phases, (viz. isoclinal to tight intrafolial fold (F1); asymmetrical to isoclinal, intrafolial folds (F2); open folds (F3) and warp folds (F4), despite the regional NE-SW Eastern Ghats trend (Krishnan, 1953; Halden et al., 1982; Park and Dash, 1984; Acharya and Dash, 1984). The trend of major lithological units exhibit NE-SW to NNE-SSW in western and southern parts of Odisha but in eastern part the trends of major lithological units are NNW-SSE to NW-SE and in places E-W.

5.4 Metamorphism

The rocks building the framework of the EGMB consist of the following mineral assemblages:

- Garnet-sillimanite-perthite-plagioclase-quartz \pm graphite (khondalite)
- Garnet-plagioclase-perthite-quartz (leptynite)
- Wollastonite-scapolite-plagioclase-garnet-calcite-clinopyroxene-sphene (calc-silicate granulite)
- Orthopyroxene-clinopyroxene-plagioclase \pm garnet (basic granulite)
- Sapphirine-spinel-orthopyroxene-garnet-quartz/corundum-cordierite-sillimanite
- (high-magnesian-aluminium granulite)
- Orthopyroxene-plagioclase-quartz-perthite (enderbite-charnockite)

The study of chemistry of these mineral assemblages together with interpretation of textural features of constituent grains brings out a coherent picture of thermal history of the Terrain. Metamorphism reached the granulite facies (Temperatures 950–1040 °C and pressures of 8 to 10 k bar), followed by isobaric cooling (under equal pressure) and decompression. Three phases of metamorphism were identified (Dasgupta 1995; Dasgupta and Sengupta 2002) — (i) early ultrahigh-temperature metamorphism with anticlockwise P–T path, (ii) granulite facies reconstitution with retrograde trajectory of near isothermal decompression and (iii) amphibolite facies metamorphism.

The early-stage ultrahigh-temperature metamorphism at temperatures higher than 1000 °C and under pressures of 8–10 k bar—representing the peak of the processes—was

witnessed by, among other areas, Vijaynagaram (Sarkar et al. 2003) and Chilka Lake (Bhattacharya 2004). The high Mg–Al granulite of Visakhapatnam district was formed at temperatures 930–740 °C under pressure of 8.5–5.9 Kbar (Lal 1997; Lal et al. 1987; Dasgupta and Sengupta 2002). The orthopyroxene-bearing enderbite rocks associated with basic granulites in the northern part of the terrain was affected by metamorphism at temperatures in excess of 950 °C and under pressure of 8–9 kbar. The elevated temperature is attributed to emplacement of basic magma (Bose et al. 2003). There was dehydration melting in the Chilka Lake area (Sen and Bhattacharya 1997). The Gangarajumuduguli charnockites were formed under anhydrous condition generated by influx of CO₂-rich fluids into rocks of lower crustal level where the temperature was 860 °C and pressure of 9 kbar (Mohan et al. 2003). As a matter of fact, ultrahigh-temperature condition prevailed practically all over the Eastern Ghats Terrain when thermal perturbation occurred on a lithospheric scale. The cause of exceptionally high heating was the under-plating or intra-plating of hot basic magma (Dasgupta and Sengupta 2002). The ultrahigh-temperature events were followed by retrograde metamorphism at temperatures 750–800 °C under pressures 6–7 kbar, as deduced from the composition of orthopyroxenes and the coronal garnet which have rims of spinel against quartz (Sarkar et al. 2003). From relict kyanites, a clockwise path with decompression followed by isobaric cooling is witnessed in the Deobhog area (Patel et al. 2001). The mineral assemblages of khondalites and associated felspathic gneisses and porphyritic charnockites of the Araku–Paderu sector indicate a temperature of 750 ± 50 °C and pressure 7.5 ± 0.5 kbar (Divakara Rao and Murthy 1998). The megacrystic granite widely distributed in the Central Khondalite Zone and Eastern Migmatite–Charnockite zone is characterized by very high strontium ratio (0.7172), negative correlation of Ba, Sr and Zr and positive correlation of REE, Th and Rb with SiO₂. The chemistry betrays their deep-seated origin through melting of the crust at 850°–1000 °C under pressure of 9 kbar (Divakara Rao et al. 2001).

CHAPTER-6: GEOSCIENCE INVESTIGATION

6.1 Geological mapping

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

6.1.1 Description of the lithological units

Khondalite

Khondalite (Fig.6.1.A) is the dominant lithological unit and covers an area of 39.810 sq.km which is the 33.453 % of the proposed area (Table 6.1). Outcrops of khondalite are exposed along the hills (central, eastern and southern side of the area). In hand specimens khondalite is reddish brown colored, medium to coarse grained, very hard and foliated and contains garnet, sillimanite, quartz and feldspar with graphite and opaque as accessory minerals. The mineral assemblage evidenced that it underwent granulite facies of metamorphism. There are three varieties of khondalite units encountered in the area. They are, khondalite proper (Fig.6.1.A), migmatized khondalite (Fig.6.1.B) and granite like khondalite (Fig.6.1.C). The khondalite proper (Fig.6.1.A) is reddish in color with very rough and foliated in appearance. The migmatized khondalite (Fig.6.1.B) contains leucosomes of quartz feldspar rich bands alternates with garnet rich bands. In the gradational contact zone between khondalite and granite gneiss, the khondalite shows the granite like appearance (Fig.6.1.C) due to less proportion of garnet. In this situation, the presence of sillimanite used to differ as khondalite from the granite gneiss.

Graphite flakes were noticed in the mineralogy of khondalite near Darukona, Bandhugurha, Kakarmaska, Gaganmati villages (PLATE-I) etc.

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

Table 6.1: Representing the area percentage of the lithological units

Lithology	Total area of the Block (In sq.km)	Total area covered (In sq.km)	Percentage (%)
Khondalite	119	39.810	33.453
Granite gneiss	119	13.436	11.291
Charnockite	119	2.572	2.161
Calc-silicate	119	0.011	0.009
Leptynite	119	0.456	0.383
Quartzite	119	0.013	0.011
Migmatite	119	0.028	0.024
Pegmatite	119	0.002	0.002
Soil cover	119	62.673	52.666

Granite gneiss

Granite gneiss (Fig.6.1.D) is the second dominant lithological unit and covers an area 13.436 sq km which is 11.291 % of the area (Table 6.1). Outcrops of granite gneiss are restricted to lower altitudes especially along the foothills and valley portion of the block. Two types of granite gneiss encountered in the area i.e. porphyritic granite gneiss and foliated granite gneiss (Fig.6.1.E, D). The porphyritic granite gneiss occurs along small oval shaped hillocks near Kumbhia and Patapadar villages and on the other hand the foliated granite gneisses encountered along the foothills near the Bandichua, Jugapadar, Buragurha, Burni and Kankubari villages.

In hand specimens the granite gneisses are pinkish white colored, coarse grained, and crudely foliated and contains garnet, quartz and feldspar with opaque as accessory minerals. Graphite flakes has also encountered in the mineralogy of granite gneiss along the foliation plane near the Ankulpadar and Jagannathpur villages.

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

Charnockite

Charnockite (Fig.6.2.C) is the third dominant lithological unit and covers an area 2.572 sq km which is 2.161 % of the explored area (Table 6.1). Bouldery outcrops of charnockite encountered near Jambagurha, Bandhugurha, Madua and Lakhabhata villages showing gradational contact with khondalite. In hand specimen charnockite is leucocratic to melanocratic, medium to coarse grained, massive rock which contains quartz, feldspar and pyroxene.

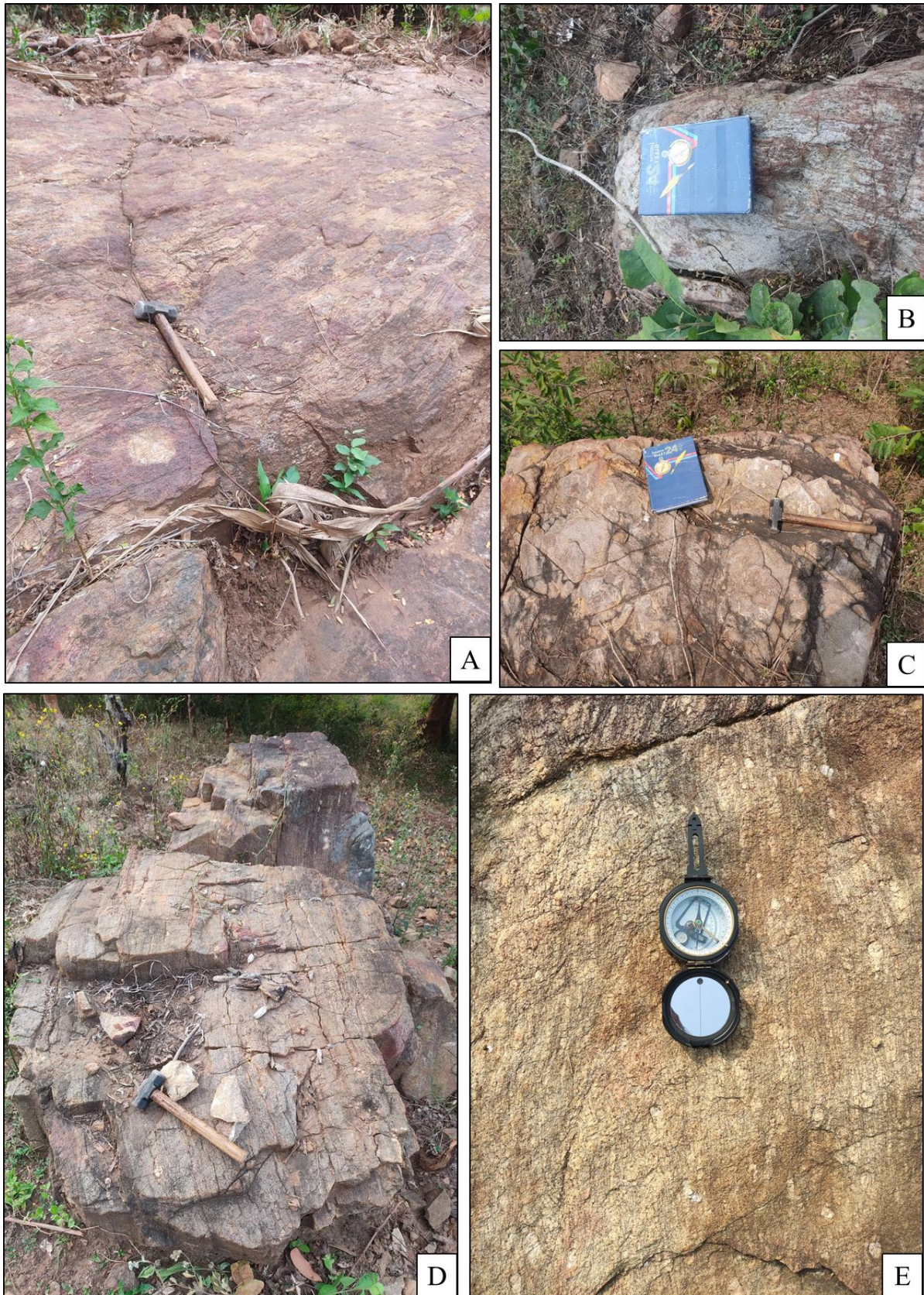


Figure 6.1: Field photographs of A. Khondalite proper, B. Migmatized khondalite, C. Granite like khondalite, D. Granite gneiss containing augen of quartz, E. Porphyritic granite gneiss



Figure 6.2: Field photographs of A. Quartzite, B. Calc-silicate gneiss shows ribs and furrow structure, C. Bouldery outcrops of charnockite



Figure 6.3: Field photographs of A. Leucosome and melanosome in migmatite, B. Pegmatite containing crystals of garnet, C. Mafic granulite enclave in granite gneiss

Calc silicate granulite

Calc- silicate granulite (Fig.6.2.B) has limited distribution and covers an area 0.011 sq km which is 0.009 % of the proposed area (Table 6.1). It was recorded along south-eastern side of Jambagurha and western side of Kiribiri village. Megascopically the rock is greenish white in colour and shows ridge and furrow structure due to differential weathering of alternate compositional banding. The essential mineral constituents of the rock are plagioclase, quartz, diopside, wollastonite and sphene. The rock shows disharmonic folds

generated due to the competent contrast between quartz feldspar rich layers and diopside, wollastonite rich layers.

Quartzite

A narrow band of quartzite (Fig.6.2.A) is found in the eastern side of Ranigurha village within granite gneiss. It is composed of quartz and garnet.

Basic granulite

Basic granulite is a dark grey, medium to coarse grained massive granulitic rock containing Pyroxene and plagioclase. Basic granulite occurs mostly as narrow bands within migmatites and migmatized khondalites. Xenoliths of basic granulite occur within granite gneiss (Fig.6.3.C).

Leptynite

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

Pegmatite

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

6.1.2 Petrographic studies

General:

Petrographic examination of thin sections of 10 borehole core samples of different lithologies exposed in the Darukona Block, Odisha is aimed to classify the various rock types present in the area including the hosts of graphite mineralization.

Petrographic observations:

Petrographic observations from thin section analyses indicate that the Darukona Block is predominantly composed of high-grade metamorphic and igneous lithologies i.e. charnockites, enderbites, khondalites, mafic granulites, and granite gneiss.

Among these rocks, khondalites and granite gneiss are the primary lithologies hosting graphite mineralization. khondalites exhibit prominent gneissic structure, characterized by the dominant orientation and elongation of mineral grain. The graphite is studied under microscope and observed as both flaky and slightly amorphous in some places. The flakes are well- developed, and occasionally branch, seen under higher magnification. In some areas, it appears as mass of graphite flakes. Thin section analysis reveals that the graphite is controlled by both lithology and structures.

Thin Section Petrography Report

Sample: DSBH-1/M-1

Rock Type: Garnetiferous Quartzite

The photomicrograph of the thin section (Fig.6.4) reveals a mineral assemblage primarily consisting of quartz, garnet, and very few feldspars, with minor occurrences of opaque minerals. Quartz grains exhibit a granoblastic texture with sutured boundaries and undulose extinction, indicative of post-metamorphic strain. Garnet occurs as subhedral to euhedral porphyroblasts, identifiable by their isotropic nature under crossed polars, and contains numerous fine-grained inclusions of quartz and feldspar. The feldspar component, mainly plagioclase, shows moderate sericitization along cleavage planes which gives evidence of later retrograde metamorphism signatored by the hydrous minerals. Opaque minerals, likely magnetite or ilmenite, are dispersed throughout the section but in very less numbers. The petrographic features suggest a medium- to high- grade metamorphic overprint. and the rock type can be identified as garnetiferous quartzite.

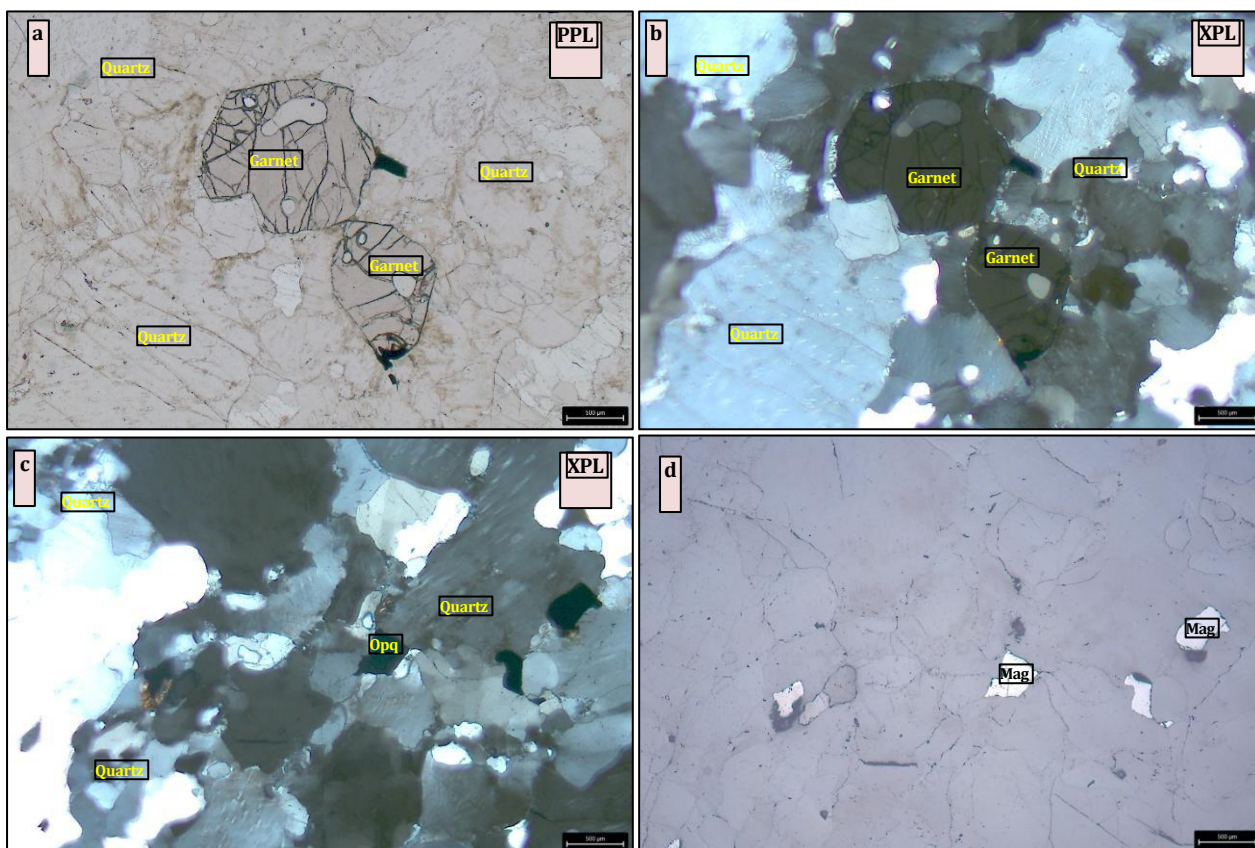


Figure 6.4: Photomicrograph of a & d-garnetiferous quartzite under plane polarised light, b & c – garnetiferous quartzite under cross polarised light

Sample: DSBH-1/M-2

Rock Type: Garnetiferous Quartzite

The thin section (Fig.6.5) reveals a mineral assemblage predominantly composed of quartz and garnet, with minor feldspar and sparse opaque minerals. Quartz grains display a granoblastic texture with sutured grain boundaries and undulose extinction, indicative of deformation and strain post-metamorphism. Garnet occurs as subhedral to euhedral porphyroblasts, easily identifiable due to its isotropic nature under crossed polars and commonly encloses numerous fine-grained inclusions of quartz and feldspar.

Feldspar, primarily plagioclase, is present in limited amounts and exhibits moderate sericitization along cleavage planes, suggesting a retrograde metamorphic overprint characterized by hydrous mineral alteration. Opaque minerals, likely magnetite or ilmenite, appear sparsely distributed the section. The observed petrographic characteristics, including the presence of garnet porphyroblasts and the textural attributes of quartz, suggest that the rock has undergone medium- to high-grade metamorphism, confirming its classification as garnetiferous quartzite.

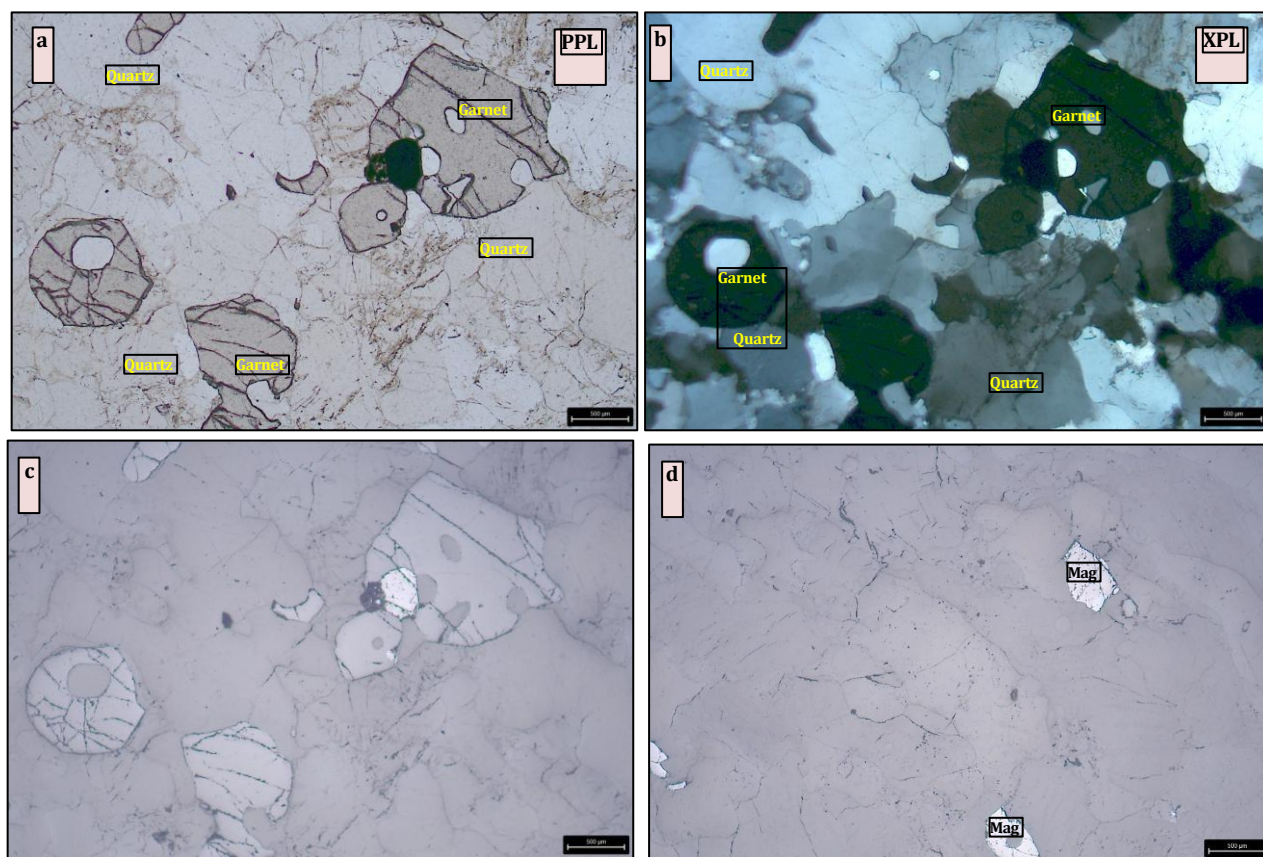


Figure 6.5: Photomicrograph of a, c, d-garnetiferous quartzite under plane polarised light, b – garnetiferous quartzite under cross polarised light

Sample: DSBH-3/M-3

Rock Type: Garnetiferous Granite Gneiss

The thin section (Fig.6.6) analysis reveals a mineral assemblage primarily composed of quartz, feldspar, and abundant garnet. Quartz grains display a granoblastic texture with interlocking boundaries and localized undulose extinction, indicative of post-metamorphic strain. Garnet occurs as subhedral to anhedral grains, extensively fractured and containing numerous inclusions of quartz and feldspar, suggesting syn-metamorphic growth.

Feldspar, predominantly plagioclase, exhibits moderate sericitization and characteristic parallel twinning. Notably, the thin section lacks a well-developed mineral orientation or visible foliation, implying a relatively weak or absent preferred fabric. The mineralogical composition and textural attributes suggest that garnetiferous granite gneiss likely represents the leucosomal component of a high-grade metamorphic system.

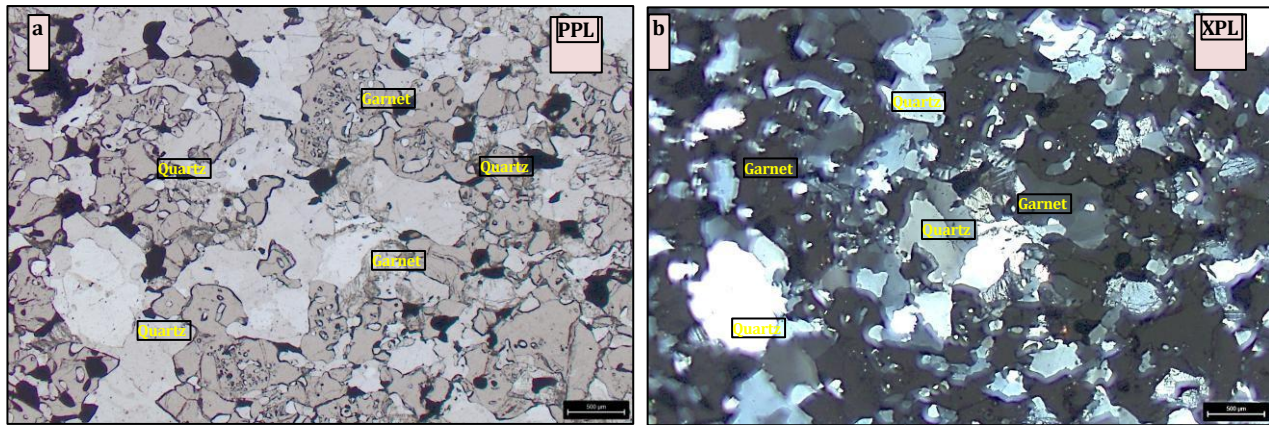


Figure 6.6: Photomicrograph of a. Garnetiferous granite gneiss under plane polarized light, b. Garnetiferous granite gneiss under crossed polarized light

Sample: DSBH-3/M-4

Rock Type: Granite Gneiss

Under the microscope, the thin section (Fig.6.7) exhibits quartzofeldspathic mineralogy with notable amounts of garnet and biotite. Quartz displays a granoblastic texture with interlocking boundaries, while feldspar, primarily plagioclase, is characterized by parallel twinning and moderate sericitization along cleavage planes.

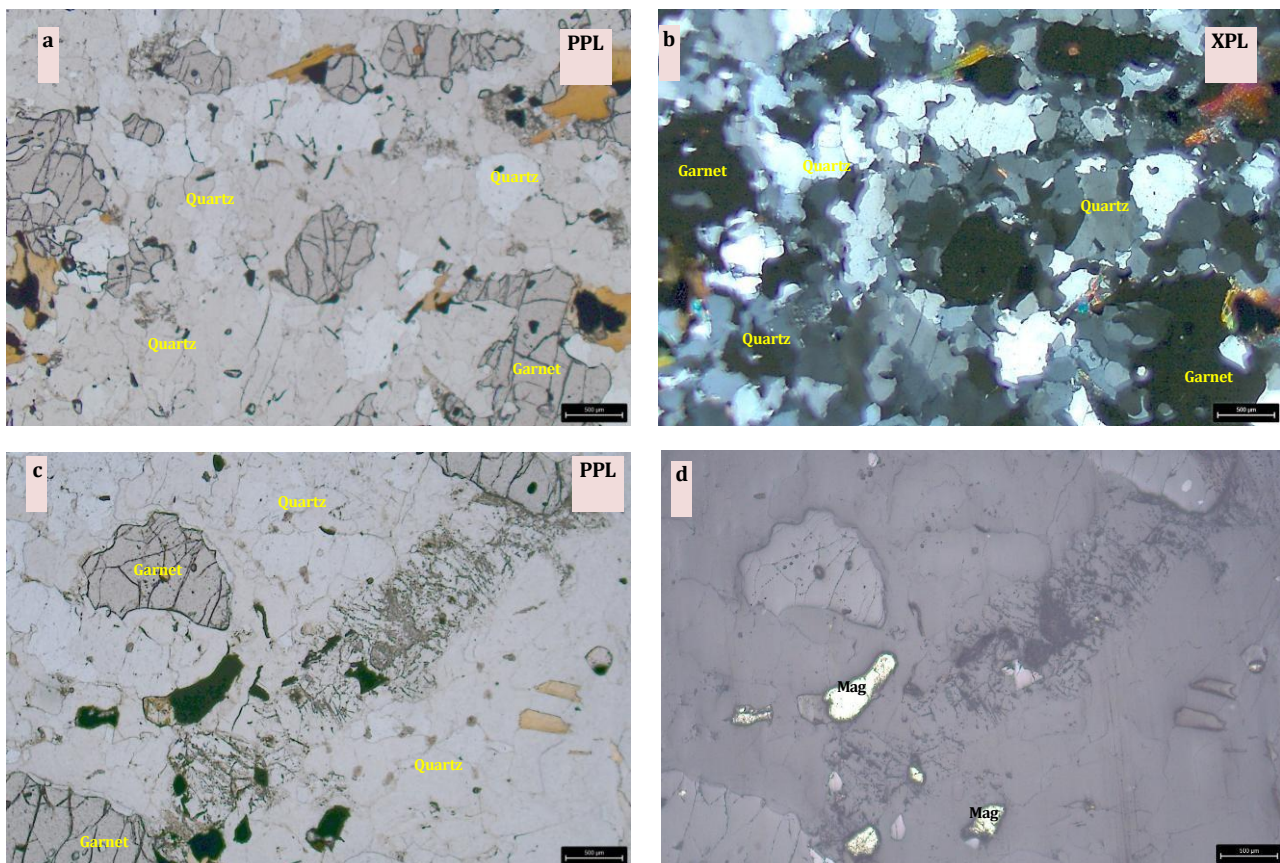


Figure 6.7: Photomicrograph of a, b, d. granite gneiss under plane polarized light, b. granite gneiss under crossed polarized light

Garnet appears as subhedral grains, exhibiting a crude directional alignment without significant elongation. Biotite, the dominant mafic phase, also follows this weak alignment, suggesting an incipient foliation. Few opaque minerals identified as magnetite are present in the thin section. The mineralogical composition and fabric development indicate garnetiferous granite gneiss.

Sample: DSBH-1/M-5

Rock Type: Granite Gneiss

Megascopic examination of the sample reveals a distinct gneissic fabric, characterized by alternating quartzofeldspathic and mica-rich domains. However, under the microscope, the thin section (Fig.6.8) predominantly exhibits a quartzofeldspathic-rich portion with minimal presence of mafic minerals.

Quartz grains display undulose extinction and sutured grain boundaries, indicative of recrystallization. Feldspar consists of both microcline and plagioclase, with some grains showing features of myrmekitic texture. Subhedral garnet is present in minor amounts, distinguished by its isotropic nature under crossed polars. Opaque minerals, likely magnetite, occur as accessory phases. The mineralogical composition and well-developed gneissic banding confirm the classification of this sample as a granite gneiss with minor garnet content.

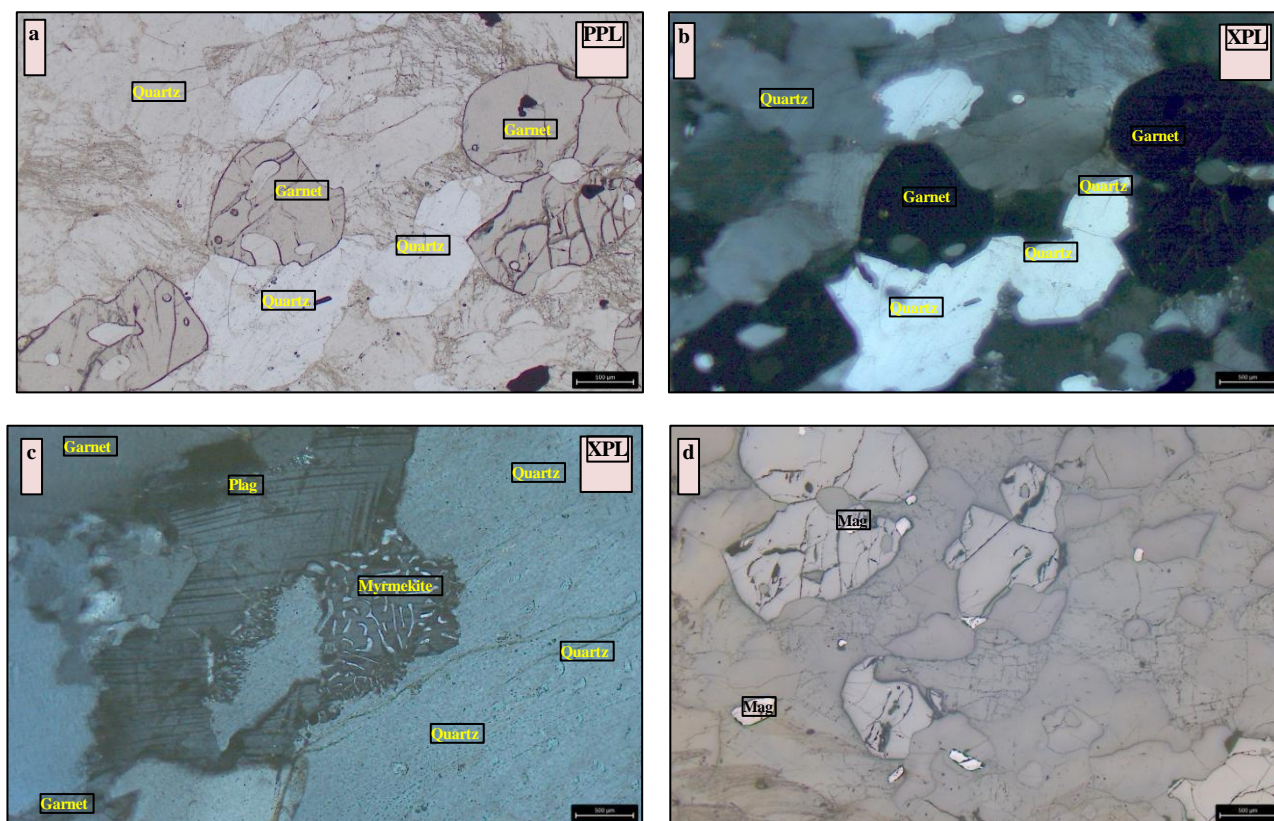


Figure 6.8: Photomicrograph of a, d. granite gneiss under crossed polarized light, b, c. granite gneiss under plane polarized light

Sample: DSBH-2/M-6

Rock Type: Granite Gneiss

The thin section (Fig.6.9) reveals a mineral assemblage dominated by quartz and feldspar, with a minor presence of garnet minerals. Quartz grains exhibit undulose extinction and sutured boundaries, indicative of recrystallization. Feldspar, consisting of both microcline and plagioclase, displays characteristic twinning and moderate alteration.

Subhedral garnet is present, distinguished by its isotropic nature under crossed polars. Opaque minerals, likely magnetite, are dispersed as accessory phases. The mineralogical composition and textural attributes confirm the classification of this sample as granite gneiss with minor garnet content.

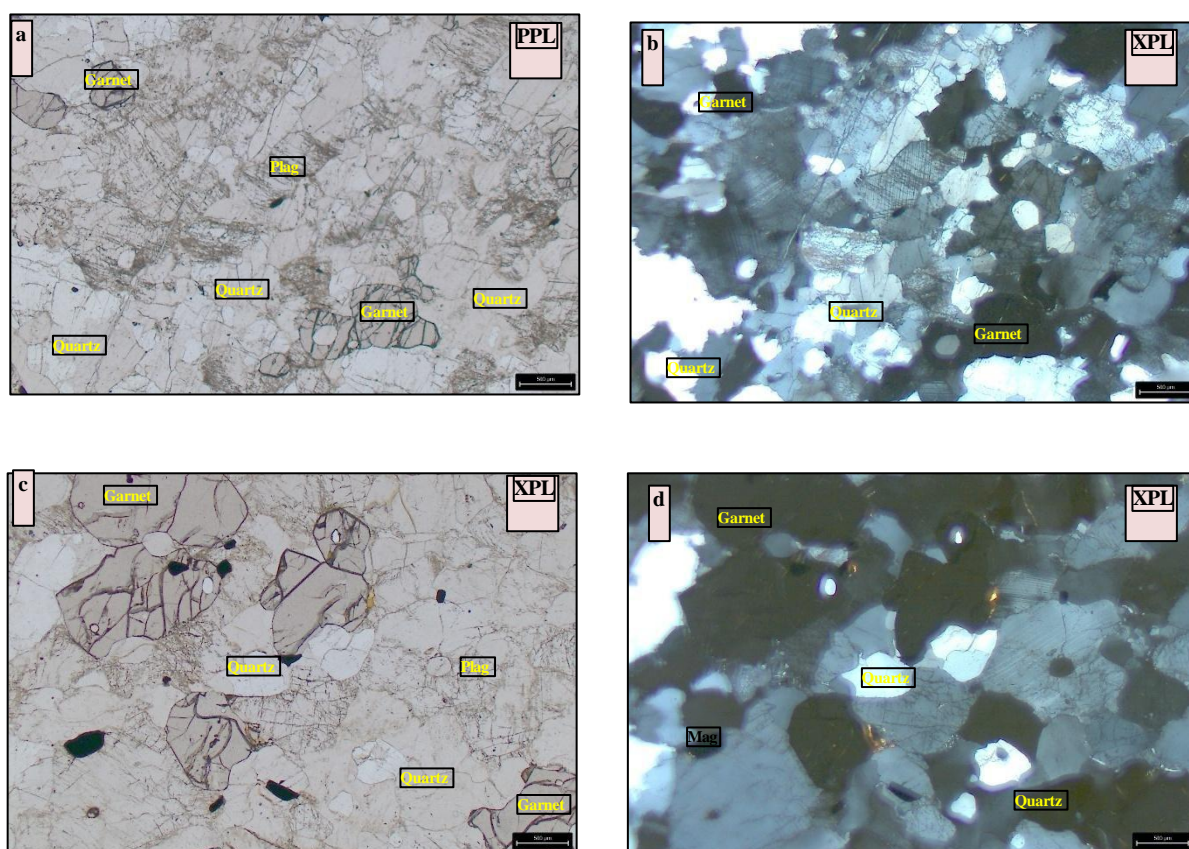


Figure 6.9: Photomicrograph of a, c. granite gneiss under plane polarized light, b, d. granite gneiss under crossed polarized light

Sample: DSBH-3/S-02/M-13

Rock Type: Khondalite with graphite

The photomicrograph of the thin section (Fig.6.10) reveals a mineralogical distribution consisting of quartz, garnet, sillimanite, and graphite, with minor presence of plagioclase feldspar. The garnets, identifiable by their isotropism under transmitted light, are highly fractured. Long, prismatic, well-developed sillimanite grains occur along the dominant foliation plane, along which small grains of flaky graphite are also present. These grains, under reflected light, show sporadic development of graphite, as depicted in the photomicrographs. The graphite is flaky, elongated, light brown in body color, and anisotropic under reflected light. The graphite grains are developed along the margins of the garnet and sillimanites and occur parallel to the alignments of those grains. The matrix is divided into alternating zones of quartz-rich and garnet-sillimanite-rich areas. Petrography indicates that the thin section is of graphite-bearing Khondalite.

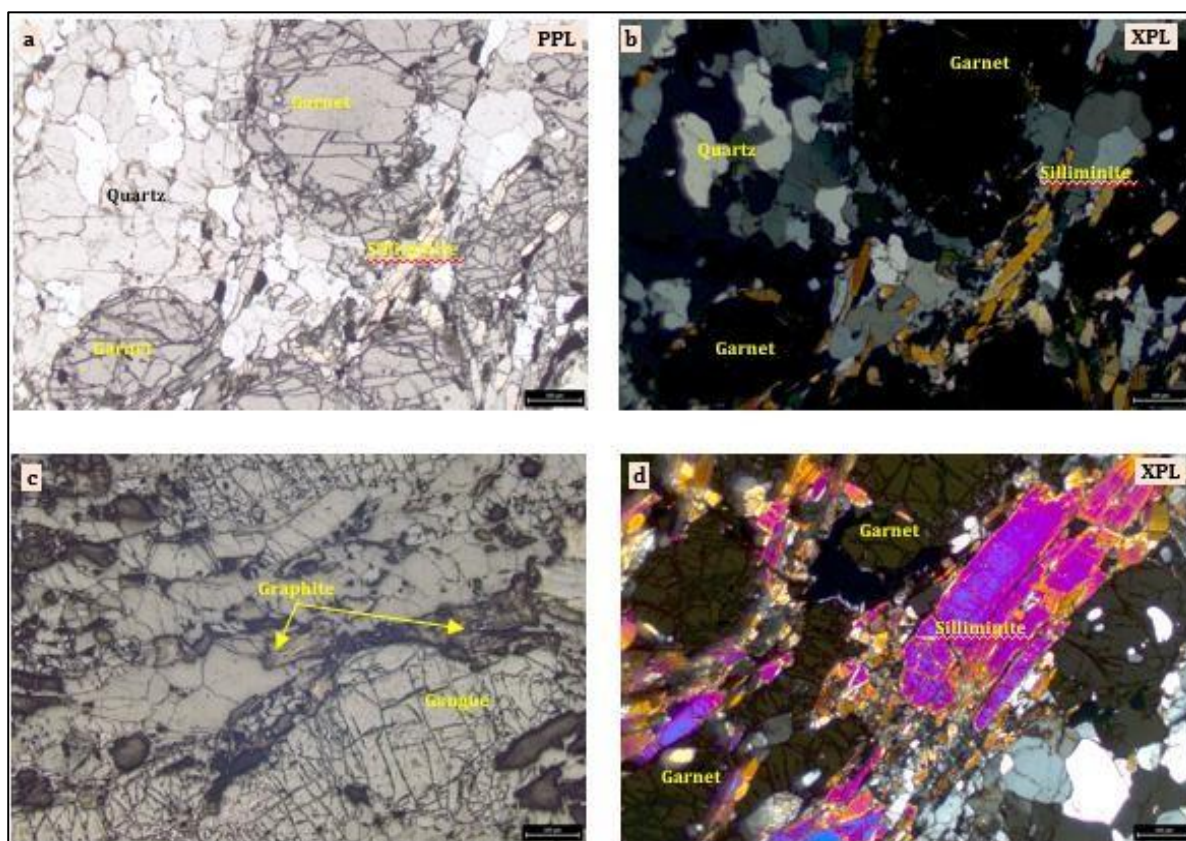


Figure 6.10: Photomicrograph of a & c. granite gneiss under plane polarized light, b & d. granite gneiss under crossed polarized light

Sample: DSBH-3/M-8

Rock Type: Leptynite

The thin section (Fig.6.11) exhibits a coarse-grained, highly fractured texture dominated by quartz and plagioclase feldspar. Quartz grains are notably large, visible to the naked eye, and display an elongated morphology. Their irregular boundaries, coupled with minor subgrain formation, suggest strain-induced recrystallization.

Plagioclase is the dominant feldspar phase, identifiable by its characteristic parallel twinning under crossed polars. The pervasive fracturing observed throughout the section further indicates significant deformation. The mineralogical composition and textural features are indicative of leptynite, a high-grade metamorphic rock characterized by its quartzofeldspathic nature and structural deformation.

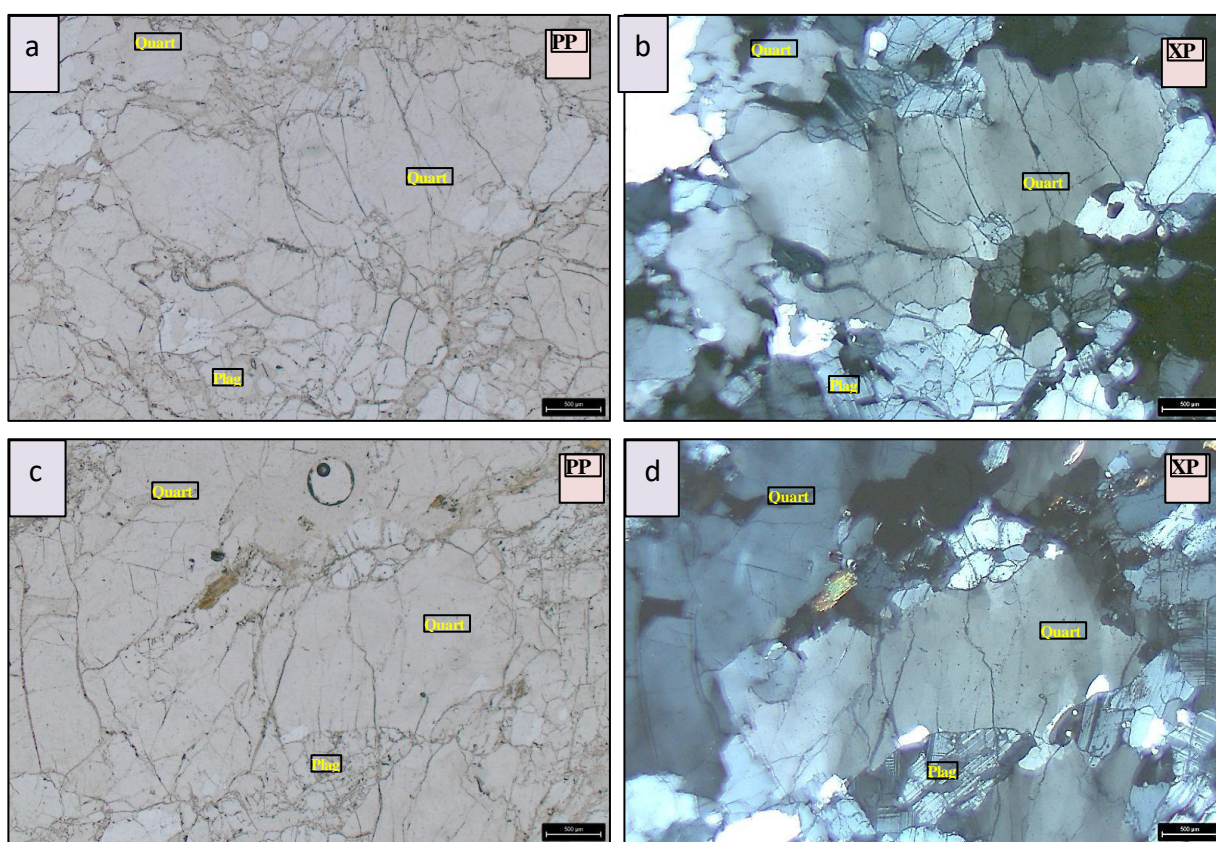


Figure 6.11: Photomicrograph of a & c. Leptynite under plane polarized light, b & d. Leptynite under crossed polarized light

Sample: DDBH-1/S-18/M-9

Rock Type: Quartzzo-feldspathic graphite gneiss

The thin section (Fig 6.12) exhibits a fine- to medium-grained, well-foliated gneissic texture dominated by quartz and plagioclase feldspar, with graphite and biotite defining the foliation. Quartz grains display undulose extinction and localized recrystallization, while plagioclase shows characteristic twinning.

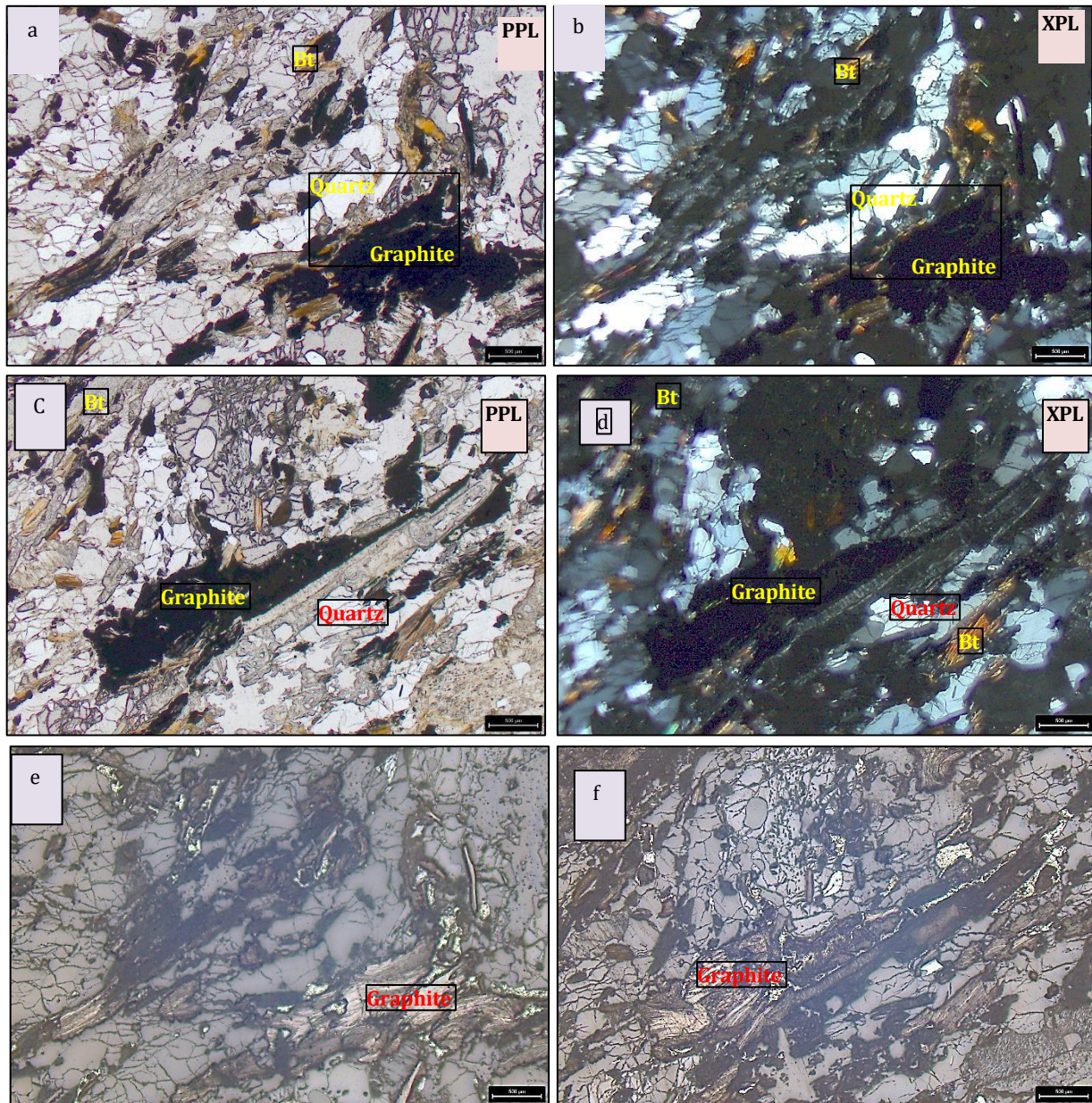


Figure 6.12: Photomicrograph of a, c & e. Quartzzo-feldspathic graphite gneiss under plane polarized light, b, d & f. Quartzzo-feldspathic graphite gneiss under crossed polarized light

Graphite is a prominent constituent, occurring as fine, elongated flakes aligned parallel to the foliation. Under plane-polarized light (PPL), graphite appears as opaque, deep black grains with well-defined edges. In crossed polarized light (XPL), it remains featureless due to its isotropic nature. Under reflective light, graphite exhibits a characteristic dull, metallic luster, distinguishing it from other opaque phases.

Biotite is present in minor amounts, contributing to the foliation. Opaque minerals are scattered throughout the section. Based on its mineralogical composition, strong foliation, and significant graphite content, this rock is identified as Quartzo-feldspathic graphite gneiss.

Sample: DSBH-2/S-33/M-10

Rock Type: Quartzo-feldspathic graphite gneiss

The thin section (Fig.6.13) exhibits a well-foliated, fine- to medium-grained gneissic texture, composed mainly of quartz, plagioclase feldspar, garnet, graphite, and biotite. Quartz grains display undulose extinction and are preferentially aligned along the foliation plane, reflecting deformation. Plagioclase occurs interstitially and exhibits characteristic twinning.

Graphite is abundantly present as fine, elongated flakes oriented along the foliation. Under plane-polarized light (PPL), it appears as deep black, opaque streaks with irregular margins. In crossed polars (XPL), it remains featureless due to its isotropic nature. Under reflected light, graphite shows a characteristic dull, metallic sheen with occasional irregular brightness variations, helping to differentiate it from other opaque phases. The parallel alignment of graphite flakes enhances the rock's strong foliation.

Garnet is a notable component, occurring as subhedral to euhedral grains, often containing inclusions of quartz and feldspar. Biotite is present in minor amounts, reinforcing the foliation fabric. Scattered opaque minerals are also observed.

The mineralogical composition, distinct foliation, and significant presence of graphite and garnet confirm that this rock is identified as Quartzo-feldspathic graphite gneiss.

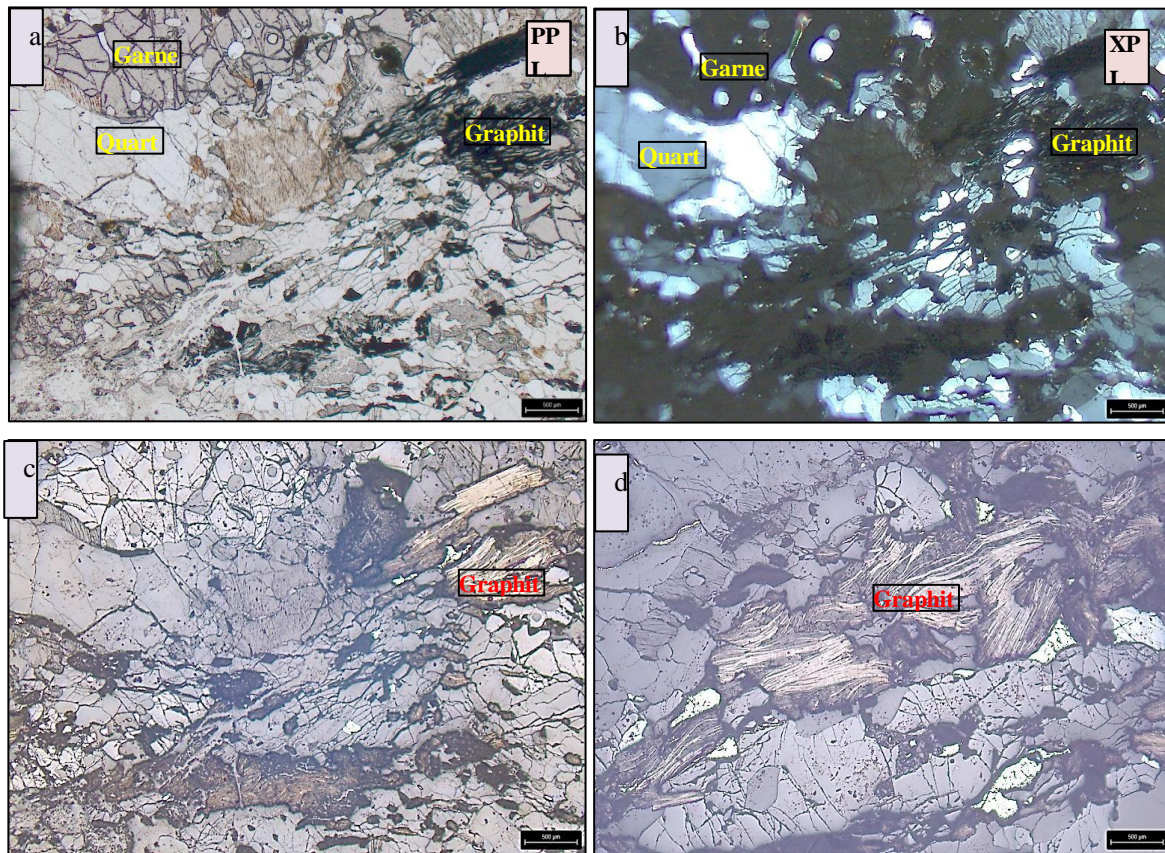


Figure 6.13: Photomicrograph of a, c & d. Quartzo-feldspathic graphite gneiss under plane polarized light, b. Quartzo-feldspathic graphite gneiss under crossed polarized light

6.1.3 Petrochemical studies

The Petrochemical composition of the samples which have been studied petrographically are given in the table no 6.2.

Table no. 6.2: Petrochemical composition of the samples which have been studied petrographically																		
S.No	Sample Number	% Al ₂ O ₃	% BaO	% CaO	% Cr ₂ O ₃	% Fe (T)	% Fe ₂ O ₃	% K ₂ O	% MgO	% MnO	% Na ₂ O	% P ₂ O ₅	% SO ₃	% TiO ₂	% SiO ₂	% SrO	% V ₂ O ₅	% LOI
2	DSBH-1/M-1	14.15	0.08	1.63	<0.05	1.78	2.55	4.2	0.38	<0.05	3.05	0.05	<0.05	0.22	73.5	<0.05	<0.05	0.06
3	DSBH-1/M-2	14.2	0.08	1.67	<0.05	1.67	2.39	4.13	0.37	<0.05	3.1	0.05	<0.05	0.22	73.58	<0.05	<0.05	0.14
4	DSBH-3/M-3	14.06	<0.05	3.78	<0.05	11.72	16.75	0.39	3.62	0.33	0.35	0.42	1.15	2	56.97	<0.05	<0.05	<0.05
5	DSBH-3/M-4	12.92	<0.05	5.14	<0.05	12.7	18.16	0.69	2.23	0.29	0.26	0.84	0.99	2.28	55.96	<0.05	<0.05	<0.05
6	DSBH-1/M-5	13.84	0.06	2.04	<0.05	3.27	4.67	2.6	0.95	0.06	2.61	<0.05	0.21	0.71	71.77	<0.05	<0.05	0.3
7	DSBH-2/M-6	14.9	0.08	2.64	<0.05	2.87	4.11	2.61	0.87	0.1	2.92	<0.05	<0.05	0.43	70.72	<0.05	<0.05	0.49
8	DSBH-3/M-8	14.01	<0.05	3.3	<0.05	1.15	1.64	1.35	0.37	<0.05	2.44	0.05	<0.05	0.1	75.65	<0.05	<0.05	0.99
9	DDBH-1/S-18/M-9	15.81	0.08	0.09	<0.05	3.25	4.64	3.14	1.16	<0.05	0.09	<0.05	3.27	0.69	61.81	<0.05	<0.05	9.05
10	DSBH-2/S-33/M-10	14.15	0.06	0.23	<0.05	3.63	5.19	3.39	1.28	<0.05	0.28	<0.05	0.97	0.59	69.47	<0.05	<0.05	4.24

6.1.4 Structure

Foliation, folds and joints are the principal structural features encountered in the study area. The descriptions of the structural features are as follow-

Foliation

Foliations are repeating layers found in metamorphic rocks. In the explored area three types of foliations were noted – Gneissosity, Gneissosity and Migmatic banding. The general trends of foliation is NW to SE dipping 40° to 70° towards south-west.

- **Gneissosity** (Fig.6.14.B) is a high grade metamorphic structure which is defined by the presence of compositional layersing. Such types of structures were observed in khondalite, granite gneiss and calc-silicate gneiss.
- **Gneissosity** (Fig.6.14.A), which is defined by the arrangement of flaky minerals parallel to the particular direction, was found in the Quartzo-feldspathic graphite gneiss where the graphite flakes define the gneissosity.
- **Migmatic layersing** (Fig.6.14.C) is originated through the process of migmatization. It is defined by the occurrence of alternating bands of leucosome (Light coloured band) and melanosome (Dark coloured band).

