



**Geological Report on Reconnaissance Survey (G-4 stage) for Iron Ore in
Arewada–Hitapadi Block (27 sq. km), District: Gadchiroli, Maharashtra.
(Toposheet No. 65A/11)**

Under

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Commodity – Iron ore**

By

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Banded Hematite Quartzite



Outcrop of Banded Hematite Quartzite

GK/GR/2025/IRON/AREWADA-HITAPADI/NMET/13

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AREWADA - HITAPADI BLOCK

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CHAPTER-01

कार्यकारी सारांश

स्वीकृत टीसीसी, एनएमईटी, वित्तीय वर्ष 2024-2025 की कार्यक्रम के अनुसार, जेमको काटी एक्सप्लोरेशन प्रा. लि., जो कि चंद्रपुर की एक अधिसूचित निजी अन्वेषण एजेंसी (NPEA) है, द्वारा गढ़चिरोली जिले के भामरागढ़ तहसील के अरेवाड़ा-हिटापाड़ी ब्लॉक में लौह अयस्क अन्वेषण (G4) किया गया। इस अन्वेषण का उद्देश्य “लौह अयस्क खनिजीकरण की संभाव्यता का आकलन करना और खनिजीकृत पट्टियों/बैंडों/क्षेत्र का सीमांकन करना” था।

अध्ययन क्षेत्र (27 वर्ग किमी) टोपोशीट संख्या-65A/11 में आता है, जो महाराष्ट्र के गढ़चिरोली जिले की पूर्वी सीमा और छत्तीसगढ़ के कांकेर, बस्तर और दंतेवाड़ा जिलों के पश्चिमी भाग से सटा हुआ है। यह क्षेत्र बहुत समय से विक्षुब्ध है और घने जंगलों, खतरनाक पर्वतीय शिखरों और खड़ी चट्टानों से आच्छादित है। अरेवाड़ा-हिटापाड़ी ब्लॉक 19°23'36" उत्तरी अक्षांश से 19°27'07.82" उत्तरी अक्षांश तथा 80°35'15" पूर्वी देशांतर से 80°39'31.69" पूर्वी देशांतर के बीच विस्तृत है।

ब्लॉक क्षेत्र बेंगपाल और बैलाडिला समूह की अधिसंवित शैल श्रेणियों से युक्त है, जो पश्चिम बस्तर क्रेटन में संरचनात्मक रूप से नियंत्रित है। भूगर्भीय संरचनाओं में बैंडेड हेमेटाइट क्वार्ट्जाइट (BHQ), बैंडेड मैग्नेटाइट क्वार्ट्जाइट (BMQ), गार्नेट युक्त क्वार्ट्ज शिस्ट, ग्रेनाइट ग्नाइस, मिगमैटाइट, हॉर्नब्लेंड शिस्ट और क्वार्ट्ज-सेरिसाइट शिस्ट सम्मिलित हैं। पहचानी गई लौह अयस्क पट्टियाँ उत्तर-पूर्व से दक्षिण-पश्चिम दिशा में प्रवृत्त हैं और इनका डुबान 60 डिग्री से लेकर खड़ी स्थिति तक है। लौह अयस्क बैंड प्रायः पहाड़ी की चोटियों पर और ढालों पर फ्लोट अयस्क के रूप में पाए जाते हैं।

खनिज अन्वेषण कार्य के अंतर्गत 27 वर्ग किमी क्षेत्र का 1:12,500 स्केल पर विस्तृत भूगर्भीय मानचित्रण किया गया तथा 31 प्राथमिक बेडरॉक नमूने, 10 चैनल नमूने, 9 लेटराइट नमूने और 6 चेक नमूने एकत्र कर प्रमुख ऑक्साइड के लिए WD-XRF पद्धति से विश्लेषण किया गया। इसके अतिरिक्त 5-5 नमूनों का पेट्रोग्राफिक, माइनरोग्राफिक और XRD अध्ययन तथा 12 नमूनों का ICP-MS अध्ययन किया गया। बेडरॉक नमूनों में Fe की मात्रा 8.70% से 48.56% तक तथा SiO₂ की मात्रा 18.45% से 73.45% तक पाई गई, जो लौह युक्त संरचनाओं के सिलिका प्रधान स्वरूप को दर्शाती है तथा TiO₂ की मात्रा प्राथमिक बेडरॉक नमूनों में 0.25% तक पाई गई। चैनल नमूनों में Fe की मात्रा 24.69% से 46.76% तक रही। परिणाम दर्शाते हैं कि यहाँ निम्न से मध्यम श्रेणी का लौह अयस्क उपलब्ध है, जिसे लाभकारीकरण द्वारा आर्थिक दृष्टि से संवर्धित किया जा सकता है। लेटराइट नमूनों में Fe की मात्रा 10.19% से 25.87% तक तथा Al₂O₃ की मात्रा 3.82% से 16.02% तक रही। जबकि ICP-MS विश्लेषण दर्शाता है कि BRS में Fe, Nb, Ti एवं V की मात्रा क्रमशः 8546 से

