

Geological Report on Reconnaissance Survey (G4) for PGE, Vanadium and associated Minerals in Bhursadongari - Murum block (100 sq. km), Balaghat District, Madhya Pradesh (Toposheet No. 64C/11)

Under

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Commodity – PGE, Vanadium and associated minerals.

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(PGE bearing Quartz-Chlorite-Hematite rock) (Vanadium, Titanium bearing Laterite with pisolites)

GK/GR/2025/PGE/BHURSAONGRI-MURUM/12

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CHAPTER-1

कार्यकारी सारांश

भुरसाडोंगरी-मुरुम ब्लॉक, जो मध्य प्रदेश के बालाघाट जिले में लगभग 100 वर्ग किमी क्षेत्र में फैला है, को राष्ट्रीय खनिज अन्वेषण न्यास (NMET) पहल के अंतर्गत एक व्यवस्थित रिकॉनिसैस सर्वेक्षण (G-4 स्तर) के अंतर्गत अध्ययन किया गया है। यह सर्वेक्षण मेसर्स जेमको काटी एक्सप्लोरेशन प्राइवेट लिमिटेड द्वारा किया गया है, जिसका उद्देश्य इस क्षेत्र में PGE (प्लैटिनम समूह के तत्व), वैनाडियम तथा अन्य संबंधित खनिजों की संभावनाओं का मूल्यांकन करना है।

अध्ययन क्षेत्र की भूगर्भीय विशेषताएं प्रिकैम्ब्रियन आमगांव ग्रेनाइट ग्नाइस, फिलाइट, मेटा-सेडिमेंट्स, एवं बेसिक मेटा-लावा इन्क्लेक्स के रूप में वर्णित की गई हैं। इसके अतिरिक्त क्षेत्र में पैलियो-प्रोटेरोज़ोइक नंदगांव वोल्केनिक ग्रुप और मेसो-प्रोटेरोज़ोइक खैरागढ़ वोल्केनिक ग्रुप की चट्टानें भी पाई जाती हैं। नंदगांव समूह को बिजली रायोलाइट्स द्वारा और खैरागढ़ समूह को बालू-पत्थर व बेसाल्ट की वैकल्पिक अनुक्रम द्वारा दर्शाया गया है। इन संरचनाओं के ऊपर कई स्थानों पर बाद की विकसित लेटराइट परतें पाई जाती हैं, जैसे आमगांव फिलाइट, सिटागोटा बेसाल्ट, कोटीमा बेसाल्ट।

बड़े पैमाने पर भूवैज्ञानिक मानचित्रण कार्य 1:12,500 के स्केल पर किया गया, जिससे समूचे 100 वर्ग किमी क्षेत्र में चट्टान के प्रकार, वैनाडियम-टाइटेनियम युक्त बॉक्साइटिक लेटराइट से लेकर एल्यूमिनस लेटराइट तक की पहचान की गई। उपलब्ध एयरो-जियोफिजिकल मैग्नेटिक मैप्स का अध्ययन कर फील्ड अवलोकनों की पुष्टि की गई। चुने गए 10 संभावित ट्रेंच स्थानों पर ट्रेंचिंग की गई [प्रत्येक 15 मीटर लंबाई x 1 मीटर चौड़ाई x 1 मीटर गहराई] — जो संकीर्ण रेखीय असामान्य क्षेत्र में स्थित थे। इसी प्रकार, 10 स्थानों पर गड्ढे (पिटिंग) भी किए गए [प्रत्येक 2 मीटर लंबाई x 1 मीटर चौड़ाई x 1 मीटर गहराई] — जहाँ TiO_2 एवं V_2O_5 से समृद्ध लेटराइट पहाड़ियाँ हैं।

कुल 63 बेडरॉक एवं चैनल नमूने एकत्रित किए गए, जिनका विश्लेषण प्रमुख ऑक्साइडों के लिए WD-XRF विधि द्वारा किया गया। इसके अतिरिक्त, इन नमूनों का विश्लेषण PGE (प्लैटिनम समूह तत्व), REE (दुर्लभ पृथ्वी तत्व) एवं अन्य संबंधित खनिजों के लिए ICP-MS, तथा सोने के लिए फायर-असे विधि से किया गया।

एक संकीर्ण लंबवत असामान्य क्षेत्र की पहचान की गई, जो करुटोला सैंडस्टोन और सिटागोटा बेसाल्ट के संपर्क क्षेत्र में है, जहाँ PGE एवं REE की उपस्थिति पाई गई। इस संपर्क क्षेत्र से कुल 113 नमूने (38 बेडरॉक व 75 ट्रेंच नमूने) लिए गए, जिनका विश्लेषण PGE खनिजीकरण क्षमता के लिए किया गया। इनमें से केवल 6 बेडरॉक नमूनों में कुल PGE 50 ppb से अधिक पाए गए; शेष बेडरॉक एवं ट्रेंच नमूनों में कुल PGE 50 ppb से कम रहे। ट्रेंच नमूनों में प्लैटिनम (Pt) लगभग सभी में पाया गया, जिसकी सांद्रता 0.005 ppm से 0.026 ppm तक रही, जो कि इस क्षेत्र में प्रमुख PGE तत्व के रूप में चिन्हित करता है। सर्वाधिक Pt मूल्य BMT-08 (7m–8m) में 0.026 ppm दर्ज किया गया, जो स्थानीय PGE संवर्धन को दर्शाता है। पैलेडियम (Pd) की उपस्थिति अपेक्षाकृत कम रही, जिसकी सांद्रता 0.005–0.011 ppm तक थी।

सोने का विश्लेषण फायर-असे विधि द्वारा 10 सतही नमूनों में किया गया, जिसमें सभी की सांद्रता 0.01 ppm से कम पाई गई, अर्थात डिटेक्शन लिमिट से नीचे।

ट्रेंच नमूनों का REE (Rare Earth Elements) के लिए भी विश्लेषण किया गया, परंतु उनके सांद्रण विविध होने के बावजूद व्यावसायिक दृष्टि से महत्वपूर्ण नहीं पाए गए। अतः इस ब्लॉक में REE का कोई प्रमुख संवर्धन नहीं पाया गया।

EPMA (इलेक्ट्रॉन प्रोब माइक्रो-एनालिसिस) अध्ययन कार्य योजना में जोड़ा गया था, ताकि संभावित PGE खनिजों की पहचान की जा सके, परंतु वर्तमान ब्लॉक में PGE सांद्रता अत्यंत कम पाए जाने के कारण और ईपीएमए (EPMA) अध्ययन के लिए आने वाले महीनों में प्रयोगशालाओं में स्लॉट की अनुपलब्धता के कारण, EPMA अध्ययन कार्य को राष्ट्रीय खनिज अन्वेषण न्यास (NMET) की तकनीकी सह-लागत समिति (TCC) की सहमति से हटा दिया गया।

भुरसाडोंगरी-मुरुम ब्लॉक के लेटराइटिक प्रोफाइल्स में V_2O_5 (वैनाडियम पेंटॉक्साइड) की सांद्रता सामान्यतः 0.10% से 0.14% के बीच रही, जबकि कुल रेंज <0.05% से 0.20% के बीच रही। खुदाई किए गए 10 टेस्ट पिट्स में से 7 में V_2O_5 की सांद्रता 0.10%–0.20% पाई गई, जो एल्यूमिनस लेटराइट्स में वैनाडियम की संभावनाओं को उत्साहजनक रूप में दर्शाता है।

ये V_2O_5 ग्रेड्स अन्य GSI द्वारा G-3 स्तर पर जांचे गए क्षेत्रों जैसे कि देपो (पापुम पारे, अरुणाचल प्रदेश) और खपरीपानी ब्लॉक (डिंडोरी, मध्यप्रदेश) में दर्ज ग्रेड्स के तुलनीय हैं। इन दोनों मामलों में, वैनाडियम की समान सांद्रता के आधार पर भंडार का आकलन किया गया था, और देपो ब्लॉक की सफल नीलामी की गई थी, जहाँ मेसर्स वेदांता लिमिटेड ने पसंदीदा बोलीदाता के रूप में ब्लॉक प्राप्त किया।



तीन संभावित खनिजीकृत क्षेत्र, क्रमशः 130 हेक्टेयर, 40 हेक्टेयर, और 6 हेक्टेयर, चिन्हित किए गए हैं, जिनमें टाइटेनियम-वैनाडियम समृद्ध एल्यूमिनस लेटराइट्स पाए गए हैं, जो आमगांव फिलाइट, सिटागोटा बेसाल्ट और कोटीमा बेसाल्ट पर स्थित हैं। यह समृद्ध लेटराइट क्षेत्र समीपवर्ती मानेरी-सितापाला ब्लॉक में भी फैले हुए हैं। इन क्षेत्रों को वर्तमान ब्लॉक क्षेत्र के साथ मिलाकर बड़े और नीलामी योग्य खनन पट्टे हेतु कॉम्पोजिट लाइसेंस (प्रॉस्पेक्टिंग लाइसेंस-कम-माइनिंग लीज) के लिए उपयुक्त खंड बनाए जा सकते हैं।



EXECUTIVE SUMMARY

The Bhursadongari-Murum Block, covering approximately 100 sq. km area in Balaghat District, Madhya Pradesh, has been subject to a systematic Reconnaissance Survey (G-4 stage) under the funding of National Mineral Exploration Trust (NMET). being conducted by M/s. Gemco Kati Exploration Private Limited, [NPEA's] aims to assess the potentiality for PGE, Vanadium and other associated mineralization within the block area.

The area is characterized by the Precambrian Amgaon Gneiss, Phyllite, Meta-Sediments, and Basic Meta-Lava Enclaves. Additionally, rocks from the Palaeo-Proterozoic Nandgaon Volcanic Group and the Meso-Proterozoic Khairagarh Volcanic Group are present. The Nandgaon Group is represented by the Bijli Rhyolites, while the Khairagarh Group consists of an alternating sequence of Sandstones and Basalts. Younger Lateritic capping has developed in several locations over these formations like Amgaon Phyllite, Sitagota and Kotima Basalt.

Large scale geological mapping was conducted at 1:12,500 scale, covering the entire of 100 sq. km area, delineating all litho-packages, vanadium-titanium bearing bauxitic laterite to aluminous laterites. Available aero-geophysical magnetic maps were studied to cross check and corroborate field observations. Fixing of probable trench locations across the narrow linear anomalous Iron and PGE zone, at 10 selected spots [15m length x 1m width x 1m depth]. Simultaneously, pitting at 10 locations [2m length x 1m width x 1m depth] were also identified on the laterite covered hill ranges enriched with TiO_2 & V_2O_5 .

A total of 63 bedrock samples (BRS) and channel samples (CS) were collected and analysed for major oxides using WD-XRF methods. These samples were also analysed for platinum group elements (PGE), rare earth element (REE) and other associated minerals using ICPMS and gold by fire assay analysis.

One narrow elongated anomalous zone along the contact of Karutola sandstone and Sitagota basalt is identified and demarcated having occurrence of platinum group elements (PGE) and rare earth elements. A total of 113 samples, including bedrock (38 samples) and trenches (75 samples from 10 trenches), were analysed to assess PGE (Platinum Group Elements) mineralization potential, out of which only 6 bedrock samples have yielded total PGE above 50 ppb & rest of the bedrock & trench samples yielded total PGE below 50 ppb. Across the trench samples, platinum (Pt) is consistently detected in nearly all samples, ranging between 0.005 ppm to 0.026 ppm, indicating the dominant PGE present in the contact zone. The highest Pt value was recorded in BMT-08 (7m–8m) at 0.026 ppm, whereas Palladium (Pd) appears less frequently than Pt, with values typically in the range between 0.005–0.011 ppm.

Gold analysis of ten surface samples using fire assay revealed concentrations below the detection limit of 0.01 ppm.



The trench samples were also analysed for Rare Earth Elements (REE). The analysis of the samples indicates that Rare Earth Elements (REE) are present in varying concentrations. Overall, the block area does not indicate substantial REE enrichment that could justify commercial value.

Initially, the EPMA study was added to the quantum of work to detect platinum group of minerals if any. Considering the low concentration of total PGE from present block & non-availability of Laboratories slots in coming months for EPMA study, the study has been dropped with due permission of technical cum costing committee (TCC) of National Mineral Exploration Trust (NMET).

The vanadium pentoxide (V_2O_5) concentrations in the lateritic profiles of the Bhursadongari–Murum Block exhibit a range, predominantly between 0.10% and 0.14%, with overall values spanning from <0.05% to 0.20%. Out of the ten test pits excavated, seven yielded V_2O_5 values within the range of 0.10%–0.20%, indicating fairly good amount of vanadium within the aluminous laterites.

These V_2O_5 grades are comparable to those reported from other GSI-conducted G3 stage investigations, such as the Depo area in Papum Pare District, Arunachal Pradesh, and the Khapripani Block in Dindori District, Madhya Pradesh. In both cases, similar vanadium concentrations supported resource estimation exercises, with the Depo block proceeding to successful auctioning, wherein M/s Vedanta Limited emerged as the preferred bidder.

The three potential mineralized areas (130-hectare, 40-hectare and 6-hectare area) have been demarcated having titanium-vanadium enriched aluminous laterites capped on Amgaon phyllite, Sitagota basalt and Kotima basalt. The demarcated titanium and vanadium bearing aluminous laterite regions are well extending into the southern Maneri-Sitapala Block. Integrating those areas with present block area, bigger auctionable blocks for composite license can be carved out.



CHAPTER-2

INTRODUCTION

2.1 Background:

2.1.1 Introduction of National Mineral Policy, 2016 and a series of amendments to the Mines and Minerals (Development & Regulation) [MMDR] Act since 2015, has received much-needed impetus to the exploration of mineral commodities in the country. These amendments also paved way for participation of Notified Private Exploration Agencies in Mineral Exploration activities to catalyze the search for various mineral commodities.

2.1.2 Subsequently, in 2020, the Geological Survey of India (GSI), being the premiere organization entrusted for the baseline data acquisition, processing and interpretation of non-fuel mineral commodities, has rolled out geological potential maps for a host of non-energy mineral commodities in the form of Atlas of Geological Potential Areas of Non-fuel Minerals in India.

2.1.3 The Atlas of Obvious Geological Potential Areas for mineralization of different non-energy mineral commodities, thus formed the starting point in recognizing potential areas for Reconnaissance Survey (G-4) for specific commodities of interest. Then identifying the gap areas wherein, the State and Central Exploration agencies have not yet carried out such exploration activities has resulted in the carving out of a block for the Reconnaissance Survey (G-4) in the present proposal.

2.1.4 Although, as per the Geological Potential Atlas, a major part of the proposed block falls in area marked as OGP-Gold, principles of Metallogenic Epochs have been applied to envisage potential mineralization as a result of Palaeo-Proterozoic Volcanism which include REE, vanadiferous titanomagnetites and possible base metals (Cu, Zn, Ni, Co). So effectively this project was conceived as a Greenfield exploration proposal backed by some field data acquired during a quick reconnaissance field visit.

2.1.5 The project proposal was presented in the 62nd meeting of Technical-Cum-Cost Committee-I [TCC] of National Mineral Exploration Trust [NMET] which was held through video conferencing on 28th, 29th February and 01st March, 2024.

2.1.6 The committee recommended the proposal for approval of EC for “Reconnaissance survey PGE, Vanadium and associated Minerals in Bhursadongari - Murum Block (100 sq.km), Balaghat District: M.P.” with an estimated cost of ₹ 61.01 lakh (including GST) within time schedule of 6 months for carrying out the proposed work and submission of report as per annexure -10A & 10 B.



2.1.7 The EC approved the project with an estimated cost of ₹ 61.01 lakh (including GST) within time schedule of 6 months during the 34th meeting of Executive Committee (EC) of NMET held on 12th March 2024.

2.1.8 The Office Memorandum was received by Gemco Kati on 12th March 2024. The project was initiated on 06th April 2024.

2.1.9 Due to non-availability of forest permission for digging trenches, the project time line was extended multiple times by the TCC, finally upto 31.08.2025 for circulation of the Geological Report.

2.2 Details of project:

The Bhursadongari-Murum Block project is a Reconnaissance Survey (G-4) focused on exploring Platinum Group Elements (PGE), vanadium, and associated minerals in a 100 sq. km area in Balaghat District, Madhya Pradesh. Initiated under India's National Mineral Policy, 2016. It is part of the National Mineral Exploration Trust (NMET) initiatives and was approved at a cost of ₹61 lakhs, with a completion timeline of 6 months. The project includes geological mapping, and geochemical analysis to identify anomalies and mineralized zones. Field challenges include dense forest cover and difficult terrain, with major delays due to late forest permissions. Below map (**Figure 1**) shows the Bhursadongari-Murum Block on **Toposheet No. 64C/11 of Survey of India (1:50,000 scale)**.

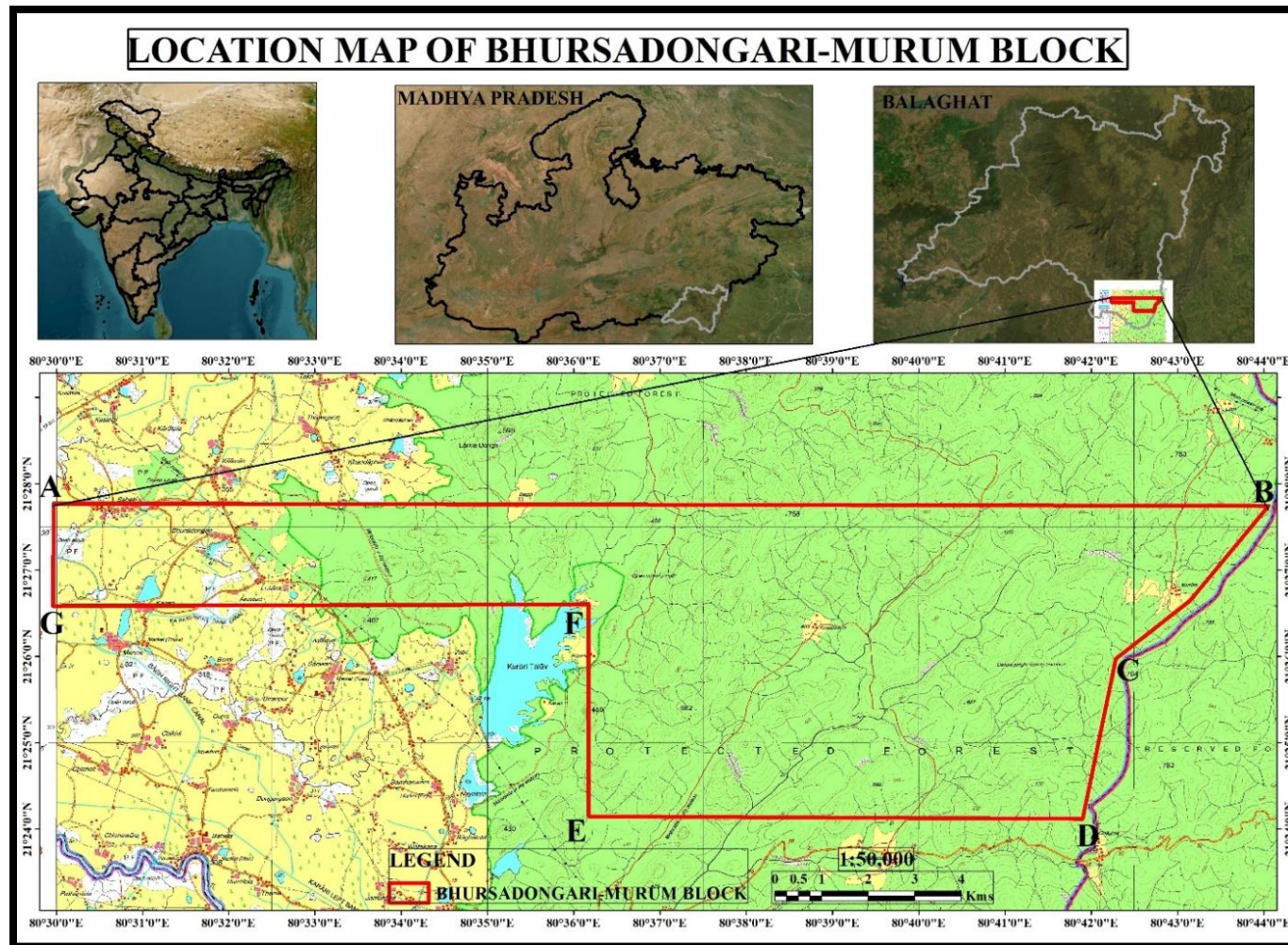


Figure 1. Location map of Bhursadongari-Murum Block on toposheet No. 64C/11 of Survey of India (1:50000 scale).

2.3 Chronology of project activities:

Table 1: Chronology of project activities.

Chronology of the project activities		
S.N.	Date	Project related activities
1	28 th , 29 th February and 1 st March 2024	Project proposal presentation: 62 nd meeting of TCC, NMET. TCC recommended the project for approval to EC, NMET.
2	12 th March 2024	Approval by 34 th EC, NMET
3	12 th March 2024	Date of receipt of sanction order of the project
4	2 nd April 2024	Application on Parivesh portal for seeking permission regarding pitting & trenching
5	6 th April 2024	Date of initiation of project work
6	24 th , 25 th and 26 th July, 2024	First review: 67 th TCC
7	16 th August 2024	Letter received from DFO, Land Management, South Balaghat Division, M.P for registration & processing fee payment
8	28 th August 2024	Registration & processing fee payment through online mode
9	24 th September 2024	Letter from CCF Balaghat to DFO, Balaghat regarding fixation of a date for site inspection visit
10	11 th October 2024	Site inspection visits by CCF Balaghat, MP
11	13 th October 2024	CCF Balaghat and V.P. (Project & Planning) Gemcokati Exploration Pvt. Ltd. meeting at CCF office
12	5 th and 6 th December 2024	Second review: 3 rd TCC II
13	26 th and 27 th December 2024	Third review: 4 th TCC II extended time period till 31 st March 2025, due to delayed forest permission for pitting and trenching
14	27 th December 2024	Applied for offline permission for pitting and trenching based on new guidelines
15	15 th January 2025	Received pitting and trenching permission from APCCF/Nodal Officer, Bhopal Office

16	29 th January 2025	Received pitting and trenching permission from DFO, Balaghat Office
17	27 th & 28 th February 2025	Fourth review: 6th TCC-II has extended project time period till 30 th June 2025, for GR submission, due to delayed in forest permission.
18	6 th March 2025	Received permission from Range office
19	6 th March 2025	Date of initiation of pitting/trenching work
20	1 st April 2025	Completion of pitting and trenching work
29	29 th May 2025	Final review: 9 th TCC II for peer review nomination and submission. TCC II recommended for peer review & submission.
30	6 th June 2025	Nomination of peer reviewer for geological report
31	9 th June 2025	Dispatch of hard copy by post and soft copy by email.
32	3 rd July 2025	Received comments through email from the reviewer
33	7 th July 2025	Received comments in hard copy from the reviewer
34	30 th July 2025	Placed before TCC with compliance report of Peer Reviewer. The TCC has approved the report & advised for circulation by 31 st August 2025.
35	20 th August 2025.	Final Report submitted to NMET Secretariate through mail.

2.4 Investigating agency:

The investigation for the Reconnaissance Survey (G-4) in the Bhursadongari-Murum Block is being carried out by Gemco Kati Exploration Private Limited, a reputed agency headquartered in Chandrapur, Maharashtra. The company is entrusted with executing geological mapping, geochemical, pitting and trenching based studies in the 100 sq. km project area. As a notified private exploration agency, Gemco Kati is actively involved in mineral exploration under India's National Mineral Exploration Trust (NMET). With expertise in advanced exploration methodologies and data interpretation, the agency plays a pivotal role in identifying potential mineral zones and contributing to India's self-reliance in critical mineral resources.

Name and Address of the Investigating agency	
(a) Name of NPEA	GEMCO KATI EXPLORATION PRIVATE LIMITED
(b) Name of Authorized Signatory	Subrata Sarkar, Vice President (Projects & Planning)
(c) Postal address:	E-77, MIDC Road, Chandrapur-442406.
(d) Telephone Number (Office):	07172-287200
(e) Fax number (Office):	07172-287200/230562
(f) Mobile No & Telephone Number (Residence):	(+) 91 7044208900
(g) E-mail address:	subrata.sarkar@gemcokati.com

2.5 Objectives of investigation:

The primary objective of the investigation in the Bhursadongari-Murum Block is to delineate zones with anomalous concentrations of Platinum Group Elements (PGE), vanadium and associated minerals. This is achieved through a systematic Reconnaissance Survey (G-4) aimed at identifying mineralized zones and understanding their geological and geochemical characteristics. The investigation involves geological mapping, analyzing available geophysical maps, trenching, pitting, and geochemical sampling, particularly in laterite-covered hills and other anomaly zones. The study focuses on understanding the mineral potential associated with Palaeo-Proterozoic volcanism, with an emphasis on platinum group minerals, vanadium and associated mineralization.

2.6 Basis for taking up investigation:

The basis for undertaking the investigation in the Bhursadongari-Murum Block stems from India's National Mineral Policy, 2016, and subsequent amendments to the Mines and Minerals (Development & Regulation) Act, which encouraged exploration activities for non-fuel minerals. The Geological Survey of India's (GSI) Atlas of Obvious Geological Potential Areas served as a critical reference, identifying this region as an area of high potential for gold, PGE, REE and other associated mineralization. The project's foundation is further supported by principles of Metallogenic Epochs, which indicate the region's geological suitability due to Palaeo-Proterozoic volcanism. A reconnaissance field visit provided initial field data and confirmed the

potential prompting the development of this greenfield exploration project. Identified as a gap area where previous exploration was limited, the block was proposed for a systematic G-4 stage survey to unlock its mineral resource potential.

2. 7 Details and nature and quantum of work proposed vs achievement:

Table 2. Showing the nature and quantum of work.

S. N.	Nature of work	Target assigned	Target achieved
1	Geological Mapping (LSM) (sq. km) on 1:12,500	100	100
2	Technological (a) Surface exploration		
	Trenching (cu. m)	150	150
	Pitting (cu. m)	20	20
3	Geochemical survey		
	(a) Bed Rock Sample (Nos.)	50	50
	(b) Trench samples (Nos.)	50	50
	(c) Latérite sampler for Vanadium (Nos)	30	30
4	Petrographic/ Minerographic studies		
	(a) Petrographic (Nos.)	20	20
	(b) Ore Microscopy (Nos.)	20	20
	(c) EPMA	15 hrs.	Dropped with TCC II permission.
5	Chemical analysis (Nos.)		
	a) Major Oxides by XRF (+ Laterite analysis for Vanadium)	55 (Including 5 check samples)	50
	b) For Gold by fire assay	11 samples	10
	c) REE by ICPMS (34 elements) (Pitting and trenching samples)	23 samples	20
	d) PGE of field samples by Ni-S fire assay in magnetic bearing gabbroic sample	112 (Including 17 check samples)	112

2.8 Personal involved:

The Bhursadongri-Murum Block involved a dedicated team of professionals who contributed their expertise across various stages of the investigation. The personnel involved:

1. **Subrata Sarkar:** Vice President (Project & Planning) & Project Coordinator of QCI-NABET has concluded the item and submitted the final report in association of his team members.
2. **Dr. Vinay Sahay** (Technical Area Expert: QCI-NABET): Senior Manager (Geology), assisted in drafting of report.
3. **Junior Geologists:** S/Shri Tejeswar Barik, Ravikant Sinha, Chinmay Rout, Nitin and Ramraj Patel have actively participated in field geological mapping & sampling, pitting and trenching. Devika Nagpure & Amit Sahoo has contributed in GIS and maps preparation. Ravikant Sinha and Nitin Baghel participated actively in forest permission activities for trenching. Kaustava Bhattacharjee, Vijay Kumar, Suraj Vidhate and Subhajit Chakraborty have assisted in report finalization and submission.
4. **Chemical Analysis:** Analysis for major oxide by XRF, was performed by Shiva Analytical (India) Pvt. Ltd., Bengaluru and JNRRDC, Nagpur, whereas analysis for Gold by fire assay, REE by ICPMS & PGE by Ni-S fire assay was performed by Shiva Analytical (India) Pvt. Ltd., Bengaluru and Lucid laboratories private limited, Hyderabad.
5. **Petrographic Study:** Petrographic sample processing and studies were conducted by the inhouse facility.

This team worked collaboratively to achieve the project's goal, combining their diverse skills to ensure the successful completion of the exploration.

2.9 Acknowledgement:

We express our sincere gratitude to Shri. Jijo George, Director & CEO, for his leadership support, motivation and encouragement, and to Shri. Nigel Job, Director & CFO, for his unwavering administrative and financial support. We also thank Shri. Lijin Sunil, MIS. We are also thankful to the members of the Technical-Cum-Cost Committee (TCC) & Executive Committee (EC), National Mineral Exploration Trust (NMET), Ministry of Mines for providing us the opportunity to successfully complete a G4 stage project and geological report from Balaghat District, Madhya Pradesh.

Our thanks extend to the officials of SU: Madhya Pradesh, GSI, Bhopal and Directorate of Geology and Mining (DGM), Madhya Pradesh for their invaluable support and encouragement. We deeply appreciate the help and cooperation extended by all individuals, whether in the office or the laboratory. Finally, we express our sincere thanks to all the members of the Gemco Kati family for their tremendous support throughout the entire period of investigation. We sincerely express our gratitude to Dr. A. V. Keshava Prasad for his association in the beginning in guiding the investigation.

CHAPTER-3

PROPERTY DESCRIPTION

3.1 A brief description of details of the area (Village Name, District, State, and Toposheet Number):

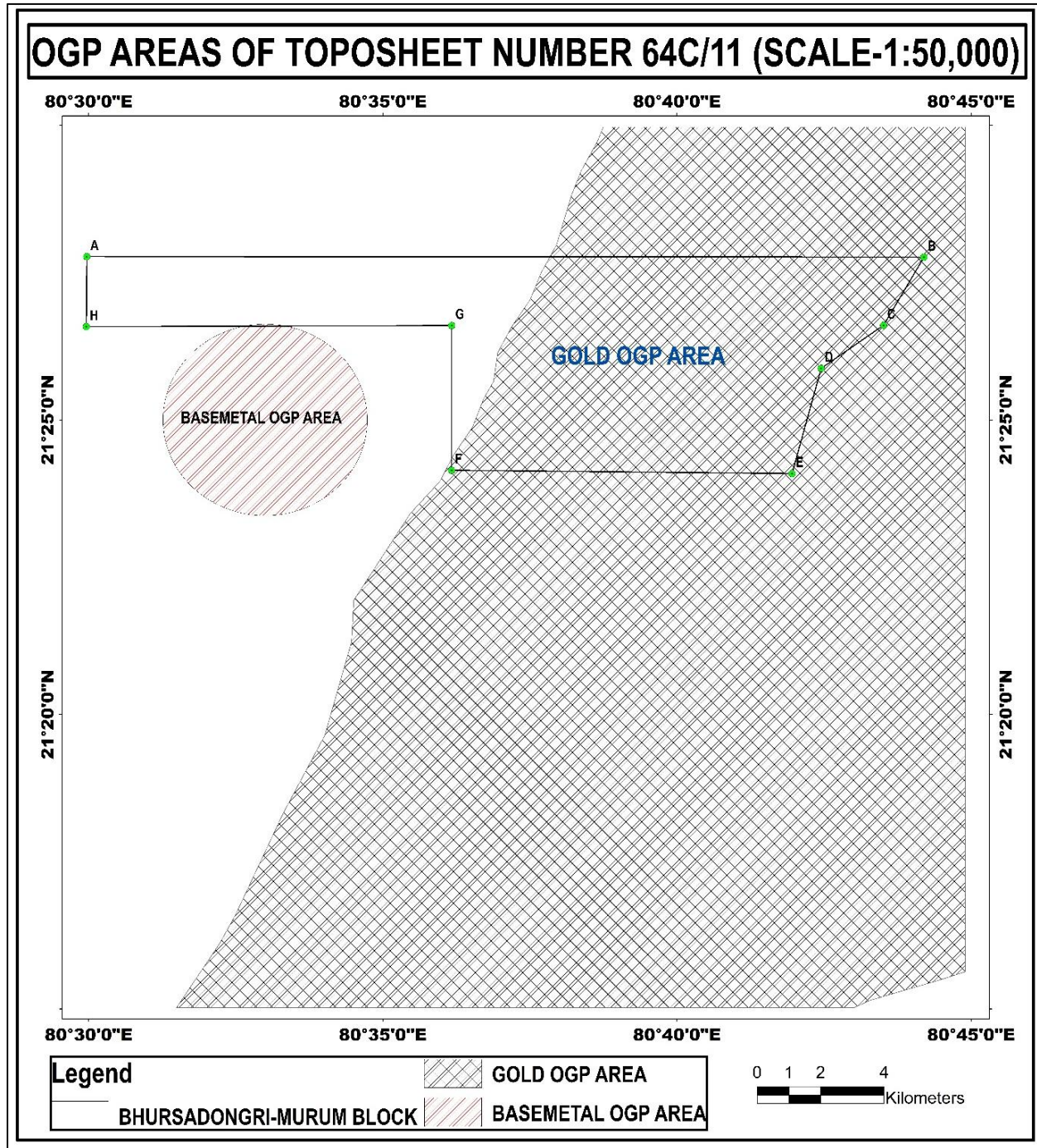
The Bhursadongari-Murum Block is located in the villages of Bhursadongari and Murum in Lanzi Tahsil, Balaghat District, Madhya Pradesh, India. The survey is conducted on Toposheet No. 64C/11, covering an area of 100 sq. km. Below **Table 3** shows block related location and accessibility information.

Table 3. Location and accessibility information of the block

Location and accessibility information of the block	
Tehsil/Taluk	Lanji
District	Balaghat
State	Madhya Pradesh
Toposheet Number	64C/11
Nearest Rail Head	Darekasa, Salekasa (About 15 Km)
Road	Located on both side of Lanji-Khairagarh Road
Airport	Gondia (50Km)

The Atlas of Geological Potential Areas (**Figure 2**) indicates that the entire Khairagarh volcano-sedimentary sequence as OGP for gold.

Figure 2. Bhursadongari-Murum block on Atlas of Geological Potential Areas of GSI.



3.2 Geo-Coordinates of Corner Points: Table 4 provides the coordinates of the block boundary points.

Table 4. The block's boundary is defined by the following coordinates:

S.N.	Boundary points	Latitude	Longitude
1	A	21°27'46.37"N	80°29'58.23"E
2	B	21°27'44.64"N	80°44'3.32"E
3	C	21°26'38.92"N	80°43'8.81"E
4	D	21°25'58.33"N	80°42'17.21"E
5	E	21°24'7.20"N	80°41'54.18"E
6	F	21°24'8.64"N	80°36'10.23"E
7	G	21°26'36.13"N	80°36'10.33"E
8	H	21°26'35.00"N	80°29'57.70"E

3.3 Land Use/Cover and Forest Type:

The block presents a mix of agricultural land in the western flat-lying area and thick forest cover in the eastern ridges and valleys. The forest is classified as dry deciduous forest with lateritic cappings and dense vegetation. The forest land is under state ownership, and permissions for exploration activities are required via the PARIVESH portal.

3.4 Free Hold/Lease Hold Details & Law and order situation:

The block includes freehold agricultural lands and state-owned forest land, requiring adherence to government regulations and permissions for exploration activities. However, the Balaghat district has been identified as one of the “most affected districts by Let Wing Extremism (LWE) vide OM No. F.No.6/2/2015-NMET/195 dated 08th July 2024. On the ground, the exploration agencies are required to inform the office of Superintendent of Police (Naxalite Cell), Balaghat, Local Police station at Lanji town and the Forest Range Office, West Lanji at Lanji town about movement and duration of the project personnel in the district.

3.5 Location and Accessibility:

The block is approximately 25 km from Amgaon and 10 km from Lanji town, connected by the Nagpur-Amgaon-Lanji road. The nearest railway stations are Darekasa and Salekasa, located about 15 km from the block, connected to the Mumbai-Howrah rail line. The nearest airports are Gondiya (50 km), Nagpur (195 km), and Jabalpur (315 km).

3.6 Climate:

The region experiences a tropical climate with an average annual rainfall of 1633 mm. The monsoon season lasts from mid-June to October, followed by a cool period from November to February. Summers are hot, with temperatures rising up to 44°C, while winters are pleasant, with lows around 15°C.

3.7 Flora and Fauna:

The area supports rich biodiversity, with common flora including teak, sal, bamboo, and grasses. Fauna includes species like deer, jackals, wild boars, and various birds. Wildlife activity is more prominent in the forested eastern region.

3.8 Geomorphology:

The block has contrasting terrain: the western part is flat and soil-covered, while the eastern region is characterized by rugged ridges and valleys with elevations ranging from 304m to 566m. A trellis drainage pattern dominates the eastern ridges, while a dendritic pattern is observed in the western plains.

3.9 Infrastructural facilities and Population:

The area has basic infrastructural facilities, including roads, small markets, and schools in nearby villages. The population relies on agriculture and forestry for livelihood. Wari village in the north-central part is a prominent settlement in the block.

3.10 Archaeological, historical sites and national parks etc.:

The survey area does not include significant archaeological or historical sites. However, nearby regions in Balaghat District are known for their ancient temples and tribal culture. The block is not within or near any national parks or wildlife sanctuaries, reducing ecological sensitivity concerns. A small portion of the block passes through the tiger corridor.

CHAPTER-4

PREVIOUS WORKS

4.1 Brief note on previous work:

Previous geological work in the Bhursadongari-Murum Block and its surrounding area has been limited due to challenging terrain and security concerns linked to Naxalite activity. Historical studies include mapping by Dr. S.N. Sarkar in 1949-50, chromite exploration by R.K. Sharma and Harbans Kumar in 1968, and regional surveys by V.D. Mahajan in 1977. Geophysical studies were enhanced by the **National Aero Geophysical Mapping Programme (NAGMP)** conducted by the Geological Survey of India (GSI) between 2017-2019, which produced high-resolution magnetic and gamma-ray spectrometric maps. However, no systematic ground geophysical or geochemical surveys were carried out in the block prior to this project. Geochemical coverage under the **National Geochemical Mapping Programme (NGCM)** has also been absent. This lack of detailed exploration highlighted the area as a gap zone, prompting the current investigation to uncover its mineral potential systematically.

4.2 Details of previous exploration/investigation carried out by other agencies/parties:

Previous exploration in the Bhursadongari-Murum Block and its surrounding areas has been sporadic and limited due to the inhospitable terrain and security concerns. The Geological Survey of India (GSI) conducted initial mapping and investigations in the region, including chromite exploration by R.K. Sharma and Harbans Kumar in 1968 and regional surveys by V.D. Mahajan in 1977. A 2012 study by Pradeep Mawar focused on adjacent toposheets, while dimension stone investigations were carried out by A.K. Dawande and others in 1997. Geophysical investigations were advanced through GSI's **National Aero Geophysical Mapping Programme (NAGMP)** (2017-2019), which provided airborne magnetic and gamma-ray spectrometric data. However, no substantial ground geophysical or geochemical studies were conducted in this specific block, and detailed exploration activities by other agencies remain sparse, leaving significant gaps in understanding the area's mineral potential. This lack of prior detailed investigation emphasized the need for the current Reconnaissance Survey.

4.3 In case the area forms part of the area covered earlier by exploration then same should be shown in the map with proper scale and a brief description:

No prior studies had been conducted in the Bhursadongari-Murum Block area. As a result, there was no available information on the presence or extension of platinum group minerals, vanadium or other associated minerals into the Bhursadongari-Murum Block, except for the region identified by GSI as having **Obvious Geological Potential (OGP)**. This knowledge gap led to the selection of this area for a reconnaissance survey, following a field visit and sampling of outcrops by geologists from the Exploration Division of Gemco Kati Exploration Pvt. Ltd.

CHAPTER-5

GEOLOGY OF THE AREA

5.1 Aerial reconnaissance:

The Aerial Reconnaissance for the Bhursadongari-Murum Block was conducted using satellite photographs to provide an overview of the region's surface geological features, surface structures, and potential mineral deposits. This method allowed for a quick and efficient survey of inaccessible or difficult-to-reach areas, offering valuable insights into the topography, rock formations, and fault systems. High-resolution satellite images helped in identifying key geological structures, such as lineaments, ridges, and drainage patterns, which are critical for the further exploration and mapping of mineral resources in the block. Additionally, the aerial reconnaissance provided an opportunity to assess the overall environmental context, facilitating the planning of ground-based field studies. Below **Figure 3** shows the block on Google Earth satellite imagery.



Figure 3. Bhursadongari-Murum Block on Google Earth imagery.

5.2 Regional geological setup of the area:

The project area is situated in the north-central part of Survey of India Toposheet 64C/11. The exposed rock formations in this region include the Precambrian Amgaon Gneiss, phyllite, meta-sediments, and basic meta-lava enclaves. Additionally, rocks from the Palaeo-Proterozoic Nandgaon Volcanic Group and the Meso-Proterozoic Khairagarh Volcanic Group are present. Younger lateritic capping has developed in several locations over these formations.

The Amgaon Gneissic Complex in the block area comprises basement gneisses and supracrustal rocks, including phyllites and enclaves of meta-lava. Additionally, the Nandgaon Group is represented by the Bijli Rhyolites, while the Khairagarh Group consists of an alternating sequence of sandstones and basalts.

The stratigraphic sequence of the lithological formations exposed in the region is presented in the **Table 5** and **Figure 4** below (Data: Bhukosh, GSI).

Table 5. Stratigraphic sequence of Bhursadongari-Murum block area (Data: Bhukosh, GSI).

Age	Supergroup	Group	Formation
Palaeo-Proterozoic – Meso-Proterozoic	Dongargarh Supergroup	Khairagarh Group	Kotima Basalt
			Ghogra Sandstone
			Mangikhuta Basalt
			Karutola Sandstone
			Sitagota Basalt
			Bortalao Sandstone
Palaeo-Proterozoic		Nandgaon Group	Bijli Rhyolites
Archaean	Amgaon Gneissic Complex	Amgaon Group	Amgaon Gneiss
			Phyllites
			Meta-lava enclaves

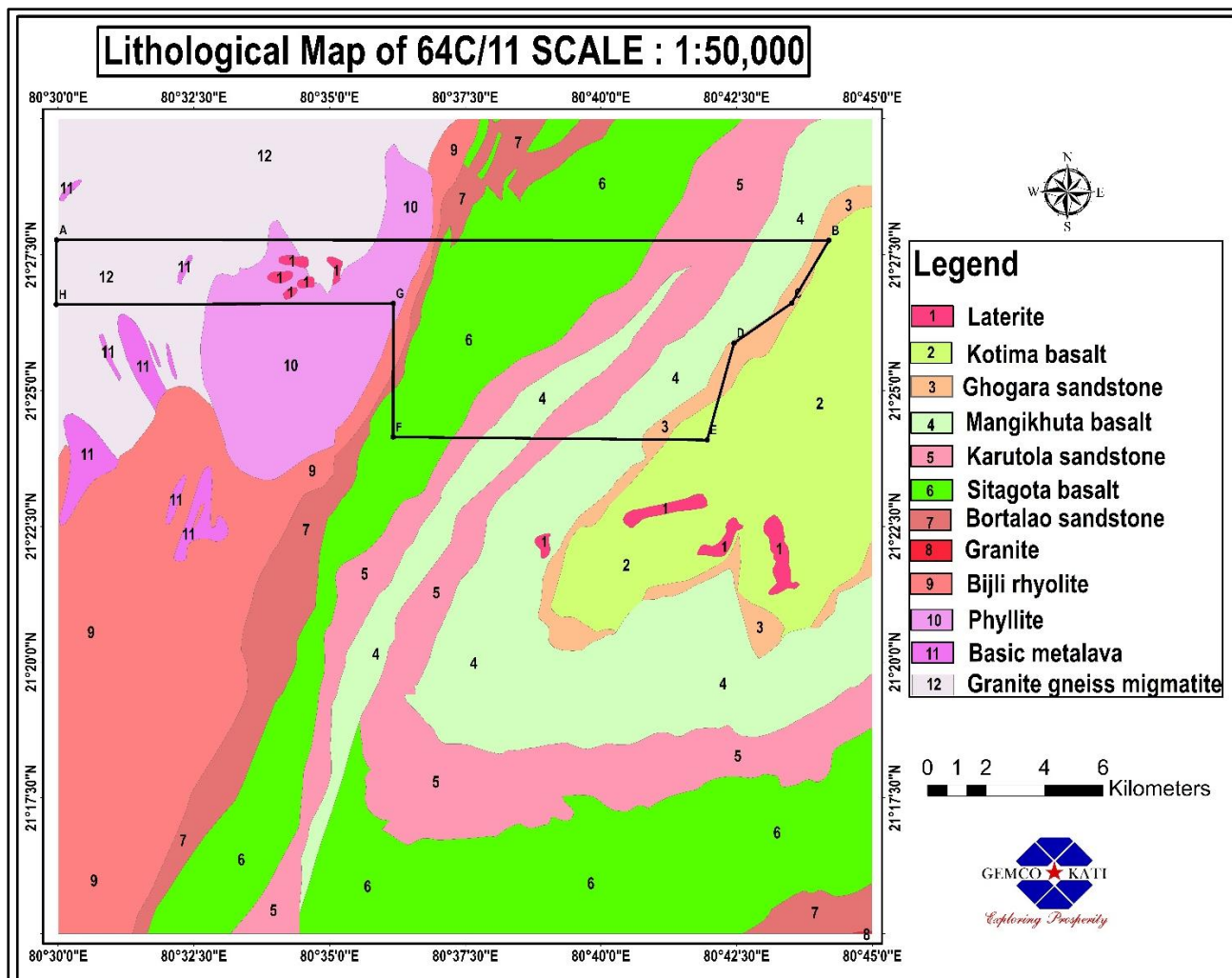


Figure 4. Lithological map of Toposheet 64C/11 (Bhukosh 1:50,000 Map, GSI); location of the Bhursadongari – Murum block is shown.

5.3 Description of Stratigraphic Units:

Amgaon Gneissic Complex

5.3.1 Amgaon granitic gneiss / migmatite:

Amgaon granitic gneiss is usually medium to coarse-grained rock with well-developed foliation. The granitic rock after a prolonged temperature and pressure influence has converted to gneiss. The texture is granoblastic, equigranular to inequigranular; gneissic foliation is defined by sub-parallel alignment of biotite flakes, elongated quartz and feldspar crystals; colour varies from light grey to pinkish grey (Pradeep Mawar, 2012 – STM in contiguous toposheets).