Folds

Various types of folds i.e. asymmetrical disharmonic fold (Fig.6.16.C), Upright fold (Fig.6.17.B), intrafolial fold (Fig.6.15.E), isoclinal fold (Fig.6.15.D), hook shaped fold and asymmetrical fold (Fig.6.16) were observed in different litho-units like granite gneiss, migmatite, migmatized khondalite, calc-silicate gneiss. The folds were categorised into three groups which indicate the 3-stage deformational history of the area. The development of isoclinal fold, tight fold and intrafolial folds evidenced the 1st stage of deformation. The hook shaped fold is evidence of superposition of two phases folding. While the asymmetrical folds in khondalite and disharmonic folds are the evidences of 3rd stage of deformation.

Faults

Along the valley of Munda Pahar some indirect evidences (Preserved in rolled boulder) of faults encountered. On the surface of some rolled boulder of khondalite fault gouge (Fig.6.18.C Finely crushed silicate materials) and slickenside ((Fig.6.18.B Polished and striated surface) recorded along the valley. Faults are the evidences of last stage of deformation.



Figure 6.14: Field photographs of A. Gneissosity in khondalite, B. Schistosity, C. Flow banding in migmatite

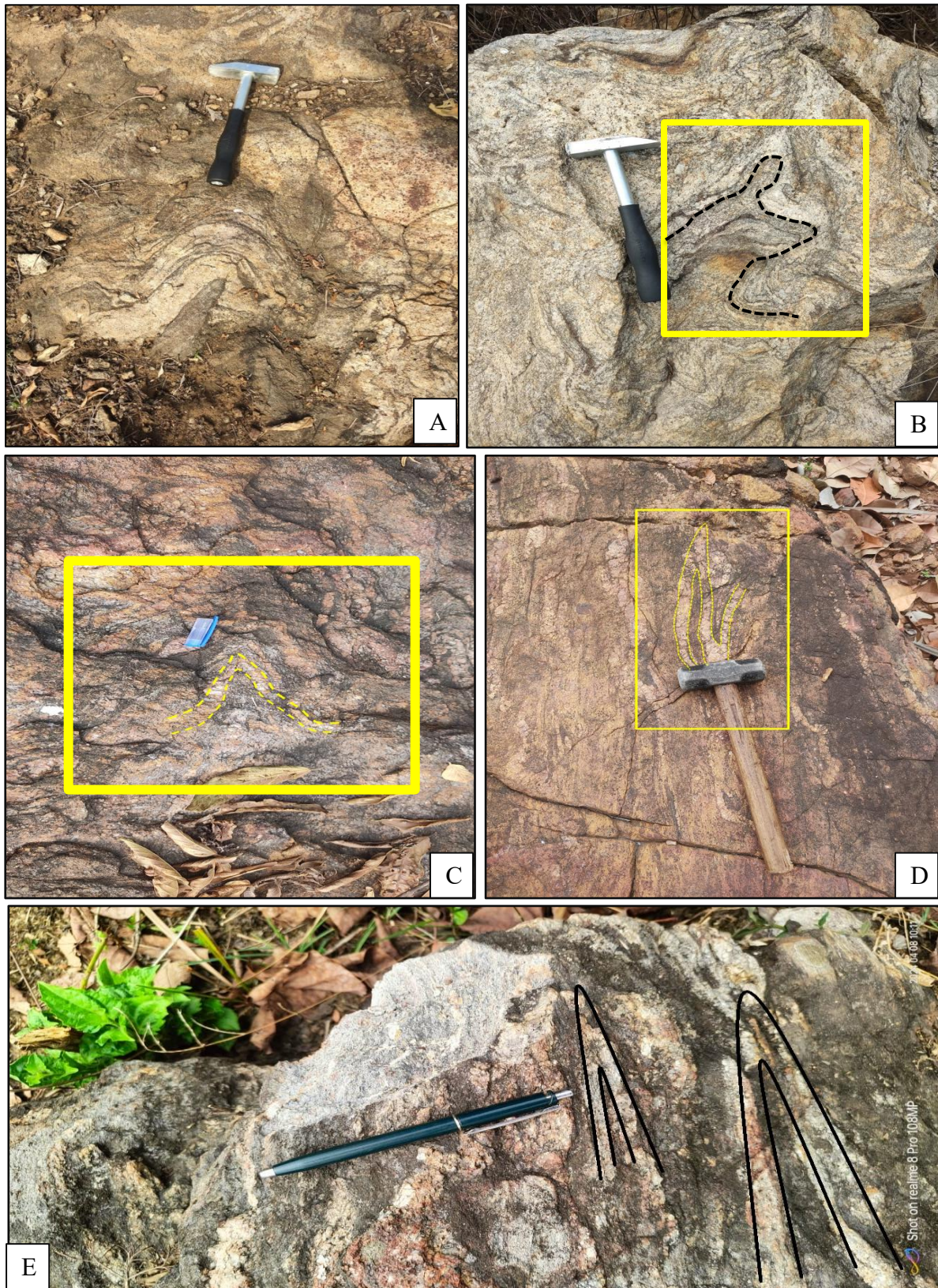


Figure 6.15: Field photographs of A. Ptygmatic fold, B. Isoclinal to tight fold, C. Open fold, D. Isoclinal fold, E. Intrafolial fold



Figure 6.16: Field photographs of A, B, C. Hook shaped fold and asymmetrical fold in khondalite.



Figure 6.17: Field photographs of A. Asymmetrical fold in khondalite, B. Upright fold in calc-granulite, C. Asymmetrical disharmonic fold in calc-silicate gneiss

Joints

Near Kumbhikada nala two sets of inclined joints (Fig.6.18.A) were observed with attitudes-

- 310°/75° North-easterly
- 50°/65° North-westerly



Figure 6.18: Field photographs of A. Joints B. Slickenside preserved on rolled boulder, C. fault gouge preserved on the surface of rolled boulder

6.1.5 Metamorphism

The mineral assemblages present in the dominant lithological units are as follow-

- Garnet+Sillimanite+Plagioclase+quartz (Khondalite)
- Garnet+Plagioclase+quartz (Leptynite)
- Orthopyroxene+Plagioclase+quartz (Charnockite)
- Orthopyroxene+Clinopyroxene+Plagioclase (Mafic granulite)

The above described mineral assemblages are the characteristics of granulite facies of metamorphism. On the other hand most of the rocks i.e. khondalite, charnockite suffered

migmatization to certain extent. Possibly the lithological units suffered ultra-high temperature metamorphism (granulite facies) and in extreme condition undergone anatexism.

The presence of biotite in the mineralogy of charnockite and mafic granulite is unexpected at such extreme condition. So, the presence of biotite indicates that the lithological units might have suffered retrograde path of metamorphism where pyroxene group of minerals transformed into biotite.

6.1.6 Mineralogy of ore zones and ore texture

The ore zones consists of litho-units i.e. quartzo-feldspathic graphite gneiss, khondalite with graphite and granite gneiss with graphite as graphite host rock and other litho-units like khondalite, granite gneiss and garnetiferous quartzite as country rock. Therefore, from mineralogical perspective the major silicate gangue minerals associated with graphite flakes are quartz, microcline, orthoclase, plagioclase, sillimanite, biotite, garnet and pyrite is the only sulphide.

6.1.7 Trenching and Pitting

Trenching:

Trench is a three dimensional excavation which is placed on the basis of geological and geophysical data collected from the field, in order to check the existence of the ore body, it's extension and the actual orientation near surface just below soil cover.

Methodology

The following steps followed for placing any trench on an ore-bearing zone –

- Trench placed at 100 m distance (both side) from the previously placed groove line where outcrops are not available on the surface as per demand of stages of investigation.
- The longest axis was across the strike of the ore body.
- If any ore body was exposed along the trench, samples were collected from floor or wall from the trench with the help of chisel and hammer. Sample length of each sample normally 1 m but it may be vary for some samples depending on exposed width of lithology.

Analytical results:

Nine numbers of trenches for cumulative volume of 100 cubic meters was made to find the extension of the graphite-bearing zone. However, graphite bearing lithological-units encountered along one trench (placed on graphite zone 6) from where 13 number of. samples were collected for chemical analysis. All the samples show encouraging results (Annexure-II).

Pitting:

Pits of dimension 1.5 m × 1.5 m × 1.5 m (fig 6.21) were made to expose the subsurface rock. However, the soil cover is too thick (More than 1.5 m) so the bedrock could not be exposed.

6.1.8 Ore Zones

There are total nine graphite bearing zones encountered during the field traverse which can be further subdivided into three major groups –

- Major graphite bearing zone (PLATE-III): As the cut off of Fixed Carbon percentage of each sample is considered minimum 2%, therefore the zones defined by more than 2%FC bearing samples are classified as major graphite bearing zones.
- Minor graphite bearing zones (PLATE-III): Where fixed carbon percentage of each sample is less than 2%.
- Inferred graphite bearing zones (PLATE-III): With very limited outcrops some doubted zones of graphite are there.



Figure 6.19: Different stages of development of groove in order to collect BRS



Figure 6.20: Different stages of development of trenches



Figure 6.21: Different stages of the development of pits

Major graphite zones

The graphite bearing zones having fixed carbon value of each sample more than 2% was categorised under major graphite bearing zone. Major graphite bearing zones are encountered within the graphite chist (Fig.6.15). Based on the analytical results, there are five major graphite bearing zones within the proposed block named as Zone A, B, C, D and E. The detailed descriptions of the zones are as follow-

Zone A: This zone is situated at a distance of 150 m to the south-west of Dukum village (PLATE-III). The outcrops of Quartzo-feldspathic graphite gneiss (Fig.6.22.A & B) occurred along the nala sections. Based on the geological and geophysical data the interpreted strike length of this zone is 308 m and the surface width is 26m. The attitude of the zone is $320^{\circ}/45^{\circ}$ south-westerly. As per the chemical analysis report (Annexure I) of collected BRS the fixed carbon percentage for this zone varies from 5.09 to 9.08 %.

Zone B: This zone is situated at a distance of 564 m to the south of Saharha village (PLATE-III). The outcrops of Quartzo-feldspathic graphite gneiss (Fig.6.22.F) were noticed along the

nala sections and on a small mount. Based on the geological and geophysical data the interpreted strike length of this zone is 150 m and the surface width is 30m. The attitude of the zone is $335^{\circ}/55^{\circ}$ south-westerly. As per the chemical analysis report (Annexure I) of collected BRS the fixed carbon percentage for this zone varies from 6.48 to 7.49 %.

Zone C: This zone is situated at a distance of 844 m to the south-east of Saharha village (PLATE-III). The outcrops of Granite gneiss with graphite are seen along the hill slope. Based on the geological and geophysical data the interpreted strike length of this zone is 178 m and the surface width is 32m. The attitude of the zone is $335^{\circ}/55^{\circ}$ south-westerly. As per the chemical analysis report (Annexure I) of collected BRS the fixed carbon percentage for this zone varies from 1.03 % to 1.41 %. But geophysical SP anomaly shows encouraging results and the maximum SP anomaly zone is observed to the western side of the graphite bearing outcrops indicative of the presence of greater concentrated band. So, this zone was considered as major graphite bearing zone.

Zone D: This zone is situated at a distance of 966 m in the north-eastern side of Dedipadar village (PLATE-III). The outcrops of Quartzo-feldspathic graphite gneiss (Fig.6.22.D & E) have occurred along the hill slope. Based on the geological and geophysical data the interpreted strike length of this zone is 178 m and the surface width is 32m. The attitude of the zone is $335^{\circ}/55^{\circ}$ south-westerly. As per the chemical analysis report (Annexure I) of collected BRS the fixed carbon percentage for this zone varies from 4.30 to 7.44 %. Exploratory drilling cannot be conducted in this zone due to local problem.

Zone E: This zone is situated at a distance of 568 m to the south-east of Rambu village (PLATE-III). The outcrops of Quartzo-feldspathic graphite gneiss (Fig.6.22.C) are seen along the hill slope in the form of elongated ridge. Based on the geological and geophysical data the interpreted strike length of this zone is 200 m and the surface width is 30m. The attitude of the zone is $320^{\circ}/55^{\circ}$ south-westerly. As per the chemical analysis report (Annexure I) of the collected BRS the average fixed carbon percentage for this zone is 2.485 %. Exploratory drilling could not be conducted in this zone due to local problem.

Minor graphite bearing zones

The graphite bearing zones having fixed carbon values of samples less than 2% are categorised under minor graphite bearing zone. The graphite flakes are disseminated throughout the host rock following the foliation planes. Based on the chemical analyses, there are four minor graphite bearing zones within the proposed block named as zone m (A), m (B), m (C) and m (D). The detailed descriptions of the zones are as follow-

Zone m (A): This graphite bearing zone is situated at a distance about 575 m to the north-east of Ankulpadar village (PLATE-III). The graphite flakes are concentrated along the foliation plane of granite gneiss.

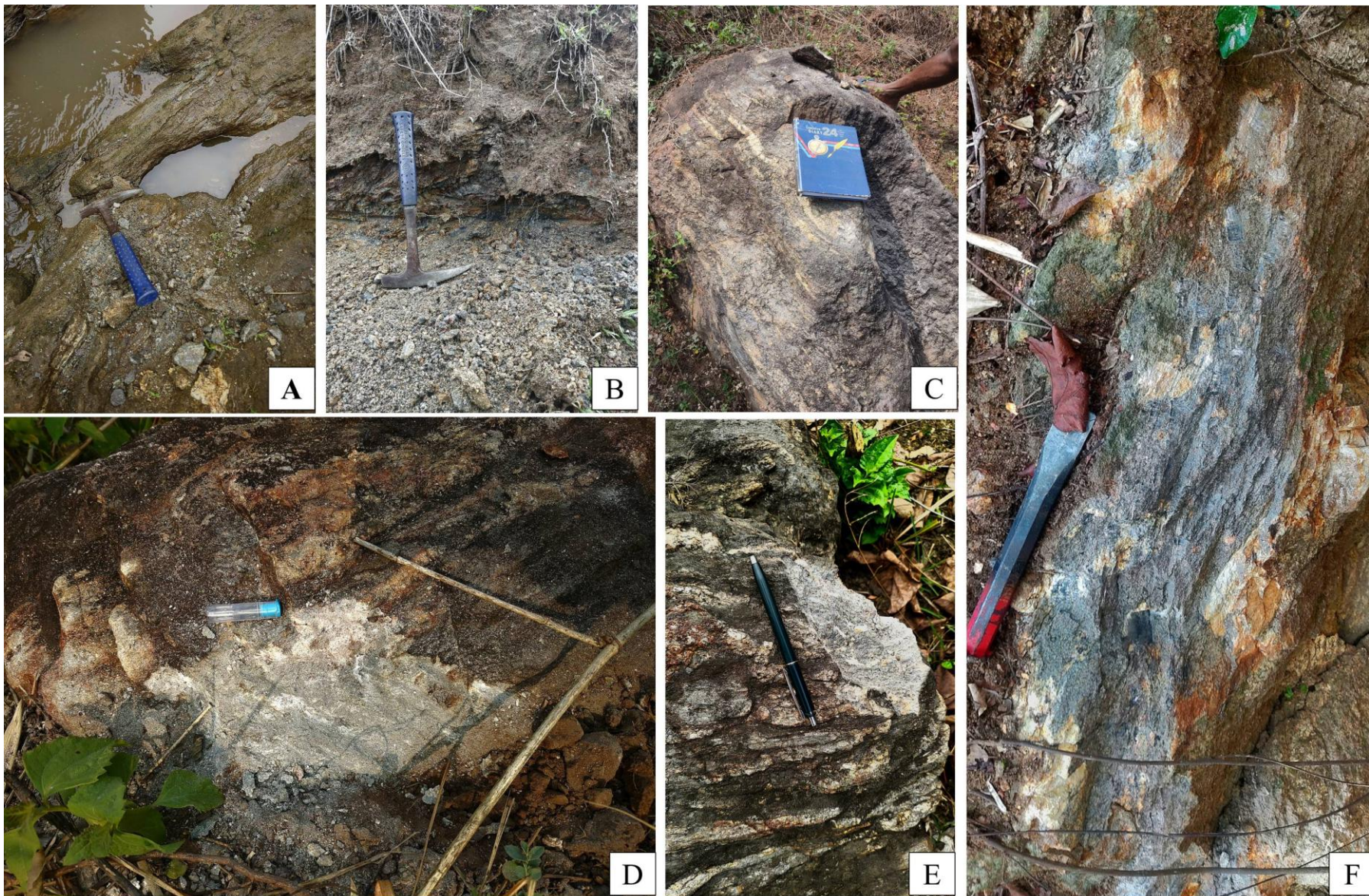


Figure 6.22: Field photographs of A. Graphite gneiss near Dukum (19°29'14.9'' N, 83°35'58.7'' E) B. Graphite gneiss near Dukum (19°29'18.9'' N, 83°35'55.1'' E), C. Graphite gneiss near Rambu (19°25'36.9'' N, 83°33'20.9'' E), D. Graphite gneiss near Dedipadar (19°28'45.2'' N, 83°36'59.7'' E), E. Graphite gneiss near Dedipadar (19°28'47.2'' N, 83°36'57.4'' E), F. Graphite gneiss near Saharha (19°26'23.4'' N, 83°36'13.6'' E)

Zone m (B): This graphite bearing zone is situated at a distance of 315 m to the north-east of Jagannathpur village (PLATE-III). The graphite flakes are concentrated along the foliation plane of Khondalite with graphite.

Zone m (C): This graphite bearing zone is situated at a distance of 501 m to the north-west of Kiribiri village (PLATE-III). The graphite flakes are concentrated along the foliation plane of khondalite.

Zone m (D): This graphite bearing zone is situated at a distance of 2 km to the northern side of Darukona village (PLATE-III). The graphite flakes are concentrated along the foliation plane of granite gneiss.

Inferred graphite bearing zones

The graphite bearing zones having limited outcrops and the concentration of fixed carbon is more than 2% are considered as inferred graphite bearing zone. Such type of graphite bearing zone (named as IR-1) was found at a distance of about 915 m to the northern side of Bararhagurha village (PLATE-III). Within this zone few large sized boulders of graphite chist are seen along the slope of a small hillock.

6.2 Geophysical exploration

Major objective

The primary objective of conducting integrated Self-Potential (SP) and magnetic studies within the four zones of interest was to delineate the concealed graphite and identify potential drilling points.

SP and Magnetic data acquisition

The Fixed Base approach was employed in this project to acquire Self-Potential (SP) data. A total of 5.27 line km in 20 profiles were surveyed, each spanning a length that varies between 250m to 280m depending on the accessibilities and feasibility of the area. A total of four major small zones were selected for both SP and magnetic study. The details of the zones are given in the table-1. Both SP and magnetic surveys were carried out during June-July 2024. The spacing between profiles was irregular depending on the spatial dimension of the areas, tailored to meet the study's specific objectives while adhering to a predetermined total profile length constraint of 5 kilometers. Data points were recorded at regular intervals of 10 meters. Geological insights into graphite occurrences informed the selection of field parameters for SP data acquisition. Profile orientation was standardized along perpendicular to the strike of the geological formations under investigation. Some profiles were taken across the known graphite areas, whereas some were not exposed areas. In some places one profile along the strike line has also been taken for comprehensive study. Details of the SP data acquisition are shown in Table 6.3. To carry out SP we have used IGIS DC resistivity meter model DDR-3 utilizing two copper sulfate porous pots as electrodes to record the SP voltage of the earth. One handheld GPS (Garmin) was used to note down latitude, longitude, and elevation information. One universal base station and different local base stations were established. Repeat readings were taken for good-quality data, enhancing reliability and confidence. Magnetic surveys were also carried out in the same areas using two proton precession magnetometers, GEM GSM19TW, where one was used as a base magnetometer, taking continuous data in minute intervals in a local cultural noise-free area. The rover magnetometer was utilized in mobile mode to collect stable, noise-free data. Repeat readings were taken for quality checks of the data. The same traverse direction was taken for the magnetic survey, too. All the precautions like avoiding any metal object, monitoring the magnetic storm and ionic activities, avoiding high voltage powerlines, etc., taken for a

standard magnetic data acquisition.

Table no 6.3: Showing the details of SP data acquisition							
Zone name	Location	Station spacing(m)	No of Profile	Profile spacing(m)	Line km	Area length, width	Profile direction
Zone E	Rambu	10	4	40	1.077	120, 30	NE-SW
Zone C, B	Sahada	10	9	70	2.4511	Zone A(286, 67), Zone-B (160, 57)	NE-SW
Zone D	Lakhobhata	10	3	50	0.8	(181,66)	NE-SW
Zone A	Dukum	10	4	90	0.943	(224, 28)	NE-SW

Table no: 6.4 Showing details of magnetic data acquisition					
Zone name	Location	No of profiles	Station spacing(m)	No of magnetic points	Profile spacing(m)
Zone E	Rambhu	4	20	85	30
Zone C, B	Sahada	6	67	133	120
Zone D	Lakhobhata	5	20	147	60
Zone A	Dukum	4	20	72	80

SP and Magnetic data processing

The preprocessing of SP data encompassed drift correction, reference electrode calibration, and the determination of absolute SP values relative to a universal reference point at each location. The absolute SP anomaly was depicted in two formats: spatially, utilizing grid anomaly strips generated through Geosoft v.8.4 software, which presented anomalies based on their spatial locations and corresponding values; and through profile plots,

illustrating the fluctuation of SP values in relation to distance. Areas characterized by negative SP values in both spatial representations and profile locations are indicative of potential promising zones for graphite occurrences.

The magnetic data processing consists of two main phases: preprocessing and advanced processing, utilizing the output data set from preprocessing. In the initial preprocessing step, each raw data file, particularly the base station file, was examined to identify any magnetic storm imprints. Subsequently, a diurnal correction was meticulously applied to each rover raw data file of the GEM system PPM using GEM Link v 5.4. For the Geomatic PPM rover magnetic data file, a specific R code was developed to apply the diurnal correction, following the algorithm employed in GEM Link. Average base value was used as a datum value in diurnal correction process. Diurnal-corrected data underwent filtering to eliminate spurious and unstable readings obtained in the proximity of cultural noise sources, such as high-tension power lines, water pumps, metallic water pipelines, etc. This process involved scrutinizing the profile plot for each specific line. Additionally, data gathered during high magnetic storm days or obtained in a non-scientific manner were systematically removed to ensure the integrity of the dataset. Some part of the preprocessing and all the advanced processing steps were carried out using Geosoft v8.4 software. Following the comprehensive preprocessing steps, the filtered magnetic data became the focus of subsequent processing. An International Geomagnetic Reference Field (IGRF) correction was initially implemented on the diurnal-corrected magnetic intensity data. The IGRF correction process was executed by subtracting the calculated IGRF value from the total magnetic field using IGRF-13 MODEL. In the processing part, regional residual separation, reduced to magnetic pole map derivation, and analytic signal map generation were attempted.

Results and Discussion

Zone-E near Rambhu

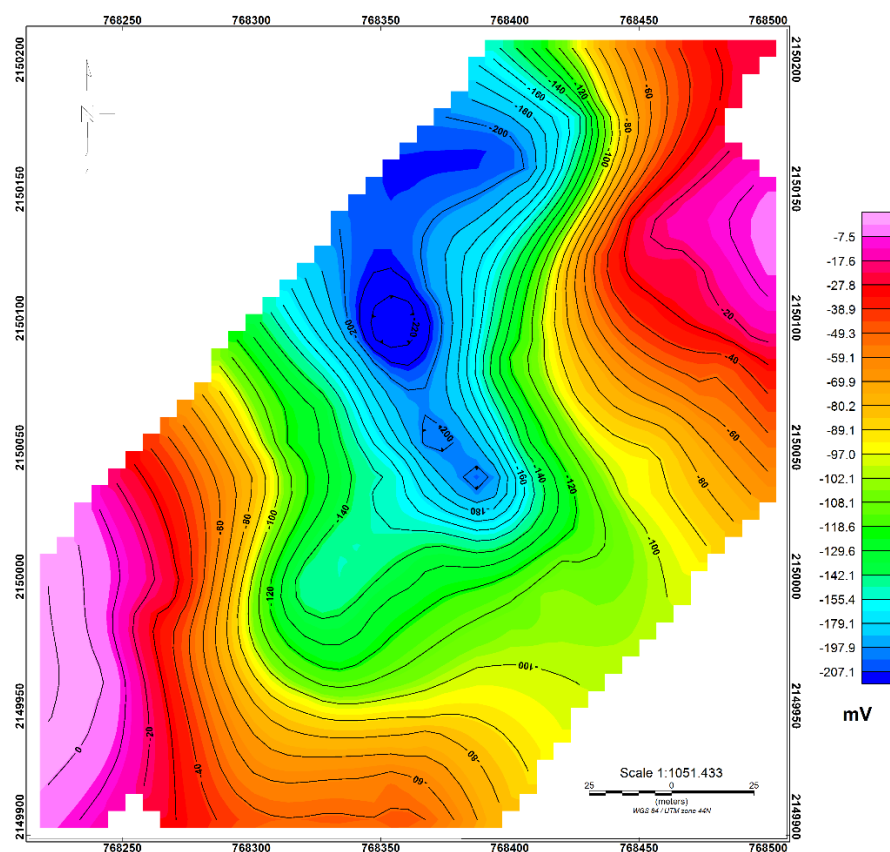


Figure 6.23: Total SP anomaly map corresponding to the zone-E near Rambhu

The total SP anomaly map for the zone-1 has highlighted the broad graphite potential zone in blue-coloured zones located at the central toward the north with NW-SE direction(Fig.6.23). SP value in this zone varies from -207mV to -197mV. This negative SP value range is highly corresponded with graphite occurrences. But the total SP anomaly map also retains information on the deeper graphite bodies, so to check on the shallow surface occurrences, a residual SP anomaly map generated (Fig.24.b).

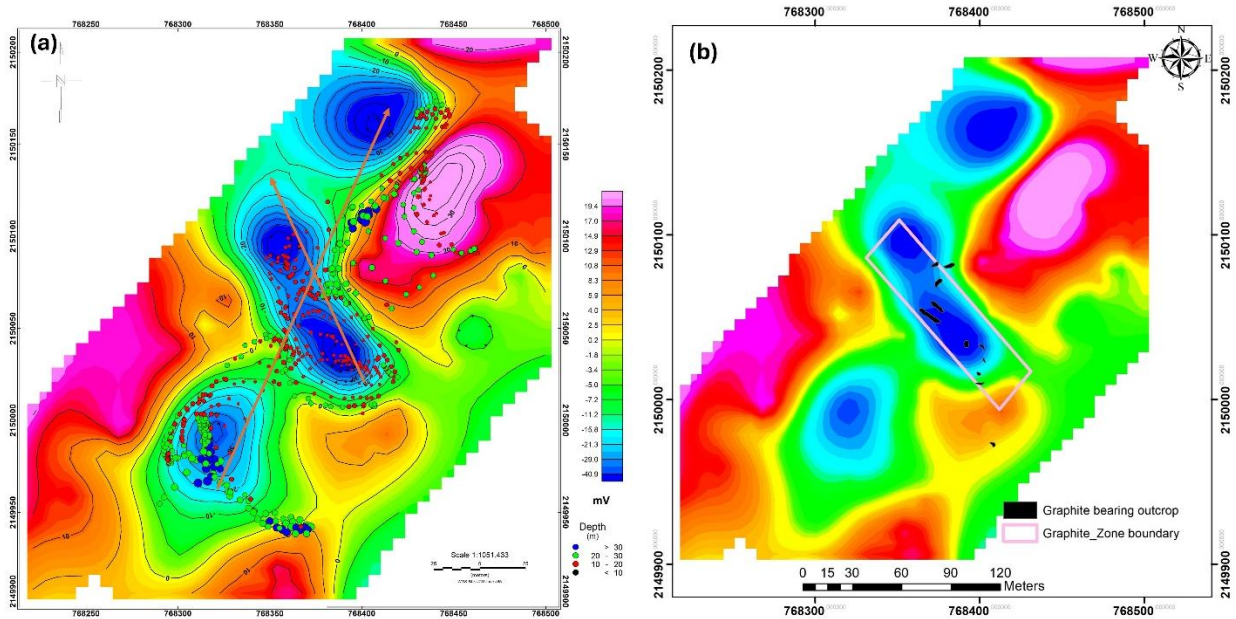


Figure 6.24: Residual SP anomaly map overlaid with Euler depth solutions (Fig.24.a), graphite bearing outcrop, and zone boundary (Fig.24.b)

The residual anomaly map highlights shallow-seated concealed graphite bodies, represented by blue-colored patches, with SP anomaly variations ranging from -20 mV to -41 mV. Exposed geological outcrops exhibit strong spatial correlation with the SP anomaly map (Fig. 6.24b), suggesting a high likelihood of shallow-surface continuity of these graphite bodies. Euler depth solutions within the blue zones are marked by red dots, indicating depths between 10 m and 20 m—reflecting the average shallow depth of the graphite bodies. Two major possible directions of occurrence are depicted by red lines in Fig.6.24a.

The Total Magnetic Intensity (TMI) map for Zone-1 (Fig.6.24.a) reveals that the magnetic field intensity ranges between 44568 nT and 44601 nT. This narrow range indicates a likely absence of highly magnetic minerals or rocks within the area. Following the application of IGRF correction, the IGRF-corrected anomaly map (Fig.6.24.b) was generated, showing negative magnetic anomalies ranging from -158 nT to -198 nT.

These negative anomalies strongly suggest that the region is predominantly composed of non-magnetic rocks, which are conducive to graphite. Graphite and its host rocks typically produce negative magnetic anomalies. On both maps, the blue-colored zones are indicative of potential graphite within the granitic gneiss lithology.

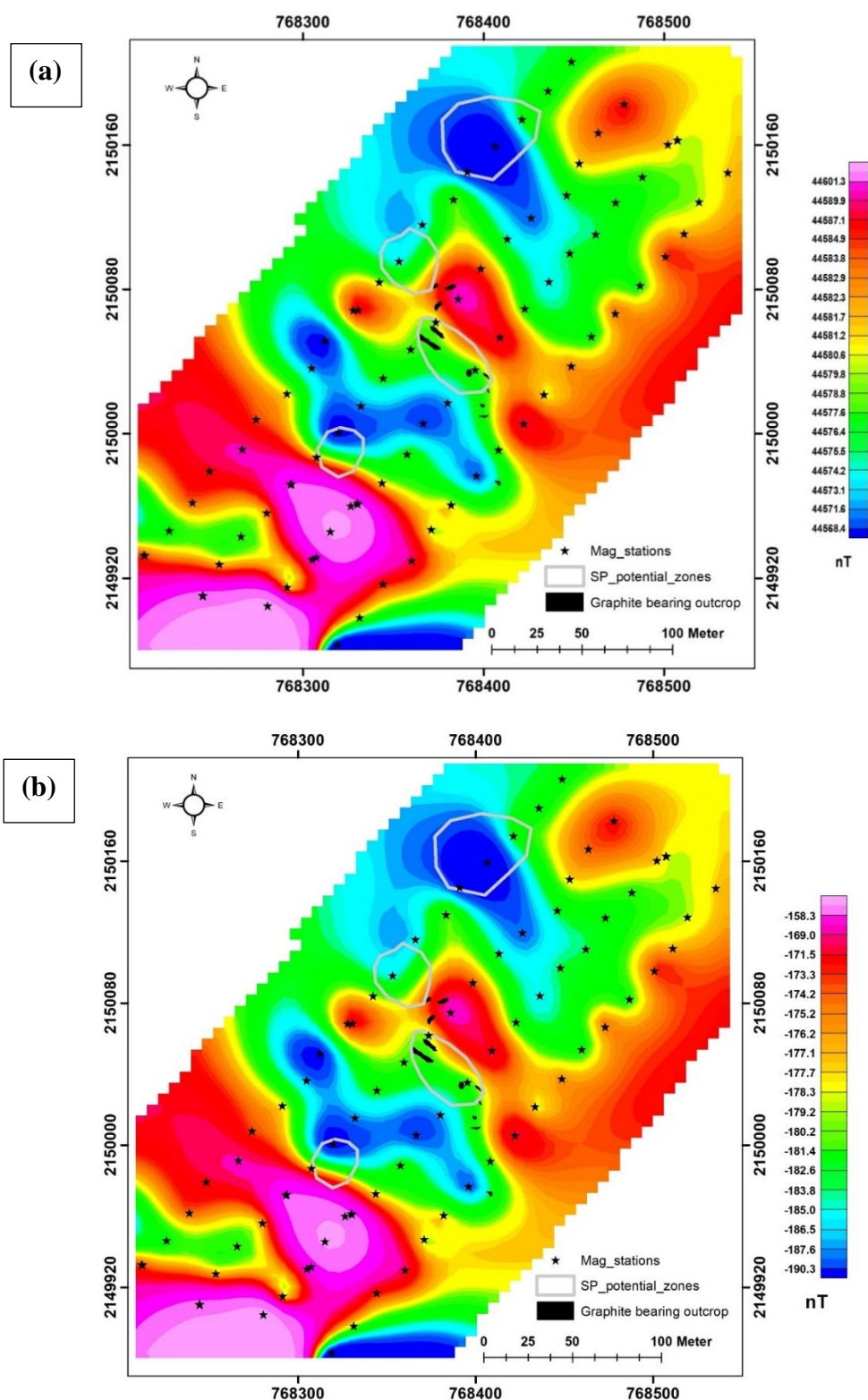


Figure 6.25: Total magnetic intensity map and IGRF corrected total magnetic anomaly map of zone-E

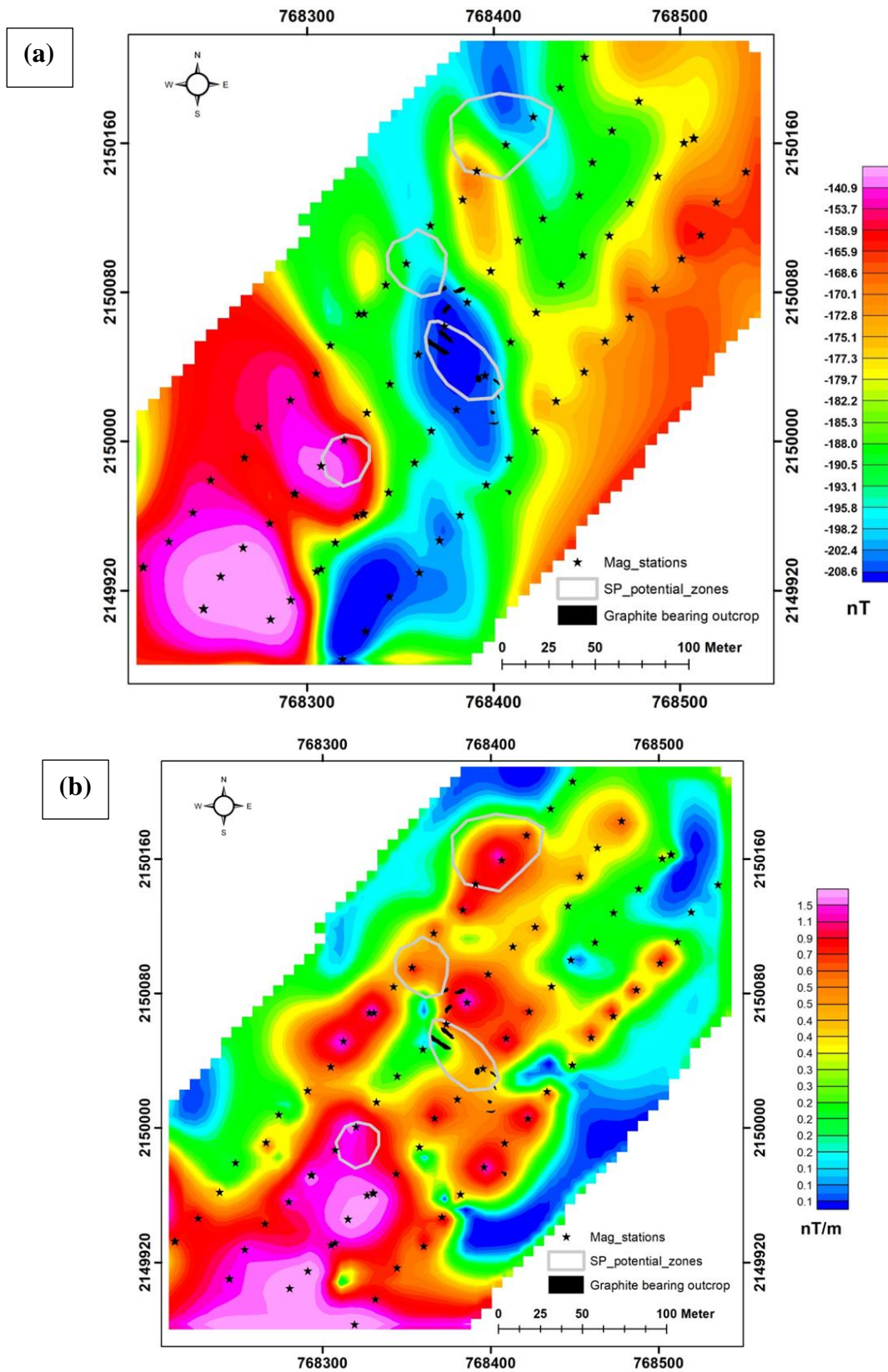


Figure 6.26: RTP anomaly map and analytic signal anomaly map for zone-E

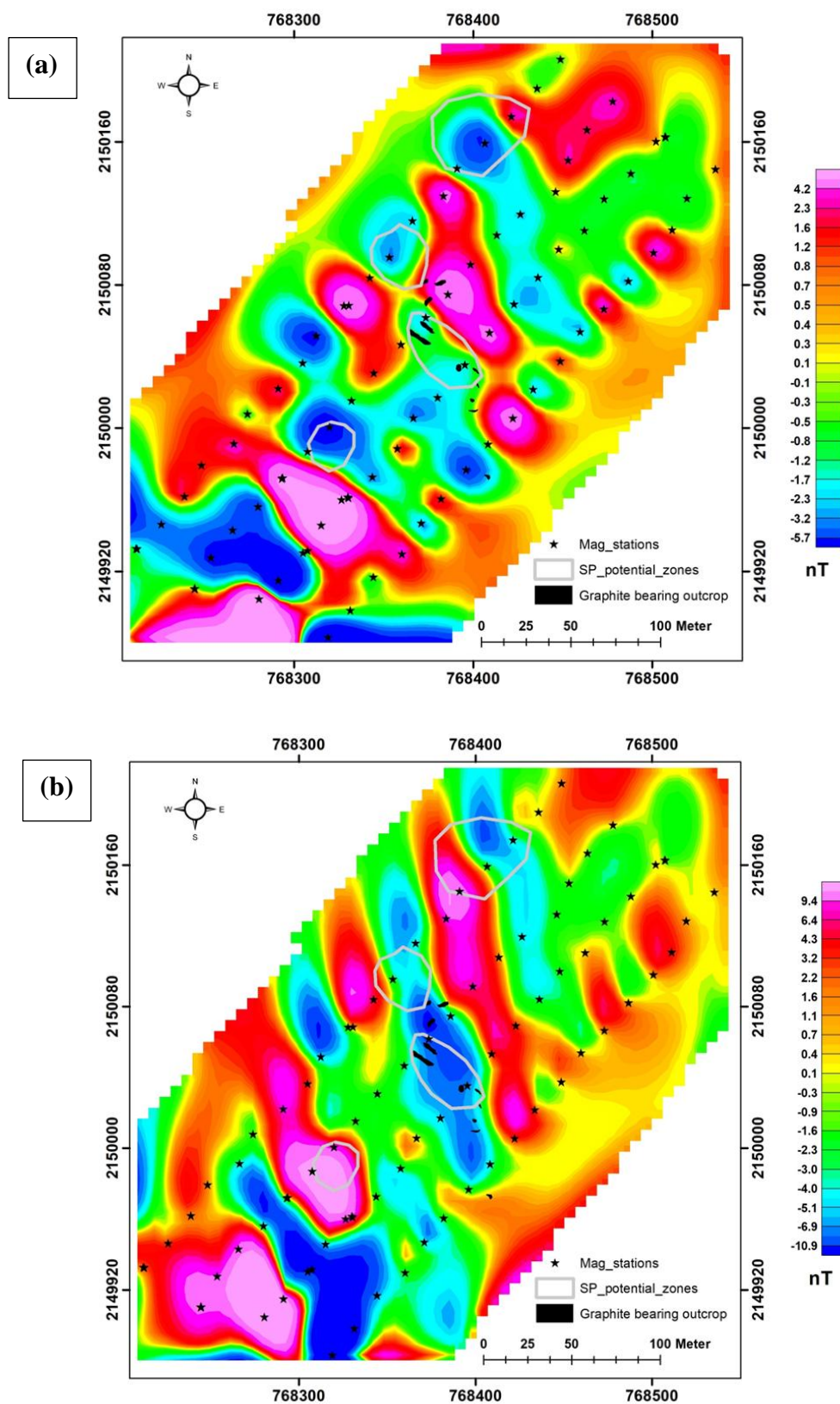


Figure 6.27: (a) Residual anomaly map from TMI map (b) residual anomaly map from RTP anomaly for zone-E

To enhance interpretation, graphite outcrops and self-potential (SP) zones were overlaid, revealing a strong spatial correlation between low magnetic anomalies and graphite

occurrences. This correlation is particularly evident in the northwest corner and central part of the area, reinforcing the likelihood of graphite incidences in these regions.

The low magnetic anomaly patches in the central region, extending from NW to SE, suggest the possible presence of concealed granitic gneiss with potential graphite mineralization. However, these anomalies were not evident in the SP anomaly map.

To refine the analysis, additional filtered maps were generated, including a residual map to highlight shallow surface features and an analytic signal map to delineate lithological boundaries. These maps provide enhanced detail, facilitating the identification and interpretation of concealed geological structures that could host graphite.

The Reduced to Pole (RTP) anomaly map reveals a central low anomaly zone, coinciding with the highest concentration of graphite outcrops (Fig. 6.28). A distinct NW-SE directional trend is apparent within these low anomaly patches (Fig.6.29.a). The analytic signal map displays high to moderately high values corresponding to negative SP anomalies and graphite occurrences, reflecting strong magnetic gradient variations in those areas (Fig.6.29.b).

To minimize directional bias, two residual anomaly maps were produced. The residual map derived from the normal magnetic anomaly (IGRF-corrected) shows greater alignment with SP anomalies, with most SP potential boundaries coinciding with low to moderately low zones. This correlation is less pronounced in the residual map derived from the RTP anomaly (Fig.6.29.a, b).

Additionally, the residual magnetic anomaly maps highlight several low anomaly zones that lack SP potential zones or graphite outcrops. These areas warrant further investigation through trenching in future studies to assess their potential for concealed graphite.

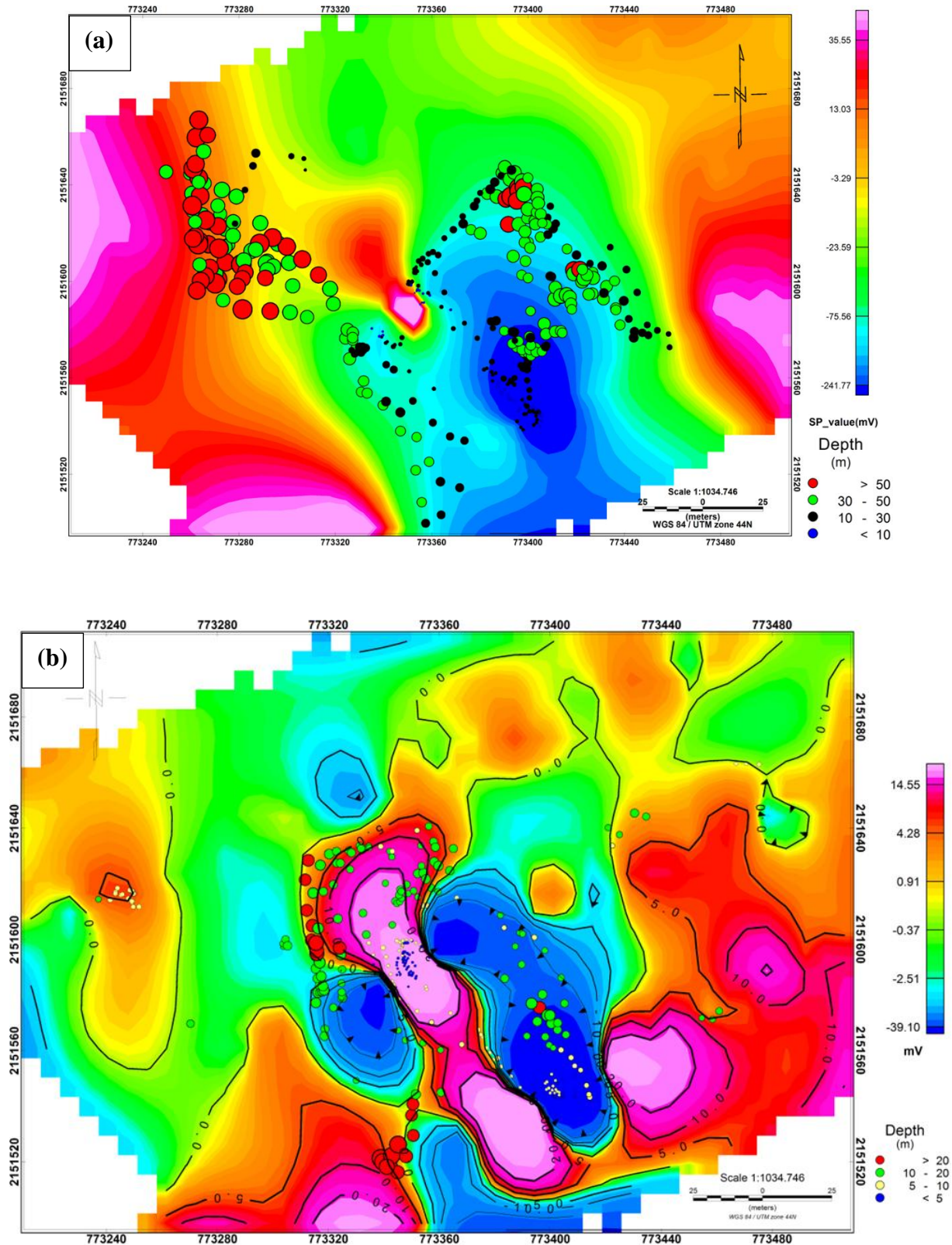
ZONE -B near Sahara

There are two sub-potential zones in zone 6. One is Zone A, and another is Zone B.

ZONE -B

The total SP anomaly map for Zone-B reveals potential concealed graphite bodies, indicated by blue anomaly zones corresponding to negative SP anomaly values ranging from -241 mV to -75 mV (Fig.6.30.a). Euler depth solutions derived from the total SP anomaly map indicate that the most frequent depth values in the graphite potential zone range between 10 m and 30 m (Fig.6.30.a). The residual SP anomaly map highlights shallow surface graphite bodies at depths between 5 m and 20 m (Fig.6.30.b). Additionally, the residual anomaly map shows strong alignment with existing graphite outcrops (Fig.6.30.c). Notably,

the map identifies a concealed anomaly zone on the western side of the block, represented by a small blue patch (Fig.6.30.c). This residual map effectively delineates the boundary and extent of both exposed and concealed graphite.



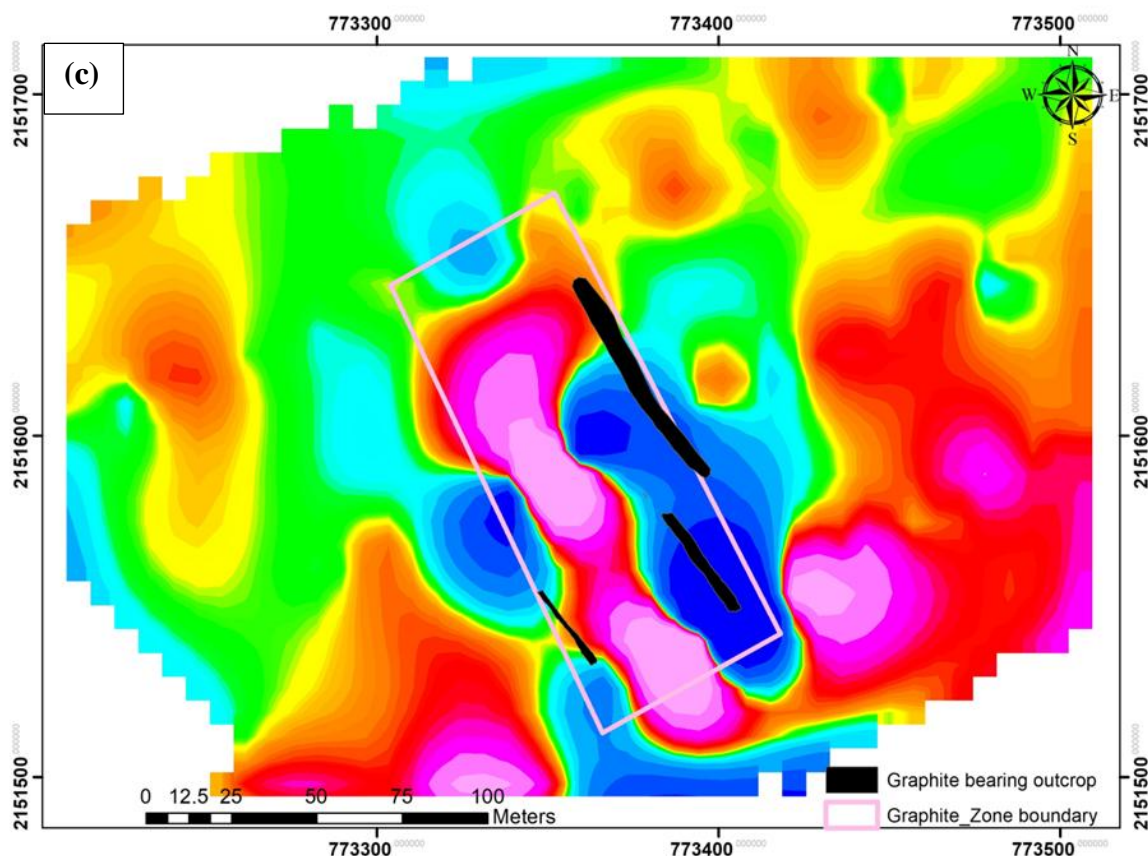


Figure 6.28: (a) Total SP anomaly map (b) Residual SP draped with Euler depth solutions clusters (c) Residual SP anomaly draped with graphite outcrop for zone -B near Sahada/Sahara.

Zone -C

The total SP anomaly map for Zone-C reveals a potential concealed graphite body in the western part of the area (Fig.6.31.a) as indicated by blue anomaly zones corresponding to negative SP anomaly values ranging from -162 mV to -101 mV (Fig.6.31.a). Euler depth solutions derived from the total SP anomaly map indicate that the most frequent depth values in the graphite potential zone range between 30m and 50 m (Fig.6.31.a). The residual SP anomaly map highlights shallow surface graphite bodies as smaller patches in the eastern side of the area trending from SE-NW. The depth values of these bodies vary between 5 m and 25 m (Fig.6.31.b). This residual map effectively delineates the boundary and extent of both exposed and concealed graphite.

The Total Magnetic Intensity (TMI) map for Zone-6B (Fig.6.32.a) reveals that the magnetic field intensity ranges between 44571 nT and 44636 nT. This narrow range indicates a likely absence of highly magnetic minerals or rocks within the area. Following the application of IGRF correction, the IGRF-corrected anomaly map (Fig.6.32.b) was generated, showing negative magnetic anomalies ranging from -132 nT to -198 nT.

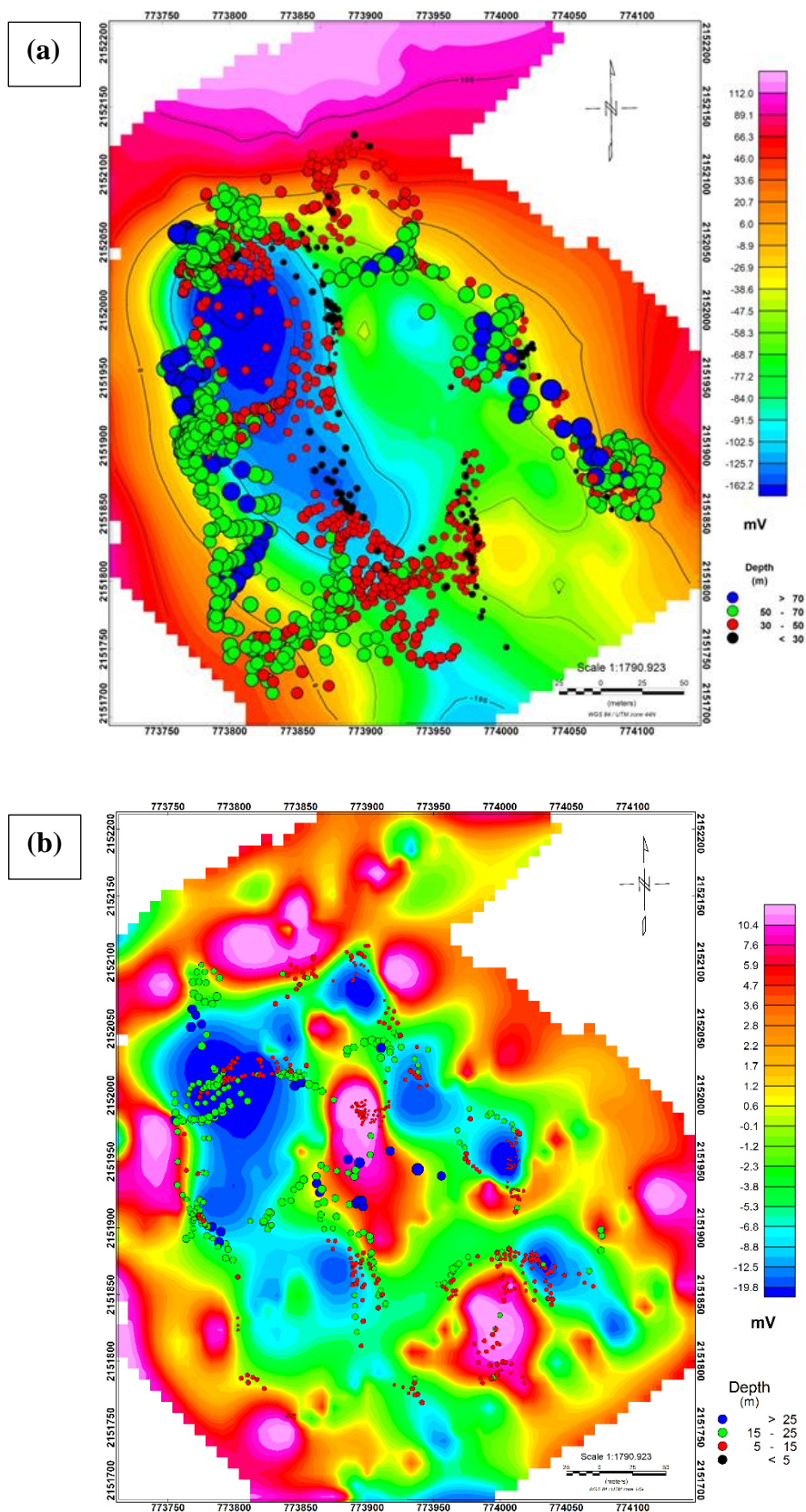


Figure 6.29: (a) Total SP anomaly map (b) Residual SP draped with Euler depth solutions clusters for zone-C near Saharha.

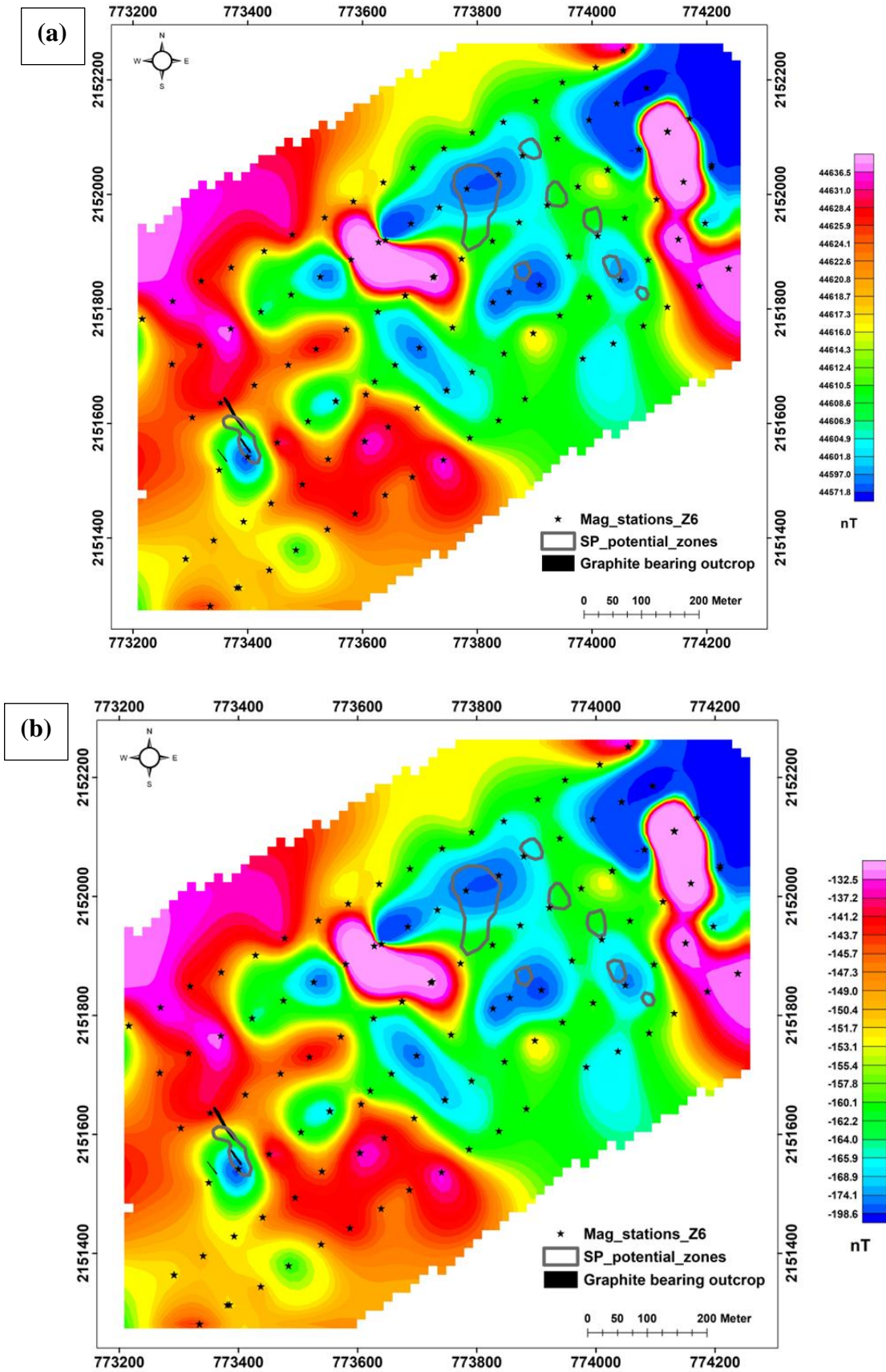


Figure 6.30: (a) Total magnetic intensity, (b) IGRF corrected anomaly map of the area.