319724 ppm, 10 ppm तक, 925 से 6824 ppm और 16 से 334 ppm तक रही। लेटराइट में Fe, Al, Sn, Mo, Ti एवं V की मात्रा क्रमशः 130291 से 184453 ppm, 38919 से 53898 ppm, 50 से 101 ppm, 1.38 से 2.38 ppm, 1324 से 1556 ppm एवं 232 से 304 ppm तक रही। जबकि स्ट्रीम सेडिमेंट नमूनों में Fe, Mo, Nb, W, V एवं Ti की मात्रा क्रमशः 48629 से 201959 ppm, 12.56 ppm तक, 6 से 31 ppm, 0.71 ppm तक, 129 से 328 ppm एवं 5561 से 25582 ppm तक पाई गई। ब्लॉक में खनिजीकृत पट्टियाँ लगभग 4 किमी की संचयी स्ट्राइक लंबाई और औसतन 8 मीटर की चौड़ाई प्रदर्शित करती हैं। लगभग 3.8 वर्ग किमी क्षेत्र को लौह अयस्क खनिजीकरण के साथ सीमांकित किया गया है।

गवेषणात्मक सर्वेक्षण (G4 स्तर) UNFC (334) आधारित संसाधन आकलन, MEMC 2015 के अनुसार, लगभग 3.36 मिलियन टन लौह अयस्क का अनुमान करता है, जिसमें इनसिटू और फ्लोट अयस्क दोनों सम्मिलित हैं तथा Fe की मात्रा 8.70% से 48.56% तक है। भू-रासायनिक विश्लेषण दर्शाता है कि यह निम्न से मध्यम श्रेणी का लौह अयस्क है, जिसे लाभकारीकरण तकनीकों द्वारा 65% से अधिक Fe सामग्री तक संवर्धित किया जा सकता है। इस क्षेत्र में बेंगपाल नाइस के भीतर महत्वपूर्ण बीएमक्यू (BMQ) एन्क्लेव हैं, जहाँ मार्टिटिसेशन के कारण जल स्तर के ऊपर मैग्नेटाइट हेमेटाइट में बदल जाता है। परिमाणीकरण संबंधी बाधाओं के कारण, G4 चरण में संसाधन आकलन मैग्नेटाइट पर केंद्रित है। लगभग 5 वर्ग किमी क्षेत्र, जिसमें वर्तमान में पहचाना गया 3.8 वर्ग किमी खनिजीकृत लौह अयस्क क्षेत्र शामिल है, का आगे विस्तृत अन्वेषण किया जा सकता है तथा इसे संयुक्त लाइसेंस (CL) के अंतर्गत खनन हेतु प्रस्तावित किया जा सकता है।

Executive Summary

In accordance with the approved programme of the TCC, NMET, for the F.S. year 2024-2025, an investigation was conducted by M/s. Gemcokati Exploration Pvt. Ltd, a Notified Private Exploration Agency (NPEA) of Chandrapur, for Iron Ore exploration (G4) in the Arewada-Hitapadi Block, Tehsil- Bhamragarh, Gadchiroli district. The objective of this investigation was “to assess the potentiality of Iron ore mineralization and demarcation of mineralized lenses/bands/zone”.

The study area (27 sq. km), is falling within the toposheet no-65A/11, located in the eastern most border of Gadchiroli District of Maharashtra and adjacent western most part of Kanker, Baster and Dantewara Districts of Chhattisgarh. The area is more or less disturbed since long back and occupied by dense forest and hazardous mountain peaks and scrap faces. The Arewada-Hitapadi block is bounded by latitude from 19°23'36"N to 19°27'07.82"N & longitude from 80°35'15"E to 80°39'31.69" E.

The block area is characterized by metasedimentary sequences of the Bengal and Bailadila Groups, structurally controlled within the Western Bastar Craton. The geological formations comprise banded hematite quartzite (BHQ), banded magnetite quartzite (BMQ), garnetiferous quartz schist, granite gneiss, migmatite, hornblende schist, and quartz sericite schist. The identified iron ore bodies exhibit a NE-SW strike, with dips ranging from 60 degrees to vertical. The iron ore bands occur as hilltop exposures and float ore along slopes within the Bhamragad Hill Range.

The mineral investigation work involved large scale geological mapping of 27 sq km on 1:12,500 scale and collection and analysis of 31 primary bed rock samples (BRS), 10 channel samples and 9 laterite samples as well as 6 check samples using WD-XRF methodology for major oxides. The study also achieved 5 samples each for Petrographic, Minerographic and XRD studies along with the study of 12 samples using ICP-MS. The Fe content in bedrock samples ranging from 8.70% to 48.56%, with SiO₂ values between 18.45% and 73.45%, indicate a siliceous nature of iron-bearing formations and Titanium oxide (TiO₂) ranges upto 0.25% in primary BRS. Channel samples yielded Fe values between 24.69% and 46.76%. The results suggest the presence of low- to medium-grade iron ore, with the potential for beneficiation to enhance its economic value. The Fe content in the laterite samples ranges from 10.19 to 25.87% and Al₂O₃ value ranges between 3.82 to 16.02%. While the ICP-MS analysis shows that the Fe, Nb, Ti & V content in the BRS range between 8546 to 319724 ppm, upto 10ppm, 925 to 6824 ppm & 16 to 334 ppm respectively. The Fe, Al, Sn, Mo, Ti & V content in the laterite range between 130291 to 184453 ppm, 38919 to 53898 ppm, 50 to 101 ppm, 1.38 to 2.38 ppm, 1324 to 1556 ppm & 232 to 304 respectively. Whereas in the stream sediment samples; Fe, Mo, Nb, W, V & Ti contents vary between 48629 to 201959 ppm, upto 12.56 ppm, 6 to 31 ppm, upto 0.71, 129 to 328 ppm & 5561 to 25582 ppm respectively. The mineralized zones within the block exhibit a cumulative strike length of approximately 4 km, with an average width of about 8 meters. An area of approximately 3.8 sq km has been delineated with iron ore mineralization for CL Block.