5.3.2 Meta-lava / metabasalt / amphibolite enclaves:

In the western parts of the block where-in rocks of Amgaon gneissic complex are present, occur a few enclaves of fine-grained massive metabasalt and medium to fine-grained amphibolite. However, extensive cultivation activities overall several decades in this part of the block, have obliterated many such enclaves shown on the Bhukosh geological map.

5.4 Dongargarh Super Group –

5.4.1 Nandgaon Volcanic Group

Only Bijli Rhyolite is exposed in the project area.

5.4.1.2 Bijli Rhyolite:

The rhyolites are hard, generally pink- and grey-coloured rocks. In the block area where outcrops were encountered, they are porphyritic texture with phenocrysts of quartz and elongated feldspar set in medium to fine grained matrix.

5.5 Dongargarh Supergroup –

5.5.1 Khairagarh Volcanic Group

As per the reported stratigraphy, there are 3 episodes of Khairagarh Basalts, alternating with clastic sediments, represented by Sandstone.

5.5.1.2 Basalt:

The three episodes of basalts are represented by Lower Sitagota Basalt, Middle Mangikhuta Basalt and Upper Kotima Basalt.

Basalts occupy the valley portions in the eastern part of the block. They are greenish grey in general and show a wide variety of textures – from hard compact fine-grained rocks to amygdular basaltic (and pitted texture where amygdales are dislodged) to porphyritic textures with phenocrysts of glassy material set in fine matrix.

5.5.1.3 Sandstone:

The three cycles of clastic sediment deposition are represented by Lower Bortalao Sandstone, Middle Karutola Sandstone and Upper Ghogra Sandstone. The clastic sedimentation of Khairagarh Volcanics start with a matured ortho-conglomerate which has well developed in one location within the present block.

The sandstones form the high ridges in the central and eastern part of the block area. They are grey to off-white to pale pink coloured hard, compact rocks. They show primary bedding and cross lamination features at places.

5.6 Laterite:

Several laterite occurrences have been mapped during the present fieldwork. These laterites have developed over the Archean supracrustals as well as Paleo- and Mesoproterozoic volcanic rocks.

5.7 Clay:

Several clay pockets have developed along with laterites capping supracrustals.

5.8 Surface indication of mineralization:

The contact zone between basalt and sandstone did not yield good values of platinum group minerals and rare earth minerals in the analyzed samples, except iron content. Samples were also analyzed for gold, but the results were not encouraging. However, the lateritic crust developed on Amgaon phyllites, Sitagota basalt and Kotima basalt yielded relatively encouraging values of titanium and vanadium.

Titanium-vanadium enriched lateritic deposits exhibit distinct surface indications that reflect their formation through prolonged weathering of phyllite and basaltic rocks. One of the key indicators is the presence of iron-rich lateritic crusts with reddish-brown, yellowish, or dark grey coloration, depending on the oxidation state of iron and titanium minerals. These lateritic profiles are typically found as caprocks or plateaus in block areas. In the south-western part of the block, laterite has developed over the Amgaon Phyllites. In the south-eastern part, it caps the Kotima Basalt, the youngest volcanic sequence of the Khairagarh Group. In the northern part it occurs as capping on Sitagota basalt.

CHAPTER-6

ACTIVITY DURING THE PERIOD (GEOSCIENCE INVESTIGATION)

6.1 Geological mapping:

Large scale on 1: 12,500 scale

The geological map of the Bhursadongari-Murum Block illustrates various rock formations and geological features present in the area. The block consists of a diverse range of rock types, including basaltic rocks such as Kotima basalt, Sitagota basalt, and Mangikhuta basalt, as well as sandstone formations like Bortalao sandstone, Karutola sandstone, and Ghogra sandstone. Metamorphic rocks, including phyllite and granitic gneiss-migmatite, are also present, along with intrusive rocks. Additionally, significant lateritic deposits indicate extensive weathering processes.

Large scale mapping was carried out using Brunton compass and hand-held GPS. Several basalt units are mapped in the area, suggesting multiple episodes of volcanic activity. The presence of basalt flows, including those of Kotima, Sitagota, and Mangikhuta, indicates that the region experienced repeated basaltic eruptions. Alongside these volcanic formations, multiple sandstone units, such as Bortalao, Karutola, and Ghogra sandstone, are delineated within the block. The occurrence of phyllite, along with higher-grade metamorphic rocks like granitic gneiss-migmatite, suggests that parts of the block have undergone significant metamorphism. The granite gneiss/migmatite forms a significant portion of the block, particularly in the eastern, central and southern areas. The Bijli rhyolite is present in distinct pockets within the block and is characterized by its hard, pink to grey coloration. The texture is predominantly porphyritic, with large phenocrysts of quartz and feldspar embedded in a fine-grained matrix.

The intercalation of basaltic flows with sedimentary sandstones points to alternating phases of volcanic activity and sediment deposition, indicating a tectonically active environment with evolving volcanic centres and sedimentary basins. Furthermore, the presence of a lateritic cover on phyllite and basalt reflects extensive surface weathering, highlighting the long-term geological processes that have shaped the region.

6.2 Outcrop map on 1: 12,500 scale:

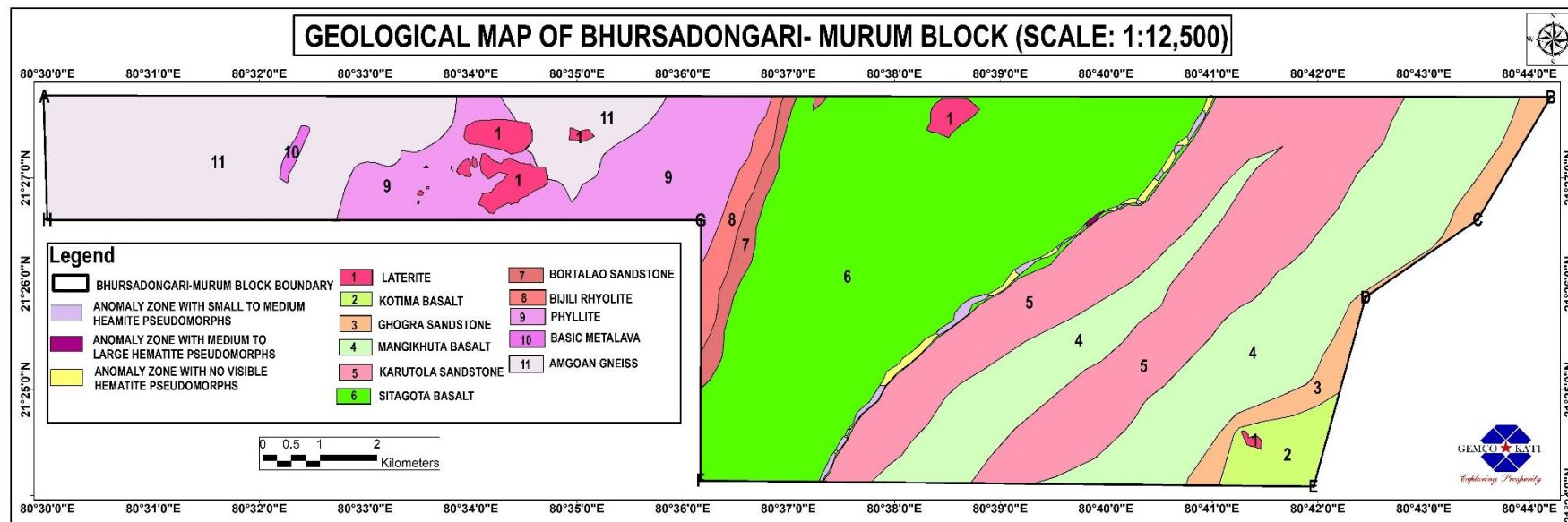


Figure 5. Outcrop map of Bhursadongari Murum Block area (1:12,500 scale).

The outcrop map of the Bhursadongari-Murum Block illustrates outcrops of various types of rocks present in the area. The block consists of a diverse range of rock types, including basaltic rocks such as Kotima basalt, Sitagota basalt, and Mangikhuta basalt, as well as sandstone formations like Bortalao sandstone, Karutola sandstone, and Ghogra sandstone. Metamorphic rocks, including phyllite and granitic gneiss-migmatite, are also present, along with intrusive rocks such as basic metalava. Additionally, significant laterites are also present in block area which are formed due to residual enrichment process on phyllites and basalts. Apart from above mentioned rocks rhyolite is also present in block area.

6.3 Description of rock types:

Ferruginous Quartzite

The ferruginous quartzite occurs as small linear ridges near the village Lohara. The rock is off-white to brownish in colour and has lot of ferruginous venations, giving a surficial reddish tint to the rock.

Amgaon granitic gneiss / migmatite

The granite gneiss/migmatite forms a significant portion of the block, particularly in the southwestern, central and southern areas. These rocks are medium to coarse-grained with a well-developed foliation, a result of prolonged compressive stress acting upon the original granitic material. The texture varies from granoblastic to inequigranular, with gneissic banding defined by the alignment of biotite, elongated quartz, and feldspar. The colour ranges from light grey to pinkish grey, indicating variations in mineral composition. The widespread presence of these rocks suggests deep-seated metamorphism and multiple phases of deformation, reflecting the tectonic history of the region.

Phyllites

The phyllites are observed in parts of the block, representing low-grade metamorphosed sedimentary rocks. These fine-grained, foliated rocks are primarily composed of quartz, sericite, and chlorite, giving them a silky sheen. The foliation results from regional compressional forces, which have aligned the platy minerals parallel to each other. The occurrence of phyllite within the block suggests an earlier sedimentary sequence that underwent metamorphism, marking a transitional phase between sedimentation and higher-grade metamorphic transformations.

Meta-lava / metabasalt / amphibolite enclaves

The basic metalava appears as enclaves within the gneissic terrain, mostly in the western, south-western part of the block. These fine-grained, massive rocks have undergone varying degrees of metamorphism, transforming into amphibolites and metabasaltic units. Although these enclaves are mapped in geological records, extensive agricultural activity over decades has obscured many of their surface expressions. Their presence suggests an early volcanic phase before subsequent metamorphic events.

Bijli Rhyolite

The Bijli rhyolite is present in distinct pockets within the block and is characterized by its hard, pink to grey coloration. The texture is predominantly porphyritic, with large phenocrysts of quartz and feldspar embedded in a fine-grained matrix. These volcanic rocks belong to the Nandgaon Group and indicate a period of intense magmatic activity, likely linked to continental rifting or extensional tectonic settings. The occurrence of rhyolite highlights the volcanic history of the region, with its silica-rich composition suggesting explosive eruptions in the past.

Dongargarh Supergroup – Khairagarh Group

Sandstone

The central and eastern part of the block is dominated by sandstone formations, including Karutola, Ghogra, and Bortalao sandstone. These rocks are grey, off-white, and pale pink in colour, forming high ridges that stand out in the landscape. Their hard and compact nature, along with the presence of well-preserved bedding and cross-lamination features, indicates a sedimentary origin. The deposition of these sandstones suggests fluvial or shallow marine conditions, possibly linked to an ancient sedimentary basin that developed during the Proterozoic era. The variation in grain size and stratification within these sandstones provides insights into the depositional environment and past sedimentary dynamics.

Basalt

Basaltic formations, including Kotima basalt, Mangikhuta basalt, and Sitagota basalt, occupy large portions of the block, particularly in the valley regions of the central and eastern part. These rocks vary in texture, ranging from hard, compact fine-grained basalts to amygdaloidal varieties, where vesicles formed by escaping gases have later been filled with secondary minerals. The presence of these basaltic flows indicates extensive volcanic activity, possibly associated with regional flood basalt events or tectonic rifting that led to widespread lava emplacement.



Figure 6. Massive basalt outcrop – Sitagota basalt.



Figure 7. Vesicular and amygdular basalt outcrop – Mangikhuta basalt.



Figure 8. Massive basalt – Kotima basalt.

Laterite

The laterite occurrences are also found in patches within block area. These laterites have developed over both Archean supracrustal rocks and Proterozoic volcanic formations, suggesting weathering under tropical climatic conditions. The chemical weathering process has led to the leaching of silica and the concentration of iron and aluminium oxides, forming the characteristic reddish-brown lateritic crust. The presence of laterite also hints at potential mineral enrichment, particularly in iron and bauxite deposits. In the western part of the block, laterite has developed over the Amgaon Phyllites. In the eastern part, it caps the Kotima Basalt, the youngest volcanic sequence of the Khairagarh Group.



Figure 9. Laterite on ferruginous quartzite and phyllite seen in the cluster of hills northeast of Lohara.

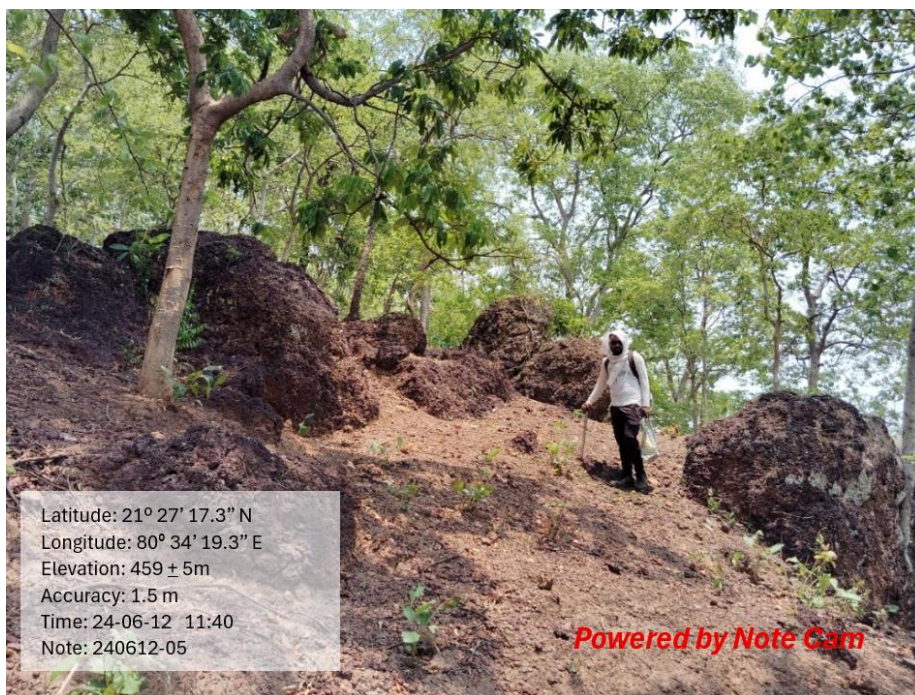


Figure 10. Laterite on ferruginous quartzite and phyllite seen in the cluster of hills northeast of Lohara.



Figure 11. Laterite on ferruginous quartzite and phyllite seen in the cluster of hills northeast of Lohara.

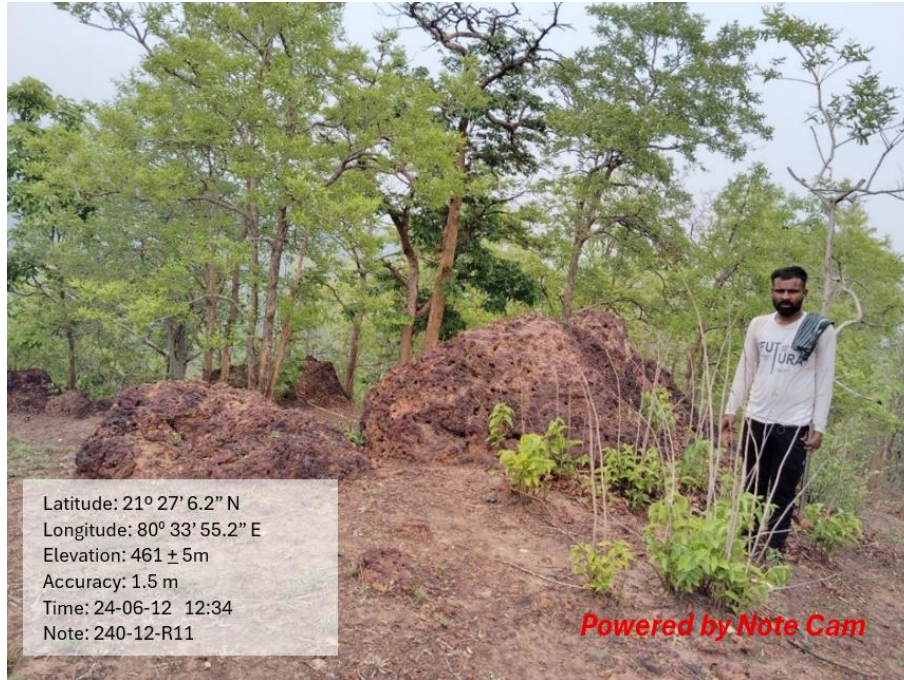


Figure 12. Laterite cap on ferruginous quartzite and phyllite on the hill north of village Wari.



Figure 13. Laterite developed on Sitagota Basalt of Khairagarh Group volcanics.



Figure 14. Laterite developed on Sitagota Basalt of Khairagarh Group volcanics.



Figure 15. Laterite developed on Sitagota Basalt of Khairagarh Group volcanics. The bauxitic laterite shows excellent development of pisolites.



Figure 16. Laterite developed on Kotima Basalt of Khairagarh Group volcanics.

6.4 Petrological study:

Thin sections and ore microscopy of various rock types present in area (**Fig-17**) amounting 20 samples have been studied for characterization and documentation of their petrography. Most of the samples are sandstones & basalts and their metamorphic variants. Many samples contain amygdulites of various shapes and sizes, indicating their protoliths were of volcanic origin. A few samples display a relict cumulate texture, although most of the primary minerals (pyroxene and plagioclase) have been transformed into an assemblage of actinolite, chlorite, and epidote. The geological map with location of petrographic samples is shown in **Figure 17**.

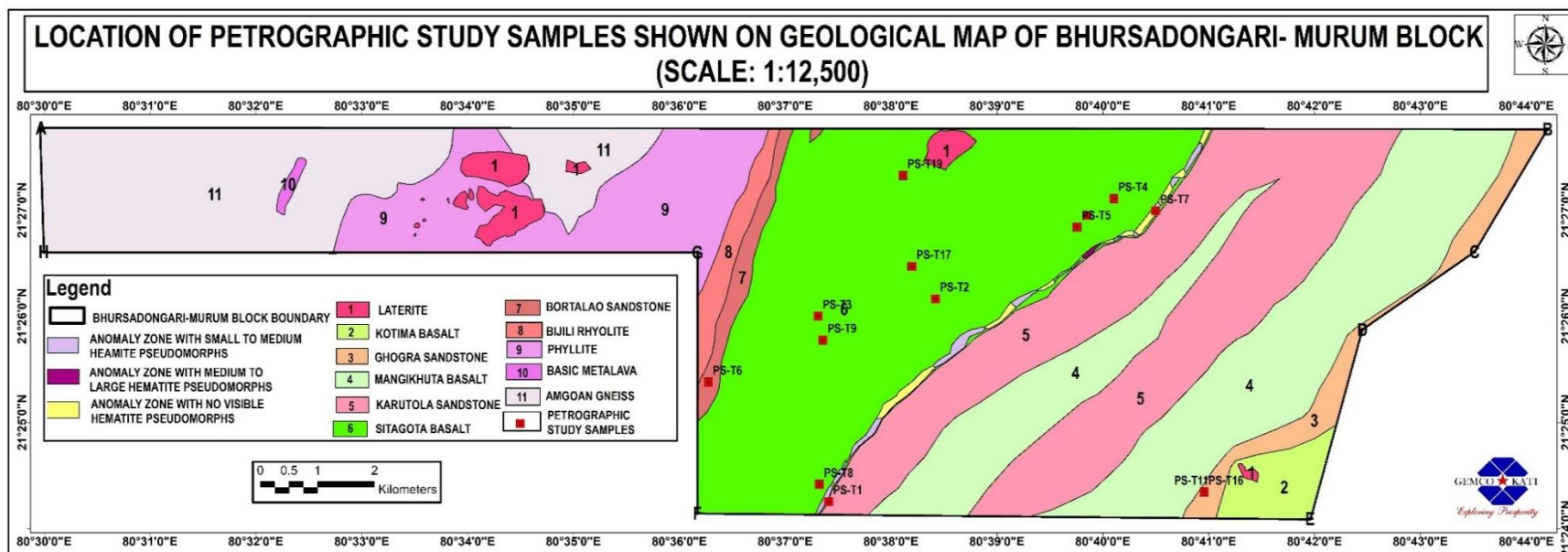


Figure 17. Location map of petrological samples.

Sample no. T1:

Sample number	Latitude	Longitude	Mineralogy	Name of rock
T-1	21° 24' 15.2"	80° 37' 24.7"	Quartz wacke with clasts and matrix of quartz from Karutola sandstone. Cement is <5% and is probably iron rich.	Sandstone



Figure 18. Outcrop of Sample No T1

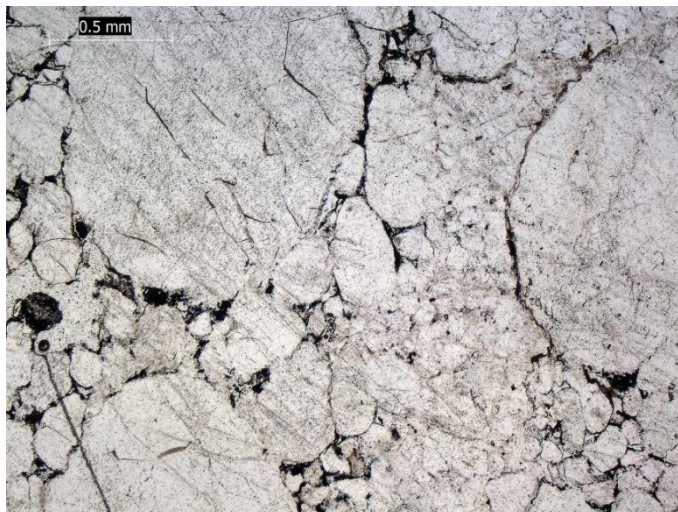


Figure 19. T1a. Photomicrograph showing well sorted, well rounded, elliptical clasts of quartz set in a matrix made of quartz grains (well sorted in terms of composition but poorly sorted in terms of size). The cement is negligible and is probably Fe rich PPL (Plane polarized light) view.

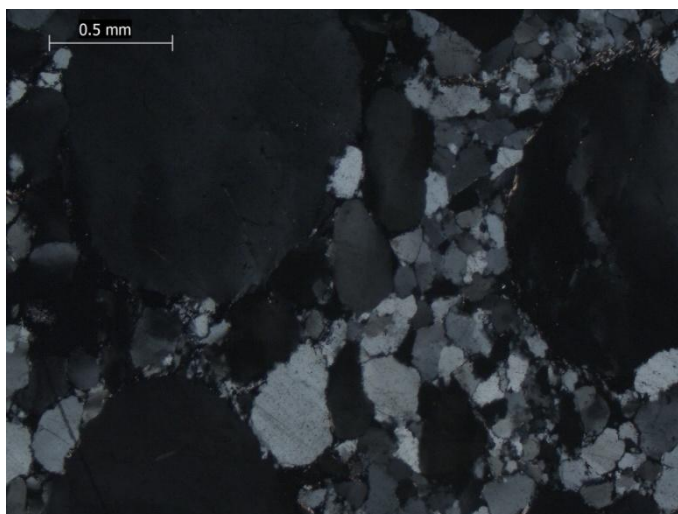


Figure 20. T1b. Photomicrograph showing well sorted, well rounded, elliptical clasts of quartz set in a matrix made of quartz grains (well sorted in terms of composition but poorly sorted in terms of size). The cement is negligible and is probably Fe rich. The undulose extinction in clasts is clearly observed. Quartz grains in the matrix do not necessarily exhibit undulose extinction. BCN (Below crossed Nicol) view.

Sample no. T2:

Sample number	Latitude	Longitude	Mineralogy	Name of rock
T-2	21° 26' 9.9"	80° 38' 25.2"	Metabasic rock with Actinolite-Plagioclase- clinopyroxene (?) and Opaque mineral assemblage (Upper Green schist facies) from Sitagota formation of Khairagarh Group. The fine grained, amygdular character of the rock probably indicates that the sample was from a crust of a metamorphosed lava unit.	Amygdalar basalt



Figure 21. T2a. Photomicrograph of a relict fine grained, nearly holocrystalline, granular texture in a rock that now stands recrystallized. The mineral assemblage is made of plagioclase laths and small prisms of mafic minerals (clinopyroxene and/ or amphibole) along with fairly well distributed Fe oxides. The presence of a large somewhat elliptical space occupied by a well crystalline assemblage probably represents an amygdale. PPL view

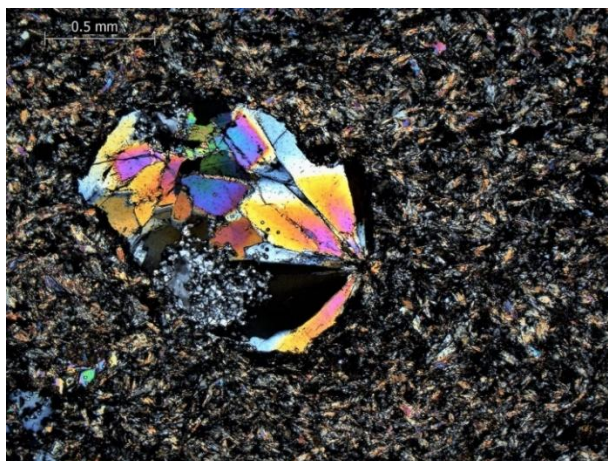


Figure 22. T2b. Photomicrograph of a relict fine grained, nearly holocrystalline, granular texture in a rock that now stands recrystallized. The mineral assemblage is made of plagioclase laths and small prisms of mafic minerals (clinopyroxene and/ or amphibole) along with fairly well distributed Fe oxides. The presence of a large somewhat elliptical space (an amygdale) occupied by a well-developed epidote. BCN view

Sample no. T3:

Sample number	Latitude	Longitude	Mineralogy	Name of rock
T-3	21° 26' 0.1"	80° 37' 18.8"	Metabasic rock from Sitagota formation of Khairagarh Group with Actinolite-Plagioclase- and Opaque mineral assemblage (Upper Green schist facies). The medium grained, well crystalline character of the rock indicates a metamorphosed lava unit.	Massive basalt



Figure 23. T3a. Photomicrograph showing a coarser grained assemblage of amphibole (altering to chlorite at places) and plagioclase plus opaque minerals. The relict sub-ophitic texture in the rock is clearly observed. PPL view.

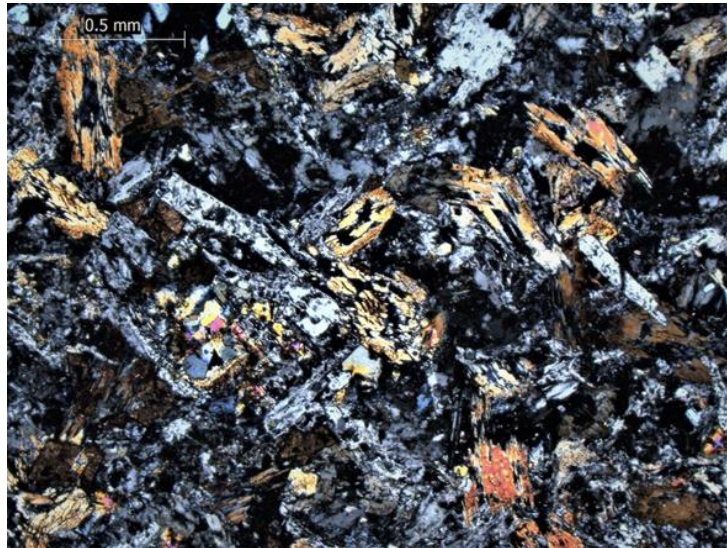


Figure 24. T3b. Photomicrograph showing a coarser grained assemblage of amphibole (altering to chlorite at places) and plagioclase plus opaque minerals. The relict sub-ophitic texture in the rock is clearly observed. BCN view.

Sample no. T4:

Sample number	Latitude	Longitude	Mineralogy	Name of rock
T-4	21° 27' 6.5"	80° 40' 6.3"	Metabasic rock from Sitagota formation of Khairagarh Group. with Actinolite-Plagioclase and Opaque mineral assemblage (Upper Green schist facies). The coarser grained, well crystalline, inequigranular relict character of the rock is very clearly observed.	Massive basalt



Figure 25. T4.1a: Photomicrograph showing a medium to fine grained assemblage of amphibole (altering to chlorite at places) and plagioclase plus opaque minerals. The mineral assemblage with higher RI observed in a part of the field of view (e.g. in the area enclosed in the red ellipse) is likely to be epidote. The relict inequigranular porphyritic texture in the rock is clearly observed. PPL view.



Figure 26. T4.1b: Photomicrograph showing a medium to fine grained assemblage of amphibole (altering to chlorite at places) and plagioclase plus opaque minerals. The mineral assemblage with higher RI observed in a part of the field of view (e.g. in the area enclosed in the red ellipse) is confirmed to be epidote. The relict inequigranular porphyritic texture in the rock is clearly observed. BCN view

Sample no. T5:

Sample number	Latitude	Longitude	Mineralogy	Name of rock
T-5	21° 26' 50.5"	80° 39' 45.4"	Metabasic rock from Sitagota formation of Khairagarh Group with Actinolite- Plagioclase- and Opaque mineral assemblage (Upper Green schist facies). The coarser grained, well crystalline character of the rock probably indicates that the sample was either from the core of a metamorphosed lava unit or represents a metamorphosed intrusive (say a dyke or a sill).	Massive basalt

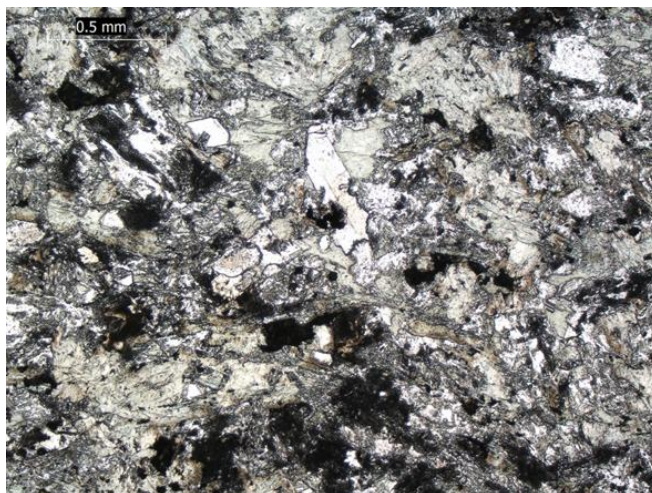


Figure 27. T5.1a: Photomicrograph showing a coarser grained assemblage of amphibole (altering to chlorite at places) and plagioclase plus opaque minerals. Grains of epidote with irregular outlines are also observed in different parts of the field of view. The relict sub-ophitic texture in the rock is clearly observed.
PPL view



Figure 28. T5.1b: Photomicrograph showing a coarser grained assemblage of amphibole (altering to chlorite at places) and plagioclase plus opaque minerals. The relict sub-ophitic texture in the rock is clearly observed. BCN view.

Sample no. T6:

Sample number	Latitude	Longitude	Mineralogy	Name of rock
T-6	21° 25' 22.8"	80° 36' 16.5"	A cataclasized rock from Bortalao formation of Khairagarh group showing presence of angular fragments of quartzo-feldspathic assemblage in a fine grained sericitic matrix. The composition of the clasts and the matrix together indicate that the cataclasized rock was either a granitoid or a feldspathic sandstone with clayey matrix.	Pebbly Sandstone



Figure 29. Outcrop of sample no T-5

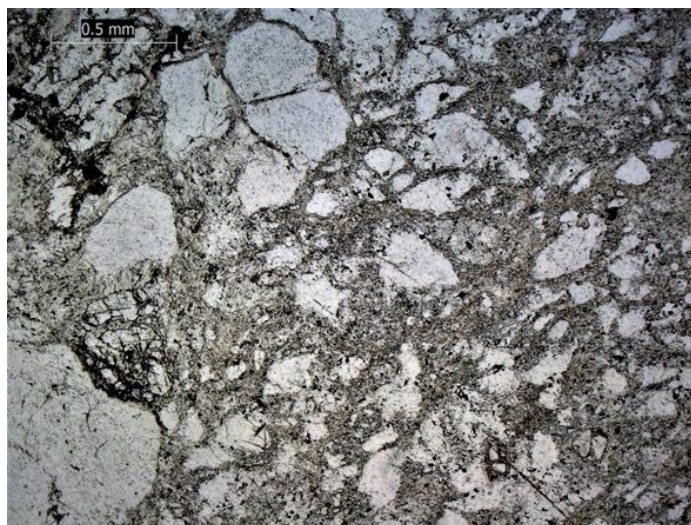


Figure 30. T6.1a: Photomicrograph showing cataclasized rock (either a granitoid or a feldspathic sandstone with clayey matrix) with the formation of assorted angular clasts of quartz (dominant) and feldspar (sub-ordinate) in a fine grained sericitic matrix. Note the difference in the degree of cataclasis in different parts of the field of view. PPL view

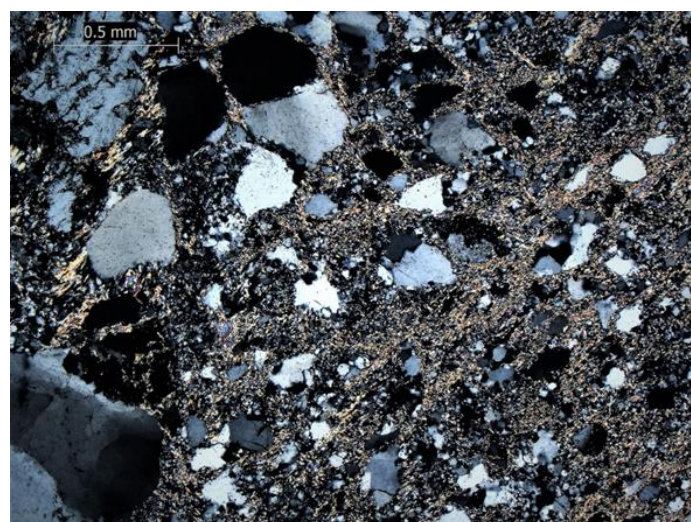


Figure 31. T6.1b: Photomicrograph showing cataclasized rock (either a granitoid or a feldspathic sandstone with clayey matrix) with the formation of assorted angular clasts of quartz (dominant and with undulose extinction generated probably as a result of cataclasis) and feldspar (sub-ordinate) in a fine grained sericitic matrix. Note the difference in the degree of cataclasis in different parts of the field of view. PPL view

Sample no. T7:

Sample number	Latitude	Longitude	Mineralogy	Name of rock
T-7	21° 26' 59.6"	80° 40' 30.0"	A quartzo-felspathic rock (granitic) rock from anomalous zone at the contact of Sitagota basalt & Karutola sandstone showing development of s-c fabric. Protomylonite in a granitic rock.	Foliated metabasalt



Figure 32. Hand specimen of sample no T-6



Figure 33. T7.1: Photomicrograph showing excellent development of s-c fabric in a granitic rock. Also note the development of idioblastic, post deformational development of opaque minerals in the rock. PPL view.

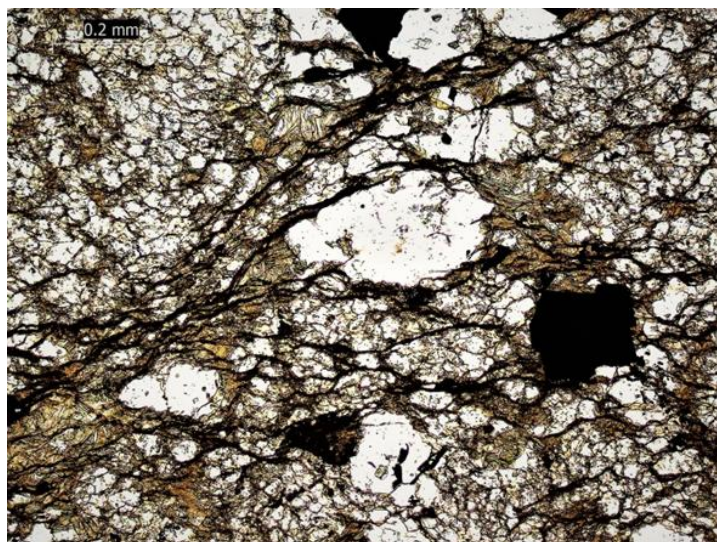


Figure 34. T7.2: Photomicrograph showing excellent development of s-c fabric in a granitic rock. The formation of green micaceous aggregate in the pressure shadow region developed towards the tapering ends of a quartz porphyroblast. PPL view.

Sample no. T8:

Sample number	Latitude	Longitude	Mineralogy	Name of rock
T-8	21° 24' 24.9"	80° 37' 19.5"	Metabasic rock from Sitagota formation of Khairagarh group with Actinolite-Plagioclase- and Opaque mineral assemblage (Upper Green schist facies). The medium to coarse grained, well crystalline character of the rock probably indicates that the sample was probably taken either from the core of a metamorphosed lava unit or from an intrusive (say dyke or a sill).	Metabasalt



Figure 35. T8.1a: Photomicrograph showing a coarser grained assemblage of amphibole (altering to chlorite at places) and plagioclase plus opaque minerals. PPL view.



Figure 36. T8.1b: Photomicrograph showing a coarser grained assemblage of amphibole (altering to chlorite at places) and plagioclase plus opaque minerals. BCN view.

Sample no. T9:

Sample number	Latitude	Longitude	Mineralogy	Name of rock
T-9	21° 25' 46.5"	80° 37' 21.4"	Metabasic rock from Sitagota formation of Khairagarh group with Anthophyllite-cummingtonite- tremolite (?) - Plagioclase- and Opaque mineral assemblage (Upper Green schist facies).	Metabasalt



Figure 37. T9.1a: Photomicrograph showing a large sheaf of amphibole (converting to fibrous assemblage at places) and plagioclase plus opaque minerals. Grains of epidote with irregular outlines are also observed in different parts of the field of view. PPL view.

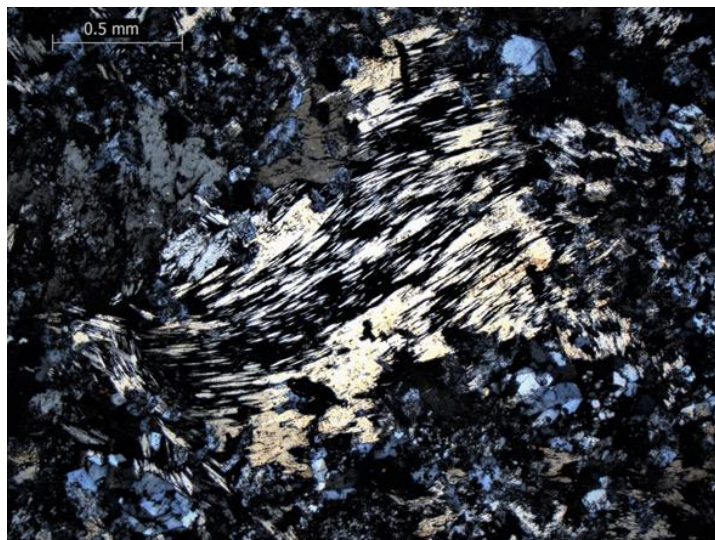


Figure 38. T9.1b: Photomicrograph showing a large sheaf of amphibole (converting to fibrous assemblage at places) and plagioclase plus opaque minerals. Grains of epidote with irregular outlines are also observed in different parts of the field of view. PPL view.

Sample no. T11:

Sample number	Latitude	Longitude	Mineralogy	Name of rock
T-11	21° 24' 20.8"	80° 39' 29.5"	Sample from Ghogra formation of Khairagarh group, Quartz arenite with clasts and matrix of quartz showing development of overgrowths around the grain boundaries of clasts and thus resulting in a clast supported rock (hence termed as an arenite).	Sandstone



Figure 39. T11- 1a: Photomicrograph showing well sorted (well sorted in terms of composition but poorly sorted in terms of size), sub-rounded to well rounded, elliptical clasts of quartz grains. Note the point and line contacts between different grains of quartz. The cement is negligible and is probably siliceous in nature PPL view.



Figure 40. T11- 1b: Photomicrograph showing well sorted (well sorted in terms of composition but poorly sorted in terms of size), sub-rounded to well rounded, elliptical clasts of quartz grains. Note the point and line contacts between different grains of quartz. The cement is negligible and is probably siliceous in nature BCN view.

Sample no. T16:

Sample number	Latitude	Longitude	Mineralogy	Name of rock
T-16	21° 24' 20.6"	80° 40' 57.4"	Sample from Ghogra formation of Khairagarh group, Quartz wacke with clasts and matrix of quartz. Matrix and cement together are 15% or so and matrix is probably iron rich.	Sandstone



Figure 41. T16- 1a: Photomicrograph showing well sorted (in terms of composition), sub-angular to well-rounded clasts of quartz set in a matrix made of quartz grains. The size difference between clasts and matrix being less pronounced). The cement is probably Fe rich. PPL view.

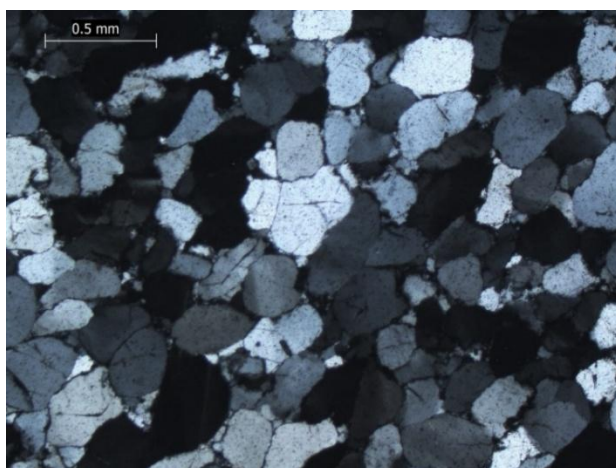


Figure 42. T16- 1b: Photomicrograph showing well sorted (in terms of composition), sub-angular to well-rounded clasts of quartz set in a matrix made of quartz grains. The size difference between clasts and matrix being less pronounced). The cement is probably Fe rich. BCN view.

12-Sample no. T17:

Sample number	Latitude	Longitude	Mineralogy	Name of rock
T-17	21° 26' 28.2"	80° 38' 11.9"	Metabasic rock from Sitagota formation of Khairagarh group with Actinolite-Plagioclase-epidote and Opaque mineral assemblage (Upper Green schist facies). The fine to medium grained and the presence of a large flattened vesicle in the rock probably indicates that the sample was probably taken from the crust of a lava unit that now stands metamorphosed.	Amygdaloidal Basalt



Figure 43. T17.1a: Photomicrograph showing a fine to medium grained assemblage of amphibole (altering to chlorite at places) and plagioclase plus opaque minerals. The relict igneous texture in the rock is largely obliterated in this field of view. PPL view.

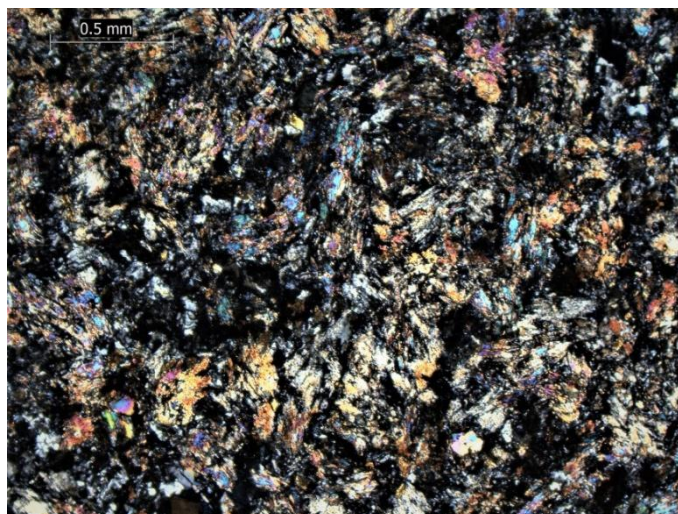


Figure 44. T17.1b: Photomicrograph showing a fine to medium grained assemblage of amphibole (altering to chlorite at places) and plagioclase plus opaque minerals. The relict igneous texture in the rock is largely obliterated in this field of view. BCN view.

Sample no. T19:

Sample number	Latitude	Longitude	Mineralogy	Name of rock
T-19	21° 27' 19.7"	80° 38' 6.9"	Metabasic rock from Sitagota formation of Khairagarh group with Actinolite- Plagioclase and Opaque mineral assemblage (Upper Green schist facies). The fine to medium grained, amygdular character of the rock probably indicates that the sample was from a crust of a metamorphosed lava unit.	Massive Basalt

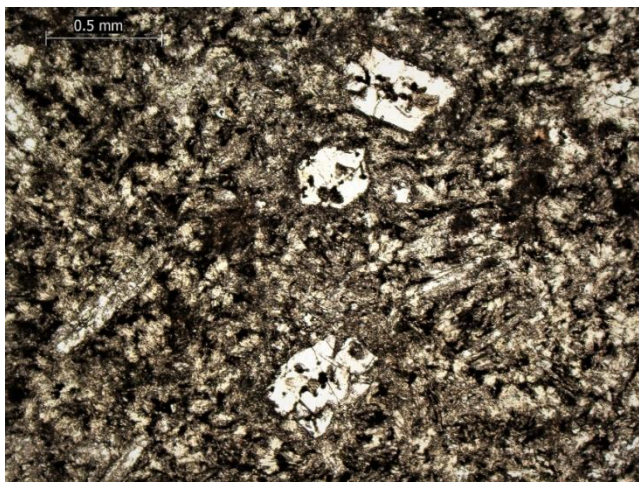


Figure 45. T19- 1a: Photomicrograph of a relict fine to medium grained, inequigranular, porphyritic nearly holocrystalline, granular texture in an igneous rock that now stands recrystallized. The mineral assemblage is made of plagioclase laths and small prisms of mafic minerals (amphibole and/ or clinopyroxene) along with fairly well distributed Fe oxides. PPL view.