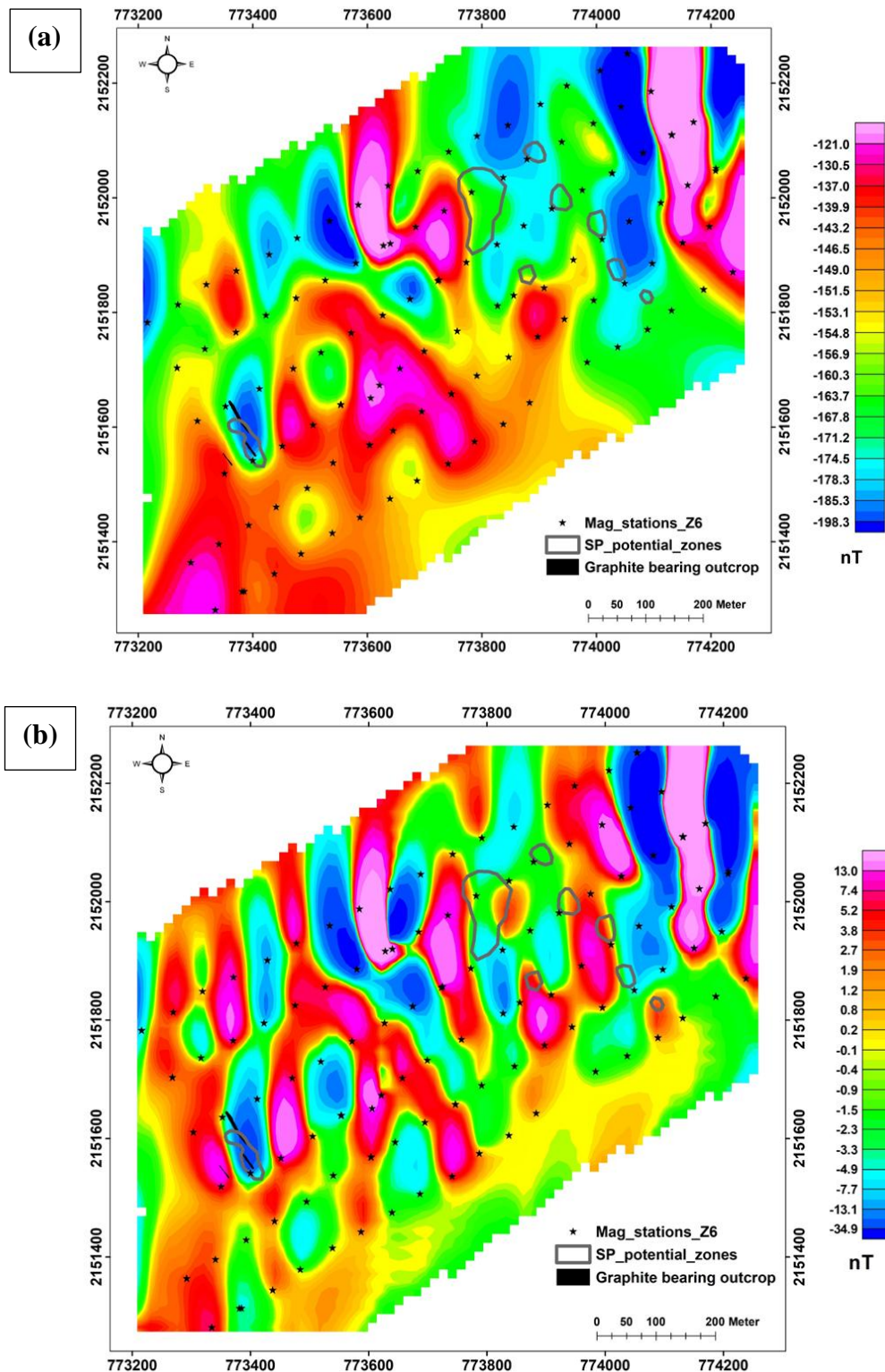


Figure 6.31: a RTP anomaly map and (b) residual anomaly map derived from RTP. Magnetic stations and boundaries of SP potential zones are overlaid on the maps

RTP anomaly map and residual RTP anomaly map have highlighted possible low magnetic rock bodies in blue-colored zones. The trend of the blue zone in the eastern part is associated with the graphite outcrop of the area. The trend in this zone is NE-SW. The blue zone of the above maps is potentially the target zone for graphite host rock, i.e., Khondalite.

The residual magnetic anomaly map from the IGRF corrected anomaly data has shown almost the same, enhancing the confidence of the results (Fig.6.34).

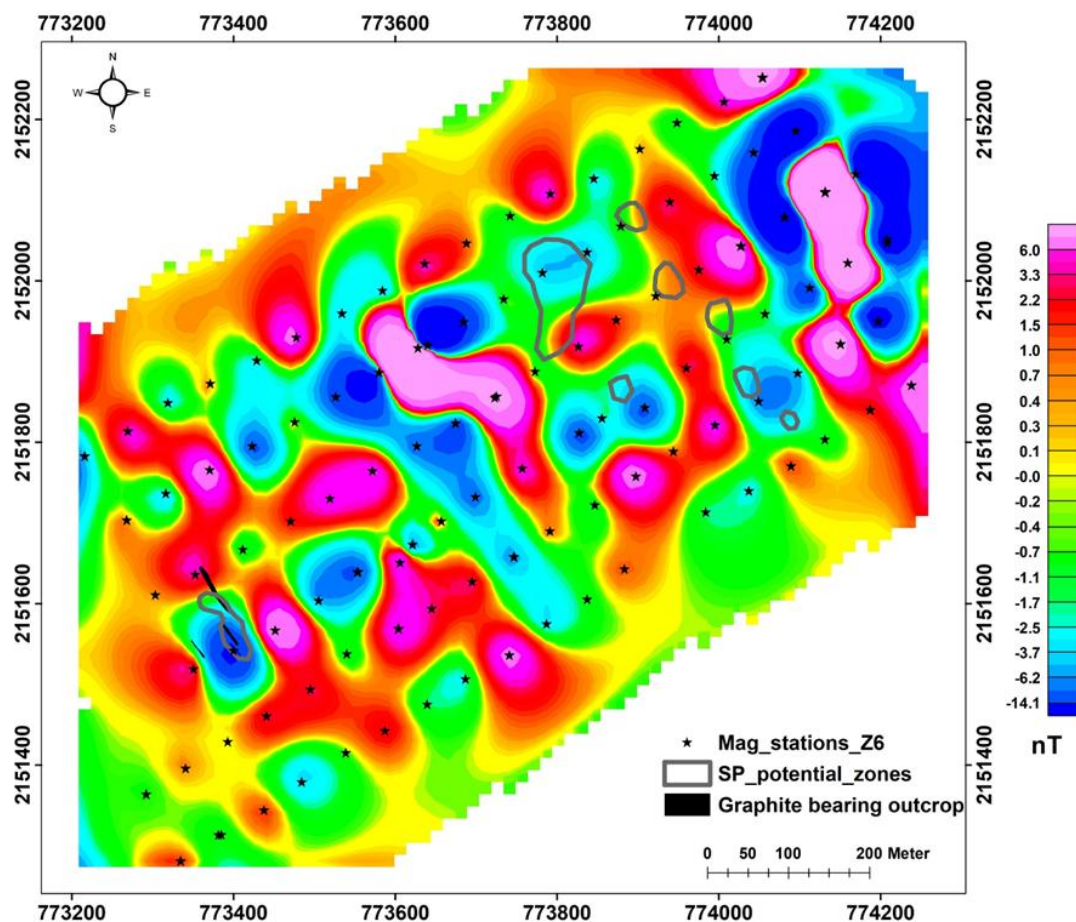
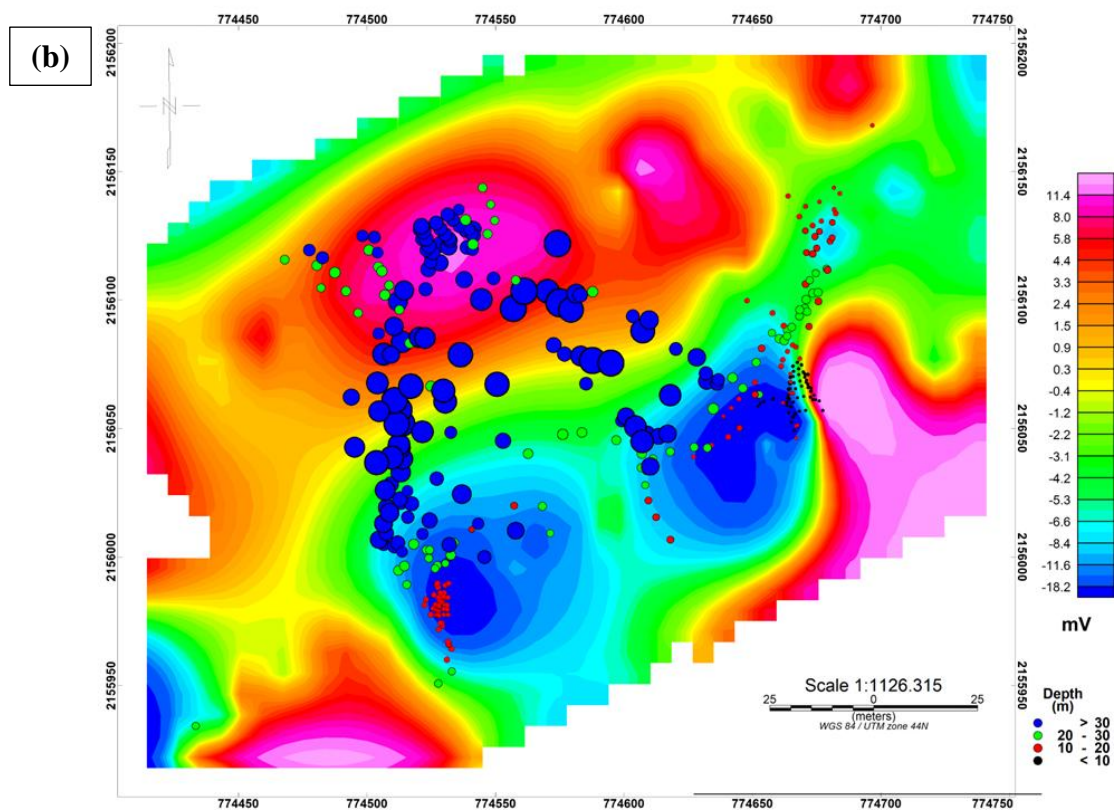
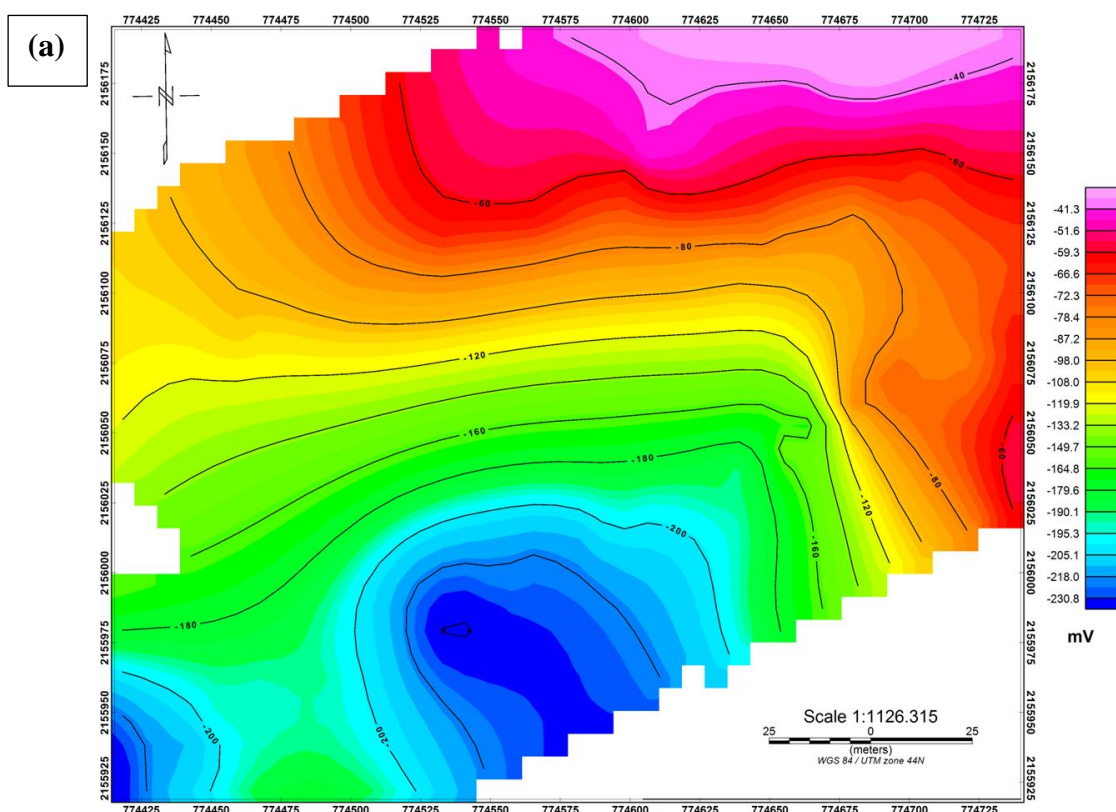


Figure 6.32: Residual anomaly map from the IGRF corrected magnetic anomaly data.

ZONE-D NEAR LAGABHATA

The total SP anomaly map for Zone-D reveals a potential concealed graphite body in the central southern part of the area (Fig.6.35.a) indicated by blue anomaly zones corresponding to negative SP anomaly values ranging from -230 mV to -218 mV (Fig.6.35.a). The residual SP anomaly map highlights shallow surface graphite bodies as smaller patches in the eastern side of the area trending from SW-NE. The depth values of these bodies vary between 10 m and 30 m (Fig.6.35.b). This residual map effectively delineates the boundary and extent of exposed and concealed graphite. Mineralization in this area, some accessible zones have come out in the block where data discrepancy exists (Fig.6.35.c).

The Total Magnetic Intensity (TMI) map for Zone-7 (Fig.6.36.a) reveals that the magnetic field intensity ranges between 44572 nT and 44620 nT. Following the application of IGRF correction, the IGRF-corrected anomaly map (Fig.6.36.b) was generated, showing negative magnetic anomalies ranging from -215 nT to -168 nT.



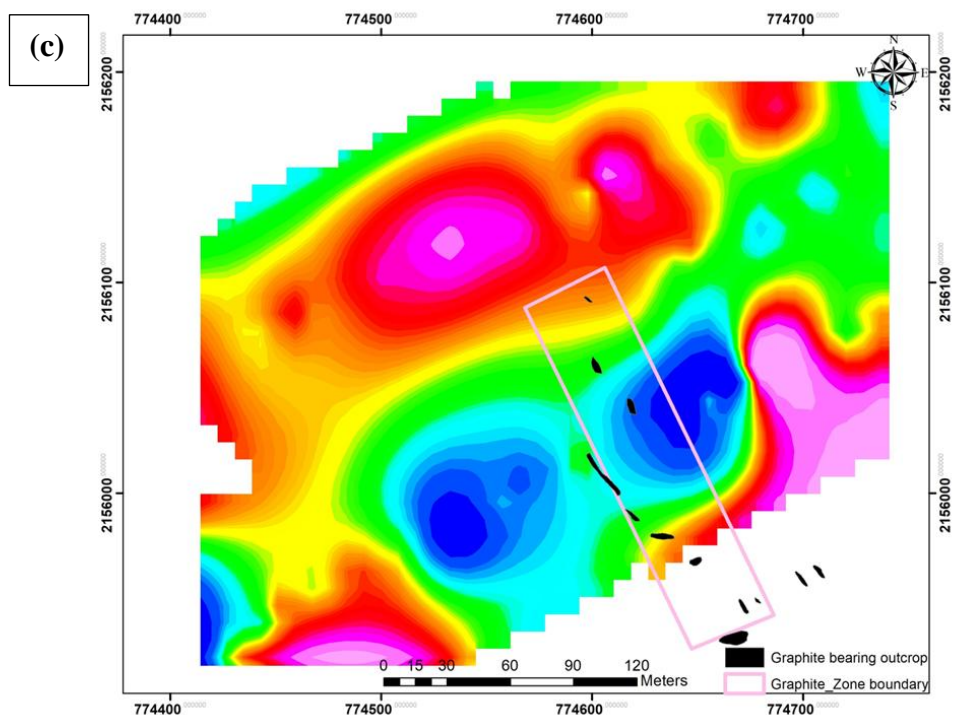
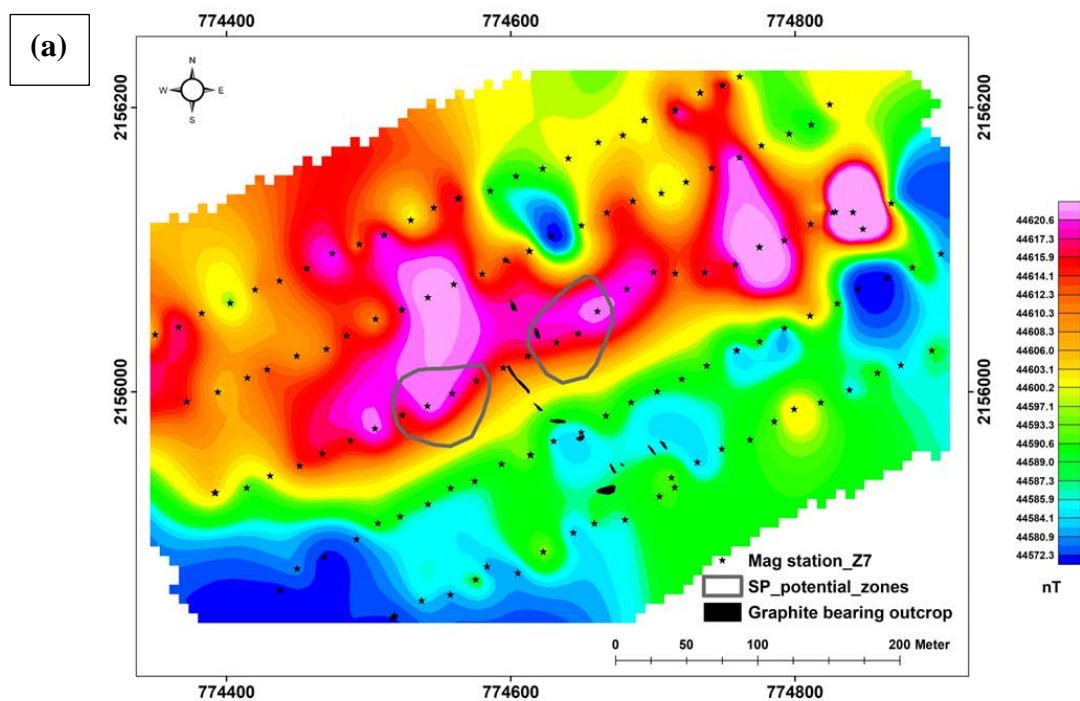


Figure 6.33: (a) Total SP anomaly map for the area zone-D near Lagabhat, (b) residual sp anomaly map draped with Euler depth solution and (c) graphite outcrop



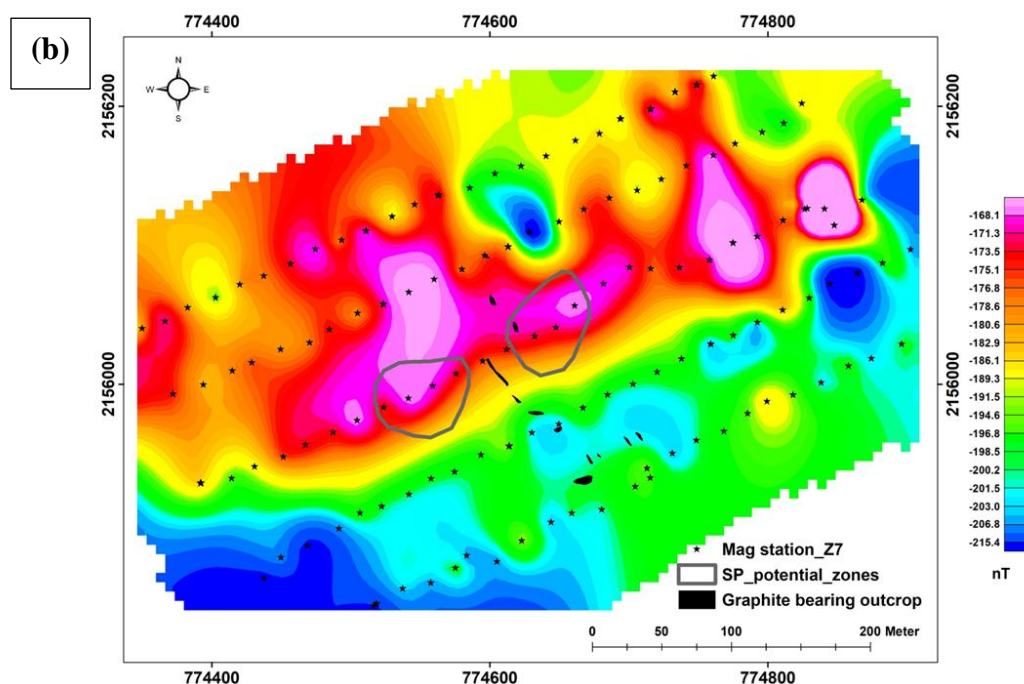


Figure 6.34: (a) Total magnetic intensity map and (b) the IGRF corrected anomaly map of the area zone D.

The total anomaly map indicates that the southern region exhibits the most negative magnetic anomalies, trending in a SW-NE direction (Fig.6.36.a, b). Moderate to low magnetic anomaly zones in this area are identified as the most likely locations for graphite occurrences, aligning with the presence of numerous graphite outcrops. The easternmost and westernmost zones of negative magnetic anomalies are key areas of interest. However, the SP anomaly zone is absent in these regions due to data discrepancies. In contrast, relatively high magnetic anomaly zones correspond to potential SP anomalies, likely resulting from lithological changes. Magnetic anomaly orientations suggest the presence of concealed lithological boundaries.

Shallow graphite bodies, which may not be apparent on the total magnetic anomaly map, can be detected in the residual magnetic anomaly map. The RTP (Reduced to Pole) map demonstrates stronger spatial correlation with SP potential zones and existing graphite outcrops, following a central SW-NE trend (Fig.6.37.a,b). This trend features two low zones at the edges and two moderate-low zones centrally located near SP anomaly zones.

The residual SP anomaly map, derived from RTP and IGRF (International Geomagnetic Reference Field) anomaly maps, aligns well with SP results and known graphite outcrops, reinforcing the reliability of these observations (Fig.6.37, b& c).

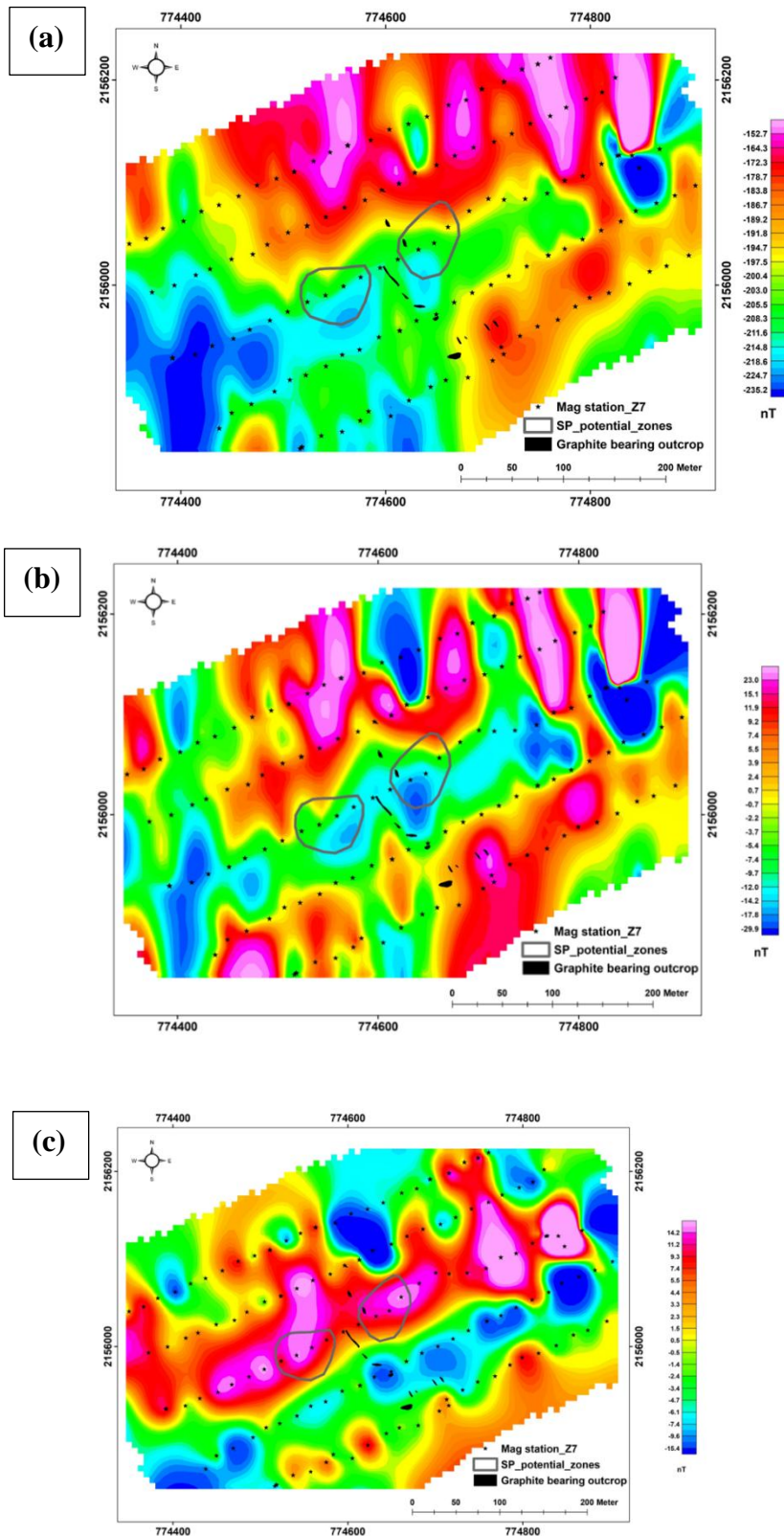


Figure 6.35: a. Residual magnetic anomaly map from the RTP data and (b) RTP anomaly map (c) Residual anomaly map from IGRF corrected data.

ZONE-A NEAR DUKUM

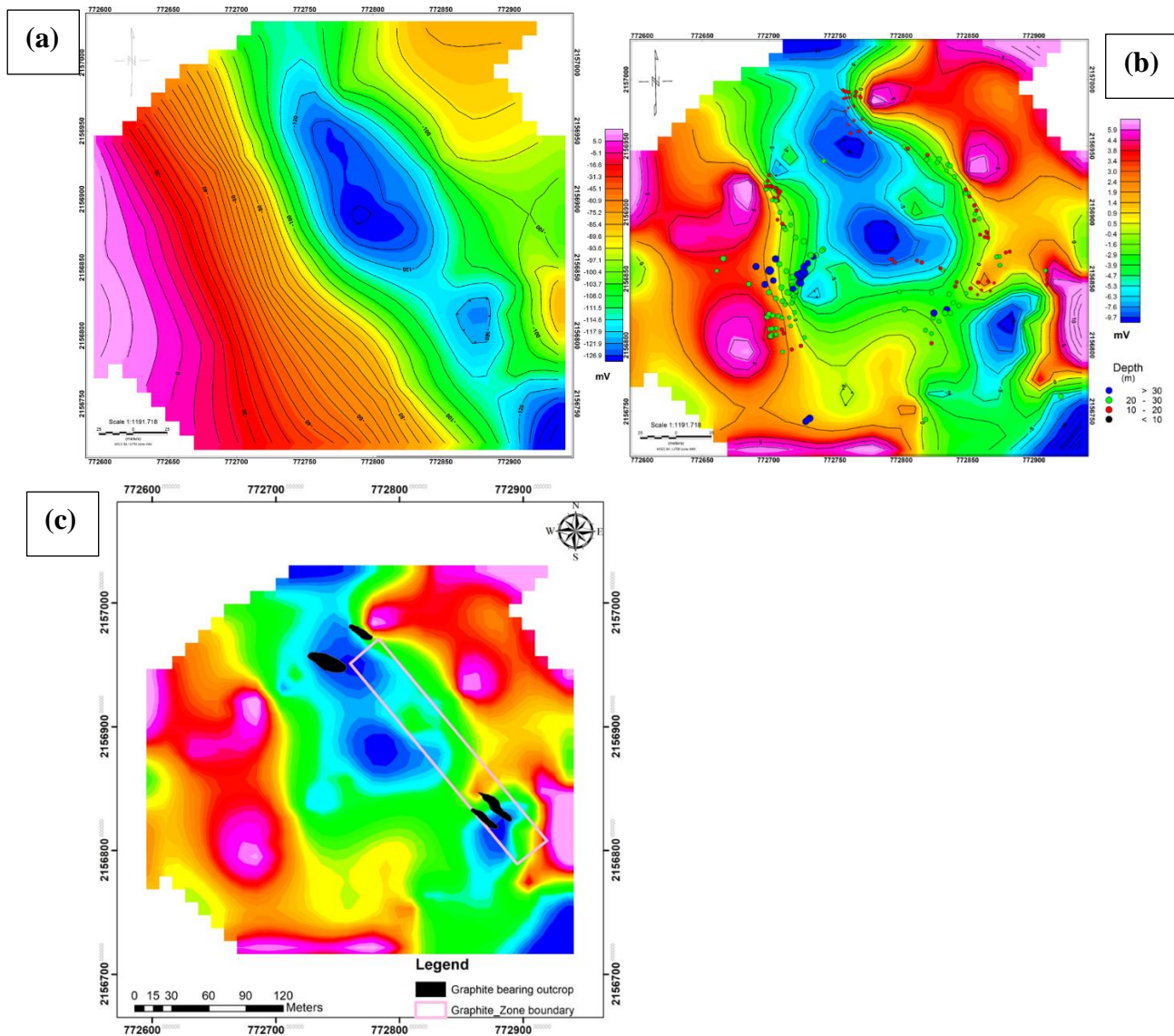


Figure 6.36: a. Total SP anomaly map b. Residual SP anomaly map draped with Euler Solution c. Residual SP anomaly map draped with the graphite exposure.

The total SP anomaly map reveals anomaly values ranging from -126 mV to 5 mV (Fig.6.38.a). A distinct SE to NW trending anomaly was identified, suggesting potential graphite mineralized zone within the blue-colored anomaly zone. The residual SP anomaly map indicates values between -9.7 mV and 5.9 mV, highlighting possible shallow surface graphite (Fig.6.38.b). Five promising zones identified in the area, indicating shallow graphite at depths of 10 to 20 meters (Fig.6.38.b). Graphite outcrops were overlaid on the residual anomaly map to differentiate between concealed graphite bodies and the shallow surface continuity of the graphite mineralization.

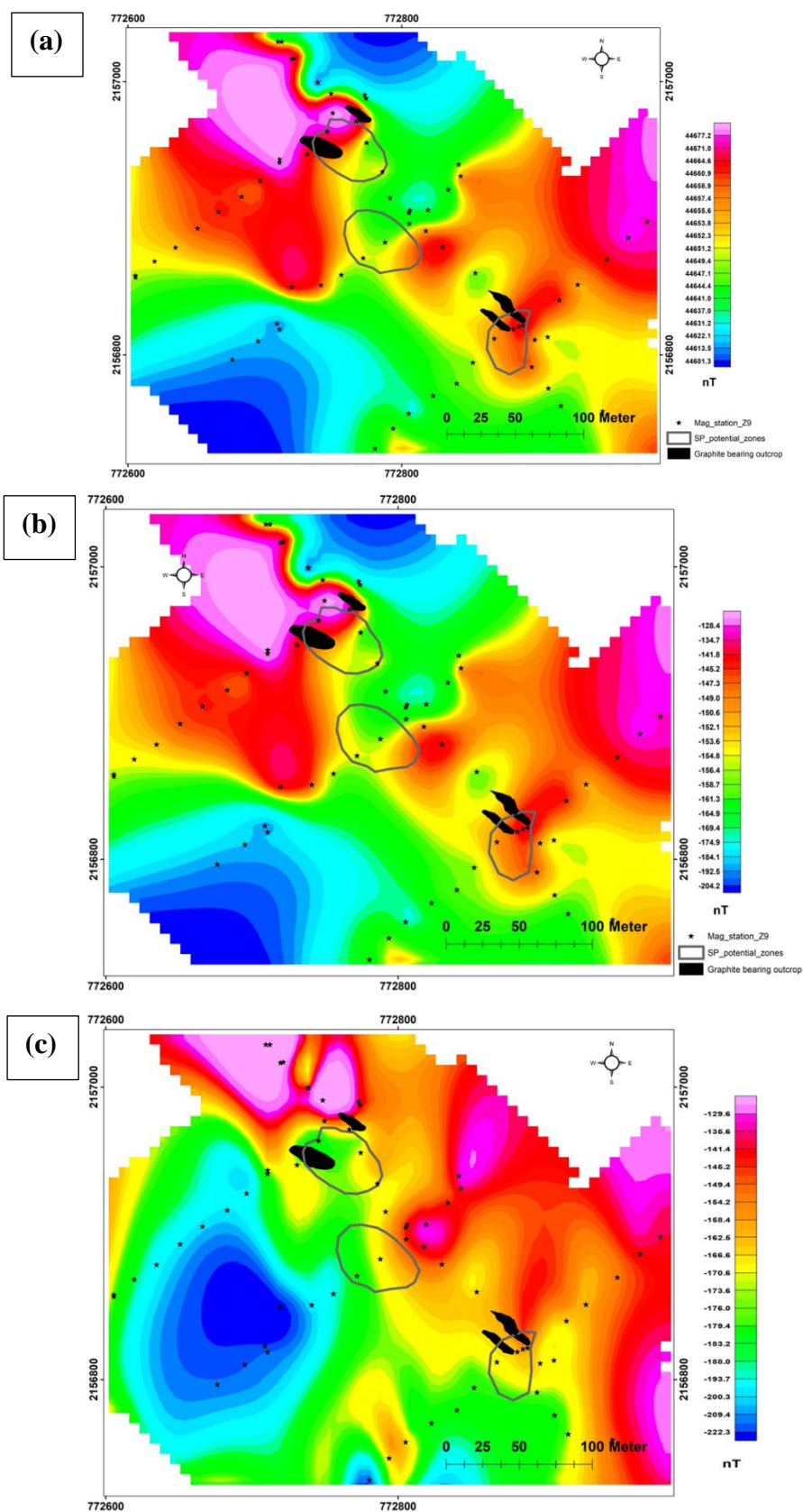


Figure 6.37: a. Total magnetic intensity map b. IGRF corrected anomaly map c. RTP anomaly map for the Zone A near Dukum.

The total magnetic intensity map, IGRF-corrected anomaly map, and RTP anomaly map for Zone A consistently highlight a distinct low magnetic anomaly in the southwestern part of the area (Fig.6.39 a,b,c). This suggests that the graphite outcrops in this region may be shallow, with limited volume, and thus are not prominently reflected in the magnetic anomaly maps as they are in the SP anomaly map. The total magnetic intensity values for the area range from 44,601 nT to 44,677 nT. The IGRF-corrected anomaly map shows values between -204 nT and -128 nT, while the RTP anomaly map ranges from -222 nT to -129 nT (Fig.6.39.b,c). Anomalies within the range of -204 nT to -184 nT on the IGRF-corrected map and -222 nT to -123 nT on the RTP map are identified as potential indicators of concealed graphite zones.

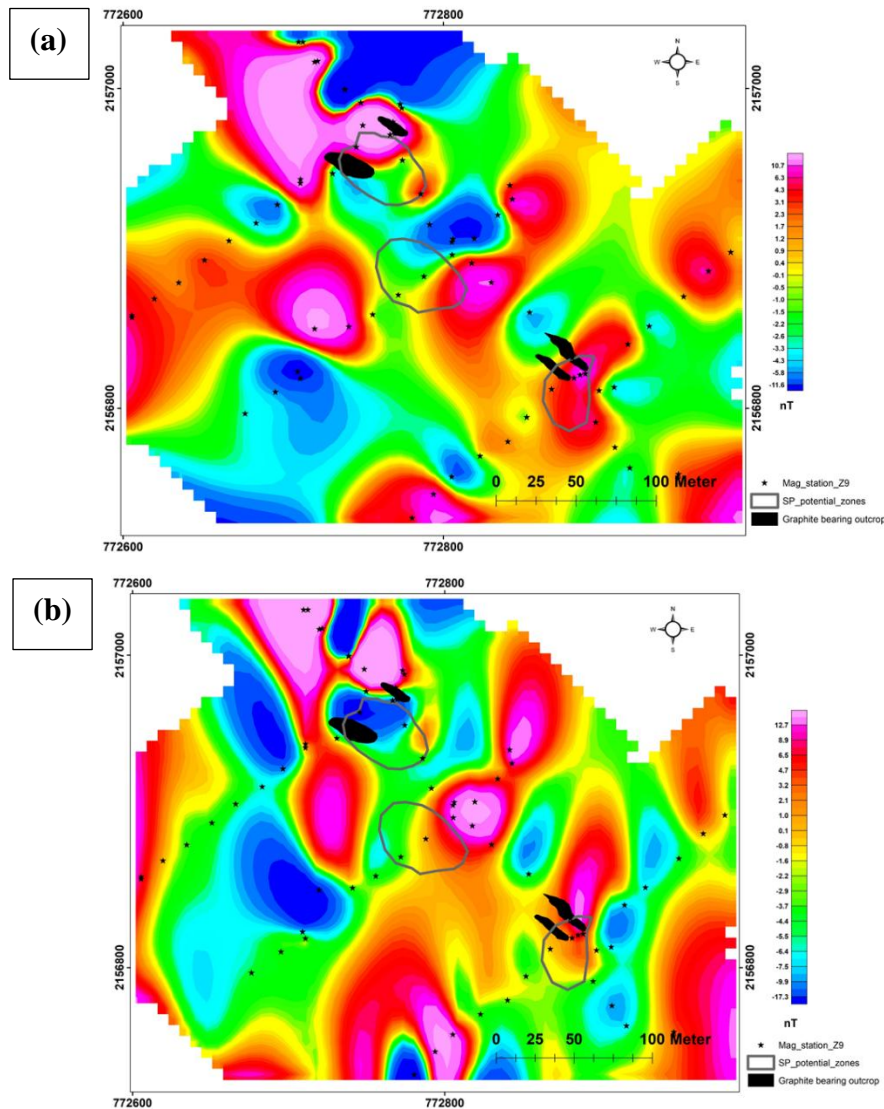


Figure 6.38: a. Residual anomaly map from IGRF anomaly and b. RTP anomaly map.

6.3 Geochemical sampling

Bed rock sampling:

Methodology of Sample collection: In order to collect samples from the exposed outcrops of graphite bearing lithological-units, the following method was adopted –

- Groove lines (Fig.6.12) are placed in order to remove the weathered surface of the outcrops. The longest axis of the groove is perpendicular to the strike of the ore body.
- After removing the weathered surface, samples are collected continuously from the groove with the help of chiesel and hammer.
- Samples length for each sample is normally 1m.
- Groove lines placed at a distance of 50 m away from each other to collect samples.

Bedrock sampling

Groove lines (Fig.6.19) were systematically placed across various graphite-bearing zones in the study area to collect fresh samples.

1. The graphite-bearing outcrops were first thoroughly cleaned to remove any unwanted material.
2. A set of parallel lines were marked along the groove line using lime.
3. The inner section of the groove was excavated to a consistent width and depth using a hammer and chiesel.
4. Fresh graphite-bearing samples were then collected from the groove line continuously with 1m interval. Sample length for each sample was 1m.
5. The collected samples were carefully placed in plastic bags, properly labeled with tags, and sent to the laboratory for analysis.

A total of 100 groove samples were collected from the different graphite bearing zones.

Analytical Results:

100 nos. of bed rock samples collected from nine graphite bearing zones. After chemical analysis, it was studied that the samples from four graphite bearing zones show encouraging values (Minimum F.C. value 4% and maximum F.C. value 9.08%). Based on the values graphite bearing zones are categorized into two groups namely major and minor. The report of the chemical analyses of the 100 nos. of BRS is given in Annexure-I.

CHAPTER-7: INTEGRATION OF GEOLOGY, GEOPHYSICS & GEOCHEMICAL EXPLORATION DATA AND INTERPRETATION.

The zone wise integration of geology, geophysics and geochemical exploration was given below-

Zone-A

Two groove lines placed to collect graphite bearing bed rock samples from the exposed portion of Quartzo-feldspathic graphite gneiss. The average FC% for the samples for the two groove lines are 6.42 % and 7.67 which were associated with SP anomaly zones bounded by SP contours -110 mV & -120 mV and -120 mV & -130 mV respectively.

Zone-B

The samples collected from the groove line with average FC% of 6.91 % which was associated with the SP anomaly zones bounded by SP contours of -250 mV and -260mV. On the other hand the average FC% of 7.66 % for the samples collected from trench placed on graphite bearing zone, was associated with -150 mV and -160 mV.

Zone-C

Average F.C % of 1.266 % and 1.383 % were associated with SP anomaly zones bounded by SP contours -40 mV to -50mV and -50 mV to -70 mV respectively. But two intense SP anomaly zone bounded by SP contour of value greater than -160 mV, were encountered in the western side of the groove lines. These anomaly zones were considered possibly due to the presence of subsurface graphite bearing litho-units.

CHAPTER-8: MINERAL PROSPECT

8.1 Surface indication

The primary indication of graphite mineralisation is the existence of graphite flakes in the sediments along the different nala sections.

Occurrences of graphite was found in two types –

- Quartzo-feldspathic graphite gneiss type
- Disseminated type

In situ outcrops of Quartzo-feldspathic graphite gneiss were mapped near Dukum, Saharha, Rambu and Kanumani villages along nala sections and slope of the hills. The disseminated graphite flakes were found in khondalite and granite gneiss near Ankulpadar, Saharha, Kiribiri and Darukona villages. Sometime the lithological units above the gneiss type s.

8.2 Mode of Occurrence

In the present explored block, there are two types of mode of occurrences of graphite, which are as follow-

- Disseminated type
- Gneiss type

Disseminated type -

In this type of occurrence the graphite flakes are disseminated throughout the host rock. The flakes show parallel alignment to the foliation of the host rock. Granite gneiss (South-eastern side of Ankulpadar village) and khondalite (Near kiribiri, Jagannathpur and Darkona village) are the principal lithological units which show such type of mineralization.

According to the chemical analysis report (Annexure I) such types of mineralization are uneconomic (Less than 2% F.C.) in nature.

Gneiss type s-

In this type of the graphite rich layers are alternate with the quartz-feldspar rich layers which defines the gneissosity of the litho-unit. Such types of ions found near Dukum, Saharha, Rambu and kanumani villages.

Such types of mineralizations are economic (Greater than 2% F.C.) in nature and show encouraging values (Up to 9.02 % F.C) (Annexure I).

8.3 Details of mineralization

Potential surface geological evidences for the existence of graphite were observed in five graphite bearing zones from A to E. The principal graphite bearing litho-units exposed on the surface are Quartzo-feldspathic graphite gneiss and Granite gneiss with graphite. Chemical analysis results for the samples collected from the graphite bearing litho-units were showing encouraging values (> 2% F.C). The detailed descriptions of the major graphite

bearing zones are described earlier under section 6.1.8.

8.4 Genesis of mineralization

The banded graphite mineralisations were found to occur as quartzo-feldspathic graphite gneiss, granite gneiss with graphite and khondalite with graphite associated with khondalite group of rock and granite gneiss. It was also noticed that the graphite mineralisation was associated with the development of pyrite crystals.

The co-existence of graphite and pyrite is possibly due to common origin from organic rich sediment which underwent high temperature regional metamorphism in deep marine reducing environment. But the organic origin can be confirmed after carbon isotope analysis which experiment was beyond the scope of this work.

CHAPTER-9: EXPLORATION BY SCOUT DRILLING

In pursuance of **NMET-mineral exploration project F. No. 23/411/2023-NMET/389**, exploratory drilling of 500 m was carried out in 6 numbers of 1st level boreholes (30m vertical depth of intersection) based on surface geological and geophysical evidences in order to investigate the existence of graphite up to 30 m vertical depth in three different graphite bearing zones. The spacing between two adjacent boreholes was decided 170 m or less, depending on surface evidences of mineralization. The detailed descriptions of the spacing of the boreholes are given under borehole planning. The drilling was commenced on 15th December 2024 and completed on 26th February, 2025. As per the MEMC rules, The exploration in the graphite bearing zones of Darukona block is covered by G-4 stage and the resources are categorized at UNFC class 334.

9.1 Methodology of drilling

As the dip of ore bodies vary between 45° to 60° in different graphite bearing zones, inclined core boreholes were planned to be drilled in order to intersect the graphite bodies at 30 m vertical depth. The inclination angle of every borehole is 45° with respect to the horizontal surface.

9.2 Borehole planning

Two types of surface data were considered as reference for placing boreholes viz: the surface geological evidence and geophysical evidence.

Borehole planning based on Geological evidence

The outcrops with zones of graphite of samples with more than or equal to 2 % were considered as the reference location for placing boreholes in order to intersect at 30 m vertical depth. Four numbers of boreholes DDBH-1, DDBH-2, DSBH-1, DSBH-2 were planned on the basis of geological consideration.

Borehole planning based on Geophysical evidence

If the surface geology not evident then maximum SP anomaly zones was considered as the reference point to intersect at 30 m vertical depth by boreholes with inclination of 45°. Two numbers of boreholes DSBH-3 and DSBH-4 were planned on the basis of geophysical evidences. The details of the boreholes are given in table no 9.1, 9.2 and 9.3.

Table no. 9.1: Details of the borehole drilled

Sl.no	Borehole number	Location information	Zone of graphite	Level of the borehole	Vertical depth	Azimuth	Inclination	Remarks
1	DDBH-1	Dukum village	A	1st level	30 m	65°	45°	The borehole was planned on the basis of Geological evidence
2	DDBH-2	Dukum village	A	1st level	30 m	65°	45°	The borehole was planned on the basis of Geological evidence
3	DSBH-1	Saharha village	B	1st level	30 m	65°	45°	The borehole was planned on the basis of Geological evidence
4	DSBH-2	Saharha village	B	1st level	30 m	65°	45°	The borehole was planned on the basis of Geological and Geophysical evidence
5	DSBH-3	Saharha village	C	1st level	30 m	65°	45°	The borehole was planned on the basis of Geological and Geophysical evidence
6	DSBH-4	Saharha village	C	1st level	30 m	65°	45°	The borehole was planned on the basis of Geophysical evidence

Table no. 9.2: Strike spacing of boreholes

Sl.no	Boreholes	Location information	Zone of graphite	Distance between boreholes along the strike
1	DDBH-1 & DDBH-2	South eastern part of Dukum village	Z-9	158.79 m
2	DSBH-1 & DSBH-2	Southern part of Saharha village	Z-6	50 m
3	DSBH-3 & DSBH-3	South eastern part of Saharha village	Z-5	160.79 m

Table no. 9.3: Details of the drilled boreholes

Sl.no	Borehole number	Latitude	Longitude	RI. of collar (m)	Azimuth	Inclination	Date of commencement	Closing depth of borehole (in meter)	Date of completion
1	DDBH-1	19°29'14.0"	83°35'56.7"	399	65°	45°	14.12.2024	57.50 m	18.12.2024
2	DDBH-2	19°29'18.0"	83°35'53.2"	397	65°	45°	19.12.2024	60 m	24.12.2024
3	DSBH-1	19°26'24.2"	83°36'11.4"	466	65°	45°	27.12.2024	64.3 m	03.01.2025
4	DSBH-2	19°26'22.7"	83°36'12.0"	465	65°	45°	04.01.2025	60 m	13.01.2025
5	DSBH-3	19°26'37.4"	83°36'26.9"	481	65°	45°	25.01.2025	156.85 m	17.02.2025
6	DSBH-4	19°26'32.7"	83°36'29.2"	485	65°	45°	20.02.2025	101.35 m	25.02.2025

BOREHOLE: DDBH-1

The borehole DDBH-1 (Plate-IV) was planned on the major graphite bearing zone-A to intersect the graphite band which dips 45° towards 245° , exposed along the nala section with encouraging results (Weighted assay of five grooveline samples is 6.41 % F.C). Hence, DDBH-1 was placed with inclination of 45° , azimuth towards $N65^\circ E$ and at a horizontal distance of 62 m from the exposed graphitic band in order to check the depth persistence of graphite band up to 30 m vertical depth.

The borehole was drilled up to a depth of 57.5 m (Summarised lithological log given in Annexure-III). Lithological units granite gneiss, garnetiferous quartzite, biotite gneiss, Quartzo-feldspathic graphite gneiss and Granite gneiss with graphite were intersected in the boreholes.

A total seven numbers of graphite bearing bands with several partings of thicknesses vary from 1.62m to 9.32 m, encountered within the depth interval from 16.8 m to 56.25 m. The cross sectional view is shown in the figure 9.1. The graphite mineralisation encountered is litho-contact controlled as it occurs along the transition zone between garnetiferous quartzite and granite gneiss.

BOREHOLE: DDBH-2

The borehole DDBH-2 (Plate-IV) was placed on the same major graphite bearing zone-A to intersect a graphite band (dipping 45° towards 245°), exposed along the nala section with encouraging results (Weighted assay of seven grooveline samples is 7.67 % F.C). With inclination of 45° , azimuth towards $N65^\circ E$, DDBH-2 was placed at a horizontal distance of 60.95 m from the exposed graphitic band in order to investigate the depth persistence of that exposed graphite band up to 30 m vertical depth.

The borehole was drilled up to a depth of 60 m (Summarised lithological log sheet given in (Annexure-IV). Granite gneiss, garnetiferous quartzite, Khondalite, fault breccia, Quartzo-feldspathic graphite gneiss and Granite gneiss with graphite were encountered in the borehole.

Two numbers of graphite bearing bands of thickness 5.49 m and 6.55 m with one meter parting thickness were intersected in the the borehole at depth interval from 22.51 to 35.55. The cross sectional view is shown in the figure 9.2.

The exposed graphite band was not intersected at the target.

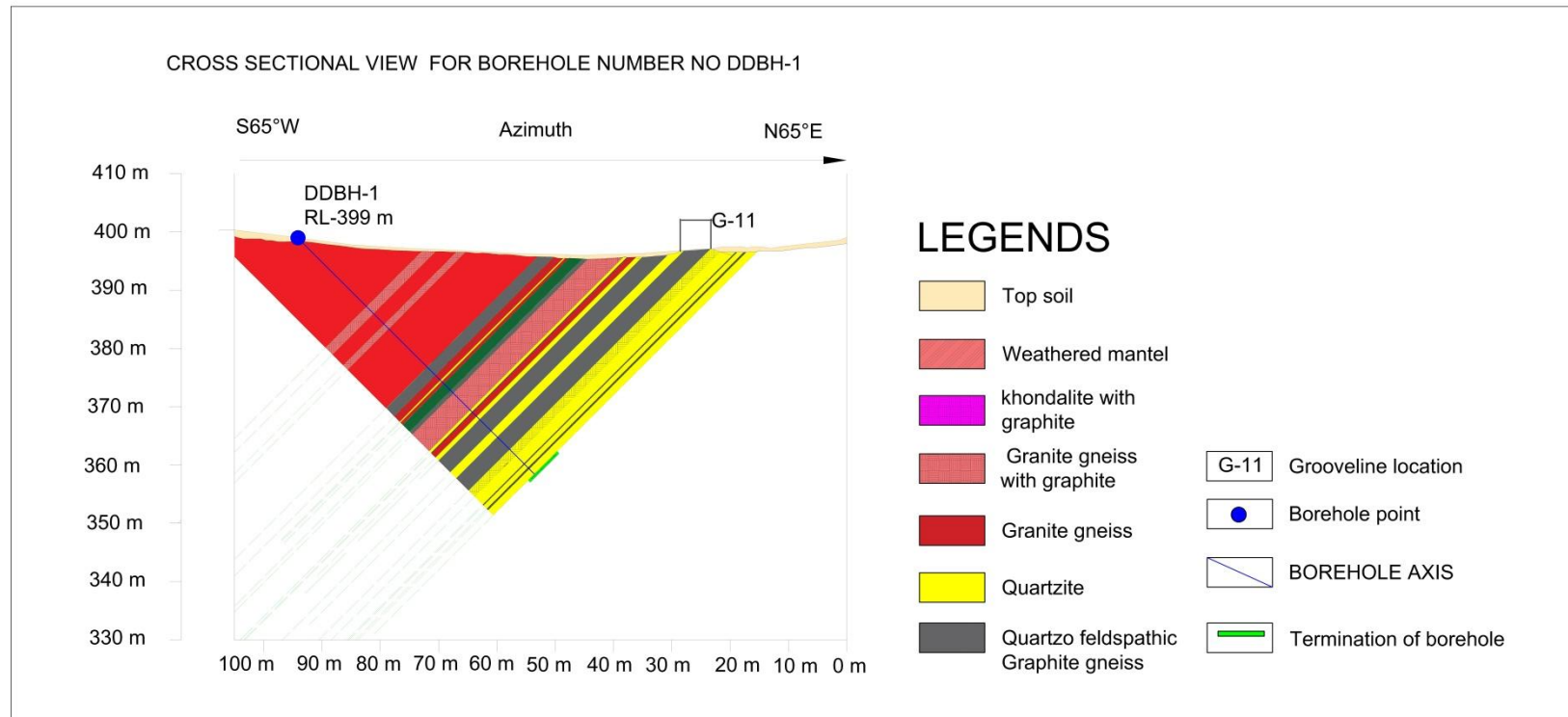


Figure 9.1: Cross sectional view of the borehole DDBH-1

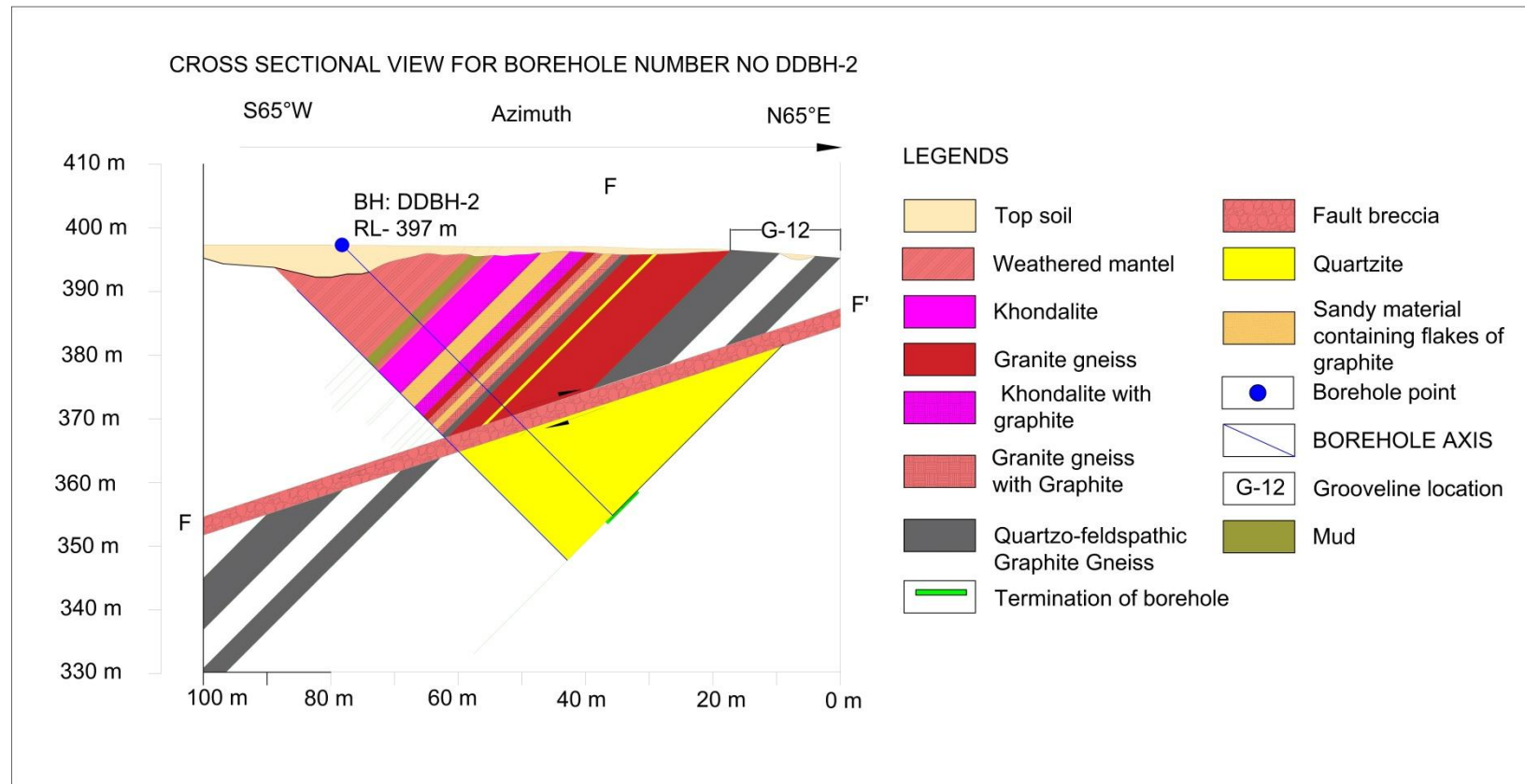


Figure 9.2: Cross sectional view of the borehole DDBH-2

A brecciated zone with 3.13 m thickness from 37.87 m to 41m was encountered and below this zone only garnetiferous quartzite was encountered. There is a possibility of displacement of graphite band by a low angle reverse fault (Dip angle- 25°) from part of the original graphite band.

BOREHOLE: DSBH-1

The borehole DSBH-1 (Plate-IV) was planned on the major graphite bearing zone-A to intersect a graphite band which is dipping 55° towards 245°, encountered along trench-1 with surface width of 13 m with encouraging results (Weighted assay of 13 trench samples is 9.08 % F.C). Hence, DSBH-1 was drilled with inclination of 45°, azimuth towards N65°E and at a horizontal distance of 44.10 m from the exposed graphitic band in order to check the depth persistence of the graphite band up to 30 m vertical depth.

The borehole was drilled up to a depth of 64.3 m (Summarised lithological log sheet given in Annexure-V). Granite gneiss, garnetiferous quartzite and leptynite were encountered.

The targeted graphite band was not encountered at the expected depth along the borehole DSBH-1.