The reconnaissance survey (G4 stage) UNFC (334)-based resource estimation, as per MEMC 2015, indicates 3.36 million tonnes of iron ore including insitu ore band and float ore zones with Fe content ranging from 8.70% to 48.56%. Geochemical assays suggest low- to medium-grade iron ore, with potential beneficiation techniques capable of upgrading Fe content to over 65%. The area contains significant BMQ enclaves within Bengal Gneisses, with martitisation altering magnetite to hematite above the water table. Resource estimation at the G4 stage focuses on magnetite due to quantification constraints. An area of about 5 sq. km, containing the currently identified 3.8 sq. km mineralized iron ore zone, can be explored further in detail and mined through composite license (CL).

CHAPTER-02

Introduction

Iron & steel is the driving force behind industrial development in any country. The vitality of the Iron & Steel Industry largely influences a country's economic status. The mining of iron ore, an essential raw material for Iron & Steel Industry is arguably of prime importance among all mining activities undertaken by any country. With the total resources of over **35284 million tonnes of haematite (Fe_2O_3) and magnetite (Fe_3O_4)** as on 01-04-2020, India is one of the leading producers of iron ore in the world.

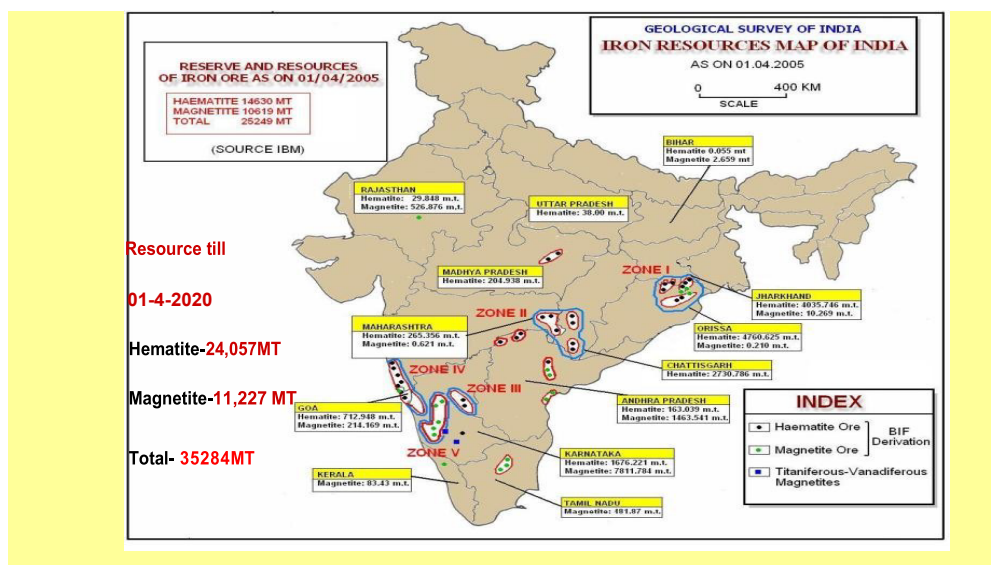
RESERVES/RESOURCES

Haematite and magnetite are the most important iron ores in India. About 79% haematite ore deposits are found in the Eastern Sector (Assam, Bihar, Chhattisgarh, Jharkhand, Odisha & Uttar Pradesh) while about 93% magnetite ore deposits occur in Southern Sector (Andhra Pradesh, Goa, Karnataka, Kerala & Tamil Nadu). Karnataka alone contributes 72% of magnetite deposit in India. Of these, haematite is considered to be superior because of its higher grade. Indian deposits of haematite belong to the Precambrian Iron Ore Series and the ore is within banded iron ore formations.

MAGNETITE:

Magnetite is another principal iron ore that also occurs in the form of oxide, either in igneous or metamorphosed banded magnetite-silica formation. As per NMI database based on UNFC system, the total reserves/resources of magnetite as on **1.4.2020** have been estimated at **35,285 million tonnes** of which 'Reserves' constitute a 202 million tonnes while 11,024 million tonnes are placed under 'Remaining Resources'. Classification on the basis of grades shows that 20% resources are of Metallurgical grade while 80% resources belong to grades that are categorized as Unclassified, Not-known and Coal Washery. The resources of others and Foundry grades constitute meagre proportions.

[Source: -Indian Bureau of Mines (IBM): Indian Minerals Yearbook 2021 (Part- III: Mineral Reviews) 60th Edition IRON ORE (ADVANCE RELEASE)]



2.1 Details of project

The Arewada-Hitapadi Block is a Reconnaissance Survey (G-4) focused on exploring iron ore resources in a 27 sq. km area in Gadchiroli District, Maharashtra. Initiated under India's National Mineral Policy, 2016, this project aligns with the Atmanirbhar Bharat vision to explore non-fuel mineral commodities. It is part of the National Mineral Exploration Trust (NMET), Ministry of Mines initiatives and was approved at a cost of ₹16.58 lakhs, with a completion timeline of 6 months. The project includes reconnaissance geological mapping and geochemical analysis to identify iron ore mineralized zones. Field challenges include dense forest cover and difficult terrain. Below map (Figure 1) shows the Arewada-Hitapadi Block on **Toposheet No. 65A/11 of Survey of India (1:50,000 Scale)**.