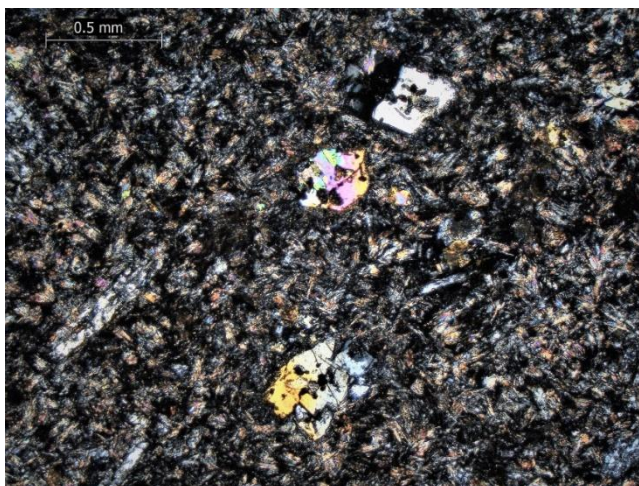


Figure 46. T19- 1b: Photomicrograph of a relict fine to medium grained, inequigranular, porphyritic nearly holocrystalline, granular texture in an igneous rock that now stands recrystallized. The mineral assemblage is made of plagioclase laths and small prisms of mafic minerals (amphibole and/ or clinopyroxene) and epidote grain assemblage along with fairly well distributed Fe oxides. PPL view.

14-Sample no. T20:

Sample number	Latitude	Longitude	Mineralogy	Name of rock
T-20	21°26'57.1"	80°39'51.1"	Metabasic rock from Sitagota formation of Khairagarh group with Actinolite- Chlorite- Plagioclase- Opaque minerals assemblage (Upper Green schist facies).	Metabasalt



Figure 47. T20.1a: Photomicrograph showing an assemblage of amphibole (altering to chlorite at places and plagioclase plus opaque minerals. (PPL view).

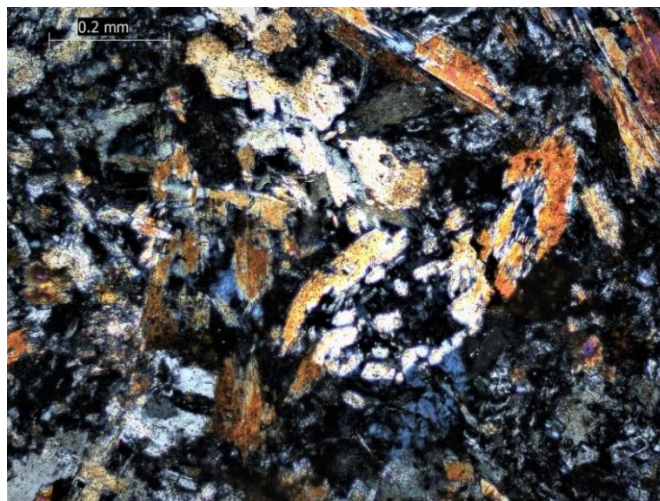


Figure 48. T20.1b: Photomicrograph showing an assemblage of amphibole (altering to chlorite and showing twinning at places and plagioclase plus opaque minerals. (BCN view).

6.5 Ore microscopic study:

20 samples have been studied for characterization and documentation of their ore minerals and their locations are shown in below **figure 49**. More or less all polished sections showed the presence of hematite/magnetite mineral.

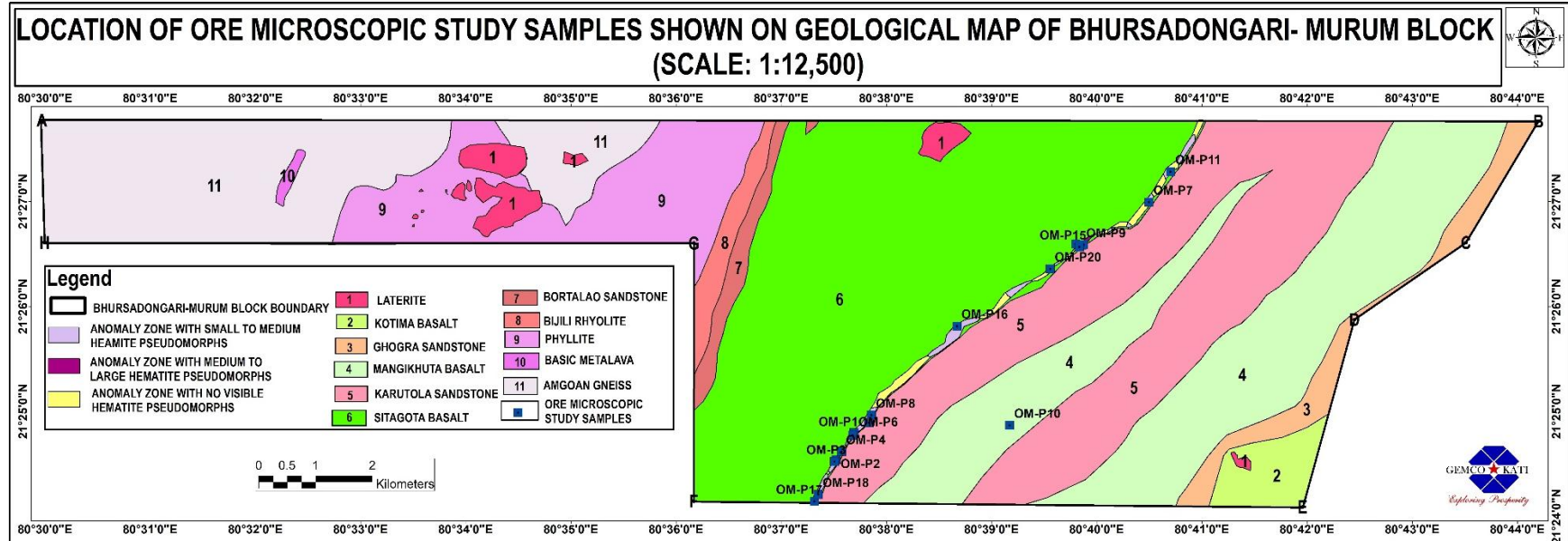


Figure 49. Location of ore microscopic samples studied from the block area.

Sample No: - P/1

Sample number	Latitude	Longitude	Name of rock
P-1	21° 24' 47.4"	80° 37' 41.6"	Hematite bearing foliated Metabasalt



Figure 50. Hand specimen Sample ID-P/1-Altered mafic rock/Metabasalt.

In reflected Light- the rock shows presence of 55% of modal distribution of oxide mineral present as euhedral to subhedral phenocryst as well as very fine inhomogeneous disseminations in the groundmass. The phenocryst shows bright steel grey color, pitted nature with development of fracture. These phenocrysts are primary suspected to be the chromite or ferric chromite are converted to magnetite/hematite due to alteration viz a viz metamorphism.

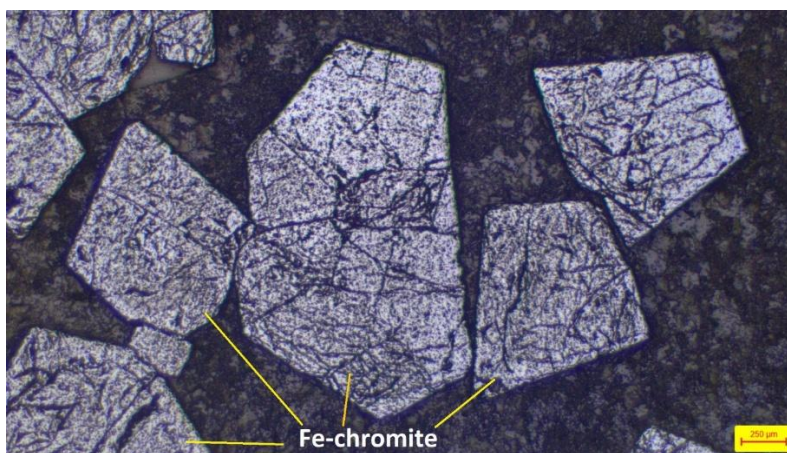


Figure 51. The photomicrograph of altered meta basalt shows presence of cumulates of euhedral ferric chromite or magnetite/hematite grains. The grains show pitted and are highly fracture nature (Reflected Light; 2.5X).

Sample No: - P/2

Sample number	Latitude	Longitude	Name of rock
P-2	21° 24' 32.6"	80° 37' 31.5"	Hematite bearing foliated Metabasalt

In reflected Light- the rock shows presence of subordinate or (5%) minor amount of oxide mineral phases presents as euhedral to subhedral grains in the altered groundmass (chlorite). They are occurring as fine disseminations and show preferred alignment to the deform planes. It is euhedral in shape and shows bright steel grey color. They show pinkish grey color magnetite as relict phase in the steel grey color hematite indicating primary magnetite grains are altered to hematite during post magmatic processes like, deformation and hydrothermal alteration.

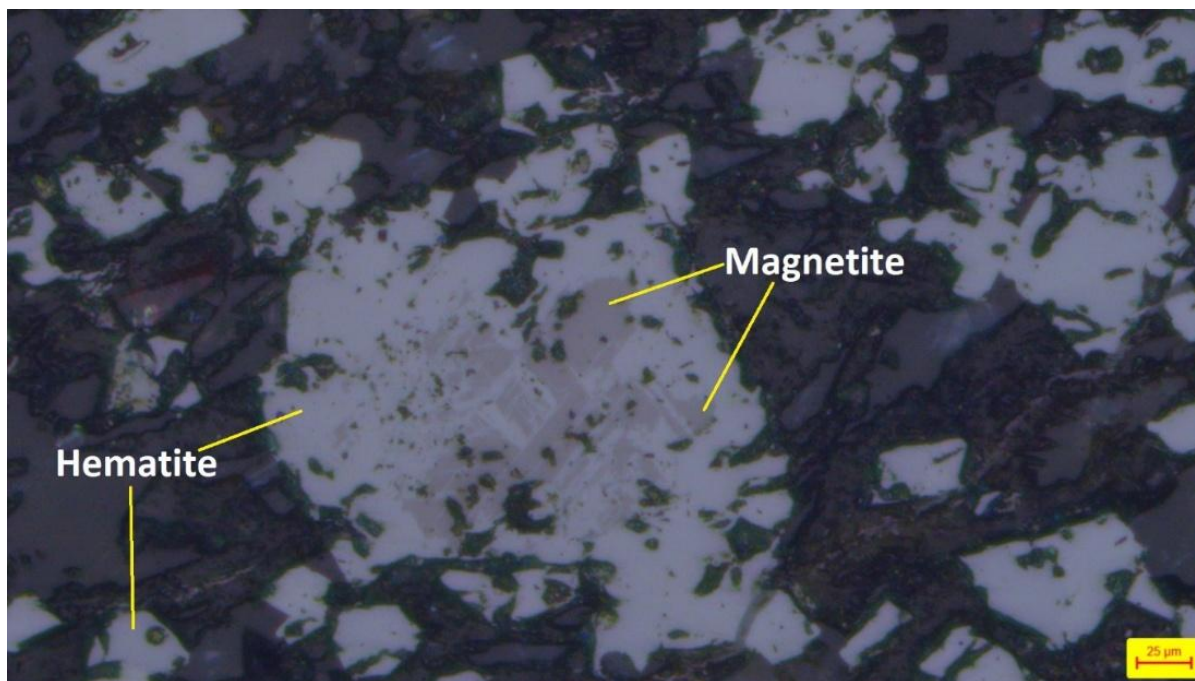


Figure 52. The photomicrograph of meta-basalt shows replacement texture with inclusion of relict magnetite (pink grey) within hematite (steel grey) crystal (Reflected Light; 20X).

Sample No: - P/3

Sample number	Latitude	Longitude	Name of rock
P-3	21° 24' 31.3"	80° 37' 30.5"	Weathered silicified Metabasalt



Figure 53. Hand specimen Sample ID-P/3 Silicified metabasalt.

In reflected Light- the rock shows presence of subordinate or (10%) minor amount of oxide mineral phases presents as subhedral grains in the altered groundmass (chlorite+quartz). It is euhedral in shape, shows bright steel grey color and pitted nature. They are suspected to magnetite/hematite minerals.

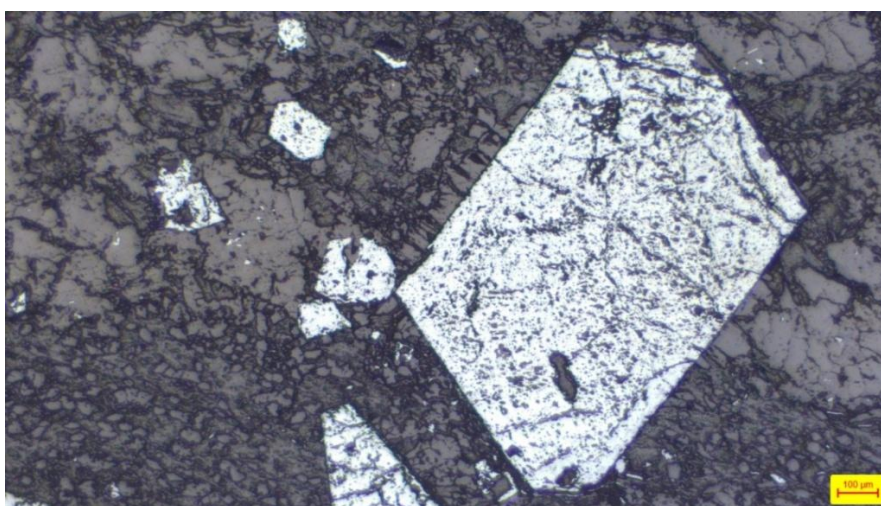


Figure 54. The photomicrograph of meta-basalt shows well developed magnetite/hematite crystal with pitted and fracture nature (Reflected Light; 10X).

Sample No: - P/4 (Silicified metabasalt contact)

Sample number	Latitude	Longitude	Name of rock
P-4	21° 24' 37.1"	80° 37' 34.6"	Silicified Metabasalt

In reflected Light- the rock shows presence of subordinate or minor amount of oxide mineral phases presents as subhedral grains in association with chlorite vein. It shows bright steel grey color, pitted nature with corroded grain boundaries. They are primary suspected to be the chromite or ferric chromite are converted to magnetite/hematite during the hydrothermal alteration.

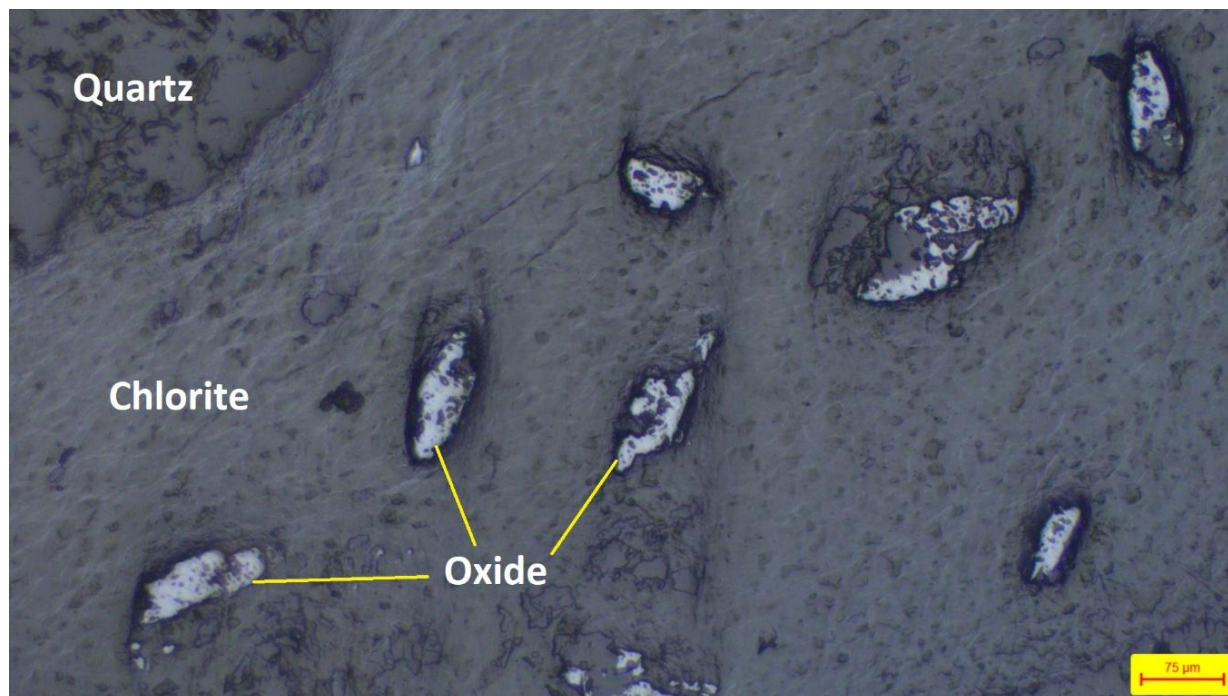


Figure 55. The photomicrograph of quartzite shows chlorite vein consist of tiny oxide grains (Fe-chromite/magnetite/hematite) (Reflected Light; 10X).

Sample No: - P/5

Sample number	Latitude	Longitude	Name of rock
P-5	21° 24' 53.6"	80° 37' 50.2"	Silicified Metabasalt



Figure 56. Silicified metabasalt.

In reflected Light- the rock shows presence of 20% to 30% modal distribution of iron oxide mineral, which are mostly euhedral to subhedral grains of magnetite and hematite. At most of the places grains are in skeletal form, shows bright steel grey color, pitted nature with development of radiation needle like hematite crystals.



Figure 57. The photomicrograph of altered meta basalt shows presence of cumulates of euhedral skeletal magnetite/hematite grains. The grains show pitted and development of radiating to needle like hematite/specularite grains (Reflected Light; 5X).

Sample No: - P/6

Sample number	Latitude	Longitude	Name of rock
P-6	21° 24' 47.3"	80° 37' 41.6"	Metabasalt



Figure 58. Altered mafic rock/Metabasalt.

In reflected Light- the rock shows presence of 70% of modal distribution of oxide mineral present as euhedral to subhedral phenocryst as well as very fine inhomogeneous disseminations in the groundmass. The phenocryst shows bright steel grey color, pitted nature with development of fracture. They preserved both magmatic cumulate phases with mutual boundary texture as well as subjected to the brittle deformation and fracturing as post magmatic effect. These phenocrysts are primary suspected to be magnetite or hematite due to alteration viz a viz metamorphism. The vein of magnetite/hematite occur as release iron oxide from primary magnetite after post magmatic effect or deformation.

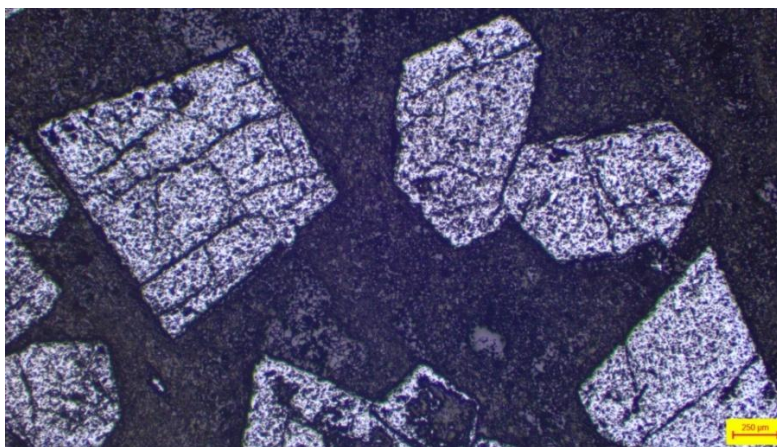


Figure 59. The photomicrograph of subhedral magnetite grains shows pitted and fracture nature (Reflected Light; 10X).

Sample No: - P/7

Sample number	Latitude	Longitude	Name of rock
P-7	21° 24' 37.1"	80° 37' 34.6"	Silicified Metabasalt



Figure 60. Silicified metabasalt.

In reflected Light- the rock shows presence of 20-25% modal distribution of iron oxide mineral, which are mostly euhedral to subhedral grains of magnetite and hematite. At most of the places grains are in fresh nature, shows bright steel grey color, with development of radiation needle like hematite or specularite crystals.

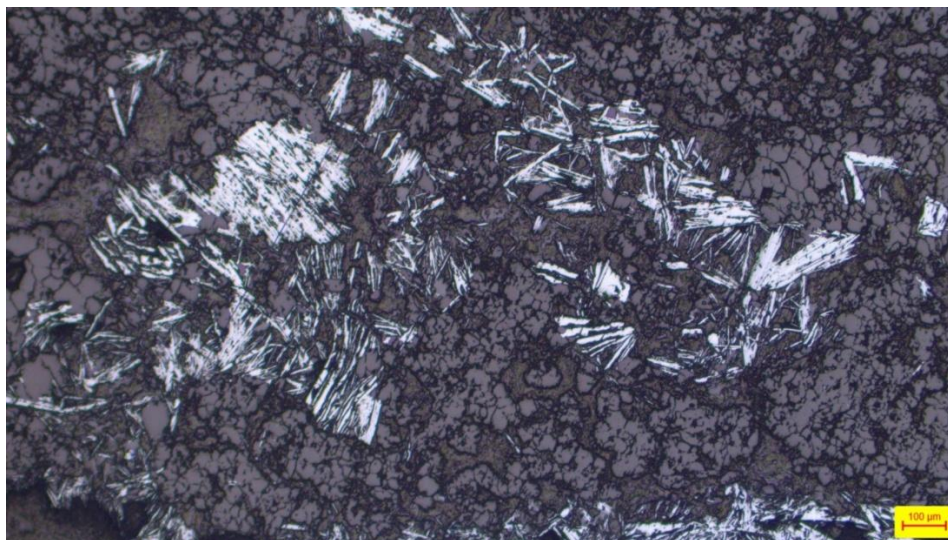


Figure 61. The photomicrograph shows development of radiating to needle like hematite/specularite grains (Reflected Light; 5X).

Sample No: - P/8

Sample number	Latitude	Longitude	Name of rock
P-8	21° 24' 57.9"	80° 37' 51.6"	Metabasalt

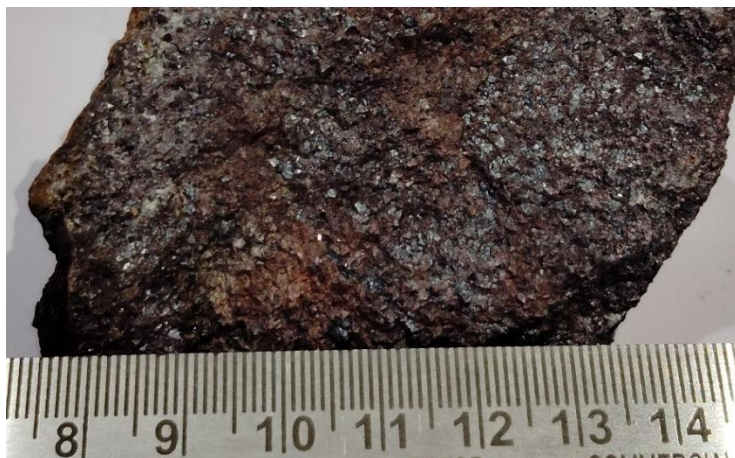


Figure 62. Altered mafic rock/Metabasalt.

In reflected Light- the rock shows presence of 70% of modal distribution of oxide mineral present as euhedral to subhedral phenocryst as well as very fine inhomogeneous disseminations in the groundmass. The phenocryst shows bright steel grey color, pitted nature with development of fracture. They preserved both magmatic cumulate phases with mutual boundary texture as well as subjected to the brittle deformation and fracturing as post magmatic effect. These phenocrysts are primary suspected to be the chromite or ferric chromite are converted to magnetite due to alteration viz a viz metamorphism.

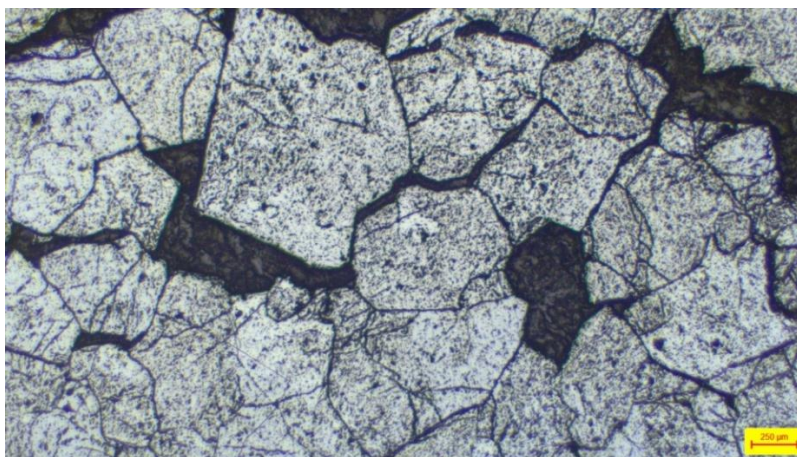


Figure 63. The photomicrograph of altered meta basalt shows presence of cumulates of euhedral ferric chromite or magnetite grains. The grains show pitted and are highly fracture nature (Reflected Light; 2.5X).

Sample No: - P/9

Sample number	Latitude	Longitude	Name of rock
P-9	21° 26' 35.2"	80° 39' 51.6"	Silicified Metabasalt



Figure 64. Silicified metabasalt.

In reflected Light- the rock shows presence of 20% to 30% modal distribution of iron oxide mineral, which are mostly euhedral to subhedral grains of magnetite and hematite. At most of the places grains are in skeletal form, shows bright steel grey color, pitted nature with development of radiation needle like hematite crystals.

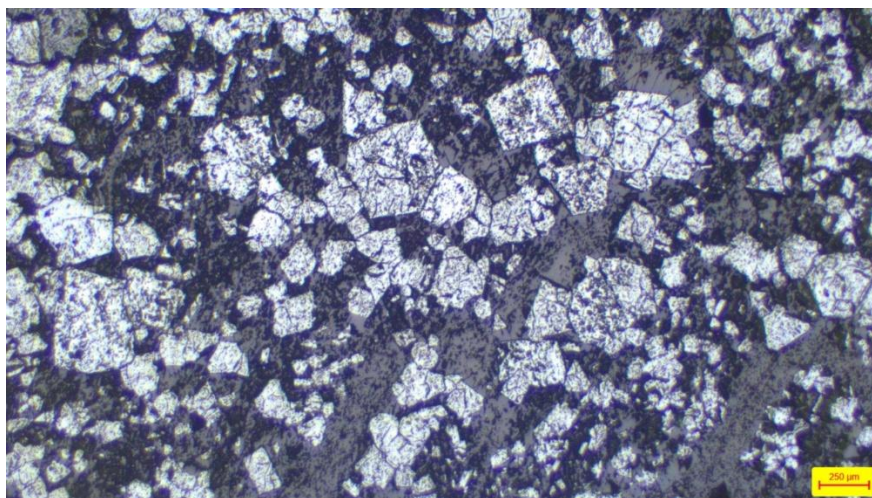


Figure 65. The photomicrograph of altered meta basalt shows presence of cumulates of euhedral magnetite/hematite grains shows pitted nature (Reflected Light; 2.5X).

Sample No: - P/10 (Altered mafic rock/Metabasalt)

Sample number	Latitude	Longitude	Name of rock
P-10	21° 24' 49.1"	80° 39' 24.8"	Metabasalt

In reflected Light- the rock shows presence of 20% of modal distribution of oxide mineral present as euhedral to subhedral phenocryst as well as very fine inhomogeneous disseminations in the groundmass. The phenocryst shows bright steel grey color, pitted nature with development of fracture. They preserved both magmatic cumulate phases with mutual boundary texture as well as subjected to the brittle deformation and fracturing as post magmatic effect. These phenocrysts are primary suspected to be the chromite or ferric chromite are converted to magnetite due to alteration viz a viz metamorphism. The fine-grained matrix also consists of dusty magnetite minerals development due to the release of iron oxide from mafic as well as primary iron oxide mineral.

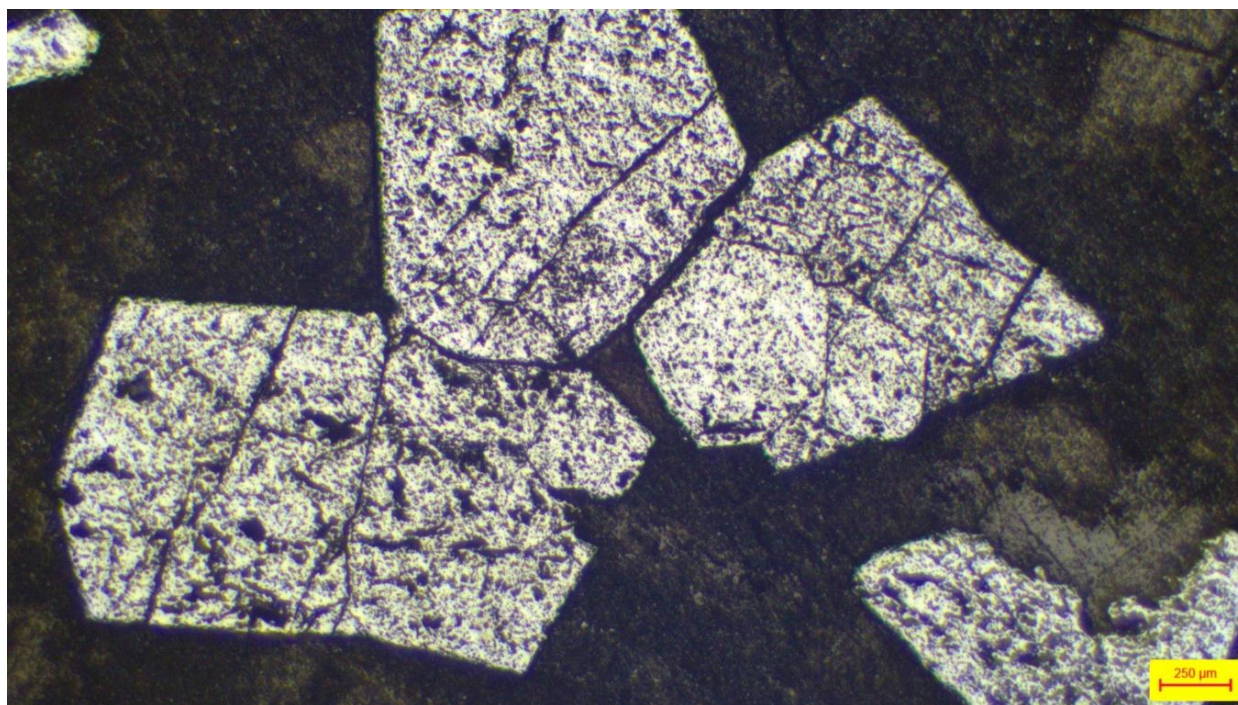


Figure 66. The photomicrograph of altered meta basalt shows presence of cumulates of iron oxide within fine grained chlorite groundmass (Reflected Light; 2.5X).

Sample No: - P/11

Sample number	Latitude	Longitude	Name of rock
P-11	21° 27' 17.0"	80° 40' 42.3"	Silicious metabasalt

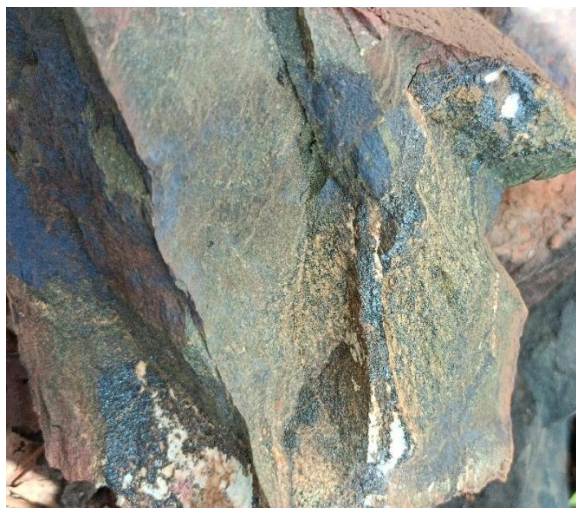


Figure 67. Silicious metabasalt.

In reflected Light- the rock shows presence of 30-25% modal distribution of iron oxide mineral, which are mostly euhedral to subhedral grains of magnetite and hematite. At most of the places grains are in fresh nature, shows bright steel grey color, with development of radiation needle like hematite or specularite crystals.

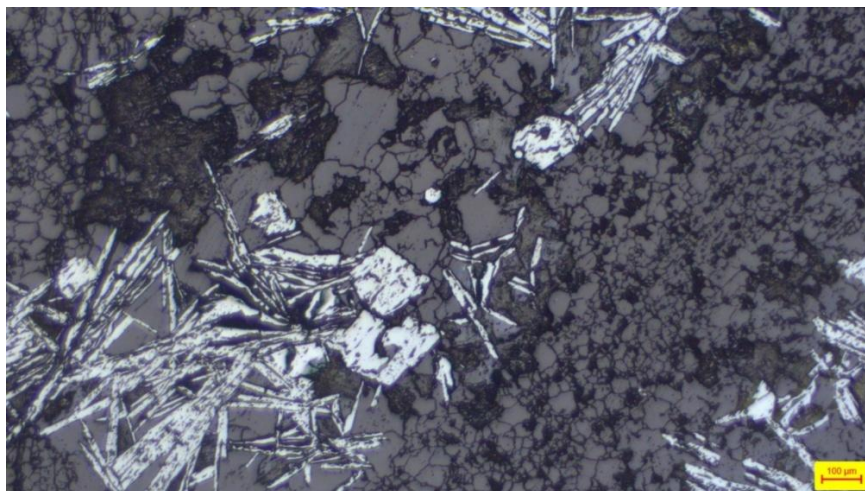


Figure 68. The photomicrograph shows presence of euhedral magnetite/hematite grains (Reflected Light; 5X).

Sample No: - P/12

Sample number	Latitude	Longitude	Name of rock
P-12	21° 26' 35.7"	80° 39' 48.2"	Metabasalt



Figure 69. Altered mafic rock/Metabasalt.

In reflected Light- the rock shows presence of 25% of modal distribution of oxide mineral present as euhedral to subhedral phenocryst as well as very fine inhomogeneous disseminations in the groundmass. The phenocryst shows bright steel grey color, pitted nature with development of fracture. They preserved both magmatic cumulate phases with mutual boundary texture as well as subjected to the brittle deformation and fracturing as post magmatic effect. They also show remobilization with development of veins and stringers. These phenocrysts are primary suspected to be the chromite or ferric chromite are converted to magnetite due to alteration viz a viz metamorphism. The veins and stringers are generally comprised of the radiating to needle like crystal of hematite or specularite. The fine-grained matrix also consists of dusty magnetite minerals development due to the release of iron oxide from mafic as well as primary iron oxide mineral.

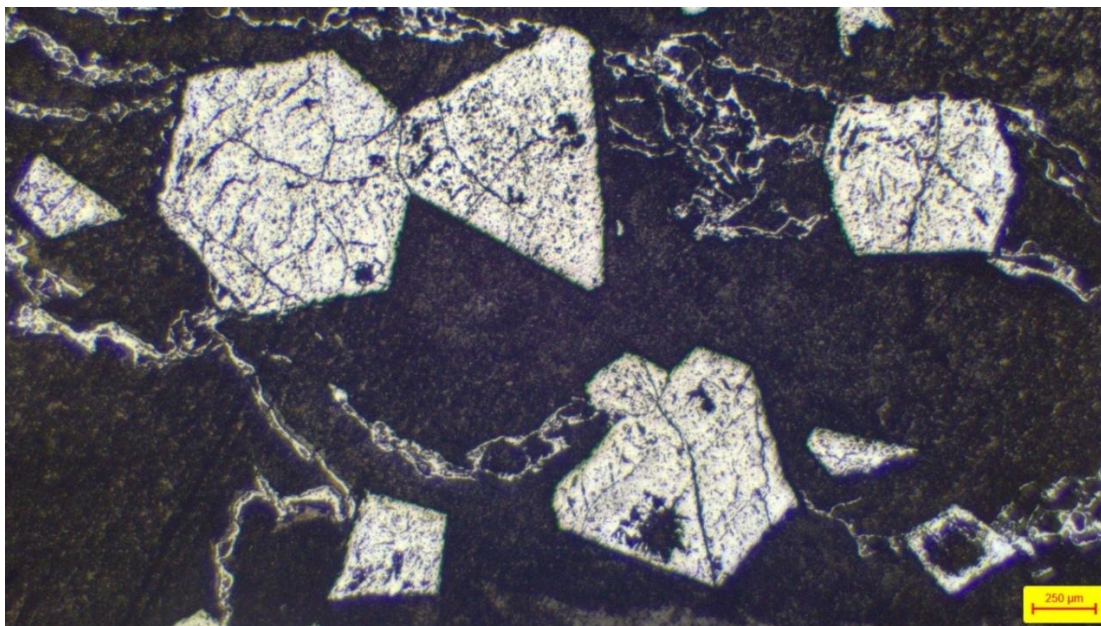


Figure 70. The photomicrograph of altered meta basalt shows presence of euhedral phenocryst of Fe-chromite or magnetite in the very fine-grained chlorite+dusty magnetite matrix, Note-the remobilization of magnetite in to the veins and stringers (Reflected Light; 2.5X).

Sample No: - P/13

Sample number	Latitude	Longitude	Name of rock
P-13	21° 24' 47.8"	80° 37' 41.7"	Metabasalt



Figure 71. Altered mafic rock/Metabasalt.

In reflected Light- the rock shows presence of 75% of modal distribution of oxide mineral present as euhedral to subhedral phenocryst as well as very fine inhomogeneous disseminations in the groundmass. The phenocryst shows bright steel grey color, pitted nature with development of fracture in magnetite. They preserved both magmatic cumulate phases with mutual boundary texture as well as subjected to the brittle deformation and fracturing as post magmatic effect.

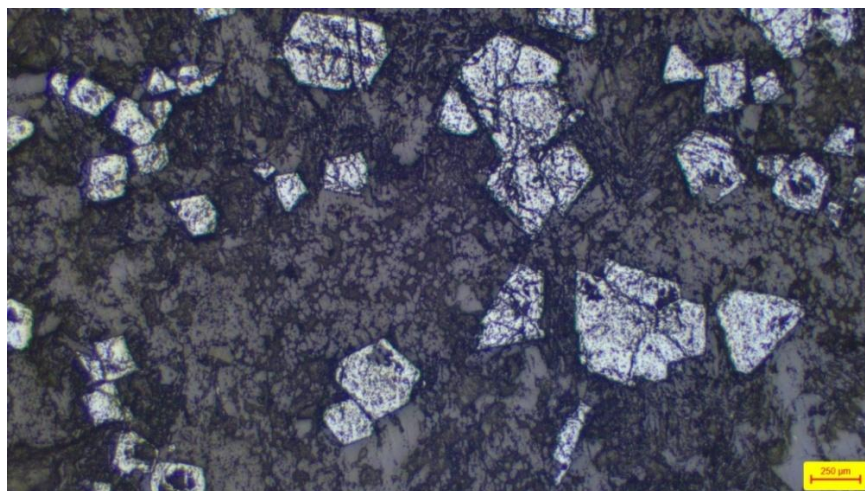


Figure 72. The photomicrograph of altered meta basalt shows presence of cumulates of euhedral magnetite grains. The grains show pitted and are highly fracture nature (Reflected Light; 2.5X).

Sample No: - P/14

Sample number	Latitude	Longitude	Name of rock
P-14	21° 26' 36.9"	80° 39' 52.0"	Metabasalt



Figure 73. Highly altered metabasalt.

In reflected Light- the rock shows presence of oxide mineral phases presents as euhedral to subhedral grains in association with chlorite vein. It shows bright steel grey color, pitted nature with corroded grain boundaries. They are primary suspected to be magnetite converted to the hematite during the post episodes/events.



Figure 74. The photomicrograph shows sieve texture within euhedral magnetite/hematite grain (Reflected Light; 5X).

Sample No: - P/15

Sample number	Latitude	Longitude	Name of rock
P-15	21° 26' 34.0"	80° 39' 50.3"	Metabasalt



Figure 75. Altered mafic rock/Metabasalt.

In reflected Light- the rock shows presence of 80% of modal distribution of oxide mineral present as euhedral to subhedral phenocryst as well as very fine inhomogeneous disseminations in the groundmass. The phenocryst shows bright steel grey color, pitted nature with development of fracture in magnetite. They preserved both magmatic cumulate phases with mutual boundary texture as well as subjected to the brittle deformation and fracturing as post magmatic effect.

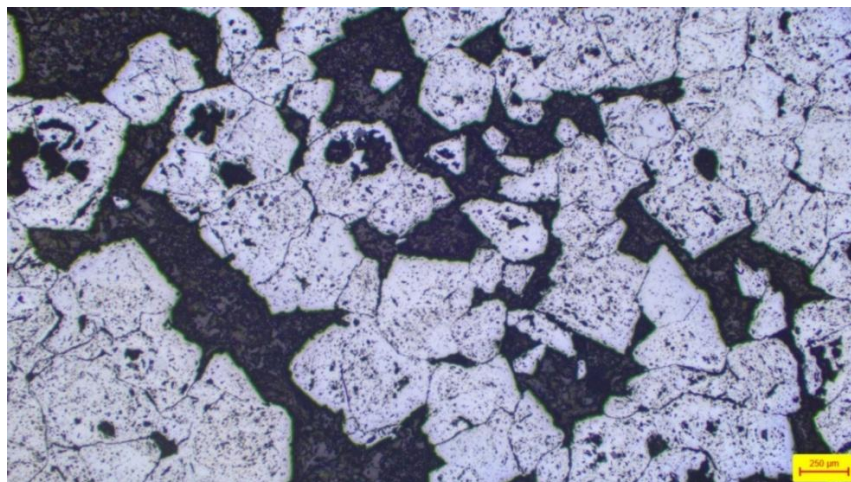


Figure 76. The photomicrograph of altered meta basalt shows presence of cumulates of euhedral magnetite grains. The grains show sieved, pitted and are highly fracture nature (Reflected Light; 2.5X).

Sample No: - P/16

Sample number	Latitude	Longitude	Name of rock
P-16	21° 25' 48.8"	80° 38' 40.4"	Silicious metabasalt

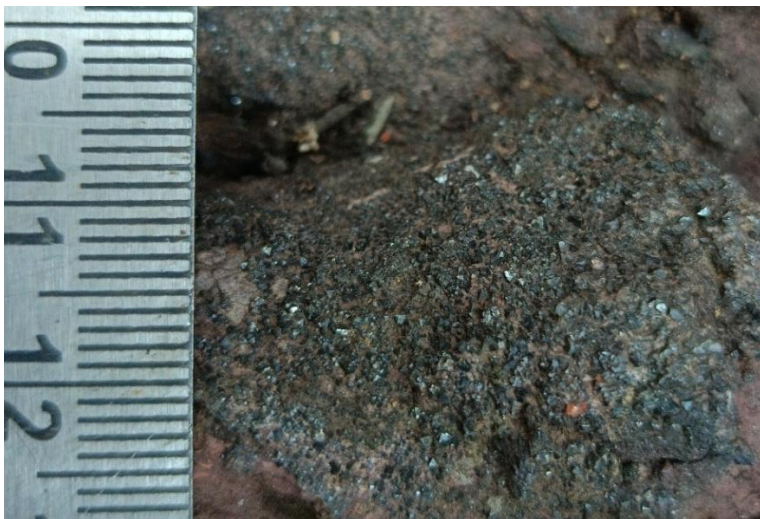


Figure 77. Silicified metabasalt.

In reflected Light- the rock shows presence (20%) minor amount of oxide mineral phases present as subhedral grains in the altered groundmass (chlorite+quartz). It is euhedral in shape, shows bright steel grey color and pitted nature. They show both development of radiating specular hematite as well as euhedral hematite as disseminations.

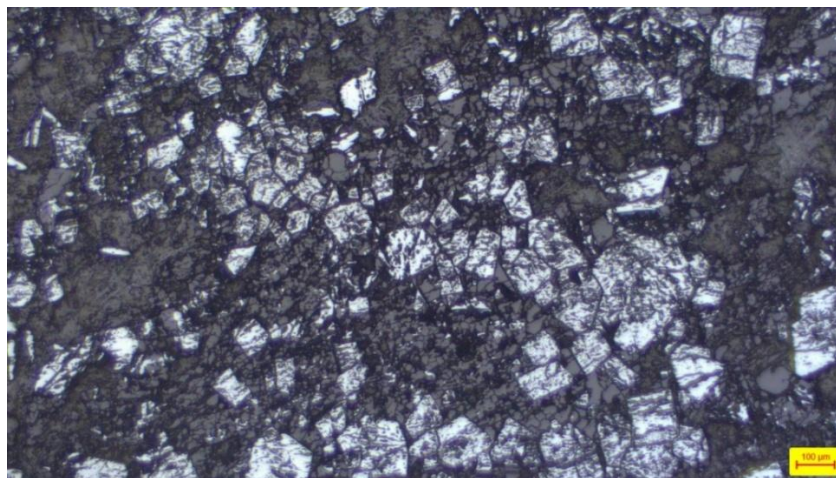


Figure 78. The photomicrograph of meta-basalt shows magnetite as micro-phenocryst in the fine-grained groundmass (Reflected Light; 2.5X).

Sample No: - P/17

Sample number	Latitude	Longitude	Name of rock
P-17	21° 24' 8.7"	80° 37' 19.0"	Silicious metabasalt



Figure 79. Silicified metabasalt.

In reflected Light- the rock shows presence of subordinate or (10%) minor amount of oxide mineral phases presents as euhedral to subhedral grains in the altered groundmass (chlorite). They are occurring as fine disseminations and show preferred alignment at places. It is euhedral in shape and shows bright steel grey color. They show pinkish grey color magnetite as relict phase in the steel grey color hematite indicating primary magnetite grains are altered to hematite during post magmatic processes like, deformation and hydrothermal alteration.