BOREHOLE: DSBH-2

The borehole DSBH-2 (Plate-IV) was planned on the major graphite bearing zone-B to intersect a graphite band (Dipping 55° towards 245°) at 30 m vertical depth, exposed along the nala section with encouraging results (Weighted assay of eight groove line samples is 6.41 %). The borehole was placed at 45° inclination towards N65°E from a horizontal distance of 62 m with respect to the exposed graphitic band.

The borehole was drilled up to a depth of 60 m (Annexure-VI). Granite gneiss, leptynite, garnetiferous quartzite, Quartzo-feldspathic graphite gneiss, Khondalite with graphite and Granite gneiss with graphite were encountered in the borehole.

A total of seven numbers of graphite bearing bands with several parting of thicknesses vary from 0.63m to 15.63 m, encountered in the borehole at depth interval from 4.24 m to 41.75 m. The cross sectional view is shown in the figure 9.4. The graphite mineralisation is hosted by khondalite group of rock.

BOREHOLE: DSBH-3

The borehole DSBH-3 (Plate-IV) was planned on the graphite bearing zone C in order to investigate the occurrence of graphite bearing lithological units at 30m vertical depth with respect to the central point of maximum SP anomaly zone as well as to investigate the depth persistence of a graphite bearing band exposed at the surface with analytical result varies between 1.03% to 1.49% (Five samples). The borehole was located at a horizontal distance of 26m with respect to the centre point of the SP anomaly zone.

The borehole was drilled up to a depth of 156.85 m (Summarised lithological log sheet given in Annexure-VII). Granite gneiss, leptynite, garnetiferous quartzite, Quartzofeldspathic graphite gneiss, Khondalite with graphite and charnockite were encountered during drilling.

A total of 9 numbers of graphite bands were encountered at depth interval from 34m to 155m with several partings. Thickness of the graphite band varies from 0.5m to 8.68m. The cross sectional view is shown in fig.9.5.

BOREHOLE: DSBH-4

The borehole DSBH-4 (Plate-IV) was planned on the graphite bearing zone C in order to investigate the subsurface existence of graphite bearing lithological units at 30m vertical depth below the maximum SP anomaly zone. The borehole was placed at a horizontal distance of 33.93 m with respect to the central point of the SP anomaly zone.

The borehole was drilled up to a depth of 101.35 m (Summarised lithological log sheet given in Annexure-VIII). Granite gneiss, leptynite, garnetiferous quartzite, Quartzofeldspathic graphite gneiss, Khondalite with graphite and Granite gneiss with graphite were encountered during drilling.

A total of 5 numbers of graphite bands were encountered within the depth interval from 31.6m to 99.31m with several partings. Thickness of the graphite bands varies from 0.5m to 8.28m. The cross sectional view is shown in fig.9.6.

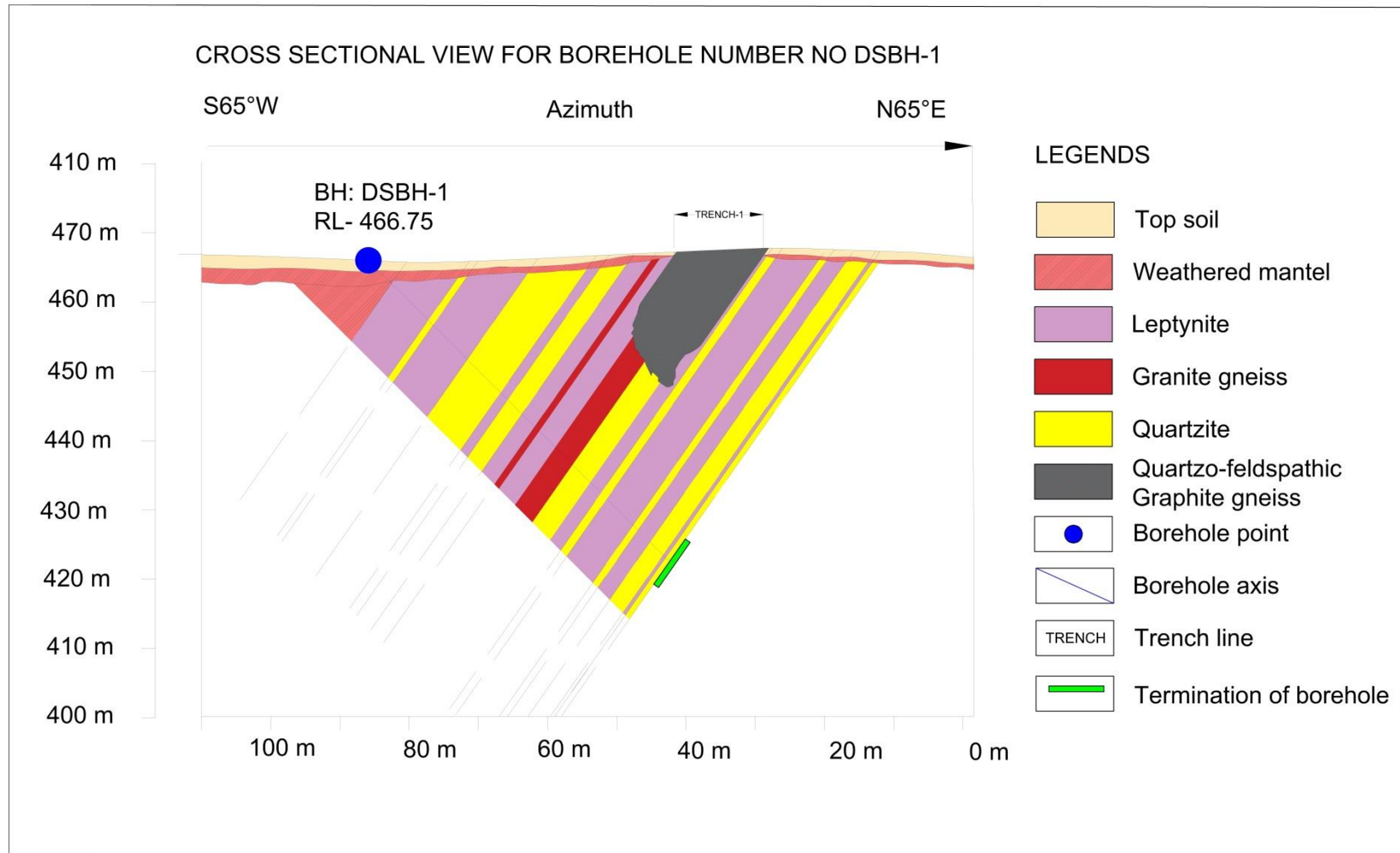


Figure 9.3: Cross sectional view of the borehole DSBH-1

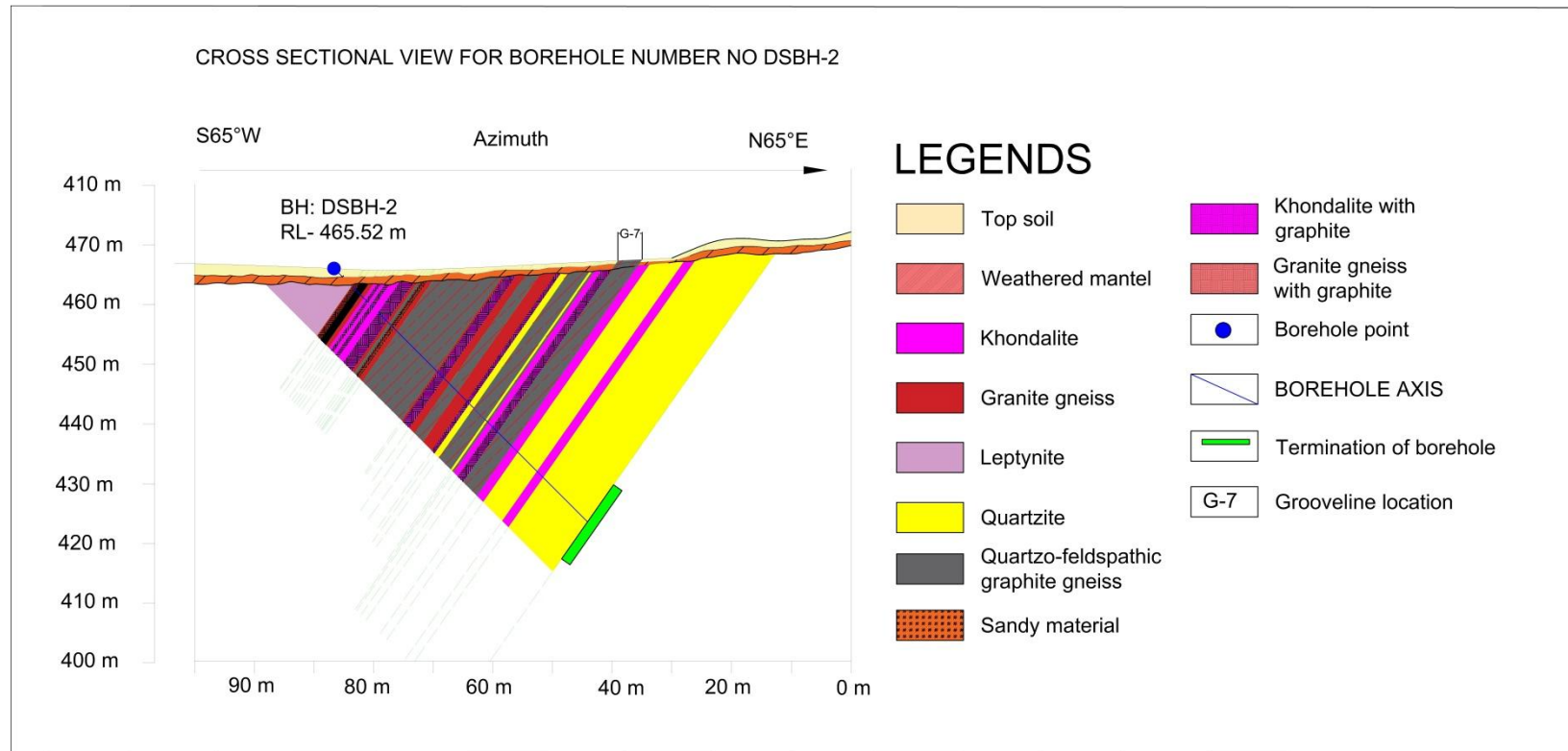


Figure 9.4: Cross sectional view of the borehole DSBH-2

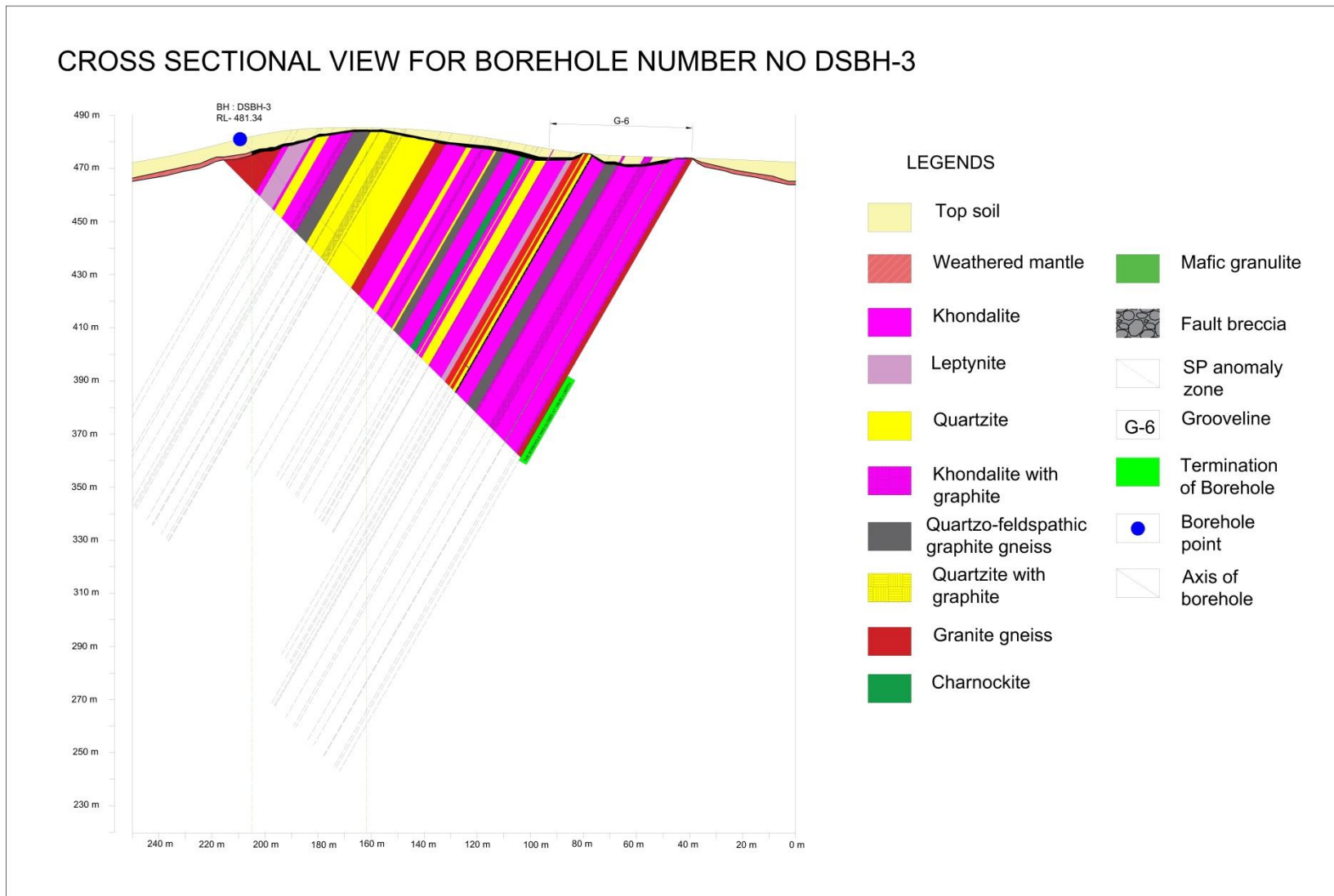


Figure 9.5: Cross sectional view of the borehole DSBH-3

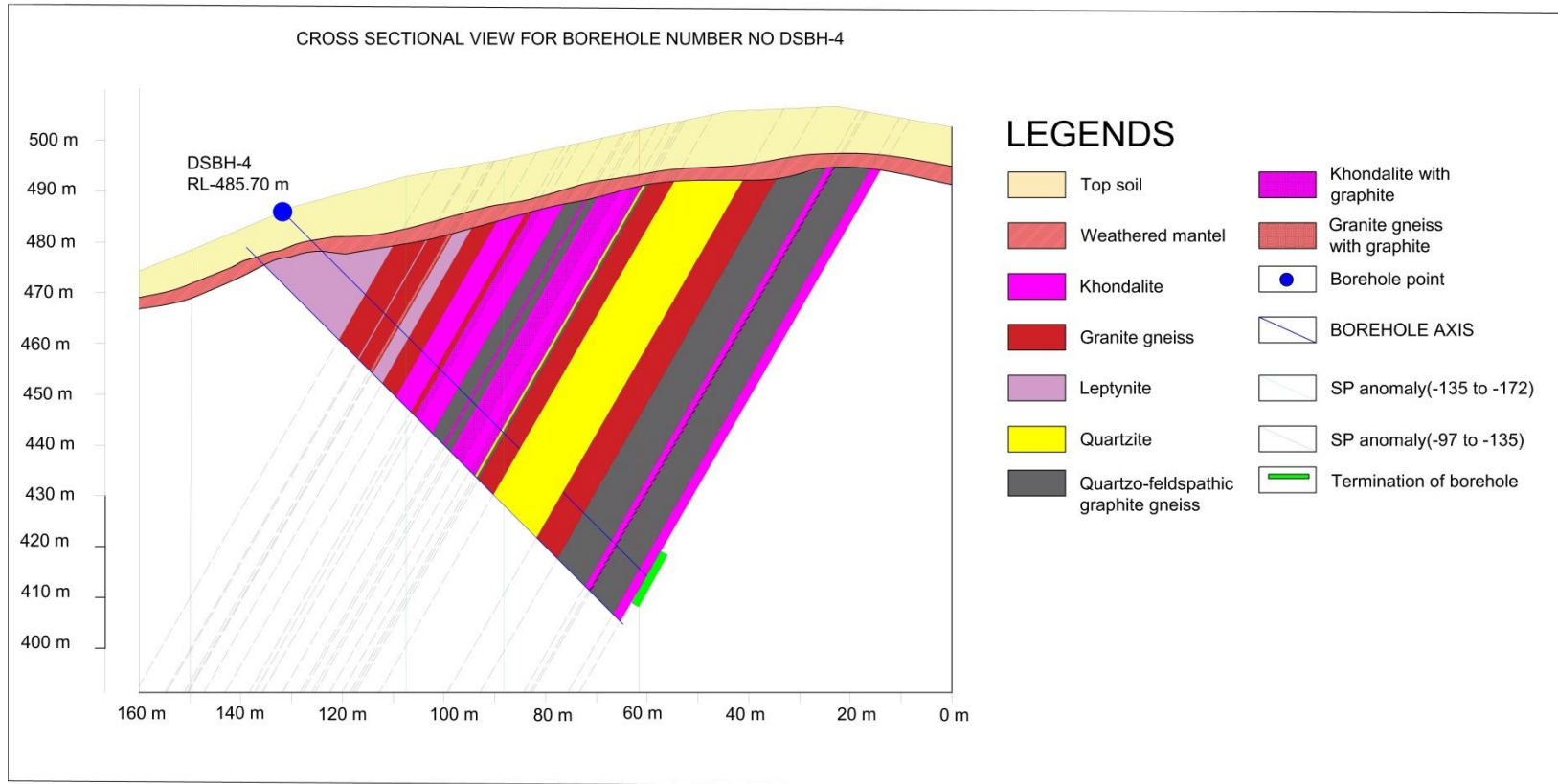


Figure 9.6: Cross sectional view of the borehole DSBH-4

9.3 Logging

Cores were preserved in metal boxes in book pattern after drilling. All the cores were logged for lithology, structure, graphite mineralisation, recovery and RQD. The simplified lithological log sheets are given in annexures from III to VIII.

9.4 Methodology of ore zone sampling and sample preparation

The sampling of the mineralised zones was carried out based on the following points-

- Initially the sample length was kept 1m for each samples generated from a particular graphite bearing band.
- If the sample length between 0.50 m to 0.99 m remains for the last portion of particular graphite bearing band, then the last sample was generated with sample length varies from 0.50 m to 0.99m. For example for a graphite bearing band of thickness 7.62 m , a total eight numbers of samples were generated where the sample length of the 1st seven sample was 1m while the sample length for the last sample was kept 0.62 m.
- If the sample length less than 0.50 m remains for the last portion of any particular graphite bearing band, then the remaining sample length was added to the previous sample and in that case the sample length for the earlier sample was kept between 1m to 1.49m. For example for a graphite bearing band of thickness 7.40 m , a total seven numbers of samples were generated where the sample length of the 1st six sample was 1m while the sample length for the last sample was kept 1.4m.
- If any particular graphite band consists of more than one graphite bearing litho-units, then continuous sampling was carried out separately for those different litho-units. For example a graphite band consists of 4.5 m thick Quartzo-feldspathic graphite gneiss and 3.2 m thick Khondalite with graphite. In this situation five numbers of samples were generated for the Quartzo-feldspathic graphite gneiss and three numbers of sample generated from the Khondalite with graphite.

The purpose for adopting this technique was to study concentration of graphite with different litho-units.

- Some of the samples were also generated to check concentration of graphite along parting between zones.

The sample preparation was carried out in the following method-

- At first the cores were split into two parts with the help of core cutter machine. Then the half splitted cores were crushed to a 75 micron (Equivalent to 200 mesh) and reduced the sample weight to 750g through coning and quartering. The generated samples were divided into three parts for proximate, ICPMS and check sample analysis. Sample weight was kept 250g for each to send them to laboratory.

9.5 Chemical analysis and laboratory procedure

The samples were analysed for their fixed carbon content. Generally proximate analysis is carried out for determination of FC of graphite. The standard for chemical procedure followed for determination of FC is IS 14852:2000 of Bureau of Indian standard. The process of proximate analysis starts with the freeing of moisture content and determination of volatile matter and ash content. After determination of these 02 parameters, the sum of these two is deducted from 100. The result thus obtained from this is the fixed carbon.

Determination of moisture:

About 5 g of the sample is weighed in a tarred porcelain dish and covered with a watch glass. Then the dish is placed in an air oven maintained at a temperature $150 \pm 10^\circ\text{C}$ and removes the watch glass from it. Then the sample is heated for 02 hours in the oven and the dish is covered with the watch glass before it is taken out of the oven. Then the dish is cooled in a desiccator and weighed. The following formula is used for calculation of moisture content.

$$\text{Moisture \%} = A/B \times 100$$

Where, A= loss in weight in g of the material after heating and B= weight in g of the material taken.

Determination of volatile matter:

Nearly 1 g of the moisture free sample is introduced in a weighted volatile matter crucible with tightly fitted lid. Then the crucible is heated in a muffle furnace maintained at temperature of $925 \pm 250^\circ\text{C}$ for 7 minutes. The bottom of the crucible shall not rest on the floor of the muffle furnace. Then remove the crucible from the muffle furnace after 7 minutes and cool it in desiccators and weigh. The following formula is used for calculation of volatile matter content.

$$\text{Volatile matter \%} = A/B \times 100$$

Where A= loss in weight in g of the moisture free sample after heating up to $925 \pm 250^\circ\text{C}$
B= weight in g of the moisture free sample taken.

Determination of ash:

Nearly 1 g of the moisture free sample is taken in a silica crucible, keep the crucible in a muffle furnace and heat to $500 \pm 100^\circ\text{C}$ within one hour and $775 \pm 100^\circ\text{C}$ in two hours. A slow stream of air is maintained through the muffle furnace. The temperature is further increased to $925 \pm 250^\circ\text{C}$ and kept for one hour. Cool it in a desiccator and weigh the sample. The procedure is repeated till the residue in the crucible is constant in weight. The following formula is used for calculation of ash content.

$$\text{Ash \%} = A/B \times 100$$

Where A= Weight of ash in g and B= weight in of the sample taken.

After determination of these parameters, FC is calculated with the formula

$$\text{FC \%} = 100 - (\text{VM \%} + \text{Ash \%})$$

Where, FC= Fixed carbon

VM= Volatile matter

Ash= Ash content

Proximate analysis

A total 144 numbers of core samples were generated for proximate analysis. The analysis report is given in annexure IX

Check samples

10% of the total core samples (14 nos) were submitted to Shiva Analytics for check sample analysis. The analytical results were given in the annexure –X.

Analysis of minor and trace element

A total 144 numbers of core samples were analysed for minor and trace elements. The analysis report is given in annexure – XI.

9.6 Details of the borehole drilled in the ore zones and their correlation

The details of the intersected mineralised zones are given in the table 10.1.2. Within the graphite bearing zone A the band B-5 was correlatable for both the borehole DDBH-1 and DDBH-2. For zone C, B-13 was correlatable for DSBH-3 and DSBH-4. Rest of the bands interpreted to show pinch and swell behaviour.

CHAPTER-10: RESOURCE ESTIMATION

Graphite mineralisation was observed to occur in different graphite bearing zones. Geological evidences necessary for resource estimation were collected systematically by different geological and geophysical methods. After demarcation of the graphite bearing zones, 500 m drilling was carried out in six numbers of boreholes to gather the subsurface evidences. After interpretation, it is noticed that the graphite bearing zone consists of few discrete graphite bands. But the graphite bands show pinch and swell nature when compared to two adjacent boreholes placed on the same graphite bearing zones. So, resource estimation was done on the principle of ore resource of any banded type. Resource of graphite was estimated separately for the graphite bearing zones by cross sectional area method considering a cut off of fixed carbon value of 2%.

10.1 Detailed description of the ore zones

The detailed descriptions of the graphite bearing zones in terms of surface evidence are discussed in chapter 6.1.6. In this section the description is given based on subsurface evidences. The zone wise descriptions are as follow-

Graphite Zone A

The Zone A is located to the south west of Dukum village (PLATE-IV). Two boreholes DDBH-1 and DDBH-2 were drilled to explore the subsurface geological evidences of the graphite mineralization up to 30 m vertical depth.

Based on the surface and subsurface evidences, a total eight number of graphite bands (PLATE-V) were interpreted in zone A. The maximum and minimum thicknesses of the bands encountered were 5.0 m and 0.70 m. The average FC% for the bands varies from 2.14% to 4.97%. The sectional view of the graphite bands of average FC% greater than 2% were shown in PLATE-VII.

Graphite Zone-B

The Zone B is located to the southern side of Saharha village. Two boreholes DSBH-1 and DSBH-2 were drilled to understand the subsurface geological evidences of the graphite mineralization up to 30 m vertical depth.

In total four number of graphite bands (PLATE-V) were interpreted based on the surface and subsurface geological evidences where the average true thickness of the bands varies from 1.9 m to 12.6 m and the average fixed carbon content varies from 3.42% to 9.08%. The sectional view of the graphite bands of average FC% greater than 2% were shown in PLATE-VII.

Graphite zone C

The Zone C is located to the south-eastern side of Saharha village. Two boreholes DSBH-3 and DSBH-4 were planned based on geophysical evidences to gather the subsurface nature of the graphite mineralization up to 30 m vertical depth.

Two numbers of graphite bands (PLATE-V) of average true thickness of 8.38 m and 2.23 m with average FC% of 2.9 % and 3.52% respectively were interpreted for the zone-C. The sectional view of the graphite bands of average FC% greater than 2% are shown in PLATE-VII.

10.2 Cut-off grade

The F.C values for graphite amples containing crystalline graphite collected from the surface outcrop ranges from 0.11% to 10.65%. So, 2% F.C was considered as cut off for resource estimation for graphite.

10.3 Bulk density calculation

As per the sanctioned quantum of work, bulk density studies (Table 10.1) were carried out by Shiva analyticals India Limited for 5 numbers of samples. Additionally, the bulk density studies were carried out for the other samples at the project site based on Archimedes' principle (Annexure XII). Finally the values were verified by the laboratory tested samples.

Table no. 10.1: Bulk density result		
Sl. No.	Sample number	Bulk Density (gm/cm ³)
1	DDBH-1/S-18/M-9	2.40
2	DSBH-2/S-33/M-10	2.63
3	DDBH-1/S-13/M-11	2.24
4	DSBH-3/S-06/M-12	2.40
5	DSBH-3/S-02/M-13	2.36

10.4 Assumption of resource estimation

The following factors were considered for resource estimation –

- The cut-off was considered as 2% FC for graphite zones for resource estimation.
- Band wise average bulk density was estimated. Unit for bulk density was tonne/m³ or no unit may be used.
- True thicknesses of the graphite bearing bands were calculated trigonometrically.
- The volume was calculated by $V = \text{Strike influence} \times \text{dip influence} \times \text{true thickness}$.
- Strike influence of 50% of borehole interval between two successive boreholes was considered for the side having geological confidence and 25% was taken for the side of less geological confidence.
- Average grade for graphite bearing band was calculated using the formula $\frac{\sum(l_1 \times A_1 + l_2 \times A_2 \dots)}{\sum(l_1 + l_2 \dots)}$ where, l_1 = sample length and A_1 = Fixed carbon percentage.
- Resource of graphite was calculated by using the formula

$$T_g = V_g \times \rho_g$$

Where, T_g = Resource of graphite, V_g = Volume of graphite band, ρ_g = average bulk density of graphite band.

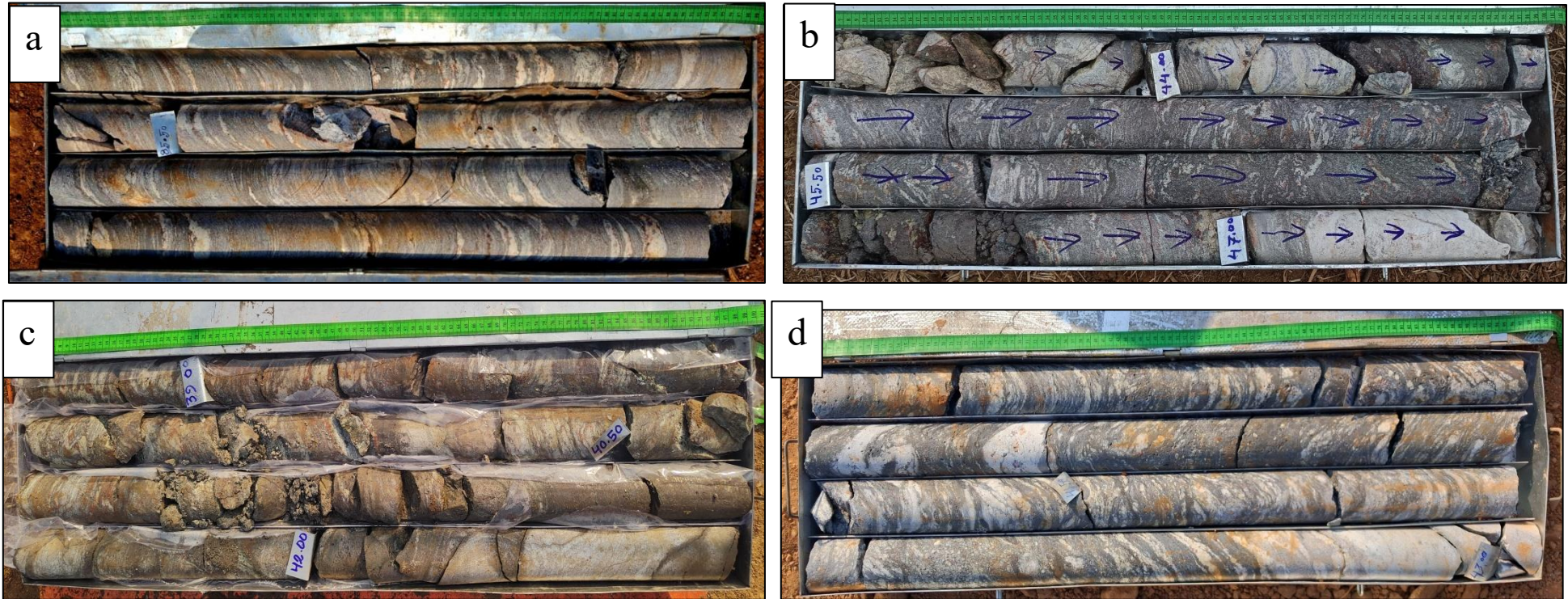


Figure 10.1: Core photographs of a. Quartzo-feldspathic graphite gneiss from borehole DSBH-4; b. Quartzo-feldspathic graphite gneiss from borehole DDBH-1; c. Quartzo-feldspathic graphite gneiss from borehole DSBH-2; d. Quartzo-feldspathic graphite gneiss from borehole DSBH-3

10.5 Resource estimation by cross section method

10.5.1. Resource for Graphite at 2% cut off

The resource for graphite was estimated by cross sectional method based on the assumptions described in section 10.4. The zone wise resource calculation sheet is given in table 10.2. Cumulative resource for graphite in zone-A, zone-B and zone-C were 0.079 million tonne, 0.031 million tonne and 0.085 million tonne respectively at 2% cut off.

Table no. 10.2: Calculation sheet of resource for graphite at 2% Cut off										
Borehole Number	Depth From (m)	Depth To (m)	Band for Graphite	Average FC%	True Thickness (m)	Strike Influence (m)	Dip length (m)	Band Wise Volume (m³)	Average Bulk Density (Tonne/m³)	Band Wise Resource of Graphite at 2% cut off (Million tonne)
DDBH-2	24	25	B-1	2.28	1.00	80	8.84	707.11	2.85	0.002
	26	27	B-2	2.63	1.00	80	14.32	1145.52	2.97	0.003
	27	28		2.71	1.00	80	14.85	1187.94	2.54	0.003
	31	32	B-3	2.75	1.00	80	11.31	905.10	2.47	0.002
Grooveline G-12			B-5	2.65	2.00	120	22.50	5400.00	2.30	0.012
			B-4	4.66	5.00	80	22.50	9000.00	2.55	0.023
Grooveline G-11			B-7	6.42	7	80	14.83	8304.80	2.54	0.021
DDBH-1	21.1	22.18	B-5	2.21	1.08	120	7.84	1016.30	2.29	0.002
	37.19	37.88	B-6	4.97	0.69	80	13.39	739.28	2.37	0.002
	41	41.95	B-7	2.14	0.95	80	14.83	1127.20	2.57	0.003
	45.5	46.5	B-8	2.47	1.00	80	16.44	1315.22	2.43	0.003
	46.5	47.06		2.12	0.56	80	16.64	745.40	2.66	0.002
Cumulative Resource of Graphite for zone -A at 2% cut off										0.079
DSBH-2	16.65	17.65	B-9	3.37	0.98	25	9.36	230.45	2.26	0.001
	17.65	18.65		7.06	0.98	25	9.89	243.51	2.29	0.001
	18.65	19.65		3.24	0.98	25	10.42	256.57	2.09	0.001
	19.65	20.65		3.20	0.98	25	10.95	269.62	2.17	0.001

Table no. 10.2: Calculation sheet of resource for graphite at 2% Cut off										
Borehole Number	Depth From (m)	Depth To (m)	Band for Graphite	Average FC%	True Thickness (m)	Strike Influence (m)	Dip length (m)	Band Wise Volume (m ³)	Average Bulk Density (Tonne/m ³)	Band Wise Resource of Graphite at 2% cut off (Million tonne)
	20.65	21.65	B-10	2.32	0.98	25	11.48	282.68	2.34	0.001
	21.65	22.88		2.14	1.21	25	12.13	367.45	2.42	0.001
	27.01	28.01		4.67	0.98	25	14.85	365.72	2.68	0.001
	28.01	28.95		2.18	0.93	25	15.35	355.31	2.52	0.001
	40.48	41.75	B-11	3.42	1.25	25	14.76	461.54	2.45	0.001
Grooveline G-7			B-11	6.9	7.84	25	19.00	3724.00	2.45	0.009
TRENCH			B-12	9.09	12.62	25	19.00	5994.50	2.46	0.015
Cumulative Resource of Graphite for zone -B at 2% cut off										0.031
DSBH-3	34	35	B-13	3.00	0.97	120	18.56	2151.44	2.35	0.005
	35	35.58		3.97	0.56	120	18.87	1268.51	2.31	0.003
	35.58	36.18		3.64	0.58	120	19.19	1334.39	2.66	0.004
	36.18	37		4.10	0.79	120	19.62	1864.99	2.38	0.004
	37	38		3.19	0.97	120	20.15	2335.85	2.51	0.006
	38	39		2.57	0.97	120	20.68	2397.32	2.48	0.006
	39	40		2.22	0.97	120	21.21	2458.79	2.28	0.006
	40	41		5.35	0.97	120	21.74	2520.26	2.32	0.006
	41	42		5.13	0.97	120	22.27	2581.73	2.41	0.006
	42	42.68		2.91	0.66	120	22.63	1784.00	2.51	0.004
	129.19	130.19	B-14	2.61	0.97	80	46.03	3556.78	2.38	0.008
	130.19	131.19		1.59	0.97	80	46.38	3584.10	2.38	0.009
	131.19	132.5		6.36	1.27	80	46.85	4742.05	2.71	0.013
DSBH-4	49.94	50.94	B-13	2.18	0.97	120	18.01	2087.51	2.37	0.005
Cumulative Resource for Graphite of the zone -C at 2% cut off										0.085

10.5.2 Resource estimation by SURPAC Model

The resource for graphite mineralization estimated by SURPAC Modeling is as follow-

Table no. 10.3 Resource estimation sheet for zone A					
Zone	Band	Volume (in Cubic meter)	Bulk Density (average)	Tonnes	Resource in MT
A	B1	778	2.854	2220.412	0.00222
	B2	2282	2.755	6286.91	0.006287
	B3	989	2.47	2442.83	0.002443
	B4	8584	2.55	21889.2	0.021889
	B5	6937	2.29	15885.73	0.015886
	B6	1163	2.37	2756.31	0.002756
	B7	8486	2.55	21639.3	0.021639
	B8	2056	2.54	5222.24	0.005222
Total Resource of Graphite ore body (FC\geq 2%)		31275			0.078343\approx0.078

Table no. 10.4 Resource estimation sheet for zone B					
Zone	Band	Volume (in Cubic meter)	Bulk Density (average)	Tonnes	Resource in MT
B	B9	1666	2.26	3765.16	0.003765
	B10	639	2.60	1661.40	0.001661
	B11	4239	2.45	10385.55	0.010386
	B12	5809	2.46	14290.14	0.01429
Total Resource of Graphite ore body (FC\geq 2%)		12353			0.030102\approx0.030

Table no. 10.5 Resource estimation sheet for zone C					
Zone	Band	Volume (in Cubic meter)	Bulk Density (average)	Tonnes	Resource in MT
C	B13	22959	2.42	55560.78	0.055561
	B14	11635	2.49	28971.15	0.028971
Total Resource of Graphite ore body (FC\geq 2%)		34594			0.084532\approx0.085

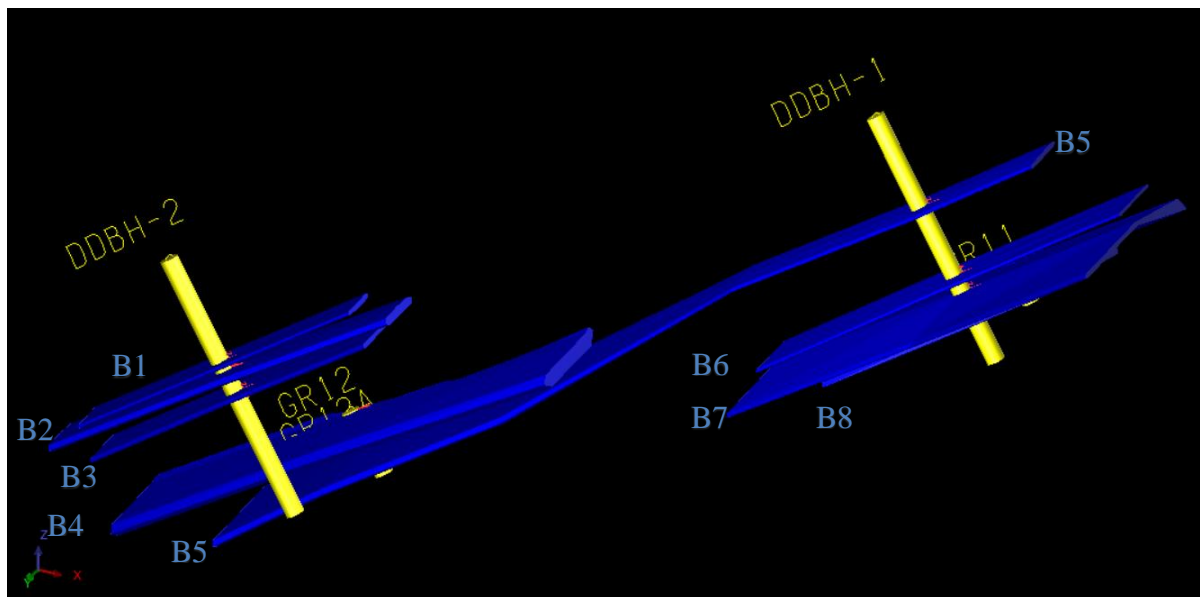


Figure 10.2: Solid Model for Graphite mineralization for Zone A

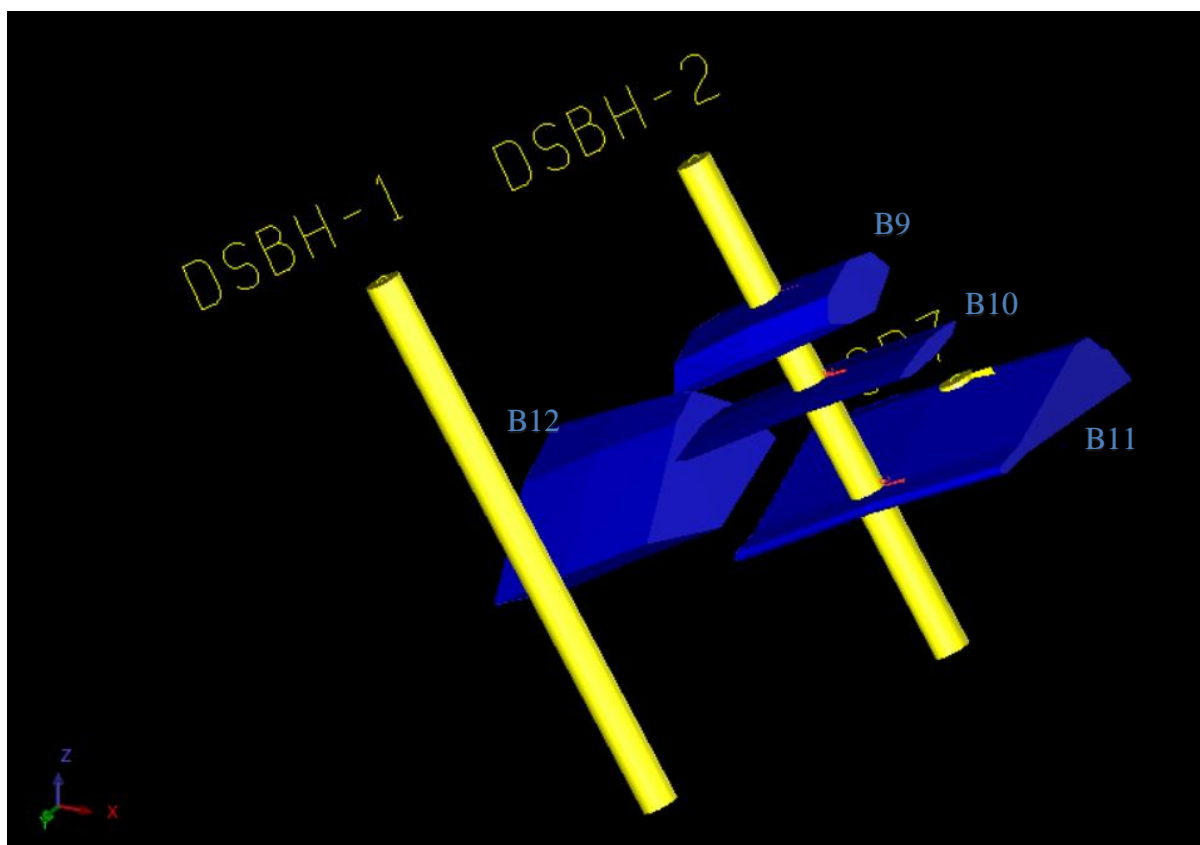


Figure 10.3: Solid Model for Graphite mineralization for Zone B

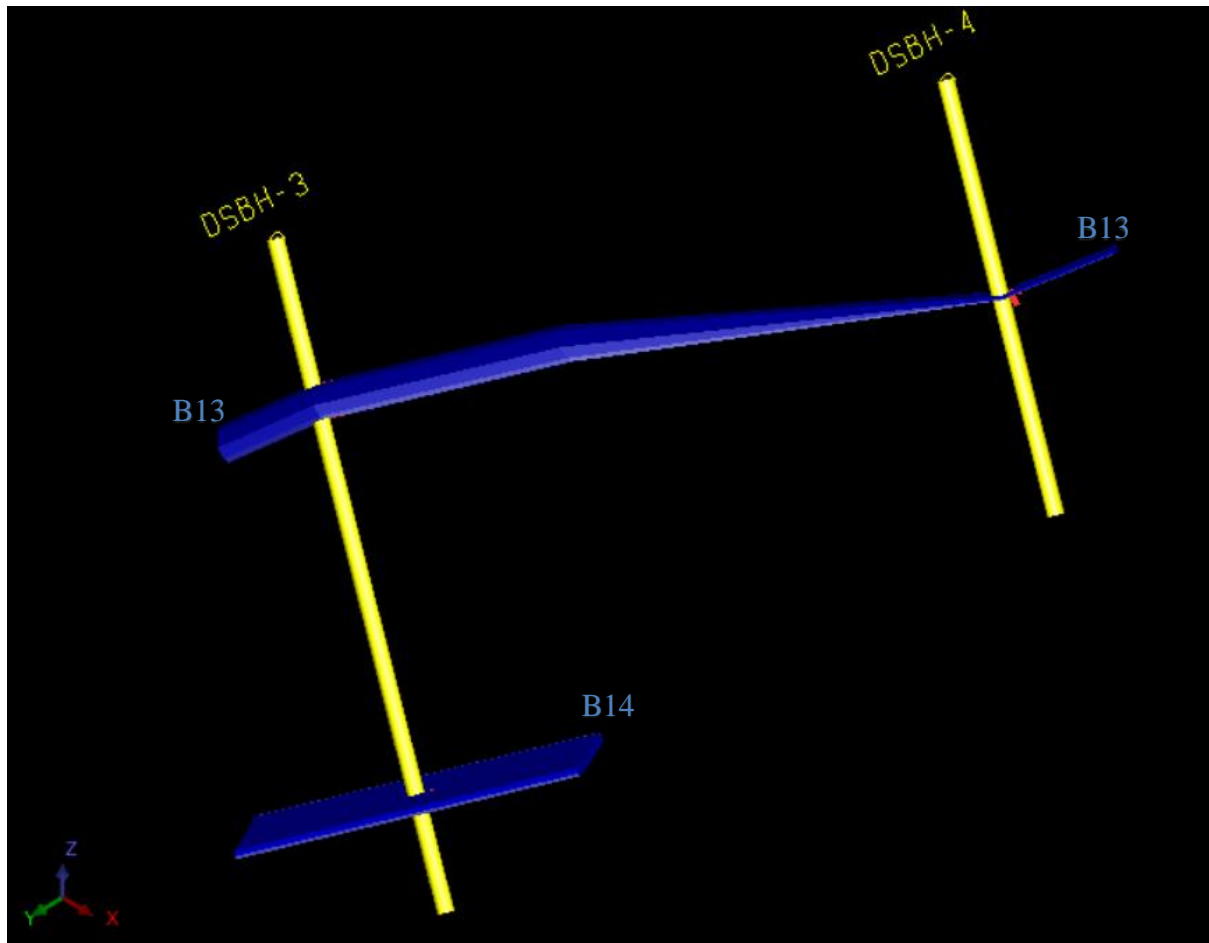


Figure 10.4: Solid Model for Graphite mineralization for Zone C

CHAPTER-11: CONCLUSION AND RECOMMENDATION

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

CHAPTER-12: LOCALITY INDEX

Table no. 14: Locality Index			
Serial no.	Name of the village	Latitude	Longitude
1	BERHAPADAR	19°29'32.4" N	83°35'43.0"E
2	DUKUM	19°29'21.1" N	83°35'59.7"E
3	BEDIPADAR	19°28'30.3" N	83°36'28.9"E
4	GAGANAMATI	19°27'46.0" N	83°36'42.0"E
5	SAHARHA	19°26'47.9" N	83°36'05.6"E
6	NARINGIPANGA	19°28'28.4" N	83°35'20.2"E
7	KUMBHIA	19°28'15.8" N	83°34'42.7"E
8	PATAPADAR	19°27'25.1" N	83°34'56.5"E
9	DARUKONA	19°26'03.0" N	83°34'27.9"E
10	KANDUGURHA	19°25'57.7" N	83°34'48.1"E
11	MADUA	19°25'30.7" N	83°34'32.9"E
12	RAMBU	19°25'50.9" N	83°33'04.5"E
13	ANKULPADAR	19°26'10.6" N	83°33'17.1"E
14	KAKARMAKA	19°27'40.4" N	83°32'58.3"E
15	KIRIBIRI	19°27'40.1" N	83°32'23.5"E
16	URLAJHORI	19°28'57.8" N	83°32'13.8"E
17	JAGANNATHPUR	19°29'42.6" N	83°31'48.7"E
18	NARINGIHURHA	19°29'06.2" N	83°30'44.2"E
19	JAMBAGURHA	19°28'10.4" N	83°30'53.7"E
20	KANKUBADI	19°27'11.6" N	83°30'10.3"E
21	BURHNI	19°27'05.7" N	83°31'21.5"E
22	BANDHUGURHA	19°25'14.3" N	83°30'35.3"E
23	BARARHAGURHA	19°25'29.1" N	83°32'36.2"E

CHAPTER-13: REFERENCES

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Annexure -I: Analytical results of bedrock samples (BRS) collected from the graphite bearing zones of Darukona Block, Rayagada District, Odisha

SL NO	SAMPLE CODE	SAMPLE ID	LATITUDE	LONGITUDE	ELEVATION	LITHOLOGY	MOISTURE (%)	VM (%)	ASH (%)	S (%)	FC (%)
1	FST - 778	DR/Z1/G1/1	19.42690871	83.55589491	501.334412	Granite gneiss with graphite	0.86	4.02	91.81	0.17	4.00
2	FST - 779	DR/Z1/G1/2	19.42682219	83.55578623	499.458832	Granite gneiss with graphite	0.48	2.38	96.50	0.15	0.97
3	FST - 780	DR/Z1/G1/3	19.42607545	83.55484819	489.440948	Granite gneiss with graphite	0.38	1.23	98.59	0.12	0.06
4	FST - 781	DR/Z1/G1/4	19.42527354	83.55384087	482.104431	Granite gneiss with graphite	0.34	0.78	99.04	0.10	0.08
5	FST - 782	DR/Z1/G1/5	19.42517947	83.55372271	481.463867	Granite gneiss with graphite	0.39	1.40	98.48	0.11	0.01
6	FST - 783	DR/Z1/G2/1	19.43003386	83.55456364	481.268707	Granite gneiss with graphite	0.59	2.29	97.34	0.13	0.24
7	FST - 784	DR/Z1/G2/2	19.42995372	83.55446298	485.076355	Granite gneiss with graphite	0.52	1.83	97.87	0.12	0.18
8	FST - 785	DR/Z1/G2/3	19.42988172	83.55437253	490.828613	Granite gneiss with graphite	0.47	1.48	98.10	0.11	0.31
9	FST - 786	DR/Z1/G2/4	19.4291582	83.55346365	548.040283	Granite gneiss with graphite	0.32	1.17	98.37	0.10	0.36
10	FST - 787	DR/Z1/G2/5	19.42780987	83.55176992	473.356537	Granite gneiss with graphite	0.22	0.82	98.77	0.09	0.32
11	FST - 788	DR/Z-2/G-3/1	19.46402659	83.53699741	416.72	Khondalite with graphite	0.30	1.29	98.36	0.11	0.24
12	FST - 789	DR/Z-2/G-3/2	19.46387968	83.53681283	418.980774	Khondalite with graphite	0.34	1.99	97.73	0.13	0.15
13	FST - 790	DR/Z-2/G-3/3	19.46387388	83.53680553	419.054199	Khondalite with graphite	0.30	1.49	97.72	0.12	0.67
14	FST - 791	DR/Z-2/G-3/4	19.4635487	83.53639696	423.919312	Khondalite with graphite	0.33	0.98	98.76	0.09	0.17
15	FST - 792	DR/Z-2/G-3/5	19.46354289	83.53638967	423.992279	Khondalite with graphite	0.31	1.00	98.80	0.10	0.10
16	FST - 795	DR/Z-2/G-3/6	19.46320959	83.53597089	425.670349	Khondalite with graphite	0.36	0.98	98.79	0.09	0.14
17	FST - 796	DR/Z-2/G-3/7	19.46315036	83.53589647	426.167694	Khondalite with graphite	0.37	1.10	98.67	0.10	0.13
18	FST - 797	DR/Z-2/G-3/8	19.46300635	83.53571553	427.595947	Khondalite with graphite	0.30	0.27	99.44	0.10	0.19
19	FST - 798	DR/Z-2/G-3/9	19.46267247	83.53529602	424.244812	Khondalite with graphite	0.31	0.78	99.01	0.08	0.13
20	FST - 799	DR/Z-3/G-4/1	19.43360158	83.55579026	472.707245	Granite gneiss with graphite	0.14	0.13	99.41	0.07	0.39
21	FST - 800	DR/Z-3/G-4/2	19.43352319	83.55569179	474.503998	Granite gneiss with graphite	0.22	0.49	99.06	0.05	0.40
22	FST - 801	DR/Z-3/G-4/3	19.43346802	83.55562249	475.408539	Granite gneiss with graphite	0.15	0.71	99.14	0.04	0.11
23	FST - 802	DR/Z-3/G-4/4	19.43345641	83.5556079	475.561096	Granite gneiss with graphite	0.10	0.51	99.35	0.06	0.08

Annexure -I: Analytical results of bedrock samples (BRS) collected from the graphite bearing zones of Darukona Block, Rayagada District, Odisha

SL NO	SAMPLE CODE	SAMPLE ID	LATITUDE	LONGITUDE	ELEVATION	LITHOLOGY	MOISTURE (%)	VM (%)	ASH (%)	S (%)	FC (%)
24	FST - 803	DR/Z-3/G-4/5	19.43339137	83.5555262	476.127747	Granite gneiss with graphite	0.16	0.86	98.80	0.08	0.26
25	FST - 804	DR/Z-3/G-4/6	19.43338441	83.55551745	476.162415	Granite gneiss with graphite	0.14	0.75	98.75	0.09	0.41
26	FST - 805	DR/Z-3/G-4/7	19.43336002	83.55548681	476.271271	Granite gneiss with graphite	0.12	0.47	99.24	0.10	0.19
27	FST - 806	DR/Z-4/G-5/1	19.49668944	83.53310694	385.21	Khondalite with graphite	0.16	0.40	99.38	0.08	0.14
28	FST - 807	DR/Z-4/G-5/2	19.49668364	83.53309965	385.323395	Khondalite with graphite	0.15	0.65	99.08	0.07	0.20
29	FST - 808	DR/Z-4/G-5/3	19.4966308	83.53303324	386.400848	Khondalite with graphite	0.27	0.55	99.20	0.09	0.16
30	FST - 809	DR/Z-4/G-5/4	19.49622084	83.53251805	403.556335	Khondalite with graphite	0.19	0.32	99.48	0.09	0.11
31	FST - 810	DR/Z-4/G-5/5	19.49617671	83.53246259	405.215729	Khondalite with graphite	0.23	0.31	99.51	0.08	0.10
32	FST - 811	DR/Z-4/G-5/6	19.4961442	83.53242172	406.102295	Khondalite with graphite	0.22	0.52	99.03	0.07	0.38
33	FST - 884	DR/Z-5/G-6/1	19.44438514	83.60894295	474.03	Granite gneiss with graphite	0.32	4.71	93.88	0.11	1.30
34	FST - 885	DR/Z-5/G-6/2	19.44438132	83.60893432	473.931641	Granite gneiss with graphite	0.37	4.67	93.85	0.12	1.36
35	FST - 886	DR/Z-5/G-6/3	19.4443775	83.60892569	473.840149	Granite gneiss with graphite	0.33	4.68	93.74	0.09	1.49
36	FST - 887	DR/Z-5/G-6/4	19.44436491	83.60889721	473.568481	Granite gneiss with graphite	0.56	6.80	92.43	0.14	0.63
37	FST - 888	DR/Z-5/G-6/5	19.44436109	83.60888858	473.494537	Granite gneiss with graphite	0.69	5.39	93.44	0.14	1.03
38	FST - 889	DR/Z-5/G-6/6	19.44435727	83.60887994	473.404358	Granite gneiss with graphite	2.49	3.22	95.71	0.13	0.94
39	FST - 890	DR/Z-5/G-6/7	19.44435345	83.60887131	473.319305	Granite gneiss with graphite	0.58	5.29	93.79	0.12	0.80
40	FST - 891	DR/Z-5/G-6/8	19.44434963	83.60886268	473.23938	Granite gneiss with graphite	0.65	4.93	94.24	0.08	0.75
41	FST - 892	DR/Z-6/G-7/1	19.43985398	83.60378747	467.795471	Quartzo-feldspathic graphite gneiss	1.78	4.52	88.82	0.17	6.49
42	FST - 893	DR/Z-6/G-7/2	19.43985016	83.60377884	467.74707	Quartzo-feldspathic graphite gneiss	1.79	4.67	87.93	0.15	7.25
43	FST - 894	DR/Z-6/G-7/3	19.43984635	83.60377021	467.698669	Quartzo-feldspathic graphite gneiss	1.76	4.32	88.78	0.14	6.76
44	FST - 895	DR/Z-6/G-7/4	19.43984253	83.60376158	467.650269	Quartzo-feldspathic graphite gneiss	1.61	4.00	89.30	0.14	6.56
45	FST - 896	DR/Z-6/G-14/1	19.44027118	83.60366087	466.809875	Quartzo-feldspathic graphite gneiss	1.38	4.52	87.89	0.10	7.49
46	FST - 897	DR/Z-6/G-14/2	19.44026736	83.60365223	466.831116	Quartzo-feldspathic graphite gneiss	1.62	4.29	88.48	0.11	7.12

Annexure -I: Analytical results of bedrock samples (BRS) collected from the graphite bearing zones of Darukona Block, Rayagada District, Odisha

SL NO	SAMPLE CODE	SAMPLE ID	LATITUDE	LONGITUDE	ELEVATION	LITHOLOGY	MOISTURE (%)	VM (%)	ASH (%)	S (%)	FC (%)
47	FST - 898	DR/Z-6/G-14/3	19.44026354	83.6036436	466.849762	Quartzo-feldspathic graphite gneiss	0.53	2.51	90.19	0.16	7.14
48	FST - 899	DR/Z-6/G-14/4	19.44025972	83.60363497	466.865845	Quartzo-feldspathic graphite gneiss	0.63	2.94	90.40	0.18	6.48
49	FST - 900	DR/Z-7/G-8/1	19.47936907	83.61692939	499.71637	Quartzo-feldspathic graphite gneiss	1.83	3.35	92.15	0.15	4.35
50	FST - 901	DR/Z-7/G-8/2	19.47936525	83.61692075	499.414429	Quartzo-feldspathic graphite gneiss	1.59	3.19	92.35	0.16	4.30
51	FST - 902	DR/Z-7/G-8/3	19.47934273	83.61686982	497.58078	Quartzo-feldspathic graphite gneiss	1.32	6.58	88.03	0.17	5.22
52	FST - 903	DR/Z-7/G-8/4	19.47933891	83.61686119	497.261169	Quartzo-feldspathic graphite gneiss	1.19	5.86	88.77	0.11	5.26
53	FST - 904	DR/Z-7/G-8/5	19.47925526	83.61667205	489.614899	Quartzo-feldspathic graphite gneiss	1.29	6.16	88.88	0.15	4.81
54	FST - 905	DR/Z-7/G-8/6	19.47923445	83.616625	488.055786	Quartzo-feldspathic graphite gneiss	1.20	2.85	89.52	0.19	7.44
55	FST - 906	DR/Z-7/G-8/7	19.47923064	83.61661637	487.798981	Quartzo-feldspathic graphite gneiss	1.33	3.49	91.26	0.11	5.14
56	FST - 907	DR/Z-7/G-13/8	19.47978935	83.61596499	457.494781	Quartzo-feldspathic graphite gneiss	1.61	2.92	91.94	0.09	5.05
57	FST - 908	DR/Z-7/G-13/9	19.47978553	83.61595636	457.505219	Quartzo-feldspathic graphite gneiss	1.70	3.38	91.32	0.08	5.22
58	FST - 909	DR/Z-7/G-13/10	19.47978171	83.61594773	457.517365	Quartzo-feldspathic graphite gneiss	1.54	3.20	91.66	0.13	5.01
59	FST - 916	DR/Z-5/G-9/1	19.44258284	83.60994217	494.180328	Granite gneiss with graphite	1.16	6.07	92.59	0.12	1.22
60	FST - 917	DR/Z-5/G-9/2	19.44257902	83.60993354	494.433655	Granite gneiss with graphite	1.16	6.01	92.50	0.18	1.31
61	FST - 918	DR/Z-5/G-9/3	19.4425752	83.60992491	494.685303	Granite gneiss with graphite	1.13	5.93	92.72	0.17	1.18
62	FST - 919	DR/Z-5/G-9/4	19.44257138	83.60991628	494.935242	Granite gneiss with graphite	1.15	5.67	92.75	0.17	1.41
63	FST - 920	DR/Z-5/G-9/5	19.44256757	83.60990765	495.183472	Granite gneiss with graphite	1.40	6.56	92.07	0.16	1.21
64	FST - 921	DR/Z-5/G-9/6	19.44248739	83.60972641	499.864868	Granite gneiss with graphite	0.96	6.48	92.89	0.14	0.49
65	FST - 922	DR/Z-5/G-9/7	19.44248358	83.60971778	500.048126	Granite gneiss with graphite	0.79	6.37	92.87	0.15	0.61
66	FST - 923	DR/Z-5/G-9/8	19.44247976	83.60970915	500.239441	Granite gneiss with graphite	0.93	6.88	92.40	0.14	0.58
67	FST - 924	DR/Z-5/G-9/9	19.44247594	83.60970052	500.426514	Granite gneiss with graphite	1.24	6.62	92.20	0.18	1.00