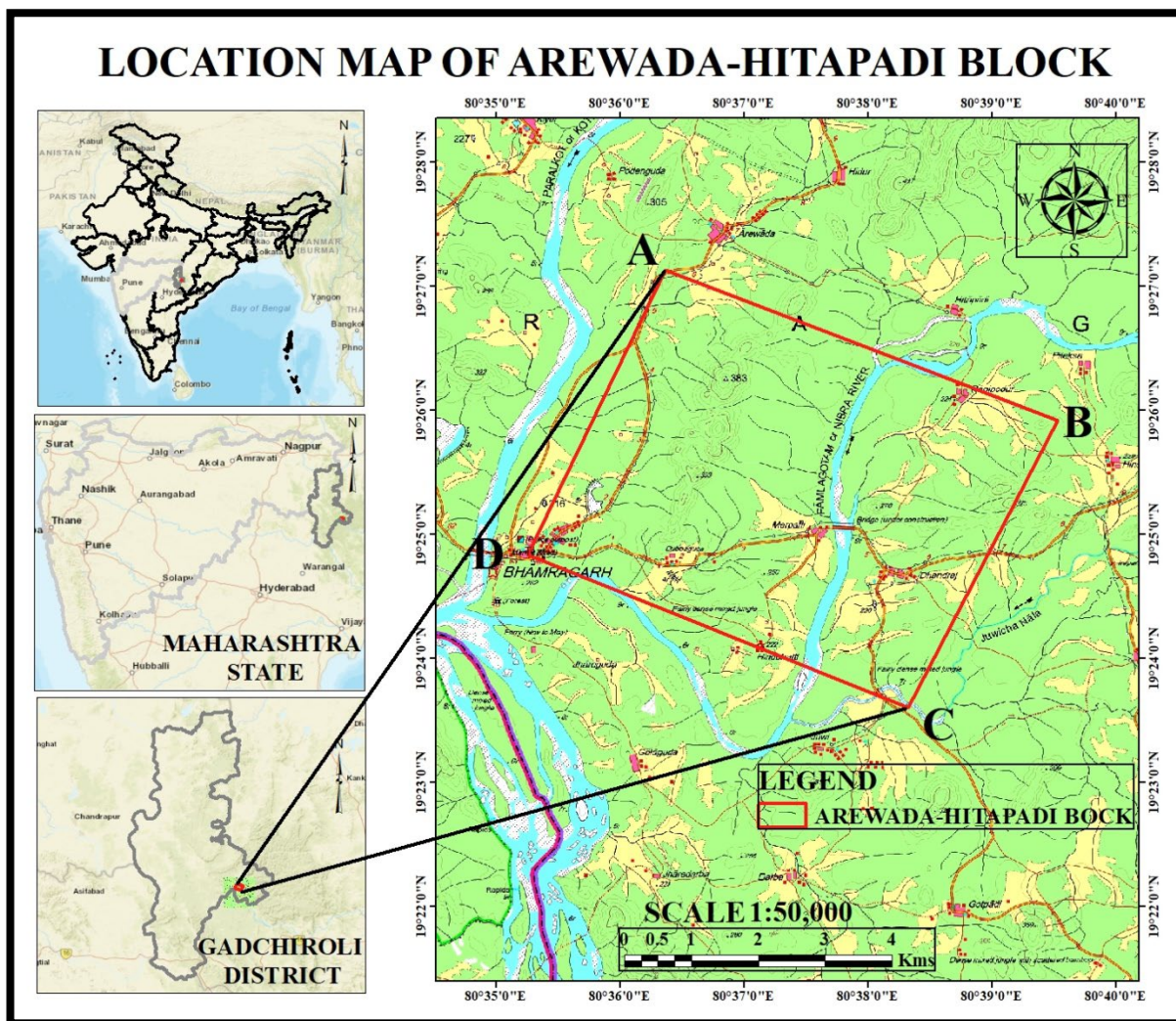


Figure 1. Location map of Arewada-Hitapadi Block. (Source: SOI Toposheet)

The Geological mapping carried out during 1977-78 (In parts of Toposheet-65A/07) by GSI [S.K. Pattanaik & S.K. Sengupta vide Acc.No-CR-013642] comprises metasediments, metabasics, magnetite's and gneisses belonging to the Archaean Bengpal Group of rocks. The area has also seen volcanic activity contemporaneous with the Bengpal deposition. Migmatites and granite gneisses are the most dominant rock types together with variations of schists and BMQ. The BMQ enclaves occurring as long linear hillocks within the gneisses and associated with quartzite in



large scale. The remaining part of the Toposheet was geologically mapped in this part, during F.S-1978-79 (Toposheet-65A/06) by GSI [H.P. Saxena, S.K. Das, B. Zaheer and S.K. Sengupta vide Acc. No- CR-014491].

Recently, Mr. Subrata Sarkar et al. from M/s Gemco Kati Exploration Private Limited, NPEA's from Chandrapur explored in Gadchiroli over an area of 440 Sq. km. (In parts of Toposheet-65A/06,07 &10) and reported Iron ore. The 5 G4 reports are available in the public domain of NMET portal.

Out of 15,433 sq.km area of Gadchiroli District, almost entire area is unexplored, except few 100 sq km areas in the western part bordering Chandrapur District & 440 sq km in the eastern part Gadchiroli Dist. Therefore, hardly any exploration data is available for this area in public domain. With this backdrop this item was proposed.