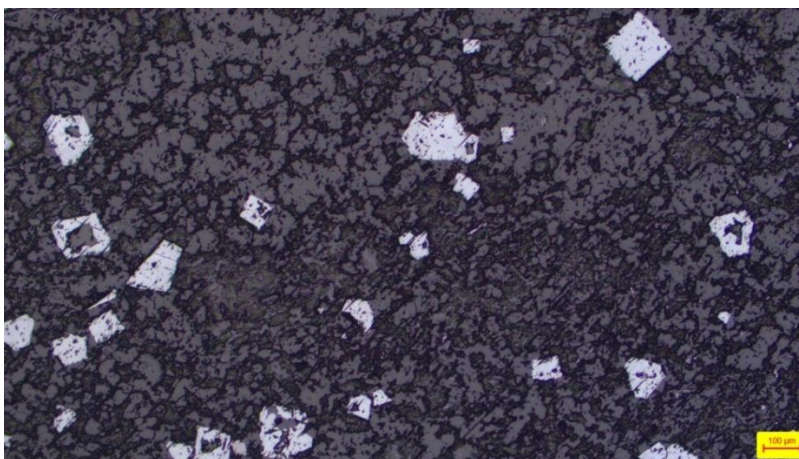


Figure 80. The photomicrograph of meta-basalt shows hematite grains set-in fine-grained groundmass (Reflected Light; 10X).

Sample No: - P/18

Sample number	Latitude	Longitude	Name of rock
P-18	21° 24' 12.5"	80° 37' 21.2"	Sheared metabasalt



Figure 81. Sheared metabasalt.

In reflected Light- the rock shows presence of 20% oxide mineral phases presents as euhedral to subhedral grains in the altered groundmass (chlorite). They are occurring as fine disseminations and show preferred alignment to the deform planes. It is euhedral in shape and shows bright steel grey color. They show pinkish grey color magnetite as relict phase in the steel grey color hematite indicating primary magnetite grains are altered to hematite during post magmatic processes like, deformation and hydrothermal alteration.

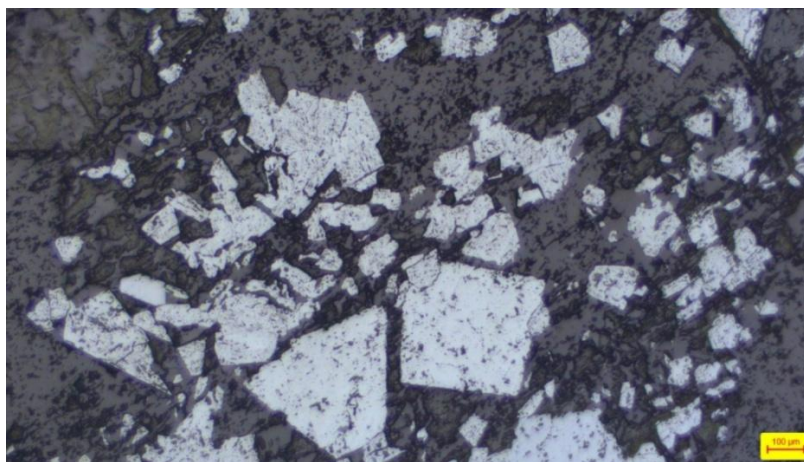


Figure 82. The photomicrograph of meta-basalt shows hematite grains set-in fine-grained groundmass shows pitted nature (Reflected Light; 10X).

Sample No: - P/19

Sample number	Latitude	Longitude	Name of rock
P-19	21° 24' 46.4"	80° 37' 40.9"	Metabasalt



Figure 83. Altered mafic rock/Metabasalt.

In reflected Light- the rock shows presence of 55% of modal distribution of oxide mineral present as euhedral to subhedral phenocryst as well as very fine inhomogeneous disseminations in the groundmass. The phenocryst shows bright steel grey color, pitted nature with development of fracture. These phenocrysts are primary suspected to be the chromite or ferric chromite are converted to magnetite/hematite due to alteration viz a viz metamorphism.

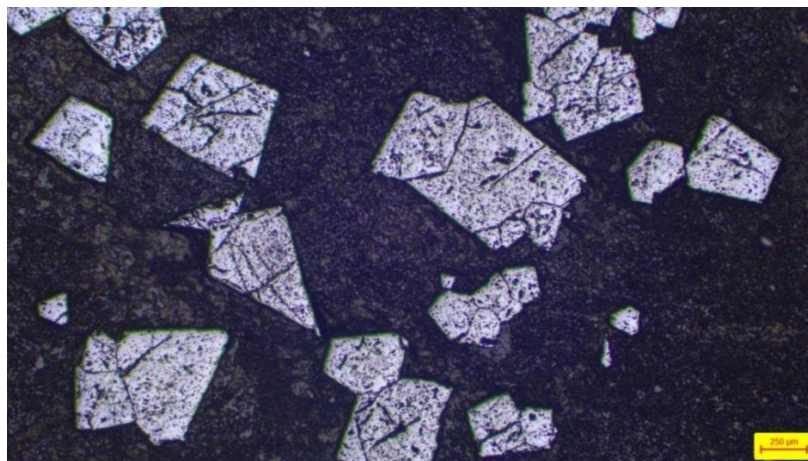


Figure 84. The photomicrograph of altered meta basalt shows presence of cumulates of euhedral magnetite/hematite grains. The grains show pitted and are highly fracture nature (Reflected Light; 2.5X).

Sample No: - P/20 (Sheared metabasalt)

Sample number	Latitude	Longitude	Name of rock
P-20	21° 26' 21.5"	80° 39' 33.6"	Silicious metabasalt

In reflected Light- the rock shows presence of subordinate or minor amount of oxide mineral phases presents as subhedral grains in association with chlorite vein. It shows bright steel grey color, pitted nature with corroded grain boundaries. They are generally magnetite grains altered to hematite during the hydrothermal events.

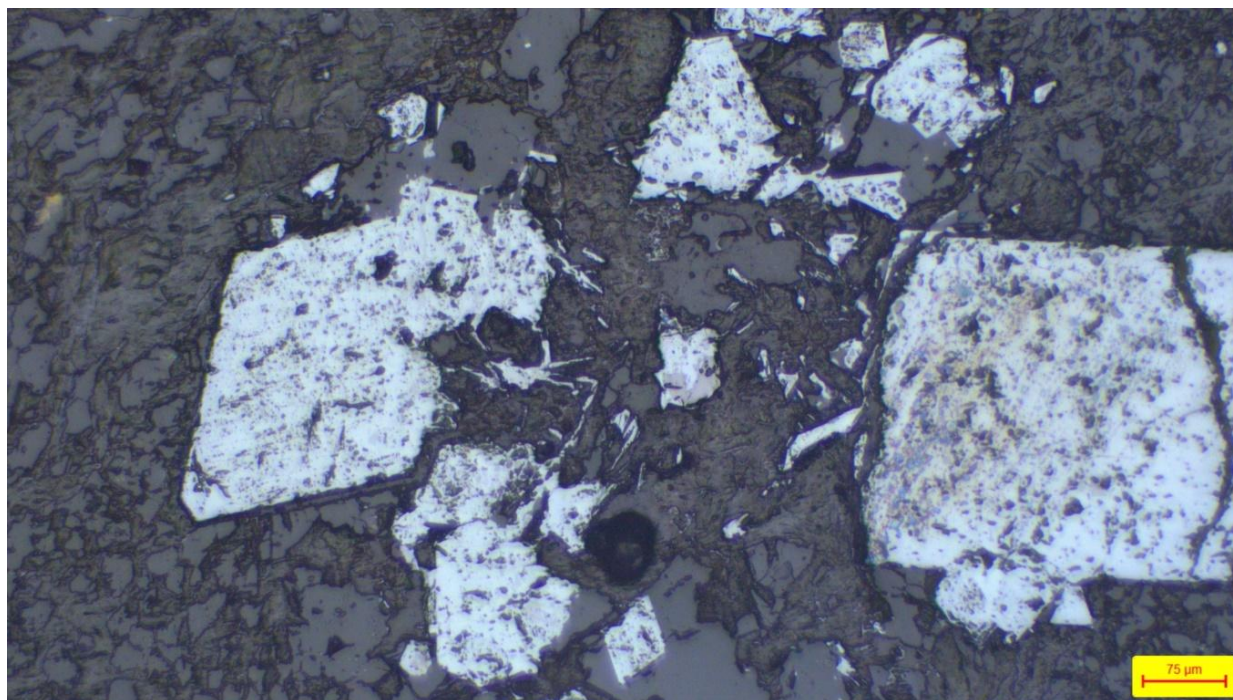


Figure 85. The photomicrograph shows development of need like specular hematite along the euhedral magnetite/hematite) (Reflected Light; 10X).

6.6 Whole rock analysis (Major oxides):

The objective of major oxide analysis is to identify mineralization in laterite, to determine the chemical composition of rock and mineral samples by quantifying the concentration of key oxides & to correlate chemical composition of host rock with PGE content if possible. This analysis helps in understanding the geochemical characteristics, mineralogical composition, and petrogenesis of the rocks. The major oxides typically analysed include silica (SiO_2), alumina (Al_2O_3), iron oxides (Fe_2O_3 , FeO), calcium oxide (CaO), magnesium oxide (MgO), sodium oxide (Na_2O), potassium oxide (K_2O), titanium dioxide (TiO_2), manganese oxide (MnO), and phosphorus pentoxide (P_2O_5) (**Table 6**).

The data contains various oxides that provide insights into the geochemical composition of the samples. Silicon dioxide (SiO_2) is present in significant amounts, indicating the presence of silicate-rich minerals such as quartz and feldspar. Aluminium oxide (Al_2O_3) appears in moderate to high concentrations, suggesting the presence of aluminosilicate minerals, possibly from weathered feldspar, lateritic or bauxite deposits. Iron oxide (Fe_2O_3) shows a wide range of values, with some samples exhibiting exceptionally high percentages, likely pointing to iron ore mineralization in the form of hematite or magnetite.

Titanium dioxide (TiO_2) is consistently found in varied proportions, suggesting the presence of minerals like rutile or ilmenite. Calcium oxide (CaO) and magnesium oxide (MgO) appear in varying amounts, potentially representing calcium and magnesium bearing minerals. The presence of sodium oxide (Na_2O) and potassium oxide (K_2O) suggests feldspar or clay minerals contributing to the composition. Sulphur trioxide (SO_3) is detected in small quantities, possibly linked to sulfate minerals. Loss on ignition (LOI) values vary across the samples, indicating volatile components such as hydroxides, carbonates, or organic matter. The geochemical trends observed in the dataset highlight the diverse nature of the mineralogical composition, ranging from silicate-dominated rocks to iron-rich parts and possible lateritic weathering products.

In the region where the Sitagota basalt is in contact with the Karutola sandstone, martite formed through oxidation of magnetite. Hydrothermal fluids rich in oxygen, water, and carbon dioxide may have scavenged iron along the pathway & exsolved through foliated contact zone between Sitagota basalt & Karutola sandstone forming iron-bearing minerals like magnetite. Later due to oxidising fluids or surficial condition magnetite, oxidized it into hematite, forming martite as a pseudomorph. This meant that martite retained the octahedral crystal shape of magnetite, even though its chemical composition had changed. The result was a reddish-brown to steel-grey iron oxide mineral, distributed as disseminated grains as well as segregated bands within the sandstone. This process increased the iron content in the sandstone, also may have been the cause of PGE enrichment.

Table 6. Analysis Results of BRS and channel samples (Major oxide by XRF).

S.N.	Sample ID	Lithology	Latitude	Longitude	Fe	SiO ₂	Al ₂ O ₃	S	P	MnO	P ₂ O ₅	TiO ₂	MgO	CaO	K ₂ O	Fe ₂ O ₃	SO ₃	BaO	V ₂ O ₅	Na ₂ O	LOI	SrO	ZrO ₂	Cr ₂ O ₃
1	030523-03	Bijli rhyolite	21° 26' 17.60"	80° 36' 14.74"		96.22	0.97			<0.05	<0.05	0.05	<0.05	<0.05	0.07	2.14	<0.05	<0.05	<0.05	0.084	0.36	<0.05	<0.05	<0.05
2	231127-02	Laterite over phyllite	21° 26' 58.04"	80° 34' 34.07"	34.01	18.66	19.28	0.02	0.12	<0.05	0.28	0.98	0.1	<0.05	0.17	48.62	0.05	0.08	0.14	<0.08	11.53			
3	231127-03	Laterite over phyllite	21° 27' 5.12"	80° 34' 30.59"	32.76	20.95	19.18	<0.01	0.1	<0.05	0.22	1.32	0.09	<0.05	0.06	46.83	<0.05	0.09	0.14	<0.08	10.98			
4	231127-06	Laterite over phyllite	21° 27' 18.14"	80° 34' 24.51"	25.77	23.6	23.66	<0.01	0.11	<0.05	0.26	1.17	0.17	0.06	0.38	36.85	<0.05	0.14	0.11	<0.08	13.46			
5	231127-07	Laterite over phyllite	21° 27' 21.81"	80° 34' 26.35"	31.11	19.61	20.24	<0.01	0.36	<0.05	0.82	1.13	0.12	0.06	0.25	44.48	<0.05	0.12	0.09	<0.08	12.99			
6	231127-08	Laterite over phyllite	21° 27' 23.69"	80° 34' 15.72"	33.1	20.83	19.64	<0.01	0.12	<0.05	0.27	0.83	0.24	0.11	1.1	47.33	<0.05	0.11	0.07	<0.08	9.39			
7	231127-12	Laterite over phyllite	21° 27' 3.93"	80° 34' 10.33"	29.94	22.62	20.92	<0.01	0.04	<0.05	0.1	0.91	0.13	<0.05	0.43	42.8	<0.05	0.09	0.1	<0.08	11.77			
8	231127-15	Laterite over phyllite	21° 26' 52.34"	80° 34' 19.30"	44.77	10.67	11.56	<0.01	0.2	<0.05	0.47	0.43	0.09	<0.05	0.45	64	<0.05	0.08	0.08	<0.08	12.08			
9	231127-16	Laterite over phyllite	21° 26' 50.66"	80° 34' 25.36"	33.72	19.4	19.29	<0.01	0.1	<0.05	0.23	0.84	0.14	<0.05	0.74	48.2	<0.05	0.11	0.09	<0.08	10.89			
10	231127-17	Laterite over phyllite	21° 26' 56.75"	80° 34' 45.90"	41.98	23.64	9.87	<0.01	0.26	0.06	0.6	0.45	1.7	2.12	1.32	60.01	<0.05	<0.05	0.1	<0.08	<0.1			
11	231127-18	Laterite over phyllite	21° 27' 23.93	80° 35' 8.034"	34.74	18.99	17.29	<0.01	0.19	<0.05	0.44	1.03	0.18	<0.05	0.83	49.66	<0.05	0.07	0.08	<0.08	11.34			
12	231127-11	Laterite over phyllite	21° 27' 7.44"	80° 34' 7.90"	29.95	22.44	21.31	<0.01	0.06	<0.05	0.13	0.93	0.13	<0.05	0.51	42.83	<0.05	0.11	0.1	<0.08	11.43			
13	240124-01	Foliated quartz hematite chlorite rock from anomalous zone	21° 24' 46.35"	80° 37' 40.61"	42.64	18.64	13.3	<0.01	0.03	<0.05	0.06	0.96	<0.05	<0.05	2.21	60.97	<0.05	<0.05	0.05	0.29	3.45	<0.05		
14	240124-01'	Foliated quartz hematite chlorite rock from anomalous zone	21° 24' 46.35"	80° 37' 40.61"	39.6	24.41	12.32	<0.01	0.05	<0.05	0.11	0.93	<0.05	<0.05	2.02	56.62	<0.05	<0.05	0.05	0.24	3.23	<0.05		
15	240124-04	Foliated quartz hematite chlorite rock from anomalous zone	21° 24' 53.59"	80° 37' 50.24"	36.77	37.21	6.48	<0.01	<0.01	<0.05	<0.05	0.45	<0.05	<0.05	1.72	52.57	<0.05	<0.05	<0.05	0.08	1.35	<0.05		
16	240124-05	Foliated quartz hematite chlorite rock from anomalous zone	21° 24' 55.54"	80° 37' 51.48"	32.69	38.83	9.32	<0.01	<0.01	<0.05	<0.05	0.65	<0.05	<0.05	2.25	46.73	<0.05	<0.05	<0.05	0.08	1.95	<0.05		
17	CS-3.1	Channel sample from shear or mixed zone near Sitagota basalt & Karutola sandstone contact	21° 24' 12.45"	80° 37' 20.98"		46.29	12.19			0.076	0.15	0.9	2.64	<0.05	0.24	32.03	<0.05	<0.05	<0.05	<0.08	5.21	<0.05		
18	CS-3.2	Channel sample from shear or mixed zone near Sitagota basalt & Karutola sandstone contact	21° 24' 12.45"	80° 37' 20.98"		43.98	14.88			0.13	0.21	1.21	3.14	0.1	0.31	30.12	<0.05	<0.05	<0.05	<0.08	5.71	<0.05		
19	CS-3.3	Channel sample from shear or mixed zone near Sitagota basalt & Karutola sandstone contact	21° 24' 12.45"	80° 37' 20.98"		51.27	11.82			0.06	0.42	0.91	2.53	0.2	0.11	27.75	<0.05	<0.05	0.05	<0.08	4.57	<0.05		

S.N.	Sample ID	Lithology	Latitude	Longitude	Fe	SiO ₂	Al ₂ O ₃	S	P	MnO	P ₂ O ₅	TiO ₂	MgO	CaO	K ₂ O	Fe ₂ O ₃	SO ₃	BaO	V ₂ O ₅	Na ₂ O	LOI	SrO	ZrO ₂	Cr ₂ O ₃
20	CS-3.4	Channel sample from shear or mixed zone near Sitagota basalt & Karutola sandstone contact	21° 24' 12.45"	80° 37' 20.98"		42.45	9.99			<0.05	0.31	0.74	1.41	0.13	0.34	39.47	<0.05	<0.05	<0.05	<0.08	4.91	<0.05		
21	240504-22	Massive basalt from Sitagota formation	21° 27' 6.54"	80° 40' 6.35"	9.79	49.55	14.15	<0.05	<0.05	0.14	0.13	1.14	5.77	9.81	0.37	13.99	<0.05	<0.05	<0.05	2.24	2.49	<0.05		
22	240524-R08	Massive basalt from Sitagota formation	21° 24' 33.72"	80° 37' 0.31"	9.77	48.36	14.18	<0.05	<0.05	0.17	0.11	0.89	6.85	10.84	0.37	13.97	<0.05	<0.05	<0.05	1.69	2.36	<0.05		
23	240531-17	Leucocratic probably andesitic basalt from Sitagota formation	21° 26' 1.46"	80° 36' 48.89"	7.72	49.59	12.92	<0.05	<0.05	0.14	0.06	0.51	9.89	11.19	0.29	11.04	<0.05	<0.05	<0.05	1.66	2.51	<0.05		
24	240531-R01	Massive basalt from Sitagota formation	21° 25' 46.60"	80° 37' 30.36"	9.42	49.5	14.14	<0.05	0.05	0.18	0.11	0.9	6.76	10.64	0.21	13.47	0.091	<0.05	<0.05	1.57	2.28	<0.05		
25	240607-R12	Massive basalt from Sitagota formation	21° 27' 19.68"	80° 38' 6.90"	9.53	49.85	14.22	<0.05	<0.05	0.13	0.12	1.02	6.33	9.86	0.23	13.63	<0.05	<0.05	<0.05	2.15	2.29	<0.05		
26	240502-23	Gabbroic rock from Sitagota formation	21° 27' 33.28"	80° 40' 5.31"	9.56	49.27	14.13	<0.05	<0.05	0.18	0.11	0.93	6.15	11.32	0.11	13.66	<0.05	<0.05	<0.05	1.58	2.41	<0.05		
27	240503-05	Multiphase rock from Sitagota formation probably showing magma mixing	21° 27' 26.82"	80° 40' 20.98"	8.78	47.13	15.09	<0.05	0.06	0.15	0.11	0.92	4.58	16.49	<0.05	12.55	<0.05	<0.05	<0.05	0.14	2.62	<0.05		
28	240506-01	Gabbroic rock from Sitagota formation	21° 26' 56.34"	80° 40' 8.51"	9.53	50.33	13.73	<0.05	0.06	0.14	0.14	1.08	5.01	9.16	0.08	13.63	<0.05	<0.05	<0.05	1.93	4.61	<0.05		
29	240506-07	Gabbroic rock from Sitagota formation	21° 26' 57.10"	80° 39' 51.14"	10.46	49.22	13.53	<0.05	0.05	0.17	0.15	1.19	5.18	10.87	0.37	14.96	<0.05	<0.05	<0.05	1.51	2.67	<0.05		
30	240517-06	Gabbro from Sitagota formation	21° 26' 9.91"	80° 38' 25.19"	9.73	49.42	13.93	<0.05	<0.05	0.17	0.12	0.95	6.4	10.19	0.28	13.91	0.053	<0.05	<0.05	2.21	2.24	<0.05		
31	240517-R19	Massive basalt from Sitagota formation	21° 26' 26.15"	80° 38' 7.79"	9.49	49.47	14.24	<0.05	<0.05	0.16	0.11	0.91	6.32	10.39	0.34	13.56	<0.05	<0.05	<0.05	2.07	2.28	<0.05		
32	240518-R07	Massive basalt from Sitagota formation	21° 25' 56.57"	80° 38' 3.34"	9.69	48.94	13.82	<0.05	0.05	0.16	0.11	0.95	6.87	9.3	0.84	13.86	<0.05	0.06	<0.05	1.92	3.03	<0.05		
33	240523-R18	Gabbroic rock from Sitagota formation	21° 24' 46.40"	80° 37' 32.21"	9.43	50.38	14.53	<0.05	0.06	0.13	0.12	1.05	5.92	8.81	0.26	13.48	<0.05	<0.05	<0.05	2.18	2.99	<0.05		
34	240527-R01	Gabbroic rock from Sitagota formation	21° 24' 24.935"	80° 37' 19.45"	9.64	49.75	13.99	<0.05	<0.05	0.13	0.13	1.06	5.7	10.79	0.18	13.78	<0.05	<0.05	<0.05	1.84	2.47	<0.05		
35	240529-05	Amygdular basalt from Sitagota formation	21° 24' 53.02"	80° 36' 51.49"	9.21	49.84	13.22	<0.05	<0.05	0.15	0.11	0.91	8.02	9.12	0.44	13.17	<0.05	<0.05	<0.05	2.52	2.33	<0.05		
36	240530-19	Gabbro from Sitagota formation	21° 25' 31.23"	80° 37' 13.97"	9.73	48.3	14.27	<0.05	0.05	0.15	0.1	0.84	7.01	10.83	0.16	13.91	<0.05	<0.05	<0.05	1.86	2.41	<0.05		
37	240531-05	Gabbro from Sitagota formation	21° 26' 0.08"	80° 37' 18.76"	9.47	50.35	14.17	<0.05	<0.05	0.12	0.12	0.97	5.71	9.6	0.25	13.54	<0.05	<0.05	<0.05	2.86	2.11	<0.05		
38	240604-R03	Gabbroic rock from Sitagota formation	21° 27' 25.56"	80° 37' 22.63"	7.4	52.8	10.9	<0.05	0.07	0.11	<0.05	0.46	10.68	9.42	0.36	10.58	<0.05	<0.05	<0.05	1.57	2.82	<0.05		
39	240527-R01	Gabbroic rock from Sitagota formation	21° 24' 24.93"	80° 37' 19.45"	9.64	49.75	13.99	<0.05	<0.05	0.13	0.13	1.06	5.7	10.79	0.18	13.78	<0.05	<0.05	<0.05	1.84	2.47	<0.05		
40	240523-R18	Gabbroic rock from Sitagota formation	21° 24' 46.40"	80° 37' 32.21"	9.43	50.38	14.53	<0.05	0.06	0.13	0.12	1.05	5.92	8.81	0.26	13.48	<0.05	<0.05	<0.05	2.18	2.99	<0.05		
41	240524-R08	Massive basalt from Sitagota formation	21° 24' 33.72"	80° 37' 0.31"	9.77	48.36	14.18	<0.05	<0.05	0.17	0.11	0.89	6.85	10.84	0.37	13.97	<0.05	<0.05	<0.05	1.69	2.36	<0.05		
42	240529-05	Amygdular basalt from Sitagota formation	21° 24' 53.02"	80° 36' 51.49"	9.21	49.84	13.22	<0.05	<0.05	0.15	0.11	0.91	8.02	9.12	0.44	13.17	<0.05	<0.05	<0.05	2.52	2.33	<0.05		
43	240530-19	Gabbro from Sitagota formation	21° 25' 31.23"	80° 37' 13.97"	9.73	48.3	14.27	<0.05	0.05	0.15	0.1	0.84	7.01	10.83	0.16	13.91	<0.05	<0.05	<0.05	1.86	2.41	<0.05		

S.N.	Sample ID	Lithology	Latitude	Longitude	Fe	SiO2	Al2O3	S	P	MnO	P2O5	TiO2	MgO	CaO	K2O	Fe2O3	SO3	BaO	V2O5	Na2O	LOI	SrO	ZrO2	Cr2O3
44	231125-02	Foliated quartz hematite chlorite rock from Anomaly zone	21° 24' 15.71"	80° 37' 23.51"	49.1	23.37	2.12	<0.01	0.36	<0.05	0.83	0.16	0.18	1.41	0.06	70.17	<0.05	0.1	<0.05	<0.08	1.52			
45	231125-04	Foliated quartz hematite chlorite rock from Anomaly zone	21° 24' 15.40"	80° 37' 22.35"	47.26	22.48	6.27	<0.01	0.03	<0.05	0.08	0.55	<0.05	<0.05	<0.05	67.54	<0.05	0.06	<0.05	<0.08	2.87			
46	231125-06	Foliated quartz hematite chlorite rock from Anomaly zone	21° 24' 14.43"	80° 37' 19.61"	34.38	42.54	4.64	<0.01	0.03	0.09	0.07	0.29	0.68	0.06	0.09	49.13	<0.05	0.1	<0.05	<0.08	2.27			
47	240610-R03	Laterite over phyllite	21° 27' 20.58"	80° 35' 3.87"	31.98	19.1	19.35	<0.05	0.23	<0.05	0.59	1.34	0.1	<0.05	0.59	45.73	<0.05	<0.05	0.12	<0.08	12.79	<0.05		
48	240611-16	Laterite over phyllite	21° 27' 10.51"	80° 34' 22.05"	34.52	23.6	13.79	<0.05	0.09	<0.05	0.54	0.78	0.05	<0.05	0.16	49.36	<0.05	<0.05	0.09	<0.08	11.41	<0.05		
49	240611-22	Laterite over phyllite	21° 27' 2.23"	80° 34' 20.88"	35.59	18.84	17.69	<0.05	0.09	<0.05	0.2	0.69	0.08	<0.05	0.58	50.9	<0.05	<0.05	0.08	<0.08	10.69	<0.05		
50	240612-17	Laterite over phyllite	21° 27' 24.91"	80° 34' 31.41"	29.56	24.25	20.42	<0.05	0.09	<0.05	0.21	1.11	0.16	0.07	0.67	42.28	<0.05	<0.05	0.12	<0.08	10.48	<0.05		
51	240612-R11	Laterite over phyllite	21° 27' 6.23"	80° 33' 55.20"	32.69	20.85	19.48	<0.05	0.07	<0.05	0.22	1.1	0.11	<0.05	0.62	46.74	<0.05	<0.05	0.12	<0.08	10.49	<0.05		
52	240613-25	Laterite over phyllite	21° 26' 51.39"	80° 33' 30.99"	31.98	22	19.4	<0.05	0.11	<0.05	0.17	0.71	0.13	<0.05	0.89	45.73	<0.05	<0.05	0.17	<0.08	10.47	<0.05		
53	240613-R17	Laterite over phyllite	21° 26' 54.24"	80° 33' 36.18"	31.91	21.56	19.18	<0.05	0.09	<0.05	0.26	0.85	0.12	<0.05	0.67	45.62	<0.05	<0.05	0.08	<0.08	11.35	<0.05		
54	240613-R18	Laterite over phyllite	21° 26' 53.48"	80° 33' 35.60"	32.61	20.8	19.28	<0.05	0.11	<0.05	0.22	1.03	0.06	<0.05	0.15	46.63	<0.05	<0.05	0.1	<0.08	11.48	<0.05		
55	240612-06	Laterite over phyllite	21° 27' 18.57"	80° 34' 9.77"	35.75	18.23	17.59	<0.05	0.06	<0.05	0.3	1.39	0.05	0.06	0.1	51.13	<0.05	<0.05	0.11	<0.08	10.79	<0.05		
56	240606-R09	Laterite over Sitagota formation	21° 26' 56.54"	80° 38' 2.53"	24.26	5.35	31.05	<0.05	0.13	<0.05	0.22	4.1	0.12	0.06	<0.05	34.7	<0.05	<0.05	0.11	<0.08	24.05	<0.05		
57	240607-01	Laterite over Sitagota formation	21° 27' 35.92"	80° 38' 21.31"	19.58	6.88	38.32	<0.05	0.16	<0.05	0.3	6.2	0.12	0.34	<0.05	28.01	0.07	<0.05	0.21	<0.08	19.3	<0.05		
58	240607-30	Laterite over Sitagota formation	21° 27' 26.51"	80° 38' 19.27"	33.04	1.13	27.89	<0.05	0.1	<0.05	0.38	6.17	0.07	<0.05	<0.05	47.25	0.1	<0.05	0.24	<0.08	16.53	<0.05		
59	240608-23	Laterite over Sitagota formation	21° 27' 37.73"	80° 38' 30.60"	27.44	4.54	31.25	<0.05	0.13	<0.05	0.25	6.63	0.1	<0.05	<0.05	39.24	0.09	<0.05	0.2	<0.08	17.42	<0.05		
60	240608-R12	Laterite over Sitagota formation	21° 27' 32.20"	80° 38' 36.55"	32.96	5.91	26.54	<0.05	0.26	<0.05	0.22	4.54	0.09	<0.05	<0.05	47.13	0.08	<0.05	0.2	<0.08	15	<0.05		
61	240617-R-12	Laterite over Kotima formation	21° 24' 30.80"	80° 41' 21.8"	40.32	11.38	16.05	<0.05	0.17	<0.05	0.39	3.35	0.05	<0.05	0.07	57.64	0.09	<0.05	0.22	<0.08	10.54	<0.05		
62	21-11-24-06	Rock form anomaly/PGE zone	21° 24' 12.70"	80° 37' 20.90"	33.09	38.52	7.64	<0.08	0.05	0.12	0.12	0.63	1.25	<0.05	0.4	47.32	<0.08	<0.05	<0.05	0.08	3.82	<0.05		
63	21-11-24-08	Rock form anomaly/PGE zone	21° 24' 11.00"	80° 37' 23.10"	34.58	49.65	0.44	<0.08	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.09	49.45	<0.08	<0.05	<0.05	0.08	0.2	<0.05		

6.7 Platinum group elements (PGE) analysis:

About 38 bed rock samples were analyzed along the contact or hybrid zone of Karutola sandstone and Sitagota basalt where earlier samples, in Maneri Sitapala project, yielded relatively higher values of platinum group elements. The primary focus was on analyzing the distribution of platinum (Pt), palladium (Pd), ruthenium (Ru), rhodium (Rh), iridium (Ir), and osmium (Os) to assess the PGM potential in the sampled area of the block. The sample locations are shown in below **Figure 86**.

Platinum (Pt) is present in majority of samples indicating it is the dominant PGE present in the contact zone region. The total PGE content varies significantly across different samples, indicating spatial heterogeneity in PGM concentration. The highest total PGE value observed is 0.308 ppm (308 ppb) in Sample ID 240124-05 (**Table 7**). In this sample platinum value is 0.27 ppm (270 ppb). Except this one sample, all samples are having PGE values below 100 ppb. Some samples exhibit multi-element occurrences, such as Pt and Ru, while many others show values below the detection limit (BDL) for all elements. The contact zone samples between basalt and sandstone did not yield good values of platinum group minerals in the analyzed samples.

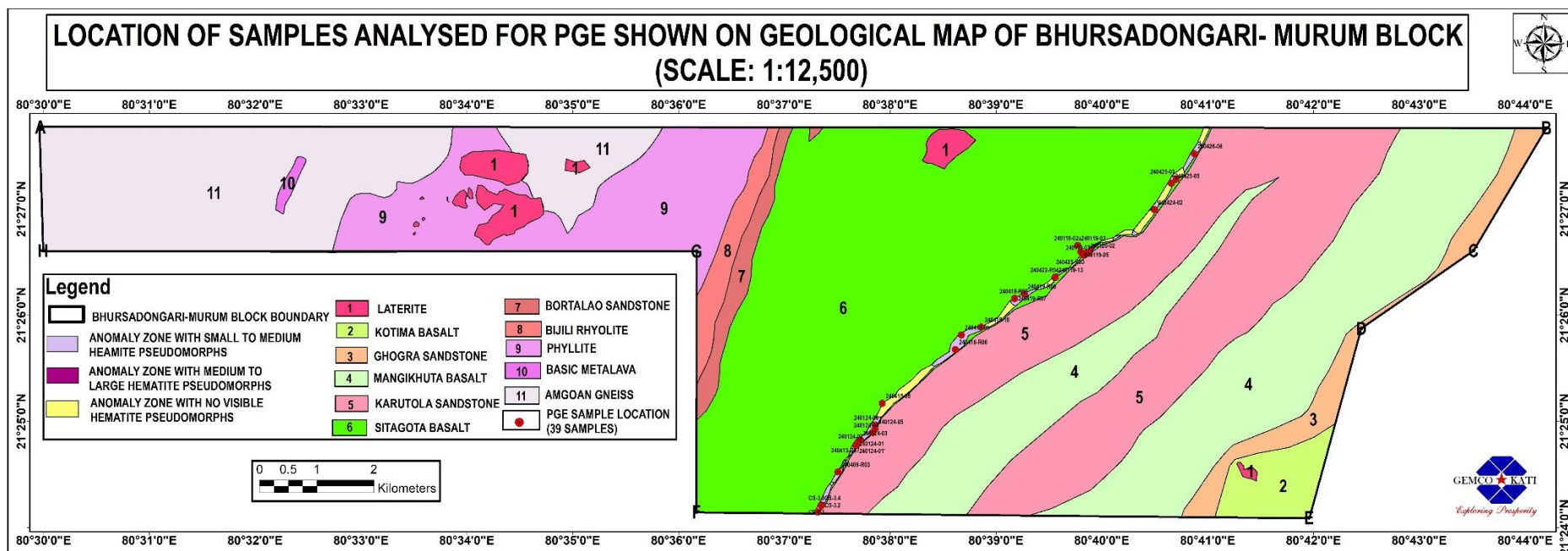


Figure 86. Location map of samples analyzed for platinum group elements analysis.

Table 7. Analysis Results of BRS Samples (PGE by NiS fire assay).

S.N.	Sample ID	Lithology	Latitude	Longitude	Pt	Pd	Ru	Rh	Ir	Os	Total PGE (ppm)	Total PGE (ppb)
1	240119-02	Basalt, coarse grained	21° 26' 39.41"	80° 39' 46.43"	0.021	<0.005	<0.005	<0.005	0.007	<0.005	0.028	28
2	240119-02a	Basalt, coarse grained	21° 26' 39.41"	80° 39' 46.43"	0.028	<0.005	0.02	<0.005	0.012	<0.005	0.06	60
3	240119-05	Ferruginous Sandstone, Hematite crystal bearing	21° 26' 35.76"	80° 39' 48.23"	0.025	<0.005	0.01	<0.005	<0.005	<0.005	0.035	35
4	240119-05A	Ferruginous Sandstone, Hematite crystal bearing	21° 26' 35.74"	80° 39' 48.23"	0.039	0.006	0.02	0.008	0.01	<0.005	0.084	84
4	240119-05A	Ferruginous Sandstone, Hematite crystal bearing	21° 26' 35.74"	80° 39' 48.23"	BDL	0.015	BDL	BDL	BDL	BDL	0.015	15
5	240119-07	Ferruginous Sandstone, Hematite crystal bearing	21° 26' 34.03"	80° 39' 49.51"	0.037	<0.005	0.02	0.006	0.007	<0.005	0.069	69
6	240119-13	Ferruginous Sandstone, Hematite crystal bearing	21° 26' 21.52"	80° 39' 33.61"	0.018	<0.005	0.021	<0.005	<0.005	<0.005	0.039	39
7	240120-02	Spinel crystal bearing anomaly zone	21° 26' 35.18"	80° 39' 51.59"	0.029	<0.005	0.034	0.007	<0.005	<0.005	0.07	70
8	240124-01	Spinel crystal bearing anomaly zone	21° 24' 46.35"	80° 37' 40.61"	0.011	<0.005	0.028	0.006	<0.005	<0.005	0.045	45
9	240124-01a	Spinel crystal bearing anomaly zone	21° 24' 46.44"	80° 37' 40.93"	0.029	<0.005	0.022	<0.005	<0.005	<0.005	0.052	52
10	240124-01'	Spinel crystal bearing anomaly zone	21° 24' 46.35"	80° 37' 40.61"	0.01	<0.005	0.01	<0.005	<0.005	<0.005	0.02	20
11	240124-02	Spinel crystal bearing anomaly zone	21° 24' 47.26"	80° 37' 41.60"	0.02	<0.005	0.01	<0.005	0.012	<0.005	0.042	42
12	240124-03	Spinel crystal bearing anomaly zone	21° 24' 49.10"	80° 37' 42.55"	0.01	<0.005	0.02	<0.005	<0.005	<0.005	0.03	30
13	240124-03A	Spinel crystal bearing anomaly zone	21° 24' 49.49"	80° 37' 43.23"	<0.005	<0.005	0.04	<0.005	<0.005	<0.005	0.04	40
14	240124-04	Spinel crystal bearing anomaly zone	21° 24' 53.59"	80° 37' 50.24"	0.042	<0.005	0.04	0.007	<0.005	<0.005	0.089	89
15	240124-06	Spinel crystal bearing anomaly zone	21° 24' 57.90"	80° 37' 51.58"	<0.005	<0.005	0.02	<0.005	<0.005	<0.005	0.02	20
16	240124-05	Spinel crystal bearing anomaly zone	21° 24' 55.54"	80° 37' 51.49"	0.27	<0.005	0.03	0.008	<0.005	<0.005	0.308	308
17	240406-03	Foliated quartz chlorite hematite rock	21° 24' 8.65"	80° 37' 19.00"	0.005	0.009	<0.005	<0.005	<0.005	<0.005	0.014	14
18	240406-06	Foliated quartz chlorite hematite rock	21° 24' 12.53"	80° 37' 21.15"	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0	0
19	240409-R03	Foliated quartz chlorite hematite rock	21° 24' 31.35"	80° 37' 30.52"	0.007	0.005	<0.005	<0.005	<0.005	<0.005	0.012	12
20	240413-R05	Spinel bearing rock from anomaly zone	21° 24' 47.83"	80° 37' 41.65"	0.015	0.008	<0.005	<0.005	<0.005	0.006	0.028	28
21	240413-R07	Spinel bearing rock from anomaly zone	21° 24' 47.40"	80° 37' 41.64"	<0.005	0.013	0.005	<0.005	<0.005	<0.005	0.018	18
22	240415-05	Foliated quartz chlorite hematite rock	21° 25' 10.18"	80° 37' 55.57"	0.01	<0.005	0.01	<0.005	<0.005	<0.005	0.02	20
23	240416-01	Foliated quartz chlorite hematite rock	21° 25' 48.79"	80° 38' 40.41"	<0.005	0.01	<0.005	<0.005	<0.005	<0.005	0.01	10

S.N.	Sample ID	Lithology	Latitude	Longitude	Pt	Pd	Ru	Rh	Ir	Os	Total PGE (ppm)	Total PGE (ppb)
24	240416-R06	Foliated quartz chlorite hematite rock	21° 25' 40.59"	80° 38' 37.11"	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0	0
25	240418-10	Foliated quartz chlorite hematite rock	21° 25' 53.24"	80° 38' 51.72"	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0	0
26	240419-R07	Foliated quartz chlorite hematite rock	21° 26' 9.41"	80° 39' 10.59"	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0	0
26	240419-R07	Foliated quartz chlorite hematite rock	21° 26' 9.41"	80° 39' 10.59"	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0	0
27	240419-R08	Foliated quartz chlorite hematite rock	21° 26' 12.06"	80° 39' 16.14"	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0	0
28	240422-R04	Foliated quartz chlorite hematite rock	21° 26' 21.39"	80° 39' 33.74"	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0	0
29	240423-R03	Foliated quartz chlorite hematite rock	21° 26' 34.04"	80° 39' 50.28"	<0.005	<0.005	0.007	<0.005	<0.005	<0.005	0.007	7
30	240423-R05	Foliated quartz chlorite hematite rock	21° 26' 35.28"	80° 39' 52.64"	<0.005	0.007	<0.005	<0.005	<0.005	<0.005	0.007	7
31	240424-02	Foliated quartz chlorite hematite rock	21° 26' 59.61"	80° 40' 29.96"	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0	0
32	240425-03	Foliated quartz chlorite hematite rock	21° 27' 17.02"	80° 40' 42.32"	0.014	0.007	<0.005	<0.005	<0.005	<0.005	0.022	22
33	240425-05	Foliated quartz chlorite hematite rock	21° 27' 14.65"	80° 40' 39.48"	<0.005	0.005	0.006	<0.005	<0.005	<0.005	0.012	12
34	240426-08	Foliated quartz chlorite hematite rock	21° 27' 31.39"	80° 40' 52.47"	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0	0
35	CS-3.1	Foliated quartz chlorite hematite rock	21° 24' 12.45"	80° 37' 20.98"	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0	0
36	CS-3.2	Foliated quartz chlorite hematite rock	21° 24' 12.45"	80° 37' 20.98"	0.006	<0.005	<0.005	<0.005	<0.005	<0.005	0.006	6
37	CS-3.3	Foliated quartz chlorite hematite rock	21° 24' 12.45"	80° 37' 20.98"	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.005	5
38	CS-3.4	Foliated quartz chlorite hematite rock	21° 24' 12.45"	80° 37' 20.98"	0.012	<0.005	<0.005	<0.005	<0.005	<0.005	0.012	12
<input checked="" type="checkbox"/> Check sample results from Lucid laboratory, Hyderabad. <input type="checkbox"/> Sample results from Shiva Analytical, Bengaluru.												

6.8 Mineralogy of the ore zones:

About 20 polished sections were prepared to study the mineralogy of iron ore rich zone along the contact zone of Karutola sandstone and Sitagota basalt. All polished sections showed the presence of hematite mineral. It is dark brownish grey, medium to coarse grained, massive and compact. It comprises mainly a cumulate of oxide metallic ore mineral forming cubic /octahedral crystals. The ore mineral is nonmagnetic and steel grey in colour has metallic lustre, brown streak, high specific gravity and exhibits alteration to a brownish red amorphous material.

The section in transmitted light shows mostly opaque grains with straight and regular grain boundaries. The low volume cementing material or the matrix is greyish or colourless and is studded with fine particles of opaque minerals. The cementing material exhibits uneven or patchy greyish interference colours. It may be siliceous or clayey in composition and has a large percentage of dispersed fine-grained Fe-oxide (?) opaque minerals. In reflected light a portion of the section shows euhedral minerals of square, rhombic or polygonal shapes, regular outline, deep fractures, greyish white colour and moderate reflectance. An overall cumulate texture is indicated. The discrete euhedral polygonal grains exhibit strong anisotropism. The grains may have intergrown twinning of individuals in different orientations which exhibit differential extinction.



Figure 87. The foliated quartz-chlorite-hematite rock with rich disseminations of Euhedral crystals of Hematite.



Figure 88. The foliated quartz-chlorite-Hematite rock, with disseminated euhedral Hematite crystals.

6.9 Pitting:

About 10 pits were excavated in the block area (**Figure 89**). Each pit measured 1 meter in width, 1 meter in depth, and 2 meters in length. Samples were taken from each pit to characterize it stratigraphically as well as spatially. The pits were excavated into laterized Amgaon phyllite (7 pits), laterized Sitagota basalt (2 pits) and laterized Kotima basalt (1 pit) to assess the quality of the mineralized zones in terms of iron, alumina, titanium, and vanadium content, based on the results of outcrop sample analysis (**Table 8 & 9**).

The alumina (Al_2O_3) content in the samples shows considerable variation. The values range from a minimum of 12.49% to a maximum of 31.14%. Most of the samples fall within the range of approximately 13% to 20%, suggesting aluminous laterite nature of the majority of the pit samples. However, a few significantly higher values, particularly those above 29%, point to zones of strong alumina enrichment. These elevated concentrations indicate towards a bauxite-rich pockets.

The iron (Fe) content in the samples varies from a low of 27.33% to a high of 43.54%. The overall distribution shows that most of the values lie in the range of 33% to 41%, indicating a consistently moderate to high-grade iron presence across the samples. The average iron content appears to be around 35.29%, which is indicative of a fairly iron-rich zone, suitable for further exploration.

The titanium dioxide (TiO_2) content in the samples shows a clear distinction between a few high-concentration values and a majority of lower ones in the pit samples. The TiO_2 values range from 0.63% to 4.72%. However, three samples show significantly higher concentrations, above 2.9%, with one reaching nearly 4.72%, indicating potential zones of Ti-rich mineralization.

The vanadium pentoxide (V_2O_5) content in the samples shows a narrow and fairly consistent range. The values span from <0.05% to 0.20%, with most values clustering between 0.10% and 0.14%. This consistency suggests limited but uniformly distributed vanadium presence in the analyzed area.

The V_2O_5 values observed in the aluminous laterites of the Bhursadongari–Murum Block (from 10 pits, 7 pits yielded vanadium values in the range of 0.10% to 0.20%) are comparable to grades in other region's Geological Survey of India-led G3 stage projects:

1. Arunachal Pradesh (Depo area, Papum Pare District) for Graphite and Vanadium (Field season program: 2018-2019):

- ❖ At 0.05% V_2O_5 cut-off, 0.388805 MT with 0.188% grade.
- ❖ At 0.1% cut-off, 0.300012 MT with 0.228% grade.

These values led to G3 resource estimation and auctioned. M/s Vedanta Limited was the preferred bidder.

2. Madhya Pradesh (Khapripani Block, Dindori District) for Bauxite and Aluminous Laterites (Field season program: 2021-2022):

- ❖ 68.8461 MT at 0.05% V_2O_5 cut-off and
- ❖ 35.4617 MT at 0.10% cut-off from aluminous laterite zones.

Above examples substantiate that vanadium values from 0.10%–0.20%, from pitting upto 1 meter depth, hold commercial significance, especially in surficial lateritic contexts containing, titanium, aluminium and iron.