Annexure -I: Analytical results of bedrock samples (BRS) collected from the graphite bearing zones of Darukona Block, Rayagada District, Odisha

SL NO	SAMPLE CODE	SAMPLE ID	LATITUDE	LONGITUDE	ELEVATION	LITHOLOGY	MOISTURE (%)	VM (%)	ASH (%)	S (%)	FC (%)
68	FST - 925	DR/Z-5/G-9/10	19.44247212	83.60969189	500.609314	Granite gneiss with graphite	0.78	6.28	93.21	0.16	0.35
69	FST - 926	DR/Z-5/G-9/11	19.4424683	83.60968326	500.787811	Granite gneiss with graphite	0.97	7.06	91.51	0.14	1.29
70	FST - 927	DR/Z-5/G-9/12	19.44246449	83.60967463	500.962067	Granite gneiss with graphite	0.94	7.04	92.08	0.17	0.71
71	FST - 928	DR/Z-5/G-9/13	19.44246067	83.60966599	501.13205	Granite gneiss with graphite	0.86	6.62	92.64	0.15	0.59
72	FST - 929	DR/Z-8/G-10/1	19.45593182	83.56547919	488.177124	Granite gneiss with graphite	0.21	1.03	98.14	0.13	0.70
73	FST - 930	DR/Z-8/G-10/2	19.45592664	83.56547139	488.134674	Granite gneiss with graphite	0.21	1.12	97.81	0.12	0.95
74	FST - 931	DR/Z-8/G-10/3	19.45592146	83.56546359	488.091217	Granite gneiss with graphite	0.16	1.21	97.97	0.09	0.73
75	FST - 932	DR/Z-8/G-10/4	19.45591628	83.56545579	488.046692	Granite gneiss with graphite	0.22	0.88	98.58	0.07	0.47
76	FST - 933	DR/Z-8/G-10/5	19.4559111	83.56544799	488.001099	Granite gneiss with graphite	0.19	0.77	98.23	0.08	0.92
77	FST - 934	DR/Z-8/G-10/6	19.45590591	83.56544019	487.954468	Granite gneiss with graphite	0.15	0.63	98.60	0.09	0.68
78	FST - 935	DR/Z-8/G-10/7	19.45590021	83.5654316	487.901978	Granite gneiss with graphite	0.13	0.76	98.26	0.07	0.91
79	FST - 936	DR/Z-8/G-10/8	19.45589503	83.5654238	487.853149	Granite gneiss with graphite	0.11	0.86	98.25	0.08	0.81
80	FST - 937	DR/Z-8/G-10/9	19.45588985	83.565416	487.803284	Granite gneiss with graphite	0.28	1.49	97.57	0.09	0.85
81	FST - 938	DR/Z-8/G-10/10	19.45588467	83.5654082	487.75238	Granite gneiss with graphite	0.18	0.81	98.47	0.10	0.62
82	FST - 939	DR/Z-8/G-10/11	19.45587949	83.5654004	487.700409	Granite gneiss with graphite	0.26	0.86	98.09	0.14	0.91
83	FST - 940	DR/Z-8/G-10/12	19.45587431	83.5653926	487.6474	Granite gneiss with graphite	0.22	0.84	98.14	0.08	0.94
84	FST - 941	DR/Z-8/G-10/13	19.45586913	83.5653848	487.593323	Granite gneiss with graphite	0.29	0.80	98.33	0.11	0.76
85	FST - 942	DR/Z-8/G-10/14	19.45586394	83.565377	487.538208	Granite gneiss with graphite	0.31	0.81	98.25	0.12	0.82
86	NMCI/FST/24-25/1117	DR/Z-9/G-11/1	19.48855364	83.59867172	394.150452	Quartzo-feldspathic graphite gneiss	2.57	2.40	91.55	0.15	5.90
87	NMCI/FST/24-25/1118	DR/Z-9/G-11/2	19.48854982	83.59866309	394.21286	Quartzo-feldspathic graphite gneiss	2.75	2.90	91.87	0.14	5.09
88	NMCI/FST/24-25/1119	DR/Z-9/G-11/3	19.48854601	83.59865446	394.276154	Quartzo-feldspathic graphite gneiss	1.62	1.75	90.25	0.15	7.85
89	NMCI/FST/24-25/1120	DR/Z-9/G-11/4	19.48853837	83.59863719	394.405273	Quartzo-feldspathic graphite gneiss	2.26	2.67	90.86	0.14	6.33

Annexure -I: Analytical results of bedrock samples (BRS) collected from the graphite bearing zones of Darukona Block, Rayagada District, Odisha

SL NO	SAMPLE CODE	SAMPLE ID	LATITUDE	LONGITUDE	ELEVATION	LITHOLOGY	MOISTURE (%)	VM (%)	ASH (%)	S (%)	FC (%)
90	NMCI/FST/24-25/1121	DR/Z-9/G-11/5	19.48853455	83.59862856	394.4711	Quartzo-feldspathic graphite gneiss	2.00	2.16	91.27	0.14	6.43
91	NMCI/FST/24-25/1122	DR/Z-9/G-11/6	19.48853074	83.59861992	394.537811	Quartzo-feldspathic graphite gneiss	1.63	1.95	90.89	0.16	7.00
92	NMCI/FST/24-25/1123	DR/Z-9/G-11/7	19.48852692	83.59861129	394.605347	Quartzo-feldspathic graphite gneiss	2.01	2.33	91.16	0.18	6.33
93	NMCI/FST/24-25/1109	DR/Z-9/G-12/1	19.48788285	83.59947987	395.211212	Quartzo-feldspathic graphite gneiss	1.57	2.44	90.85	0.17	6.54
94	NMCI/FST/24-25/1110	DR/Z-9/G-12/2	19.48787903	83.59947124	395.082642	Quartzo-feldspathic graphite gneiss	1.09	3.41	88.95	0.15	7.49
95	NMCI/FST/24-25/1111	DR/Z-9/G-12/3	19.48787521	83.59946261	394.953217	Quartzo-feldspathic graphite gneiss	1.20	3.76	89.70	0.14	6.40
96	NMCI/FST/24-25/1112	DR/Z-9/G-12/4	19.4878714	83.59945397	394.822937	Quartzo-feldspathic graphite gneiss	2.14	0.27	90.57	0.14	9.02
97	NMCI/FST/24-25/1113	DR/Z-9/G-12/5	19.48786758	83.59944534	394.691803	Quartzo-feldspathic graphite gneiss	2.29	0.38	90.53	0.18	8.91
98	NMCI/FST/24-25/1114	DR/IR-1	19.43313889	83.54333333	449.399994	Quartzo-feldspathic graphite gneiss	1.62	2.45	91.38	0.19	5.98
99	NMCI/FST/24-25/1115	DR/IR-2	19.43286111	83.54333333	455.600006	Quartzo-feldspathic graphite gneiss	1.10	2.70	91.70	0.17	5.43
100	NMCI/FST/24-25/1116	DR/IR-3	19.43285729	83.5433247	455.723358	Quartzo-feldspathic graphite gneiss	1.15	2.50	90.63	0.16	6.71

Annexure -II: Analytical results of PT samples collected from the trench with graphite zone Z-6 of Darukona Block, Rayagada District, Odisha

SL NO	SAMPLE CODE	SAMPLE ID	LATITUDE	LONGITUDE	ELEVATION	LITHOLOGY	MOISTURE (%)	VM (%)	ASH (%)	S (%)	FC (%)
1	NMCI/FST/24-25/1322	DR/Z-6/TR-1/1	19.44048949	83.60355012	468.524292	Quartzo-feldspathic graphite gneiss	1.05	2.34	89.2	0	8.33
2	NMCI/FST/24-25/1323	DR/Z-6/TR-1/2	19.4404305	83.60341678	468.099609	Quartzo-feldspathic graphite gneiss	0.76	1.68	88.3	0	9.91
3	NMCI/FST/24-25/1324	DR/Z-6/TR-1/3	19.44042668	83.60340815	468.072113	Quartzo-feldspathic graphite gneiss	0.97	2.19	91.6	0	6.07
4	NMCI/FST/24-25/1325	DR/Z-6/TR-1/4	19.44042287	83.60339952	468.044617	Quartzo-feldspathic graphite gneiss	0.57	1.62	89.2	0	9
5	NMCI/FST/24-25/1326	DR/Z-6/TR-1/5	19.44041905	83.60339089	468.017151	Quartzo-feldspathic graphite gneiss	0.49	1.61	88.3	0	9.96
6	NMCI/FST/24-25/1327	DR/Z-6/TR-1/6	19.44048567	83.60354149	468.496796	Quartzo-feldspathic graphite gneiss	0.67	1.92	87.3	0	10.65
7	NMCI/FST/24-25/1328	DR/Z-6/TR-1/7	19.44048185	83.60353286	468.46933	Quartzo-feldspathic graphite gneiss	0.9	2.11	90.9	0	6.78
8	NMCI/FST/24-25/1329	DR/Z-6/TR-1/8	19.44047803	83.60352423	468.441833	Quartzo-feldspathic graphite gneiss	0.65	1.66	89.8	0	8.3
9	NMCI/FST/24-25/1330	DR/Z-6/TR-1/9	19.44047421	83.6035156	468.414337	Quartzo-feldspathic graphite gneiss	0.77	1.67	87.9	0	10.26
10	NMCI/FST/24-25/1331	DR/Z-6/TR-1/10	19.4404704	83.60350697	468.386841	Quartzo-feldspathic graphite gneiss	0.68	1.99	88.9	0	9.01
11	NMCI/FST/24-25/1332	DR/Z-6/TR-1/11	19.44046658	83.60349834	468.359375	Quartzo-feldspathic graphite gneiss	0.61	1.75	88	0	10.17

Annexure -II: Analytical results of PT samples collected from the trench with graphite zone Z-6 of Darukona Block, Rayagada District, Odisha

SL NO	SAMPLE CODE	SAMPLE ID	LATITUDE	LONGITUDE	ELEVATION	LITHOLOGY	MOISTURE (%)	VM (%)	ASH (%)	S (%)	FC (%)
12	NMCI/FST/24-25/1333	DR/Z-6/TR-1/12	19.44046276	83.60348971	468.331879	Quartzo-feldspathic graphite gneiss	0.34	1.88	88.2	0	9.75
13	NMCI/FST/24-25/1334	DR/Z-6/TR-1/13	19.44045894	83.60348108	468.304382	Quartzo-feldspathic graphite gneiss	0.43	1.51	88.3	0	10.07

Annexure -III: Summarised litholog sheet of DDBH-1 of Darukona Block, Rayagada District, Odisha

BOREHOLE NO. - DDBH-1							DATE OF COMMENCEMENT : 14.12.2024			
LATITUDE - 19°29'14.03"							DATE OF COMPLETION: 18.12.2024			
LONGITUDE - 83°35'56.652"							WATER LEVEL AT THE TIME OF COMPLETION: 1.79 m			
DEPTH FROM (m)	DEPTH TO (m)	TOTAL RUN LENGTH (m)	TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	CORE RECOVERY OF LITHO-UNITS (m)	EXTRAPOLATED THICKNESS (m)	LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
0	0.5	0.5	0.5	100	0.5	0.5	Top soil	HQ	Brownish yellow colour	0
0.5	1	0.5	0.5	100	0.5	0.5	Top soil	HQ	Brownish yellow colour	0
1	1.5	0.5	0.5	100	0.5	0.5	Weather mantle	HQ	Brownish in color with fragments of granite gneiss	0
1.5	2	0.5	0.5	100	0.5	0.5	Weather mantle	HQ	Brownish in color with fragments of granite gneiss	0
2	2.5	0.5	0.48	96	0.48	0.5	Granite gneiss	HQ	Brownish white in colour containing augen of quartz	40
2.5	3	0.5	0.47	94	0.47	0.5	Granite gneiss	HQ	Brownish white in colour containing augen of quartz and opaque mineral	30
3	3.5	0.5	0.5	100	0.5	0.5	Granite gneiss	HQ	Brownish white in colour	58

Annexure -III: Summarised litholog sheet of DDBH-1 of Darukona Block, Rayagada District, Odisha

BOREHOLE NO. - DDBH-1							DATE OF COMMENCEMENT : 14.12.2024			
LATITUDE - 19°29'14.03"							DATE OF COMPLETION: 18.12.2024			
LONGITUDE - 83°35'56.652"							WATER LEVEL AT THE TIME OF COMPLETION: 1.79 m			
DEPTH FROM (m)	DEPTH TO (m)	TOTAL RUN LENGTH (m)	TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	CORE RECOVERY OF LITHO-UNITS (m)	EXTRAPOLATED THICKNESS (m)	LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
									containing augen of quartz and opaque mineral	
3.5	4	0.5	0.46	92	0.46	0.5	Granite gneiss	HQ	Brownish white in colour containing augen of quartz and opaque mineral	22
4	5	1	0.92	92	0.92	1	Granite gneiss	HQ	Brownish white in colour containing augen of quartz and opaque mineral	31
5	8	3	2.8	93.33	2.8	3	Granite gneiss	HQ	Brownish white in colour containing augen of quartz and opaque mineral	50.67
8	11	3	2.87	95.67	2.87	3	Granite gneiss	HQ	Brownish white in colour containing augen of quartz and opaque mineral	52.00
11	14	3	2.83	94.33	2.83	3	Granite gneiss	HQ	Coarse grained, brownish white in colour showing gneissosity	47.33
14	15.5	1.5	1.35	90	1.35	1.5	Granite gneiss	HQ	Coarse grained, brownish white in colour showing gneissosity	28.67
15.5	17	1.5	1.34	89.33	1.2	1.3	Granite gneiss	HQ	Coarse grained, brownish white in colour showing gneissosity	0.00
					0.14	0.2	Granite gneiss with graphite	HQ	Coarse grained, brownish in colour containing graphite along the foliation plane	0.00
17	18.5	1.5	1.38	92.00	1.38	1.5	Granite gneiss with graphite	HQ	Coarse grained, brownish in colour containing graphite along	7.33

Annexure -III: Summarised litholog sheet of DDBH-1 of Darukona Block, Rayagada District, Odisha

BOREHOLE NO. - DDBH-1							DATE OF COMMENCEMENT : 14.12.2024			
LATITUDE - 19°29'14.03"							DATE OF COMPLETION: 18.12.2024			
LONGITUDE - 83°35'56.652"							WATER LEVEL AT THE TIME OF COMPLETION: 1.79 m			
DEPTH FROM (m)	DEPTH TO (m)	TOTAL RUN LENGTH (m)	TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	CORE RECOVERY OF LITHO-UNITS (m)	EXTRAPOLATED THICKNESS (m)	LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
									the foliation plane	
18.5	20	1.5	1.3	86.67	1.3	1.5	Granite gneiss	HQ	Coarse grained, brownish white in colour showing gneissosity	0.00
20	21.5	1.5	1.5	100.00	1.1	1.1	Granite gneiss	HQ	Coarse grained, brownish white in colour showing gneissosity	0.00
					0.4	0.4	Granite gneiss with graphite	HQ	Coarse grained, brownish in colour containing graphite along the foliation plane	0.00
21.5	23	1.5	1.37	91.33	0.64	0.68	Granite gneiss with graphite	HQ	Coarse grained, brownish in colour containing graphite along the foliation plane	0.00
					0.73	0.82	Granite gneiss	HQ	Coarse grained, brownish in colour showing gneissosity	12.20
23	24.5	1.5	1.42	94.67	1.42	1.5	Granite gneiss	HQ	Coarse grained, brownish in colour highly weathered rock	0
24.5	26	1.5	1.24	82.67	0.13	0.16	Granite gneiss	HQ	highly weathered fragmented rock	0
					0.54	0.62	Mud	HQ	Highly weathered rock with mud	0
					0.37	0.42	Granite gneiss	HQ	Highly weathered fragmented rock	0
					0.2	0.3	Mud	HQ	Dark coloured silty mud	0
26	27.5	1.5	1.49	99.33	0.69	0.69	Mud	HQ	Dark coloured silty mud	0
					0.4	0.4	Granite gneiss	HQ	Highly weathered fragmented rock	0
					0.4	0.41	Mud	HQ	Dark coloured sandy mud	0

Annexure -III: Summarised litholog sheet of DDBH-1 of Darukona Block, Rayagada District, Odisha

BOREHOLE NO. - DDBH-1							DATE OF COMMENCEMENT : 14.12.2024			
LATITUDE - 19°29'14.03"							DATE OF COMPLETION: 18.12.2024			
LONGITUDE - 83°35'56.652"							WATER LEVEL AT THE TIME OF COMPLETION: 1.79 m			
DEPTH FROM (m)	DEPTH TO (m)	TOTAL RUN LENGTH (m)	TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	CORE RECOVERY OF LITHO-UNITS (m)	EXTRAPOLATED THICKNESS (m)	LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
									containing fragments of granite gneiss	
27.5	29	1.5	1.45	96.67	1.45	1.5	Granite gneiss	HQ	Highly weathered fragmented rock	0
29	30.5	1.5	1.47	98.00	0.77	0.77	Granite gneiss	HQ	Off white colored granite gneiss	19.48
					0.7	0.73	Granite gneiss	HQ	Coarse grained, brownish white in colour showing gneissosity	0
30.5	31.5	1	0.95	95.00	0.95	1	Granite gneiss	HQ	Coarse grained, brownish white in colour showing gneissosity	0
31.5	32.5	1	0.9	90.00	0.9	1	Quartzo-feldspathic graphite gneiss	HQ	Greyish in color, highly fractured rock containing graphite	0
32.5	33.5	1	0.9	90.00	0.9	1	Quartzo-feldspathic graphite gneiss	HQ	Greyish in color, highly fractured rock containing graphite	0
33.5	34.5	1	0.98	98.00	0.98	1	Granite gneiss	HQ	Fragmented granite gneiss with mud	0
34.5	35	0.5	0.43	86.00	0.23	0.3	Granite gneiss	HQ	Fragmented granite gneiss with mud	0
					0.2	0.2	Garnetiferous Quartzite	HQ	Whitish colored rock containing pinkish garnet and muscovite	0
35	36.5	1.5	1.46	97.33	0.49	0.52	Granite gneiss	HQ	Fragmented granite gneiss	0
					0.97	0.98	Biotite gneiss	HQ	Dark greenish colored highly weathered rock showing greenish streak and containing 14 cm	21.43

Annexure -III: Summarised litholog sheet of DDBH-1 of Darukona Block, Rayagada District, Odisha

BOREHOLE NO. - DDBH-1							DATE OF COMMENCEMENT : 14.12.2024			
LATITUDE - 19°29'14.03"							DATE OF COMPLETION: 18.12.2024			
LONGITUDE - 83°35'56.652"							WATER LEVEL AT THE TIME OF COMPLETION: 1.79 m			
DEPTH FROM (m)	DEPTH TO (m)	TOTAL RUN LENGTH (m)	TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	CORE RECOVERY OF LITHO-UNITS (m)	EXTRAPOLATED THICKNESS (m)	LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
									muddy portion	
36.5	38	1.5	1.46	97.33	0.68	0.69	Biotite gneiss	HQ	Dark greenish colored highly weathered rock showing greenish streak and containing 14 cm muddy portion	0.00
					0.68	0.69	Quartzo-feldspathic graphite gneiss	HQ	Greyish in color, fractured rock containing graphite	36.23
					0.1	0.12	Granite gneiss with graphite	HQ	Gneissose rock containing graphite along foliation plane	0.00
38	39.5	1.5	1.4	93.33	1.4	1.5	Granite gneiss with graphite	HQ	Very coarse grained greyish white colored rock containing graphite along foliation plane	20.67
39.5	41	1.5	1.45	96.67	1.45	1.5	Granite gneiss with graphite	HQ	Very coarse grained greyish white colored rock containing graphite along foliation plane	52.67
41	42.5	1.5	1.48	98.67	0.94	0.95	Granite gneiss with graphite	HQ	Very coarse grained greyish white colored rock containing graphite along foliation plane	23.16
					0.43	0.43	Garnetiferous Quartzite	HQ	whitish colored rock containing pinkish garnet. (may be vein)	0.00
					0.11	0.12	Granite gneiss with graphite	HQ	Coarse grained greyish white colored rock containing graphite along foliation plane	0.00

Annexure -III: Summarised litholog sheet of DDBH-1 of Darukona Block, Rayagada District, Odisha										
BOREHOLE NO. - DDBH-1							DATE OF COMMENCEMENT : 14.12.2024			
LATITUDE - 19°29'14.03"							DATE OF COMPLETION: 18.12.2024			
LONGITUDE - 83°35'56.652"							WATER LEVEL AT THE TIME OF COMPLETION: 1.79 m			
DEPTH FROM (m)	DEPTH TO (m)	TOTAL RUN LENGTH (m)	TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	CORE RECOVERY OF LITHO-UNITS (m)	EXTRAPOLATED THICKNESS (m)	LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
42.5	44	1.5	1.48	98.67	0.98	0.99	Granite gneiss	HQ	Fragmented granite gneiss containing mica	0.00
					0.5	0.51	Garnetiferous Quartzite	HQ	whitish colored rock containing 4 cm graphite band and pinkish garnet	0.00
44	45.5	1.5	1.47	98.00	0.22	0.22	Garnetiferous Quartzite	HQ	whitish colored rock containing pinkish garnet	0.00
					1.25	1.28	Quartzo-feldspathic graphite gneiss	HQ	Greyish colored rock where the graphite occurs parallel to the plane of gneissosity.	86.72
45.5	47	1.5	1.5	100.00	1.5	1.5	Quartzo-feldspathic graphite gneiss	HQ	Greyish colored rock where the graphite occurs parallel to the plane of gneissosity.	72.67
47	48.5	1.5	1.5	100.00	0.06	0.06	Quartzo-feldspathic graphite gneiss	HQ	Greyish colored rock where the graphite occurs parallel to the plane of gneissosity.	0
					1.44	1.44	Garnetiferous Quartzite	HQ	Coarse grained, whitish colored rock containing pinkish garnet	46.53
48.5	50	1.5	1.5	100.00	1.5	1.5	Quartzo-feldspathic graphite gneiss	HQ	Greyish colored rock where the graphite occurs parallel to the plane of gneissosity and containing 10 cm thick quartz band at bottom.	96.00

Annexure -III: Summarised litholog sheet of DDBH-1 of Darukona Block, Rayagada District, Odisha

BOREHOLE NO. - DDBH-1							DATE OF COMMENCEMENT : 14.12.2024			
LATITUDE - 19°29'14.03"							DATE OF COMPLETION: 18.12.2024			
LONGITUDE - 83°35'56.652"							WATER LEVEL AT THE TIME OF COMPLETION: 1.79 m			
DEPTH FROM (m)	DEPTH TO (m)	TOTAL RUN LENGTH (m)	TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	CORE RECOVERY OF LITHO-UNITS (m)	EXTRAPOLATED THICKNESS (m)	LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
50	51.5	1.5	1.39	92.67	1.39	1.5	Quartzo-feldspathic graphite gneiss	HQ	Greyish colored rock where the graphite occurs parallel to the plane of gneissosity.	40.00
51.5	53	1.5	1.48	98.67	1.48	1.5	Graphite bearing quartzite	HQ	coarse grained+ whitish colored rock containing graphite and large crystals of garnet.	52.67
53	54.5	1.5	1.43	95.33	1.43	1.5	Garnetiferous Quartzite	HQ	coarse grained, colourless rock containing large crystals of garnet.	34.67
54.5	56	1.5	1.47	98	0.44	0.44	Garnetiferous Quartzite	HQ	coarse grained, colourless rock containing large crystals of garnet.	79.55
					0.18	0.2	Graphite bearing quartzite	HQ	Coarse grained+ whitish colored rock containing graphite and large crystals of garnet.	0.00
					0.78	0.79	Garnetiferous Quartzite	HQ	Coarse grained, colourless rock containing large crystals of garnet.	67.09
					0.07	0.07	Graphite bearing quartzite	HQ	coarse grained+ whitish colored rock containing graphite and large crystals of garnet.	0.00
56	57.5	1.5	1.5	100	0.25	0.25	Graphite bearing quartzite	HQ	coarse grained+ whitish colored rock containing graphite and large crystals of garnet.	0.00

Annexure -III: Summarised litholog sheet of DDBH-1 of Darukona Block, Rayagada District, Odisha										
BOREHOLE NO. - DDBH-1							DATE OF COMMENCEMENT : 14.12.2024			
LATITUDE - 19°29'14.03"							DATE OF COMPLETION: 18.12.2024			
LONGITUDE - 83°35'56.652"							WATER LEVEL AT THE TIME OF COMPLETION: 1.79 m			
DEPTH FROM (m)	DEPTH TO (m)	TOTAL RUN LENGTH (m)	TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	CORE RECOVERY OF LITHO-UNITS (m)	EXTRAPOLATED THICKNESS (m)	LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
					1.25	1.25	Garnetiferous Quartzite	HQ	coarse grained, colourless rock containing large crystals of garnet.	57.60
THE BOREHOLE WAS CLOSED ON 18.12.2024 AT 57.50 M DEPTH IN QUARTZITE										

Annexure -IV: Summarised litholog sheet of DDBH-2 of Darukona Block, Rayagada District, Odisha

BOREHOLE NO. - DDBH-2							DATE OF COMMENCEMENT : 19.12.2024			
LATITUDE - 19°29'18.0"							DATE OF COMPLETION: 24.12.2024			
LONGITUDE - 83°35'53.17"							WATER LEVEL AT THE TIME OF COMPLETION: 9.50 m			
DEPTH FROM (m)	DEPTH TO (m)	TOTAL RUN LENGTH (m)	TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	CORE RECOVERY OF LITHO- UNITS (m)	EXTRAPOLATED THICKNESS (m)	LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
0	0.5	0.5	0.45	90	0.45	0.5	Top soil	HQ	Brownish yellow in colour	0
0.5	1	0.5	0.47	94	0.47	0.5	Top soil	HQ	Brownish yellow in colour	0
1	1.5	0.5	0.47	94	0.47	0.5	Top soil	HQ	Brownish yellow in colour	0
1.5	2	0.5	0.45	90	0.45	0.5	Top soil	HQ	Brownish yellow in colour	0
2	2.5	0.5	0.48	96	0.48	0.5	Top soil	HQ	Brownish yellow in colour	0
2.5	3	0.5	0.47	94	0.47	0.5	Top soil	HQ	Brownish yellow in colour	0
3	3.5	0.5	0.48	96	0.48	0.5	Top soil	HQ	Brownish yellow in colour	0
3.5	4	0.5	0.47	94	0.47	0.5	Top soil	HQ	Brownish yellow in colour	0
4	5	1	0.97	97	0.97	1	Top soil	HQ	Brownish yellow in colour	0
5	6	1	0.99	99	0.99	1	Top soil	HQ	Brownish yellow in colour	0
6	7	1	0.95	95	0.95	1	Mud	HQ	Brownish colour mud with fragments of granite gneiss	0
7	8	1	0.97	97	0.97	1	Mud	HQ	Brownish colour mud with fragments of granite gneiss	0
8	9	1	0.99	99	0.99	1	Mud	HQ	Brownish colour mud with fragments of granite gneiss	0
9	10	1	0.98	98	0.98	1	Mud	HQ	Brownish colour mud with fragments of granite gneiss	0
10	11	1	0.99	99	0.99	1	Mud	HQ	Brownish colour mud with fragments of granite gneiss	0
11	12	1	0.97	97	0.97	1	Mud	HQ	Brownish colour mud with fragments of granite gneiss	0
12	13	1	0.98	98	0.98	1	Mud	HQ	Brownish colour mud with fragments of granite gneiss	0

Annexure -IV: Summarised litholog sheet of DDBH-2 of Darukona Block, Rayagada District, Odisha										
BOREHOLE NO. - DDBH-2							DATE OF COMMENCEMENT : 19.12.2024			
LATITUDE - 19°29'18.0"							DATE OF COMPLETION: 24.12.2024			
LONGITUDE - 83°35'53.17"							WATER LEVEL AT THE TIME OF COMPLETION: 9.50 m			
DEPTH FROM (m)	DEPTH TO (m)	TOTAL RUN LENGTH (m)	TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	CORE RECOVERY OF LITHO- UNITS (m)	EXTRAPOLATED THICKNESS (m)	LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
13	14	1	0.98	98	0.98	1	Mud	HQ	Brownish colour mud with fragments of granite gneiss	0
14	15	1	0.96	96	0.96	1	Sandy material	HQ	Brownish yellow colour sandy material with few fragments of granite gneiss	0
15	16	1	0.94	94	0.3	0.33	Sandy material	HQ	Brownish yellow colour sandy material with few fragments of granite gneiss	0
					0.64	0.67	Mud	HQ	Brownish yellow colour	0
16	17	1	0.96	96	0.96	1	Mud	HQ	Brownish yellow colour	0
17	18	1	0.97	97	0.97	1	Sandy material	HQ	Brownish yellow colour	0
18	19	1	0.96	96	0.96	1	Khondalite	HQ	Reddish white in colour, highly fragmented	0
19	20	1	0.95	95	0.95	1	Khondalite	HQ	Reddish white in colour, highly fragmented	11
20	21	1	0.97	97	0.97	1	Khondalite	HQ	Reddish white in colour, highly fragmented	0
21	22	1	0.95	95	0.95	1	Khondalite	HQ	Reddish white in colour, highly fragmented	0
22	23	1	0.94	94	0.46	0.51	Khondalite	HQ	Reddish white in colour, highly fragmented	0
					0.45	0.49	Khondalite with graphite	HQ	Reddish white in colour, highly fragmented containing flakes of	0

Annexure -IV: Summarised litholog sheet of DDBH-2 of Darukona Block, Rayagada District, Odisha										
BOREHOLE NO. - DDBH-2							DATE OF COMMENCEMENT : 19.12.2024			
LATITUDE - 19°29'18.0"							DATE OF COMPLETION: 24.12.2024			
LONGITUDE - 83°35'53.17"							WATER LEVEL AT THE TIME OF COMPLETION: 9.50 m			
DEPTH FROM (m)	DEPTH TO (m)	TOTAL RUN LENGTH (m)	TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	CORE RECOVERY OF LITHO-UNITS (m)	EXTRAPOLATED THICKNESS (m)	LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
									graphite	
23	24	1	0.95	95	0.95	1	Sandy material	HQ	Brownish yellow colour containing flakes of graphite	0
24	25	1	0.94	94	0.94	1	Sandy material	HQ	Brownish yellow colour containing flakes of graphite	0
25	26	1	0.95	95	0.95	1	Sandy material	HQ	Brownish yellow colour containing flakes of graphite	0
26	27	1	0.95	95	0.95	1	Khondalite with graphite	HQ	Greyish in coloured, highly weathered containing flakes of graphite	0
27	28	1	0.94	94	0.94	1	Khondalite with graphite	HQ	Brownish white colored rock containing sillimanite and graphite	13
28	29	1	0.93	93	0.93	1	Granite gneiss	HQ	Coarse grained, brownish white in colour showing gneissosity	0
29	30	1	0.94	94	0.94	1	Granite gneiss with graphite	HQ	Gneissose rock containing graphite along foliation plane	0
30	31	1	0.95	95	0.95	1	Sandy material	HQ	Containing flakes of graphite	0
31	32	1	0.92	92	0.92	1	Granite gneiss	HQ	Containing both	0

Annexure -IV: Summarised litholog sheet of DDBH-2 of Darukona Block, Rayagada District, Odisha										
BOREHOLE NO. - DDBH-2							DATE OF COMMENCEMENT : 19.12.2024			
LATITUDE - 19°29'18.0"							DATE OF COMPLETION: 24.12.2024			
LONGITUDE - 83°35'53.17"							WATER LEVEL AT THE TIME OF COMPLETION: 9.50 m			
DEPTH FROM (m)	DEPTH TO (m)	TOTAL RUN LENGTH (m)	TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	CORE RECOVERY OF LITHO- UNITS (m)	EXTRAPOLATED THICKNESS (m)	LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
							with graphite		amorphous and flaky graphite	
32	33	1	0.95	95	0.1	0.15	Granite gneiss with graphite	HQ	Containing both amorphous and flaky graphite	0
					0.85	0.85	Quartzo-feldspathic graphite gneiss	HQ	Highly fractured rock containing graphite flakes parallel to the palne of gneissosity	0
33	34	1	0.94	94	0.94	1	Sandy material	HQ	Containing fragments of Granite gneiss with graphite.	0
34	35	1	0.95	95	0.95	1	Sandy material	HQ	Containing fragments of Granite gneiss with graphite	0
35	36	1	0.9	90	0.5	0.55	Sandy material	HQ	Containing fragments of Granite gneiss with graphite	0
					0.4	0.45	Quartzite	HQ	whitish colored rock containing pinkish garnet	57.78
36	37	1	0.94	94	0.94	1	Fragmented granite gneiss	HQ	Coarse grained, brownish white in colour	0
37	38	1		0	0.85	0.87	Fragmented granite gneiss	HQ	Coarse grained, brownish white in colour	0

Annexure -IV: Summarised litholog sheet of DDBH-2 of Darukona Block, Rayagada District, Odisha										
BOREHOLE NO. - DDBH-2							DATE OF COMMENCEMENT : 19.12.2024			
LATITUDE - 19°29'18.0"							DATE OF COMPLETION: 24.12.2024			
LONGITUDE - 83°35'53.17"							WATER LEVEL AT THE TIME OF COMPLETION: 9.50 m			
DEPTH FROM (m)	DEPTH TO (m)	TOTAL RUN LENGTH (m)	TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	CORE RECOVERY OF LITHO-UNITS (m)	EXTRAPOLATED THICKNESS (m)	LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
					0.1	0.13	Fault Breccia	HQ	Brecciated rock containing fragments of rock like granite gneiss, garnetiferous quartzite, quartzite	0
38	39	1	0.9	90	0.9	1	Fault Breccia	HQ	Brecciated rock containing fragments of rock like granite gneiss, garnetiferous quartzite, quartzite	0
39	40	1	0.92	92	0.92	1	Fault Breccia	HQ	Brecciated rock containing fragments of rock like granite gneiss, garnetiferous quartzite, quartzite	0
40	41	1	0.93	93	0.93	1	Fault Breccia	HQ	Brecciated rock containing fragments of rock like granite gneiss, garnetiferous quartzite, quartzite	0
41	42	1	0.96	96	0.96	1	Garnetiferous quartzite	HQ	coarse grained, colourless rock containing larger crystals of garnet.	47
42	44	2	1.98	99	1.98	2	Garnetiferous	HQ	coarse grained, colourless	52.5

Annexure -IV: Summarised litholog sheet of DDBH-2 of Darukona Block, Rayagada District, Odisha										
BOREHOLE NO. - DDBH-2							DATE OF COMMENCEMENT : 19.12.2024			
LATITUDE - 19°29'18.0"							DATE OF COMPLETION: 24.12.2024			
LONGITUDE - 83°35'53.17"							WATER LEVEL AT THE TIME OF COMPLETION: 9.50 m			
DEPTH FROM (m)	DEPTH TO (m)	TOTAL RUN LENGTH (m)	TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	CORE RECOVERY OF LITHO- UNITS (m)	EXTRAPOLATED THICKNESS (m)	LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
							quartzite		and fractured rock containing larger crystals of garnet.	
44	46	2	1.98	99	1.98	2	Garnetiferous quartzite	HQ	coarse grained, colourless and fractured rock containing larger crystals of garnet.	34.5
46	47.5	1.5	1.5	100	1.5	1.5	Garnetiferous quartzite	HQ	coarse grained, colourless rock containing larger crystals of garnet.	0
47.5	49	1.5	1.5	100	1.5	1.5	Garnetiferous quartzite	HQ	coarse grained, colourless rock containing larger crystals of garnet.	0
49	50.5	1.5	1.5	100	1.5	1.5	Garnetiferous quartzite	HQ	coarse grained, colourless rock containing larger crystals of garnet.	20.67
50.5	52	1.5	1.5	100	1.5	1.5	Garnetiferous quartzite	HQ	coarse grained, colourless rock containing larger crystals of garnet.	72
52	53.5	1.5	1.5	100	1.5	1.5	Garnetiferous quartzite	HQ	coarse grained, colourless rock containing larger crystals of garnet.	77.33
53.5	54.5	1	0.98	98	0.98	1	Garnetiferous	HQ	coarse grained, colourless	70

Annexure -IV: Summarised litholog sheet of DDBH-2 of Darukona Block, Rayagada District, Odisha										
BOREHOLE NO. - DDBH-2							DATE OF COMMENCEMENT : 19.12.2024			
LATITUDE - 19°29'18.0"							DATE OF COMPLETION: 24.12.2024			
LONGITUDE - 83°35'53.17"							WATER LEVEL AT THE TIME OF COMPLETION: 9.50 m			
DEPTH FROM (m)	DEPTH TO (m)	TOTAL RUN LENGTH (m)	TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	CORE RECOVERY OF LITHO-UNITS (m)	EXTRAPOLATED THICKNESS (m)	LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
							quartzite		rock containing larger crystals of garnet.	
54.5	56	1.5	1.49	99.33	1.49	1.5	Garnetiferous quartzite	HQ	coarse grained, colourless rock containing larger crystals of garnet.	41.33
56	57.5	1.5	1.48	98.67	1.48	1.5	Garnetiferous quartzite	HQ	coarse grained, colourless rock containing larger crystals of garnet.	32
57.5	59	1.5	1.5	100	1.5	1.5	Garnetiferous quartzite	HQ	coarse grained, colourless rock containing larger crystals of garnet.	49.33
59	60	1	0.98	98	0.98	1	Garnetiferous quartzite	HQ	coarse grained, colourless rock containing larger crystals of garnet.	35
THE BOREHOLE WAS CLOSED ON 24.12.2024 AT 60m DEPTH IN QUARTZITE										

Annexure -V: Summarised litho log sheet of DSBH-1 of Darukona Block, Rayagada District, Odisha

BOREHOLE NO. - DSBH-1							DATE OF COMMENCEMENT : 27.12.2024			
LATITUDE - 19°26'22.75"							DATE OF COMPLETION: 03.01.2025			
LONGITUDE - 83°36'12.0"							WATER LEVEL AT THE TIME OF COMPLETION: 07m			
DEPTH FROM (m)	DEPTH TO (m)	TOTAL RUN LENGTH (m)	TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	CORE RECOVERY OF LITHO-UNITS (m)	EXTRAPOLATED THICKNESS (m)	LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
0	0.5	0.5	0.45	90	0.45	0.5	Top Soil	HQ	Dark brown coloured	0
0.5	1	0.5	0.47	94	0.47	0.5	Top Soil	HQ	Dark brown coloured	0
1	1.5	0.5	0.46	92	0.46	0.5	Top Soil	HQ	Dark brown coloured	0
1.5	2	0.5	0.49	98	0.49	0.5	Top Soil	HQ	Dark brown coloured	0
2	2.5	0.5	0.47	94	0.45	0.5	Top Soil	HQ	Brownish yellow in colour	0
2.5	3	0.5	0.48	96	0.48	0.5	Top Soil	HQ	Brownish yellow in colour	0
3	3.5	0.5	0.49	98	0.49	0.5	Top Soil	HQ	Brownish yellow in colour	0
3.5	4	0.5	0.48	96	0.48	0.5	Top Soil	HQ	Brownish yellow in colour	0
4	5	1	0.98	98	0.98	1	Top Soil	HQ	Brownish yellow in colour	0
5	6	1	0.97	97	0.97	1	Mud soil	HQ	Brownish colour	0
6	7	1	0.98	98	0.98	1	Mud soil	HQ	Brownish colour	0
7	7.5	0.5	0.48	96	0.48	0.5	Sandy material	HQ	Brownish yellow in colour	0
7.5	9	1.5	1.4	93.33	1.4	1.5	Leptynite	HQ	Whitish grey coloured quartzo-felspathic rock with pink garnet lacking gneissosity.	39.33
9	10.5	1.5	1.42	94.67	1.42	1.5	Leptynite	HQ	Highly fractured Quartz rich whitish grey coloured rock with pink garnet lacking gneissosity.	0
10.5	12	1.5	1.45	96.67	1.45	1.5	Leptynite	HQ	Whitish in color, coarse grained rock containing	38.67

Annexure -V: Summarised litho log sheet of DSBH-1 of Darukona Block, Rayagada District, Odisha

BOREHOLE NO. - DSBH-1							DATE OF COMMENCEMENT : 27.12.2024			
LATITUDE - 19°26'22.75"							DATE OF COMPLETION: 03.01.2025			
LONGITUDE - 83°36'12.0"							WATER LEVEL AT THE TIME OF COMPLETION: 07m			
DEPTH FROM (m)	DEPTH TO (m)	TOTAL RUN LENGTH (m)	TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	CORE RECOVERY OF LITHO-UNITS (m)	EXTRAPOLATED THICKNESS (m)	LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
									blebs of quartz.	
12	13.5	1.5	1.48	98.67	1.48	1.5	Leptynite	HQ	Whitish in color, coarse grained rock containing blebs of quartz.	59.33
13.5	15	1.5	1.42	94.67	1.42	1.5	Leptynite	HQ	Whitish in color, coarse grained rock containing blebs of quartz.	37.33
15	16	1	0.96	96	0.96	1	Garnetiferous quartzite	HQ	coarse grained, colourless rock containing larger crystals of garnet.	69
16	17.5	1.5	1.48	98.67	1.48	1.5	Leptynite	HQ	Whitish in color, coarse grained rock containing blebs of quartz.	95.33
17.5	19	1.5	1.44	96	1.44	1.5	Leptynite	HQ	Whitish in color, coarse grained rock containing blebs of quartz.	36.67
19	20.5	1.5	1.48	98.67	1.48	1.5	Leptynite	HQ	Whitish in color, coarse grained rock containing blebs of quartz.	71.33
20.5	22	1.5	1.49	99.33	1.49	1.5	Leptynite	HQ	Whitish in color, coarse grained rock containing blebs of quartz.	48
22	23	1	1	100	1	1	Leptynite	HQ	Whitish in color, coarse grained rock containing blebs of quartz.	53

Annexure -V: Summarised litho log sheet of DSBH-1 of Darukona Block, Rayagada District, Odisha

BOREHOLE NO. - DSBH-1							DATE OF COMMENCEMENT : 27.12.2024			
LATITUDE - 19°26'22.75"							DATE OF COMPLETION: 03.01.2025			
LONGITUDE - 83°36'12.0"							WATER LEVEL AT THE TIME OF COMPLETION: 07m			
DEPTH FROM (m)	DEPTH TO (m)	TOTAL RUN LENGTH (m)	TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	CORE RECOVERY OF LITHO-UNITS (m)	EXTRAPOLATED THICKNESS (m)	LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
23	24.5	1.5	1.5	100	1.5	1.5	Garnetiferous quartzite	HQ	coarse grained, colourless rock containing larger crystals of garnet.	59.33
24.5	26	1.5	1.48	98.67	1.48	1.5	Garnetiferous quartzite	HQ	coarse grained, colourless rock containing larger crystals of garnet.	72
26	27.5	1.5	1.47	98	1.47	1.5	Garnetiferous quartzite	HQ	coarse grained, colourless rock containing larger crystals of garnet.	58
27.5	29	1.5	1.46	97.33	1.46	1.5	Garnetiferous quartzite	HQ	coarse grained, colourless rock containing larger crystals of garnet.	86
29	30	1	0.98	98	0.8	0.8	Garnetiferous quartzite	HQ	coarse grained, colourless rock containing larger crystals of garnet.	40
					0.18	0.2	Leptynite	HQ	Whitish in color, coarse grained fractured rock containing blebs of quartz.	0
30	30.5	0.5	0.48	96	0.4	0.5	Leptynite	HQ	Whitish in color, coarse grained rock containing blebs of quartz.	0
30.5	32	1.5	1.47	98.00	0.74	0.75	Leptynite	HQ	Whitish in color, coarse grained fractured rock containing blebs of quartz.	64
					0.73	0.75	Garnetiferous	HQ	coarse grained, colourless	70.67

Annexure -V: Summarised litho log sheet of DSBH-1 of Darukona Block, Rayagada District, Odisha

BOREHOLE NO. - DSBH-1							DATE OF COMMENCEMENT : 27.12.2024			
LATITUDE - 19°26'22.75"							DATE OF COMPLETION: 03.01.2025			
LONGITUDE - 83°36'12.0"							WATER LEVEL AT THE TIME OF COMPLETION: 07m			
DEPTH FROM (m)	DEPTH TO (m)	TOTAL RUN LENGTH (m)	TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	CORE RECOVERY OF LITHO-UNITS (m)	EXTRAPOLATED THICKNESS (m)	LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
							quartzite		rock containing larger crystals of garnet.	
32	33.5	1.5	1.48	98.67	1.48	1.5	Garnetiferous quartzite	HQ	coarse grained, colourless rock containing larger crystals of garnet.	84
33.5	35	1.5	1.44	96.00	0.63	0.65	Garnetiferous quartzite	HQ	coarse grained, colourless rock containing larger crystals of garnet.	78.46
					0.81	0.85	Leptynite	HQ	Whitish in color, coarse grained rock containing blebs of quartz with biotite content.	56.47
35	36.5	1.5	1.47	98.00	1.47	1.5	Leptynite	HQ	Whitish in color, coarse grained rock containing blebs of quartz and biotite.	58
36.5	38	1.5	1.47	98.00	0.24	0.25	Leptynite	HQ	Whitish in color, coarse grained rock containing blebs of quartz.	0
					0.91	0.92	Granite gneiss	HQ	Coarse grained, brownish white in colour showing gneissosity containing biotite.	82.61
					0.32	0.33	Leptynite	HQ	Whitish in color, coarse grained rock containing	0

Annexure -V: Summarised litho log sheet of DSBH-1 of Darukona Block, Rayagada District, Odisha

BOREHOLE NO. - DSBH-1							DATE OF COMMENCEMENT : 27.12.2024			
LATITUDE - 19°26'22.75"							DATE OF COMPLETION: 03.01.2025			
LONGITUDE - 83°36'12.0"							WATER LEVEL AT THE TIME OF COMPLETION: 07m			
DEPTH FROM (m)	DEPTH TO (m)	TOTAL RUN LENGTH (m)	TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	CORE RECOVERY OF LITHO-UNITS (m)	EXTRAPOLATED THICKNESS (m)	LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
									blebs of quartz.	
38	39.5	1.5	1.48	98.67	1.48	1.5	Leptynite	HQ	Whitish in color, coarse grained fractured rock containing blebs of quartz.	45.33
39.5	40	0.5	0.46	92.00	0.46	0.5	Leptynite	HQ	Whitish in color, coarse grained rock containing blebs of quartz.	34
40	41.5	1.5	1.44	96.00	0.94	0.96	Leptynite	HQ	Whitish in color, coarse grained rock containing blebs of quartz.	37.5
					0.5	0.54	Granite gneiss	HQ	Coarse grained, brownish white in colour with biotite showing gneissosity	27.78
41.5	43	1.5	1.48	98.67	1.48	1.5	Granite gneiss	HQ	Coarse grained, brownish white in colour showing gneissosity	50
43	44.5	1.5	1.39	92.67	1.39	1.5	Granite gneiss	HQ	Coarse grained, brownish white in colour with fracture showing gneissosity	39.33
44.5	45.5	1	0.99	99	0.99	1	Garnetiferous quartzite	HQ	coarse grained, colourless rock containing larger crystals of garnet.	80
45.5	47	1.5	1.48	98.67	1.48	1.5	Garnetiferous quartzite	HQ	coarse grained, colourless rock containing larger crystals of garnet.	42

Annexure -V: Summarised litho log sheet of DSBH-1 of Darukona Block, Rayagada District, Odisha

BOREHOLE NO. - DSBH-1							DATE OF COMMENCEMENT : 27.12.2024			
LATITUDE - 19°26'22.75"							DATE OF COMPLETION: 03.01.2025			
LONGITUDE - 83°36'12.0"							WATER LEVEL AT THE TIME OF COMPLETION: 07m			
DEPTH FROM (m)	DEPTH TO (m)	TOTAL RUN LENGTH (m)	TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	CORE RECOVERY OF LITHO-UNITS (m)	EXTRAPOLATED THICKNESS (m)	LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
47	48.5	1.5	1.47	98	1.1	1.12	Garnetiferous quartzite	HQ	coarse grained, colourless rock containing larger crystals of garnet.	72.32
					0.37	0.38	Leptynite	HQ	Whitish in color, coarse grained rock containing blebs of quartz.	0
48.5	50	1.5	1.45	96.67	1.45	1.5	Leptynite	HQ	Whitish in color, coarse grained fractured rock containing blebs of quartz.	0
50	51.5	1.5	1.46	97.33	0.24	0.28	Leptynite	HQ	Whitish in color, coarse grained rock containing blebs of quartz.	0
					1.22	1.22	Garnetiferous quartzite	HQ	coarse grained, colourless rock containing larger crystals of garnet.	75.41
51.5	53	1.5	1.45	96.67	1.45	1.5	Leptynite	HQ	Whitish in color, coarse grained rock containing blebs of quartz.	8.67
53	54.5	1.5	1.46	97.33	1.46	1.5	Leptynite	HQ	Whitish in color, coarse grained rock containing blebs of quartz.	55.33
54.5	56	1.5	1.48	98.67	1.48	1.5	Leptynite	HQ	Whitish in color, coarse grained rock containing blebs of quartz.	43.33
56	57.5	1.5	1.45	96.67	0.83	0.86	Leptynite	HQ	Whitish in color, coarse	52.33

Annexure -V: Summarised litho log sheet of DSBH-1 of Darukona Block, Rayagada District, Odisha

BOREHOLE NO. - DSBH-1							DATE OF COMMENCEMENT : 27.12.2024			
LATITUDE - 19°26'22.75"							DATE OF COMPLETION: 03.01.2025			
LONGITUDE - 83°36'12.0"							WATER LEVEL AT THE TIME OF COMPLETION: 07m			
DEPTH FROM (m)	DEPTH TO (m)	TOTAL RUN LENGTH (m)	TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	CORE RECOVERY OF LITHO-UNITS (m)	EXTRAPOLATED THICKNESS (m)	LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
									grained rock containing blebs of quartz.	
					0.62	0.64	Garnetiferous quartzite	HQ	coarse grained, colourless rock containing larger crystals of garnet.	59.38
57.5	59	1.5	1.45	96.67	0.35	0.37	Garnetiferous quartzite	HQ	coarse grained, colourless rock containing larger crystals of garnet.	51.35
					1.1	1.13	Leptynite	HQ	Whitish in color, coarse grained rock containing blebs of quartz.	49.56
59	60	1	0.95	95.00	0.95	1	Leptynite	HQ	Whitish in color, coarse grained rock containing blebs of quartz.	0
60	61.5	1.5	1.48	98.67	0.28	0.3	Leptynite	HQ	Whitish in color, coarse grained rock containing blebs of quartz.	0
					1.2	1.2	Garnetiferous quartzite	HQ	coarse grained, colourless rock containing larger crystals of garnet.	80
61.5	63	1.5	1.49	99.33	1.49	1.5	Garnetiferous quartzite	HQ	coarse grained, colourless rock containing larger crystals of garnet.	42
63	63.5	0.5	0.5	100.00	0.5	0.5	Leptynite	HQ	Whitish in color, coarse grained rock containing	32

Annexure -V: Summarised litho log sheet of DSBH-1 of Darukona Block, Rayagada District, Odisha										
BOREHOLE NO. - DSBH-1							DATE OF COMMENCEMENT : 27.12.2024			
LATITUDE - 19°26'22.75"							DATE OF COMPLETION: 03.01.2025			
LONGITUDE - 83°36'12.0"							WATER LEVEL AT THE TIME OF COMPLETION: 07m			
DEPTH FROM (m)	DEPTH TO (m)	TOTAL RUN LENGTH (m)	TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	CORE RECOVERY OF LITHO- UNITS (m)	EXTRAPOLATED THICKNESS (m)	LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
									blebs of quartz.	
63.5	64.3	0.8	0.79	98.75	0.79	0.8	Garnetiferous quartzite	HQ	coarse grained, colourless rock containing larger crystals of garnet.	0
THE BORREHOLE WAS CLOSED ON 03.01.2025 AT 64.3 m DEPTH										

Annexure -VI: Summarised litho log sheet of DSBH-2 of Darukona Block, Rayagada District, Odisha

BOREHOLE NO. - DSBH-2							DATE OF COMMENCEMENT : 04.01.2025			
LATITUDE - 19°26'24.18"							DATE OF COMPLETION: 13.01.2025			
LONGITUDE - 83°36'11.46"							WATER LEVEL AT THE TIME OF COMPLETION: 10.25 m			
RUN		TOTAL RUN LENGTH (m)	CORE				LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
DEPTH FROM (m)	DEPTH TO (m)		TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	RECOVERY OF LITHO- UNITS (m)	EXTRAPOLATED THICKNESS (m)				
0	0.5	0.5	0.45	90	0.45	0.5	Top soil	HQ	Brownish yellow in colour	0
0.5	1	0.5	0.47	94	0.47	0.5	Top soil	HQ	Brownish yellow in colour	0
1	1.5	0.5	0.45	90	0.45	0.5	Top soil	HQ	Brownish yellow in colour	0
1.5	2	0.5	0.46	92	0.46	0.5	Top soil	HQ	Brownish yellow in colour	0
2	2.5	0.5	0.45	90	0.45	0.5	Weathered mantle	HQ	Whitish in colour with fragments of leptynite	0
2.5	3	0.5	0.46	92	0.46	0.5	Weathered mantle	HQ	Whitish in colour with fragments of leptynite	0
3	4	1	0.97	97	0.97	1	Weathered mantle	HQ	Whitish in colour with fragments of leptynite	0
4	5	1	0.96	96	0.07	0.09	Leptynite	HQ	Quartzofelspathic whitish grey coloured fragmented rock	0
					0.13	0.15	Granite gneiss	HQ	Brownish white in colour highly weathered rock	0
					0.76	0.76	Granite gneiss with graphite	HQ	Coarse grained, brownish in colour highly weathered rock containing graphite along the foliation plane	0
5	6.5	1.5	1.47	98	1.23	1.25	Sandy material	HQ	Yellowish brown in colour	0
					0.24	0.25	Granite gneiss(?)	HQ	Brownish yellow colour highly weathered rock	0
6.5	8	1.5	1.48	98.67	0.43	0.45	Granite gneiss(?)	HQ	Brownish yellow colour highly	0

Annexure -VI: Summarised litho log sheet of DSBH-2 of Darukona Block, Rayagada District, Odisha

BOREHOLE NO. - DSBH-2							DATE OF COMMENCEMENT : 04.01.2025			
LATITUDE - 19°26'24.18"							DATE OF COMPLETION: 13.01.2025			
LONGITUDE - 83°36'11.46"							WATER LEVEL AT THE TIME OF COMPLETION: 10.25 m			
RUN		TOTAL RUN LENGTH (m)	CORE				LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
DEPTH FROM (m)	DEPTH TO (m)		TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	CORE RECOVERY OF LITHO- UNITS (m)	EXTRAPOLATED THICKNESS (m)				
									weathered rock	
					0.54	0.54	Khondalite	HQ	Reddish in colour highly weathered rock	0
					0.51	0.51	Khondalite with graphite	HQ	Reddish in colour highly fractured rock where graphite occurs along the foliation plane	0
8	9.5	1.5	1.47	98.00	0.54	0.55	Khondalite	HQ	Reddish in colour highly fractured rock	21.82
					0.67	0.68	Khondalite with graphite	HQ	Reddish white in colour highly fractured rock where graphite occurs along the foliation plane	0.00
					0.26	0.27	Khondalite	HQ	Reddish in colour highly fractured rock	0.00
9.5	11	1.5	1.47	98.00	0.85	0.87	Khondalite	HQ	Reddish in colour highly weathered rock	0.00
					0.62	0.63	Khondalite with graphite	HQ	Reddish white in colour highly fractured rock where graphite occurs along the foliation plane	0.00
11	12	1	1	100.00	1	1	Khondalite with graphite	HQ	Reddish white in colour where graphite occurs along the foliation plane	52.00
12	13.5	1.5	1.5	100.00	0.46	0.46	Khondalite with graphite	HQ	Reddish white in colour where graphite occurs along the foliation plane	0.00
					0.46	0.46	Granite gneiss	HQ	Whitish in colour fractured	0.00

Annexure -VI: Summarised litho log sheet of DSBH-2 of Darukona Block, Rayagada District, Odisha

BOREHOLE NO. - DSBH-2							DATE OF COMMENCEMENT : 04.01.2025			
LATITUDE - 19°26'24.18"							DATE OF COMPLETION: 13.01.2025			
LONGITUDE - 83°36'11.46"							WATER LEVEL AT THE TIME OF COMPLETION: 10.25 m			
RUN		TOTAL RUN LENGTH (m)	CORE				LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
DEPTH FROM (m)	DEPTH TO (m)		TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	CORE RECOVERY OF LITHO- UNITS (m)	EXTRAPOLATED THICKNESS (m)				
									containing quartz feldspar rich band	
					0.5	0.5	Quartzo-feldspathic graphite gneiss	HQ	Highly fractured rock containing graphite flakes parallel to the palne of gneissosity	0.00
					0.08	0.08	Granite gneiss with graphite	HQ	Coarse grained, brownish in colour highly weathered rock containing graphite along the foliation plane	0.00
13.5	15	1.5	1.45	96.67	0.31	0.32	Granite gneiss with graphite	HQ	Coarse grained, brownish white in colour highly weathered rock containing graphite along the foliation plane	0.00
					0.11	0.12	Granite gneiss	HQ	coarse grained, Whitish in colour	91.67
					0.2	0.21	Granite gneiss with graphite	HQ	Coarse grained, brownish white in colour highly weathered rock containing graphite along the foliation plane	85.71
					0.73	0.75	Granite gneiss	HQ	coarse grained, Whitish in colour	13.33
					0.1	0.1	Quartzo-feldspathic	HQ	Grayish white coloured rock	0.00