In the instance of 53rd, 67th and 70th Technical-cum-cost committee (TCC) of NMET meetings and subsequently, the Executive Committee (EC) in its 37th and 38th EC meeting held on 29th November 2024, has approved the **“Arewada-Hitapadi Iron Ore Block-27 sq km”**, to M/s. Gemcokati Exploration Pvt. Ltd, a Notified Private Exploration Agency (NPEA) of Chandrapur.

The work has been executed under DDG SU:MH, Pune vide Office Memorandum (OM) NO- File No. 23/529/2024-NMET/757, New Delhi, dated the 06th January 2025 during F.S-2024-25 for a period of 6 months. During the final review in **80th TCC-I, NMET** meeting, held on dated **29th August 2025**, the project report was approached to submit before **31st August 2025**.

Accordingly, the investigation was carried out in the area within the Bhamragarh Tehsil, Gadchiroli District, Maharashtra, under the guidance and supervision of Subrata Sarkar, Vice-President, Gemco Kati & Director (R), G.S.I. and successfully accomplished with finalization of report in association with his team members. The sequence of project schedule in time bound manner is tabulated below:

Name of the Block	Commodity	Stage	Duration	Approved. cost
Reconnaissance Survey for Iron ore In Arewada-Hitapadi Block (27 sq. Km), District: Gadchiroli, Maharashtra, (G-4)	Iron Ore.	G4	06 months (Initially approved)	Rs-16,57,688/ Including GST
Objective	To assess the potentiality of Iron Ore and demarcation of mineralized zone.			

FLOW CHART OF THE PROJECT ACTIVITIES AND TIME SCHEDULE		
01	In Principle Approval from DGM, MS.	Received vide letter No-Tech/1842/2023/1518, dated the 09 th May 2023.
02	1 st Approval from TCC, NMET Secretariat, MoM, New Delhi.	<p>The proposal presented during 53rd TCC, NMET held on hybrid mode, dated the 24th May 2023, where, the committee suggested to submit the proposal after the outcome of the adjacent blocks.</p> <p>Submitted during 67th TCC, NMET held online, dated the 25th July 2024 after incorporating encouraging analytical values of Iron Ore from the block areas. The committee recommends the proposal for the approval of EC for "Reconnaissance Survey (G4) for Iron Ore in Arewada – Hitapadi area, District: Gadchiroli, Maharashtra." with an estimated cost of Rs. 56.35 lakhs (including GST) within time schedule of 08 months and submission of report as per Annexures 7A & 7B. The item will be reviewed after 04 months.</p>
03	Letter from DGM, MS	A letter from DG, DGM, Maharashtra received through e-mail which informed about the overlapping with PL block of M/s JSW steel Ltd. which was not known previously. Total 27.76 Sq km areas can be available if 42.24 Sq. km. area granted previously under PL to M/S JSW steel Ltd is excluded. The matter is sub-judice and pending in Honourable Supreme Court.
04	1 st Approval from EC	<p>Approved subjected to revision of area and further assessment of cost by TCC by the 37th EC meeting, held on 23rd September 2024.</p> <p>Discussion: DS & HoD, NMET informed the house that the proposal of M/S GemcoKati Pvt. Ltd. pertaining to iron ore exploration in Arewada-Hitapadi block of Maharashtra is a subjudice block. DGM, Maharashtra informed that out of 69 km² proposed by M/s GemcoKati 42 km² area is subjudice but exploration is feasible in the remaining 27 km² area. After discussion, it was decided that the project be approved subjected to obtaining clarification from DG, DGM, Maharashtra about the area that is not in dispute as well as examination of cost for the reduced area by TCC.</p>
05	2 nd Approval from TCC, NMET Secretariat, MoM, New Delhi.	Resubmitted the Block after reducing the overlapping area during 70 th TCC held on dated 25 th October 2024. The committee approved the modified block and the revised cost recommended Rs. 16.58 lakhs with 6 months timeline as in Annexure 9A & 9B.
06	2 nd Approval from EC	Received final approval from the 38 th EC meeting, held on 29 th November 2024 and OM dated 6 th January 2025
07	1 st Review	The 73 rd TCC-1 which was conducted on 30 th & 31 st January 2025 recommended to present the integrated map, details of sampling & analytical results in next TCC-1 meeting.
08	2 nd Review	The 76 th TCC-1 which was conducted on 30 th April & 31 st May 2025 suggested that quality of map may be improved and presented in upcoming 77 th TCC-I.
09	3 rd Review	The 77 th TCC-I did not approve for peer review of the GR. The committee instructed Gemcokati Pvt. Ltd to incorporate the suggestions in report and present again in the next TCC-I meeting. The meeting was held on 26 th & 27 th May 2025 through video conferencing.
10	4 th Review	The 78 th TCC-I recommended a timeline extension of 2 months upto 31.08.2025 for additional analysis and submission of GR. The meeting was held on 26 th , 27 th & 30 th June 2025 through video conferencing.
11	Submission of Report	The approval for final submission of the Geological report was obtained on 29th August 2025 during the deliberation of final review in 80th TCC-I before 31st August 2025 .