The silica (SiO_2) content in the samples displays a moderately wide range, varying from a low of 6.88% to a high of 21.49%. The distribution shows a moderate increase, with initial values below 10% and later values reaching above 18%, indicating zones of relatively higher siliceous material in some parts of the area.

Table 8. Analyzed pits having some relevant major oxides.

S.N.	Sample ID	Type of laterites	Latitude	Longitude	Al ₂ O ₃	Fe	Fe ₂ O ₃	SiO ₂	TiO ₂	V ₂ O ₅
1	BM-PIT-01/X	Laterized Kotima basalt	21°24'29.9"N	80°41'22.9"E	12.49	43.54	62.26	14.10	2.96	0.11
2	BM-PIT-02/X	Laterized Sitagota basalt	21°27'26.8"N	80°38'30.0"E	29.23	29.33	41.93	8.06	3.73	0.20
3	BM-PIT-03/X	Laterized Sitagota basalt	21°27'38.3"N	80°38'30.7"E	31.14	27.33	39.08	6.88	4.72	0.14
4	BM-PIT-04/X	Laterized Amgaon phyllite	21°27'21.5"N	80°35'2.6"E	20.29	30.86	44.13	21.24	1.09	0.08
5	BM-PIT-05/Y	Laterized Amgaon phyllite	21°27'23.7"N	80°34'5.2"E	13.79	41.46	59.28	14.35	0.63	<0.05
6	BM-PIT-06/X	Laterized Amgaon phyllite	21°27'21.6"N	80°34'24.1"E	15.50	38.92	55.65	18.05	1.23	0.12
7	BM-PIT-07/Y	Laterized Amgaon phyllite	21°27'4.9"N	80°34'10.7"E	18.04	36.17	51.71	18.44	0.99	0.14
8	BM-PIT-08/X	Laterized Amgaon phyllite	21°26'57.3"N	80°34'35.2"E	17.90	33.63	48.09	21.49	0.92	0.10
9	BM-PIT-09/Z	Laterized Amgaon phyllite	21°26'45.8"N	80°34'12.3"E	16.87	35.84	51.24	19.48	0.69	0.07
10	BM-PIT-10/Y	Laterized Amgaon phyllite	21°27'4.9"N	80°33'56.3"E	18.66	35.72	51.07	19.63	0.93	0.18

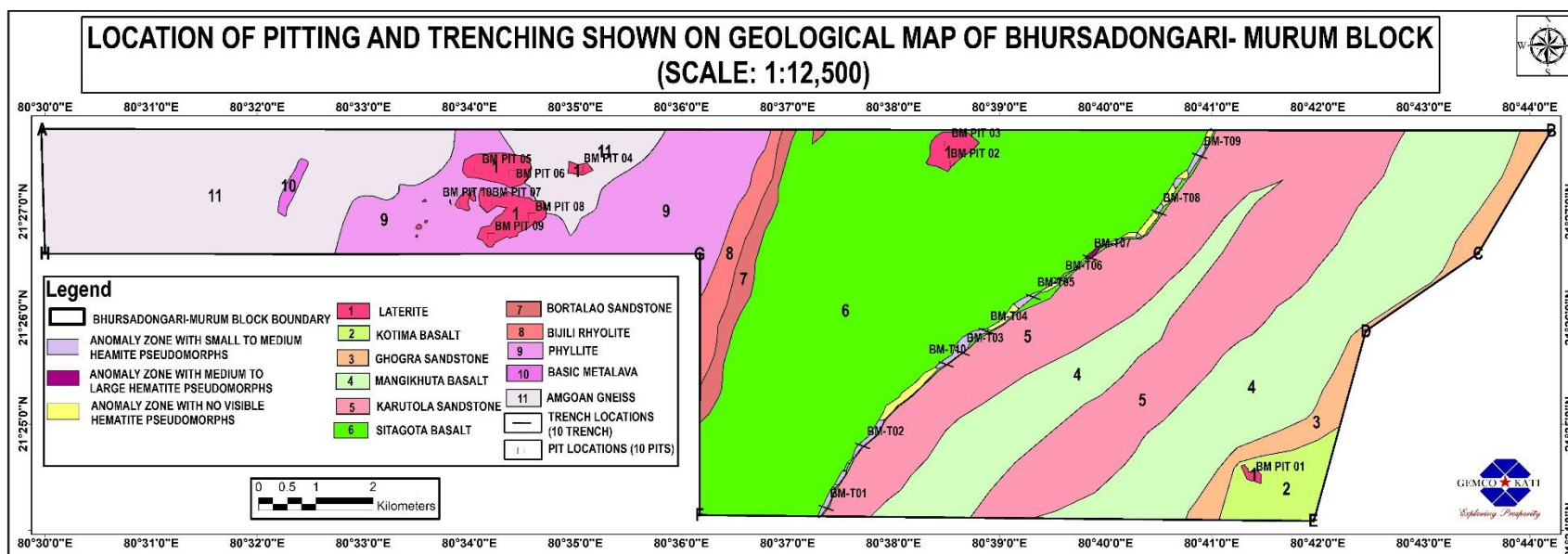


Figure 89. Location of pit and trenches.

Table 9. Analyzed pits having result of major oxides.

S.N.	Sample ID	Type of laterites	Latitude	Longitude	Al ₂ O ₃	BaO	CaO	Fe	Fe ₂ O ₃	K ₂ O	MgO	MnO	Na ₂ O	P	S	P ₂ O ₅	SO ₃	SrO	SiO ₂	TiO ₂	V ₂ O ₅	LOI
1	BM-PIT-01/X	Laterized Kotima basalt	21°24'29.9"N	80°41'22.9"E	12.49	<0.05	<0.05	43.54	62.26	<0.05	<0.05	<0.05	<0.08	<0.05	<0.05	0.11	<0.05	<0.05	14.1	2.96	0.11	7.73
2	BM-PIT-02/X	Laterized Sitagota basalt	21°27'26.8"N	80°38'30.0"E	29.23	<0.05	<0.05	29.33	41.93	0.1	0.1	<0.05	<0.08	0.13	<0.05	0.3	<0.05	<0.05	8.06	3.73	0.20	15.96
3	BM-PIT-03/X	Laterized Sitagota basalt	21°27'38.3"N	80°38'30.7"E	31.14	<0.05	<0.05	27.33	39.08	0.11	0.11	<0.05	<0.08	0.11	<0.05	0.26	0.07	<0.05	6.88	4.72	0.14	17.13
4	BM-PIT-04/X	Laterized Amgaon phyllite	21°27'21.5"N	80°35'2.6"E	20.29	<0.05	<0.05	30.86	44.13	0.64	0.12	<0.05	<0.08	0.28	<0.05	0.64	<0.05	<0.05	21.24	1.09	0.08	11.55
5	BM-PIT-05/Y	Laterized Amgaon phyllite	21°27'23.7"N	80°34'5.2"E	13.79	<0.05	<0.05	41.46	59.28	0.74	0.12	<0.05	<0.08	0.28	<0.05	0.64	<0.05	<0.05	14.35	0.63	<0.05	10.23
6	BM-PIT-06/X	Laterized Amgaon phyllite	21°27'21.6"N	80°34'24.1"E	15.5	<0.05	<0.05	38.92	55.65	0.22	0.07	0.11	<0.08	0.17	<0.05	0.39	<0.05	<0.05	18.05	1.23	0.12	8.41
7	BM-PIT-07/Y	Laterized Amgaon phyllite	21°27'4.9"N	80°34'10.7"E	18.04	<0.05	<0.05	36.17	51.71	0.32	0.06	<0.05	<0.08	0.08	<0.05	0.18	<0.05	<0.05	18.44	0.99	0.14	9.84
8	BM-PIT-08/X	Laterized Amgaon phyllite	21°26'57.3"N	80°34'35.2"E	17.9	<0.05	<0.05	33.63	48.09	0.2	0.06	<0.05	<0.08	0.07	<0.05	0.17	<0.05	<0.05	21.49	0.92	0.10	10.83
9	BM-PIT-09/Z	Laterized Amgaon phyllite	21°26'45.8"N	80°34'12.3"E	16.87	<0.05	<0.05	35.84	51.24	1.06	0.14	<0.05	<0.08	0.07	<0.05	0.16	<0.05	<0.05	19.48	0.69	0.07	10.05
10	BM-PIT-10/Y	Laterized Amgaon phyllite	21°27'4.9"N	80°33'56.3"E	18.66	<0.05	<0.05	35.72	51.07	0.59	0.09	<0.05	<0.08	0.08	<0.05	0.18	0.05	<0.05	19.63	0.93	0.18	8.33

6.10 Trenching:

About ten trenches were excavated in the block area. Each trench measured 1 meter in width, 1 meter in depth, and 15 meters in length. The trenches were excavated along the contact zone between Karutola Sandstone and Sitagota Basalt to evaluate the mineralization potential of PGE (Platinum Group Elements) and iron (**Figure 90**). About 10 samples were analyzed for their major oxides contents and about 75 samples were analyzed for their platinum group elements contents.

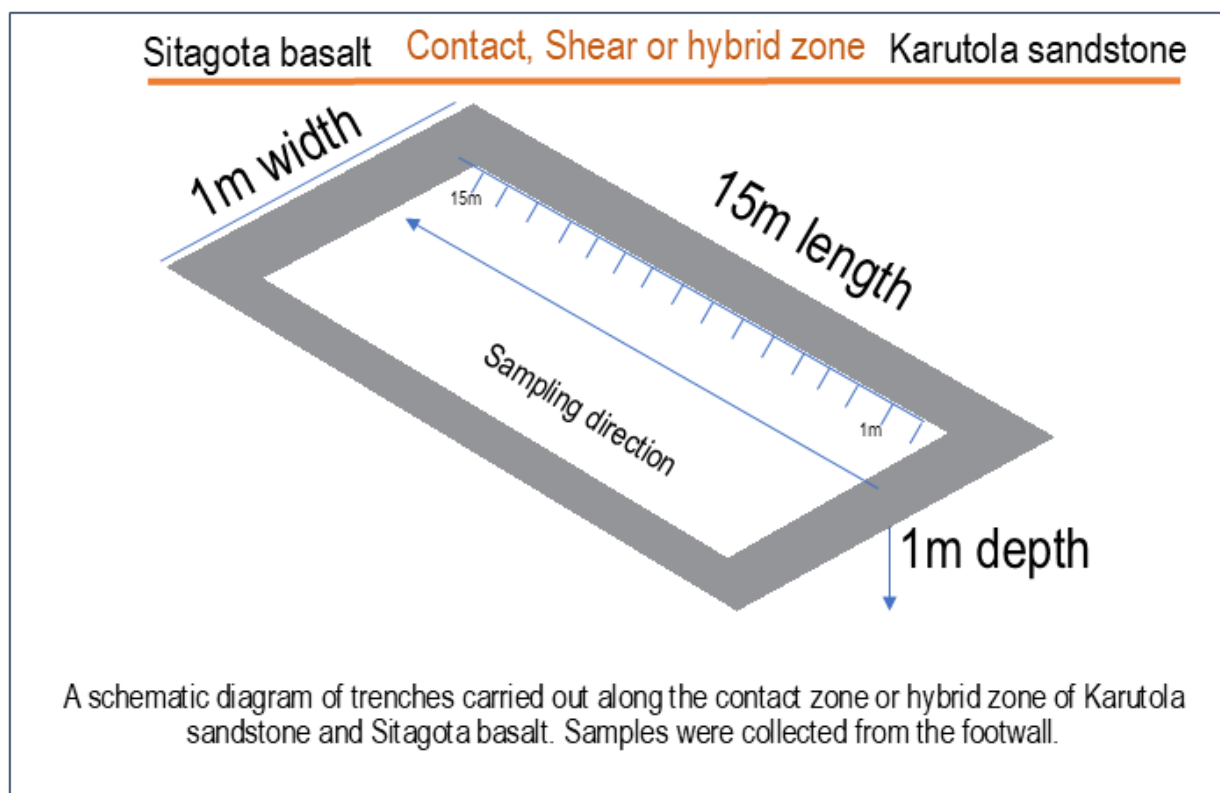


Figure 90. A schematic diagram of trenches carried out along the contact or hybrid zone of Karutola sandstone and Sitagota basalt. Samples were of 1 meter length from footwall of the trenches. The details of each trench samples can be found at the attached **Annexure**.

The following procedures were utilized to prepare and analyze trench samples for PGE analysis at Shiva Analytical, Bengaluru:

Dry the sample to remove moisture. Crush the sample in a jaw crusher, to a size of <2 mm. Pulverize this in a ring mill to get a sample size of 90% passing 200mesh (75microns) and transfer into a coded sample packet and preserve the sample in the sample cover taking care to avoid contamination at each and every step by flushing with compressed air and barren rock wash in between the samples.

Platinum Group Elements (PGE) by Nickel Sulphide Fire Assay:

This method describes the Fire Assay method for production of nickel sulphide button, followed by nickel sulphide digestion procedure used for the preparation of all types of geological exploration, mining and ore grade rock chips, soils, stream sediment samples for the subsequent analysis either by ICPMS. The elements of interest are Platinum, Palladium, Rhodium, Iridium, Ruthenium, Osmium.

Procedure:

The sample is weighed in a fusion crucible containing flux of Nickel powder, Sulphur, Borax, Silica, fused in a preheated fusion furnace at high temperatures for 120 minutes and then cooled. After cooling the nickel sulphide button is separated by breaking the fire assay crucible. The obtained nickel sulphide button is cooled, weight of each button noted on the work sheet, pulverized to 200mesh (75 micron) in a ring mill, digested in Hydrochloric acid and precipitated solution and filtered. The filter along with residue is digested in aqua regia and analysed by Inductively Coupled Plasma Mass Spectrometer for PPB Levels.

Major oxides result of trench samples:

The alumina (Al_2O_3) content across the samples varies significantly, with the highest concentration observed in BMT-09 (20.32%) and the lowest in BMT-04 (5.65%). This variation suggests differing degrees of lateritic weathering influence, with BMT-09 indicating potential aluminium enrichment.

Iron (Fe) and ferric oxide (Fe_2O_3) are major components, particularly high in BMT-07 (51.58% Fe, 73.75% Fe_2O_3) and BMT-10 (47.35% Fe, 67.70% Fe_2O_3), indicating a strong presence of iron oxides like hematite or magnetite and pointing toward potential iron ore zones.

Silicon dioxide (SiO_2) shows high variability, peaking in BMT-05 (47.31%) and BMT-03 (44.69%), indicating quartz-rich or silicate-dominated zones, while lower values in BMT-07 and BMT-10 reflect silica depletion in iron-rich environments.

Titanium dioxide (TiO_2) ranges from 0.36% to 1.59%, with the highest value in BMT-09, likely due to the presence of ilmenite or other titanium-bearing minerals. Vanadium pentoxide (V_2O_5) is mostly undetectable, except in trace amounts in BMT-04, BMT-08, and BMT-09, indicating minimal vanadium content.

Magnesium oxide (MgO) is most concentrated in BMT-01 (3.41%), suggesting the presence of magnesium-bearing silicate minerals, while other samples show lower amounts. Other components were found to be in trace amounts or below their detection limits.

Major oxide analysis of trench samples indicates towards a ferruginous sandstone with few having aluminous oxides indicating influence of residual enrichment process.

Table 10. Major oxides analysis of samples from trenching along the contact zone of Karutola sandstone and Sitagota basalt.

S.N.	Sample ID	Lithology	Latitude	Longitude	Al ₂ O ₃	BaO	CaO	Fe	Fe ₂ O ₃	K ₂ O	MgO	MnO	Na ₂ O	P	S	P ₂ O ₅	SO ₃	SrO	SiO ₂	TiO ₂	V ₂ O ₅	LOI
1	BMT-01 (1m to 2m)	Foliated quartz chlorite hematite rock	21°24'12.5"N	80°37'21.7"E	15.54	<0.05	0.18	21.92	31.34	0.53	3.41	0.1	<0.08	0.11	<0.05	0.24	<0.05	<0.05	39.9	1.35	<0.05	7.18
2	BMT-02 (4m to 5m)	Cumulates of euhedral (octahedral) medium to large sized hematite pseudomorphs with fine grained brown colour matrix in between	21°24'47.5"N	80°37'42.4"E	12.97	<0.05	<0.05	27.4	39.18	0.78	0.07	<0.05	0.2	<0.05	<0.05	0.05	<0.05	<0.05	41.48	0.95	<0.05	4.21
3	BMT-03 (4m to 5m)	Foliated quartz hematite chlorite rock, metallic lustre	21°25'33.7"N	80°38'29.7"E	9.84	<0.05	<0.05	26.56	37.98	0.07	1.56	<0.05	<0.08	0.08	<0.05	0.19	<0.05	<0.05	44.69	0.83	<0.05	4.63
4	BMT-04 (5m to 6m)	Fine grained, massive, hard, showing conchoidal fracture, greyish shiny appearance, quartz hematite chlorite rock	21°25'40.2"N	80°38'38.8"E	5.65	<0.05	<0.05	40.23	57.52	0.07	0.52	0.07	0.08	<0.05	<0.05	0.06	<0.05	<0.05	33.06	0.36	0.06	2.5
5	BMT-05 (7m to 8m)	Foliated quartz hematite chlorite rock	21°26'11.7"N	80°39'19.0"E	14.45	<0.05	<0.05	20.44	29.22	<0.05	0.08	<0.05	<0.08	<0.05	<0.05	<0.05	<0.05	<0.05	47.31	1.05	<0.05	7.58
6	BMT-06 (7m to 8m)	Foliated quartz chlorite hematite rock	21°26'21.2"N	80°39'34.7"E	12.7	<0.05	0.15	21.86	31.25	0.88	1.21	0.15	<0.08	0.15	<0.05	0.34	<0.05	<0.05	44.27	1.05	<0.05	7.81
7	BMT-07 (9m to 10m)	Cumulates of euhedral (octahedral) medium to large sized hematite pseudomorphs with fine grained brown colour matrix in between	21°26'34.0"N	80°39'51.0"E	7.17	<0.05	0.24	51.58	73.75	0.74	<0.05	<0.05	0.15	0.44	<0.05	1.01	0.09	0.18	13.5	0.46	<0.05	2.59
8	BMT-08 (11m to 12m)	Foliated quartz hematite chlorite rock	21°26'59.3"N	80°40'30.1"E	8.31	<0.05	<0.05	29.74	42.53	0.16	1.38	0.1	<0.08	0.05	<0.05	0.13	<0.05	<0.05	42.83	0.49	0.05	3.79



S.N.	Sample ID	Lithology	Latitude	Longitude	Al ₂ O ₃	BaO	CaO	Fe	Fe ₂ O ₃	K ₂ O	MgO	MnO	Na ₂ O	P	S	P ₂ O ₅	SO ₃	SrO	SiO ₂	TiO ₂	V ₂ O ₅	LOI
9	BMT-09 (1m to 2m)	Foliated meta basalt	21°27'31.4"N	80°40'53.1"E	20.32	<0.05	0.29	17.36	24.82	<0.05	1.96	0.13	<0.08	0.16	<0.05	0.37	<0.05	<0.05	45.82	1.59	0.07	4.34
10	BMT-10 (13m to 14m)	Fine to medium grained, pinkish coloured with greyish metallic content highly iron rich rock	21°25'52.6"N	80°38'52.2"E	6.21	<0.05	<0.05	47.35	67.7	<0.05	<0.05	0.22	<0.08	0.52	<0.05	1.2	<0.05	<0.05	12.74	0.49	<0.05	11.22

Platinum group elements result of trench samples:

About 75 samples were analyzed for their platinum group elements contents from trenching. The trenches were carried out along the contact zone of Karutola sandstone and Sitagota basalt where earlier samples yielded values of platinum group elements.

Across the trench samples, platinum (Pt) is consistently detected in nearly all samples, ranging from 0.005 ppm to 0.026 ppm, indicating it is the dominant PGE present in the region. The highest Pt value was recorded in BMT-08 (7m–8m) at 0.026 ppm, suggesting localized PGE enrichment.

Palladium (Pd) appears less frequently than Pt, with values typically in the 0.005–0.011 ppm range when detected. Notably, it co-occurs with Pt in several trench sections, such as in BMT-03 (7m–8m) and BMT-04 (10m–11m).

Ruthenium (Ru) is rarely detected and only appears in select samples, such as BMT-06 (13m–14m) and BMT-07 (2m–3m), where it reaches 0.007–0.010 ppm, indicating only trace-level presence.

Rhodium (Rh) is occasionally present, often in concentrations around 0.006–0.014 ppm, with a few samples (e.g., BMT-09 and BMT-08) showing slightly higher values. Its detection, though infrequent, aligns with zones where Pd is also present, possibly indicating a shared geochemical association.

Iridium (Ir) and osmium (Os) are generally below detection limits (BDL) across all samples, suggesting minimal presence or highly dispersed occurrence in the trenches.

Table 11. Platinum group elements analysis of trench samples along the contact zone of Karutola sandstone and Sitagota basalt.

S.N.	Sample Id	Lithology	Latitude	Longitude	Pt	Pd	Ru	Rh	Ir	Os	Total PGE (ppm)	Total PGE (ppb)
1	BMT-01 (4m to 5m)	Foliated quartz chlorite hematite rock	21°24'12.5"N	80°37'21.7"E	0.017	BDL	BDL	BDL	BDL	BDL	0.017	17
2	BMT-01(5m to 6m)	Foliated quartz chlorite hematite rock	21°24'12.5"N	80°37'21.7"E	0.017	BDL	BDL	0.006	BDL	BDL	0.023	23
3	BMT-01 (6m to 7m)	Foliated quartz chlorite hematite rock	21°24'12.5"N	80°37'21.7"E	0.019	0.008	BDL	BDL	BDL	BDL	0.027	27
4	BMT-01 (7m to 8m)	Foliated quartz chlorite hematite rock	21°24'12.5"N	80°37'21.7"E	0.018	BDL	BDL	BDL	BDL	BDL	0.018	18
5	BMT-01 (9m to 10m)	Foliated quartz chlorite hematite rock	21°24'12.5"N	80°37'21.7"E	0.02	0.007	BDL	BDL	BDL	BDL	0.027	27
6	BMT-01 (10m to 11m)	Foliated quartz chlorite hematite rock	21°24'12.5"N	80°37'21.7"E	0.018	0.007	BDL	BDL	BDL	BDL	0.025	25
7	BMT-01 (11m to 12m)	Foliated quartz chlorite hematite rock	21°24'12.5"N	80°37'21.7"E	0.017	0.006	BDL	BDL	BDL	BDL	0.023	23
8	BMT-01 (12m to 13m)	Foliated quartz chlorite hematite rock	21°24'12.5"N	80°37'21.7"E	0.014	BDL	BDL	BDL	BDL	BDL	0.014	14
9	BMT-01 (13m to 14m)	Foliated quartz chlorite hematite rock	21°24'12.5"N	80°37'21.7"E	0.018	BDL	BDL	BDL	BDL	BDL	0.018	18
10	BMT-02 (2m to 3m)	Cumulates of euhedral (octahedral) medium to large sized hematite pseudomorphs with fine grained brown colour matrix in between	21°24'47.5"N	80°37'42.4"E	0.017	BDL	BDL	0.006	BDL	BDL	0.023	23
11	BMT-02 (5m to 6m)	Cumulates of euhedral (octahedral) medium to large sized hematite pseudomorphs with fine grained brown colour matrix in between	21°24'47.5"N	80°37'42.4"E	0.015	BDL	BDL	BDL	BDL	BDL	0.015	15
12	BMT-02 (6m to 7m)	Cumulates of euhedral (octahedral) medium to large sized hematite pseudomorphs with fine grained brown colour matrix in between	21°24'47.5"N	80°37'42.4"E	0.019	0.007	BDL	BDL	BDL	BDL	0.026	26
13	BMT-02 (7m to 8m)	Cumulates of euhedral (octahedral) medium to large sized hematite pseudomorphs with fine grained brown colour matrix in between	21°24'47.5"N	80°37'42.4"E	0.016	0.006	BDL	BDL	BDL	BDL	0.022	22
14	BMT-02(9m to 10m)	Cumulates of euhedral (octahedral) medium to large sized hematite pseudomorphs with fine grained brown colour matrix in between	21°24'47.5"N	80°37'42.4"E	0.015	0.006	BDL	BDL	0.006	BDL	0.027	27

S.N.	Sample Id	Lithology	Latitude	Longitude	Pt	Pd	Ru	Rh	Ir	Os	Total PGE (ppm)	Total PGE (ppb)
15	BMT-02(10m to 11m)	Cumulates of euhedral (octahedral) medium to large sized hematite pseudomorphs with fine grained brown colour matrix in between	21°24'47.5"N	80°37'42.4"E	0.016	BDL	BDL	BDL	BDL	BDL	0.016	16
16	BMT-02 (11m to 12m)	Cumulates of euhedral (octahedral) medium to large sized hematite pseudomorphs with fine grained brown colour matrix in between	21°24'47.5"N	80°37'42.4"E	0.02	BDL	BDL	BDL	BDL	BDL	0.02	20
17	BMT-02 (12m to 13m)	Cumulates of euhedral (octahedral) medium to large sized hematite pseudomorphs with fine grained brown colour matrix in between	21°24'47.5"N	80°37'42.4"E	0.017	0.008	BDL	BDL	BDL	BDL	0.025	25
17	BMT-02 (12m to 13m)	Cumulates of euhedral (octahedral) medium to large sized hematite pseudomorphs with fine grained brown colour matrix in between	21°24'47.5"N	80°37'42.4"E	0.092	BDL	0.035	BDL	BDL	BDL	0.127	127
18	BMT-02 (13m to 14m)	Cumulates of euhedral (octahedral) medium to large sized hematite pseudomorphs with fine grained brown colour matrix in between	21°24'47.5"N	80°37'42.4"E	0.017	BDL	BDL	BDL	BDL	BDL	0.017	17
19	BMT-03 (0m to 1m)	Foliated quartz hematite chlorite rock, metallic lustre	21°25'33.7"N	80°38'29.7"E	0.021	0.008	BDL	BDL	BDL	BDL	0.029	29
20	BMT-03 (1m to 2m)	Foliated quartz hematite chlorite rock, metallic lustre	21°25'33.7"N	80°38'29.7"E	0.019	0.006	BDL	BDL	BDL	BDL	0.025	25
21	BMT-03 (2m to 3m)	Foliated quartz hematite chlorite rock, metallic lustre	21°25'33.7"N	80°38'29.7"E	0.017	BDL	BDL	0.006	BDL	BDL	0.023	23
22	BMT-03 (7m to 8m)	Foliated quartz hematite chlorite rock, metallic lustre	21°25'33.7"N	80°38'29.7"E	0.016	0.011	0.008	0.006	BDL	BDL	0.041	41
23	BMT-03(9m to 10m)	Foliated quartz hematite chlorite rock, metallic lustre	21°25'33.7"N	80°38'29.7"E	0.017	BDL	BDL	0.006	BDL	BDL	0.023	23
24	BMT-03(10m to 11m)	Foliated quartz hematite chlorite rock, metallic lustre	21°25'33.7"N	80°38'29.7"E	0.015	BDL	BDL	BDL	BDL	BDL	0.015	15
25	BMT-03 (11m to 12m)	Foliated quartz hematite chlorite rock, metallic lustre	21°25'33.7"N	80°38'29.7"E	0.017	BDL	BDL	BDL	BDL	BDL	0.017	17
25	BMT-03 (11m to 12m)	Foliated quartz hematite chlorite rock, metallic lustre	21°25'33.7"N	80°38'29.7"E	0.094	BDL	0.028	BDL	BDL	BDL	0.122	122

S.N.	Sample Id	Lithology	Latitude	Longitude	Pt	Pd	Ru	Rh	Ir	Os	Total PGE (ppm)	Total PGE (ppb)
26	BMT-03(12m to 13m)	Foliated quartz hematite chlorite rock, metallic lustre	21°25'33.7"N	80°38'29.7"E	0.017	BDL	BDL	BDL	BDL	BDL	0.017	17
27	BMT-04 (2m to 3m)	Ferruginous sandstone, fine-grained, hard, friable, low metallic content Sandstone	21°25'40.2"N	80°38'38.8"E	0.017	0.011	BDL	BDL	BDL	BDL	0.028	28
28	BMT-04 (3m to 4m)	Ferruginous sandstone, fine-grained, hard, friable, low metallic content Sandstone	21°25'40.2"N	80°38'38.8"E	0.015	BDL	BDL	BDL	BDL	BDL	0.015	15
29	BMT-04(4m to 5m)	Fine grained, massive, hard, showing conchoidal fracture, greyish shiny appearance, quartz hematite chlorite rock	21°25'40.2"N	80°38'38.8"E	0.014	BDL	BDL	BDL	BDL	BDL	0.014	14
30	BMT-04(9m to 10m)	Fine grained, massive, hard, showing conchoidal fracture, greyish shiny appearance, quartz hematite chlorite rock	21°25'40.2"N	80°38'38.8"E	0.014	0.011	BDL	BDL	BDL	BDL	0.025	25
31	BMT-04(10m to 11m)	Fine grained, massive, hard, showing conchoidal fracture, greyish shiny appearance, quartz hematite chlorite rock	21°25'40.2"N	80°38'38.8"E	0.014	0.011	BDL	0.009	BDL	BDL	0.034	34
32	BMT-04 (11m to 12m)	Fine grained, massive, hard, showing conchoidal fracture, greyish shiny appearance, quartz hematite chlorite rock	21°25'40.2"N	80°38'38.8"E	0.014	BDL	0.009	BDL	BDL	BDL	0.023	23
33	BMT-04(12m to 13m)	Fine grained, massive, hard, showing conchoidal fracture, greyish shiny appearance, quartz hematite chlorite rock	21°25'40.2"N	80°38'38.8"E	0.015	0.011	BDL	BDL	BDL	BDL	0.026	26
34	BMT-04(13m to 14m)	Fine grained, massive, hard, showing conchoidal fracture, greyish shiny appearance, quartz hematite chlorite rock	21°25'40.2"N	80°38'38.8"E	0.013	0.011	BDL	BDL	BDL	BDL	0.024	24
35	BMT-04(14m to 15m)	Fine grained, massive, hard, showing conchoidal fracture, greyish shiny appearance, quartz hematite chlorite rock	21°25'40.2"N	80°38'38.8"E	0.012	0.011	BDL	BDL	BDL	BDL	0.023	23
36	BMT-05(3m to 4m)	Foliated quartz hematite chlorite rock	21°26'11.7"N	80°39'19.0"E	0.019	0.007	BDL	BDL	BDL	BDL	0.026	26

S.N.	Sample Id	Lithology	Latitude	Longitude	Pt	Pd	Ru	Rh	Ir	Os	Total PGE (ppm)	Total PGE (ppb)
37	BMT-05(5m to 6m)	Foliated quartz hematite chlorite rock	21°26'11.7"N	80°39'19.0"E	0.023	BDL	BDL	BDL	BDL	BDL	0.023	23
38	BMT-05(10m to 11m)	Foliated quartz hematite chlorite rock	21°26'11.7"N	80°39'19.0"E	0.017	0.011	BDL	BDL	BDL	BDL	0.028	28
38	BMT-05(10m to 11m)	Foliated quartz hematite chlorite rock	21°26'11.7"N	80°39'19.0"E	0.062	0.052	BDL	BDL	BDL	BDL	0.114	114
39	BMT-05 (11m to 12m)	Foliated quartz hematite chlorite rock	21°26'11.7"N	80°39'19.0"E	0.022	0.01	BDL	BDL	BDL	BDL	0.032	32
40	BMT-05(13m to 14m)	Foliated quartz hematite chlorite rock	21°26'11.7"N	80°39'19.0"E	0.02	BDL	BDL	BDL	BDL	BDL	0.02	20
41	BMT-05(14m to 15m)	Foliated quartz hematite chlorite rock	21°26'11.7"N	80°39'19.0"E	0.02	BDL	BDL	BDL	BDL	BDL	0.02	20
42	BMT-06(3m to 4m)	Foliated quartz chlorite hematite rock	21°26'21.2"N	80°39'34.7"E	0.015	BDL	BDL	BDL	BDL	BDL	0.015	15
43	BMT-06 (5m to 6m)	Foliated quartz chlorite hematite rock	21°26'21.2"N	80°39'34.7"E	0.019	BDL	BDL	BDL	BDL	BDL	0.019	19
44	BMT-06(10m to 11m)	Foliated quartz chlorite hematite rock	21°26'21.2"N	80°39'34.7"E	0.02	BDL	BDL	BDL	BDL	BDL	0.02	20
45	BMT-06(10m to 11m)	Foliated quartz chlorite hematite rock	21°26'21.2"N	80°39'34.7"E	0.017	BDL	BDL	BDL	BDL	BDL	0.017	17
46	BMT-06 (11m to 12m)	Foliated quartz chlorite hematite rock	21°26'21.2"N	80°39'34.7"E	0.018	BDL	BDL	BDL	BDL	BDL	0.018	18
46	BMT-06 (11m to 12m)	Foliated quartz chlorite hematite rock	21°26'21.2"N	80°39'34.7"E	BDL	BDL	BDL	BDL	0.02	BDL	0.02	20
47	BMT-06(13m to 14m)	Foliated quartz chlorite hematite rock	21°26'21.2"N	80°39'34.7"E	0.017	BDL	0.007	0.006	BDL	BDL	0.03	30
48	BMT-06(14m to 15m)	Foliated quartz chlorite hematite rock	21°26'21.2"N	80°39'34.7"E	0.016	BDL	BDL	BDL	BDL	BDL	0.016	16
49	BMT-07(1m to 2m)	Cumulates of euhedral (octahedral) medium to large sized hematite pseudomorphs with fine grained brown colour matrix in between	21°26'34.0"N	80°39'51.0"E	0.015	BDL	BDL	0.008	BDL	BDL	0.023	23
50	BMT-07 (2m to 3m)	Cumulates of euhedral (octahedral) medium to large sized hematite pseudomorphs with fine grained brown colour matrix in between	21°26'34.0"N	80°39'51.0"E	0.015	BDL	0.007	BDL	BDL	BDL	0.022	22
51	BMT-07(4m to 5m)	Cumulates of euhedral (octahedral) medium to large sized hematite pseudomorphs with fine grained brown colour matrix in between	21°26'34.0"N	80°39'51.0"E	0.015	BDL	BDL	BDL	BDL	BDL	0.015	15

52	BMT-07 5m to 6m)	Cumulates of euhedral (octahedral) medium to large sized hematite pseudomorphs with fine grained brown colour matrix in between	21°26'34.0"N	80°39'51.0"E	0.017	BDL	BDL	BDL	BDL	BDL	0.017	17
53	BMT-07(6m to 7m)	Cumulates of euhedral (octahedral) medium to large sized hematite pseudomorphs with fine grained brown colour matrix in between	21°26'34.0"N	80°39'51.0"E	0.016	0.011	BDL	BDL	BDL	BDL	0.027	27
54	BMT-07(12m to 13m)	Cumulates of euhedral (octahedral) medium to large sized hematite pseudomorphs with fine grained brown colour matrix in between	21°26'34.0"N	80°39'51.0"E	0.02	0.007	BDL	BDL	BDL	BDL	0.027	27
54	BMT-07(12m to 13m)	Cumulates of euhedral (octahedral) medium to large sized hematite pseudomorphs with fine grained brown colour matrix in between	21°26'34.0"N	80°39'51.0"E	0.095	BDL	0.025	0.014	0.095	BDL	0.229	229
55	BMT-07(13m to 14m)	Cumulates of euhedral (octahedral) medium to large sized hematite pseudomorphs with fine grained brown colour matrix in between	21°26'34.0"N	80°39'51.0"E	0.025	0.009	BDL	BDL	BDL	BDL	0.034	34
56	BMT-08 (2m to 3m)	Foliated quartz hematite chlorite rock	21°26'59.3"N	80°40'30.1"E	0.022	0.006	BDL	BDL	BDL	BDL	0.028	28
57	BMT-08(3m to 4m)	Foliated quartz hematite chlorite rock	21°26'59.3"N	80°40'30.1"E	0.019	0.006	BDL	0.006	BDL	BDL	0.031	31
58	BMT-08(4m to 5m)	Foliated quartz hematite chlorite rock	21°26'59.3"N	80°40'30.1"E	0.021	BDL	BDL	BDL	BDL	BDL	0.021	21
59	BMT-08(5m to 6m)	Foliated quartz hematite chlorite rock	21°26'59.3"N	80°40'30.1"E	0.024	0.006	BDL	0.007	BDL	BDL	0.037	37
60	BMT-08(7m to 8m)	Foliated quartz hematite chlorite rock	21°26'59.3"N	80°40'30.1"E	0.026	BDL	BDL	BDL	BDL	BDL	0.026	26
60	BMT-08(7m to 8m)	Foliated quartz hematite chlorite rock	21°26'59.3"N	80°40'30.1"E	0.081	BDL	BDL	BDL	BDL	BDL	0.081	81
61	BMT-08(9m to 10m)	Foliated quartz hematite chlorite rock	21°26'59.3"N	80°40'30.1"E	0.017	BDL	BDL	0.008	BDL	BDL	0.025	25
62	BMT-08(14m to 15m)	Foliated quartz hematite chlorite rock	21°26'59.3"N	80°40'30.1"E	0.018	0.006	BDL	BDL	BDL	BDL	0.024	24
63	BMT-09 (2m to 3m)	Foliated meta basalt	21°27'31.4"N	80°40'53.1"E	0.006	BDL	0.018	BDL	BDL	BDL	0.024	24
64	BMT-09 (3m to 4m)	Foliated meta basalt	21°27'31.4"N	80°40'53.1"E	0.005	BDL	0.015	0.014	BDL	BDL	0.034	34
65	BMT-09 (4m to 5m)	Foliated meta basalt	21°27'31.4"N	80°40'53.1"E	0.005	BDL	BDL	BDL	BDL	BDL	0.005	5
66	BMT-09 (5m to 6m)	Foliated meta basalt	21°27'31.4"N	80°40'53.1"E	BDL	BDL	BDL	BDL	BDL	BDL	0	0
67	BMT-09 (6m to 7m)	Foliated meta basalt	21°27'31.4"N	80°40'53.1"E	0.007	0.005	0.01	0.014	BDL	BDL	0.036	36

S.N.	Sample Id	Lithology	Latitude	Longitude	Pt	Pd	Ru	Rh	Ir	Os	Total PGE (ppm)	Total PGE (ppb)
68	BMT-09 (7m to 8m)	Foliated meta basalt	21°27'31.4"N	80°40'53.1"E	0.008	BDL	0.01	0.009	BDL	BDL	0.027	27
69	BMT-09 (8m to 9m)	Foliated meta basalt	21°27'31.4"N	80°40'53.1"E	BDL	BDL	BDL	BDL	BDL	BDL	0	0
70	BMT-09 (9m to 10m)	Foliated meta basalt	21°27'31.4"N	80°40'53.1"E	BDL	0.008	BDL	BDL	BDL	BDL	0.008	8
71	BMT-10(4m to 5m)	Foliated quartz chlorite hematite rock, metallic lustre	21°25'52.6"N	80°38'52.2"E	0.017	BDL	BDL	BDL	BDL	BDL	0.017	17
72	BMT-10(5m to 6m)	Foliated quartz chlorite hematite rock, metallic lustre	21°25'52.6"N	80°38'52.2"E	0.015	BDL	BDL	BDL	BDL	BDL	0.015	15
72	BMT-10(5m to 6m)	Foliated quartz chlorite hematite rock, metallic lustre	21°25'52.6"N	80°38'52.2"E	0.078	BDL	BDL	BDL	BDL	BDL	0.078	78
73	BMT-10(6m to 7m)	Foliated quartz chlorite hematite rock, metallic lustre	21°25'52.6"N	80°38'52.2"E	0.015	0.011	BDL	BDL	BDL	BDL	0.026	26
74	BMT-10(7m to 8m)	Fine to medium grained, pinkish coloured with greyish metallic content highly iron rich rock	21°25'52.6"N	80°38'52.2"E	0.016	BDL	BDL	BDL	BDL	BDL	0.016	16
75	BMT-10(9m to 10m)	Fine to medium grained, pinkish coloured with greyish metallic content highly iron rich rock	21°25'52.6"N	80°38'52.2"E	0.015	BDL	BDL	BDL	BDL	BDL	0.015	15
75	BMT-10(9m to 10m)	Fine to medium grained, pinkish coloured with greyish metallic content highly iron rich rock	21°25'52.6"N	80°38'52.2"E	0.023	0.012	BDL	BDL	0.085	BDL	0.12	120
<div> <div></div> Check sample results from Lucid Laboratory, Hyderabad. <div></div> Results from Shiva Analytical, Bengaluru. </div>												

6.11 Geophysical Studies (Source: NAGMP, GSI):

Geological Survey of India had acquired high resolution aero geophysical data through the National aero Geophysical Mapping Programme (NAGMP). So, the gridded data for the SOI toposheet 64C/11 was obtained and the geophysical maps were compared with the results of mapping. They are shown in the **Figures 91-93** below.

Three types of maps were analyzed to decipher the evidences from magnetic data. **Analytical signal map, first vertical derivative map and reduced to pole map (Figure 91-93)**. An analytical signal map, in the context of magnetic surveying, is a visual representation that enhances the visibility of magnetic anomalies and structures within the subsurface. It's created by calculating the amplitude of the analytic signal, which is derived from the gradients of a magnetic anomaly. A first vertical derivative map in magnetic surveys highlights the rate of change of the magnetic field in the vertical direction. This type of map enhances shorter wavelength signals and can be used to identify geological structures, lineaments, and faults. It essentially suppresses long-wavelength features, improving the resolution of closely spaced anomalies. A reduced-to-pole (RTP) map in magnetic surveying transforms observed magnetic anomalies to what they would be if measured at the north magnetic pole. This process helps to visualize the shape and location of magnetic sources more clearly by removing distortions caused by the Earth's magnetic field's inclination and declination.

Anomaly zone having iron can be visualized in black ellipse (**Figure 91-93**). The BRS sample results and trenching sample results corroborates it. The reduced to pole map clearly indicates an elongated zone in Maneri Sitapala block and extending into Bhursadongari Murum block area. The magnetic intensity data is more pronounced along this zone which is the contact zone of Karutola sandstone and Sitagota basalt. The relatively higher magnetic intensity values in upper part of the block area are most probably due to laterized part containing iron. BRS sample results and pit results corroborate it. BRS and pit samples have shown relatively higher content of iron, along with alumina, titanium and vanadium.

The Analytical Signal Map (**Figure 91**) indicates higher magnetic anomaly zones along the contact between the Karutola Sandstone and Sitagota Basalt.

The integrated analysis of the Analytical Signal Map, First Vertical Derivative Map, and Reduced-to-Pole Map reveals significant magnetic anomalies along the contact zone between the Karutola Sandstone and Sitagota Basalt. These anomalies correlate well with BRS and trench sample results, which indicate enrichment of iron. The elongated magnetic zone extending across the Maneri-Sitapala block, particularly its lower and upper part, warrants further investigation through drilling to confirm the presence of iron-rich zones.

Figure 91. The Analytical Signal Map of Aero Magnetic data of the Bhursadongari - Murum Block; The Anomaly zone is located within the black ellipse.

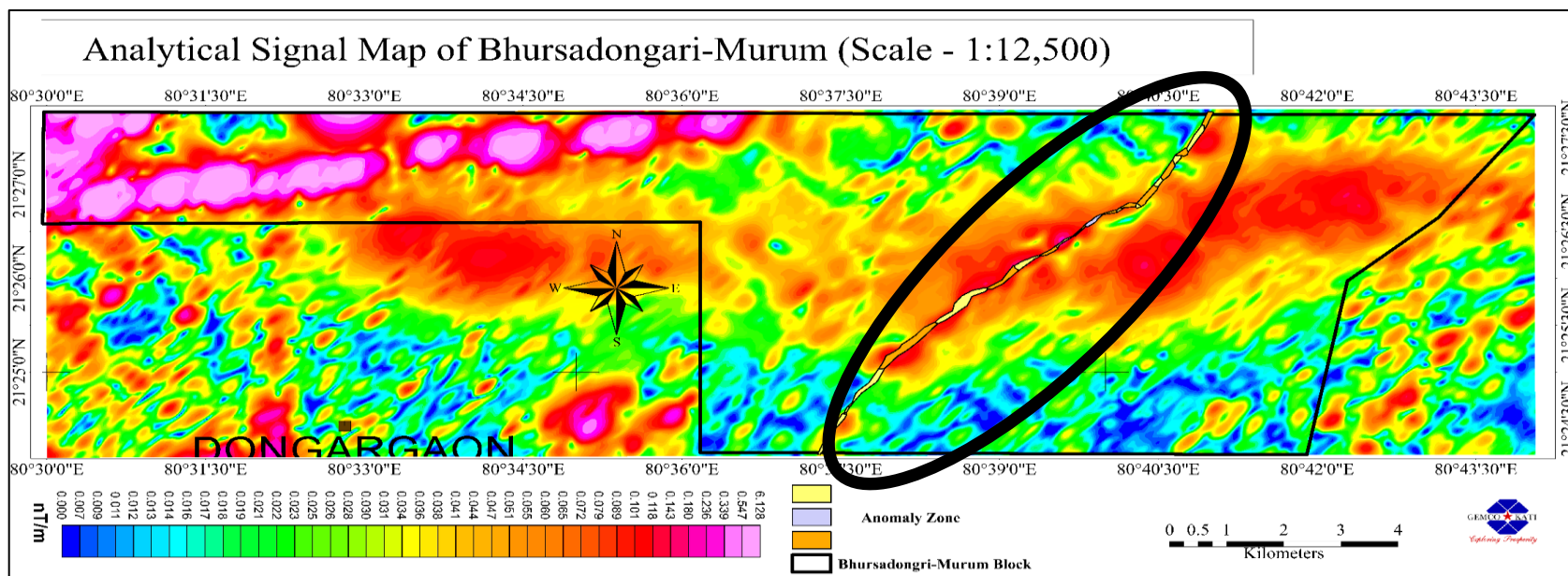


Figure 92. The First Vertical Derivative Map of Aero Magnetic data of the Bhursadongari - Murum Block; The Anomaly zone is located within the black ellipse.