Annexure -VI: Summarised litho log sheet of DSBH-2 of Darukona Block, Rayagada District, Odisha

BOREHOLE NO. - DSBH-2							DATE OF COMMENCEMENT : 04.01.2025			
LATITUDE - 19°26'24.18"							DATE OF COMPLETION: 13.01.2025			
LONGITUDE - 83°36'11.46"							WATER LEVEL AT THE TIME OF COMPLETION: 10.25 m			
RUN		TOTAL RUN LENGTH (m)	CORE				LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
DEPTH FROM (m)	DEPTH TO (m)		TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	CORE RECOVERY OF LITHO- UNITS (m)	EXTRAPOLATED THICKNESS (m)				
							graphite gneiss		where the gneissosity is defined by graphite rich layers alternating with quartz feldspar rich layers	
15	16	1	1	100.00	1	1	Quartzo-feldspathic graphite gneiss	HQ	Grayish white coloured rock where the gneissosity is defined by graphite rich layers alternating with quartz feldspar rich layers	15.00
16	17	1	1	100.00	1	1	Quartzo-feldspathic graphite gneiss	HQ	Grayish white coloured rock where the gneissosity is defined by graphite rich layers alternating with quartz feldspar rich layers	51.00
17	18.5	1.5	1.45	96.67	1.45	1.5	Quartzo-feldspathic graphite gneiss	HQ	Grayish white coloured rock where the gneissosity is defined by graphite rich layers alternating with quartz feldspar rich layers	48.67
18.5	20	1.5	1.47	98.00	1.47	1.5	Quartzo-feldspathic graphite gneiss	HQ	Grayish white coloured rock where the gneissosity is defined by graphite rich layers alternating with quartz	68.00

Annexure -VI: Summarised litho log sheet of DSBH-2 of Darukona Block, Rayagada District, Odisha

BOREHOLE NO. - DSBH-2							DATE OF COMMENCEMENT : 04.01.2025			
LATITUDE - 19°26'24.18"							DATE OF COMPLETION: 13.01.2025			
LONGITUDE - 83°36'11.46"							WATER LEVEL AT THE TIME OF COMPLETION: 10.25 m			
RUN		TOTAL RUN LENGTH (m)	CORE				LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
DEPTH FROM (m)	DEPTH TO (m)		TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	CORE RECOVERY OF LITHO- UNITS (m)	EXTRAPOLATED THICKNESS (m)				
									feldspar rich layers	
20	21.5	1.5	1.5	100.00	1.5	1.5	Quartzo-feldspathic graphite gneiss	HQ	Grayish white coloured rock where the gneissosity is defined by graphite rich layers alternating with quartz feldspar rich layers	87.33
21.5	23	1.5	1.43	95.33	1.43	1.5	Quartzo-feldspathic graphite gneiss	HQ	Grayish white coloured rock where the gneissosity is defined by graphite rich layers alternating with quartz feldspar rich layers	42.67
23	24.5	1.5	1.5	100.00	0.13	0.13	Quartzo-feldspathic graphite gneiss	HQ	Grayish white coloured rock where the gneissosity is defined by graphite rich layers alternating with quartz feldspar rich layers	0.00
					1.05	1.05	Quartzo-feldspathic graphite gneiss	HQ	Grayish white coloured rock where the gneissosity is defined by graphite rich layers alternating with quartz feldspar rich layers	31.43
					0.32	0.32	Garnetiferous granite gneiss	HQ	Grayish white coloured highly fragmented rock where the	0.00

Annexure -VI: Summarised litho log sheet of DSBH-2 of Darukona Block, Rayagada District, Odisha

BOREHOLE NO. - DSBH-2							DATE OF COMMENCEMENT : 04.01.2025			
LATITUDE - 19°26'24.18"							DATE OF COMPLETION: 13.01.2025			
LONGITUDE - 83°36'11.46"							WATER LEVEL AT THE TIME OF COMPLETION: 10.25 m			
RUN		TOTAL RUN LENGTH (m)	CORE				LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
DEPTH FROM (m)	DEPTH TO (m)		TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	CORE RECOVERY OF LITHO- UNITS (m)	EXTRAPOLATED THICKNESS (m)				
									gneissosity is defined by garnet rich layers alternating with quartz feldspar rich layers	
24.5	26	1.5	1.47	98.00	1.47	1.5	Khondalite with graphite	HQ	Reddish white coloured rock where the graphite flakes are oriented parallel to the foliation plane also containing mica rich layers at the bottom	10.67
26	27.5	1.5	1.48	98.67	1.24	1.26	Garnetiferous granite gneiss	HQ	Grayish white coloured rock where the gneissosity is defined by garnet and biotite rich layers alternating with quartz feldspar rich layers	43.65
					0.24	0.24	Quartzo-feldspathic graphite gneiss	HQ	Grayish white coloured rock where the gneissosity is defined by graphite rich layers alternating with quartz feldspar rich layers	0.00
27.5	29	1.5	1.46	97.33	1.46	1.5	Quartzo-feldspathic graphite gneiss	HQ	Grayish white coloured fractured rock where the gneissosity is defined by graphite rich layers alternating with quartz feldspar rich	8.67

Annexure -VI: Summarised litho log sheet of DSBH-2 of Darukona Block, Rayagada District, Odisha

BOREHOLE NO. - DSBH-2							DATE OF COMMENCEMENT : 04.01.2025			
LATITUDE - 19°26'24.18"							DATE OF COMPLETION: 13.01.2025			
LONGITUDE - 83°36'11.46"							WATER LEVEL AT THE TIME OF COMPLETION: 10.25 m			
RUN		TOTAL RUN LENGTH (m)	CORE				LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
DEPTH FROM (m)	DEPTH TO (m)		TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	CORE RECOVERY OF LITHO- UNITS (m)	EXTRAPOLATED THICKNESS (m)				
									layers	
29	30.5	1.5	1.42	94.67	0.19	0.2	Quartzo-feldspathic graphite gneiss	HQ	Grayish white coloured fractured rock where the gneissosity is defined by graphite rich layers alternating with quartz feldspar rich layers	0.00
					1.23	1.3	Garnetiferous granite gneiss	HQ	Grayish white coloured fractured rock where the gneissosity is defined by garnet and biotite rich layers alternating with quartz feldspar rich layers	22.31
30.5	32	1.5	1.39	92.67	0.8	0.87	Garnetiferous granite gneiss	HQ	Grayish white coloured fractured rock where the gneissosity is defined by garnet and biotite rich layers alternating with quartz feldspar rich layers	0.00
					0.59	0.63	Khondalite with graphite	HQ	Reddish white coloured rock where the graphite flakes are oriented parallel to the foliation plane	77.78
32	33.5	1.5	1.5	100.00	1	1	Garnetiferous	HQ	coarse grained, colourless rock	16.00

Annexure -VI: Summarised litho log sheet of DSBH-2 of Darukona Block, Rayagada District, Odisha

BOREHOLE NO. - DSBH-2							DATE OF COMMENCEMENT : 04.01.2025			
LATITUDE - 19°26'24.18"							DATE OF COMPLETION: 13.01.2025			
LONGITUDE - 83°36'11.46"							WATER LEVEL AT THE TIME OF COMPLETION: 10.25 m			
RUN		TOTAL RUN LENGTH (m)	CORE				LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
DEPTH FROM (m)	DEPTH TO (m)		TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	CORE RECOVERY OF LITHO- UNITS (m)	EXTRAPOLATED THICKNESS (m)				
							quartzite		containing larger crystals of garnet.	
					0.5	0.5	Quartzo-feldspathic graphite gneiss	HQ	Grayish white coloured fractured rock where the gneissosity is defined by graphite rich layers alternating with quartz feldspar rich layers	96.00
33.5	35	1.5	1.46	97.33	1.46	1.5	Quartzo-feldspathic graphite gneiss	HQ	Grayish white coloured fractured rock where the gneissosity is defined by graphite rich layers alternating with quartz feldspar rich layers	62.67
35	36.5	1.5	1.44	96.00	0.8	0.82	Quartzo-feldspathic graphite gneiss	HQ	Grayish white coloured rock where the gneissosity is defined by graphite rich layers alternating with quartz feldspar rich layers	53.66
					0.34	0.36	Garnetiferous quartzite	HQ	coarse grained, colourless rock containing larger crystals of garnet.	61.11
					0.3	0.32	Quartzo-feldspathic graphite gneiss	HQ	Grayish white coloured fractured rock where the	0

Annexure -VI: Summarised litho log sheet of DSBH-2 of Darukona Block, Rayagada District, Odisha

BOREHOLE NO. - DSBH-2							DATE OF COMMENCEMENT : 04.01.2025			
LATITUDE - 19°26'24.18"							DATE OF COMPLETION: 13.01.2025			
LONGITUDE - 83°36'11.46"							WATER LEVEL AT THE TIME OF COMPLETION: 10.25 m			
RUN		TOTAL RUN LENGTH (m)	CORE				LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
DEPTH FROM (m)	DEPTH TO (m)		TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	CORE RECOVERY OF LITHO- UNITS (m)	EXTRAPOLATED THICKNESS (m)				
									gneissosity is defined by graphite rich layers alternating with quartz feldspar rich layers	
36.5	37.5	1	0.98	98.00	0.98	1	Khondalite	HQ	Reddish in colour sillimanite bearing rock	67
37.5	39	1.5	1.5	100.00	1.23	1.23	Khondalite with graphite	HQ	Reddish white coloured rock where the graphite flakes are oriented parallel to the foliation plane	21.14
					0.27	0.27	Quartzo-feldspathic graphite gneiss	HQ	Grayish white coloured fractured rock where the gneissosity is defined by graphite rich layers alternating with quartz feldspar rich layers	137.04
39	40.5	1.5	1.5	100.00	1.5	1.5	Quartzo-feldspathic graphite gneiss	HQ	Grayish white coloured fractured rock where the gneissosity is defined by graphite rich layers alternating with quartz feldspar rich layers	42.00
40.5	42	1.5	1.46	97.33	1.46	1.5	Quartzo-feldspathic graphite gneiss	HQ	Grayish white coloured fractured rock where the	57.33

Annexure -VI: Summarised litho log sheet of DSBH-2 of Darukona Block, Rayagada District, Odisha

BOREHOLE NO. - DSBH-2							DATE OF COMMENCEMENT : 04.01.2025			
LATITUDE - 19°26'24.18"							DATE OF COMPLETION: 13.01.2025			
LONGITUDE - 83°36'11.46"							WATER LEVEL AT THE TIME OF COMPLETION: 10.25 m			
RUN		TOTAL RUN LENGTH (m)	CORE				LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
DEPTH FROM (m)	DEPTH TO (m)		TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	CORE RECOVERY OF LITHO- UNITS (m)	EXTRAPOLATED THICKNESS (m)				
									gneissosity is defined by graphite rich layers alternating with quartz feldspar rich layers	
42	43.5	1.5	1.46	97.33	1.46	1.5	Khondalite	HQ	Grayish white coloured fractured rock where the gneissosity is defined by garnet and biotite rich layers alternating with quartz feldspar rich layers	54.67
43.5	45	1.5	1.5	100.00	1.5	1.5	Garnetiferous quartzite	HQ	coarse grained, coloured rock containing tiny crystals of garnet.	94.67
45	46.5	1.5	1.5	100.00	1.5	1.5	Garnetiferous quartzite	HQ	coarse grained, colourless rock containing tiny crystals of garnet.	77.33
46.5	48	1.5	1.48	98.67	1.48	1.5	Garnetiferous quartzite	HQ	coarse grained, colourless fractured rock containing tiny crystals of garnet.	41.33
48	49.5	1.5	1.46	97.33	1.46	1.5	Khondalite		Reddish white coloured, highly fractured rock containing sillimanite	20.67
49.5	51	1.5	1.47	98.00	1.47	1.5	Garnetiferous quartzite	HQ	Coarse grained, colourless fractured rock containing tiny	0.00

Annexure -VI: Summarised litho log sheet of DSBH-2 of Darukona Block, Rayagada District, Odisha										
BOREHOLE NO. - DSBH-2							DATE OF COMMENCEMENT : 04.01.2025			
LATITUDE - 19°26'24.18"							DATE OF COMPLETION: 13.01.2025			
LONGITUDE - 83°36'11.46"							WATER LEVEL AT THE TIME OF COMPLETION: 10.25 m			
RUN		TOTAL RUN LENGTH (m)	CORE				LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
DEPTH FROM (m)	DEPTH TO (m)		TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	CORE RECOVERY OF LITHO- UNITS (m)	EXTRAPOLATED THICKNESS (m)				
									crystals of garnet.	
51	52.5	1.5	1.42	94.67	1.42	1.5	Garnetiferous quartzite	HQ	Coarse grained, colourless fractured rock containing tiny crystals of garnet.	21.33
52.5	54	1.5	1.43	95.33	1.43	1.5	Garnetiferous quartzite	HQ	coarse grained, colourless fractured rock containing tiny crystals of garnet.	16.00
54	55.5	1.5	1.47	98	1.47	1.5	Garnetiferous quartzite	HQ	coarse grained, colourless rock containing tiny crystals of garnet.	45.33
55.5	57	1.5	1.49	99.33	1.49	1.5	Garnetiferous quartzite	HQ	coarse grained, colourless rock containing 10 cm of charnockite band at the bottom	66.67
57	58.5	1.5	1.49	99.33	1.49	1.5	Garnetiferous quartzite	HQ	coarse grained, colourless rock containing tiny crystals of garnet.	64.67
58.5	60	1.5	1.47	98	1.47	1.5	Garnetiferous quartzite	HQ	coarse grained, colourless rock containing tiny crystals of garnet.	66.00
THE BOREHOLE WAS CLOSED AT 60m DEPTH ON 13.01.2025 IN GARNETIFEROUS QUARTZITE										

Annexure -VII: Summarised litho log sheet of DSBH-3 of Darukona Block, Rayagada District, Odisha

BOREHOLE NO. - DSBH-3							DATE OF COMMENCEMENT : 24.01.2025			
LATITUDE - 19°26'37.43"							DATE OF COMPLETION: 17.02.2025			
LONGITUDE - 83°36'26.91"							WATER LEVEL AT THE TIME OF COMPLETION: 15.65 m			
RUN		CORE					LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
DEPTH FROM (m)	DEPTH TO (m)	TOTAL RUN LENGTH (m)	TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	CORE RECOVERY OF LITHO-UNITS (m)	EXTRAPOLATED THICKNESS (m)				
0.00	0.50	0.50	0.50	100.00	0.50	0.50	Top soil	HQ	Reddish brown in colour	0
0.50	1	0.50	0.50	100.00	0.5	0.5	Top soil	HQ	Reddish brown in colour	0
1.00	1.5	0.50	0.50	100.00	0.5	0.5	Top soil	HQ	Reddish brown in colour	0
1.50	2	0.50	0.50	100.00	0.5	0.5	Top soil	HQ	Reddish brown in colour	0
2.00	2.5	0.50	0.50	100.00	0.5	0.5	Top soil	HQ	Reddish brown in colour	0
2.50	3	0.50	0.50	100.00	0.5	0.5	Top soil	HQ	Reddish brown in colour	0
3.00	3.5	0.50	0.50	100.00	0.5	0.5	Top soil	HQ	Reddish brown in colour	0
3.50	4	0.50	0.50	100.00	0.5	0.5	Top soil	HQ	Reddish brown in colour	0
4.00	4.5	0.50	0.50	100.00	0.5	0.5	Top soil	HQ	Brownish yellow in colour	0
4.50	5	0.50	0.50	100.00	0.5	0.5	Top soil	HQ	Brownish yellow in colour	0
5.00	6.5	1.50	1.45	96.67	1.45	1.5	Top soil	HQ	Brownish yellow in colour	0
6.50	7	0.50	0.46	92.00	0.46	0.5	Weathered mantle	HQ	Brownish colored material containing fragments of granite gneiss	0
7.00	8	1.00	0.95	95.00	0.95	1	Weathered mantle	HQ	Reddish brown colored material containing fragments of granite gneiss	0
8.00	9	1.00	0.98	98.00	0.98	1	Granite gneiss	HQ	Coarse grained whitish colored highly fractured rock containing quartz feldspar and opaque minerals	0
9.00	10	1.00	1.00	100.00	1	1	Granite gneiss	HQ	Coarse grained whitish colored highly fractured rock containing quartz feldspar and opaque minerals	0

Annexure -VII: Summarised litho log sheet of DSBH-3 of Darukona Block, Rayagada District, Odisha

BOREHOLE NO. - DSBH-3							DATE OF COMMENCEMENT : 24.01.2025			
LATITUDE - 19°26'37.43"							DATE OF COMPLETION: 17.02.2025			
LONGITUDE - 83°36'26.91"							WATER LEVEL AT THE TIME OF COMPLETION: 15.65 m			
RUN		CORE					LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
DEPTH FROM (m)	DEPTH TO (m)	TOTAL RUN LENGTH (m)	TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	CORE RECOVERY OF LITHO-UNITS (m)	EXTRAPOLATED THICKNESS (m)				
10.00	11	1.00	1.00	100.00	1	1	Granite gneiss	HQ	Coarse grained whitish colored highly fractured rock containing quartz feldspar and opaque minerals	0
11.00	12	1.00	1.00	100.00	1	1	Granite gneiss	HQ	Coarse grained whitish colored highly fractured rock containing quartz feldspar and opaque minerals	30
12.00	13	1.00	1.00	100.00	1	1	Granite gneiss	HQ	Coarse grained brownish coloured rock which is highly fractured in nature	0
13.00	14	1.00	1.00	100.00	1	1	Granite gneiss	HQ	Coarse grained brownish white coloured rock which is highly fractured in nature	12
14.00	15	1.00	1.00	100.00	1	1	Granite gneiss	HQ	Coarse grained brownish white coloured rock which is highly fractured in nature	43
15.00	16	1.00	0.94	94.00	0.74	0.74	Granite gneiss	HQ	Coarse grained brownish white coloured rock which is highly fractured in nature	18
					0.2	0.26	Khondalite	HQ	Pinkish colored rock containing quartz, feldspar, garnet and sillimanite	0
16.00	17	1.00	0.96	96.00	0.96	1	Khondalite	HQ	Pinkish colored rock containing quartz, feldspar,	51

Annexure -VII: Summarised litho log sheet of DSBH-3 of Darukona Block, Rayagada District, Odisha

BOREHOLE NO. - DSBH-3							DATE OF COMMENCEMENT : 24.01.2025			
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LONGITUDE - 83°36'26.91"							WATER LEVEL AT THE TIME OF COMPLETION: 15.65 m			
RUN		CORE					LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
DEPTH FROM (m)	DEPTH TO (m)	TOTAL RUN LENGTH (m)	TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	CORE RECOVERY OF LITHO-UNITS (m)	EXTRAPOLATED THICKNESS (m)				
									garnet and sillimanite	
17.00	18	1.00	0.99	99.00	0.79	0.79	Khondalite	HQ	Pinkish colored rock containing quartz, feldspar, garnet and sillimanite	38
					0.2	0.21	Leptynite	HQ	Coarse grained whitish colored fractured rock containing blebs of quartz	0
18.00	19	1.00	0.98	98.00	0.98	1	Leptynite	HQ	Coarse grained whitish colored fractured rock containing blebs of quartz	0
19.00	20	1.00	0.96	96.00	0.96	1	Leptynite	HQ	Coarse grained whitish colored highly fractured rock containing blebs of quartz	0
20.00	21.5	1.50	1.40	93.33	1.4	1.5	Leptynite	HQ	Coarse grained whitish colored highly fractured rock containing blebs of quartz	37
21.50	23	1.50	1.45	96.67	1.45	1.5	Leptynite	HQ	very coarse grained whitish colored highly fractured rock containing blebs of quartz	47
23.00	24.5	1.50	1.5	100.00	1.4	1.4	Leptynite	HQ	very coarse grained whitish colored highly fractured rock containing blebs of quartz	29
					0.1	0.1	Khondalite	HQ	Reddish white in color containing quartz, feldspar, garnet and sillimanite	0

Annexure -VII: Summarised litho log sheet of DSBH-3 of Darukona Block, Rayagada District, Odisha

BOREHOLE NO. - DSBH-3							DATE OF COMMENCEMENT : 24.01.2025			
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LONGITUDE - 83°36'26.91"							WATER LEVEL AT THE TIME OF COMPLETION: 15.65 m			
RUN		TOTAL RUN LENGTH (m)	CORE				LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
DEPTH FROM (m)	DEPTH TO (m)		TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	RECOVERY OF LITHO- UNITS (m)	EXTRAPOLATED THICKNESS (m)				
24.50	26	1.50	1.48	98.67	1	1	Khondalite	HQ	Reddish white in color containing quartz, feldspar, garnet and sillimanite	39
					0.48	0.5	Garnetiferous quartzite	HQ	Medium grained rock composed of quartz	22
26.00	27.5	1.50	1.48	98.67	1.48	1.5	Garnetiferous quartzite	HQ	Medium grained rock composed of quartz	40
27.50	29.5	2.00	1.5	75.00	1.5	2	Garnetiferous quartzite	HQ	Medium grained rock composed of quartz and garnet	38
29.50	31	1.50	1.48	98.67	1.48	1.5	Khondalite	HQ	Reddish white in color containing quartz, feldspar, garnet and sillimanite	30
31.00	32.5	1.50	1.5	100.00	1.5	1.5	Khondalite	HQ	Reddish white in color containing quartz, feldspar, garnet and sillimanite	57
32.50	34	1.5	1.46	97.33	1.46	1.5	Khondalite	HQ	Reddish white in color containing quartz, feldspar, garnet and sillimanite	14
34.00	35.5	1.5	1.5	100.00	1.5	1.5	Khondalite with graphite	HQ	Coarse grained greyish red colored rock containing alternate bands of graphite rich layers and garnet sillimanite rich layers	63
35.50	37	1.5	1.45	96.67	0.07	0.08	Khondalite with graphite	HQ	Coarse grained greyish red	0

Annexure -VII: Summarised litho log sheet of DSBH-3 of Darukona Block, Rayagada District, Odisha

BOREHOLE NO. - DSBH-3							DATE OF COMMENCEMENT : 24.01.2025			
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LONGITUDE - 83°36'26.91"							WATER LEVEL AT THE TIME OF COMPLETION: 15.65 m			
RUN		CORE					LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
DEPTH FROM (m)	DEPTH TO (m)	TOTAL RUN LENGTH (m)	TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	CORE RECOVERY OF LITHO-UNITS (m)	EXTRAPOLATED THICKNESS (m)				
									colored rock containing alternate bands of graphite rich layers and garnet sillimanite rich layers	
					0.58	0.6	Khondalite	HQ	Reddish white in color containing quartz, feldspar, garnet and sillimanite	67
					0.8	0.82	Khondalite with graphite	HQ	Coarse grained greyish red colored rock containing alternate bands of graphite rich layers and garnet sillimanite rich layers	67
37.00	38.5	1.5	1.47	98.00	1.47	1.5	Quartzo-feldspathic graphite gneiss	HQ	Greyish colored coarse grained rock showing alternate gneissic band of graphite rich layers and quartz feldspar rich layers	89
38.50	40	1.5	1.5	100.00	1.5	1.5	Quartzo-feldspathic graphite gneiss	HQ	Greyish colored coarse grained rock showing alternate gneissic band of graphite rich layers and quartz feldspar rich layers	94
40.00	41.5	1.5	1.5	100.00	1.5	1.5	Quartzo-feldspathic graphite gneiss	HQ	Greyish colored coarse grained rock showing alternate gneissic band of	96

Annexure -VII: Summarised litho log sheet of DSBH-3 of Darukona Block, Rayagada District, Odisha

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LONGITUDE - 83°36'26.91"							WATER LEVEL AT THE TIME OF COMPLETION: 15.65 m			
RUN		CORE					LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
DEPTH FROM (m)	DEPTH TO (m)	TOTAL RUN LENGTH (m)	TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	CORE RECOVERY OF LITHO-UNITS (m)	EXTRAPOLATED THICKNESS (m)				
									graphite rich layers and quartz feldspar rich layers	
41.50	43	1.5	1.46	97.33	1.16	1.18	Quartzo-feldspathic graphite gneiss	HQ	Greyish colored coarse grained rock showing alternate gneissic band of graphite rich layers and quartz feldspar rich layers	0
					0.3	0.32	Garnetiferous quartzite	HQ	Coarse grained colorless rock containing very tiny crystals of pink garnet	0
43.00	44.5	1.5	1.5	100.00	1.5	1.5	Garnetiferous quartzite	HQ	Coarse grained colorless rock containing very tiny crystals of pink garnet	57
44.50	46	1.5	1.48	98.67	0.97	0.99	Garnetiferous quartzite	HQ	Coarse grained colorless rock containing very tiny crystals of pink garnet	296
					0.37	0.37	Graphite bearing quartzite	HQ	Greyish white colored rock	86
					0.14	0.14	Garnetiferous quartzite	HQ	Coarse grained colorless rock containing very tiny crystals of pink garnet	100
46.00	47.5	1.5	1.5	100.00	1.5	1.5	Garnetiferous quartzite	HQ	Coarse grained colorless rock containing very tiny crystals of pink garnet	31
47.50	49	1.5	1.5	100.00	1.5	1.5	Garnetiferous quartzite	HQ	Coarse grained colorless rock	38

Annexure -VII: Summarised litho log sheet of DSBH-3 of Darukona Block, Rayagada District, Odisha

BOREHOLE NO. - DSBH-3							DATE OF COMMENCEMENT : 24.01.2025			
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LONGITUDE - 83°36'26.91"							WATER LEVEL AT THE TIME OF COMPLETION: 15.65 m			
RUN			CORE				LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
DEPTH FROM (m)	DEPTH TO (m)	TOTAL RUN LENGTH (m)	TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	CORE RECOVERY OF LITHO-UNITS (m)	EXTRAPOLATED THICKNESS (m)				
									containing very tiny crystals of pink garnet	
49.00	50.5	1.5	1.45	96.67	1.39	1.42	Garnetiferous quartzite	HQ	Coarse grained colorless rock containing very tiny crystals of pink garnet	66
					0.06	0.08	Graphite bearing quartzite	HQ	Greyish white colored rock containing layers of graphite	0
50.50	52	1.5	1.48	98.67	1.48	1.5	Graphite bearing quartzite	HQ	Greyish white colored rock containing layers of graphite	65
52.00	53.5	1.5	1.45	96.67	1	1	Graphite bearing quartzite	HQ	Greyish white colored rock containing layers of graphite	0
					0.45	0.5	Garnetiferous quartzite	HQ	Coarse grained colorless rock containing very tiny crystals of pink garnet	0
53.50	55	1.5	1.42	94.67	0.43	0.46	Garnetiferous quartzite	HQ	Coarse grained colorless rock containing very tiny crystals of pink garnet	85
					0.33	0.36	Graphite bearing Quartzite	HQ	Greyish white colored rock containing layers of graphite	44
					0.66	0.68	Garnetiferous quartzite	HQ	Coarse grained colorless rock containing very tiny crystals of pink garnet	71
55.00	56.5	1.5	1.46	97.33	1.46	1.5	Garnetiferous quartzite	HQ	Coarse grained colorless rock containing very tiny crystals of pink garnet	61

Annexure -VII: Summarised litho log sheet of DSBH-3 of Darukona Block, Rayagada District, Odisha

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RUN		TOTAL RUN LENGTH (m)	CORE				LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
DEPTH FROM (m)	DEPTH TO (m)		TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	RECOVERY OF LITHO- UNITS (m)	EXTRAPOLATED THICKNESS (m)				
56.50	58	1.5	1.5	100.00	1.5	1.5	Garnetiferous quartzite	HQ	Coarse grained colorless rock containing very tiny crystals of pink garnet	0
58.00	59.5	1.5	1.5	100.00	1.5	1.5	Garnetiferous quartzite	HQ	Coarse grained colorless rock containing very tiny crystals of pink garnet	90
59.50	61	1.5	1.44	96.00	1.44	1.5	Garnetiferous quartzite	HQ	Coarse grained colorless rock containing very tiny crystals of pink garnet	77
61.00	62.5	1.5	1.42	94.67	1.42	1.5	Garnetiferous quartzite	HQ	Coarse grained colorless rock containing very tiny crystals of pink garnet	67
62.50	64	1.5	1.46	97.33	1.46	1.5	Garnetiferous quartzite	HQ	Coarse grained colorless rock containing very tiny crystals of pink garnet	75
64.00	65	1	0.96	96.00	0.96	1	Garnetiferous quartzite	HQ	Medium grained rock composed of quartz and garnet	75
65.00	65.5	0.5	0.48	96.00	0.48	0.5	Garnetiferous quartzite	HQ	Medium grained rock composed of quartz,garnet and biotite rich layers within in.	96
65.50	66.5	1	0.99	99.00	0.99	1	Garnetiferous quartzite	HQ	Medium grained rock composed of quartz,garnet and biotite rich layers within	88

Annexure -VII: Summarised litho log sheet of DSBH-3 of Darukona Block, Rayagada District, Odisha

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LONGITUDE - 83°36'26.91"							WATER LEVEL AT THE TIME OF COMPLETION: 15.65 m			
RUN		TOTAL RUN LENGTH (m)	CORE				LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
DEPTH FROM (m)	DEPTH TO (m)		TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	RECOVERY OF LITHO- UNITS (m)	EXTRAPOLATED THICKNESS (m)				
									in.	
66.50	68	1.5	1.47	98.00	1.47	1.5	Quartzo feldspathic garnet gneiss	HQ	Medium grained rock containing quartz feldspar and garnet rich layers showing well defined gneissosity.	101
68.00	68.5	0.5	0.49	98.00	0.49	0.5	Quartzo feldspathic garnet gneiss	HQ	Medium grained rock containing quartz feldspar and garnet rich layers showing well defined gneissosity.	100
68.50	69.5	1	0.99	99.00	0.99	1	Quartzo feldspathic garnet gneiss	HQ	Medium grained rock containing quartz feldspar and garnet rich layers showing well defined gneissosity.	81
69.50	72.5	3	2.97	99.00	0.99	1	Quartzo feldspathic garnet gneiss	HQ	Medium grained rock containing quartz feldspar and garnet rich layers showing well defined gneissosity.	82
					1.98	2	Khondalite	HQ	Reddish white in color containing quartz, feldspar, garnet and sillimanite	74
72.5	74	1.5	1.38	92.00	1.38	1.5	Khondalite	HQ	Reddish white in color	45

Annexure -VII: Summarised litho log sheet of DSBH-3 of Darukona Block, Rayagada District, Odisha

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RUN		TOTAL RUN LENGTH (m)	CORE				LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
DEPTH FROM (m)	DEPTH TO (m)		TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	RECOVERY OF LITHO- UNITS (m)	EXTRAPOLATED THICKNESS (m)				
									containing quartz, feldspar, garnet and sillimanite	
74	75.5	1.5	1.42	94.67	1.42	1.5	Khondalite	HQ	Reddish white in color containing quartz, feldspar, garnet and sillimanite	67
75.5	77	1.5	1.49	99.33	1.49	1.5	Khondalite	HQ	Reddish white in color containing quartz, feldspar, garnet and sillimanite	92
77	78.5	1.5	1.49	99.33	1.07	1.08	Khondalite	HQ	Reddish white in color containing quartz, feldspar, garnet and sillimanite	75
					0.42	0.42	Garnetiferous quartzite	HQ	Medium grained rock composed of quartz,garnet and traces of pyrite.	95
78.5	80	1.5	1.48	98.67	1.48	1.5	Garnetiferous quartzite	HQ	Medium grained rock composed of quartz,garnet and traces of pyrite.	70
80	81.5	1.5	1.48	98.67	1.48	1.5	Khondalite	HQ	Reddish white in color containing quartz, feldspar, garnet and sillimanite	72
81.5	83	1.5	1.49	99.33	1.49	1.5	Khondalite	HQ	Reddish white in color containing quartz, feldspar, garnet and sillimanite	65
83	84.5	1.5	1.42	94.67	0.14	0.2	Khondalite	HQ	Reddish white in color containing quartz, feldspar,	0

Annexure -VII: Summarised litho log sheet of DSBH-3 of Darukona Block, Rayagada District, Odisha

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RUN		CORE					LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
DEPTH FROM (m)	DEPTH TO (m)	TOTAL RUN LENGTH (m)	TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	RECOVERY OF LITHO-UNITS (m)	EXTRAPOLATED THICKNESS (m)				
									garnet and sillimanite	
					1.28	1.3	Graphite biotite garnet quartz feldspar gneiss	HQ	Medium grained rock containing graphite,quartz feldspar,biotite and garnet rich layers showing well defined gneissosity.	53
84.5	86	1.5	1.48	98.67	1.48	1.5	Khondalite	HQ	Reddish white in color containing quartz, feldspar, garnet and sillimanite	89
86	87.5	1.5	1.49	99.33	1.49	1.5	Khondalite	HQ	Reddish white in color containing quartz, feldspar, garnet and sillimanite	91
87.5	89	1.5	1.5	100	0.63	0.63	Khondalite	HQ	Reddish white in color containing quartz, feldspar, garnet and sillimanite	71
					0.87	0.87	Garnetiferous quartzite	HQ	Medium grained rock composed of quartz,garnet and traces of pyrite.	37
89	90.5	1.5	1.5	100	1.5	1.5	Quartzo-feldspathic graphite gneiss	HQ	Greyish colored coarse grained rock showing alternate gneissic band of graphite rich layers and quartz feldspar rich layers	73
90.5	92	1.5	1.5	100	1.5	1.5	Quartzo-feldspathic graphite gneiss	HQ	Greyish colored coarse grained rock showing	79

Annexure -VII: Summarised litho log sheet of DSBH-3 of Darukona Block, Rayagada District, Odisha

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LONGITUDE - 83°36'26.91"							WATER LEVEL AT THE TIME OF COMPLETION: 15.65 m			
RUN		TOTAL RUN LENGTH (m)	CORE				LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
DEPTH FROM (m)	DEPTH TO (m)		TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	RECOVERY OF LITHO- UNITS (m)	EXTRAPOLATED THICKNESS (m)				
									alternate gneissic band of graphite rich layers and quartz feldspar rich layers	
92	93.5	1.5	1.44	96	1.44	1.5	Khondalite	HQ	Reddish white in color containing quartz, feldspar, garnet and sillimanite. Seems to be a gradational rock.	67
93.5	95	1.5	1.47	98	1.47	1.5	Khondalite	HQ	Reddish white in color containing quartz, feldspar, garnet and sillimanite. Seems to be a gradational rock.	61
95	96.5	1.5	1.49	99.33	1.49	1.5	Khondalite	HQ	Reddish white in color containing quartz, feldspar, garnet and sillimanite. Also containing pyrite along the fracture plane.	64
96.5	98	1.5	1.49	99.33	1.49	1.5	Khondalite	HQ	Reddish white in color containing quartz, feldspar, garnet and sillimanite. Seems to be a gradational rock.	51
98	99.5	1.5	1.5	100	1.5	1.5	Charnockite	HQ	Dark coloured greenish grained rock with quartz and feldspar.	71
99.5	101	1.5	1.5	100	1.17	1.17	Charnockite	HQ	Dark coloured greenish grained rock with quartz and	47

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RUN		CORE					LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
DEPTH FROM (m)	DEPTH TO (m)	TOTAL RUN LENGTH (m)	TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	CORE RECOVERY OF LITHO-UNITS (m)	EXTRAPOLATED THICKNESS (m)				
									feldspar.	
					0.31	0.33	Khondalite	HQ	Reddish white in color containing quartz, feldspar, garnet and sillimanite.	67
101	102.5	1.5	1.5	100	1.06	1.08	Khondalite	HQ	Reddish white in color containing quartz, feldspar, garnet and sillimanite.	60
					0.4	0.42	Garnetiferous quartzite	HQ	Medium grained rock composed of quartz,garnet and traces of pyrite.	0
102.5	104	1.5	1.44	96	1.44	1.5	Khondalite	HQ	Reddish white in color containing quartz, feldspar, garnet and sillimanite.	71
104	105.5	1.5	1.49	99.33	1.49	1.5	Garnetiferous quartzite	HQ	Medium grained rock composed of quartz,garnet and traces of pyrite.	77
105.5	106.5	1	1	100	1	1	Garnetiferous quartzite	HQ	Medium grained rock composed of quartz,garnet and traces of pyrite.	93
106.5	108	1.5	1.42	94.67	1.23	1.3	Garnetiferous quartzite	HQ	Medium grained rock composed of quartz,garnet and traces of pyrite.	38
					0.19	0.2	Khondalite with graphite	HQ	Coarse grained greyish red colored rock containing alternate bands of graphite	95

Annexure -VII: Summarised litho log sheet of DSBH-3 of Darukona Block, Rayagada District, Odisha

BOREHOLE NO. - DSBH-3							DATE OF COMMENCEMENT : 24.01.2025			
LATITUDE - 19°26'37.43"							DATE OF COMPLETION: 17.02.2025			
LONGITUDE - 83°36'26.91"							WATER LEVEL AT THE TIME OF COMPLETION: 15.65 m			
RUN		CORE					LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
DEPTH FROM (m)	DEPTH TO (m)	TOTAL RUN LENGTH (m)	TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	CORE RECOVERY OF LITHO-UNITS (m)	EXTRAPOLATED THICKNESS (m)				
									rich layers and garnet sillimanite rich layers	
108	109.5	1.5	1.47	98	0.13	0.13	Khondalite with graphite	HQ	Coarse grained greyish red colored rock containing alternate bands of graphite rich layers and garnet sillimanite rich layers	100
					1.34	1.37	Khondalite	HQ	Reddish white in color containing quartz, feldspar, garnet and sillimanite. With traces of pyrite.	86
109.5	111	1.5	1.48	98.67	1.48	1.5	Khondalite	HQ	Reddish white in color containing quartz, feldspar, garnet and sillimanite.	76
111	112.5	1.5	1.47	98.00	1.47	1.5	Khondalite	HQ	Reddish white in color containing quartz, feldspar, garnet, sillimanite and biotite	85
112.5	113.5	1	0.98	98.00	0.98	1	Khondalite	HQ	Reddish white in color containing quartz, feldspar, garnet, sillimanite and 19 cm thin biotite rich layers	78
113.5	114.5	1	0.98	98.00	0.98	1	Khondalite	HQ	Reddish white in color containing quartz, feldspar, garnet and sillimanite.	86
114.5	116	1.5	1.38	92.00	1.38	1.5	Leptynite	HQ	Whitish colored rock	46

Annexure -VII: Summarised litho log sheet of DSBH-3 of Darukona Block, Rayagada District, Odisha

BOREHOLE NO. - DSBH-3							DATE OF COMMENCEMENT : 24.01.2025			
LATITUDE - 19°26'37.43"							DATE OF COMPLETION: 17.02.2025			
LONGITUDE - 83°36'26.91"							WATER LEVEL AT THE TIME OF COMPLETION: 15.65 m			
RUN		TOTAL RUN LENGTH (m)	CORE				LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
DEPTH FROM (m)	DEPTH TO (m)		TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	RECOVERY OF LITHO- UNITS (m)	EXTRAPOLATED THICKNESS (m)				
									containing blebs of quartz, feldspar and garnet	
116	116.5	0.5	0.5	100.00	0.5	0.5	Leptynite	HQ	Whitish colored rock containing blebs of quartz, feldspar and garnet	78
116.5	117.5	1	0.95	95.00	0.95	1	Granite gneiss	HQ	Whitish rock containing quartz, feldspar, biotite, pyrite and garnet	65
117.5	119	1.5	1.5	100.00	1.24	1.24	Granite gneiss	HQ	Whitish rock containing quartz, feldspar, biotite, pyrite and garnet	88
					0.26	0.26	Garnetiferous Quartzite	HQ	Medium to coarse grained rock composed of quartz,garnet	96
119	120.5	1.5		0.00	0.35	0.35	Garnetiferous Quartzite	HQ	Medium to coarse grained rock composed of quartz,garnet	83
					1.15	1.15	Granite gneiss	HQ	Whitish rock containing quartz, feldspar, biotite, pyrite and garnet	98
120.5	122	1.5	1.48	98.67	0.15	0.15	Granite gneiss	HQ	Whitish rock containing quartz, feldspar, biotite, pyrite and garnet	100
					1.33	1.35	Garnetiferous Quartzite	HQ	Medium to coarse grained rock composed of	0

Annexure -VII: Summarised litho log sheet of DSBH-3 of Darukona Block, Rayagada District, Odisha

BOREHOLE NO. - DSBH-3							DATE OF COMMENCEMENT : 24.01.2025			
LATITUDE - 19°26'37.43"							DATE OF COMPLETION: 17.02.2025			
LONGITUDE - 83°36'26.91"							WATER LEVEL AT THE TIME OF COMPLETION: 15.65 m			
RUN		CORE					LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
DEPTH FROM (m)	DEPTH TO (m)	TOTAL RUN LENGTH (m)	TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	CORE RECOVERY OF LITHO- UNITS (m)	EXTRAPOLATED THICKNESS (m)				
									quartz,garnet	
122	123.5	1.5	1.49	99.33	0.39	0.39	Fault Breccia	HQ	Brecciated rock containing fragments of garnetiferous quartzite and khondalite	
					1.1	1.11	Khondalite	HQ	Reddish white colored and highly fractured rock containing quartz, feldspar, garnet, sillimanite	0
123.5	125	1.5	1.48	98.67	1.48	1.5	Khondalite	HQ	Reddish white colored rock containing quartz, feldspar, garnet, sillimanite	58
125	126.5	1.5	1.5	100.00	1.5	1.5	Khondalite	HQ	Reddish white colored rock containing quartz, feldspar, garnet, sillimanite	57
126.5	128	1.5	1.5	100.00	1.5	1.5	Khondalite	HQ	Reddish white colored rock containing quartz, feldspar, garnet, sillimanite	79
128	129.5	1.5	1.5	100.00	0.19	0.19	Khondalite	HQ	Reddish white colored rock containing quartz, feldspar, garnet, sillimanite	0
					1.31	1.31	Quartzo-feldspathic graphite gneiss	HQ	Greyish colored rock showing alternate bands of graphite rich band and garnet-quartz-feldspar rich bands	90
129.5	131	1.5	1.47	98.00	1.47	1.5	Quartzo-feldspathic	HQ	Greyish colored rock showing	77

Annexure -VII: Summarised litho log sheet of DSBH-3 of Darukona Block, Rayagada District, Odisha

BOREHOLE NO. - DSBH-3							DATE OF COMMENCEMENT : 24.01.2025			
LATITUDE - 19°26'37.43"							DATE OF COMPLETION: 17.02.2025			
LONGITUDE - 83°36'26.91"							WATER LEVEL AT THE TIME OF COMPLETION: 15.65 m			
RUN		TOTAL RUN LENGTH (m)	CORE				LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
DEPTH FROM (m)	DEPTH TO (m)		TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	RECOVERY OF LITHO- UNITS (m)	EXTRAPOLATED THICKNESS (m)				
							graphite gneiss		alternate bands of graphite rich band and garnet-quartz-feldspar rich bands	
131	132.5	1.5	1.5	100.00	1.5	1.5	Quartzo-feldspathic graphite gneiss	HQ	Greyish colored rock showing alternate bands of graphite rich band and garnet-quartz-feldspar rich bands	83
132.5	134	1.5	1.5	100.00	0.98	0.98	Khondalite with graphite	HQ	Coarse grained greyish colored migmatized rock containing alternate bands of graphite rich layers and garnet sillimanite rich layers	98
		0			0.52	0.52	Khondalite	HQ	Reddish white colored migmatized rock containing quartz, feldspar, garnet and sillimanite	73
134	135.5	1.5	1.49	99.33	1.49	1.5	Khondalite	HQ	Reddish white colored migmatized rock containing quartz, feldspar, garnet and sillimanite	52
135.5	137	1.5	1.49	99.33	1.49	1.5	Khondalite	HQ	Reddish white colored migmatized rock containing quartz, feldspar, garnet and sillimanite	87
137	138.5	1.5	1.5	100.00	1.5	1.5	Khondalite	HQ	Reddish white colored	96

Annexure -VII: Summarised litho log sheet of DSBH-3 of Darukona Block, Rayagada District, Odisha

BOREHOLE NO. - DSBH-3							DATE OF COMMENCEMENT : 24.01.2025			
LATITUDE - 19°26'37.43"							DATE OF COMPLETION: 17.02.2025			
LONGITUDE - 83°36'26.91"							WATER LEVEL AT THE TIME OF COMPLETION: 15.65 m			
RUN		TOTAL RUN LENGTH (m)	CORE				LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
DEPTH FROM (m)	DEPTH TO (m)		TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	RECOVERY OF LITHO- UNITS (m)	EXTRAPOLATED THICKNESS (m)				
									migmatized rock containing quartz, feldspar, garnet and sillimanite	
138.5	140	1.5	1.5	93.33	1.5	1.5	Khondalite	HQ	Reddish white colored migmatized rock containing quartz, feldspar, garnet and sillimanite	41
140	141.5	1.5	1.4	97.33	1.4	1.5	Graphite bearing migmatized khondalite	HQ	Coarse grained greyish colored migmatized rock containing alternate bands of graphite rich layers and garnet sillimanite rich layers together with containing biotite	31
141.5	143	1.5	1.46	100.00	1.46	1.5	Graphite bearing migmatized khondalite	HQ	Coarse grained greyish colored migmatized rock containing alternate bands of graphite rich layers and garnet sillimanite rich layers together with containing biotite	83
143	144.5	1.5	1.5	100.00	1.5	1.5	Khondalite	HQ	Reddish white colored and migmatized rock containing quartz, feldspar, garnet and sillimanite	87

Annexure -VII: Summarised litho log sheet of DSBH-3 of Darukona Block, Rayagada District, Odisha

BOREHOLE NO. - DSBH-3							DATE OF COMMENCEMENT : 24.01.2025			
LATITUDE - 19°26'37.43"							DATE OF COMPLETION: 17.02.2025			
LONGITUDE - 83°36'26.91"							WATER LEVEL AT THE TIME OF COMPLETION: 15.65 m			
RUN		TOTAL RUN LENGTH (m)	CORE				LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
DEPTH FROM (m)	DEPTH TO (m)		TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	RECOVERY OF LITHO- UNITS (m)	EXTRAPOLATED THICKNESS (m)				
144.5	146	1.5	1.5	95.33	1.5	1.5	Khondalite	HQ	Reddish white colored and migmatized rock containing quartz, feldspar, garnet and sillimanite	80
146	147.5	1.5	1.43	100.00	1.43	1.5	Khondalite	HQ	Reddish white colored and migmatized rock containing quartz, feldspar, garnet and sillimanite	89
147.5	149	1.5	1.5		0.9	0.9	Khondalite	HQ	Reddish white colored and migmatized rock containing quartz, feldspar, garnet and sillimanite	96
					0.27	0.27	Mafic granulite	HQ	Dark colored medium to coarse grained rock containing quartz, feldspar and pyroxene	0
				100.00	0.33	0.33	Khondalite	HQ	Reddish white colored and migmatized rock containing quartz, feldspar, garnet and sillimanite	67
149	150.5	1.5	1.5	93.33	1.5	1.5	Khondalite	HQ	whitish colored coarse grained granite gneiss like rock containing quartz, feldspar, garnet, sillimanite and biotite and pyrite	43

Annexure -VII: Summarised litho log sheet of DSBH-3 of Darukona Block, Rayagada District, Odisha

BOREHOLE NO. - DSBH-3							DATE OF COMMENCEMENT : 24.01.2025			
LATITUDE - 19°26'37.43"							DATE OF COMPLETION: 17.02.2025			
LONGITUDE - 83°36'26.91"							WATER LEVEL AT THE TIME OF COMPLETION: 15.65 m			
RUN		CORE					LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
DEPTH FROM (m)	DEPTH TO (m)	TOTAL RUN LENGTH (m)	TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	CORE RECOVERY OF LITHO-UNITS (m)	EXTRAPOLATED THICKNESS (m)				
150.5	152	1.5	1.4	93.33	1.4	1.5	Khondalite	HQ	whitish colored coarse grained granite gneiss like rock containing quartz, feldspar, garnet, sillimanite and biotite and pyrite	31
152	153.5	1.5	1.4	93.33	1.4	1.5	Khondalite	HQ	whitish colored coarse grained granite gneiss like rock containing quartz, feldspar, garnet, sillimanite and biotite and pyrite	21
153.5	155	1.5	1.5	100.00	0.6	0.6	Khondalite	HQ	whitish colored coarse grained granite gneiss like rock containing quartz, feldspar, garnet, sillimanite and pyrite	
					0.9	0.9	Khondalite with graphite	HQ	whitish colored coarse grained granite gneiss like rock containing quartz, feldspar, garnet, sillimanite and few graphite and pyrite rich layers	74
155	156.5	1.5	1.43	95.33	1.43	1.5	Granite gneiss	HQ	Whitish colored rock containing quartz feldspar garnet biotite and pyrite	51

Annexure -VII: Summarised litho log sheet of DSBH-3 of Darukona Block, Rayagada District, Odisha										
BOREHOLE NO. - DSBH-3							DATE OF COMMENCEMENT : 24.01.2025			
LATITUDE - 19°26'37.43"							DATE OF COMPLETION: 17.02.2025			
LONGITUDE - 83°36'26.91"							WATER LEVEL AT THE TIME OF COMPLETION: 15.65 m			
RUN		CORE					LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
DEPTH FROM (m)	DEPTH TO (m)	TOTAL RUN LENGTH (m)	TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	CORE RECOVERY OF LITHO-UNITS (m)	EXTRAPOLATED THICKNESS (m)				
156.5	156.85	0.35	0.35	100.00	0.35	0.35	Granite gneiss	HQ	Whitish colored rock containing quartz feldspar garnet biotite and pyrite	69
THE BOREHOLE WAS CLOSED ON 17.02.2025 AT 156.85 M DEPTH IN GRANITE GNEISS										

Annexure -VIII: Summarised litho log sheet of DSBH-4 of Darukona Block, Rayagada District, Odisha

BOREHOLE NO. - DSBH-4							DATE OF COMMENCEMENT : 19.02.2025			
LATITUDE - 19°26'32.7"							DATE OF COMPLETION: 26.02.2025			
LONGITUDE - 83°36'29.2"							WATER LEVEL AT THE TIME OF COMPLETION: 32.30 m			
RUN		TOTAL RUN LENGTH (m)	CORE							
DEPTH FROM (m)	DEPTH TO (m)		TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	CORE RECOVERY OF LITHO- UNITS (m)	EXTRAPOLATED THICKNESS (m)	LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
0	0.4	0.4	0.4	100	0.4	0.4	TOP SOIL	HQ	Brownish red colored	0
0.4	1	0.6	0.6	100	0.6	0.6	TOP SOIL	HQ	Brownish red colored	0
1	1.5	0.5	0.5	100	0.5	0.5	TOP SOIL	HQ	Brownish red colored	0
1.5	2	0.5	0.5	100	0.5	0.5	TOP SOIL	HQ	Brownish red colored	0
2	2.5	0.5	0.5	100	0.5	0.5	TOP SOIL	HQ	Brownish red colored	0
2.5	3	0.5	0.5	100	0.5	0.5	TOP SOIL	HQ	Brownish red colored	0
3	3.5	0.5	0.5	100	0.5	0.5	TOP SOIL	HQ	Brownish red colored	0
3.5	4	0.5	0.5	100	0.5	0.5	TOP SOIL	HQ	Brownish red colored	0
4	4.5	0.5	0.5	100	0.5	0.5	TOP SOIL	HQ	Brownish red colored	0
4.5	5	0.5	0.5	100	0.5	0.5	TOP SOIL	HQ	Brownish red colored	0
5	5.5	0.5	0.5	100	0.5	0.5	TOP SOIL	HQ	Brownish red colored	0
5.5	6	0.5	0.5	100	0.5	0.5	TOP SOIL	HQ	Brownish red colored	0
6	7	1	1	100	1	1	TOP SOIL	HQ	Brownish red colored	0
7	8	1	1	100	1	1	TOP SOIL	HQ	Brownish red colored	0
8	9.5	1.5	1.5	100	1.5	1.5	WEATHERED MANTLE	HQ	Brownish white in color with fragments of leptynite	0
9.5	11	1.5	1.5	100	1.5	1.5	WEATHERED MANTLE	HQ	Brownish white in color with fragments of leptynite	0
11	12.5	1.5	1.4	93.33	1.4	1.5	Leptynitte	HQ	Whitish Colored rock containing blebs of quartz, feldspar, garnet	63
12.5	14	1.5	1.33	88.67	1.33	1.5	Leptynitte	HQ	Whitish Colored rock containing blebs of quartz,	68

Annexure -VIII: Summarised litho log sheet of DSBH-4 of Darukona Block, Rayagada District, Odisha

BOREHOLE NO. - DSBH-4							DATE OF COMMENCEMENT : 19.02.2025			
LATITUDE - 19°26'32.7"							DATE OF COMPLETION: 26.02.2025			
LONGITUDE - 83°36'29.2"							WATER LEVEL AT THE TIME OF COMPLETION: 32.30 m			
RUN		TOTAL RUN LENGTH (m)	CORE				LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
DEPTH FROM (m)	DEPTH TO (m)		TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	RECOVERY OF LITHO- UNITS (m)	EXTRAPOLATED THICKNESS (m)				
									feldspar and garnet	
14	15.5	1.5	1.4	93.33\	1.4	1.5	Leptynitte	HQ	Whitish Colored highly fragmented rock containing blebs of quartz, feldspar and garnet	0
15.5	17	1.5	1.36	90.67	1.36	1.5	Leptynitte	HQ	Whitish Colored highly fragmented rock containing blebs of quartz, feldspar and garnet	0
17	18.5	1.5	1.45	96.67	1.45	1.5	Leptynitte	HQ	Whitish Colored highly fragmented rock containing blebs of quartz, feldspar and garnet	0
18.5	20	1.5	1.41	94	1.41	1.5	Leptynitte	HQ	Whitish Colored highly fragmented rock containing blebs of quartz, feldspar and garnet	15
20	21.5	1.5	1.4	93.33	1.4	1.5	Leptynitte	HQ	Whitish Colored highly fragmented rock containing blebs of quartz, feldspar and garnet	78
21.5	23	1.5	1.4	93.33	1.4	1.5	Leptynitte	HQ	Whitish Colored highly fragmented rock containing blebs of quartz, feldspar and	34

Annexure -VIII: Summarised litho log sheet of DSBH-4 of Darukona Block, Rayagada District, Odisha

BOREHOLE NO. - DSBH-4							DATE OF COMMENCEMENT : 19.02.2025			
LATITUDE - 19°26'32.7"							DATE OF COMPLETION: 26.02.2025			
LONGITUDE - 83°36'29.2"							WATER LEVEL AT THE TIME OF COMPLETION: 32.30 m			
RUN		TOTAL RUN LENGTH (m)	CORE				LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
DEPTH FROM (m)	DEPTH TO (m)		TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	RECOVERY OF LITHO- UNITS (m)	EXTRAPOLATED THICKNESS (m)				
									garnet with thin bands of biotite	
23	24.5	1.5	1.43	95.33	1.43	1.5	Granite gneiss	HQ	Pinkish colored coarsed grained rock containing quartz, feldspar and biotite	31
24.5	25.5	1	1	100	1	1	Granite gneiss	HQ	Pinkish colored coarsed grained rock containing quartz, feldspar and biotite	27
25.5	27	1.5	1.5	100	1.5	1.5	Granite gneiss	HQ	Pinkish colored coarsed grained rock containing quartz, feldspar and biotite	17
27	28.5	1.5	1.49	99.33	1.23	1.23	Granite gneiss	HQ	Pinkish colored coarsed grained rock containing quartz, feldspar and biotite	37
					0.26	0.27	Leptynitte	HQ	Whitish Colored highly fragmented rock containing blebs of quartz, feldspar and garnet with thin bands of biotite	100
28.5	30	1.5	1.43	95.33	1.43	1.5	Granite gneiss	HQ	Pinkish colored coarsed grained rock containing quartz, feldspar and biotite	70
30	31.5	1.5	1.5	100	1.5	1.5	Granite gneiss	HQ	Pinkish colored coarsed grained rock containing	32

Annexure -VIII: Summarised litho log sheet of DSBH-4 of Darukona Block, Rayagada District, Odisha

BOREHOLE NO. - DSBH-4							DATE OF COMMENCEMENT : 19.02.2025			
LATITUDE - 19°26'32.7"							DATE OF COMPLETION: 26.02.2025			
LONGITUDE - 83°36'29.2"							WATER LEVEL AT THE TIME OF COMPLETION: 32.30 m			
RUN		TOTAL RUN LENGTH (m)	CORE				LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
DEPTH FROM (m)	DEPTH TO (m)		TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	CORE RECOVERY OF LITHO- UNITS (m)	EXTRAPOLATED THICKNESS (m)				
									quartz, feldspar and biotite	
31.5	33	1.5	1.5	100	0.1	0.1	Granite gneiss	HQ	Pinkish colored coarsed grained rock containing quartz, feldspar and biotite	100
					0.5	0.5	Granite gneiss with graphite	HQ	Pinkish colored coarsed grained rock containing graphite quartz, feldspar and biotite	0
					0.22	0.22	Granite gneiss	HQ	Pinkish colored coarsed grained rock containing quartz, feldspar and biotite	100
					0.68	0.68	Leptynitte	HQ	Whitish Colored highly fragmented rock containing blebs of quartz, feldspar, garnet with bands of biotite	78
33	34.5	1.5	1.48	98.67	1.48	1.5	Leptynitte	HQ	Whitish Colored highly fragmented rock containing blebs of quartz, feldspar and garnet	78
34.5	36	1.5	1.37	91.33	0.55	0.6	Leptynitte	HQ	Whitish Colored highly fragmented rock containing blebs of quartz, feldspar and garnet	55
					0.82	0.9	Granite gneiss	HQ	Pinkish white colored coarsed	44

Annexure -VIII: Summarised litho log sheet of DSBH-4 of Darukona Block, Rayagada District, Odisha