2.2 Investigating agency

The investigation for the Reconnaissance Survey (G-4) in the Arewada-Hitapadi Block is being carried out by **Gemco Kati Exploration Private Limited**, a reputed agency headquartered in Chandrapur, Maharashtra. The company is entrusted with executing detailed geological, geochemical studies in the 27 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). Key personnel leading this project include Subrata Sarkar (Project & Planning), Dr. Vinay Sahay, Senior Manager (Geology), Suraj Vidhate, Ramraj Patel, Nitin Baghel, Vijay Kumar, Devika Nagpure and Amit Sahoo (Junior Geologists). 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

2.3 Objectives of investigation

The objective of proposing this item is to assess the potentiality of Iron Ore and for demarcation of mineralized zone through surface sampling and results of chemical analysis.

On the basis of evidences of mineralization as witnessed during first field visit, the present exploration programme (G4) has been finally proposed to fulfill the following objectives.

- 1) To carry out Geological mapping on 1:12,500 scale for demarcation of mineralized zone (BIF) and Iron ore bearing host rock with the structural features to identify the surface manifestations and lateral disposition of the mineralized zones.
- 2) To collect bedrock samples of ore zone and to analyze for Major Oxides through WD-XRF.
- 3) To collect petrological and mineralogical samples of selected host rocks to study petrographic characters and chemical composition of rocks respectively.
- 4) To analysis of check samples.
- 5) Finally, to demarcate the mineralized zones for facilitating auctioning process by DGM, Maharashtra.

2.4 Basis for taking up investigation

(A) The proposed area falls under Western Bastar Craton which hosts numerous Iron Ore occurrences along three distinct parallel arcuate ridges starting from Surjagad Hill range in the north (65A/06) to Damkod Wadvi Hill Range (65A/06 & 65A/10) in the middle and Bhamragad Hill Range (65A/11) in the southern most part.

(B) DGM Maharashtra is the pioneer Govt. Agency in initiating the investigation during 1963-64 and continued till 1970-71 in the Surjagarh Hill range.

(C) The proposed block falls within the Bhamragad Hill Range (65A/11), where Iron ore is seen exposed on hill tops with spreading of float ore in the slope.

(D) The exploration work in this part has not been advanced since 1980 however, 5 (G4) blocks have been explored recently in the adjacent areas on Damkodwadi Hill range and further south with NMET funding by Gemco Kati Exploration (P) Ltd.

(E) In view of potentiality of the area as detailed above, the area was scanned through limited field work by the Officials of Gemco Kati and collected few Grab samples, yielding grade of Iron ore from 27.84% to 49.59 % (Total Fe).

(F) The area seems to be potential and need to be explored and proper geological report to be brought out with resources of Iron ore under UNFC G4 stage to facilitate State Govt for initiating auctioning process.

2.5 Details and nature and quantum of work proposed vs achievement

Table 1. Below table shows the approved and achieved nature, quantum and type of work.

Nature and Quantum of Work vs. Achievement				
S.N.	Components	Quantum	Achievement	Remarks
1(A)	Geological Mapping			
	Geological Mapping, (1:12,500 scale)	27 sq. km	27 sq. km	Achieved successfully.
1(B)	Collection of surface samples			
	BRS, Channel Sampling	50	50	Achieved successfully.
2	Laboratory Studies			
2.1	ICPMS for 34 Elements	10	12	Analysis was carried out by the Shiva Lab. Bengaluru.
2.2	Major Oxide Analysis			
	Estimation of major oxides by XRF/whole rock analysis for primary samples (CaO, MgO, SiO ₂ , Al ₂ O ₃ , LOI, Na ₂ O, Fe ₂ O ₃ , MnO, K ₂ O, TiO ₂ , SO ₃ , P ₂ O ₅ , Cr ₂ O ₃ , ZnO, V ₂ O ₅)	50 (40 BRS & 10 channel samples)	50	Analysis was carried out by the Shiva Lab. Bengaluru.
2.3	Check samples	5	5	Analysis was carried out by the JNARDDC, Nagpur
3	Physical & Petrological Studies			
3.1	Preparation of thin section	5	5	The studies were carried out from G.S.I, C.R, Nagpur and JNARDDC,
3.2	Petrological report of thin section	5	5	
3.3	Preparation of polish section	5	7	

3.4	Minerographic report of rock sample	5	7	Nagpur
3.5	Digital Photographs	5	5	
3.6	XRD Studies	5	7	

2.6 Personnel involved

The Arewada-Hitapadi Block investigation is led by a team of experienced professionals from Gemco Kati Exploration Private Limited, ensuring a thorough and systematic exploration process. The key personnel included:

1. **Subrata Sarkar:** Vice President (Project & Planning) served as the leader & guiding authority and supervised each phase of the project planning & execution, ensuring adherence to the proposed timeline and objectives.
2. **Junior Geologists:** Geological mapping and sampling activities are conducted by **Chinmay Rout, Ramraj Patel, Suraj Vidhate, Nitin and Vijay Kumar.**
3. **GIS & Maps:** Additionally, **Devika Nagpure** contributes by preparing GIS data and maps, which are critical for visualizing geological details.
4. **Chemical Analysis:** Analysis was performed by **Shiva Analytical (India) Pvt. Ltd., Bengaluru,** and **JNRRDC, Nagpur.**
5. **Petrographic and XRD Study:** Petrographic sample processing and XRD studies were conducted by the **Geological Survey of India, CR, Nagpur** as well as **JNARDDC, Nagpur.**

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

2.7 Mode of operation of different work components and associated agency

The mode of operation for the Arewada-Hitapadi Block investigation involves a combination of fieldwork, laboratory analyses. Geological mapping at a scale of 1:12,500 is conducted to delineate the surface features, rock types, and structural anomalies and sampling. Chemical analysis of collected samples is performed at accredited laboratories to identify anomalous concentrations of iron ore. Petrographic studies are conducted to examine mineral textures and compositions.