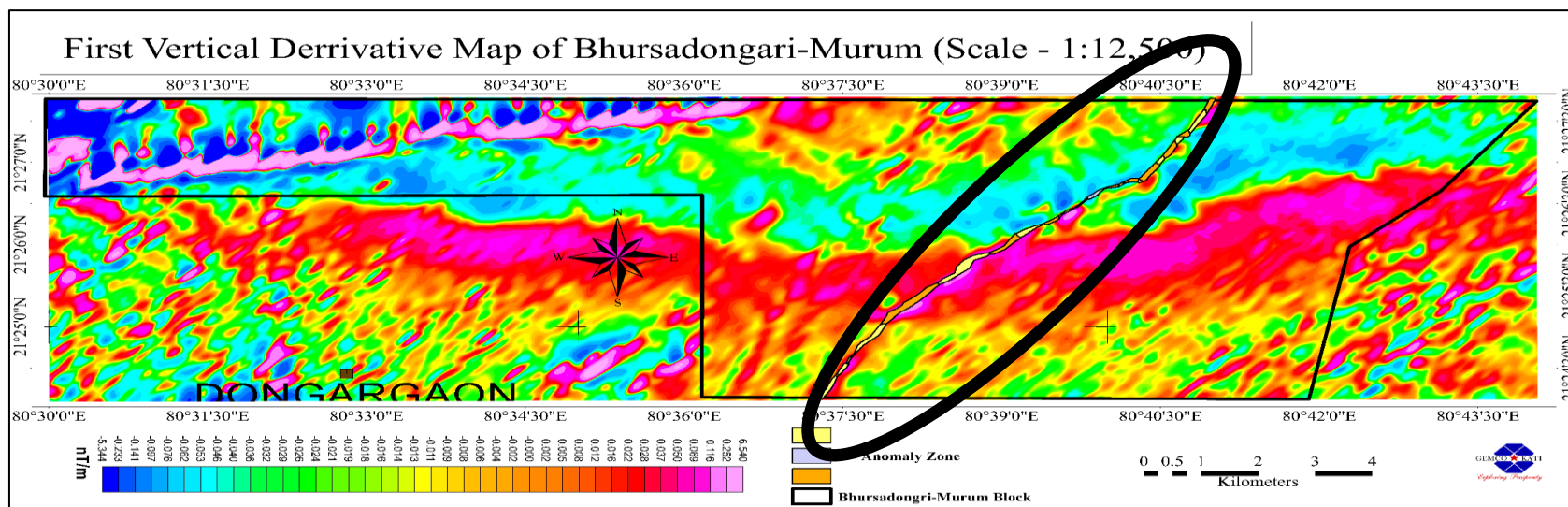
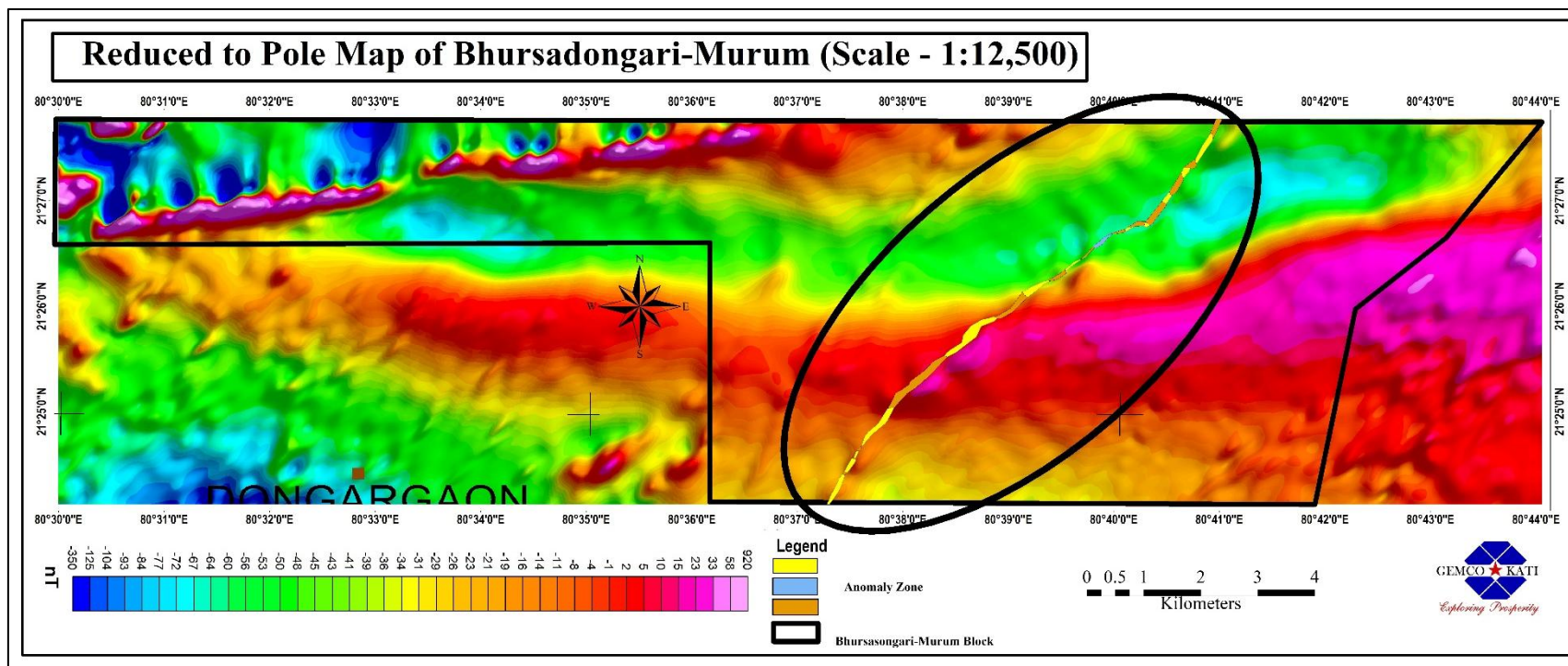


Figure 93. The Reduced to Pole Map of Aero Magnetic data of the Bhursadongari - Murum Block; The Anomaly zone is located within the black ellipse.



6.12 Structure:

Outcrops of Amgaon gneiss, phyllites are poor in the western part of the block. But good outcrops of Bijli rhyolites are exposed in the central parts of the block along linear zones. The general foliation of these rocks trend in an NNE-SSW direction with steep sub-vertical dips. The Khairagarh Group of Volcano-sedimentary suite of rocks which occupy the entire eastern part of the block forms the main focus of this survey.

In the google earth imagery, the disposition of Khairagarh group of rocks is seen as a regional scale synformal structure, with axial plane trending NE – SW. Within the limits of the toposheet, the western arm of the synformal structure extends over a distance of 27km while eastern arm is seen for nearly 17 km. Both the arms extend beyond the toposheet limits. The 50k Bhukosh geological map of Geological Survey of India has interpreted this regional scale of structure as a Syncline; accordingly in the stratigraphic sequence, Bortalao Sandstone marks the beginning and Kotima Basalt marks the end of Khairagarh Volcanic Group.

But during mapping it was observed that a regional scale deformational structure like this has not resulted in even a rudimentary pervasive foliation. Both basalt and sandstone are massive and structure-less. Even the vesicles, and amygdaloids and their distribution are seemingly un-affected and retain their original shapes. No stretching or flattening is observed in those structures.

These observations raise questions on the interpretation of the synformal structure as a synclinal fold. It may be possible that the original configuration of the basin itself was like that in which the Khairagarh volcanic and clastic rocks got emplaced and deposited.

6.13 Metamorphism:

Regionally, as per the available reports, Amgaon Gneiss, phyllite and mafic enclaves and the Nandgaon Volcanic show amphibolite facies metamorphism. In contrast, the Khairagarh Group basalts and sandstones appear to be unmetamorphosed. But as would be shown later, under thin sections, a very low-grade metamorphism is observed with development of actinolite and chlorite in the basalts; while the sandstones also appear to have undergone the influence of metamorphism, especially along the contact zone of the Karutola sandstone and Sitagota basalt.

CHAPTER-7

MINERAL PROSPECT

7.1 Surface indication:

The anomalous or hybrid zone at the contact between Sitagota basalt and Karutola sandstone yield anomalous values for platinum group minerals. Samples were also analyzed for gold but didn't yield any gold. However, the lateritic crust developed on Sitagota basalt yielded relatively encouraging values of titanium and vanadium within the lateritic bauxite.

Titanium-vanadium enriched lateritic deposits exhibit distinct surface indications that reflect their formation through prolonged weathering of phyllite and basaltic rocks. One of the key indicators is the presence of iron-rich lateritic crusts with reddish-brown, yellowish, or dark grey coloration, depending on the oxidation state of iron and titanium minerals. These lateritic profiles are typically found as cap rocks or plateaus in block areas. In the western part of the block, laterite has developed over the Amgaon Phyllites. In the eastern part, it caps Sitagota Basalt & Kotima Basalt.

Platinum group of elements

On the western slopes of Karutola sandstone ridges, a NE-SW [9 km in length x 50m in width] geologically anomalous zone of rock containing euhedral hematite crystals is seen. Unambiguous outcrops are rare because of relatively steep slope; and thick vegetation cover makes finding such occurrences even more difficult. The above along the contact zone of Karutola sandstone and Sitagota basalt.

The rock exposed mesocratic to melanocratic in appearance; it has thin venations of quartz. The characteristic feature of this zone is ubiquitous presence of perfectly euhedral double octahedral crystals of Hematite. Initially they were thought of as magnetite – but the crystals were weakly magnetic and yielded cherry red coloured streak. Since at places, magnetic nature of the crystals was noticeable, it was concluded in the field that these may represent Hematite pseudomorphs of Magnetite precursor crystals

The samples were collected as bedrock samples (BRS) and channel samples of 1m length each from trenches at various locations all along the contact zone of Sitagota basalt and Karutola sandstone to characterize the zone in more detail in context of PGE mineralization. List of the samples & PGE values are in table-7 & table-11. The primary focus was on analyzing the distribution of platinum (Pt), palladium (Pd), ruthenium (Ru), rhodium (Rh), iridium (Ir), and osmium (Os) to assess the PGM potential in the sampled area of the block. The total PGE content varies significantly across different samples of same lithotype, indicating spatial heterogeneity in PGM concentration.

About 38 bed rock samples & 75 trench samples from the anomalous zone were analysed for PGE by NiS fire assay. Six BRSs out of 38 yielded total PGE above 50ppb ranging 308 to 60ppb rest yielded below 50 ppb total PGE. Whereas all the trench samples yielded total PGE below 50ppb.

Iron (Fe) and ferric oxide (Fe_2O_3) are major components, particularly high in BMT-07 (51.58% Fe, 73.75% Fe_2O_3) and BMT-10 (47.35% Fe, 67.70% Fe_2O_3), indicating a strong presence of iron oxides like hematite or magnetite and pointing toward potential iron enrichment.

Silicon dioxide (SiO_2) shows high variability, peaking in BMT-05 (47.31%) and BMT-03 (44.69%), indicating quartz-rich or silicate-dominated zones, while lower values in BMT-07 and BMT-10 reflect silica depletion in iron-rich environments.

Titanium dioxide (TiO_2) ranges from 0.36% to 1.59%, with the highest value in BMT-09, likely due to the presence of ilmenite or other titanium-bearing minerals. Vanadium pentoxide (V_2O_5) is mostly undetectable, except in trace amounts in BMT-04, BMT-08, and BMT-09, indicating minimal vanadium content.



Figure 94. Sample ID: 240124-05, yielding total PGE 308ppb.

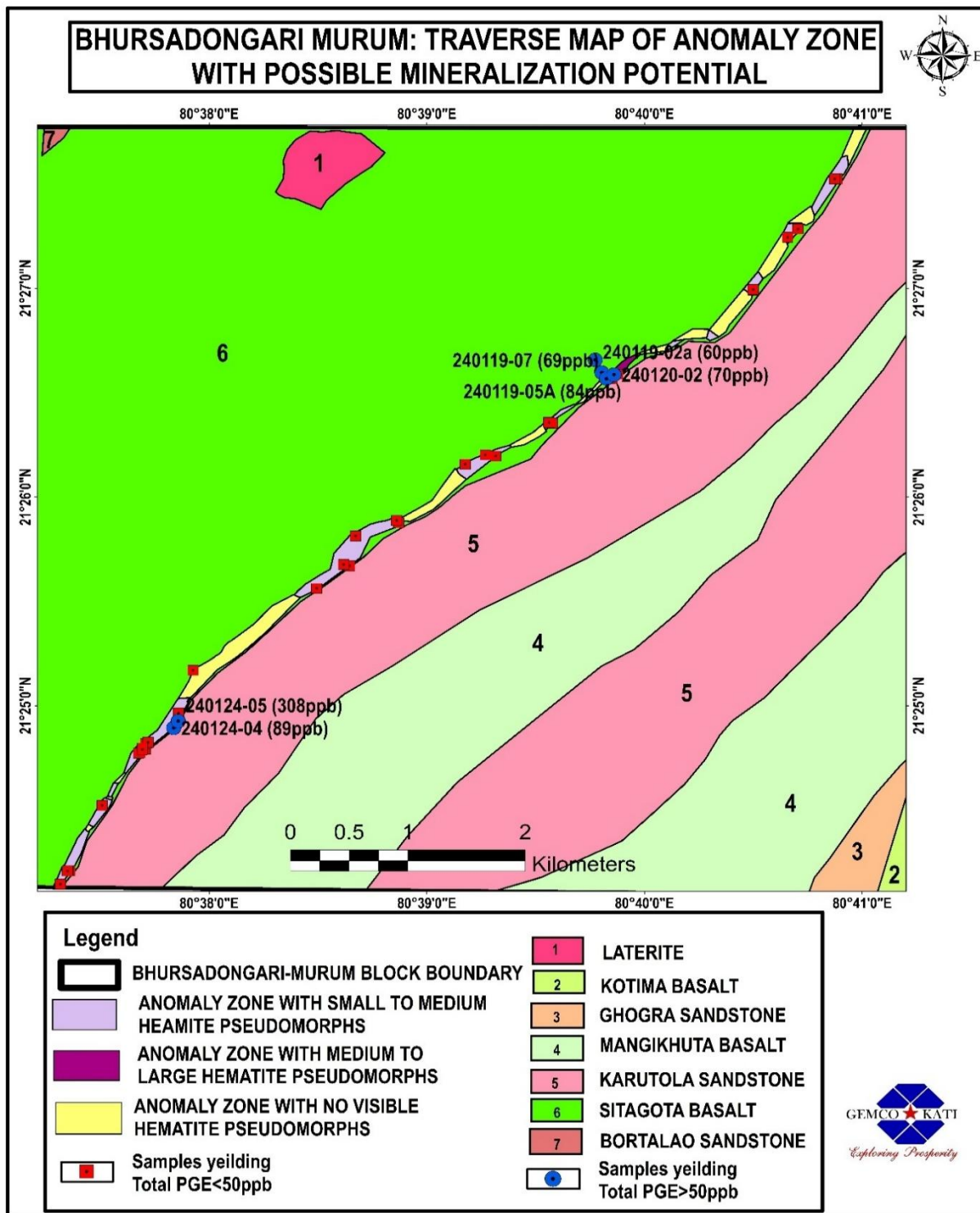


Figure 95. Traverse map of anomaly zone of Bhursadongari-Murum block.



Figure 96. Sample ID: 240124-04, yielding total PGE 89ppb.



Figure 97. Sample ID: 240119-07, yielding total PGE 69ppb.

Gold

Based on positive results of gold analysis of samples from anomalous zone in adjacent Maneri-Sitapala block, multiple samples from this zone in the block area were also analysed for gold. The gold (Au) analysis was conducted using the standard operating procedure SOP/OM/058, with a limit of quantification (LOQ) of 0.01 ppm (mg/kg). The results indicate that all analysed samples contain gold concentrations below the detection limit of 0.01 ppm.

All 10 samples show gold content as "<0.01 ppm" (parts per million), which means the gold content is below the detectable limit of 0.01 ppm (**Table 12**). These results indicate that none of the ten analysed samples contain gold concentrations of geochemical significance (above 0.01 ppm).

Table 12. Gold analysis Fire Assay.

S.N.	Sample ID	Nature of samples	Latitude	Longitude	Au
1	21-11-24-06	BRS collected from the contact zone of Karutola sandstone and Sitagota Basalt	21° 24' 12.70"	80° 37' 20.90"	<0.01
2	21-11-24-08		21° 24' 11.00"	80° 37' 23.10"	<0.01
3	BMT-05(4m to 5m)	Trench samples along the contact zone of Karutola sandstone and Sitagota Basalt	21°26'11.7"N	80°39'19.0"E	<0.01
4	BMT-05(12m to 13m)		21°26'11.7"N	80°39'19.0"E	<0.01
5	BMT-06(12m to 13m)		21°26'21.2"N	80°39'34.7"E	<0.01
6	BMT-07(3m to 4m)		21°26'34.0"N	80°39'51.0"E	<0.01
7	BMT-08(6m to 7m)		21°26'59.3"N	80°40'30.1"E	<0.01
8	BMT-10(3m to 4m)		21°25'52.6"N	80°38'52.2"E	<0.01
9	BMT-10(10m to 11m)		21°25'52.6"N	80°38'52.2"E	<0.01
10	BMT-10(11m to 12m)		21°25'52.6"N	80°38'52.2"E	<0.01

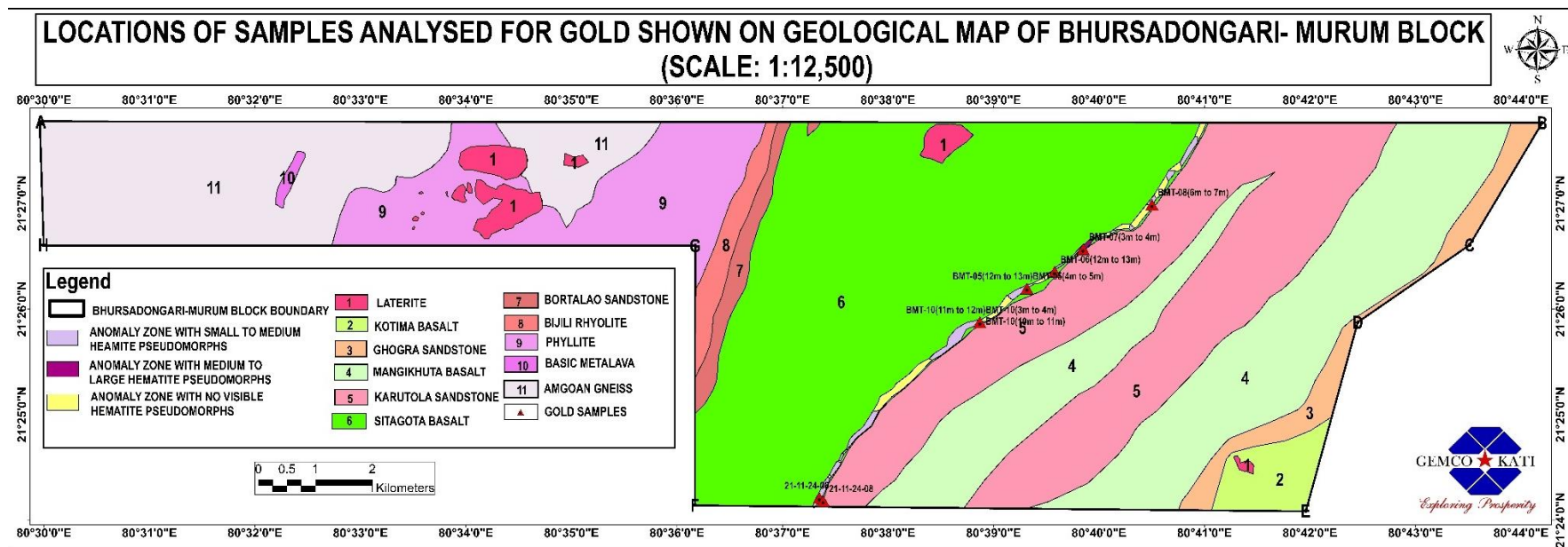


Figure 98. Location of samples analyzed for gold.

Rare Earth Elements (REE)

The analysis of the block area data as shown in below **Figure 99** and **Table 13** indicates that Rare Earth Elements (REE) are present in varying concentrations, but not in significantly high amounts. REEs, including the lanthanides, scandium (Sc), and yttrium (Y), are essential for modern technologies, yet their economic viability depends on their concentration and extractability.

In the given samples, Light Rare Earth Elements (LREEs) such as lanthanum (La), cerium (Ce), praseodymium (Pr), and neodymium (Nd) are more abundant compared to Heavy Rare Earth Elements (HREEs). The trench sample BMT-01 (3m–4m) shows low to moderate REE concentrations, with La at 8.83 ppm and Ce at 19.55 ppm. Heavy REEs such as Tb, Ho, Tm, Yb, and Lu are mostly below detection limits. The deeper interval BMT-01 (14m–15m) reflects a decline in REE values, particularly La (5.34 ppm) and Ce (11.41 ppm), with multiple HREEs still undetected, indicating minimal REE enrichment in this trench.

BMT-02 (0m–1m) is notably enriched in REEs, especially light REEs such as La (26.50 ppm), Ce (42.93 ppm), and Nd (24.33 ppm), and it also contains high Y (15.51 ppm) and Sc (59.62 ppm), suggesting strong mineralization. The following meter (1m–2m) in BMT-02 shows a significant drop in REE values, with La at 8.88 ppm and Ce at 18.74 ppm, suggesting localized enrichment near the surface.

BMT-03 samples show moderate REE values. The 3m–4m interval has La at 5.35 ppm and Nd at 6.65 ppm, while the 6m–7m interval displays a slight increase in La (7.04 ppm) and Nd (8.23 ppm). Both depths show HREEs mostly below detection, with moderate Sc and Y values, indicating limited REE enrichment.

BMT-04 samples exhibit low to moderate REE levels. The 6m–7m interval contains La at 11.55 ppm and Ce at 15.07 ppm, though most heavy REEs are below detection. In the 7m–8m interval, Ce and Nd slightly increase to 10.55 ppm and 9.51 ppm, respectively, suggesting some REE presence but without strong enrichment.

BMT-05 shows consistent and relatively high REE content in both 1m–2m and 2m–3m intervals. La and Ce values are above 14 and 29 ppm respectively in both samples, while Nd exceeds 16 ppm. Gd, Dy, and Y values are elevated, with Y reaching over 21 ppm, indicating a REE-enriched horizon.

BMT-06 reflects strong REE signatures at both sampled depths. The 6m–7m interval shows La at 11.00 ppm and Nd at 13.34 ppm. The 9m–10m interval is more enriched, with La at 16.54 ppm, Ce at 32.24 ppm, and Nd at 18.31 ppm, along with notable Y and Sc levels.

BMT-07 is distinguished by very high REE content, particularly in the 7m–8m interval, where Sm (12.12 ppm), Gd (24.18 ppm), and Dy (20.99 ppm) are the highest among all samples. Yttrium is extremely

elevated at 60.23 ppm, indicating exceptional REE enrichment. The deeper interval (11m–12m) remains enriched, especially in Nd (28.47 ppm), though overall values are slightly reduced compared to the upper sample.

BMT-08 (10m–11m) shows moderate to strong REE presence with La at 13.65 ppm, Nd at 16.63 ppm, and Y at 16.33 ppm. The 12m–13m interval is notably enriched, with La at 29.06 ppm and Nd at 31.97 ppm. Though HREEs remain relatively modest, this interval is one of the most REE-rich in the dataset.

BMT-09 presents variable REE content. The 12m–13m sample is relatively low in REEs, with La at 7.20 ppm and Nd at 9.31 ppm. However, the 13m–14m interval shows higher values, with La at 14.62 ppm and Nd at 18.81 ppm, indicating increasing REE concentration with depth.

BMT-10 (2m–3m) is highly enriched in REEs, with La at 26.89 ppm, Nd at 27.94 ppm, and elevated MREEs and HREEs such as Dy (5.18 ppm) and Ho (1.18 ppm). Yttrium is also high at 28.34 ppm, suggesting significant REE mineralization. In contrast, the deeper 14m–15m sample has low REE values, with La at 11.75 ppm and Nd at 8.65 ppm, and most HREEs below detection, indicating a sharp decline in REE content with depth.

Overall, the block area data does not indicate substantial REE enrichment that would justify commercial value. The findings suggest that while REEs are present in the region, they do not occur in economically significant amounts.

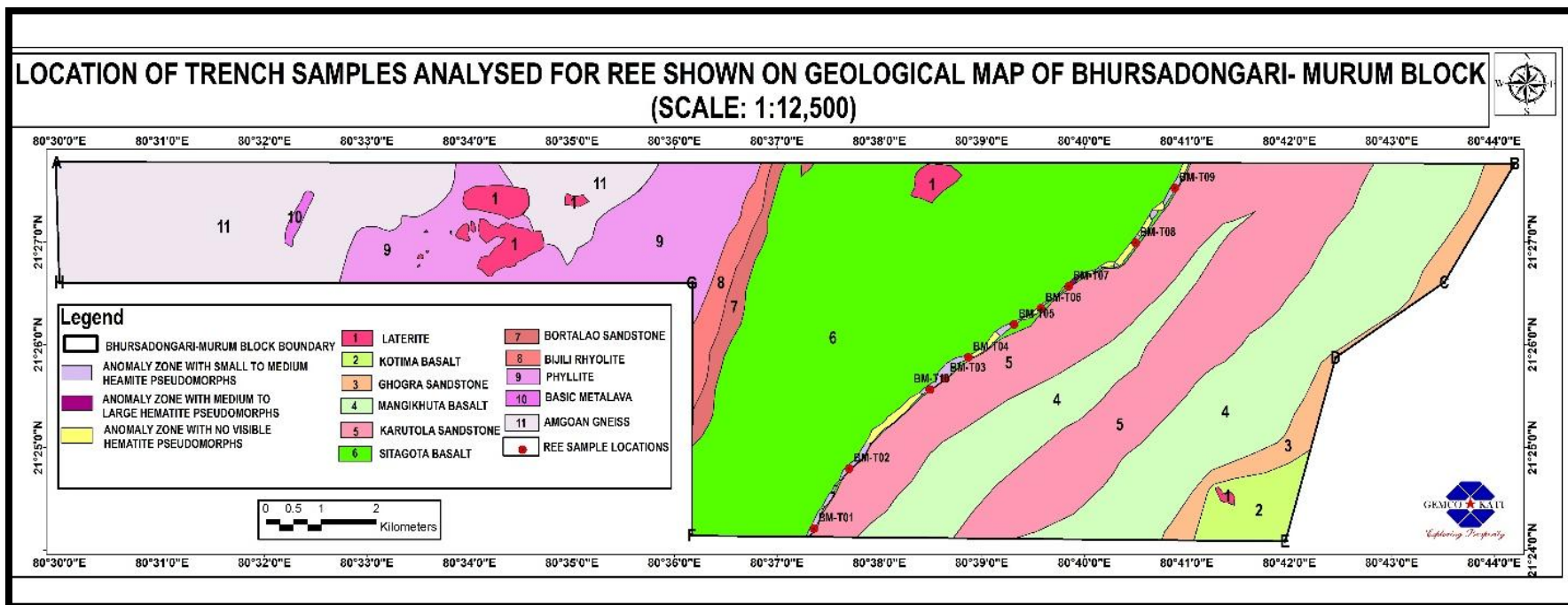


Figure 99. Location map of trench samples analyzed for Rare Earth Elements (REE).

Table 13. Rare earth elements analysis results of trench samples.

S.N.	Sample Id	Lithology	Latitude	Longitude	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Sc	Y
1	BMT-01 (3m to 4m)	Foliated quartz chlorite hematite rock	21°24'12.5"N	80°37'21.7"E	8.83	19.55	2.65	12.21	2.9	0.58	2.73	<0.5	1.68	<0.5	1.02	<0.5	1.38	<0.5	27.05	8.25
2	BMT-01 (14m to 15m)	Foliated quartz chlorite hematite rock	21°24'12.5"N	80°37'21.7"E	5.34	11.41	1.54	7.07	1.73	0.52	1.71	<0.5	1.14	<0.5	0.73	<0.5	1	<0.5	22.96	5.13
3	BMT-02 (0m to 1m)	Cumulates of euhedral (octahedral) medium to large sized hematite pseudomorphs with fine grained brown colour matrix in between	21°24'47.5"N	80°37'42.4"E	26.5	42.93	6.1	24.33	5.18	1.27	4.87	0.7	3.88	0.76	2.29	<0.5	2.47	<0.5	59.62	15.51
4	BMT-02 (1m to 2m)	Cumulates of euhedral (octahedral) medium to large sized hematite pseudomorphs with fine grained brown colour matrix in between	21°24'47.5"N	80°37'42.4"E	8.88	18.74	2.19	9.59	1.85	0.57	1.94	<0.5	1.65	<0.5	1.13	<0.5	1.5	<0.5	38.51	7.52
5	BMT-03 (3m to 4m)	Foliated quartz hematite chlorite rock, metallic lustre	21°25'33.7"N	80°38'29.7"E	5.35	9.55	1.46	6.65	1.87	0.52	1.8	<0.5	1.57	<0.5	1.27	<0.5	1.49	<0.5	29.76	9.65
6	BMT-03 (6m to 7m)	Foliated quartz hematite chlorite rock, metallic lustre	21°25'33.7"N	80°38'29.7"E	7.04	10.7	1.89	8.23	2.11	0.64	1.93	<0.5	1.23	<0.5	0.83	<0.5	0.98	<0.5	22.57	6.31
7	BMT-04 (6m to 7m)	Fine grained, massive, hard, showing conchoidal fracture, greyish shiny appearance, quartz hematite chlorite rock	21°25'40.2"N	80°38'38.8"E	11.55	15.07	2.43	9.11	1.74	<0.5	1.53	<0.5	1.02	<0.5	0.54	<0.5	<0.5	<0.5	10.91	3.66
8	BMT-04 (7m to 8m)	Fine grained, massive, hard, showing conchoidal fracture, greyish shiny appearance,	21°25'40.2"N	80°38'38.8"E	10.18	10.55	2.13	9.51	2.22	0.6	2.09	<0.5	1.45	<0.5	0.76	<0.5	0.8	<0.5	9.87	5.39

S.N.	Sample Id	Lithology	Latitude	Longitude	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Sc	Y
		quartz hematite chlorite rock																		
9	BMT-05 (1m to 2m)	Foliated quartz hematite chlorite rock	21°26'11.7"N	80°39'19.0"E	14.43	29.59	3.96	16.82	4.21	1.16	4.79	0.66	3.87	0.87	2.75	<0.5	3.17	0.53	31.61	20.41
10	BMT-05 (2m to 3m)	Foliated quartz hematite chlorite rock	21°26'11.7"N	80°39'19.0"E	14.37	30.07	3.86	17.28	4.18	1.11	4.85	0.7	4.12	0.92	2.82	<0.5	3.3	0.54	34.75	21.3
11	BMT-06 (6m to 7m)	Foliated quartz chlorite hematite rock	21°26'21.2"N	80°39'34.7"E	11	21.75	3.01	13.34	3.29	0.97	3.34	<0.5	2.81	0.62	1.96	<0.5	2.45	<0.5	32.85	14.55
12	BMT-06 (9m to 10m)	Foliated quartz chlorite hematite rock	21°26'21.2"N	80°39'34.7"E	16.54	32.24	4.23	18.31	4.41	1.37	4.55	0.64	3.54	0.73	2.36	<0.5	2.97	<0.5	31.2	17.06
13	BMT-07 (7m to 8m)	Cumulates of euhehedral (octahedral) medium to large sized hematite pseudomorphs with fine grained brown colour matrix in between	21°26'34.0"N	80°39'51.0"E	15.89	33.24	5.45	29.92	12.12	4.25	24.18	4.01	20.99	3.22	6.72	0.73	3.85	0.51	40.09	60.23
14	BMT-07 (11m to 12m)	Cumulates of euhehedral (octahedral) medium to large sized hematite pseudomorphs with fine grained brown colour matrix in between	21°26'34.0"N	80°39'51.0"E	12.97	32.51	5.31	28.47	9.16	1.38	7.12	0.82	3.9	0.74	2.1	<0.5	1.92	<0.5	53.14	14.21
15	BMT-08 (10m to 11m)	Foliated quartz hematite chlorite rock	21°26'59.3"N	80°40'30.1"E	13.65	26.58	3.76	16.63	4.09	1.27	4.19	0.6	3.6	0.75	2.22	<0.5	2.52	<0.5	28.3	16.33
16	BMT-08 (12m to 13m)	Foliated quartz hematite chlorite rock	21°26'59.3"N	80°40'30.1"E	29.06	44.81	7.42	31.97	7.03	2.05	6.15	0.68	3.42	0.57	1.77	<0.5	1.87	<0.5	19.33	12.47
17	BMT-09 (12m to 13m)	Foliated meta basalt	21°27'31.4"N	80°40'53.1"E	7.2	16.77	2.16	9.31	2.51	0.64	2.55	<0.5	2.02	<0.5	1.47	<0.5	1.48	<0.5	31.33	10.35
18	BMT-09 (13m to 14m)	Foliated meta basalt	21°27'31.4"N	80°40'53.1"E	14.62	18.17	4.4	18.81	4.71	1.46	5.73	0.7	3.94	0.68	2.02	<0.5	1.68	<0.5	28.83	17.33



S.N.	Sample Id	Lithology	Latitude	Longitude	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Sc	Y
19	BMT-10 (2m to 3m)	Foliated quartz chlorite hematite rock, metallic lustre	21°25'52.6"N	80°38'52.2"E	26.89	32.91	6.38	27.94	6.28	1.94	6.36	0.9	5.18	1.18	3.47	0.55	3.68	0.59	33.26	28.34
20	BMT-10 (14m to 15m)	Foliated quartz chlorite hematite rock, metallic lustre	21°25'52.6"N	80°38'52.2"E	11.75	11.75	2.3	8.65	1.67	<0.5	1.66	<0.5	1.02	<0.5	0.56	<0.5	0.59	<0.5	6.77	4.05

Titanium and vanadium bearing laterites

The lateritic crust developed on Kotima basalt, Sitagota basalt and Amgaon phyllite yielded relatively encouraging values of titanium and vanadium.

In the eastern part, it caps the Kotima Basalt, the youngest volcanic sequence of the Khairagarh Group & also Sitagota basalt (Figure 5). In the western part of the block, laterite has developed over the Amgaon Phyllites. Lateritic titanium-vanadium deposits exhibit distinct surface indications that reflect their formation through prolonged weathering of phyllite and basaltic rocks. One of the key indicators is the presence of iron-rich lateritic crusts with reddish-brown, yellowish, or dark grey coloration, depending on the oxidation state of iron and titanium minerals. These lateritic profiles are typically found as caprocks or plateaus in block areas. Major oxide concentration of BRSs collected from laterites are included in **Table-6** & that of pit samples are in **Table-9**.

The alumina (Al_2O_3) content in the samples shows considerable variation. The Al_2O_3 values of laterite developed over Kotima basalt range of 12.49% to 16.05%. Similarly, Fe_2O_3 (57.64 to 62.26%), TiO_2 (2.96 to 3.35%), V_2O_5 (0.11 to 0.22%). Cumulative mapped area of laterite capping over Kotima basalt is about 6 hectares.



Figure 100. Laterite developed over Kotima basalt.



Figure 101. Laterite developed over Kotima basalt.

Range of concentration major oxide in laterite developed over Sitagota basalt is as follows, Al_2O_3 26.54 to 38.32%, Fe_2O_3 28.01 to 47.13%, TiO_2 4.10 to 8.06%, V_2O_5 0.11 to 0.24%. Cumulative mapped area of laterite capping over Sitagota basalt is about 40 hectares.



Figure 102. Laterite developed over Sitagota basalt.

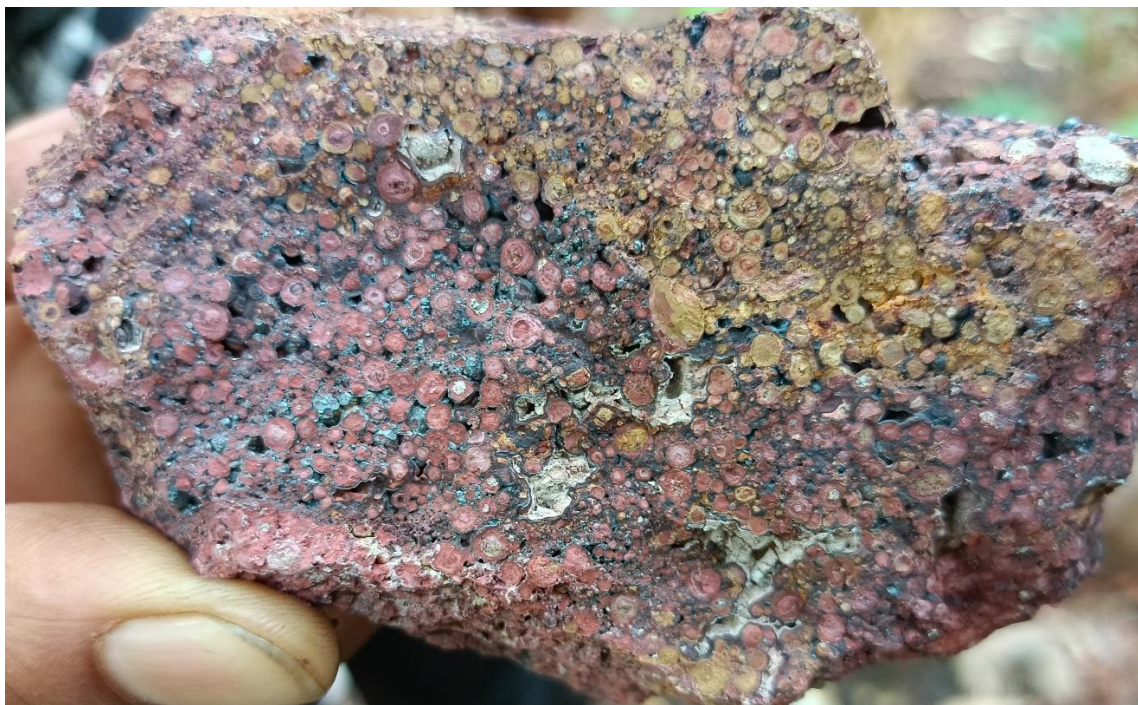


Figure 103. Laterite developed over Sitagota basalt.

Range of concentration major oxide in laterite developed over Phyllite is Al_2O_3 (9.87 to 23.66%), Fe_2O_3 (36.85 to 60.01%), TiO_2 (0.09 to 1.39%), V_2O_5 (upto 0.18%). Cumulative mapped area of laterite capping over phyllite is about 130 hectares.



Figure 104. Laterite developed over Phyllite.



Figure 105. Laterite developed over Phyllite.

Most of the samples fall in the range of 20%, suggesting aluminous laterite nature of the pit samples. However, a few significantly higher values, particularly those above 29%, point to zones of strong alumina enrichment. These elevated concentrations indicate towards bauxite-rich pockets which is indicative of a fairly alumina-rich zone, suitable for further exploration.

The iron (Fe) content in the samples varies from a low of 27.33% to a high of 43.54%. The overall distribution shows that most of the values lie in the range of 33% to 41%, indicating a consistently moderate to high-grade iron presence across the samples. The average iron content appears to be around 35.29%.

The titanium dioxide (TiO_2) content in the samples shows a clear distinction between a few high-concentration values and a majority of lower ones in the pit samples. The TiO_2 values range from 0.63% to 4.72%. However, three pit samples show significantly higher concentrations, above 2.9%, with one reaching nearly 4.72%, indicating potential zones of Ti-rich mineralization.

The vanadium pentoxide (V_2O_5) content in the samples shows a narrow and fairly consistent range. The values span from <0.05% to 0.20%, with most values clustering between 0.10% and 0.14%. This consistency suggests uniformly distributed vanadium presence in the lateritic section.

The V_2O_5 values observed in the aluminous laterites of the Bhursadongari–Murum Block (from 10 pits, 7 pits yielded vanadium values in the range of 0.10% to 0.20%) are comparable to grades in other region's Geological Survey of India-led G3 stage projects:

1. Arunachal Pradesh (Depo area, Papum Pare District) for Graphite and Vanadium (Field season program: 2018-2019):

- ❖ At 0.05% V_2O_5 cut-off, 0.388805 MT with 0.188% grade.
- ❖ At 0.1% cut-off, 0.300012 MT with 0.228% grade.

These values led to G3 resource estimation and auctioned. M/s Vedanta Limited was the preferred bidder.

2. Madhya Pradesh (Khapripani Block, Dindori District) for Bauxite and Aluminous Laterites (Field season program: 2021-2022):

- ❖ 68.8461 MT at 0.05% V_2O_5 cut-off and
- ❖ 35.4617 MT at 0.10% cut-off from aluminous laterite zones.

Above examples substantiate that vanadium values from 0.10%–0.20%, from pitting upto 1 meter depth, hold commercial significance, especially in surficial lateritic contexts containing, titanium, aluminium and iron.

7.2 Mode of occurrence:

Lateritic titanium-vanadium deposits occur as residual concentrations formed due to the intense weathering of basalt and phyllites. These deposits develop in tropical and subtropical climates where prolonged chemical weathering leads to the leaching of silica and enrichment of minerals like aluminium, titanium and vanadium. The deposits typically occur as lateritic caps, plateaus, and extensive soil profiles overlying the weathered phyllitic and basaltic bedrock.

Structurally, they are often found as horizontally capping or layers with varying thicknesses, depending on the degree of weathering and topographic control. These deposits are near-surface and amenable to open-pit mining, making them an important source of titanium and vanadium, along with iron and alumina.

7.3 Alteration zones:

In the block area, the alteration zone is characterized by intense chemical weathering processes that modify the original mineral composition of rocks. Rocks, such as basalt and phyllites altered geochemically, leading to the formation of secondary minerals like kaolinite, goethite, limonite and hematite. Silica leaching and iron & aluminium enrichment are common, resulting in the development of ferruginous and aluminous

lateritic profiles. This zone played a crucial role in the concentration of valuable elements, including titanium and vanadium, particularly in lateritic weathering profiles.

7.4 Genesis of mineralization:

Titanium, vanadium bearing aluminous laterites

In the block area, lateritic titanium-vanadium occurrences form primarily through the intense chemical weathering of rocks, such as basalt and phyllites under tropical to subtropical climatic conditions. Continuous leaching of silica and mobile elements results in the residual enrichment of immobile elements (titanium and vanadium). The development of these occurrences in the block area are also influenced by topography with enrichment taking place on plateau surfaces, ridges, and weathered slopes.

Iron rich zone at the contact of Karutola sandstone and Sitagota basalt

Along and near the contact zone of Sitagota basalt & Karutola sandstone, martite/hematite formed through hydrothermal alteration. The high temperature from the basaltic lava flow affected the adjacent Karutola sandstone, causing thermal metamorphism. The basaltic magma released fluids, rich in oxygen, water, and carbon dioxide, which infiltrated the sandstone and reacted with iron-bearing minerals. Martite is a variety of the iron oxide mineral hematite (Fe_2O_3). It forms when magnetite (Fe_3O_4) and another iron oxides, undergo oxidation. The resulting hematite crystals often retain the shape and structure of the original magnetite crystals, characterized by its pseudomorphic appearance. Martite typically exhibits the same physical properties as hematite, including its reddish-brown colour and hardness. However, it's often found in an octahedral shape that is identical with the original magnetite crystals. In the identified anomalous zone, within our block area hematite occurs as disseminated grains as well as in the form of cumulates along and near the contact zone between the Karutola sandstone and Sitagota basalt. This process probably increased the iron & PGE content along the contact zone between the Karutola sandstone and Sitagota basalt, turning it into a potential mineralization zone along the contact between the Sitagota basalt and Karutola sandstone. The martite-rich zone became an iron ore deposit along the contact zone areas of the Karutola sandstone and Sitagota basalt, where the geochemical alteration was intense and widespread.

CHAPTER-8 RESOURCE ESTIMATION

8.1 Detailed description of ore zones:

PGE mineralization is present along the narrow contact zone of the Karutola sandstone and Sitagota basalt trending from NE-SW direction. The mineralized iron ore zone extends for a strike length of about 9km having varying grade, with an average width of 50 meters based on trench data.

8.2 Resource estimation, category of resources as per MEMC, 2015 along with UNFC classification:

Geochemical analysis of lateritic material from three distinct lithological settings has revealed significant enrichment in economically important elements:

The alumina (Al_2O_3) content in the samples shows considerable variation. The values range from a minimum of 12.49% to a maximum of 38.32%.

As per Ministry of Mines Notification dated 25th April 2018 the threshold value of Bauxite mineral has been classified in following two categories: -

(1) For Aluminous laterite: Al_2O_3 - 20% (Min.)

(2) For Bauxite: Al_2O_3 - 30% (Min.) and SiO_2 (Total) -7% (Max.).

Most of the samples fall in the range of 20%, suggesting aluminous laterite nature of the pit samples. However, laterite developed over the Sitagota basalt have Al_2O_3 27 to 38%, with four out of seven samples have Al_2O_3 above 30% point to zones of strong alumina enrichment as shown in the table below. These elevated concentrations indicate towards bauxite-grade pockets suitable for further exploration.

Analysis results of samples of laterite developed over the Sitagota basalt									
S.N	SAMPLE ID	Fe ₂ O ₃ (%)	Al ₂ O ₃ (%)	TiO ₂ (%)	V ₂ O ₅ (%)	Sc (ppm)	Ga (ppm)	Nb (ppm)	Area
1	240606-R09	34.70	31.05	4.10	0.11	~	~	~	TOTAL AREA OF LATERITE IS APPROXIMATELY 40 HECTARES
2	240607-01	28.01	38.32	6.20	0.21	~	~	~	
3	240607-30	47.25	27.89	6.17	0.24	~	~	~	
4	240608-23	39.24	31.25	6.63	0.20	39.91	81.52	48	
5	240608-R12	47.13	26.54	4.54	0.20	~	~	~	
6	BM-PIT-2/X	41.93	29.23	3.73	0.20				
7	BM-PIT-3/X	39.08	31.14	4.72	0.14				

Tentative resources can be calculated based on the assumptions as specified below.

Assumption-1: Total area of laterite capping over the Sitagota basalt is 40 Hectares.

Assumption-2: Average concentration of Al_2O_3 is 30% & that of V_2O_5 , TiO_2 , Sc, Ga, Nb is 0.20% ,5%, 40ppm, 80ppm & 48 ppm respectively.