BOREHOLE NO. - DSBH-4							DATE OF COMMENCEMENT : 19.02.2025			
LATITUDE - 19°26'32.7"							DATE OF COMPLETION: 26.02.2025			
LONGITUDE - 83°36'29.2"							WATER LEVEL AT THE TIME OF COMPLETION: 32.30 m			
RUN		TOTAL RUN LENGTH (m)	CORE				LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
DEPTH FROM (m)	DEPTH TO (m)		TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	CORE RECOVERY OF LITHO- UNITS (m)	EXTRAPOLATED THICKNESS (m)				
									grained rock containing quartz, feldspar and biotite	
36	37.5	1.5	1.46	97.33	1.46	1.5	Granite gneiss	HQ	Pinkish white colored coarsed grained rock containing quartz, feldspar and biotite	79
37.5	39	1.5	1.46	97.33	1.46	1.5	Granite gneiss	HQ	Pinkish white colored coarsed grained fractured rock containing quartz, feldspar and biotite and opaque	0
39	40.5	1.5	1.5	100		1.5	Khondalite	HQ	Pinkish colored rock containing very thin bands (less than 5 cm) of graphite	0
40.5	42	1.5	1.45	96.67	1.45	1.5	Khondalite	HQ	Pinkish colored rock with alternate bands of garnet rich layers and quartz feldspar rich layers	43
42	43	1	1	100	1	1	Khondalite	HQ	Pinkish colored rock with alternate bands of garnet rich layers and quartz feldspar rich layers	14
43	44.5	1.5	1.46	97.33	0.22	0.24	Khondalite	HQ	Pinkish colored rock with alternate bands of garnet rich layers and quartz feldspar rich layers	45

Annexure -VIII: Summarised litho log sheet of DSBH-4 of Darukona Block, Rayagada District, Odisha

BOREHOLE NO. - DSBH-4							DATE OF COMMENCEMENT : 19.02.2025			
LATITUDE - 19°26'32.7"							DATE OF COMPLETION: 26.02.2025			
LONGITUDE - 83°36'29.2"							WATER LEVEL AT THE TIME OF COMPLETION: 32.30 m			
RUN		TOTAL RUN LENGTH (m)	CORE							
DEPTH FROM (m)	DEPTH TO (m)		TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	CORE RECOVERY OF LITHO- UNITS (m)	EXTRAPOLATED THICKNESS (m)	LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
					0.98	0.98	Granite gneiss	HQ	Whitish colored rock containing quartz, feldspar and biotite	47
					0.26	0.28	Khondalite with graphite	HQ	Pinkish colored rock with alternate bands of garnet rich layers and quartz feldspar rich layers with graphite flakes along foliation plane	0
44.5	46	1.5	1.48	98.67	0.85	0.85	Khondalite with graphite	HQ	Pinkish colored rock with alternate bands of garnet rich layers and quartz feldspar rich layers with graphite flakes along foliation plane	65
					0.63	0.65	Khondalite	HQ	Pinkish colored rock with alternate bands of garnet rich layers and quartz feldspar rich layers	38
46	47.5	1.5	1.5	100	1.5	1.5	Khondalite	HQ	Pinkish colored rock with alternate bands of garnet rich layers and quartz feldspar rich layers	54
47.5	49	1.5	1.46	97.33	1.4	1.44	Khondalite	HQ	Pinkish colored rock with alternate bands of garnet rich layers and quartz feldspar	46

Annexure -VIII: Summarised litho log sheet of DSBH-4 of Darukona Block, Rayagada District, Odisha

BOREHOLE NO. - DSBH-4							DATE OF COMMENCEMENT : 19.02.2025			
LATITUDE - 19°26'32.7"							DATE OF COMPLETION: 26.02.2025			
LONGITUDE - 83°36'29.2"							WATER LEVEL AT THE TIME OF COMPLETION: 32.30 m			
RUN		TOTAL RUN LENGTH (m)	CORE				LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
DEPTH FROM (m)	DEPTH TO (m)		TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	RECOVERY OF LITHO- UNITS (m)	EXTRAPOLATED THICKNESS (m)				
									rich layers	
					0.06	0.06	Quartzo-feldspathic graphite gneiss	HQ	Greyish colored rock with aletrnate bands of graphite rich band and quartz feldspar rich band	0
49	50.5	1.5	1.4	93.33	1.4	1.5	Quartzo-feldspathic graphite gneiss	HQ	Greyish colored rock with aletrnative bands of graphite rich band and quartz feldspar rich band	76
50.5	52	1.5	1.5	100	1.5	1.5	Quartzo-feldspathic graphite gneiss	HQ	Greyish colored rock with aletrnate bands of graphite rich band and quartz feldspar rich band	63
52	52.5	0.5	0.5	100	0.5	0.5	Khondalite with graphite	HQ	Pinkish colored rock with alternat bands of garnet rich layers and quartz feldspar rich layers with graphite flakes along foliation plane	0
52.5	54	1.5	1.5	100	1.5	1.5	Quartzo-feldspathic graphite gneiss	HQ	Greyish colored rock with aletrnate bands of graphite rich band and quartz feldspar rich band	55
54	55.5	1.5	1.5	100	0.07	0.07	Quartzo-feldspathic graphite gneiss	HQ	Greyish colored rock with aletrnate bands of graphite	0

Annexure -VIII: Summarised litho log sheet of DSBH-4 of Darukona Block, Rayagada District, Odisha

BOREHOLE NO. - DSBH-4							DATE OF COMMENCEMENT : 19.02.2025			
LATITUDE - 19°26'32.7"							DATE OF COMPLETION: 26.02.2025			
LONGITUDE - 83°36'29.2"							WATER LEVEL AT THE TIME OF COMPLETION: 32.30 m			
RUN		TOTAL RUN LENGTH (m)	CORE				LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
DEPTH FROM (m)	DEPTH TO (m)		TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	CORE RECOVERY OF LITHO- UNITS (m)	EXTRAPOLATED THICKNESS (m)				
									rich band and quartz feldspar rich band	
					0.57	0.57	Khondalite	HQ	Pinkish colored rock with aletrnate bands of garnet rich layers and quartz feldspar rich layers	0
					0.86	0.86	Khondalite with graphite	HQ	Pinkish colored rock with aletrnate bands of garnet rich layers and quartz feldspar rich layers with graphite flakes along foliation plane	0
55.5	57	1.5	1.5	100	1.5	1.5	Khondalite with graphite	HQ	Pinkish colored rock with aletrnate bands of garnet rich layers and quartz feldspar rich layers with graphite flakes along foliation plane	55
57	58.5	1.5	1.42	94.67	0.2	0.22	Khondalite with graphite	HQ	Pinkish colored rock with aletrnate bands of garnet rich layers and quartz feldspar rich layers with graphite flakes along foliation plane	50
					1.22	1.28	Khondalite	HQ	Pinkish colored rock with aletrnate bands of garnet rich layers and quartz feldspar	16

Annexure -VIII: Summarised litho log sheet of DSBH-4 of Darukona Block, Rayagada District, Odisha

BOREHOLE NO. - DSBH-4							DATE OF COMMENCEMENT : 19.02.2025			
LATITUDE - 19°26'32.7"							DATE OF COMPLETION: 26.02.2025			
LONGITUDE - 83°36'29.2"							WATER LEVEL AT THE TIME OF COMPLETION: 32.30 m			
RUN		TOTAL RUN LENGTH (m)	CORE				LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
DEPTH FROM (m)	DEPTH TO (m)		TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	RECOVERY OF LITHO- UNITS (m)	EXTRAPOLATED THICKNESS (m)				
									rich layers	
58.5	60	1.5	1.46	97.33	0.85	0.88	Khondalite	HQ	Pinkish colored rock with aletrnate bands of garnet rich layers and quartz feldspar rich layers	18
					0.61	0.62	Khondalite with graphite	HQ	Pinkish colored rock with aletrnate bands of garnet rich layers and quartz feldspar rich layers with graphite flakes along foliation plane	69
60	61.5	1.5	1.4	93.33	0.83	0.85	Khondalite with graphite	HQ	Pinkish colored rock with aletrnate bands of garnet rich layers and quartz feldspar rich layers with graphite flakes along foliation plane	71
					0.39	0.44	Quartzite	HQ		85
					0.18	0.21	Quartzo-feldspathic graphite gneiss	HQ	Greyish colored rock with aletrnate bands of graphite rich band and quartz feldspar rich band	100
61.5	63	1.5	1.38	92	0.28	0.3	Quartzo-feldspathic graphite gneiss	HQ	Greyish colored rock with aletrnate bands of graphite rich band and quartz feldspar rich band	0

Annexure -VIII: Summarised litho log sheet of DSBH-4 of Darukona Block, Rayagada District, Odisha

BOREHOLE NO. - DSBH-4							DATE OF COMMENCEMENT : 19.02.2025			
LATITUDE - 19°26'32.7"							DATE OF COMPLETION: 26.02.2025			
LONGITUDE - 83°36'29.2"							WATER LEVEL AT THE TIME OF COMPLETION: 32.30 m			
RUN		TOTAL RUN LENGTH (m)	CORE				LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
DEPTH FROM (m)	DEPTH TO (m)		TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	RECOVERY OF LITHO- UNITS (m)	EXTRAPOLATED THICKNESS (m)				
					1.1	1.2	Granite gneiss	HQ	Whitish colored rock containing quartz, feldspar and biotite	44
63	64.5	1.5	1.45	96.67	1.45	1.5	Granite gneiss	HQ	Whitish colored rock containing quartz, feldspar, biotite & garnet	59
64.5	66	1.5	1.4	93.33	1.4	1.5	Granite gneiss	HQ	Whitish colored rock containing quartz, feldspar, biotite & garnet	61
66	67.5	1.5	1.44	96	1.44	1.5	Garnetiferous Quartzite	HQ	Medium to coarse grained rock composed of quartz & garnet	54
67.5	69	1.5	1.38	92	1.38	1.5	Garnetiferous Quartzite	HQ	Medium to coarse grained rock composed of quartz & garnet	55
69	70.5	1.5	1.43	95.33	1.43	1.5	Garnetiferous Quartzite	HQ	Medium to coarse grained rock composed of quartz & garnet	45
70.5	72	1.5	1.46	97.33	1.46	1.5	Garnetiferous Quartzite	HQ	Medium to coarse grained rock composed of quartz & garnet	51
72	73.5	1.5	1.49	99.33	1.49	1.5	Garnetiferous Quartzite	HQ	Medium to coarse grained rock composed of quartz & garnet	34

Annexure -VIII: Summarised litho log sheet of DSBH-4 of Darukona Block, Rayagada District, Odisha

BOREHOLE NO. - DSBH-4							DATE OF COMMENCEMENT : 19.02.2025			
LATITUDE - 19°26'32.7"							DATE OF COMPLETION: 26.02.2025			
LONGITUDE - 83°36'29.2"							WATER LEVEL AT THE TIME OF COMPLETION: 32.30 m			
RUN		TOTAL RUN LENGTH (m)	CORE							
DEPTH FROM (m)	DEPTH TO (m)		TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	CORE RECOVERY OF LITHO- UNITS (m)	EXTRAPOLATED THICKNESS (m)	LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
73.5	75	1.5	1.48	98.67	1.48	1.5	Garnetiferous Quartzite	HQ	Medium to coarse grained rock composed of quartz & garnet	62
75	76.5	1.5	1.49	99.33	1.49	1.5	Garnetiferous Quartzite	HQ	Medium to coarse grained rock composed of quartz & garnet	43
76.5	78	1.5	1.5	100	1.5	1.5	Garnetiferous Quartzite	HQ	Medium to coarse grained rock composed of quartz & garnet. Vertical fracture encountered.	43
78	79.5	1.5	1.48	98.67	1.48	1.5	Granite gneiss	HQ	Whitish colored rock containing quartz, feldspar, biotite & garnet.	31
79.5	81	1.5	1.49	99.33	1.49	1.5	Granite gneiss	HQ	Whitish colored rock containing quartz, feldspar, biotite & garnet.	63
81	82.5	1.5	1.44	96	1.44	1.5	Granite gneiss	HQ	Whitish colored rock containing quartz, feldspar, biotite & garnet.	49
82.5	84	1.5	1.5	100	1.3	1.3	Granite gneiss	HQ	Whitish colored rock containing quartz, feldspar, biotite & garnet.	80
					0.2	0.2	Quartzo-feldspathic graphite gneiss	HQ	Greyish colored rock with aletrnate bands of graphite	100

Annexure -VIII: Summarised litho log sheet of DSBH-4 of Darukona Block, Rayagada District, Odisha

BOREHOLE NO. - DSBH-4							DATE OF COMMENCEMENT : 19.02.2025			
LATITUDE - 19°26'32.7"							DATE OF COMPLETION: 26.02.2025			
LONGITUDE - 83°36'29.2"							WATER LEVEL AT THE TIME OF COMPLETION: 32.30 m			
RUN		TOTAL RUN LENGTH (m)	CORE				LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
DEPTH FROM (m)	DEPTH TO (m)		TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	RECOVERY OF LITHO- UNITS (m)	EXTRAPOLATED THICKNESS (m)				
									rich band and quartz feldspar rich band	
84	85.5	1.5	1.46	97.33	1.46	1.5	Quartzo-feldspathic graphite gneiss	HQ	Greyish colored rock with aletrnate bands of graphite rich band and quartz feldspar rich band	80
85.5	87	1.5	1.5	100	1.5	1.5	Quartzo-feldspathic graphite gneiss	HQ	Greyish colored rock with aletrnate bands of graphite rich band and quartz feldspar rich band	83
87	88.5	1.5	1.49	99.33	1.49	1.5	Quartzo-feldspathic graphite gneiss	HQ	Greyish colored rock with aletrnate bands of graphite rich band and quartz feldspar rich band	94
88.5	90	1.5	1.5	100	1.5	1.5	Quartzo-feldspathic graphite gneiss	HQ	Greyish colored rock with aletrnate bands of graphite rich band and quartz feldspar rich band	88
90	91.5	1.5	1.45	96.67	1.45	1.5	Quartzo-feldspathic graphite gneiss	HQ	Greyish colored rock with aletrnate bands of graphite rich band and quartz feldspar rich band	86
91.5	93	1.5	1.5	100	1.1	1.1	Khondalite	HQ	Pinkish colored rock with aletrnate bands of garnet rich	47

Annexure -VIII: Summarised litho log sheet of DSBH-4 of Darukona Block, Rayagada District, Odisha

BOREHOLE NO. - DSBH-4							DATE OF COMMENCEMENT : 19.02.2025			
LATITUDE - 19°26'32.7"							DATE OF COMPLETION: 26.02.2025			
LONGITUDE - 83°36'29.2"							WATER LEVEL AT THE TIME OF COMPLETION: 32.30 m			
RUN		TOTAL RUN LENGTH (m)	CORE				LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
DEPTH FROM (m)	DEPTH TO (m)		TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	CORE RECOVERY OF LITHO- UNITS (m)	EXTRAPOLATED THICKNESS (m)				
									layers and quartz feldspar rich layers	
					0.4	0.4	Khondalite with graphite	HQ	Pinkish colored rock with aletrnate bands of garnet rich layers and quartz feldspar rich layers with graphite flakes along foliation plane	50
93	94.5	1.5	1.48	98.67	1.48	1.5	Quartzo-feldspathic graphite gneiss	HQ	Greyish colored rock with aletrnate bands of graphite rich band and quartz feldspar rich band	40
94.5	96	1.5	1.46	97.33	1.46	1.5	Quartzo-feldspathic graphite gneiss	HQ	Greyish colored rock with aletrnate bands of graphite rich band and quartz feldspar rich band	69
96	97.5	1.5	1.47	98	1.47	1.5	Quartzo-feldspathic graphite gneiss	HQ	Greyish colored rock with aletrnate bands of graphite rich band and quartz feldspar rich band	97
97.5	99	1.5	1.5	100	1.5	1.5	Quartzo-feldspathic graphite gneiss	HQ	Greyish colored rock with aletrnate bands of graphite rich band and quartz feldspar rich band	32
99	100.5	1.5	1.5	100	0.31	0.31	Quartzo-feldspathic	HQ	Greyish colored rock with	94

Annexure -VIII: Summarised litho log sheet of DSBH-4 of Darukona Block, Rayagada District, Odisha

BOREHOLE NO. - DSBH-4							DATE OF COMMENCEMENT : 19.02.2025			
LATITUDE - 19°26'32.7"							DATE OF COMPLETION: 26.02.2025			
LONGITUDE - 83°36'29.2"							WATER LEVEL AT THE TIME OF COMPLETION: 32.30 m			
RUN		TOTAL RUN LENGTH (m)	CORE							
DEPTH FROM (m)	DEPTH TO (m)		TOTAL CORE RECOVERY (m)	RECOVERY PERCENTAGE (%)	CORE RECOVERY OF LITHO- UNITS (m)	EXTRAPOLATED THICKNESS (m)	LITHOLOGY	CORE SIZE	DESCRIPTION	RQD %
							graphite gneiss		aletrnate bands of graphite rich band and quartz feldspar rich band	
					1.19	1.19	Khondalite	HQ	Pinkish colored rock with aletrnate bands of garnet rich layers and quartz feldspar rich layers	50
100.5	101.35	0.85	0.85	100	0.85	0.85	Khondalite	HQ	Pinkish colored rock with aletrnate bands of garnet rich layers and quartz feldspar rich layers	74
THE BOREHOLE WAS CLOSED ON 26.02.2025 AT 101.35 M DEPTH IN KHONDALITE										

Annexure IX Proximate analysis reports for core samples						
SL NO	SAMPLE NUMBER	MOISTURE (%)	VM (%)	ASH (%)	S (%)	FC (%)
1	DDBH - 1/ S-1	1.56	4.12	95.15	0.10	0.63
2	DDBH - 1/ S-2	1.32	3.02	96.37	0.11	0.50
3	DDBH - 1/ S-3	0.80	2.36	97.10	0.08	0.46
4	DDBH - 1/ S-4	1.59	3.82	95.43	0.13	0.62
5	DDBH - 1/ S-5	2.54	4.71	94.13	0.16	1.01
6	DDBH - 1/ S-6	1.90	3.98	93.67	0.14	2.21
7	DDBH - 1/ S-7	2.15	3.52	95.57	0.09	0.82
8	DDBH - 1/ S-8	2.88	4.04	94.09	0.12	1.76
9	DDBH - 1/ S-9	1.48	3.07	91.80	0.16	4.97
10	DDBH - 1/ S-10	0.94	2.60	96.10	0.08	1.22
11	DDBH - 1/ S-11	1.06	2.91	95.70	0.09	1.30
12	DDBH - 1/ S-12	1.02	2.78	95.87	0.11	1.24
13	DDBH - 1/ S-13	1.29	4.35	93.38	0.14	2.14
14	DDBH - 1/ S-14	0.54	1.29	98.51	0.06	0.14
15	DDBH - 1/ S-15	1.69	3.71	95.19	0.13	0.97
16	DDBH - 1/ S-16	0.96	2.68	97.08	0.08	0.16
17	DDBH - 1/ S-17	1.28	5.01	92.85	0.15	1.99
18	DDBH - 1/ S-18	1.33	5.42	91.94	0.17	2.47
19	DDBH - 1/ S-19	1.42	3.95	93.79	0.14	2.12
20	DDBH - 1/ S-20	0.56	0.59	99.07	0.04	0.30
21	DDBH - 1/ S-21	1.18	3.83	94.21	0.12	1.84
22	DDBH - 1/ S-22	1.24	3.77	94.61	0.11	1.51
23	DDBH - 1/ S-23	1.27	3.29	94.91	0.12	1.68
24	DDBH - 1/ S-24	2.09	1.03	97.62	0.07	1.29
25	DDBH - 1/ S-25	0.50	1.70	97.56	0.06	0.68
26	DDBH - 1/ S-26	0.98	1.29	97.33	0.07	1.31
27	DDBH - 1/ S-27	0.99	1.45	97.34	0.08	1.13
28	DDBH - 1/ S-28	1.28	1.88	96.82	0.10	1.20
29	DDBH - 2/ S-1	2.63	3.35	95.05	0.14	1.46
30	DDBH - 2/ S-2	2.11	1.28	98.31	0.08	0.33
31	DDBH - 2/ S-3	4.23	0.71	96.92	0.09	2.28
32	DDBH - 2/ S-4	2.00	1.35	98.32	0.06	0.27
33	DDBH - 2/ S-5	2.96	4.07	93.16	0.14	2.63
34	DDBH - 2/ S-6	2.80	3.78	93.39	0.12	2.71
35	DDBH - 2/ S-7	3.20	3.34	95.22	0.11	1.32
36	DDBH - 2/ S-8	3.40	2.79	95.76	0.09	1.37

Annexure IX Proximate analysis reports for core samples						
SL NO	SAMPLE NUMBER	MOISTURE (%)	VM (%)	ASH (%)	S (%)	FC (%)
37	DDBH - 2 /S-9	1.60	2.99	95.89	0.12	1.00
38	DDBH - 2 /S-10	2.97	4.43	92.67	0.15	2.75
39	DDBH - 2 /S-11	1.92	3.50	95.09	0.09	1.32
40	DDBH - 2 /S-12	2.04	3.02	96.01	0.07	0.90
41	DDBH - 2 /S-13	1.81	3.22	96.42	0.10	0.26
42	DDBH - 2 /S-14	1.25	3.38	96.38	0.08	0.16
43	DSBH-2 /S-1	2.88	3.54	95.96	0.14	0.36
44	DSBH-2 /S-2	2.08	2.48	97.13	0.18	0.21
45	DSBH-2 /S-3	3.49	3.35	96.17	0.16	0.32
46	DSBH-2 /S-4	2.38	2.78	96.97	0.14	0.11
47	DSBH-2 /S-5	2.25	3.77	95.56	0.18	0.49
48	DSBH-2 /S-6	2.41	3.24	96.52	0.14	0.10
49	DSBH-2 /S-7	2.40	4.58	94.55	0.18	0.69
50	DSBH-2 /S-8	2.90	4.73	93.20	0.17	1.90
51	DSBH-2 /S-9	1.98	4.28	93.64	0.17	1.91
52	DSBH-2 /S-10	3.31	3.83	95.80	0.16	0.21
53	DSBH-2 /S-11	1.38	2.69	97.07	0.15	0.08
54	DSBH-2 /S-12	1.96	4.38	94.62	0.17	0.83
55	DSBH-2 /S-13	1.67	3.60	95.72	0.14	0.54
56	DSBH-2 /S-14	0.81	2.41	97.16	0.17	0.26
57	DSBH - 2 /S-15	1.95	4.61	93.26	0.13	2.00
58	DSBH - 2 /S-16	2.15	3.43	94.64	0.11	1.82
59	DSBH - 2 /S-17	1.80	5.56	90.91	0.15	3.37
60	DSBH - 2 /S-18	0.59	3.35	89.42	0.17	7.06
61	DSBH - 2 /S-19	1.47	3.17	93.46	0.13	3.24
62	DSBH - 2 /S-20	0.99	2.55	94.14	0.11	3.20
63	DSBH - 2 /S-21	1.74	2.12	95.47	0.09	2.32
64	DSBH - 2 /S-22	2.29	3.48	94.26	0.12	2.14
65	DSBH - 2 /S-23	1.15	2.66	96.85	0.06	0.43
66	DSBH - 2 /S-24	0.95	1.52	98.09	0.04	0.35
67	DSBH - 2 /S-25	1.94	3.41	96.18	0.07	0.34
68	DSBH - 2 /S-26	1.32	1.88	93.34	0.11	4.67
69	DSBH - 2 /S-27	1.51	2.33	95.34	0.14	2.18
70	DSBH - 2 /S-28	2.54	3.88	95.57	0.12	0.43
71	DSBH - 2 /S-29	2.72	3.21	96.35	0.09	0.35
72	DSBH - 2 /S-30	1.17	1.32	98.20	0.05	0.43

Annexure IX Proximate analysis reports for core samples						
SL NO	SAMPLE NUMBER	MOISTURE (%)	VM (%)	ASH (%)	S (%)	FC (%)
73	DSBH - 2 /S-31	1.10	0.71	99.08	0.04	0.17
74	DSBH - 2 /S-32	1.70	2.76	96.04	0.08	1.12
75	DSBH - 2 /S-33	1.73	2.91	96.46	0.06	0.56
76	DSBH - 2 /S-34	2.50	1.98	96.86	0.07	1.08
77	DSBH - 2 /S-35	1.64	1.33	98.14	0.05	0.48
78	DSBH - 2 /S-36	1.28	2.07	97.52	0.09	0.32
79	DSBH - 2 /S-37	1.70	3.11	96.47	0.11	0.31
80	DSBH - 2 /S-38	1.37	3.11	96.50	0.09	0.30
81	DSBH - 2 /S-39	1.60	2.59	97.12	0.06	0.23
82	DSBH - 2 /S-40	1.19	2.98	93.49	0.11	3.42
83	DSBH - 3 /S-1	1.82	4.61	92.25	0.14	3.00
84	DSBH - 3 /S-2	1.48	3.26	92.61	0.16	3.97
85	DSBH - 3 /S-3	2.62	3.08	93.15	0.13	3.64
86	DSBH - 3 /S-4	0.90	3.32	92.43	0.15	4.10
87	DSBH - 3 /S-5	1.43	3.58	93.12	0.11	3.19
88	DSBH - 3 /S-6	1.40	3.79	93.50	0.14	2.57
89	DSBH - 3 /S-7	1.59	4.43	93.21	0.14	2.22
90	DSBH - 3 /S-8	1.74	4.23	90.25	0.17	5.35
91	DSBH - 3 /S-9	1.24	3.69	91.03	0.15	5.13
92	DSBH - 3 /S-10	1.06	3.72	93.24	0.13	2.91
93	DSBH - 3 /S-11	0.88	2.10	97.09	0.07	0.74
94	DSBH - 3 /S-12	0.65	2.20	97.27	0.08	0.45
95	DSBH - 3 /S-13	0.90	2.13	97.37	0.06	0.44
96	DSBH - 3 /S-14	1.15	2.94	96.63	0.10	0.33
97	DSBH - 3 /S-15	0.82	1.35	98.39	0.05	0.21
98	DSBH - 3 /S-16	1.10	1.41	97.95	0.07	0.57
99	DSBH - 3 /S-17	1.01	3.20	96.18	0.09	0.54
100	DSBH - 3 /S-18	0.95	2.84	96.70	0.10	0.37
101	DSBH - 3 /S-19	1.49	3.44	96.02	0.12	0.43
102	DSBH - 3 /S-20	1.49	2.24	97.37	0.08	0.31
103	DSBH - 3 /S-21	1.00	1.19	98.05	0.04	0.73
104	DSBH - 3 /S-22	1.70	3.15	95.90	0.11	0.84
105	DSBH - 3 /S-23	2.17	5.01	92.22	0.16	2.61
106	DSBH - 3 /S-24	2.08	4.72	93.57	0.12	1.59
107	DSBH - 3 /S-25	1.98	3.19	90.27	0.18	6.36
108	DSBH - 3 /S-26	1.03	0.90	98.64	0.06	0.40

Annexure IX Proximate analysis reports for core samples						
SL NO	SAMPLE NUMBER	MOISTURE (%)	VM (%)	ASH (%)	S (%)	FC (%)
109	DSBH - 3 /S-27	1.59	2.07	97.40	0.08	0.45
110	DSBH - 3 /S-28	1.43	2.37	96.99	0.13	0.51
111	DSBH - 3 /S-29	0.93	0.93	98.66	0.05	0.36
112	DSBH - 3 /S-30	1.12	0.72	98.86	0.04	0.38
113	DSBH-4/S-1	1.45	1.61	97.85	0.07	0.47
114	DSBH-4/S-2	1.74	1.92	96.97	0.10	1.01
115	DSBH-4/S-3	1.90	3.54	94.15	0.13	2.18
116	DSBH-4/S-4	2.00	3.53	94.92	0.11	1.43
117	DSBH-4/S-5	2.46	3.05	96.48	0.08	0.39
118	DSBH-4/S-6	2.20	4.27	94.63	0.14	0.96
119	DSBH-4/S-7	1.22	3.40	95.57	0.12	0.90
120	DSBH-4/S-8	0.95	2.03	97.67	0.08	0.22
121	DSBH-4/S-9	1.15	2.84	96.68	0.10	0.38
122	DSBH-4/S-10	1.45	3.36	96.08	0.11	0.45
123	DSBH-4/S-11	0.90	3.77	95.33	0.14	0.76
124	DSBH-4/S-12	0.60	1.52	98.09	0.07	0.32
125	DSBH-4/S-13	0.10	0.63	98.91	0.05	0.41
126	DSBH-4/S-14	0.69	3.78	95.59	0.09	0.55
127	DSBH-4/S-15	0.84	2.35	97.18	0.13	0.34
128	DSBH-4/S-16	1.25	3.60	95.82	0.15	0.44
129	DSBH-4/S-17	1.15	3.50	95.07	0.16	1.27
130	DSBH-4/S-18	0.89	3.76	95.06	0.14	1.04
131	DSBH-4/S-19	0.81	1.74	97.72	0.09	0.44
132	DSBH-4/S-20	1.21	2.38	96.50	0.12	1.00
133	DSBH-4/S-21	1.16	2.01	97.66	0.11	0.23
134	DSBH-4/S-22	1.24	1.96	97.13	0.09	0.82
135	DSBH-4/S-23	0.75	2.05	97.15	0.11	0.70
136	DSBH-4/S-24	0.76	3.14	96.23	0.15	0.48
137	DSBH-4/S-25	0.70	0.69	98.88	0.04	0.39
138	DSBH-4/S-26	0.97	2.47	97.06	0.13	0.34
139	DSBH-4/S-27	0.95	2.24	96.85	0.11	0.80
140	DSBH-4/S-28	0.64	2.80	96.20	0.13	0.87
141	DSBH-4/S-29	0.69	2.70	96.57	0.14	0.59
142	DSBH-4/S-30	0.67	3.37	95.57	0.16	0.90
143	DSBH-4/S-31	0.44	3.28	95.62	0.14	0.97
144	DSBH-4/S-32	0.31	3.15	95.74	0.11	0.99

Annexure X Analytical results of proximate analysis for external check (10% of the total generated core samples)

Sl.NO.	SAMPLE NUMBER	ANALYSIS SAMPLE MOISTURE (%)	ASH (%)	VOLATILE MATTER (%)	FIXED CARBON (%)	FC BY INTERNAL ANALYSIS (%)
1	DDBH-1/S-7	1.69	93.44	3.14	1.73	0.82
2	DDBH-1/S-9	1.17	90.40	2.71	5.72	4.97
3	DDBH-1/S-21	0.66	92.85	3.43	3.05	1.84
4	DDBH-2/S-11	1.43	93.83	3.12	1.61	1.32
5	DSBH-2/S-16	1.69	92.44	3.42	2.45	1.82
6	DSBH-2/S-22	1.46	92.12	3.21	3.20	2.14
7	DSBH-2/S-32	0.89	94.23	3.24	1.64	1.12
8	DSBH-3/S-5	0.84	91.58	3.96	3.62	3.19
9	DSBH-3/S-7	0.86	91.70	4.75	2.69	2.22
10	DSBH-3/S-19	0.89	94.58	3.62	0.92	0.43
11	DSBH-3/S-25	0.89	94.56	3.63	0.92	6.36
12	DSBH-4/S-3	1.15	92.66	3.55	2.64	2.18
13	DSBH-4/S-22	0.37	95.75	2.57	1.32	0.82
14	DSBH-4/S-28	0.42	95.97	2.69	0.92	0.87

Annexure XI Analytical results of minor and trace elements (in ppm)																																														
SL. NO	SAMPLE NUMBER	Li	Be	B	Sc	Co	Ga	Ge	Se	Rb	Y	Nb	Mo	Cd	In	Sn	Sb	Te	Cs	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Hf	Ta	W	Ti	Bi	Th	U	Cu	Ni	Pb	Sr	Zn	Zr
1	DDBH-1/S-1	13.8	1.0	<5	10.6	157.6	19.6	<0.5	0.8	120.4	17.3	0.8	1.3	<0.5	<0.5	<0.5	<0.5	<0.5	1.3	66.0	140.4	13.9	50.3	8.6	1.8	7.0	0.7	3.6	0.7	2.2	<0.5	2.1	<0.5	1.0	0.8	737	<0.5	0.9	24.7	1.1	73	27	27	203	65	31
2	DDBH-1/S-2	11.8	0.8	<5	10.8	148.0	20.2	<0.5	<0.5	143.8	23.1	0.6	0.8	<0.5	<0.5	<0.5	<0.5	<0.5	1.1	76.3	168.1	16.0	57.4	9.5	2.0	7.7	0.9	4.6	0.9	2.8	<0.5	2.7	<0.5	0.9	<0.5	691	0.6	0.7	28.3	1.5	59	24	32	166	57	36
3	DDBH-1/S-3	9.5	0.6	<5	12.5	226.9	16.4	<0.5	1.0	94.6	31.4	1.7	0.7	<0.5	<0.5	<0.5	<0.5	<0.5	0.9	64.1	138.2	12.9	46.5	8.1	1.7	8.3	1.1	6.1	1.2	3.7	0.5	3.6	0.5	2.7	0.9	1045	<0.5	0.8	21.8	1.9	78	21	24	176	85	45
4	DDBH-1/S-4	11.6	0.9	<5	12.3	142.6	18.3	<0.5	1.9	90.3	29.5	0.6	0.9	<0.5	<0.5	<0.5	<0.5	<0.5	0.9	77.0	162.2	16.1	58.7	10.3	1.8	9.5	1.2	6.2	1.2	3.6	<0.5	3.4	0.5	1.2	0.5	639	<0.5	0.8	26.6	1.5	125	37	19	160	114	39
5	DDBH-1/S-5	4.5	1.4	<5	11.6	167.0	19.1	<0.5	2.6	104.0	24.7	1.6	3.0	2.4	<0.5	1.9	1.3	0.6	1.7	55.7	106.5	11.2	40.4	7.1	1.8	7.1	0.9	5.0	1.0	3.0	<0.5	2.9	<0.5	3.6	<0.5	692	<0.5	0.8	14.9	1.3	85	45	31	149	127	43
6	DDBH-1/S-6	10.0	1.1	<5	12.2	132.5	16.7	<0.5	2.6	85.0	27.6	5.2	2.2	1.4	<0.5	3.0	4.7	1.7	1.6	57.8	116.0	12.4	44.5	7.2	1.5	7.1	0.9	5.0	1.0	3.1	<0.5	3.1	<0.5	6.2	2.5	513	0.6	3.0	20.5	2.1	40	49	18	126	174	58
7	DDBH-1/S-7	8.3	1.5	<5	9.6	117.2	18.2	<0.5	<0.5	120.6	16.2	1.2	2.9	0.5	<0.5	<0.5	<0.5	<0.5	2.3	35.1	62.4	6.8	23.9	4.1	1.4	3.8	0.5	2.7	0.5	1.6	<0.5	1.5	<0.5	1.2	<0.5	541	0.6	<0.5	7.5	0.6	65	31	83	217	218	11
8	DDBH-1/S-8	9.0	1.0	<5	6.9	116.0	13.5	<0.5	1.3	45.6	17.8	1.5	1.8	<0.5	<0.5	<0.5	2.1	<0.5	1.3	31.9	61.6	7.0	25.6	4.4	1.2	4.2	0.5	3.2	0.7	2.2	<0.5	2.3	<0.5	1.1	<0.5	549	<0.5	1.0	8.7	1.1	73	31	13	124	156	41
9	DDBH-1/S-9	17.6	1.8	<5	10.3	178.1	14.3	<0.5	<0.5	80.2	28.4	<0.5	8.6	<0.5	<0.5	<0.5	0.5	0.6	2.2	31.1	59.7	6.7	24.7	4.5	1.0	4.5	0.6	3.9	0.9	2.8	<0.5	2.9	<0.5	2.7	<0.5	521	0.5	<0.5	7.3	1.0	127	51	20	97	136	9
10	DDBH-1/S-10	9.4	2.2	<5	7.0	205.4	14.5	<0.5	0.9	118.9	23.4	1.6	2.1	<0.5	<0.5	1.6	<0.5	<0.5	1.1	20.6	32.2	3.0	9.9	1.9	1.5	3.3	0.7	4.1	0.9	2.6	<0.5	2.5	<0.5	0.9	<0.5	973	0.5	0.8	4.7	<0.5	65	39	33	178	54	21
11	DDBH-1/S-11	10.7	1.7	<5	7.6	227.8	16.5	<0.5	1.4	129.3	25.8	2.4	1.1	<0.5	<0.5	<0.5	0.5	0.6	1.1	28.1	46.7	4.4	15.2	2.8	1.4	4.3	0.8	5.0	1.0	2.7	<0.5	2.5	<0.5	2.2	0.8	1061	0.5	1.0	9.4	0.7	130	52	34	154	31	36
12	DDBH-1/S-12	14.6	2.1	<5	4.9	247.5	16.9	<0.5	0.6	127.8	18.7	2.2	1.3	<0.5	<0.5	<0.5	<0.5	0.6	1.3	18.3	26.9	2.3	7.5	1.6	1.3	2.6	0.6	3.5	0.7	1.9	<0.5	1.7	<0.5	1.5	0.7	1151	0.5	0.9	4.4	<0.5	76	46	31	142	38	43
13	DDBH-1/S-13	21.2	2.5	<5	13.2	146.8	20.0	<0.5	1.4	128.5	26.0	2.3	1.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.5	23.4	37.0	3.4	11.5	2.4	1.5	3.6	0.7	4.7	1.0	3.0	<0.5	2.9	<0.5	2.0	1.0	605	0.5	0.9	5.4	0.6	118	70	32	152	60	53

Annexure XI Analytical results of minor and trace elements (in ppm)																																														
SL. NO	SAMPLE NUMBER	Li	Be	B	Sc	Co	Ga	Ge	Se	Rb	Y	Nb	Mo	Cd	In	Sn	Sb	Te	Cs	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Hf	Ta	W	Tl	Bi	Th	U	Cu	Ni	Pb	Sr	Zn	Zr
14	DDBH-1/S-14	7.6	1.1	<5	4.6	280.7	14.2	<0.5	<0.5	220.8	15.9	1.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	2.0	36.5	56.3	4.9	14.8	2.2	2.6	3.1	<0.5	3.0	0.6	1.7	<0.5	1.5	<0.5	0.9	0.7	1326	0.9	<0.5	3.6	<0.5	8	8	59	359	51	18
15	DDBH-1/S-15	15.9	1.9	<5	5.9	213.0	10.0	<0.5	1.6	79.5	26.8	<0.5	1.0	<0.5	<0.5	<0.5	<0.5	<0.5	6.8	29.0	65.8	7.6	30.0	6.3	1.0	6.4	0.9	5.2	1.0	3.0	<0.5	2.8	<0.5	0.7	<0.5	591	0.5	0.5	6.0	1.1	85	70	9	54	131	34
16	DDBH-1/S-16	12.8	1.6	<5	3.3	217.9	16.1	<0.5	0.8	149.3	10.3	1.2	0.6	<0.5	<0.5	<0.5	<0.5	<0.5	1.7	33.8	61.0	6.1	20.8	3.1	2.2	3.2	<0.5	2.0	<0.5	1.2	<0.5	1.2	<0.5	2.4	0.8	967	0.6	<0.5	9.1	0.7	49	31	43	294	46	48
17	DDBH-1/S-17	34.9	1.7	<5	13.0	158.8	20.7	<0.5	2.8	136.9	21.4	1.0	2.0	<0.5	<0.5	0.6	<0.5	0.5	2.9	56.8	116.0	12.1	43.6	7.7	2.0	7.3	0.9	4.4	0.8	2.3	<0.5	2.2	<0.5	2.3	0.7	697	0.6	1.2	19.2	1.6	107	73	17	77	100	79
18	DDBH-1/S-18	40.5	1.7	<5	13.7	157.8	22.5	<0.5	1.4	147.3	25.3	1.1	2.0	<0.5	<0.5	0.5	<0.5	0.8	2.9	61.2	127.0	13.0	47.9	8.5	2.0	7.9	1.0	5.1	1.0	2.8	<0.5	2.5	<0.5	3.0	0.7	667	0.6	0.6	20.1	1.8	103	70	16	71	74	95
19	DDBH-1/S-19	19.7	2.1	<5	10.1	181.0	20.2	<0.5	<0.5	139.1	16.2	3.1	1.4	<0.5	<0.5	0.9	<0.5	0.8	2.3	29.3	51.9	4.9	17.2	2.9	1.5	3.6	0.5	3.2	0.6	1.8	<0.5	1.7	<0.5	2.4	4.2	795	0.5	0.7	9.1	0.6	87	66	27	93	129	42
20	DDBH-1/S-20	10.3	0.8	<5	<0.5	293.3	16.0	<0.5	<0.5	205.4	5.1	1.6	<0.5	<0.5	<0.5	1.0	<0.5	<0.5	2.1	31.3	43.1	3.4	9.7	1.3	2.1	1.3	<0.5	0.9	<0.5	0.6	<0.5	0.7	<0.5	2.8	1.7	793	0.8	<0.5	2.3	0.6	<5	<5	59	196	12	6
21	DDBH-1/S-21	21.5	1.9	<5	15.0	244.8	21.8	<0.5	<0.5	141.2	23.8	1.3	4.0	<0.5	<0.5	<0.5	<0.5	<0.5	2.0	33.2	65.7	6.7	23.0	4.1	1.0	5.0	0.8	5.7	1.2	3.5	<0.5	3.2	<0.5	2.3	<0.5	947	0.6	<0.5	13.5	1.3	91	71	48	107	46	14
22	DDBH-1/S-22	20.5	1.3	<5	9.9	205.4	19.3	<0.5	0.7	188.4	24.5	2.9	1.8	<0.5	<0.5	0.6	<0.5	0.6	2.7	22.7	30.7	2.6	8.6	2.0	1.7	3.9	0.8	4.7	0.9	2.6	<0.5	2.4	<0.5	2.3	0.9	825	0.7	<0.5	4.9	0.8	98	67	47	166	60	48
23	DDBH-1/S-23	11.0	0.8	<5	12.0	204.6	15.5	<0.5	1.5	181.9	43.8	1.2	2.7	<0.5	<0.5	0.5	<0.5	<0.5	2.3	32.4	49.5	4.2	13.5	2.8	1.8	5.2	1.1	7.5	1.6	5.0	0.7	4.7	0.7	1.3	<0.5	857	0.7	<0.5	5.1	1.9	115	79	49	171	58	45
24	DDBH-1/S-24	10.2	<0.5	<5	10.1	260.8	13.8	<0.5	1.1	210.6	33.5	6.4	3.3	<0.5	<0.5	0.8	0.6	0.7	1.4	30.5	43.2	3.6	11.1	2.2	2.1	4.2	0.9	5.9	1.3	3.9	0.6	3.9	0.6	4.0	0.9	1113	0.8	<0.5	5.0	0.7	104	69	57	214	37	43
25	DDBH-1/S-25	9.6	<0.5	<5	3.2	280.5	12.1	<0.5	<0.5	262.4	20.3	1.7	1.6	<0.5	<0.5	<0.5	<0.5	<0.5	2.3	27.3	36.3	2.9	9.1	1.4	2.2	2.4	<0.5	3.4	0.8	2.5	<0.5	2.6	<0.5	1.0	0.7	1147	1.0	<0.5	5.0	1.2	58	39	66	241	23	39
26	DDBH-1/S-26	15.8	0.8	<5	11.6	389.6	11.9	<0.5	1.8	75.7	64.1	0.8	2.3	<0.5	<0.5	<0.5	<0.5	<0.5	1.1	28.9	49.0	4.4	14.6	2.8	1.1	5.1	1.2	9.6	2.5	9.0	1.5	10.6	1.7	2.4	<0.5	1268	<0.5	<0.5	2.8	0.9	69	41	25	128	42	71
27	DDBH-1/S-27	17.0	1.0	<5	11.4	337.8	13.3	<0.5	<0.5	79.7	51.9	0.8	2.8	<0.5	<0.5	1.1	1.3	0.8	1.4	29.1	50.4	4.6	15.2	3.3	1.1	5.2	1.1	8.1	2.0	6.5	1.0	7.0	1.1	2.0	<0.5	1386	<0.5	<0.5	4.8	2.8	49	30	23	115	64	51
28	DDBH-1/S-28	15.0	1.1	<5	5.9	267.4	14.1	<0.5	0.9	114.5	32.8	1.3	1.9	<0.5	<0.5	<0.5	<0.5	<0.5	2.0	42.5	78.4	7.5	25.3	4.1	1.5	5.0	0.8	5.5	1.3	4.1	0.6	4.0	0.6	1.4	0.5	1158	<0.5	<0.5	12.9	1.9	72	35	32	163	44	43
29	DDBH-2/S-1	15.3	1.7	<5	11.9	130.1	15.9	<0.5	1.6	84.5	33.5	5.6	3.2	<0.5	<0.5	1.1	4.1	3.0	1.8	110.0	250.9	27.5	103.4	16.6	1.3	14.0	1.5	7.4	1.4	4.3	0.6	4.0	0.6	1.6	4.1	511	<0.5	1.5	83.3	2.4	142	65	17	91	126	30
30	DDBH-2/S-2	10.2	0.8	<5	14.0	171.3	12.9	<0.5	<0.5	107.8	30.8	3.5	1.3	<0.5	<0.5	1.0	<0.5	<0.5	0.9	51.6	111.1	11.1	40.2	7.0	1.5	7.1	1.0	6.2	1.2	3.8	0.5	3.7	0.6	3.5	0.9	757	<0.5	<0.5	23.6	1.4	44	27	24	106	159	35
31	DDBH-2/S-3	9.0	0.8	<5	12.5	188.3	12.9	<0.5	<0.5	111.8	28.4	1.2	1.4	<0.5	<0.5	<0.5	<0.5	<0.5	0.9	49.8	105.2	10.5	38.3	6.6	1.6	7.0	1.0	5.9	1.2	3.6	0.6	3.5	0.5	1.4	<0.5	850	<0.5	<0.5	21.3	1.4	37	26	24	104	106	40

Annexure XI Analytical results of minor and trace elements (in ppm)																																																			
SL. NO	SAMPLE NUMBER	Li	Be	B	Sc	Co	Ga	Ge	Se	Rb	Y	Nb	Mo	Cd	In	Sn	Sb	Te	Cs	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Hf	Ta	W	Tl	Bi	Th	U	Cu	Ni	Pb	Sr	Zn	Zr					
32	DDBH-2/S-4	9.8	0.8	<5	12.5	232.8	13.6	<0.5	<0.5	117.0	29.7	0.8	1.3	<0.5	<0.5	0.5	<0.5	<0.5	0.9	50.5	108.4	10.8	39.4	6.9	1.6	6.7	1.1	6.0	1.2	3.6	0.5	3.4	0.5	1.3	<0.5	1107	<0.5	<0.5	22.0	1.5	37	24	23	108	120	43					
33	DDBH-2/S-5	13.0	1.9	<5	7.0	125.2	14.7	<0.5	1.6	62.2	32.0	0.6	2.7	0.7	<0.5	<0.5	<0.5	<0.5	0.9	41.6	83.2	9.4	35.3	6.7	1.6	6.9	1.0	5.7	1.2	3.8	0.6	4.0	0.6	1.7	<0.5	466	<0.5	<0.5	11.2	1.3	155	139	13	151	281	30					
34	DDBH-2/S-6	12.0	2.4	<5	9.4	176.6	15.6	<0.5	1.2	66.8	40.4	<0.5	2.6	0.8	<0.5	<0.5	<0.5	<0.5	0.6	54.4	109.6	12.3	45.2	8.5	1.7	8.8	1.3	7.5	1.6	4.7	0.7	4.5	0.7	1.3	<0.5	720	<0.5	<0.5	18.5	1.9	191	131	16	145	286	33					
35	DDBH-2/S-7	10.8	1.7	<5	9.0	113.3	15.5	<0.5	1.9	82.2	30.7	1.1	3.5	1.2	<0.5	<0.5	<0.5	0.7	1.0	54.4	115.4	11.9	44.0	7.9	1.8	8.0	1.1	5.8	1.2	3.6	0.5	3.4	0.5	1.2	<0.5	455	<0.5	<0.5	19.0	1.8	100	149	23	214	177	40					
36	DDBH-2/S-8	10.2	1.1	<5	11.3	131.6	15.3	<0.5	0.6	114.5	27.4	<0.5	1.8	0.7	<0.5	<0.5	<0.5	<0.5	1.2	59.1	127.9	12.7	46.4	7.8	1.7	7.4	1.0	5.3	1.1	3.1	<0.5	3.1	<0.5	1.6	<0.5	566	<0.5	<0.5	21.9	1.8	87	71	34	148	293	61					
37	DDBH-2/S-9	11.2	1.0	<5	9.6	125.8	15.8	<0.5	0.7	90.3	26.4	0.8	3.7	0.5	<0.5	<0.5	<0.5	0.6	1.4	51.2	107.8	11.2	40.9	7.5	1.6	7.4	1.0	5.3	1.0	3.1	<0.5	3.0	<0.5	1.6	<0.5	538	0.5	<0.5	19.1	1.9	73	69	21	131	205	53					
38	DDBH-2/S-10	9.9	1.2	<5	5.0	66.5	14.2	<0.5	1.5	65.0	15.8	1.0	3.1	<0.5	<0.5	1.4	<0.5	<0.5	1.5	34.1	70.7	7.7	28.8	5.2	1.2	4.9	0.6	3.2	0.6	1.9	<0.5	1.6	<0.5	1.0	<0.5	281	<0.5	<0.5	12.6	1.7	55	59	22	98	175	42					
39	DDBH-2/S-11	17.1	1.8	<5	13.7	78.1	23.9	<0.5	<0.5	196.1	123.1	0.9	4.5	<0.5	<0.5	<0.5	<0.5	<0.5	5.1	49.4	94.7	9.9	34.8	6.0	1.7	5.6	0.8	3.9	0.8	2.3	<0.5	2.1	<0.5	0.6	<0.5	468	0.7	<0.5	12.2	1.2	42	19	26	112	53	15					
40	DDBH-2/S-12	13.7	1.1	<5	10.2	72.2	17.9	<0.5	<0.5	151.1	125.5	2.8	3.1	<0.5	<0.5	0.5	<0.5	<0.5	4.1	53.9	108.2	11.6	42.4	7.2	1.8	7.3	0.9	4.9	1.0	2.9	<0.5	2.8	<0.5	2.6	0.6	333	0.5	<0.5	20.7	2.2	44	25	24	107	84	68					
41	DDBH-2/S-13	8.8	1.3	<5	16.4	85.6	14.7	<0.5	1.2	116.1	135.6	3.4	10.9	<0.5	<0.5	1.7	<0.5	<0.5	1.9	82.8	160.2	18.3	66.5	11.3	1.8	10.6	1.4	7.1	1.4	4.2	0.6	3.9	0.6	3.1	1.5	437	<0.5	0.6	36.4	3.0	63	37	31	148	109	84					
42	DDBH-2/S-14	20.1	1.6	<5	7.5	113.1	12.8	<0.5	<0.5	41.0	20.4	2.1	5.1	<0.5	<0.5	0.6	<0.5	<0.5	0.9	36.5	75.0	7.6	27.2	4.6	1.0	4.8	0.7	4.0	0.8	2.3	<0.5	2.2	<0.5	1.5	<0.5	450	<0.5	0.7	12.9	1.2	61	50	20	66	74	58					
43	DSBH-2/S-1	15.1	1.0	<5	13.8	82.6	16.3	<0.5	<0.5	119.3	27.7	2.2	2.5	<0.5	<0.5	<0.5	1.5	<0.5	2.0	49.3	99.0	10.8	39.2	7.2	1.6	7.0	1.0	5.4	1.1	3.3	<0.5	3.1	<0.5	1.8	1.0	195	0.7	0.6	17.6	1.8	49	70	15	89	123	75					
44	DSBH-2/S-2	11.9	1.1	<5	9.6	78.9	15.8	<0.5	0.7	77.5	26.2	3.6	1.3	<0.5	<0.5	<0.5	<0.5	<0.5	0.8	30.0	60.6	6.4	22.7	4.2	1.1	4.7	0.8	5.0	1.0	2.8	<0.5	2.6	<0.5	1.3	1.0	297	<0.5	<0.5	5.6	1.3	15	44	47	266	82	53					
45	DSBH-2/S-3	16.8	2.4	<5	27.9	82.1	17.5	<0.5	1.5	111.8	48.8	7.4	2.1	0.5	<0.5	2.8	<0.5	<0.5	4.0	35.2	74.6	8.2	30.9	6.6	1.8	8.1	1.5	9.0	2.0	5.8	0.8	5.6	0.9	2.7	1.0	180	0.7	0.9	13.0	1.5	53	106	6	85	255	91					
46	DSBH-2/S-4	10.6	0.7	<5	19.1	57.7	18.3	<0.5	0.9	153.5	53.1	4.6	1.7	<0.5	<0.5	1.1	<0.5	<0.5	1.8	55.7	116.3	12.2	44.0	8.3	1.8	8.0	1.2	6.7	1.3	4.1	0.6	3.9	0.6	1.8	1.0	236	0.6	0.6	20.9	1.7	35	27	16	111	100	52					
47	DSBH-2/S-5	12.6	0.5	<5	14.6	42.8	19.3	<0.5	0.7	124.7	25.6	2.5	1.0	<0.5	<0.5	1.5	<0.5	<0.5	1.4	68.5	133.8	14.6	51.5	8.3	1.6	7.4	0.9	5.0	1.0	3.0	<0.5	2.8	<0.5	2.9	1.0	214	<0.5	<0.5	32.4	1.9	39	11	20	108	57	80					
48	DSBH-2/S-6	11.6	<0.5	<5	13.6	72.8	20.1	<0.5	1.1	124.9	23.8	4.8	5.7	<0.5	<0.5	3.0	0.9	1.1	1.2	58.3	107.3	11.5	39.2	6.8	1.4	6.5	0.9	4.7	1.0	2.9	<0.5	2.8	<0.5	3.5	0.6	341	<0.5	0.6	22.6	1.3	43	12	25	143	57	58					
49	DSBH-2/S-7	19.7	0.6	<5	14.5	27.2	19.3	<0.5	0.5	101.3	19.2	2.7	2.1	<0.5	<0.5	<0.5	<0.5	<0.5	1.3	72.4	135.3	14.1	49.1	8.5	1.4	7.5	0.9	4.1	0.8	2.3	<0.5	2.2	<0.5	2.6	0.8	148	<0.5	<0.5	27.3	2.2	35	17	20	131	62	109					

Annexure XI Analytical results of minor and trace elements (in ppm)																																														
SL. NO	SAMPLE NUMBER	Li	Be	B	Sc	Co	Ga	Ge	Se	Rb	Y	Nb	Mo	Cd	In	Sn	Sb	Te	Cs	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Hf	Ta	W	Tl	Bi	Th	U	Cu	Ni	Pb	Sr	Zn	Zr
50	DSBH-2/S-8	10.0	1.0	<5	12.7	35.5	17.1	<0.5	<0.5	81.1	21.8	3.5	2.5	<0.5	<0.5	1.4	<0.5	<0.5	1.1	50.8	90.0	9.6	33.1	5.7	1.0	5.6	0.8	4.4	0.8	2.6	<0.5	2.3	<0.5	2.1	0.9	163	<0.5	<0.5	16.3	1.6	66	26	28	152	91	105
51	DSBH-2/S-9	15.8	1.6	<5	10.9	57.0	20.8	<0.5	1.1	94.4	37.2	2.7	5.6	<0.5	<0.5	1.4	<0.5	<0.5	1.8	62.1	126.1	13.3	49.3	9.6	1.4	9.8	1.4	7.3	1.4	4.1	0.6	3.6	0.5	2.6	0.6	170	<0.5	<0.5	20.2	3.1	101	75	18	124	176	69
52	DSBH-2/S-10	23.9	1.7	<5	14.1	79.5	17.5	<0.5	2.4	107.4	39.8	2.9	4.0	0.6	<0.5	0.7	<0.5	<0.5	2.1	51.1	101.0	11.3	41.8	7.7	1.2	7.9	1.2	7.0	1.4	4.4	0.6	4.1	0.6	2.2	1.6	266	0.7	<0.5	18.3	2.8	92	74	20	108	134	90
53	DSBH-2/S-11	16.8	1.7	<5	7.8	67.9	13.6	<0.5	0.6	134.7	14.5	1.9	3.7	0.5	<0.5	10.6	5.4	0.7	2.0	21.9	42.2	4.8	17.7	3.4	1.1	3.2	<0.5	2.7	0.6	1.6	<0.5	1.5	<0.5	3.5	<0.5	313	0.7	<0.5	6.4	1.2	33	22	40	177	58	30
54	DSBH-2/S-12	15.8	1.5	<5	7.5	71.3	12.7	<0.5	1.8	116.6	25.2	2.2	2.7	1.2	<0.5	1.3	<0.5	<0.5	2.7	31.0	64.5	8.0	31.7	6.7	1.8	6.3	0.9	5.2	1.1	3.3	0.5	3.3	0.5	<0.5	<0.5	365	0.7	<0.5	5.4	1.4	43	18	20	227	88	13
55	DSBH-2/S-13	18.9	1.3	<5	12.9	80.6	15.9	<0.5	2.3	117.0	29.8	2.7	1.7	<0.5	<0.5	1.0	1.8	<0.5	1.9	62.0	131.9	15.1	56.0	10.3	1.5	9.2	1.2	6.2	1.2	3.6	0.5	3.5	0.5	0.9	<0.5	435	0.7	<0.5	16.1	2.4	33	19	22	136	81	26
56	DSBH-2/S-14	11.5	1.2	<5	3.0	111.7	13.1	<0.5	<0.5	164.3	13.1	1.0	1.4	<0.5	<0.5	1.6	<0.5	<0.5	1.1	18.6	35.8	3.9	13.7	2.9	1.1	2.8	<0.5	2.4	<0.5	1.4	<0.5	1.7	<0.5	1.7	<0.5	585	0.9	<0.5	4.4	1.7	86	23	53	143	32	42
57	DSBH-2/S-15	16.1	1.7	<5	5.8	123.3	11.0	<0.5	2.1	100.6	19.5	1.0	5.8	<0.5	<0.5	5.8	13.8	1.5	2.3	30.7	61.2	7.3	27.9	5.6	1.3	5.6	0.8	4.1	0.8	2.1	<0.5	1.7	<0.5	2.3	<0.5	507	0.6	<0.5	8.2	2.0	169	56	22	124	99	38
58	DSBH-2/S-16	24.3	2.7	<5	10.4	148.0	14.3	<0.5	<0.5	123.3	37.1	0.5	1.8	1.3	<0.5	<0.5	<0.5	<0.5	4.5	33.3	66.9	8.4	31.6	7.0	1.6	7.7	1.2	7.1	1.5	4.0	0.6	3.6	0.6	<0.5	<0.5	452	0.7	<0.5	6.6	2.4	148	43	17	143	116	12
59	DSBH-2/S-17	13.7	2.5	<5	7.4	104.2	10.8	<0.5	2.6	97.4	28.0	0.9	7.8	0.9	<0.5	1.9	<0.5	<0.5	3.1	32.9	65.4	8.6	34.4	7.7	1.8	8.2	1.2	6.9	1.2	3.3	<0.5	2.9	<0.5	1.8	<0.5	384	0.7	<0.5	7.2	4.0	197	92	21	197	241	64
60	DSBH-2/S-18	4.4	0.6	<5	2.4	221.8	8.7	<0.5	3.2	39.5	13.8	<0.5	9.5	<0.5	<0.5	0.7	<0.5	<0.5	0.7	35.0	73.5	8.6	33.0	6.2	1.4	5.7	0.7	3.3	0.6	1.3	<0.5	0.8	<0.5	<0.5	<0.5	862	<0.5	<0.5	7.1	4.0	32	16	21	126	237	64
61	DSBH-2/S-19	8.3	0.8	<5	2.5	165.6	11.1	<0.5	3.8	83.1	11.8	1.2	10.3	<0.5	<0.5	<0.5	<0.5	<0.5	0.8	26.1	54.4	5.9	22.1	4.4	1.2	4.3	0.5	2.6	<0.5	1.2	<0.5	0.8	<0.5	0.8	<0.5	828	0.6	<0.5	5.4	2.1	35	14	33	96	84	23
62	DSBH-2/S-20	48.5	0.8	11.8	10.4	184.0	13.0	<0.5	3.4	106.3	25.5	2.1	6.7	0.7	<0.5	1.1	<0.5	<0.5	1.0	42.1	81.2	8.6	30.9	5.5	1.6	5.4	0.8	4.4	1.0	3.0	<0.5	3.3	0.5	1.1	<0.5	916	0.6	<0.5	12.5	1.9	139	33	37	109	53	31
63	DSBH-2/S-21	69.5	1.0	<5	8.8	153.5	13.1	<0.5	2.9	99.3	24.3	1.7	5.8	0.8	<0.5	1.0	<0.5	<0.5	1.0	38.0	77.6	8.3	29.9	5.3	1.3	5.4	0.8	4.3	0.9	2.9	<0.5	2.9	<0.5	1.5	<0.5	818	0.6	<0.5	12.0	1.5	154	38	36	93	50	28
64	DSBH-2/S-22	14.3	1.3	<5	5.0	151.6	16.2	<0.5	<0.5	100.5	18.7	1.1	9.4	0.6	<0.5	<0.5	<0.5	<0.5	1.0	33.0	66.5	7.0	24.4	4.3	1.5	3.9	0.5	2.9	0.6	1.9	<0.5	1.9	<0.5	<0.5	<0.5	744	0.7	<0.5	4.8	1.2	172	42	39	117	22	7
65	DSBH-2/S-23	10.7	0.7	<5	7.7	189.5	12.9	<0.5	1.7	159.6	20.3	1.3	5.2	1.1	<0.5	1.0	1.1	<0.5	1.3	35.0	61.5	6.1	20.7	3.3	1.7	3.5	<0.5	3.2	0.7	2.6	<0.5	2.8	<0.5	1.5	<0.5	981	0.9	<0.5	5.4	1.5	110	23	39	130	53	40
66	DSBH-2/S-24	10.8	0.6	16.7	16.7	197.4	14.4	<0.5	0.9	120.9	40.0	16.0	2.8	1.1	<0.5	1.1	2.6	<0.5	0.8	46.2	88.1	8.7	30.3	6.0	1.5	7.1	1.2	7.2	1.5	4.3	0.6	4.2	0.6	11.1	<0.5	1044	0.6	<0.5	11.3	0.9	56	36	30	135	71	46
67	DSBH-2/S-25	29.8	2.0	<5	13.5	182.4	17.9	<0.5	1.1	136.2	28.7	4.9	3.7	0.5	<0.5	2.9	<0.5	<0.5	3.1	49.6	105.0	10.7	37.8	6.3	1.4	6.5	0.9	5.2	1.1	3.2	<0.5	3.1	<0.5	4.0	0.6	950	0.6	<0.5	17.3	1.6	36	35	16	167	142	86