2.7.2-Chemical analysis:

For Primary Samples using WD-XRF & ICPMS

- 1) Shiva Analyticals (India) Private Limited, Hospet, Bengaluru. (NABL accredited Standard ISO/IEC 17025:2017 & Cert. no.- TC-12626 with issue date- 31/01/2024 and valid until 30/01/2026)

For Check Samples using WD-XRF

- 2) JNARDDC, Nagpur.

2.7.3-Petrographic, Minerographic and XRD studies.

- 1) GSI, CR, Nagpur.
- 2) JNARDDC, Nagpur

2.8 Acknowledgement

The authors express their sincere thanks to Mr. Jijo George, Director & CEO, for his dynamic leadership and constant motivation, to Mr. Nigel Job, Director & CFO, for all out administrative and financial support. The authors are thankful to the members of the TCC, NMET for giving us an opportunity, that make us possible in bringing out a G4 report successfully from this extremely difficult terrain of Gadchiroli District. We owe our thanks to all our stake holders and service provider for their valuable contributions from time to time in successful completion of the assignment. The authors are grateful to Sri. Sarat Kumar Jena, the Reviewer for improving the manuscript of the report. Help and co-operation extended by all individuals either in the Office or in the laboratory are gratefully acknowledged. Finally, expressing our sincere thanks to all members of Gemco Kati family, for their enormous support during the entire period of investigation.

CHAPTER-03

Property description

3.1 Village Name, District, State, and Toposheet Number:

The Arewada-Hitapadi Block is located in the villages of Arewada in Bhamragarh Tehsil, Gadchiroli District, Maharashtra, India. The survey is conducted on Toposheet No. 65A/11, covering an area of 27 sq. km. Table 2 given below shows the block related location and accessibility information.

Table 2. Shows location and accessibility information

Tehsil/Taluk	Bhamragarh
District	Gadchiroli
State	Maharashtra
Toposheet Number	65A/11
Nearest Rail Head	Balharshah is the nearest Railway Station operated by Central Railways connecting Nagpur via Chandrapur Station. The distance being 210 Km from the Block area.
Road	The study area is well connected with Nagpur/Chandrapur towns by State Highway and accessible throughout the year via Bhamragad, Allapalli and Ashti, which is about 200 km from Chandrapur and 350 Km from Nagpur Town.
Airport	Nagpur Airport: 320 km from Block area.

3.2 Geo-Coordinates of Corner Points:

Table 3. The block's boundary is defined by the following coordinates:

Corner points	Longitude			Latitude		
(A)	80 ⁰	36'	21.66"	19 ⁰	27'	07.82"
(B)	80 ⁰	39'	31.69"	19 ⁰	25'	54.91"
(C)	80 ⁰	38'	19.00"	19 ⁰	23'	36.00"
(D)	80 ⁰	35'	15.00"	19 ⁰	24'	50.00"

3.3 Land Use/Cover and Forest Type:

The area is forming a flat terrain with small inselberg in between. The part of the area displays moderately high relief with high hills and hill-ranges. The hill ranges are trending NE-SW being covered by fairly dense mixed jungle mainly Bushes and Bamboo is designated as forest land. The rest of the area are private land, where seasonal agriculture is practiced in the valley part.

3.4 Free Hold/Lease Hold Details:

The block includes both freehold agricultural lands and state-owned forest land.

3.5 Location and Accessibility:

The study area is well connected with Nagpur/Chandrapur towns by State Highway and accessible throughout the year via Bhamragad, Allapalli and Ashti, which is about 200 km from Chandrapur and 350 Km from Nagpur Town. Balharshah is the nearest Railway Station operated by Central Railways connecting Nagpur via Chandrapur Station. The distance being 210 Km from the Block area. Nearest airport is Nagpur which is about 320 km from the block.

3.6 Climate: (Source: Indian Meteorological Department)

The area is having dry and partly humid climate. The southwest monsoon commences from June and continuous till September. The winter starts from late October/early November and continue to February.

Mean annual rain fall-The area experiences an annual average rainfall of about 140 cm during monsoon between June to October. A thick soil cover aided by a good rainfall has given rise to moderately thick vegetation cover forming deciduous type of forests.

Temperature-The highest and lowest temperatures of the area vary between 45°C and 15°C. May is the hottest month whereas, December is the coldest month of the season

3.7 Flora and Fauna: (Source: Chandrapur Forest Publications)

The forest of Gadchiroli endowed with mainly important species viz. Teak, Bija, Ain, Hirda, Haldu, Shivan, Moha, Salai, Movai, Dhawda, Khair, Tendu etc. tree species found growing luxuriantly. The Gadchiroli area is home to many species of wild animals like tiger, leopard, jungle cat, sloth bear and wild dog, wild boar, spotted deer, sambar, barking deer, blue bull, jungle cat, jackal, peacock, jungle fowl and flying squirrel. Many of the species are included under the endangered species' list.