Assumption-3: Density of laterite is 2500kg/m³.

The table below shows the resources calculated based on the above assumptions at various depths of laterite assuming the same concentrations even at depths.

Sl.No.	Depth (in meters)	Area (in m ²)	Density (in Kg/m ³)	Bauxite (in million tonne)	Al_2O_3 (in million tonnes at 30%)	V_2O_5 (in tonne at 0.20%)	TiO_2 (in tonne at 5%)	Sc (in tonne at 40 ppm)	Ga (in tonne at 80 ppm)	Nb (in tonne at 48 ppm)
1	1	400000	2500	1	0.3	2000	50000	40	80	48
2	2	400000	2500	2	0.6	4000	100000	80	160	96
3	5	400000	2500	5	1.5	10000	250000	200	400	240
4	10	400000	2500	10	3	20000	500000	400	800	480

The iron (Fe) content in the samples of laterite varies from a low of 27.33% to a high of 43.54%. The overall distribution shows that most of the values lie in the range of 33% to 41%, indicating a consistently moderate to high-grade iron presence across the samples. The average iron content appears to be around 35.29%.

The titanium dioxide (TiO_2) content in the samples shows a clear distinction between a few high-concentration values and a majority of lower ones in the pit samples. The TiO_2 values range from 0.63% to 4.72%. However, three pit samples show significantly higher concentrations, above 2.9%, with one reaching nearly 4.72%, indicating potential zones of Ti-rich mineralization.

The vanadium pentoxide (V_2O_5) content in the samples shows a narrow and fairly consistent range. The values span from <0.05% to 0.20%, with most values clustering between 0.10% and 0.14%. This consistency suggests uniformly distributed vanadium presence in the lateritic section.

The V_2O_5 values observed in the aluminous laterites of the Bhursadongari–Murum Block (from 10 pits, 7 pits yielded vanadium values in the range of 0.10% to 0.20%) are comparable to grades in other region's Geological Survey of India-led G3 stage projects:

1. Arunachal Pradesh (Depo area, Papum Pare District) for Graphite and Vanadium (Field season program: 2018-2019):

- ❖ At 0.05% V_2O_5 cut-off, 0.388805 MT with 0.188% grade.
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These values led to G3 resource estimation and auctioned. M/s Vedanta Limited was the preferred bidder.

2. Madhya Pradesh (Khapripani Block, Dindori District) for Bauxite and Aluminous Laterites (Field season program: 2021-2022):

- ❖ 68.8461 MT at 0.05% V_2O_5 cut-off and
- ❖ 35.4617 MT at 0.10% cut-off from aluminous laterite zones.

Above examples substantiate that vanadium values from 0.10%–0.20%, from pitting upto 1 meter depth, hold commercial significance, especially in surficial lateritic contexts containing, titanium, aluminium and iron.

Due to the paucity of well-distributed and adequately spaced pitting data, resource estimation has been avoided at this stage. Further detailed exploration, including systematic subsurface sampling, would be essential to support reliable resource classification and estimation in accordance with MEMC 2015 and UNFC guidelines.

CHAPTER-9

CONCLUSION AND RECOMMENDATION

9.1 Conclusion:

1. One narrow elongated anomalous zone [9Km X 50 meters] along the contact of Karutola sandstone and Sitagota basalt is identified and demarcated having occurrence of platinum group elements (PGE) and rare earth elements.
2. The basalt is part of Sitagota Fm. of Khairagarh Gr. and shows an altered nature with formation of predominantly green color chlorite and epidote at places and shows the development of a schistosity plane, which defines foliation to the rock and indicate a deformed nature.
3. Whereas, the Sandstone is part of Karutola Fm of Khairagarh Gr. and shows sharp contact with Sitagota basalt and marked by the development of a brittle-ductile shear zone. The sandstone is medium-grained, moderate to well sorted in nature, and shows a red to brown color due to the presence of ferruginous matrix or the presence of iron oxide layers. The zone shows peculiar characteristics and features in both lithologies indicated by the development of mylonitic foliation (S-C fabric) with formation shear lenses with a sinister sense of movement. In contrast, the sandstone shows a dominantly brittle nature with the development of fractures with strong silicification.
4. A total of 113 samples, including bedrock (38 samples) and trenches (75 samples from 10 trenches) from the Sitagota Basalt–Karutola Sandstone contact zone, were analyzed to assess PGE (Platinum Group Elements) mineralization potential. Six BRs out of 38 yielded total PGE above 50ppb ranging 308 to 60ppb rest yielded below 50 ppb total PGE. Whereas all the trench samples yielded total PGE below 50ppb. Across the trench samples, platinum (Pt) is consistently detected in nearly all samples, ranging from 0.005 ppm to 0.026 ppm, indicating it is the dominant PGE present in the contact zone. The highest Pt value was recorded in BMT-08 (7m–8m) at 0.026 ppm, suggesting localized PGE enrichment. Palladium (Pd) appears less frequently than Pt, with values typically in the 0.005–0.011 ppm range when detected. Trench samples study yielded relatively lower values of platinum group elements.
5. The trench samples were also analyzed for Rare Earth Elements (REE). The analysis of the samples indicates that Rare Earth Elements (REE) are present in varying concentrations, but not in significantly high amounts. Overall, the block area data does not indicate substantial REE enrichment that would justify commercial value.
6. Gold analysis of ten surface samples using fire assay revealed concentrations below the detection limit of 0.01 ppm.
7. The bauxitic laterite containing vanadium and titanium are being reported for the first time from this area, may consider under auctioning (CL) of Critical mineral. The G4 stage reconnaissance survey in Bhursadongari-Murum Block area outlined 3 potential vanadium bearing titaniferous aluminous laterite to bauxitic regions (**Figure 106**) for further detail exploration and mining through a Composite License.

Region 1:

Total area of the mapped lateritized zone developed over the Amgaon phyllite in region 1 is cumulatively 130-hectare, area shows significant enrichment of iron, aluminium, titanium and vanadium. The demarcated potential area is based on outcrop data as well as pit data.

S.N.	Sample ID	Type of laterites	Latitude	Longitude	Al ₂ O ₃	Fe	Fe ₂ O ₃	SiO ₂	TiO ₂	V ₂ O ₅
1	BM-PIT-04/X	Laterized Amgaon phyllite (Pits)	21°27'21.5"N	80°35'2.6"E	20.29	30.86	44.13	21.24	1.09	0.08
2	BM-PIT-05/Y		21°27'23.7"N	80°34'5.2"E	13.79	41.46	59.28	14.35	0.63	<0.05
3	BM-PIT-06/X		21°27'21.6"N	80°34'24.1"E	15.50	38.92	55.65	18.05	1.23	0.12
4	BM-PIT-07/Y		21°27'4.9"N	80°34'10.7"E	18.04	36.17	51.71	18.44	0.99	0.14
5	BM-PIT-08/X		21°26'57.3"N	80°34'35.2"E	17.90	33.63	48.09	21.49	0.92	0.10
6	BM-PIT-09/Z		21°26'45.8"N	80°34'12.3"E	16.87	35.84	51.24	19.48	0.69	0.07
7	BM-PIT-10/Y		21°27'4.9"N	80°33'56.3"E	18.66	35.72	51.07	19.63	0.93	0.18
8	231127-06	Laterized Amgaon phyllite (BRS)	21° 27' 18.14"	80° 34' 24.51"	23.66	25.77	36.85	23.6	1.17	0.11
9	231127-11		21° 27' 7.44"	80° 34' 7.90"	21.31	29.95	42.83	22.44	0.93	0.1
10	231127-12		21° 27' 3.93"	80° 34' 10.33"	20.92	29.94	42.8	22.62	0.91	0.1
11	240612-17		21° 27' 24.91"	80° 34' 31.41"	20.42	29.56	42.28	24.25	1.11	0.12
12	231127-07		21° 27' 21.81"	80° 34' 26.35"	20.24	31.11	44.48	19.61	1.13	0.09
13	231127-08		21° 27' 23.69"	80° 34' 15.72"	19.64	33.1	47.33	20.83	0.83	0.07
14	240612-R11		21° 27' 6.23"	80° 33' 55.20"	19.48	32.69	46.74	20.85	1.1	0.12
15	240613-25		21° 26' 51.39"	80° 33' 30.99"	19.4	31.98	45.73	22	0.71	0.17
16	240610-R03		21° 27' 20.58"	80° 35' 3.87"	19.35	31.98	45.73	19.1	1.34	0.12
17	231127-16		21° 26' 50.66"	80° 34' 25.36"	19.29	33.72	48.2	19.4	0.84	0.09
18	231127-02		21° 26' 58.04"	80° 34' 34.07"	19.28	34.01	48.62	18.66	0.98	0.14
19	240613-R18		21° 26' 53.48"	80° 33' 35.60"	19.28	32.61	46.63	20.8	1.03	0.1
20	231127-03		21° 27' 5.12"	80° 34' 30.59"	19.18	32.76	46.83	20.95	1.32	0.14
21	240613-R17		21° 26' 54.24"	80° 33' 36.18"	19.18	31.91	45.62	21.56	0.85	0.08
22	240611-22		21° 27' 2.23"	80° 34' 20.88"	17.69	35.59	50.9	18.84	0.69	0.08
23	240612-06		21° 27' 18.57"	80° 34' 9.77"	17.59	35.75	51.13	18.23	1.39	0.11
24	231127-18		21° 27' 23.93"	80° 35' 8.034"	17.29	34.74	49.66	18.99	1.03	0.08

Analytical results of 7 pits indicate aluminium oxide (Al₂O₃) ranging from 13.79% to 20.29%, iron (Fe) content between 33.63% and 41.46%, titanium dioxide (TiO₂) from 0.63% to 1.23%, and vanadium pentoxide (V₂O₅) in the range of below detection limit to 0.18%.

The laterization of the Amgaon phyllite has notably enriched titanium and vanadium, highlighting the mineral potential of the area. With the 130-hectare extent, this region shows considerable exploration potential. Further detailed spatial and subsurface investigations are recommended to assess its economic viability.

Region 2:

Total area of the mapped lateritized zone developed over the Sitagota basalt in region 2 is cumulatively more than 40-hectare, area shows significant enrichment of iron, aluminium, titanium and vanadium. Titanium and vanadium are relatively more enriched than lateritized Amgaon phyllites.

S.N.	Sample ID	Type of laterites	Latitude	Longitude	Al ₂ O ₃	Fe	Fe ₂ O ₃	SiO ₂	TiO ₂	V ₂ O ₅
1	BM-PIT-02/X	Lateritized Sitagota basalt (pits)	21°27'26.8"N	80°38'30.0"E	29.23	29.33	41.93	8.06	3.73	0.20
2	BM-PIT-03/X		21°27'38.3"N	80°38'30.7"E	31.14	27.33	39.08	6.88	4.72	0.14
3	240607-01	Lateritized Sitagota basalt (BRS)	21° 27' 35.92"	80° 38' 21.31"	38.32	19.58	28.01	6.88	6.2	0.21
4	240608-23		21° 27' 37.73"	80° 38' 30.60"	31.25	27.44	39.24	4.54	6.63	0.20
5	240606-R09		21° 26' 56.54"	80° 38' 2.53"	31.05	24.26	34.7	5.35	4.1	0.11
6	240607-30		21° 27' 26.51"	80° 38' 19.27"	27.89	33.04	47.25	1.13	6.17	0.24
7	240608-R12		21° 27' 32.20"	80° 38' 36.55"	26.54	32.96	47.13	5.91	4.54	0.20

Analytical results of 2 pits indicate aluminium oxide (Al₂O₃) ranging from 29.23% to 31.14%, iron (Fe) content between 27.33% and 29.33%, titanium dioxide (TiO₂) from 3.73% to 4.72%, and vanadium pentoxide (V₂O₅) in the range of 0.14% to 0.20%. The alumina content indicates bauxitic grade.

The laterization of the Sitagota basalt has relatively more enriched titanium and vanadium, highlighting the mineral potential of the area. With the 40hectares extent, this region shows considerable exploration potential. Further detailed investigations are recommended to assess its economic viability.

Region 3:

The region three is iron ore bearing along the zone of Karutola sandstone and Sitagota sandstone, along with concentration of PGE elements. The mineralized iron ore zone extends for a strike length of about 9 kms, with an average width of 50 meters based on trench data. Iron (Fe) and ferric oxide (Fe₂O₃) are major components, particularly high in BMT-07 (51.58% Fe, 73.75% Fe₂O₃) and BMT-10 (47.35% Fe, 67.70% Fe₂O₃), indicating presence of iron oxides like hematite or magnetite and pointing toward potential iron ore zones. The BRS and trench samples yielded relatively low values of PGE. These values are not encouraging to take any further work for PGE.

Region 4: 140 hectares

Total area of the mapped lateritized zone developed over the Kotima basalt in region 4 is 6 hectares, area also shows significant enrichment of iron, aluminium, titanium and vanadium. Titanium is relatively more enriched than lateritized Amgaon phyllites.

S.N.	Sample ID	Type of laterites	Latitude	Longitude	Al ₂ O ₃	Fe	Fe ₂ O ₃	SiO ₂	TiO ₂	V ₂ O ₅
1	BM-PIT-01/X	Laterized Kotima basalt (Pit)	21°24'29.9"N	80°41'22.9"E	12.49	43.54	62.26	14.10	2.96	0.11
2	240617-R-12	Laterite Kotima basalt (BRS)	21° 24' 30.80"	80° 41' 21.8"	16.05	40.32	57.64	11.38	3.35	0.22

Analytical results of 1 pit indicate aluminium oxide (Al₂O₃) ranging from 12.49%, iron (Fe) content 43.54%, titanium dioxide (TiO₂) from 2.96%, and vanadium pentoxide (V₂O₅) 0.11%. However, lower adjacent Maneri Sitapala block area has revealed relatively more enriched alumina content in lateritic Kotima basalt in comparison to Bhursadongari-Murum block. These both areas should be integrated.

The V₂O₅ values observed in the aluminous laterites of the Bhursadongari–Murum Block (from 10 pits, 7 pits yielded vanadium values in the range of 0.10% to 0.20%) are comparable to grades in other region's Geological Survey of India-led G3 stage projects:

1. Arunachal Pradesh (Depo area, Papum Pare District) for Graphite and Vanadium (Field season program: 2018-2019):

- ❖ At 0.05% V₂O₅ cut-off, 0.388805 MT with 0.188% grade.
- ❖ At 0.1% cut-off, 0.300012 MT with 0.228% grade.

These values led to G3 resource estimation and auctioned. M/s Vedanta Limited was the preferred bidder.

2. Madhya Pradesh (Khapripani Block, Dindori District) for Bauxite and Aluminous Laterites (Field season program: 2021-2022):

- ❖ 68.8461 MT at 0.05% V₂O₅ cut-off and
- ❖ 35.4617 MT at 0.10% cut-off from aluminous laterite zones.

Above examples substantiate that vanadium values from 0.10%–0.20%, from pitting upto 1 meter depth, hold commercial significance, especially in surficial lateritic contexts containing, titanium, aluminium and iron.

9.2 Recommendation:

1. Samples collected from the anomalous zone delineated in this study as majority of BRSs & all of the trench samples yielded low PGE values. Preliminary, these values are not encouraging at first instance for PGE exploration.
2. The vanadium pentoxide (V_2O_5) concentrations in the lateritic profiles of the Bhursadongari–Murum Block exhibit a range, predominantly between 0.10% and 0.14%, with overall values spanning from <0.05% to 0.20%. Of the ten test pits excavated, seven returned V_2O_5 values within the 0.10%–0.20% range. The grade of vanadium is encouraging.
3. Laterite developed over the Sitagota basalt is aluminous laterite to bauxitic in nature with average Al_2O_3 31%, TiO_2 5.2%, V_2O_5 0.2%. can be placed for auctioning under CL.

These V_2O_5 grades are comparable to those reported from other GSI-conducted G3 stage investigations, such as the Depo area in Papum Pare District, Arunachal Pradesh, and the Khapripani Block in Dindori District, Madhya Pradesh. The titanium, vanadium bearing aluminous laterite regions are well extending into the lower adjacent Maneri-Sitapala (MS) Block. Integrating those areas [Region-1,2 &4] with present block areas, bigger blocks can be made for auctioning under CL.

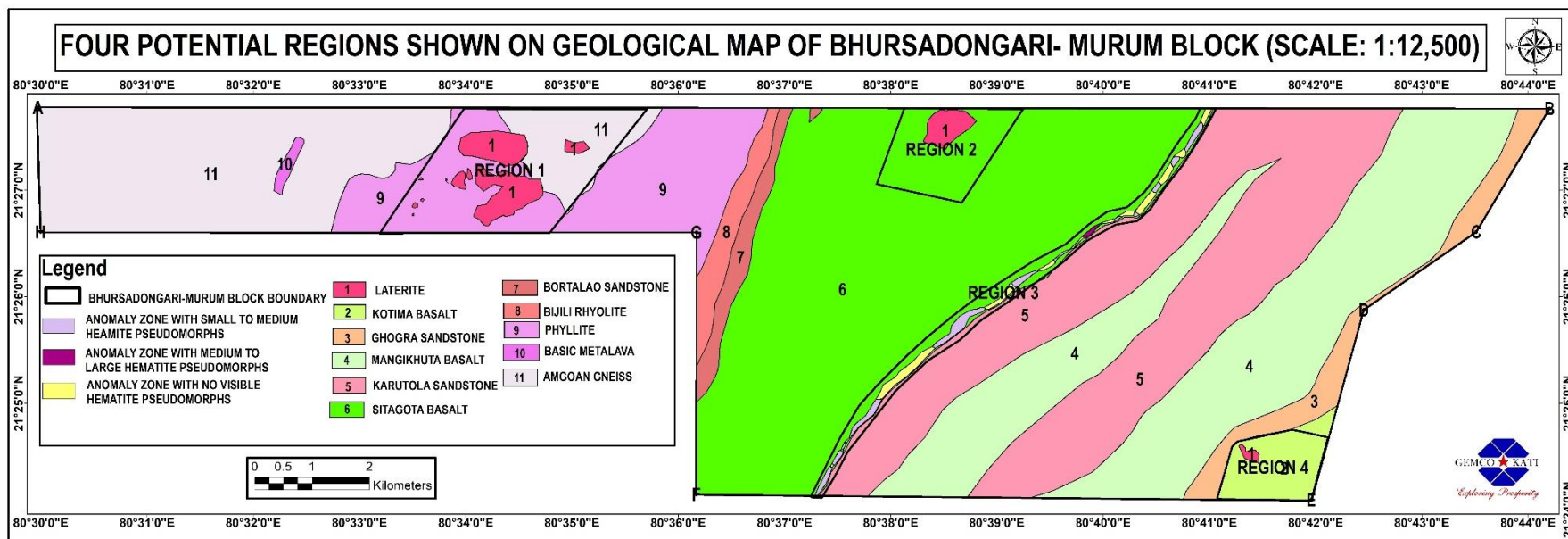


Figure 106. Four potential regions demarcated in block area.

CHAPTER-10

EXPENDITURE

S.N.	Items of work	Units	Rate/unit	Quantity	Approved amount	Revised amount
1.1	Geologist man days (1 No) for large scale (LSM) Geological mapping/Trenching	days	11,000	120	13,20,000	13,20,000
1.2	Geologist man days (1 No) for Geological mapping & Report (HQ)	days	9,000	30	2,70,000	2,70,000
1.3	Labour (field) for (Total 4 Nos i.e. 2 workers per one geologist)	per worker	504	240	1,20,960	1,20,960
1.4	Charges for one sampler per day (1 party)	one sampler per day	5100	30	1,53,000	1,53,000
1.5	Labour (4 nos)	day	504	120	60,480	60,480
	Sub-Total (1)				19,24,440	19,24,440
2	Trenching (PT)					
2.1	Trenching	cu.m.	3330	150	4,99,500	4,99,500
2.2	Pitting	cu.m.	3800	20	76,000	76,000
	Sub-Total (2)				5,75,500	5,75,500
3	Laboratory Studies					
A	CHEMICAL ANALYSIS					
3.1	Au by Fire Assay	Nos	2380	10	23,800	23,800
3.2	Major Oxides by XRF (including laterite analysis for Vanadium)	Nos	4200	50	2,10,000	2,10,000
3.3	For PGE by fire assay	Nos	11,800	20	2,36,000	2,36,000
3.4	Au by Fire Assay	Nos	2380	1	2,380	2,380
3.5	Major Oxides by XRF (including laterite analysis for Vanadium)	Nos	4200	5	21,000	21,000
3.6	For PGE by fire assay	Nos	11,800	2	23,600	23,600
	Trench/Pit samples					
3.7	Major Oxides by XRF (including laterite analysis for Vanadium)	Nos	4200	20	84,000	84,000
3.8	For PGE by fire assay	Nos	11,800	75	8,85,000	8,85,000
3.9	REE+ traces by ICP in Spinel bearing PGE anomaly zone	per sample	7,731	20	1,54,620	1,54,620
3.11	Major Oxides by XRF (including laterite analysis for Vanadium)	Nos	4200	20	84,000	84,000

S.N.	Items of work	Units	Rate/unit	Quantity	Approved amount	Revised amount
3.12	For PGE by fire assay	Nos	11,800	15	1,77,000	1,77,000
3.13	REE by ICP in Spinel bearing PGE anomaly zone	per sample	5,380	3	16,140	16,140
B	PHYSICAL & PETROLOGICAL STUDIES					
3.14	Preparation of thin section	Nos	2,353	20	47,060	47,060
3.15	Study of thin section	Nos	4,232	20	84,640	84,640
3.16	Preparation of polished section	Nos	1,549	20	30,980	30,980
3.17	Study of Polished section	Nos	4,232	20	84,640	84,640
3.18	Digital Photographs	Nos	280	40	11,200	11,200
3.19	EPMA studies	Per hour	8,540	15	1,28,100	0
	Sub-Total 3				23,04,160	21,76,060
	Total (1 to 3)				48,04,100	46,76,000
4	Geological Report Preparation	5 hard copies with a soft copy	i	1	2,40,205	2,33,800
5	Preparation of Exploration Proposal	5 hard copies with a soft copy	2% of the cost or Rs. 5 lakh which is less		96,082	93,520
6	Peer Review Charges		30000	1	30,000	30,000
7	Total Estimated Cost without GST				51,70,387	50,33,320
8	Provision for GST (18%)				9,30,670	9,05,998
9	Total Estimated Cost with GST				61,01,057	59,39,318
				Say, in Lakhs	61.01	59.39

CHAPTER-11

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CHAPTER-12

LOCALITY INDEX

S.N.	Latitude	Longitude	Locality
1	21°26'6.61"N	80°30'40.51"E	Maneri
2	21°25'50.81"N	80°31'55.25"E	Bordi
3	21°25'53.79"N	80°34'34.30"E	Wari
4	21°23'38.21"N	80°39'40.18"E	Sitapala
5	21°23'54.64"N	80°34'35.77"E	Baghatola
6	21°22'51.94"N	80°35'16.29"E	Timkitola
7	21°26'45.06"N	80°43'1.39"E	Murum
8	21°27'22.23"N	80°31'53.20"E	Bhursadongari
9	21°26'50.42"N	80°32'38.39"E	Lohara

ANNX-1.

PIT LOCATIONS.

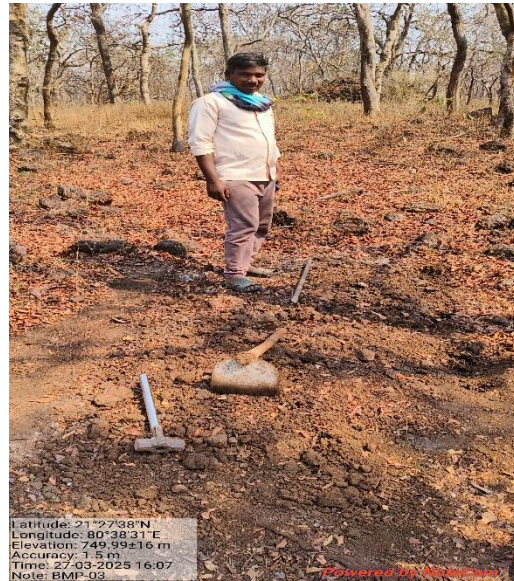
Pit 1



Pit 2



Pit 3



Pit 4



Pit 5



Pit 6



Pit 7



Pit 8



Pit 9



Pit 10



ANNX-2. TRENCH LOCATIONS.

Trench 1



Trench 2



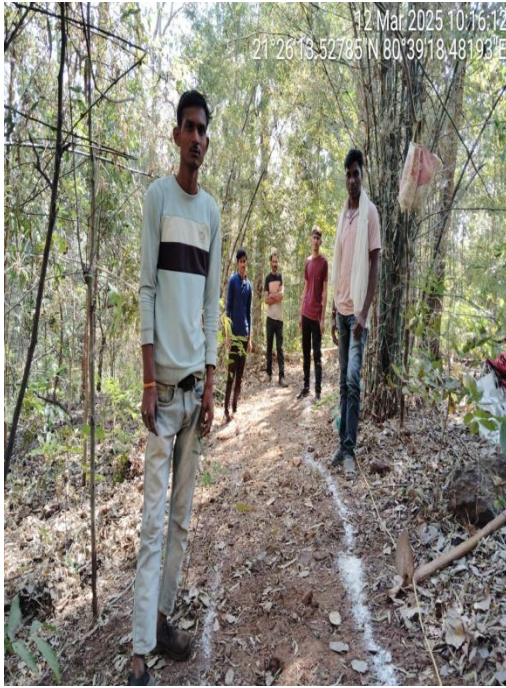
Trench 3



Trench 4



Trench 5



Trench 6



Trench 7



Trench 8



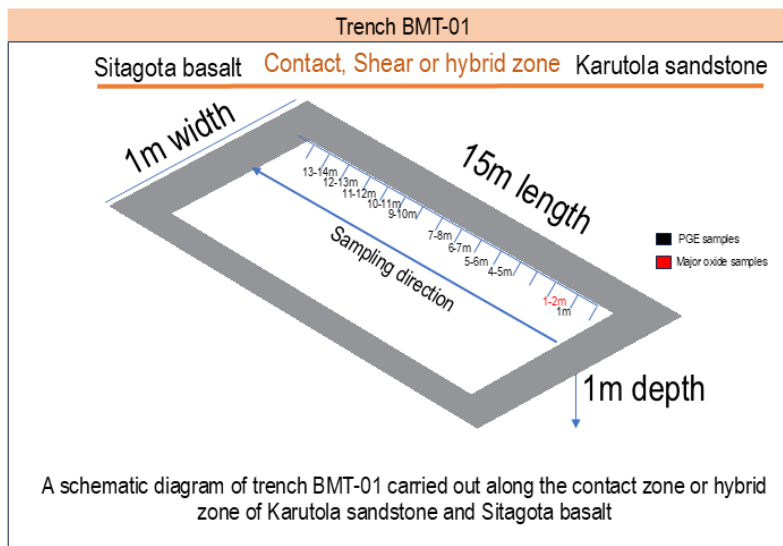
Trench 9



Trench 10

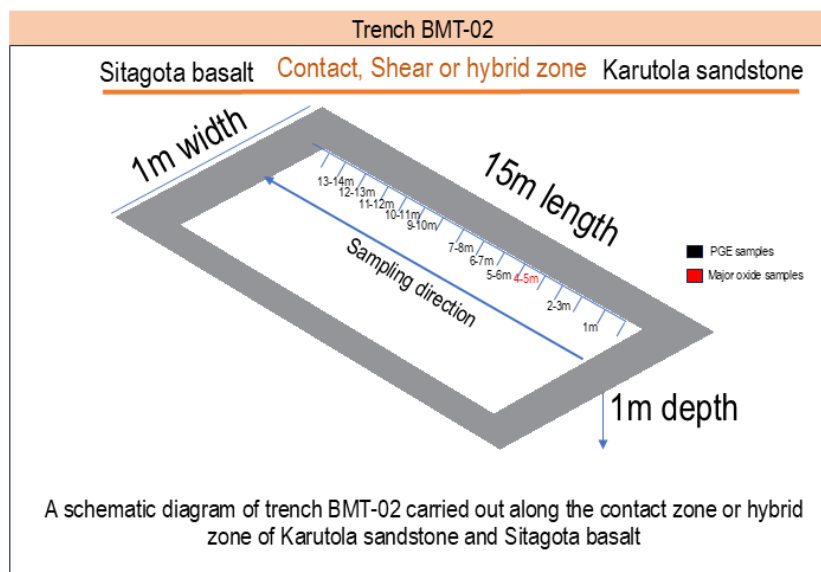


ANNX-3. SCHEMATIC DIAGRAM OF TRENCHES WITH PGE AND MAJOR OXIDE SAMPLES



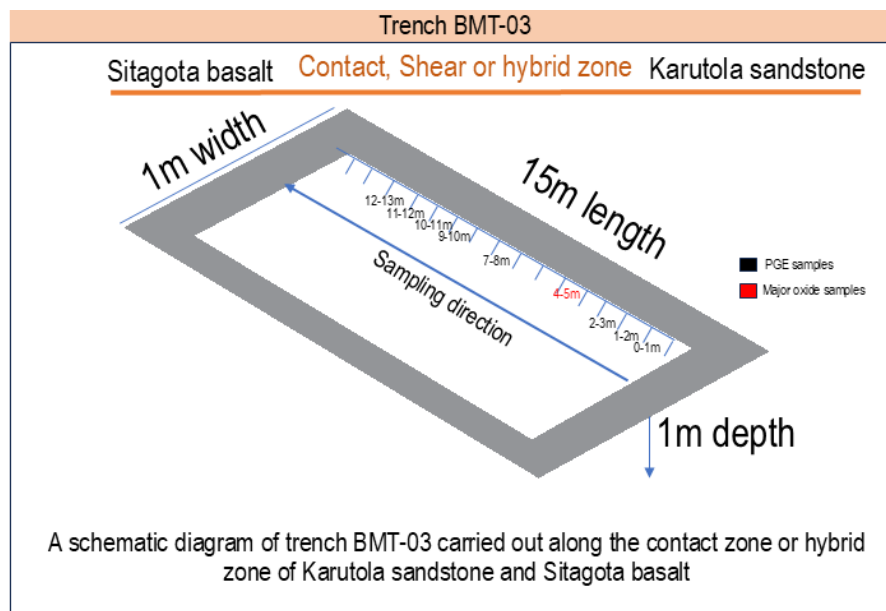
Trench ID	Latitude	Longitude
BMT-01	21° 24' 12.50"N	80° 37' 21.68"E

Figure 1. A schematic diagram of trench BMT-01 carried out along the contact zone or hybrid zone of Karutola sandstone and Sitagota basalt.



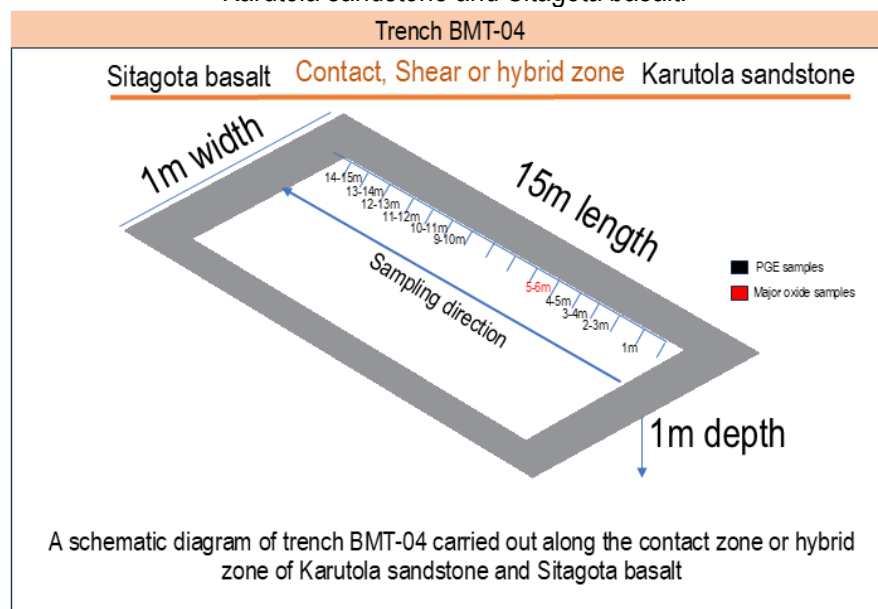
Trench ID	Latitude	Longitude
BMT-02	21° 24' 47.49"N	80° 37' 42.43"E

Figure 2. A schematic diagram of trench BMT-02 carried out along the contact zone or hybrid zone of Karutola sandstone and Sitagota basalt.



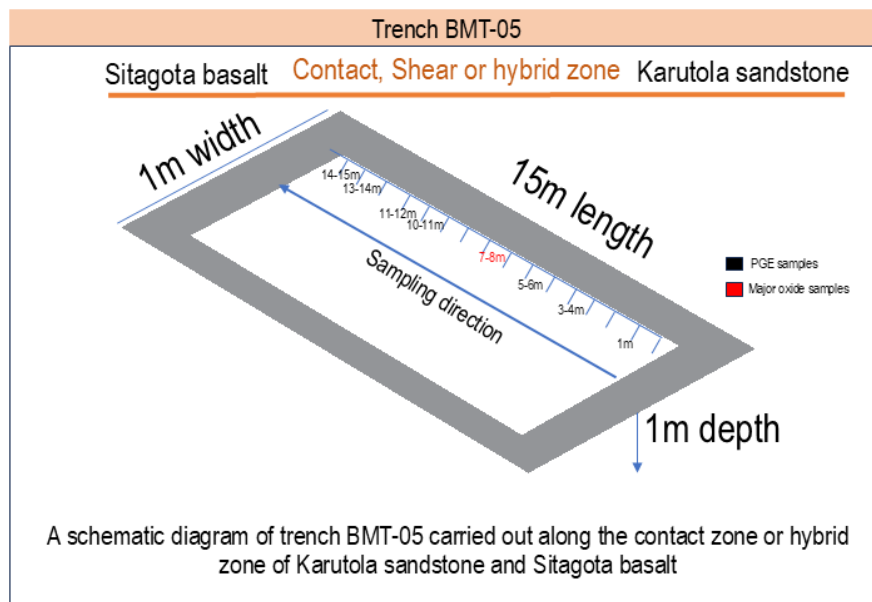
Trench ID	Latitude	Longitude
BMT-03	21° 25' 40.23"N	80° 38' 38.75"E

Figure 3. A schematic diagram of trench BMT-03 carried out along the contact zone or hybrid zone of Karutola sandstone and Sitagota basalt.



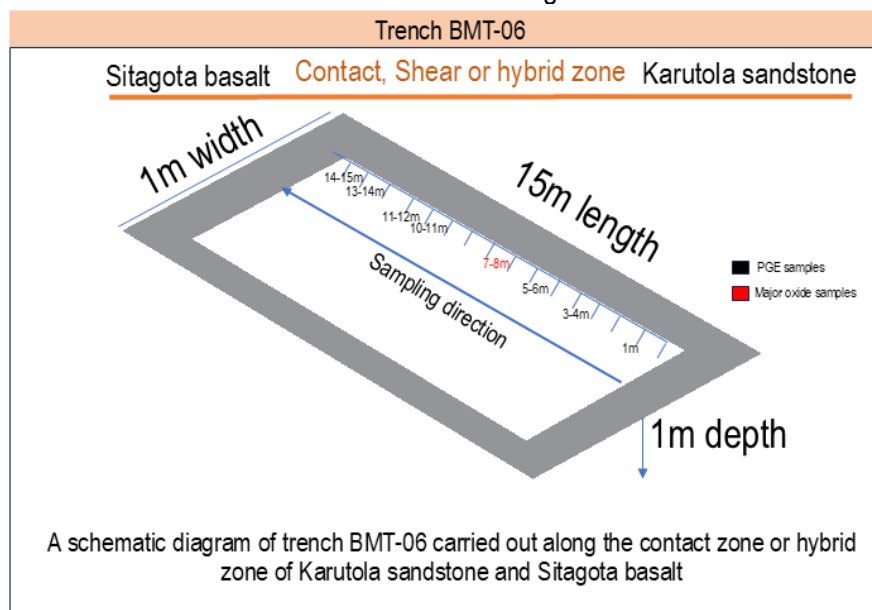
Trench ID	Latitude	Longitude
BMT-04	21° 25' 52.57"N	80° 38' 52.25"E

Figure 4. A schematic diagram of trench BMT-04 carried out along the contact zone or hybrid zone of Karutola sandstone and Sitagota basalt.



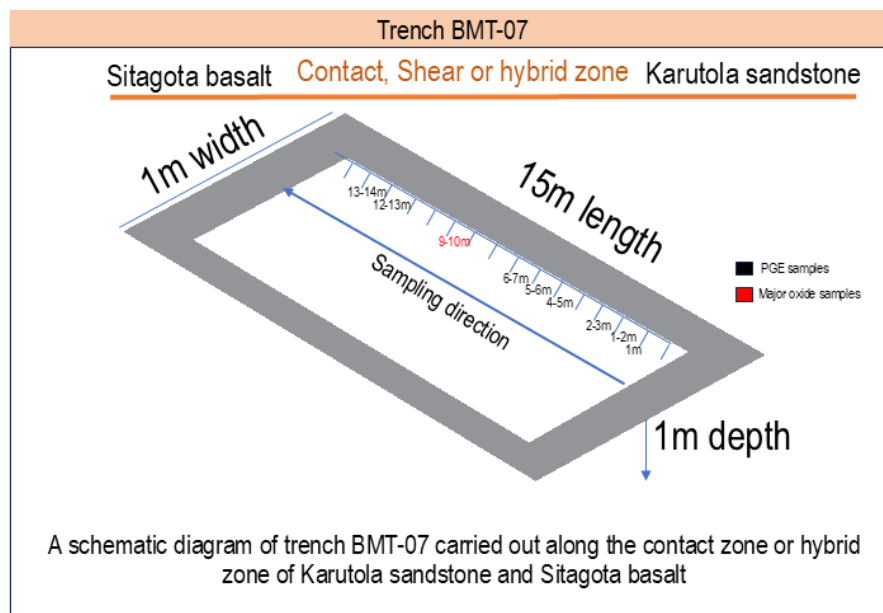
Trench ID	Latitude	Longitude
BMT-05	21° 26' 11.73"N	80° 39' 19.01"E

Figure 5. A schematic diagram of trench BMT-05 carried out along the contact zone or hybrid zone of Karutola sandstone and Sitagota basalt.



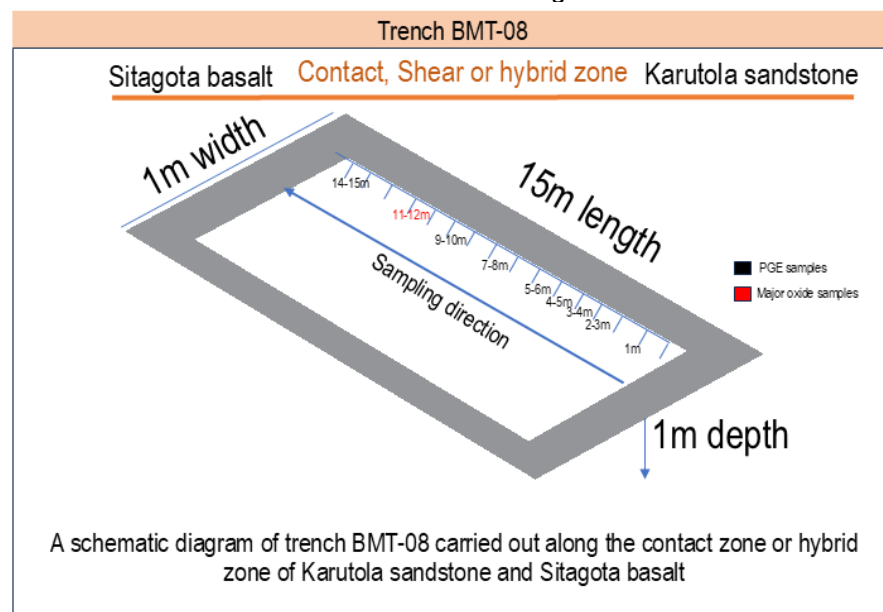
Trench ID	Latitude	Longitude
BMT-06	21° 26' 21.19"N	80° 39' 34.66"E

Figure 6. A schematic diagram of trench BMT-06 carried out along the contact zone or hybrid zone of Karutola sandstone and Sitagota basalt.



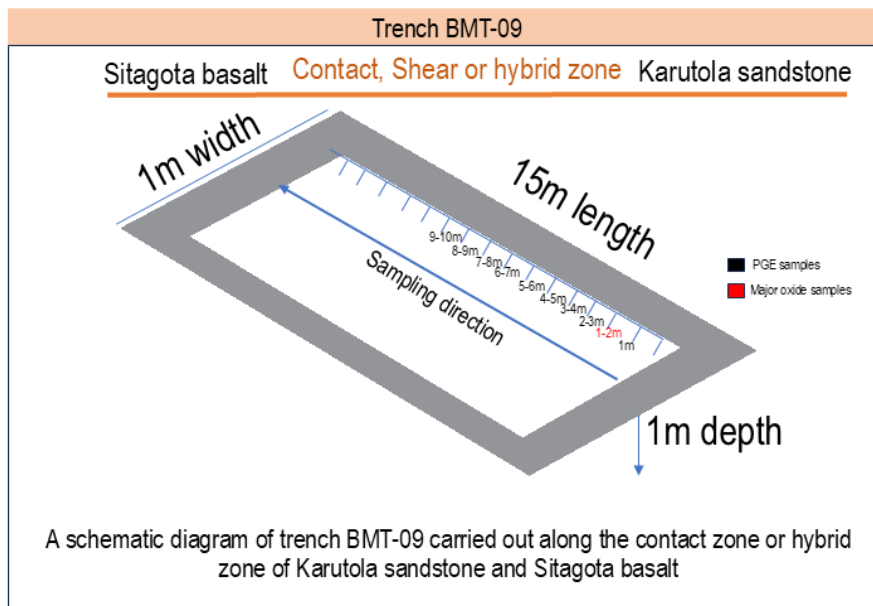
Trench ID	Latitude	Longitude
BMT-07	21° 26' 33.96"N	80° 39' 50.98"E

Figure 7. A schematic diagram of trench BMT-07 carried out along the contact zone or hybrid zone of Karutola sandstone and Sitagota basalt.



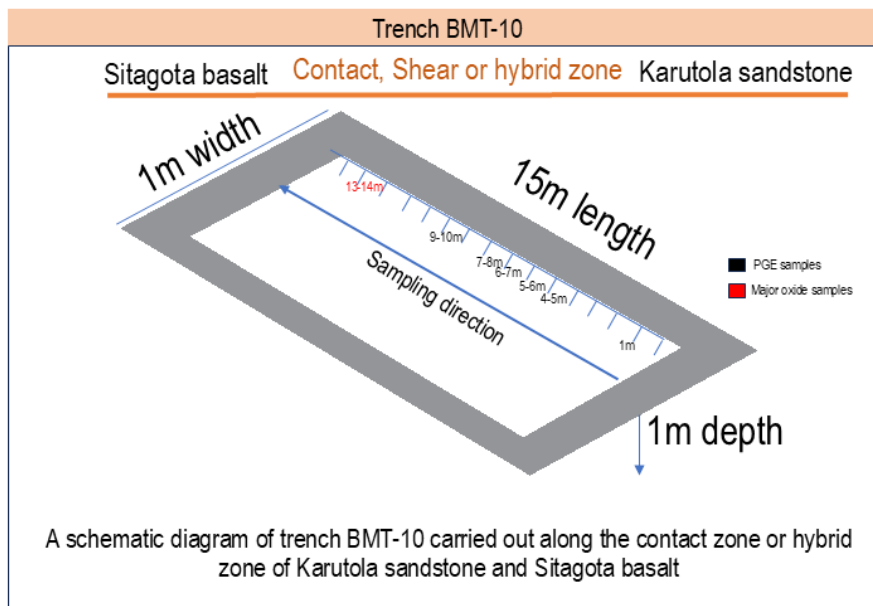
Trench ID	Latitude	Longitude
BMT-08	21° 26' 59.37"N	80° 40' 30.06"E

Figure 8. A schematic diagram of trench BMT-08 carried out along the contact zone or hybrid zone of Karutola sandstone and Sitagota basalt.



Trench ID	Latitude	Longitude
BMT-09	21° 27' 31.45"N	80° 40' 53.08"E

Figure 9. A schematic diagram of trench BMT-09 carried out along the contact zone or hybrid zone of Karutola sandstone and Sitagota basalt.



Trench ID	Latitude	Longitude
BMT-10	21° 25' 33.70"N	80° 38' 29.66"E

Figure 10. A schematic diagram of trench BMT-10 carried out along the contact zone or hybrid zone of Karutola sandstone and Sitagota basalt.

ANNX-4.
COMPLAINEE REPORT ON COMMENTS OF PEER REVIEWER.

Peer reviewer comments	Compliances
1. The Bhursadongari – Murum Block exposes from west to east, Amgoan Gneiss, Basic meta lava and phyllite of older Amgoan Gneissic Complex. This sequence is followed in the east by Bijili Rhyolite and a thick alternating sequence of Bartola Sandstone and Sitagota Basalt, followed by Karutola Sandstone, Mangikhuta Basalt, Ghogra Sandstone and a small patch of Kotima Basalt in the southeastern part of the block. Laterite capping is reported over the phyllite as well as on the basaltic rocks.	The observations presented in the report were pointed out by the Peer Reviewer. As such, no action is required from our end.
2. This work has led to delineating a 9km long and 10m wide hematite rich zone at the contact between Sitagota basalt and Karutola sandstone and it has been marked as Region-1 in the Geological map prepared by the authors.	The observations presented in the report were pointed out by the Peer Reviewer. As such, no action is required from our end.
3. This zone was tested by collecting 75 Trench samples spread over the entire length of this zone trending in a NE-SW direction, and analyzed for PGE (Table-11). It is not clear as to what is the reason for restricting the sampling only to this hematite rich zone for PGE.	A total of 75 trench samples were collected from the Bhursadongari–Murum (BM) Block along the entire NE–SW trending hematite-rich zone and analyzed for PGE (Table-11). The sampling was focused on this specific lithological contact based on analogous geological settings observed in the adjoining Maneri–Sitapala Block, where PGE values of up to 480 ppb were recorded within hematite-bearing zone. Given the apparent geological continuity of this mineralized horizon into the BM Block, systematic sampling was undertaken to evaluate the PGE potential within this zone.