Annexure XI Analytical results of minor and trace elements (in ppm)																																														
SL. NO	SAMPLE NUMBER	Li	Be	B	Sc	Co	Ga	Ge	Se	Rb	Y	Nb	Mo	Cd	In	Sn	Sb	Te	Cs	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Hf	Ta	W	Tl	Bi	Th	U	Cu	Ni	Pb	Sr	Zn	Zr
68	DSBH-2/S-26	17.0	0.6	<5	11.2	235.9	12.5	<0.5	4.9	88.5	28.1	0.8	9.5	0.8	<0.5	<0.5	<0.5	<0.5	1.6	41.8	83.1	9.3	33.7	5.9	1.4	5.6	0.8	4.6	1.0	3.4	<0.5	3.4	0.6	0.8	<0.5	1122	0.6	<0.5	13.4	1.4	125	96	19	161	144	31
69	DSBH-2/S-27	20.4	1.0	<5	12.4	288.3	15.7	<0.5	1.5	93.1	31.7	2.2	5.2	0.7	<0.5	<0.5	<0.5	<0.5	1.3	47.4	96.7	10.3	36.0	6.4	1.4	6.5	0.9	5.0	1.0	3.3	<0.5	3.1	<0.5	1.0	1.2	964	<0.5	<0.5	16.0	1.3	173	106	20	163	94	34
70	DSBH-2/S-28	37.0	2.1	<5	14.0	138.4	17.9	<0.5	<0.5	116.7	31.3	3.7	2.4	3.7	<0.5	<0.5	0.6	<0.5	6.0	34.9	76.1	7.6	26.5	4.9	1.3	5.5	0.9	5.0	1.0	3.2	<0.5	3.1	<0.5	2.0	0.8	644	<0.5	<0.5	9.9	1.0	34	67	9	50	125	55
71	DSBH-2/S-29	30.5	2.5	<5	10.7	178.4	18.4	<0.5	<0.5	98.8	27.0	4.7	1.2	0.7	<0.5	<0.5	<0.5	<0.5	5.3	33.2	78.1	7.7	27.0	5.2	1.1	5.4	0.8	4.4	0.9	2.7	<0.5	2.5	<0.5	1.9	0.5	801	<0.5	<0.5	10.4	1.3	14	59	8	66	147	91
72	DSBH-2/S-30	18.4	0.7	<5	11.4	280.5	14.1	<0.5	<0.5	120.2	26.8	3.1	2.7	<0.5	<0.5	1.2	<0.5	2.0	1.0	47.3	84.1	9.1	31.1	5.5	1.3	5.5	0.8	4.6	0.9	2.8	<0.5	2.5	<0.5	1.6	<0.5	1120	0.6	<0.5	15.8	1.0	72	41	23	125	76	61
73	DSBH-2/S-31	11.1	<0.5	<5	10.5	213.6	12.4	<0.5	<0.5	132.6	24.2	7.0	2.2	<0.5	<0.5	3.3	<0.5	<0.5	<0.5	48.3	84.5	8.7	29.3	5.2	1.3	5.5	0.8	4.5	0.9	2.7	<0.5	2.6	<0.5	3.7	<0.5	1199	0.6	<0.5	14.0	1.0	67	35	28	95	49	68
74	DSBH-2/S-32	27.7	1.3	<5	17.1	106.1	19.6	<0.5	<0.5	173.4	30.7	1.8	2.6	<0.5	<0.5	<0.5	<0.5	<0.5	1.8	47.1	82.1	8.8	29.9	5.5	1.4	6.2	0.9	5.1	1.0	2.9	<0.5	2.7	<0.5	1.4	0.6	627	0.7	<0.5	13.7	0.9	81	59	24	75	54	15
75	DSBH-2/S-33	21.9	1.1	<5	14.4	159.8	17.2	<0.5	0.9	118.3	26.6	2.3	3.9	<0.5	<0.5	9.2	1.0	<0.5	0.8	37.7	68.5	7.3	24.9	4.9	1.0	5.5	0.8	4.7	1.0	2.7	<0.5	2.6	<0.5	2.3	<0.5	857	<0.5	0.6	13.0	0.7	69	59	16	66	69	63
76	DSBH-2/S-34	15.7	1.2	<5	11.7	207.3	16.0	<0.5	0.9	114.7	24.2	3.9	2.0	<0.5	<0.5	<0.5	<0.5	<0.5	0.9	47.3	81.2	8.9	29.4	5.1	1.3	5.5	0.8	4.5	0.9	2.6	<0.5	2.5	<0.5	2.8	<0.5	1085	<0.5	<0.5	16.3	0.9	74	42	23	81	80	84
77	DSBH-2/S-35	18.7	1.2	<5	7.3	158.3	15.6	<0.5	<0.5	154.4	22.2	6.3	0.6	<0.5	<0.5	0.9	<0.5	<0.5	0.7	33.4	55.9	5.7	18.3	3.1	1.2	3.6	0.6	3.7	0.8	2.3	<0.5	2.3	<0.5	1.8	<0.5	873	0.7	<0.5	9.2	1.3	32	20	46	120	40	82
78	DSBH-2/S-36	17.5	1.2	<5	12.8	144.2	16.4	<0.5	<0.5	137.4	27.5	2.9	1.8	<0.5	<0.5	<0.5	<0.5	<0.5	0.7	54.0	91.2	10.1	34.0	5.8	1.5	6.1	0.9	4.9	1.0	3.1	<0.5	2.9	<0.5	2.7	<0.5	725	0.6	<0.5	19.2	1.5	66	43	22	117	69	114
79	DSBH-2/S-37	19.1	1.4	<5	14.2	130.4	18.7	<0.5	0.8	163.5	29.4	2.1	1.9	<0.5	<0.5	1.2	1.3	<0.5	1.0	67.0	114.8	12.9	44.2	7.2	1.6	7.1	1.0	5.2	1.1	3.3	<0.5	3.2	<0.5	3.0	<0.5	646	0.7	<0.5	29.8	1.5	84	50	25	113	59	86
80	DSBH-2/S-38	18.3	1.1	<5	14.2	110.8	14.9	<0.5	0.7	151.1	23.9	5.4	2.4	<0.5	<0.5	2.5	0.6	<0.5	0.9	49.3	89.7	9.6	32.8	5.3	1.4	5.3	0.8	4.3	0.9	2.6	<0.5	2.6	<0.5	4.7	2.1	591	0.6	0.6	19.8	1.0	92	40	26	95	56	63
81	DSBH-2/S-39	18.4	1.0	<5	13.5	95.0	16.6	<0.5	<0.5	155.0	26.7	3.2	1.7	<0.5	<0.5	0.6	<0.5	<0.5	1.0	56.3	104.0	11.3	38.5	6.3	1.7	6.2	0.9	4.9	1.0	3.0	<0.5	2.9	<0.5	1.9	<0.5	504	0.5	<0.5	16.0	1.2	79	39	27	157	60	80
82	DSBH-2/S-40	24.6	0.9	<5	12.3	131.6	13.3	<0.5	4.5	95.1	32.2	3.1	7.4	1.1	<0.5	<0.5	<0.5	<0.5	1.3	32.7	62.9	7.8	30.0	6.3	1.5	6.5	1.0	5.6	1.2	3.4	<0.5	3.2	<0.5	5.7	<0.5	621	0.6	<0.5	8.5	1.2	173	91	18	105	141	48
83	DSBH-3/S-1	6.2	1.1	<5	6.9	281.2	15.0	<0.5	1.3	54.5	19.4	5.8	7.5	0.8	<0.5	2.2	<0.5	1.0	0.8	56.3	126.7	14.8	55.3	8.8	0.8	6.8	0.7	3.3	0.7	2.0	<0.5	1.8	<0.5	0.9	<0.5	941	<0.5	<0.5	20.4	0.9	261	84	9	146	94	21
84	DSBH-3/S-2	5.9	1.3	<5	8.2	225.3	12.0	<0.5	2.2	21.2	24.2	0.9	13.9	0.9	<0.5	<0.5	<0.5	5.2	0.6	43.7	103.1	12.4	48.1	8.3	0.7	6.3	0.8	4.1	0.9	2.8	<0.5	2.6	<0.5	<0.5	<0.5	775	<0.5	0.8	11.3	1.0	132	43	<5	114	87	14
85	DSBH-3/S-3	5.3	2.6	<5	17.1	183.2	18.0	<0.5	1.9	53.1	27.0	4.3	7.7	<0.5	<0.5	3.3	<0.5	<0.5	1.2	61.4	129.3	14.2	50.5	8.0	0.8	6.8	0.8	4.4	1.0	3.1	<0.5	3.2	<0.5	2.0	2.6	918	<0.5	0.6	30.7	1.1	41	12	9	63	39	23

Annexure XI Analytical results of minor and trace elements (in ppm)																																														
SL. NO	SAMPLE NUMBER	Li	Be	B	Sc	Co	Ga	Ge	Se	Rb	Y	Nb	Mo	Cd	In	Sn	Sb	Te	Cs	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Hf	Ta	W	Tl	Bi	Th	U	Cu	Ni	Pb	Sr	Zn	Zr
86	DSBH-3/S-4	3.6	1.1	<5	7.9	142.9	13.3	<0.5	2.8	65.4	11.0	1.7	8.7	<0.5	<0.5	<0.5	<0.5	0.8	<0.5	45.8	89.6	10.5	37.8	5.7	1.2	4.6	<0.5	2.1	<0.5	1.3	<0.5	1.2	<0.5	0.6	<0.5	583	<0.5	<0.5	12.9	1.1	33	6	17	135	18	35
87	DSBH-3/S-5	7.0	1.8	<5	17.6	82.1	25.7	<0.5	<0.5	120.8	26.7	2.3	6.4	<0.5	<0.5	<0.5	<0.5	<0.5	0.7	25.2	37.6	3.8	12.6	2.8	1.5	3.8	0.7	4.1	0.9	2.7	<0.5	2.6	<0.5	0.6	0.7	521	0.6	<0.5	4.9	0.6	13	6	24	121	38	22
88	DSBH-3/S-6	5.0	0.9	<5	15.1	88.6	20.3	<0.5	0.7	100.1	24.6	2.2	4.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	25.2	41.7	4.3	15.0	3.1	1.3	4.2	0.8	4.6	1.0	2.6	<0.5	2.5	<0.5	1.8	<0.5	538	<0.5	<0.5	7.2	<0.5	16	19	16	94	52	48
89	DSBH-3/S-7	6.5	2.2	<5	15.3	84.2	25.3	<0.5	<0.5	82.2	16.3	2.3	5.4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	21.9	36.0	3.6	12.1	2.3	1.0	2.5	<0.5	2.5	0.5	1.6	<0.5	1.5	<0.5	1.4	1.0	452	<0.5	<0.5	5.7	<0.5	132	52	19	83	<5	15
90	DSBH-3/S-8	6.5	1.8	<5	9.1	74.2	24.3	<0.5	1.0	77.3	6.5	2.8	5.1	3.9	<0.5	<0.5	<0.5	<0.5	<0.5	41.6	77.5	8.1	27.7	4.1	1.2	3.3	<0.5	1.3	<0.5	0.8	<0.5	0.8	<0.5	1.2	0.6	374	<0.5	0.6	15.1	0.6	123	62	18	104	20	25
91	DSBH-3/S-9	8.9	1.4	<5	15.6	91.7	28.1	<0.5	<0.5	76.0	14.3	5.8	3.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	63.0	120.3	13.1	45.9	6.9	1.3	5.8	0.6	2.8	0.5	1.5	<0.5	1.3	<0.5	1.5	<0.5	463	<0.5	<0.5	26.4	0.7	128	60	25	103	19	26
92	DSBH-3/S-10	6.1	1.0	<5	13.9	145.6	22.0	<0.5	0.6	97.8	18.4	2.4	6.8	<0.5	<0.5	4.9	<0.5	2.7	<0.5	49.7	81.0	8.2	27.0	4.5	1.7	4.6	0.6	3.3	0.7	2.0	<0.5	1.8	<0.5	2.7	<0.5	782	0.6	<0.5	13.6	<0.5	120	54	33	221	20	30
93	DSBH-3/S-11	9.3	<0.5	<5	15.0	160.9	15.8	<0.5	<0.5	70.4	32.3	2.3	1.9	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	59.2	94.0	9.7	31.9	5.5	1.5	6.8	1.0	6.0	1.1	3.3	<0.5	3.1	<0.5	1.6	<0.5	861	<0.5	<0.5	11.2	0.6	55	54	27	228	45	44
94	DSBH-3/S-12	11.0	0.6	<5	14.9	214.5	14.6	<0.5	<0.5	74.5	35.8	3.0	2.2	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	41.4	65.0	6.6	21.5	4.3	1.2	6.0	1.0	6.3	1.3	3.7	<0.5	3.4	<0.5	2.3	<0.5	1265	<0.5	<0.5	7.8	0.9	73	52	25	207	57	68
95	DSBH-3/S-13	11.6	<0.5	<5	16.1	212.8	16.2	<0.5	0.6	99.3	32.1	2.3	1.3	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	68.5	113.9	12.8	43.3	7.6	1.5	7.7	1.0	5.8	1.2	3.4	<0.5	3.1	<0.5	3.5	<0.5	1216	<0.5	<0.5	21.8	1.4	67	65	25	111	68	79
96	DSBH-3/S-14	12.7	0.6	<5	17.4	205.3	18.0	<0.5	<0.5	109.4	34.4	1.9	2.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	71.6	119.3	13.6	46.2	7.9	1.5	7.9	1.1	6.0	1.2	3.7	0.5	3.6	0.5	3.1	<0.5	1046	0.5	<0.5	26.3	1.8	94	67	19	89	73	103
97	DSBH-3/S-15	15.8	0.6	<5	11.6	274.5	14.7	<0.5	<0.5	75.6	24.6	5.5	1.8	<0.5	<0.5	0.8	<0.5	<0.5	<0.5	52.0	86.9	9.6	31.8	5.4	1.3	5.5	0.8	4.3	0.9	2.6	<0.5	2.5	<0.5	3.6	0.5	1439	<0.5	<0.5	13.7	1.0	62	42	21	134	38	104
98	DSBH-3/S-16	15.2	<0.5	<5	12.3	239.1	13.9	<0.5	<0.5	72.0	23.2	2.4	1.9	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	46.5	74.3	8.3	27.6	4.7	1.1	5.0	0.7	4.0	0.8	2.4	<0.5	2.3	<0.5	2.3	<0.5	1362	<0.5	<0.5	12.6	0.8	76	50	19	120	51	85
99	DSBH-3/S-17	17.9	0.7	<5	18.9	153.9	16.8	<0.5	1.0	132.8	32.4	2.3	3.1	0.6	<0.5	<0.5	<0.5	<0.5	1.2	41.1	80.8	8.8	31.6	5.8	1.3	6.0	0.9	5.4	1.1	3.7	0.5	3.7	0.6	2.3	<0.5	799	0.6	<0.5	13.9	0.8	108	54	12	67	78	75
100	DSBH-3/S-18	14.8	0.6	<5	14.0	143.0	16.4	<0.5	<0.5	135.8	24.3	3.8	2.0	<0.5	<0.5	<0.5	<0.5	<0.5	1.0	54.0	108.6	11.8	41.8	7.1	1.4	6.4	0.8	4.4	0.9	2.6	<0.5	2.5	<0.5	2.0	1.6	773	0.6	<0.5	18.5	1.0	64	35	11	71	75	76
101	DSBH-3/S-19	20.4	<0.5	<5	16.3	132.4	20.5	<0.5	<0.5	141.4	31.2	2.4	2.4	<0.5	<0.5	<0.5	<0.5	<0.5	1.3	44.6	85.6	9.0	31.5	5.7	1.4	5.9	0.9	5.0	1.1	3.3	<0.5	3.0	<0.5	<0.5	<0.5	640	0.7	<0.5	11.5	0.7	68	35	13	64	46	13
102	DSBH-3/S-20	14.3	<0.5	<5	14.3	158.6	16.2	<0.5	1.1	143.1	30.8	2.1	3.1	<0.5	<0.5	1.3	0.6	0.7	1.1	50.4	100.8	10.9	38.3	6.8	1.4	6.7	0.9	5.2	1.1	3.5	0.5	3.6	0.6	3.4	0.6	818	0.6	<0.5	16.0	1.4	55	36	11	78	71	93
103	DSBH-3/S-21	17.2	0.5	<5	13.9	208.8	16.3	<0.5	<0.5	177.7	29.5	3.7	4.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.4	43.6	85.7	9.3	32.6	6.0	1.2	5.9	0.9	4.9	1.0	3.2	<0.5	3.1	<0.5	5.3	<0.5	1049	0.7	<0.5	13.5	1.6	105	49	16	91	74	166

Annexure XI Analytical results of minor and trace elements (in ppm)																																														
SL. NO	SAMPLE NUMBER	Li	Be	B	Sc	Co	Ga	Ge	Se	Rb	Y	Nb	Mo	Cd	In	Sn	Sb	Te	Cs	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Hf	Ta	W	Tl	Bi	Th	U	Cu	Ni	Pb	Sr	Zn	Zr
104	DSBH-3/S-22	21.8	0.9	<5	14.0	143.6	17.3	<0.5	<0.5	130.5	23.7	1.4	2.2	<0.5	<0.5	<0.5	<0.5	<0.5	0.9	35.8	66.4	7.1	24.9	4.4	1.2	4.8	0.7	4.1	0.8	2.4	<0.5	2.2	<0.5	1.7	<0.5	750	0.5	<0.5	12.5	0.7	58	47	13	75	48	57
105	DSBH-3/S-23	35.4	3.3	<5	8.8	67.8	24.5	<0.5	<0.5	134.6	11.5	2.0	1.7	<0.5	<0.5	<0.5	<0.5	<0.5	1.4	44.0	85.5	9.1	31.5	5.0	1.1	4.1	<0.5	2.1	<0.5	1.3	<0.5	1.3	<0.5	1.2	<0.5	285	<0.5	<0.5	17.8	0.6	136	77	14	70	78	26
106	DSBH-3/S-24	30.7	2.5	<5	17.3	91.6	23.0	<0.5	<0.5	144.9	25.3	1.3	2.1	<0.5	<0.5	31.6	<0.5	<0.5	1.4	60.1	119.5	12.8	45.1	7.0	1.3	6.4	0.8	4.3	0.9	2.9	<0.5	2.9	<0.5	1.1	<0.5	397	1.0	<0.5	25.6	0.8	100	69	16	67	60	33
107	DSBH-3/S-25	24.3	1.9	<5	28.0	111.1	21.2	<0.5	0.7	171.4	28.3	10.3	5.1	<0.5	2.4	13.2	9.1	16.0	1.8	61.8	114.9	12.2	41.4	7.1	1.5	6.6	0.9	4.9	1.0	2.9	<0.5	2.7	<0.5	4.4	10.6	596	0.8	12.3	35.9	1.5	69	47	18	82	21	9
108	DSBH-3/S-26	12.2	0.8	<5	15.4	156.8	15.5	<0.5	0.5	162.6	32.9	2.2	0.6	<0.5	<0.5	<0.5	<0.5	<0.5	0.9	73.8	128.6	14.3	48.7	8.3	1.5	8.1	1.1	5.8	1.1	3.5	<0.5	3.1	<0.5	2.7	0.8	802	0.6	<0.5	27.2	1.6	40	45	25	91	55	75
109	DSBH-3/S-27	29.4	2.2	<5	17.4	133.2	19.9	<0.5	0.6	177.6	35.0	4.2	3.7	<0.5	<0.5	1.0	<0.5	<0.5	2.2	79.8	136.0	15.1	50.9	8.7	1.7	8.3	1.1	6.1	1.2	3.7	<0.5	3.3	<0.5	4.2	<0.5	645	0.7	<0.5	32.0	2.2	58	72	29	113	93	172
110	DSBH-3/S-28	23.8	2.2	<5	15.9	99.2	18.1	<0.5	1.2	169.7	32.4	2.1	2.8	<0.5	<0.5	<0.5	<0.5	<0.5	2.7	77.7	133.4	14.9	50.4	8.6	1.6	8.3	1.1	5.8	1.1	3.4	<0.5	3.1	<0.5	2.7	<0.5	471	0.7	<0.5	30.4	2.0	59	74	27	92	98	134
111	DSBH-3/S-29	20.2	1.2	<5	19.1	139.8	18.0	<0.5	<0.5	166.0	34.2	2.8	1.3	<0.5	<0.5	<0.5	<0.5	<0.5	1.9	80.2	138.6	15.5	52.0	8.8	1.6	8.3	1.1	6.2	1.2	3.7	<0.5	3.3	<0.5	2.5	<0.5	680	0.7	<0.5	27.7	1.9	47	52	24	108	72	113
112	DSBH-3/S-30	18.7	1.0	<5	13.5	195.4	14.3	<0.5	<0.5	154.5	24.5	2.7	0.7	<0.5	<0.5	<0.5	0.9	<0.5	1.2	53.9	93.4	9.8	32.6	5.5	1.3	5.7	0.8	4.4	0.9	2.7	<0.5	2.5	<0.5	2.9	<0.5	913	0.7	<0.5	15.8	1.0	37	28	25	96	35	90
113	DSBH-4/S-1	9.7	0.5	<5	24.6	106.0	13.0	<0.5	1.9	60.8	44.5	1.0	2.8	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	39.6	75.1	7.9	28.2	5.7	1.0	7.1	1.1	7.4	1.5	4.8	0.7	4.6	0.7	3.8	<0.5	540	<0.5	<0.5	9.4	1.0	96	21	14	93	62	122
114	DSBH-4/S-2	3.2	<0.5	<5	15.9	151.8	13.6	<0.5	3.8	107.7	13.3	1.2	7.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.7	33.7	63.5	7.6	28.7	4.8	1.6	4.0	<0.5	2.3	<0.5	1.5	<0.5	1.6	<0.5	0.7	<0.5	700	0.6	<0.5	7.5	1.0	33	10	27	289	23	31
115	DSBH-4/S-3	21.4	0.6	<5	14.9	86.1	19.4	<0.5	<0.5	90.8	22.1	3.1	4.8	<0.5	<0.5	<0.5	0.6	1.0	0.5	44.2	83.2	9.0	31.6	5.5	1.3	4.7	0.7	3.5	0.7	2.2	<0.5	2.0	<0.5	<0.5	1.2	497	6.7	<0.5	13.3	0.7	110	28	24	148	<5	20
116	DSBH-4/S-4	28.7	<0.5	<5	17.4	70.5	21.1	<0.5	1.5	93.7	20.7	2.2	4.1	0.8	<0.5	<0.5	0.7	0.7	0.5	45.9	83.6	8.8	30.2	5.0	1.3	5.0	0.6	3.7	0.7	2.3	<0.5	2.2	<0.5	18.0	0.8	384	<0.5	<0.5	12.9	0.5	104	26	22	154	20	42
117	DSBH-4/S-5	7.3	<0.5	<5	28.2	69.1	19.5	<0.5	2.3	65.7	42.8	2.9	2.4	<0.5	<0.5	<0.5	0.6	0.8	<0.5	42.1	75.2	7.7	26.8	5.5	1.0	6.9	1.2	7.4	1.5	4.5	0.7	4.2	0.6	3.0	1.3	345	<0.5	<0.5	9.8	0.6	66	17	24	179	47	54
118	DSBH-4/S-6	12.6	<0.5	<5	17.4	46.9	23.3	<0.5	<0.5	102.7	23.1	2.9	2.9	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	54.4	95.3	9.9	33.5	5.6	1.5	5.6	0.7	4.1	0.8	2.4	<0.5	2.4	<0.5	1.3	1.8	195	0.5	<0.5	16.7	0.6	135	52	34	177	21	41
119	DSBH-4/S-7	8.9	<0.5	<5	18.5	105.8	18.2	<0.5	1.5	86.5	28.3	1.6	2.4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	55.3	90.8	9.6	31.7	5.8	1.3	6.4	0.9	5.1	1.0	2.9	<0.5	2.7	<0.5	1.6	<0.5	510	<0.5	<0.5	13.5	0.5	109	54	23	125	33	46
120	DSBH-4/S-8	13.8	<0.5	<5	8.4	90.5	16.5	<0.5	<0.5	61.2	13.8	0.8	0.9	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	33.5	59.7	6.0	19.6	3.3	1.1	3.7	0.5	2.6	<0.5	1.3	<0.5	1.2	<0.5	3.0	0.7	526	<0.5	<0.5	2.8	<0.5	12	14	25	511	29	32
121	DSBH-4/S-9	11.2	<0.5	<5	16.5	107.2	15.3	<0.5	1.2	62.5	29.4	1.8	2.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	52.4	85.0	9.1	30.1	5.4	1.3	6.2	0.9	5.1	1.0	3.0	<0.5	2.8	<0.5	2.1	<0.5	575	<0.5	<0.5	11.1	0.7	52	52	25	185	103	56

Annexure XI Analytical results of minor and trace elements (in ppm)																																														
SL. NO	SAMPLE NUMBER	Li	Be	B	Sc	Co	Ga	Ge	Se	Rb	Y	Nb	Mo	Cd	In	Sn	Sb	Te	Cs	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Hf	Ta	W	Tl	Bi	Th	U	Cu	Ni	Pb	Sr	Zn	Zr
122	DSBH-4/S-10	18.5	0.7	<5	17.2	65.5	18.0	<0.5	1.2	86.7	33.5	3.6	5.0	0.6	<0.5	<0.5	<0.5	<0.5	<0.5	67.7	110.2	12.4	41.7	7.4	1.8	7.7	1.1	6.0	1.2	3.6	<0.5	3.2	<0.5	2.2	0.6	313	<0.5	<0.5	25.8	1.7	59	63	20	114	93	76
123	DSBH-4/S-11	17.7	<0.5	<5	23.7	68.0	19.6	<0.5	2.1	86.7	42.3	2.0	4.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	55.6	80.9	8.6	28.3	6.3	1.8	7.9	1.3	7.4	1.5	4.4	0.6	4.2	0.6	2.6	<0.5	252	<0.5	<0.5	11.5	0.6	94	83	22	131	79	38
124	DSBH-4/S-12	24.1	<0.5	<5	7.4	79.4	17.2	<0.5	<0.5	58.9	12.3	1.4	1.4	<0.5	<0.5	<0.5	4.3	<0.5	<0.5	40.6	74.2	7.9	26.4	3.8	1.4	3.7	<0.5	2.3	<0.5	1.2	<0.5	1.1	<0.5	3.7	0.6	459	<0.5	<0.5	2.2	<0.5	7	8	32	701	61	26
125	DSBH-4/S-13	30.3	<0.5	<5	14.0	99.9	15.1	<0.5	<0.5	59.5	19.4	2.4	0.9	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	48.4	78.7	8.5	27.8	4.8	1.5	5.1	0.7	3.7	0.7	2.1	<0.5	1.9	<0.5	2.4	<0.5	531	<0.5	<0.5	8.6	<0.5	44	47	19	347	54	45
126	DSBH-4/S-14	13.9	<0.5	<5	23.6	77.1	18.5	<0.5	2.3	124.8	40.4	1.9	3.5	<0.5	<0.5	<0.5	0.6	0.9	<0.5	86.7	144.4	16.4	56.6	9.7	1.8	9.8	1.3	7.2	1.4	4.3	0.6	4.0	0.6	2.3	<0.5	300	0.6	<0.5	30.7	1.3	114	80	24	91	69	44
127	DSBH-4/S-15	14.2	0.6	<5	13.6	59.7	16.1	<0.5	<0.5	142.1	126.2	0.9	1.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	48.0	81.7	9.0	30.4	5.1	1.8	5.3	0.7	4.4	0.9	2.8	<0.5	2.9	<0.5	1.7	<0.5	276	0.7	<0.5	13.3	0.8	64	32	33	133	41	25
128	DSBH-4/S-16	20.1	0.5	<5	17.9	57.7	18.8	<0.5	1.0	127.2	230.1	0.8	2.1	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	53.5	98.6	10.9	38.4	6.7	1.3	6.6	0.9	5.3	1.1	3.3	<0.5	3.1	<0.5	1.5	<0.5	210	0.6	<0.5	21.2	0.9	103	60	21	74	53	57
129	DSBH-4/S-17	20.7	1.3	<5	18.4	50.6	18.0	<0.5	2.0	139.0	29.5	1.8	4.7	0.5	<0.5	<0.5	<0.5	<0.5	1.0	48.8	97.8	11.1	40.3	7.2	1.4	6.7	0.9	5.1	1.0	3.2	<0.5	3.0	<0.5	2.1	<0.5	216	0.7	<0.5	17.8	1.2	123	55	15	62	72	56
130	DSBH-4/S-18	22.5	0.9	<5	17.9	50.0	18.7	1.0	4.3	142.9	27.7	2.9	7.2	0.6	<0.5	3.1	1.7	1.8	1.7	56.8	114.8	12.8	46.0	8.2	1.3	7.1	0.9	4.8	1.0	3.0	<0.5	2.8	<0.5	4.7	0.6	214	0.8	1.3	21.6	1.8	109	45	12	66	85	91
131	DSBH-4/S-19	12.1	<0.5	<5	17.7	96.8	15.1	<0.5	0.8	116.8	35.0	3.0	3.0	<0.5	<0.5	<0.5	<0.5	<0.5	0.9	58.9	129.5	12.8	45.6	7.8	1.4	7.8	1.1	6.1	1.3	3.8	0.5	3.5	<0.5	1.2	<0.5	449	0.6	<0.5	17.0	1.2	74	42	11	71	66	65
132	DSBH-4/S-20	15.1	<0.5	<5	16.8	78.1	16.7	<0.5	1.4	120.4	28.2	2.1	3.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.1	63.4	129.5	13.7	48.6	8.1	1.3	7.2	0.9	4.8	1.0	3.0	<0.5	2.9	<0.5	1.9	<0.5	374	0.6	<0.5	20.3	1.3	79	43	8	58	74	86
133	DSBH-4/S-21	10.6	<0.5	<5	17.0	84.2	14.2	<0.5	0.8	123.5	27.6	1.8	2.2	<0.5	<0.5	<0.5	<0.5	<0.5	1.1	53.6	107.7	11.7	40.8	6.9	1.3	6.8	0.9	4.8	1.0	2.9	<0.5	2.6	<0.5	2.1	<0.5	412	0.6	<0.5	16.5	1.1	64	34	12	68	86	111
134	DSBH-4/S-22	11.2	<0.5	<5	23.0	62.9	16.1	<0.5	<0.5	110.2	53.6	1.2	4.3	<0.5	<0.5	<0.5	1.4	1.4	0.8	65.5	132.6	14.3	50.7	8.7	1.4	8.4	1.3	7.9	1.8	6.1	0.9	6.4	1.0	1.2	0.6	266	0.8	<0.5	20.3	1.3	47	29	12	68	38	21
135	DSBH-4/S-23	10.5	<0.5	<5	18.8	82.7	15.1	<0.5	1.1	126.6	34.1	1.4	2.7	1.3	<0.5	<0.5	<0.5	<0.5	0.9	56.2	112.4	12.1	43.0	7.3	1.6	7.2	1.0	5.8	1.2	3.8	0.5	3.8	0.6	2.6	<0.5	418	0.7	<0.5	16.6	1.0	42	26	12	70	70	100
136	DSBH-4/S-24	13.8	0.5	<5	18.1	61.2	17.3	<0.5	<0.5	135.5	29.4	2.8	2.0	<0.5	<0.5	<0.5	<0.5	<0.5	1.4	54.7	108.2	11.7	41.3	7.1	1.3	6.8	0.9	5.1	1.0	3.1	<0.5	2.9	<0.5	2.3	0.7	291	0.7	<0.5	16.5	1.1	49	31	10	60	72	101
137	DSBH-4/S-25	7.1	<0.5	<5	15.8	101.5	10.2	<0.5	<0.5	117.8	34.2	2.1	0.8	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	52.9	105.9	11.5	40.6	7.1	1.4	7.0	1.0	5.7	1.2	3.9	0.6	3.9	0.6	2.6	<0.5	503	0.6	<0.5	19.0	1.3	38	32	14	84	58	102
138	DSBH-4/S-26	16.7	<0.5	<5	17.6	68.9	16.1	<0.5	0.7	125.4	33.3	1.6	2.0	<0.5	<0.5	<0.5	<0.5	<0.5	0.8	49.5	100.0	11.0	38.7	6.8	1.4	6.4	0.9	5.5	1.2	3.8	0.5	3.9	0.6	2.4	<0.5	332	0.6	<0.5	16.1	1.2	43	29	17	73	68	82
139	DSBH-4/S-27	16.9	<0.5	<5	18.1	82.3	15.5	<0.5	1.1	103.1	130.1	1.8	2.5	0.9	<0.5	<0.5	<0.5	<0.5	0.7	45.2	90.6	9.8	35.0	6.0	1.2	5.9	0.8	5.0	1.1	3.3	<0.5	3.3	<0.5	35.5	<0.5	401	0.5	<0.5	14.4	1.0	42	35	11	61	81	81

Annexure XI Analytical results of minor and trace elements (in ppm)																																														
SL. NO	SAMPLE NUMBER	Li	Be	B	Sc	Co	Ga	Ge	Se	Rb	Y	Nb	Mo	Cd	In	Sn	Sb	Te	Cs	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Hf	Ta	W	Tl	Bi	Th	U	Cu	Ni	Pb	Sr	Zn	Zr
140	DSBH-4/S-28	70.5	<0.5	<5	16.6	101.8	18.8	<0.5	<0.5	143.5	33.4	1.7	2.8	<0.5	<0.5	<0.5	<0.5	0.5	0.8	48.9	100.2	10.5	37.2	6.5	1.5	6.5	0.9	5.5	1.1	3.5	0.5	3.5	0.5	1.2	0.8	481	0.8	<0.5	13.7	0.8	54	41	12	68	39	16
141	DSBH-4/S-29	12.5	<0.5	<5	17.6	86.6	17.0	<0.5	0.9	116.8	31.8	1.6	2.0	<0.5	<0.5	<0.5	<0.5	<0.5	0.9	56.1	112.3	12.2	42.6	7.4	1.3	6.9	0.9	5.4	1.1	3.6	<0.5	3.6	0.5	2.2	<0.5	438	0.6	<0.5	17.4	1.4	51	41	11	62	74	75
142	DSBH-4/S-30	20.9	<0.5	<5	17.2	85.3	18.7	<0.5	0.7	116.4	34.9	3.9	3.0	<0.5	<0.5	<0.5	<0.5	<0.5	1.2	58.7	119.3	12.9	45.5	7.9	1.3	7.3	1.0	5.9	1.2	3.8	0.5	3.6	0.5	3.2	<0.5	397	0.6	<0.5	18.6	1.4	54	39	10	57	77	128
143	DSBH-4/S-31	23.1	<0.5	<5	16.0	71.1	16.8	<0.5	0.8	105.0	35.0	2.6	2.7	<0.5	<0.5	<0.5	<0.5	<0.5	0.7	53.9	108.1	11.6	41.5	7.3	1.3	6.9	1.0	5.8	1.2	3.8	0.5	3.8	0.6	2.2	<0.5	340	0.6	<0.5	16.3	1.6	52	40	10	61	76	115
144	DSBH-4/S-32	37.5	<0.5	<5	17.0	70.9	16.3	<0.5	<0.5	126.4	29.3	3.1	3.6	<0.5	<0.5	<0.5	<0.5	<0.5	1.3	54.2	106.9	11.6	41.3	7.3	1.3	6.8	0.9	5.1	1.0	3.2	<0.5	3.1	<0.5	3.4	<0.5	348	0.6	<0.5	17.1	1.4	58	36	11	65	79	125

Annexure XII: Bulk density results based on Archimedes' principle

SL. NO	BOREHOLE NUMBER	SAMPLE NUMBER	INITIAL WATER HEIGHT (cm)	FINAL WATER HEIGHT (cm)	INCREASED HEIGHT (cm)	WATER WEIGHT (g)	WATER + SAMPLE WEIGHT (g)	SAMPLE WEIGHT (g)	VOLUME OF SAMPLE (cm ³)	BULK DENSITY g/cm ³
1	DDBH-1	S-1	6.3	7.9	1.6	1.03	1.352	322	125.6	2.56
2		S-2	6.2	7.3	1.1	1.025	1.246	221	86.35	2.55
3		S-3	6.2	7.4	1.2	1.02	1.3	280	94.2	2.97
4		S-4	6.1	7.3	1.2	1.015	1.253	238	94.2	2.52
5		S-5	5.9	7.1	1.2	1.005	1.218	213	94.2	2.26
6		S-6	6.3	8.2	1.9	1.037	1.378	341	149.15	2.28
7		S-7	6.5	7.9	1.4	1.039	1.301	262	109.9	2.38
8		S-8	6.3	7.2	0.9	1.039	1.202	163	70.65	2.30
9		S-9	6.3	7.3	1	1.035	1.221	186	78.5	2.36
10		S-10	6.2	7.7	1.5	1.031	1.311	280	117.75	2.37
11		S-11	6.2	8.1	1.9	1.025	1.426	401	149.15	2.68
12		S-12	6.1	7.7	1.6	1.022	1.332	310	125.6	2.46
13		S-13	6.1	7.3	1.2	1.019	1.261	242	94.2	2.56
14		S-14	6.4	7.6	1.2	1.048	1.282	234	94.2	2.48
15		S-15	6.4	7.9	1.5	1.044	1.325	281	117.75	2.38
16		S-16	6.4	7.8	1.4	1.04	1.316	276	109.9	2.51
17		S-17	6.3	8	1.7	1.037	1.363	326	133.45	2.44
18		S-18	6.3	7.9	1.6	1.034	1.339	305	125.6	2.42
19		S-19	6.3	7.9	1.6	1.031	1.365	334	125.6	2.65
20		S-20	6.3	8.3	2	1.029	1.413	384	157	2.44
21		S-21	6.2	8.1	1.9	1.026	1.379	353	149.15	2.36
22		S-22	6.1	7.2	1.1	1.022	1.22	198	86.35	2.29
23		S-23	6.5	7.7	1.2	1.047	1.292	245	94.2	2.60
24		S-24	6.4	8.1	1.7	1.041	1.389	348	133.45	2.60
25		S-25	6.4	7.8	1.4	1.038	1.322	284	109.9	2.58
26		S-26	6.3	7.8	1.5	1.036	1.327	291	117.75	2.47
27		S-27	6.3	7.5	1.2	1.032	1.281	249	94.2	2.64
28		S-28	6.2	7.7	1.5	1.031	1.329	298	117.75	2.53
29	DSBH-3	S-1	6.1	7.9	1.8	1.013	1.345	332	141.3	2.34
30		S-2	7.3	8.7	1.4	1.082	1.336	254	109.9	2.31
31		S-3	6	7.1	1.1	1.003	1.233	230	86.35	2.66

Annexure XII: Bulk density results based on Archimedes' principle

SL. NO	BOREHOLE NUMBER	SAMPLE NUMBER	INITIAL WATER HEIGHT (cm)	FINAL WATER HEIGHT (cm)	INCREASED HEIGHT (cm)	WATER WEIGHT (g)	WATER + SAMPLE WEIGHT (g)	SAMPLE WEIGHT (g)	VOLUME OF SAMPLE (cm ³)	BULK DENSITY g/cm ³
32		S-4	6	7.5	1.5	1	1.28	280	117.75	2.37
33		S-5	5.9	7.4	1.5	0.997	1.292	295	117.75	2.50
34		S-6	6.6	8.2	1.6	1.054	1.366	312	125.6	2.48
35		S-7	6.5	7.5	1	1.049	1.228	179	78.5	2.28
36		S-8	6.5	8.1	1.6	1.048	1.339	291	125.6	2.31
37		S-9	6.4	7.8	1.4	1.044	1.309	265	109.9	2.41
38		S-10	6.1	8	1.9	1.029	1.403	374	149.15	2.50
39		S-11	6.1	7.6	1.5	1.027	1.319	292	117.75	2.47
40		S-12	6.4	8.5	2.1	1.028	1.478	450	164.85	2.72
41		S-13	6.4	8.2	1.8	1.025	1.412	387	141.3	2.73
42		S-14	6.3	8.2	1.9	1.023	1.424	401	149.15	2.68
43		S-15	6.3	7.9	1.6	1.021	1.361	340	125.6	2.70
44		S-16	6.9	8.3	1.4	1.061	1.384	323	109.9	2.93
45		S-17	7.6	9	1.4	1.091	1.366	275	109.9	2.50
46		S-18	7.6	9	1.4	1.088	1.376	288	109.9	2.62
47		S-19	7.5	8.9	1.4	1.084	1.358	274	109.9	2.49
48		S-20	7.5	9.1	1.6	1.082	1.404	322	125.6	2.56
49		S-21	7.5	8.5	1	1.08	1.295	215	78.5	2.73
50		S-22	7.4	9.3	1.9	1.074	1.446	372	149.15	2.49
51		S-23	7.3	9.2	1.9	1.068	1.423	355	149.15	2.38
52		S-24	7.3	9	1.7	1.066	1.384	318	133.45	2.38
53		S-25	7.3	9.3	2	1.062	1.488	426	157	2.71
54		S-26	7.2	8.9	1.7	1.06	1.429	369	133.45	2.76
55		S-27	7.2	8.9	1.7	1.057	1.421	364	133.45	2.72
56		S-28	7.2	8.9	1.7	1.055	1.415	360	133.45	2.69
57		S-29	7.1	8.6	1.5	1.053	1.352	299	117.75	2.53
58		S-30	7.1	9.3	2.2	1.051	1.512	461	172.7	2.66
59	DSBH-2	S-1	6.3	7.3	1	1.059	1.252	193	78.5	2.45
60		S-2	6.4	7.5	1.1	1.046	1.258	212	86.35	2.45

Annexure XII: Bulk density results based on Archimedes' principle

SL. NO	BOREHOLE NUMBER	SAMPLE NUMBER	INITIAL WATER HEIGHT (cm)	FINAL WATER HEIGHT (cm)	INCREASED HEIGHT (cm)	WATER WEIGHT (g)	WATER + SAMPLE WEIGHT (g)	SAMPLE WEIGHT (g)	VOLUME OF SAMPLE (cm ³)	BULK DENSITY g/cm ³
61		S-3	6.9	8.2	1.3	1.08	1.327	247	102.05	2.42
62		S-4	7.3	8.3	1	1.11	1.297	187	78.5	2.39
63		S-5	6.5	7.5	1	1.058	1.243	185	78.5	2.35
64		S-6	6.4	7.9	1.5	1.049	1.327	278	117.75	2.36
65		S-7	6.4	7.3	0.9	1.053	1.225	172	70.65	2.43
66		S-8	6.3	7.3	1	1.059	1.252	193	78.5	2.45
67		S-9	7.3	8.3	1	1.11	1.297	187	78.5	2.38
68		S-10	6.6	7.6	1	1.064	1.239	175	78.5	2.22
69		S-11	6.5	7.4	0.9	1.057	1.235	178	70.65	2.51
70		S-12	6.5	7.4	0.9	1.053	1.243	190	70.65	2.68
71		S-13	6.4	8.1	1.7	1.05	1.419	369	133.45	2.76
72		S-14	6.4	7.5	1.1	1.046	1.258	212	86.35	2.45
73		S-15	6.3	8.2	1.9	1.044	1.376	332	149.15	2.22
74		S-16	6.2	7.9	1.7	1.04	1.342	302	133.45	2.26
75		S-17	6.2	7.5	1.3	1.035	1.266	231	102.05	2.26
76		S-18	6.1	7.9	1.8	1.031	1.354	323	141.3	2.28
77		S-19	6.1	7.9	1.8	1.028	1.324	296	141.3	2.09
78		S-20	6	8.2	2.2	1.022	1.396	374	172.7	2.16
		S-21	7	8.1	1.1	1.084	1.286	202	86.35	2.33
		S-22	6.9	8.2	1.3	1.08	1.327	247	102.05	2.42
		S-23	6.9	8.9	2	1.077	1.458	381	157	2.42
		S-24	6.8	8.1	1.3	1.071	1.359	288	102.05	2.82
		S-25	6.7	8	1.3	1.068	1.423	355	102.05	3.47
		S-26	6.7	8.5	1.8	1.063	1.442	379	141.3	2.68
		S-27	6.6	8.7	2.1	1.061	1.476	415	164.85	2.51
		S-28	6.6	8.5	1.9	1.056	1.374	318	149.15	2.13
		S-29	6.5	7.5	1	1.047	1.228	181	78.5	2.30
		S-30	6.4	7.9	1.5	1.043	1.368	325	117.75	2.76
		S-31	6.3	7.4	1.1	1.04	1.256	216	86.35	2.50

Annexure XII: Bulk density results based on Archimedes' principle

SL. NO	BOREHOLE NUMBER	SAMPLE NUMBER	INITIAL WATER HEIGHT (cm)	FINAL WATER HEIGHT (cm)	INCREASED HEIGHT (cm)	WATER WEIGHT (g)	WATER + SAMPLE WEIGHT (g)	SAMPLE WEIGHT (g)	VOLUME OF SAMPLE (cm ³)	BULK DENSITY g/cm ³
		S-32	6.3	8.3	2	1.038	1.438	400	157	2.5478
		S-33	6.3	7.8	1.5	1.035	1.331	296	117.75	2.5138
		S-34	6.6	8.4	1.8	1.061	1.417	356	141.3	2.5195
		S-35	6.5	8.4	1.9	1.057	1.419	362	149.15	2.4271
		S-36	6.5	8.6	2.1	1.053	1.49	437	164.85	2.6509
		S-37	6.4	8.4	2	1.051	1.448	397	157	2.5287
		S-38	6.4	8.1	1.7	1.05	1.398	348	133.45	2.6077
		S-39	6.4	8.5	2.1	1.047	1.486	439	164.85	2.6630
		S-40	6.3	7.5	1.2	1.045	1.276	231	94.2	2.4522
79	DDBH-2	S-1	6.8	8.5	1.7	1.059	1.417	358	133.45	2.68
80		S-2	6	7.5	1.5	1	1.28	280	117.75	2.38
81		S-3	6.8	8.1	1.3	1.071	1.359	288	102.05	2.854
82		S-4	7.1	7.8	0.7	1.08	1.24	160	54.95	2.924
83		S-5	7.3	8.2	0.9	1.092	1.244	210	70.65	2.9724
84		S-6	7.3	8.5	1.2	1.09	1.298	239	94.2	2.5372
85		S-7	7.3	9.2	1.9	1.08	1.409	352	149.15	2.3600
86		S-8	7.2	8.7	1.5	1.083	1.366	315	117.75	2.6752
87		S-9	7.1	7.7	0.6	1.075	1.173	125	47.1	2.6539
88		S-10	6.7	7.8	1.1	1.057	1.256	213	86.35	2.4667
89		S-11	6.5	7.4	0.9	1.045	1.19	150	70.65	2.1231
90		S-12	7.4	8.3	0.9	1.1	1.265	165	70.65	2.34564
91		S-13	6.4	7.9	1.5	1.049	1.327	278	117.75	2.3654
92		S-14	6.5	7.5	1	1.058	1.243	185	78.5	2.3567
93	DSBH-4	S-1	7.7	8.5	0.8	1.125	1.296	171	62.8	2.7229
94		S-2	7.4	8.3	0.9	1.1	1.265	165	70.65	2.3355
95		S-3	7.3	9	1.7	1.096	1.412	316	133.45	2.3679
96		S-4	7.3	8.4	1.1	1.092	1.303	211	86.35	2.4435
97		S-5	7.2	8.2	1	1.088	1.264	176	78.5	2.2420
98		S-6	7.2	8.5	1.3	1.086	1.327	241	102.05	2.3616
99		S-7	7.1	7.9	0.8	1.084	1.244	160	62.8	2.5478

Annexure XII: Bulk density results based on Archimedes' principle

SL. NO	BOREHOLE NUMBER	SAMPLE NUMBER	INITIAL WATER HEIGHT (cm)	FINAL WATER HEIGHT (cm)	INCREASED HEIGHT (cm)	WATER WEIGHT (g)	WATER + SAMPLE WEIGHT (g)	SAMPLE WEIGHT (g)	VOLUME OF SAMPLE (cm ³)	BULK DENSITY g/cm ³
100		S-8	7.1	7.8	0.7	1.08	1.24	160	54.95	2.9117
101		S-9	6.9	7.6	0.7	1.062	1.214	152	54.95	2.7662
102		S-10	6.8	8	1.2	1.06	1.315	255	94.2	2.7070
103		S-11	6.8	8.3	1.5	1.055	1.377	322	117.75	2.7346
104		S-12	6.7	8.2	1.5	1.052	1.364	312	117.75	2.6497
105		S-13	6.6	8.3	1.7	1.049	1.4	351	133.45	2.6302
106		S-14	6.6	8.3	1.7	1.047	1.413	366	133.45	2.7426
107		S-15	6.5	7.5	1	1.043	1.243	200	78.5	2.5478
108		S-16	6.5	7.5	1	1.04	1.249	209	78.5	2.6624
109		S-17	6.5	8.6	2.1	1.036	1.443	407	164.85	2.4689
110		S-18	6.4	8	1.6	1.034	1.337	303	125.6	2.4124
111		S-19	6.8	8.5	1.7	1.059	1.417	358	133.45	2.6827
112		S-20	6.7	7.9	1.2	1.057	1.305	248	94.2	2.6327
113		S-21	6.7	8.4	1.7	1.051	1.425	374	133.45	2.8025
114		S-22	6.6	8.1	1.5	1.048	1.363	315	117.75	2.6752
115		S-23	6.5	8.4	1.9	1.043	1.424	381	149.15	2.5545
116		S-24	6.5	8.4	1.9	1.04	1.413	373	149.15	2.5008
117		S-25	6.4	8.2	1.8	1.037	1.419	382	141.3	2.7035
118		S-26	6.4	8	1.6	1.035	1.38	345	125.6	2.7468
119		S-27	6.4	7.9	1.5	1.032	1.341	309	117.75	2.6242
120		S-28	6.3	7.9	1.6	1.03	1.361	331	125.6	2.6354
121		S-29	6.3	8	1.7	1.028	1.374	346	133.45	2.5927
122		S-30	6.3	7.6	1.3	1.025	1.295	270	102.05	2.6458
123		S-31	6.2	8	1.8	1.021	1.399	378	141.3	2.6752
124		S-32	6.2	7.4	1.2	1.018	1.265	247	94.2	2.6221

Annexure-XIII: Analytical results of minor and trace elements (in ppm) for check samples

Sl. No	Sample number	Li	Be	B	Sc	Co	Ga	Ge	Se	Rb	Y	Nb	Mo	Cd	In	Sn	Sb	Te	Cs	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Hf	Ta	W	Tl	Bi	Th	U	Cu	Ni	Pb	Sr	Zn	
1	DDBH-1/S-14	9.4	1.7	<5	4.0	8.9	19.7	0.9	<0.5	123.7	14.3	0.9	1.9	<0.5	<0.5	<0.5	<0.5	0.8	1.1	52.7	74.8	6.1	25.1	2.9	2.7	3.9	<0.5	2.8	<0.5	1.6	<0.5	1.4	<0.5	0.8	<0.5	0.6	0.5	<0.5	2.5	0.7	85	31	54	332	77	
2	DDBH-1/S-27	19.7	1.4	<5	13.7	31.1	21.7	<0.5	<0.5	86.9	58.1	<0.5	8.5	<0.5	<0.5	<0.5	<0.5	0.8	1.8	44.9	63.9	5.1	22.2	3.9	1.3	6.1	1.1	8.7	2.0	6.4	1.0	6.6	0.9	4.7	<0.5	<0.5	<0.5	0.6	5.5	3.5	160	65	28	131	214	
3	DSBH-3/S-15	18.4	0.8	<5	5.9	12.9	16.5	0.9	<0.5	47.8	22.9	<0.5	2.1	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	90.7	142.2	14.2	6.4	8.3	1.5	7.1	0.7	4.1	0.8	2.4	<0.5	2.6	<0.5	3.8	<0.5	<0.5	<0.5	<0.5	17.1	2.2	66	36	25	184	82	
4	DSBH-3/S-16	18.1	<0.5	<5	9.9	22.2	24.1	1.2	0.9	91.7	21.6	1.2	6.3	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	101.4	141.6	14.3	6.4	7.9	0.1	5.6	7.0	0.8	3.9	0.7	2.3	<0.5	1.8	<0.5	4.1	<0.5	<0.5	<0.5	<0.5	36.6	1.6	160	76	26	182	110

Annexure-XIV: Comments of the peer reviewer

SL. NO	COMMENTS	ACTION TAKEN BY MMPL
1	Contents: edit the chapter numbers as suggested. In the description part (of the contents) provide the heading only, not the complete description. Corrections may be made in pages 4 to 8, as suggested	Complied with
2	Modifications/spelling corrections to be made as pointed out in the text and plates.	Complied with
3	Summary: page 10, add title of the report. Summary should contain the highlights on mineralizations (both graphite and tungsten) as well as the resource details	Complied with
4	Page no 13: table.2.1. Make another column to record the target completed. When you refer the drilling target, provide the total number of boreholes (6 nos)	Complied with
5	Page no 11: it is written as 8 nos of boreholes for 500 m, correct it as 6 numbers of boreholes.	Complied with

Annexure-XIV: Comments of the peer reviewer		
SL. NO	COMMENTS	ACTION TAKEN BY MMPL
6	Page no 21: under previous work, when details of the authors and the year of work are given, provide the organization name too (GSI/MECL...)	Complied with
7	Page no 53: the trench numbers should have been given in the text as well as in the plates.	Complied with
8	Repetition of observations/points should be avoided as noted in page no 57 and 83.	Complied with
9	Page nos 54, 56, 57, ore zones; it is written as plate IIII, it must be plate III. Correct it.	Complied with
10	Page no 56; major graphite zones. State the correct number of zones.	Complied with
11	Page 111: resource (10.5) write the unit in the table (last row)	Complied with
12	Page 113, table 10.3: column5. Is it the W assay value? Make the correction .	As the analyses of check samples for W do not give encouraging results, therefore this point has not been adhered to.
13	Page104. It is very significant that high anomalous value of W ranging from 500 ppm to 1265 ppm has been recorded in this block. But the type of minerals (whether wolframite or scheelite) contributing for high w values has not been stated. These details may be added in the report.	As the analyses of check samples for W do not give encouraging results, therefore this point has not been adhered to.
14	Pages 111 to 114. Resource estimation: in the table provide the unit (m) for depth, strike influence, thickness etc..	Complied with
15	Page 132 annexure III. Provide the unit (m) for depth, total run length, thickness etc..	Complied with
16	Pages 174 to 180. Annexure VII; column 5, core recovery % details may be included.	Complied with
17	Pages 199 to 205. Analysis of minor and trace elements. Provide the unit (ppm?)	Complied with
18	Page 198; add one more column (for FC by internal analysis) showing the analytical results (FC) by the internal unit.	Complied with
19	Plate I; nearly 40% of the mapped area is soil covered. Additional pits/trenches should have been made to expose the litho-units and the mineralized zones.	Noted
20	Plate III: legend: write the details as suggested in plate III.	Complied with
21	Plate V: write the borehole numbers as suggested.	Complied with

Annexure-XIV: Comments of the peer reviewer		
SL. NO	COMMENTS	ACTION TAKEN BY MMPL
22	Plate VI: in the interpreted map, the W mineralized zones have been delineated/projected without details. Details may be included in the text.	As the analyses of check samples for W do not give encouraging results, therefore this point has not been adhered to.
23	Plate VIII: at borehole closed points the depth should be shown. Along the BH for major graphite mineralized zones write the true thickness with assay value (FC). For eg; [2.5mx4.10]	Complied with
24	The authors may be asked to attend to the corrections/modifications suggested in the text, plates of the report.	Complied with