<p>4. The authors should have collected some samples from the Main Sitagota basalt also, along each Trench profile as this basalt shows larger areal extent. This type of basic flow could be potential target for Ni-PGE mineralisation in favourable / critical zones where it attains sulphur saturation due to assimilation of crustal sulphur from the associated sedimentary rocks.</p>	<p>Acknowledged. Although the Sitagota basalt in the Bhursadongari–Murum Block covers a larger areal extent and holds theoretical potential for Ni-PGE mineralisation—particularly in zone where sulphur saturation could result from assimilation of crustal sulphur—there were no observable surface expressions of sulphide mineralisation within this unit. The G4 stage reconnaissance sampling was focused on the hematite-rich contact zone, which was identified as an exploration target. This approach was based on prior results from the adjoining Maneri–Sitapala Block, where elevated PGE values (up to 480 ppb) were spatially associated with hematitic alteration zones.</p>
<p>5. Although petrographic studies of the basalts were carried out, this study should have been more focused on the trench samples collected and analyzed for PGE to identify and characterize the ore minerals / BMS/ PGM.</p>	<p>Petrographic studies were conducted on basalt samples with the objective of understanding the primary mineral assemblages, alteration features, that could help to understand the PGE mineralisation. At the G4 reconnaissance stage, the focus was on broad lithological characterization, which may be hosting PGE, due to the absence of visually evident sulphide mineralization.</p>
<p>6. The Table-11 contains the analytical data of the samples collected from the trenches opened within the contact zone of Karutola s.st and Sitagota basalt. In this context, the following details may be added:</p> <p>a) Include a paragraph giving the methodology of sampling, mesh size to which the samples were powdered and the laboratory in which the samples were analyzed with specific mention about the flux used in the Fire assay method.</p>	<p>Incorporated. Page 80-81.</p>
<p>b) Please give Trench sections for all the ten trenches (BMT-1 to BMT-10) on a larger scale, clearly marking the Sitagota basalt, Karutola s.st and the hematite rich contact zone between the above two lithounit. Also mark the sample lines and the sample numbers in the trench sections.</p>	<p>Incorporated. Page 80 and annexures.</p>

<p>c) In the Table-11, please indicate the rock type of each sample, whether it is a basalt or a s.st or the hematite rich zone etc. For e.g. In Trench BMT-01, it is given that first sample was collected from 4m to 5m, and likewise the other samples were collected at 1m interval and the last sample was collected from 13m to 14m.</p> <p>Please clarify how the samples were collected and whether it is from Footwall to Hanging wall or from NW-SE. In the absence of trench sections, a clear picture is not obtained from the Report.</p>	<p>Incorporated. Rock types included. Samples were collected from the footwall. Table 11. Page 85-90.</p>
<p>d) Can we take it that the samples BMT-01/ 1 to 9 represent the entire contact zone from 4m to 14m of the Trench. Where from the sampling was started?. Please show in the Trench section.</p>	<p>Incorporated. Page 80. Sampling carried out, along the foot wall, at the trench part starting from the Karutola sandstone to Sitagota basalt. Sampling direction marked in trench section.</p>
<p>e) The analytical data presented in Table-11 clearly indicate that none of the trench samples has given more than 50 ppb of Total PGE. The PGE values given by all the 75 samples are quite insignificant, and they do not warrant any further exploration for PGE in this particular block.</p>	<p>Acknowledged. No G3 recommendation made based on current results in BM block.</p>
<p>e) The analytical data presented in Table-11 clearly indicate that none of the trench samples has given more than 50 ppb of Total PGE. The PGE values given by all the 75 samples are quite insignificant, and they do not warrant any further exploration for PGE in this particular block.</p>	<p>Acknowledged. No G3 recommendation made based on current results in BM block.</p>
<p>f) It is not clear whether EPMA studies were carried out on these trench samples. If it was carried out the details of this study may be incorporated in this Report.</p>	<p>No EPMA study was carried out. Due to time constraint and slot unavailability EPMA was dropped with approval of the 9th TCC II.</p>
<p>7. The TiO₂ values of 0.36% to 1.59% recorded in the hematite rich zone at the contact between Karutola s.st and Sitagota basalt are quite low. No significant values of vanadium (V₂O₅) is reported from this zone.</p>	<p>Acknowledged. The contact zone between Karutola s.st and Sitagota basalt is not promising for vanadium or titanium.</p>

<p>8. The trench samples collected from the above hematite rich zone (Region-1) do not show any high values of REE, except two samples from trenches BMT-2&7 analyzing scandium values of 59.62 ppm and 53.14 ppm respectively. As such this zone does not show any significant enrichment of REE as summarized by the authors on Page No.75 of the Report.</p>	<p>Acknowledged. No REE potential evident. Sc values, though anomalous in 2 samples, are not sufficient to propose follow-up exploration.</p>
<p>9. In the Laterites developed over the basalts and phyllite, the TiO₂ values are only in the range of 0.63% to 2.9% with one sample giving an elevated value of 4.72%. The V₂O₅ values of these laterite samples are also low and they are in the range of 0.10% to 0.14%.</p>	<p>The V₂O₅ values observed in the aluminous laterites of the Bhursadongari–Murum Block (from 10 pits, 7 pits yielded vanadium values in the range of 0.10% to 0.20%) are comparable to grades in other region's Geological Survey of India-led G3 stage projects:</p> <p>1. Arunachal Pradesh (Depo area, Papum Pare District) for Graphite and Vanadium (Field season program: 2018-2019):</p> <p>At 0.05% V₂O₅ cut-off, 0.388805 MT with 0.188% grade.</p> <p>At 0.1% cut-off, 0.300012 MT with 0.228% grade.</p> <p>These values led to G3 resource estimation and auctioned. M/s Vedanta Limited was the preferred bidder.</p> <p>2. Madhya Pradesh (Khapripani Block, Dindori District) for Bauxite and Aluminous Laterites (Field season program: 2021-2022):</p> <p>68.8461 MT at 0.05% V₂O₅ cut-off and</p> <p>35.4617 MT at 0.10% cut-off from aluminous laterite zones.</p> <p>Above examples substantiate that vanadium values from 0.10%–0.20%, from pitting upto 1 meter depth, hold commercial significance, especially in surficial lateritic contexts containing, titanium, aluminium and iron.</p>
<p>Conclusions: The G4 Stage Reconnaissance survey carried out in Bhursadongari – Murum Block in Balaghat Dist., Madhya Pradesh has not succeeded</p>	<p>Acknowledged. Further exploration will be conditional on positive outcome of the result on</p>

<p>in identifying / delineating any significant zone of PGE, REE and associated minerals. In view of the above observations, no further exploration is warranted in this Block at this stage. If the proposed G3 work, as and when taken up, in the adjoining Maneri – Sitapala Block yields any positive result for PGE or REE, then based on that data this Bhursadongari – Murum Block can be considered for any further work at a later date.</p>	<p>PGE from the Maneri–Sitapala Block.</p>
<p>The TiO₂ and V₂O₅ values obtained from the laterite samples in the Regions-2, 3 & 4 over the basalts and phyllite are also quite low.</p>	<p>The V₂O₅ values observed in the aluminous laterites of the Bhursadongari–Murum Block (from 10 pits, 7 pits yielded vanadium values in the range of 0.10% to 0.20%) are comparable to grades in other region's Geological Survey of India-led G3 stage projects:</p> <p>Arunachal Pradesh (Depo area, Papum Pare District) for Graphite and Vanadium (Field season program: 2018-2019):</p> <p>At 0.05% V₂O₅ cut-off, 0.388805 MT with 0.188% grade.</p> <p>At 0.1% cut-off, 0.300012 MT with 0.228% grade.</p> <p>These values led to G3 resource estimation and auctioned. M/s Vedanta Limited was the preferred bidder.</p> <p>Madhya Pradesh (Khapripani Block, Dindori District) for Bauxite and Aluminous Laterites (Field season program: 2021-2022):</p> <p>68.8461 MT at 0.05% V₂O₅ cut-off and</p> <p>35.4617 MT at 0.10% cut-off from aluminous laterite zones.</p> <p>Above examples substantiate that vanadium values from 0.10%–0.20%, from pitting upto 1 meter depth, hold commercial significance, especially in surficial lateritic contexts containing, titanium, aluminium and iron.</p>

ANNX-5 : TCC CORRESPONDENCES.

Minutes of TCC I and II

1. Minutes of 62nd TCC

Agenda 62.1.9. Reconnaissance Survey (G-4) for PGE, Vanadium & associated minerals in Bhursadongari - Murum Block (120 Sq Km), Balaghat District, Madhya Pradesh.
[Implementing Agency: Gemcokati Exploration Pvt. Ltd]

- a) The proposed Risewada-Lodhiwada Block and Bhursadongari - Murum Block belong to Dongargarh Supergroup and the blocks are the southern and northern (respectively) extensions of Maneri – Sitapala area where a G4 stage investigation has already been sanctioned by NMET.
- b) During reconnaissance traverses in the Maneri-Sitapala block, a magnetite/spinel-bearing zone with total PGE values ranging from 50ppb to 488ppb was identified, spanning approximately 340 meters along NNE-SSW direction.
- c) Followed by discovery of this PGE anomalous zone Gemcokati Exploration Pvt. Ltd has conducted two reconnaissance field traverses and confirmed the extension of magnetite / spinel bearing PGE anomaly zone to the Risewada – Lodhiwada block and Bhursadongari - Murum Block.
- d) One sample collected from the southern strike-extension of the PGE anomaly zone of Maneri-Sitapala block yielded 54ppb total PGE. Within the proposed

block, laterites have developed on Amgaon Phyllites in the west and on basalt in the east. Grab samples from the laterite capping on Amgaon phyllite yielded V₂O₅ values of 0.29% and 0.18%, while V₂O₅ values of other laterite samples from this zone range from 0.1% to 0.34%. These values exceed the IBM cut-off of 0.1% V₂O₅, indicating significant potential for vanadium mineralization.

- e) During the field traverses and grab sampling conducted from Bhursadongari - Murum Block have revealed anomalous values of PGE in 21 samples, ranging from 24 ppb to 320 ppb, and V₂O₅ in 11 samples, ranging from 0.07% to 0.14%.
- f) NAGMP maps of (Block-4) Magnetic and spectrometric maps has corroborated with field observations.
- g) In order to trace and establish the northern and southern extensions of mineralization found in in Maneri – Sitapala these two G4 stage items have been proposed.
- h) The committee found that another item of the same stage and commodity is already in progress by Gemcokati in the sector. Therefore, at a time recommending two more items of similar nature is not advisable without complete understanding of the mineralisation. Therefore, the Gemcokati was asked to choose one block this time and wait for the outcome of the ongoing item.
- i) Accordingly, Gemcokati Exploration Pvt. Ltd choose to explore the northern block i.e. Bhursadongari - Murum Block and modified the block boundary, as suggested by TCC, to 100 sq.km by leaving the lean area demarcated on the basis of geophysical anomaly.

Recommendation of TCC:

The committee recommends the proposal for approval of EC for “Reconnaissance Survey (G-4) for PGE, Vanadium & associated minerals in Bhursadongari - Murum Block (100 Sq Km), Balaghat District, Madhya Pradesh” with an estimated cost of Rs. 61.01 lakh (including GST) within time schedule of 6 months and submission of report as per annexure-6A & 6B. The item will be reviewed after 4 months.

2. Minutes of 67th TCC

Agenda 67.1.25. Reconnaissance Survey (G4) for PGE, Vanadium & associated minerals in Bhursadongari - Murum area (100 Sq Km), Balaghat District, Madhya Pradesh.

[Implementing Agency: M/s GemcoKati Exploration Pvt. Ltd]

- a) M/s GemcoKati Exploration Pvt. Ltd informed that the project 'Reconnaissance Survey (G4) for PGE, Gold & REE in Maneri-Sitapala area, Balaghat District, MP ' was approved in the 31st EC Meeting held on 12th September, 2023. The sanction order was issued on 05th October, 2023 with timeline of 08 months and approved cost was INR 64,92,482/- .the 64th TCC of NMET had approved 2 months extension upto 31.07.2024.
- b) Further, the project "Reconnaissance Survey (G4) for PGE, Vanadium & associated minerals in Bhursadongari - Murum area (100 Sq Km), Balaghat District, Madhya Pradesh' was approved in the 34th ECof NMET held on 13.03.2024 with timeline of 06months and approved cost was INR 61,01,057/-.The OM in this regard was issued on 12th March 2024.
- c) M/s GemcoKati Exploration Pvt. Ltd informed that forest permission is waited for both the projects to carry out drilling. Hence, time extension upto 31st December 2024 is sought for completion of the project.
- d) Considering the delay in receipt of forest permission the committee agreed to recommend time extension upto 31st December 2024. Also suggested GemcoKati to periodically update NMET on development.

Recommendation TCC:

The Committee recommended time extension upto 31st December 2024 for Reconnaissance Survey (G4) for PGE, Gold & REE in Maneri-Sitapala area, Balaghat District, MP and Reconnaissance Survey (G4) for PGE, Vanadium & associated minerals in Bhursadongari - Murum area (100 Sq Km), Balaghat District, Madhya Pradesh

3. Minutes of 3rd TCC II

Agenda 3.3.16 Reconnaissance Survey (G-4) for PGE, Vanadium & associated minerals in Bhursadongari - Murum Block (100 Sq Km), Balaghat District, Madhya Pradesh.

[Implementing Agency: Gemcokati Exp. Pvt. Ltd.]

- a) Gemcokati Exp. Pvt. Ltd informed that the project was approved in the 62nd TCC Meeting held on 28th, 29th February and 01st March, 2024. The OM was issued on 12th March, 2024 with timeline of 06 months and the approved cost was INR 61,01,057/-.
- b) Gemcokati Exp. Pvt. Ltd. Presented the proposal of the project and informed that forest clearance is awaited for the exploration block.

Recommendation TCC-II:

The committee deferred the proposal for next TCC-II meeting.

4. Minutes of 4th TCC II

- a) Gemcokati Pvt. Ltd. informed that the project was approved in the 62nd TCC Meeting held on 28th, 29th and 01st March, 2024. The OM was issued on 12th March, 2024 with timeline of 06 months and the approved cost was INR 61,01,057/-.
- b) Gemcokati Pvt. Ltd. further informed that Pitting and trenching work have not yet started as the Forest Clearance is awaited.
- c) The committee informed that as per latest guidelines of MoEFCC, agencies can approach forest authorities to get permission for pitting and trenching work. Accordingly, Gemcokati was asked to expedite the progress of work.

Recommendation TCC

The TCC recommended the proposal for approval of EC for timeline extension of 3 months up to 31st March 2025.

5. Minutes of 6th TCC II

**Agenda 6.2.14 Reconnaissance Survey (G-4) for PGE, Vanadium & associated minerals in Bhursadongari - Murum Block (100 Sq Km), Balaghat District, Madhya Pradesh.
[Implementing Agency: Gemcokati]**

- a) Gemcokati informed that the project was approved in the 62nd TCC Meeting held on 28th, 29th and 01st March, 2024. The OM was issued on 12th March, 2024 with timeline of 06 months and approved cost was INR 61,01,057/-.
- b) TCC-2 was informed that the project was delayed due to non-receipt forest permission and in the 39th EC of NMET held on 24.01.2025, time extension was approved till 31st March 2025.
- c) Gemcokati requested for 3-month timeline extension for GR submission.

Recommendation of TCC-II:

The TCC recommended 3 months' timeline extension upto 31st June 2025 for GR submission.

6. Minutes of 7th TCC II

Agenda 7.3.11 Reconnaissance Survey (G-4) for PGE, Vanadium & associated minerals in Bhursadongari - Murum Block (100 Sq Km), Balaghat District, Madhya Pradesh

[Implementing Agency: M/s Gemcokati Exploration Pvt. Ltd.]

- a) GemcoKati Exploration Private Ltd. informed that the project was approved in the 62nd TCC Meeting held on 28th, 29th February and 01st March, 2024. The OM was issued on 12th March, 2024 with timeline of 06 months and approved cost was INR 61,01,057/-
- b) The project was approved in 34th EC meeting of NMET held on 12th March 2024.
- c) M/s Gemcokati Exploration Pvt. Ltd. presented the status of progress of the project. Further, the agency informed that after obtaining the permission on 6th March 2025, pitting/trenching work have been done in the block.
- d) The TCC-II opined that the project should be reviewed after receipt of analytical results.

Recommendation of TCC-II:

The committee deferred the review of the project till receipt of analytical results.

7. Minutes of 9th TCC II

9.3 Review of Ongoing Projects/ Completed Projects & Timeline Extension

Agenda 9.3.1 Reconnaissance Survey (G4) for PGE, Vanadium & associated minerals in Bhursadongari - Murum Block (100 sq. km), Balaghat District, Madhya Pradesh

[Implementing Agency: M/s Gemcokati Exploration Private Limited]

- a) M/s Gemcokati Exploration Private Limited informed that the project was recommended in 62nd meeting of TCC held on 28, 29 February & 1st March 2024. The project was approved in the 34th EC Meeting held on 12th March 2024. The OM was issued on 12th March 2024 with timeline of 06 months (up to 11.09.2024) and approved cost of INR 61.01/- Lakh. Time extension till 31.03.2025 (6 months) and till 30.06.2025 (3 months) was approved by 39th and 41st EC meetings respectively.
- b) The Implementing agency briefed that forest clearance for pitting and trenching based on new forest guidelines on Pitting and Trenching was obtained (from Range Forest office) on 6th March 2025. Further, the approved project budget has increased due to the addition of registration and processing fees related to Forest Clearance. But there is no budget provision in SoC of NMET for these expenses.
- c) Based on this G4 work, three titanium, vanadium enriched aluminous laterites capped on Amgaon phyllite (600 hectares), Sitagota basalt (320 hectares) and Kotima basalt (160 hectares) have been delineated by the Implementing agency. These are also extending into lower adjacent Maneri-Sitapala block. Demarcation of potential area has been done on the basis of BRS as well as pit & trench samples results.
- d) The TCC-II agreed for the proposed peer review of the final Geological Report. The committee also agreed to drop the EPMA studies for this project, as the chemical analysis results did not yield any significant values.

Recommendations of TCC-II

The committee agreed for the proposed peer review of the final Geological Report. The committee also agreed to drop the EPMA studies. The matter of registration and processing fees for Forest Clearance will be brought to the attention of the Executive Committee (EC).

8. Minutes of 10th TCC II

Agenda 10.2.13 Reconnaissance Survey (G4) for PGE, Vanadium & associated minerals in Bhursadongari - Murum Block (100 Sq Km), Balaghat District, Madhya Pradesh

[Implementing Agency: M/s Gemcokati Exploration Private Limited]

- a) M/s Gemcokati Exploration Private Limited informed that the project was recommended in 62nd meeting of TCC held on 28, 29 February & 1st March 2024. The project was approved in the 34th EC Meeting held on 12th March 2024. The OM was issued on 12th March 2024 with timeline of 06 months (up to 11.09.2024) and approved cost of ₹61.01/- Lakh. Time extension till 31.12.2024 (3.5 months), 31.03.2025 (3 months) and till 30.06.2025 (3 months) was approved by 37th, 39th and 41st EC meetings respectively.
- b) Further, it was briefed by Gemcokati Exploration Pvt. Ltd. that peer review of the final geological report is underway. The agency requested for time extension of 2 months up to 31st August 2025 for submission of final geological report.
- c) The TCC-II opined that the final geological report will be reviewed in next TCC-II meeting after incorporation of peer review comments.

Recommendations of TCC-II

The committee recommends the proposal for approval of EC for timeline extension of 2 months up to 31st August 2025 for submission of final geological report to NMET. Final geological report will be reviewed in next TCC-II meeting after incorporation of peer review comments.

9. Minutes of 11th TCC II

Agenda 11.5.23 Reconnaissance Survey (G-4) for PGE, Vanadium & associated minerals in Bhursadongari - Murum Block (100 Sq Km), Balaghat District, Madhya Pradesh.

[Implementing Agency: M/s Gemcokati Exploration Private Limited]

- a) The project was recommended by 62th TCC held on 28th & 29th February and 01st March, 2024 and approved in 34th EC held on 13/03/2024 with an approved cost of ₹ 61.01 Lakh (including GST) for 6 months up to 13/9/2024.
- b) Gemcokati Exploration Private Limited informed that peer review has been done for the final geological report. All the comments of peer reviewer have been incorporated in the final GR. The agency proposed to exclusion of EPMA studies in this project.
- c) The TCC-II agreed for submission of final GR to NMET. The committee agreed for exclusion of EPMA studies in this project.

Recommendations of TCC-II

The committee recommends the proposal for the approval of EC for “exclusion of EPMA studies in this project” with revised cost of ₹59.39 Lakh (including GST) against initial approved cost of ₹61.01 Lakh (including GST) as per Annexures 14.



Minutes of EC

1. Minutes of 34th EC

H. Implementing Agency: M/s. Gemcokati Exp. Pvt. Ltd.					
11	Reconnaissance Survey (G-4) for PGE, Vanadium & associated minerals in Bhursadongari - Murum Block (100 Sq Km), Balaghat District, Madhya Pradesh	PGE, Vanadium & associated minerals	G4	6	61.01

2. Office of Memorandum

**Government of India
Ministry of Mines
National Mineral Exploration Trust**

File No. 23/450/2024-NMET/ 605

New Delhi, 12th March, 2024

OFFICE MEMORANDUM

Subject: Approval of mineral exploration projects executed by M/s. Gemcokati Exp. Pvt. Ltd (Reconnaissance Survey (G-4) for PGE, Vanadium & associated minerals in Bhursadongari - Murum Block (100 Sq Km), Balaghat District, Madhya Pradesh) through NMET fund.

On the recommendation of the Technical-cum-Cost Committee (TCC) in its 62nd meeting held on 28th, 29th and 01st March, 2024, the Secretary, Mines and Chairman, Executive Committee (EC) of NMET approved the mineral exploration projects of M/s. Gemcokati Exp. Pvt. Ltd through NMET fund as per following details:

S. No	Project/Block Name	Agency	Duration (Months)	Approved Cost (₹ Including GST)
1	Reconnaissance Survey (G-4) for PGE, Vanadium & associated minerals in Bhursadongari - Murum Block (100 Sq Km), Balaghat District, Madhya Pradesh	M/s. Gemcokati Exp. Pvt. Ltd.	6	61,01,057
Total (Rupees Sixty one lakh one thousand and fifty seven only)				61,01,057 /-

2. M/s. Gemcokati Exp. Pvt. Ltd shall submit progress on monthly basis to NMET Secretariat. The TCC, NMET shall review the progress of project and provide update to the Executive Committee.

3. M/s. Gemcokati Exp. Pvt. Ltd shall complete the project as per the above terms and within timeline as per detail mentioned below:

- Field Mobilization & Exploration Work : Till 3rd month (up to 11.06.2024)
- Laboratory Studies : Till 5th month (up to 11.08.2024)
- Report writing with Peer Reviewer and submission to NMET : Till 6th month (up to 11.09.2024)

4. Further, as per clause 3.2(viii) of the Office Memorandum no. 6/3/2015-NMET/380 dated 12th December 2023 regarding Mode of engagement of Notified Private Exploration Agencies and funding by NMET for exploration of Critical and Strategic Minerals, NPEA may avail mobilization advance (up to 30% of the approved project cost) upon submission of Bank Guarantee (BG, including e-bank guarantee) of equal value of advance to NMET.


[Vivek Kumar Sharma]
Director & HoD, NMET

Annexure 6A

Estimate cost for Reconnaissance Survey (G-4) for PGE, Vanadium & associated mineral in Bhursadongari - Murum Block, Balaghat District, MP. Total block area- 102 sq km; Completion Time- 6 Months

S. No.	Item of Work *	Unit *	Rates as per NMETSoc 2020-21		Estimated Cost of the Proposal	
			SoC-Item No. *	Rates as per SoC * (a)	Qty. (b)	Total Amount (Rs) (a*b)
A	Geological Mapping Other Geological Work & Surveying					
	Geological mapping, (1:12,500 scale) & Trenching , drilling work					
i	a. Charges for Geologists per day (Field) for geological mapping & trenching work, drilling work	Geologists per day	1.2b	11,000	120	13,20,000
ii	b. Labours Charges; Base rate	2 Labourers per day	5.7	504	240	1,20,960
	c. Charges for Geologists per day (HQ)	day	1.2a	9,000	30	2,70,000
	d. Charges for one Sampler per day (1 Party)	one sampler per day	1.5.2	5,100	30	1,53,000
	e. Labours (4 Nos)	day		504	120	60,480
	Sub Total- A					19,24,440
B	Ground Geophysical Survey					
1	IP. Induced Polarization (I.P) cum Resistivity S.P and Magnetic (30 Lkm)	8-10 Line Km				
3	Geophysicist party days (Field)	per day				

4	c. Labours Charges	day				
5	Geophysicist party days (HQ)	per day				
Sub Total- B						-
C	Survey work					
a	DGPS Survey for BH fixation & RL determination	Per Point of observation				
b	Charges of Surveyor (1 party) for Geophysical survey layout work & Block boundary demarcation	one surveyor per day				
c	Labours Charges for survey work;	day				
Sub-Total C						-
D	Trenching/Pitting					
	a) Excavation of Trenches	per cu.m	2.1.1	3,330	150	499500
	b) Excavation of Pits	per cu.m	2.1.2	3,800	20	76000
E	DRILLING (after review)					
1	Drilling up to 300m (Hard Rock)	m				
2	Borehole deviation Survey by Multishot Camera	m				
3	Land / Crop Compensation (in case the BH falls in agricultural Land)	per BH				
4	Construction of concrete Pillar (12"x12"x30")	per borehole				
5	Transportation of Drill Rig & Truck associated per drill (2 rigs)	Km				
6	Monthly Accomodation Charges for drilling Camp (up to 2 Rigs)	month				
7	Drilling Camp Setting Cost	Nos				
8	Drilling Camp Winding up Cost	Nos				
9	Road Making (Flat Terrain)	Km				
10	Drill Core Preservation	per m				
Sub Total E						-

F	Borehole Geophysical Logging	5 Bhs of 350m each				
G	LABORATORY STUDIES					
1	Chemical Analysis					
i)	Geochemical Sampling-Surface samples (Bedrock/Channel /Soil/Stream sediment)					
	a. Au by Fire Assay	Nos	4.1.5a	2,380	10	23,800
	b. Major Oxides by XRF (including Laterite Analysis for Vanadium)	Nos	4.1.15a	4,200	50	2,10,000
	c. For PGE by Fire Assay	Nos	4.1.5d	11,800	20	2,36,000
ii)	Surface Check samples (10% External)					
	a. Au by Fire Assay	Nos	4.1.5a	2,380	1	2,380
	b. Major Oxides by XRF (including Laterite Analysis for Vanadium)	Nos	4.1.15a	4,200	5	21,000
	c. For PGE	Nos	4.1.5d	11,800	2	23,600
iii)	Trench & Check Samples from Trench					-
	Trench / Pit samples					-
	a. Au by Fire Assay	Nos				-
	b. Major Oxides by XRF (Laterite Analysis for Vanadium)	Nos	4.1.15a	4,200	20	84,000
	c. For PGE	Nos	4.1.5d	11,800	75	8,85,000
	d. REE +traces by ICP in Spinel-bearing PGE Anomaly zone	per sample	4.1.14	7,731	20	1,54,620
iv)	Trench Check samples (10% External)					
	a. Au by Fire Assay	Nos				
	b. Major Oxides by XRF (Laterite Analysis of Pit samples for Vanadium)	Nos	4.1.15a	4,200	20	84,000
	c. For PGE	Nos	4.1.5d	11,800	15	1,77,000
	d. REE by ICP in Spinel-bearing PGE Anomaly zone	per sample	4.1.13	5,380	3	16,140
v)	BH Core samples					

	a. Au by Fire Assay	Nos				
	b. For Ag, Ni, Co, Cr, Cu, Pb, Zn, V, Ti by ICPMS-34 elements	Nos				
	c. For PGE	Nos				
vi)	BH Core samples (10%External)					
	a. Au by Fire Assay	Nos				
	b. For Ag, Ni, Co, Cr, Cu, Pb, Zn, V, Ti by AAS Method	Nos				
	c. For PGE	Nos				
2	Physical & Petrological Studies					
i	Preparation of thin section	Nos	4.3.1	2,353	20	47,060
ii	Study of thin section	Nos	4.3.4	4,232	20	84,640
iii	Preparation of polish section	Nos	4.3.0	1,549	20	30,980
iv	study of polished section	Nos	4.3.4	4,232	20	84,640
v	Digital Photographs	Nos	4.3.7	280	40	11,200
vi	Whole Rock Analysis	Nos				
vii	Sp. Gravity	Nos				
viii	SEM Studies	per hour			-	
ix	EPMA Studies	per hour	4.4.1	8,540	15	1,28,100
x	XRD Studies	Nos	4.5.1	4,000	-	-
						23,04,160
H	Total A to G					48,04,100
I	Geological Report Preparation	5 Hard copies with a soft copy	5.2	i		2,40,205
J	Peer review Charges		As per EC decision	30,000	1	30,000



K	Preparation of Exploration Proposal (5 Hard copies with a soft copy)	5 Hard copies with a soft copy	5.1	2% of the Cost or Rs. 5.0 Lakhs whichever is less		96,082
L	Total Estimated Cost without GST					51,70,387
M	Provision for GST (18% of L)					9,30,670
N	Total Estimated Cost with GST					61,01,057
				Rs. in Lakhs		61.01
Note:						
1	Strict adherence to the Ministry of Finance's and GFR guidelines is mandatory. Every transaction must adhere to GFR rule 21.					
2	In case of delay/non- performance, the appropriate action will be taken by competent authority against delinquent agency as per prevailing govt. of India rules/guidelines on procurement.					
3	If any part of the project is outsourced, the amount will be reimbursed as per the Paragraph 3 of NMETSoC and Item no. 6 of NMETSoC. In case of excusion of the project by NEA on its own, a Certifiате regarding non outsourcing of any component/project is required.					
4	Necessary efforts should be made to minimize any adverse impact on the environment during exploration activities.					

Parathi
04/3/2024

S. Div
04/03/2024

Timeline Schedule for Reconnaissance Survey (G-4) for PGE, Vanadium & associated mineral in Bhursadongari - Murum Block, Balaghat District, Madhya Pradesh.								
S. No.			1	2	3	4	5	6
1	Camp Setting	Months/Days						
2	Geological Mapping & Sampling	days						
3	Geophysical survey	L. km						
4	Geophysicist party days (HQ) for data interpretation & Report	Days						
5	Pitting/Trenching	cu.m						
6	Surface Drilling (1 rigs)	m						
7	Survey Party days	days						
8	Geologist Man days	days						
9	Sampler Man days	days						
10	Camp Winding	months						
11	Laboratory Studies	Nos.						
12	Report Writing with Peer Review	months						

Parathi
04/03/2024

Sai
04/02/2024

TCC APPROVED REVISED COST SHEET

Sl no.	Item of Work	Unit	Rates as per NMET SoC 2020-21		Estimated Cost of the Proposal	Total Amount (Rs)	Total Amount (Rs)
			SoC-Item Sl No.	Rates as per SoC	Qty.	REVISED	INITIALLY APPROVED
1	Large scale (LSM) Geological mapping/Trenching.						
1.1	Geologist man days (1 No) for Large scale (LSM) Geological mapping/Trenching	days	1.2b	11,000	120	13,20,000	13,20,000
1.2	Geologist man days (1 No) for Geological mapping & Report (HQ)	days	1.2a	9,000	30	2,70,000	2,70,000
1.3	Labour (field) for (Total 4 Nos i.e. 2 workers per one geologist)	per worker	5.7	504	240	1,20,960	1,20,960
1.4	Charges for one sampler per day(1 party)	one sampler per day	1.5.2	5100	30	1,53,000	1,53,000
1.5	Labours (4 nos)	day		504	120	60,480	60,480
	Sub-Total (1)					19,24,440	19,24,440
2	Trenching (PT)						
2.1	Trenching	cu.m.	2.1.1	3330	150	4,99,500	4,99,500
2.2	Pitting	cu.m.	2.1.2	3800	20	76,000	76,000
	Sub-Total (2)					5,75,500	5,75,500
3	Laboratory Studies						
A	CHEMICAL ANALYSIS						
	Geochemical sampling-surface samples (bed rock/channel/soil/stream sediment)						
3.1	Au by Fire Assay	Nos	4.1.5a	2380	10	23,800	23,800

3.2	Major Oxides by XRF (including laterite analysis for Vanadium)	Nos	4.1.15a	4200	50	2,10,000	2,10,000
3.3	For PGE by fire assay	Nos	4.1.5d	11,800	20	2,36,000	2,36,000
*	REE+ traces by ICP in Spinel bearing PGE anomaly zone						
	Surface check samples (10% external)						
3.3	Au by Fire Assay	Nos	4.1.5a	2380	1	2,380	2,380
3.4	Major Oxides by XRF (including laterite analysis for Vanadium)	Nos	4.1.15a	4200	5	21,000	21,000
3.5	For PGE by fire assay	Nos	4.1.5d	11,800	2	23,600	23,600
	Trench and Check samples from Trench						
	Trench/Pit samples						
3.6	Major Oxides by XRF (including laterite analysis for Vanadium)	Nos	4.1.15a	4200	20	84,000	84,000
3.7	For PGE by fire assay	Nos	4.1.5d	11,800	75	8,85,000	8,85,000
3.8	REE+ traces by ICP in Spinel bearing PGE anomaly zone	per sample	4.1.14	7,731	20	1,54,620	1,54,620
	Trench Check samples (10% external)						
3.9	Major Oxides by XRF (including laterite analysis for Vanadium)	Nos	4.1.15a	4200	20	84,000	84,000
3.1	For PGE by fire assay	Nos	4.1.5d	11,800	15	1,77,000	1,77,000
3.11	REE by ICP in Spinel bearing PGE anomaly zone	per sample	4.1.13	5,380	3	16,140	16,140
B	PHYSICAL & PETROLOGICAL STUDIES						
3.12	Preparation of thin section	Nos	4.3.1	2,353	20	47,060	47,060
3.13	Study of thin section	Nos	4.3.4	4,232	20	84,640	84,640
3.14	Preparation of polished section	Nos	4.3.0	1,549	20	30,980	30,980
3.15	Study of Polished section	Nos	4.3.4	4,232	20	84,640	84,640
3.16	Digital Photographs	Nos	4.3.7	280	40	11,200	11,200
3.17	EPMA studies	Per hour	4.4.1	8,540	0	0	1,28,100
3.18	XRD Studies	Nos	4.5.1	4,000			-



	Sub-Total 3					21,76,060	23,04,160
	Total (1 to 3)					46,76,000	48,04,100
4	Geological Report Preparation	5 hard copies with a soft copy	5.2	i	1	2,40,205	2,40,205
5	Preparation of Exploration Proposal	5 hard copies with a soft copy	5.1	2% of the cost or rs 5 lakh which is less		96,082	96,082
6	Peer Review Charges		As per EC decision	30000	1	30,000	30,000
7	Total Estimated Cost without GST					50,42,287	51,70,387
8	Provision for GST (18%)					9,07,612	9,30,670
9	Total Estimated Cost with GST					59,49,899	61,01,057
					Say, in Lakhs	59.49	61.01

ANNEXTURE-6

FOREST PERMISSION & WORK COMPLETION LETTER

कार्यालय वनमंडलाधिकारी दक्षिण (सा.) वनमंडल बालाघाट म.प्र.



दूरभाष नं.-(07632-248414)
email - dfotsbghat@mp.gov.in

क्रमांक / तकनीकी / प्रति, 766

बालाघाट, दिनांक 29/01/2025

अपर प्रधान मुख्य वन संरक्षक,
(भू-प्रबंध)
भोपाल (म.प्र.)

विषय :- वन मंडल दक्षिण बालाघाट के वन परिक्षेत्र पूर्व लांजी एवं पश्चिम लांजी के अन्तर्गत विभिन्न कक्षों के रकबा 9031 हेक्टेयर वनभूमि में Reconnaissance Survey (G-4) for PGE, Vanadium & associated minerals in Bhursadingri - Murum Block द्वारा Pitting or Trenching GRAB SAMPLING की अनुमति बाबत - M/s Gemco kati Exploration Private Limited, Chandrapur (Maharashtra) - 442401 का ऑनलाईन प्रस्ताव क्रमांक : FP/MP/SRY/492034/2024

संदर्भ :- (1) आपका पत्र क्रमांक/एफ-1/857/2025/FP/MP/SRY/492034/2024/187, 188 दिनांक 15.01.2025,
(2) आवेदक विभाग/संस्थान- M/s Gemco kati Exploration Private Limited, Chandrapur (Maharashtra) का पत्र दिनांक 24.01.2025, जो इस वनमंडल कार्यालय में आवक प्राप्ति क्रमांक 917 दिनांक 27.01.2025

—00—

निवेदन है, कि विषयांतर्गत प्रकरण में संदर्भित पत्र क्रमांक (1) द्वारा जारी सैद्धांतिक स्वीकृति में अधिरोपित समस्त शर्तों (शर्त क्रमांक 1 से 19 तक) का पालन प्रतिवेदन मय वचनपत्रों सहित आवेदक विभाग/संस्थान- M/s Gemco kati Exploration Private Limited, Chandrapur (Maharashtra) द्वारा उनके पत्र दिनांक 24.01.2025 से प्रेषित किया है, जो अवलोकनार्थ संलग्न सादर सम्प्रेषित हैं।

संलग्न :- उपरोक्तानुसार।

(अधर गुप्ता)
भा.व.से.

वनमंडल अधिकारी
दक्षिण (सा.) वनमंडल बालाघाट
बालाघाट, दिनांक 29/01/2025

पू0क्रमांक / तकनीकी / प्रति, 767

- मुख्य वन संरक्षक, बालाघाट वनवृत्त, बालाघाट (म.प्र.) की ओर उपरोक्त विषयांतर्गत संदर्भांकित तारतम्य में आवेदक विभाग/संस्थान द्वारा संदर्भित पत्र क्रमांक (2) से प्रेषित पालन प्रतिवेदन की छायाप्रति संलग्न कर सूचनार्थ सादर सम्प्रेषित।
- उपवनमंडलाधिकारी, लांजी (सा0) उपवनमंडल की ओर उपरोक्त विषयांतर्गत संदर्भांकित तारतम्य में आवेदक विभाग/संस्थान द्वारा संदर्भित पत्र क्रमांक (2) से प्रेषित पालन प्रतिवेदन की छायाप्रति संलग्न कर सूचनार्थ एवं आवश्यक कार्यवाही हेतु अग्रेषित। विषयांकित प्रकरण में उपरोक्त संदर्भित कार्यालय प्रधान मुख्य वनसंरक्षक (कक्ष भू-प्रबंध) मध्यप्रदेश, भोपाल के पत्र क्रमांक/एफ-1/857/2025/FP/MP/SRY/492034/2024/187, 188 दिनांक 15.01.2025 द्वारा दिये गये निर्देशानुसार पत्र में उल्लेखित समस्त अधिरोपित शर्तों (शर्त क्रमांक 1 से 19 तक) का पूर्णरूपेण अनुपालन करते हुये एवं आवेदक विभाग/संस्थान से कराते हुये कार्य प्रारंभ करने दिया जावे। आप स्वयं कार्य के दौरान क्षेत्र की सतत मॉनिटरिंग किया जाना सुनिश्चित करें तथा अधिनस्त वन परिक्षेत्र अधिकारी/परिक्षेत्र सहायकों/बीट गार्डों की ड्यूटी लगाई जावे।
- वन परिक्षेत्र अधिकारी, पश्चिम लांजी/पूर्व लांजी (सा0) परिक्षेत्र की ओर उपरोक्त विषयांतर्गत संदर्भांकित तारतम्य में आवेदक विभाग/संस्थान द्वारा संदर्भित पत्र क्रमांक (2) से प्रेषित पालन प्रतिवेदन की छायाप्रति संलग्न कर सूचनार्थ एवं आवश्यक कार्यवाही हेतु अग्रेषित। विषयांकित प्रकरण में उपरोक्त संदर्भित कार्यालय प्रधान मुख्य वनसंरक्षक (कक्ष भू-प्रबंध) मध्यप्रदेश, भोपाल के पत्र क्रमांक/एफ-1/857/2025/FP/MP/SRY/492034/2024/187, 188 दिनांक 15.01.2025 द्वारा दिये गये निर्देशानुसार पत्र में उल्लेखित समस्त अधिरोपित शर्तों (शर्त क्रमांक 1 से 19 तक) का पूर्णरूपेण अनुपालन करते हुये एवं आवेदक विभाग/संस्थान से कराते हुये कार्य प्रारंभ करने दिया जावे। आप स्वयं कार्य के दौरान क्षेत्र की सतत मॉनिटरिंग किया जाना सुनिश्चित करें तथा अधिनस्त परिक्षेत्र सहायकों/बीट गार्डों की ड्यूटी लगाई जावे।
- आवेदक संस्था- M/s Gemco kati Exploration Private Limited, Address: 34 Bapat Nagar, Nagpur Road, Chandrapur District - Chandrapur (Maharashtra) - 442401 की ओर उपरोक्त विषयांतर्गत संदर्भांकित आपके पत्र दिनांक 24.01.2025 के तारतम्य में सूचनार्थ एवं आवश्यक कार्यवाही हेतु अग्रेषित। कृपया तत्संबंध में इस वनमंडल के संबंधित उपवनमंडलाधिकारी लांजी (सा.) उपवनमंडल एवं वन परिक्षेत्र अधिकारी पूर्व लांजी/पश्चिम लांजी (सा.) परिक्षेत्र से सम्पर्क स्थापित कर उपरोक्त संदर्भित पत्र में दिये गये निर्देशानुसार प्रकरण में जारी सैद्धांतिक स्वीकृति कार्यालय प्रधान मुख्य वन संरक्षक (कक्ष भू-प्रबंध) म.प्र. भोपाल के पत्र क्रमांक/एफ-1/857/2025/FP/MP/SRY/492034/2024/187, 188 दिनांक 15.01.2025 में उल्लेखित समस्त अधिरोपित शर्तों (शर्त क्रमांक 1 से 19 तक) में दिये गये निर्देशों का पूर्णरूपेण अनुपालन करते हुये उपरोक्त संबंधित क्षेत्रीय वनधिकारियों के मार्गदर्शन एवं देखरेख में कार्य प्रारंभ करने का कष्ट करें।

संलग्न :- उपरोक्तानुसार।

(अधर गुप्ता)
भा.व.से.

वनमंडल अधिकारी
दक्षिण (सा.) वनमंडल बालाघाट
बालाघाट, दिनांक 29/01/2025

E:\Computer 2\DM\Project\FCA 2.0 Cases\GEMCOKATI EXPLORATIONS\Bhursadongri - Murum Block\Memo.docx



दिनांक: 07/04/2025

सेवा मे,

वन परिक्षेत्र अधिकारी पश्चिम लांजी/ पूर्व लांजी (सा.) परिक्षेत्र,

जिला- बालाघाट, मध्य प्रदेश

विषय:- वन मंडल दक्षिण बालाघाट के वन परिक्षेत्र पूर्व लांजी एवं पश्चिम लांजी के अंतर्गत विभिन्न कक्षाओं के रकबा 9031 हेक्टेयर वनभूमि में Reconnaissance Survey (G-4) for PGE Vanadium & associated minerals Bhursadongri-Murum Block में M/S जेमको काटी एक्सप्लोरेशन प्राइवेट लिमिटेड, चंद्रपुर, महाराष्ट्र-442401 के द्वारा Pitting , Trenching एवं sampling का कार्य पूर्ण करने के संबंध।

महाशय,

उपर्युक्त विषय के संबंध में वनमण्डल अधिकारी के पत्र क्रमांक तकनीकी/677 दिनांक 24-01-2025 के संदर्भ में M/S जेमको काटी एक्सप्लोरेशन प्राइवेट लिमिटेड, चंद्रपुर, महाराष्ट्र-442401 के द्वारा , Bhursadongri-Murum Block में Pitting, Trenching एवं sampling का कार्य समस्त नियमों एवं शर्तों का पालन करते हुए दिनांक 01-04-2025 तक वन विभाग के कर्मचारियों की उपस्थिति में पूर्ण कर लिया गया है।

कार्य का विवरण:-

1. Pitting के दौरान 9 Pit प्रत्येक 1m*1m*2 m से 500g के कुल 27 सैपल संग्रहित किये गये - कुल 27 सैपल 13.5 kg.
2. Trenching के दौरान 10 Trench प्रत्येक 1m*1m*15 m से 500g के कुल 150 सैपल संग्रहित किये गये। - कुल 150 सैपल 75kg.
3. Pitting एवं Trenching के पश्चात Pits एवं trenches को नियमानुसार पूरी तरह से पहले जैसा समतल कर दिया गया है।

अतः M/S जेमको काटी एक्सप्लोरेशन प्राइवेट लिमिटेड, चंद्रपुर, महाराष्ट्र-442401 वन विभाग के समस्त अधिकारियों एवं कर्मचारियों का कार्य के दौरान सहयोग प्रदान करने के लिए आभार व्यक्त करती है।

संलग्न:-

1. पीट एवं ट्रेंच फोटोग्राफ्स

भवदीय
VP- Project & Planning

Subrata Sarkar
07.04.2025
सुब्रत संस्कार (4044208B00)

वाइस प्रेसिडेंट (प्रोजेक्ट एवं प्लानिंग)

जेमको काटी एक्सप्लोरेशन प्राइवेट लिमिटेड

चंद्रपुर, महाराष्ट्र-442401

प्रतिलिपि:-

1. अपर प्रधान मुख्य वन संरक्षक (भू- प्रबंध), भोपाल मध्य प्रदेश
2. मुख्य वन संरक्षक, वन व्रत, बालाघाट मध्य प्रदेश
3. वनमण्डल अधिकारी (सा.) वनमण्डल , जिला- बालाघाट मध्य प्रदेश
4. उप वन मण्डल अधिकारी लांजी (सा.) उप वन मण्डल , जिला- बालाघाट मध्य प्रदेश

Corp Off : E77, MIDC, Chandrapur, 442401

Regd Off : PLOT NO. 34, BAPAT NAGAR, CHANDRAPUR 442401, MAHARASHTRA

CIN : U14292MH2010PTC211467

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