3.8 Geomorphology: (Source: Satellite and SOI topographic maps)

Geomorphologically, this area is under denudation process with Pediment-Pediplain complex, residual hills with granitic litho-type. Resistant Banded Iron Formation represent structural hills with less denudational effect. The area exhibits a matured topography having attained peneplanation and surrounded by high hills. The area is represented by hilly forested terrain with intermittent valleys in between the block area. The relief difference is not much, the highest and lowest points being 521m in Kuku towards the North Meta and 220m in Dhandraj towards the south respectively.

Streams are flowing along the slope from NE-SW. Streams are complex anastomosing which reflects the terrain is a part of folded sequence. Streams are structurally controlled as it signifies normal faulting along the older folded beds. These streams join later to or small rivulets which can be categorized as second/ higher order streams, the prominent being Nibra River flowing NE-SW in the western part (outside of the block area), a perennial tributary which flows in the block area. All first and second/higher order streams are directly draining to main Nibra river.

3.9 Infrastructure Facilities, Population & Socio-economic condition:

Majority of the villages are small with very low population density. The socio-economic condition of the area is extremely pitiable with the inhabitants belonging to tribal (Adivasi) community. The literacy rate is very poor. Life

sustainability for an average villager is solely based on seasonal paddy cultivation and forest products including Bamboo and Tendu leaf etc. Many are engaged as migrant labourer in adjacent Towns.

Villagers depend on bore-wells and few dug wells for water supply. Hand pumps are the source for potable water. There is scarcity of water in summer seasons since the rivers and Nala's dry out. Power/electricity supply is available to all villages. Fuel outlets are only available in Etapalli & Bhamragarh. No regular transport services are available between interior villages and adjacent Towns due to poor road network. Mobile network facility is extremely poor in this part. The Sub-Police Stations in this area operates only through wireless communication.

3.10 National Parks, Archaeological and Historical Sites & etc.:

The charpala wildlife sanctuary is located in the Gadchiroli district of Maharashtra. spread over an area of approx. 140 km, it has thick forest growth with occasional stretches of grass lands. Wadadam Fossil Park is located in a village known as Wadadam in Sironcha taluka in the district of Gadchiroli of Maharashtra State. It is about 19 km from Sironcha and about 189 km South of District Headquarters Gadchiroli. In India, Sironcha is one of the five places in the country where a large number of fossils have been discovered. A full skeleton of a dinosaur was unearthed in 1959 in Kothapalli-Pochampally village, this fossil has been kept in National Museum in Kolkata.

Few places of tourist interest in Gadchiroli are an old temple in Armori, stone circle in Arsoda, group of twenty cromlechs or Kistvaens in Chamurshi, rock caves in Jharapapra, Group of Temples in Markanda, Fortress of Tipagarh in Murumgaon, large Temple in Thanegaon, Fort wall and Temple of Bhandareswar in Waira.

CHAPTER-04

Previous works

4.1 A very brief note on previous work

Pascoe (1950) mention the geology of Bengpal Group in parts of eastern Maharashtra and western Chhattisgarh in "A Manual of Geology of India & Burma". The Directorate of Geology and Mining (DGM), Maharashtra State (MS), carried out exploration for iron ore in the Surjagarh area by C. N. Chari et al. between 1967 and 1975. The first systematic geological mapping of this area, within Toposheets 65A/06 and 65A/10, was conducted during 1977-78 (including parts of Toposheet 65A/07) by the Geological Survey of India (GSI), under the supervision of S.K. Pattanaik and S.K. Sengupta (Acc. No. CR-013642). The area consists of metasediments, metabasics, magnetites, and gneisses belonging to the Archean Bengpal Group of rocks. In the field season 1978-79, Shri H.P. Saxena, S.K. Das, B. Zaheer, and S. K. Sengupta mapped the remaining part of the Toposheets. Further mapping of parts of Toposheets 65A/06, 65A/07, and 65A/11 was carried out by S.S. Jain and S. K. Pattanaik during the same field season (1978-79). Additionally, a regional integrated survey to locate base metal occurrences through stream sediment surveys in the southeastern extension of the Chamursi-Ghot belt, covering parts of Toposheets 65A/02 and 65A/06, was undertaken by T. Krishnama Charlu and K. Kumaran during the 1978-79 field season. A preliminary appraisal of sillimanite occurrences near Gundapuri was conducted by K. Kameswar Rao during the 1980-81 field season. Furthermore, a preliminary appraisal of the reported base metal occurrences in Bhandara and Gadchiroli districts was carried out by Shyamal Kumar Sengupta and Swapan Kumar Das during the 1982-83 field season.

In the year 1976-77, Aftab Ahsan carried out geological mapping in the area of Toposheet No. 65A/11 and classified the Pre-Cambrian metasediments into older Arewada Group and younger Bhamragarh Group and correlated these with the Bengpals and Bailadilas of Bastar & Jeypore area. According to him the contact between the Arewada and the Bhamragarh is unconformable, marked by conglomerate. The structural, lithological and stratigraphical similarities between the Arewada and Bhamragarh groups of rocks on the one hand and the Bengpal and Bailadila groups of rocks on the other hand are so striking that these have to be considered to represent the NW continuity of the Bastar rocks. The oldest meta-sedimentaries in the area are the Arewada group, developed around Arewada village. Although-separated by a wide stretch from the typical area of the Bengpal group, these litho units have great resemblance with each other. In this area metasediment occurring mostly as enclaves within the migmatitic assemblages, are nowhere seen over great strike length. The migmatisation has resulted in large scale homogenization of the resultant rock. The younger lithologic unit commencing from the basal conglomerate horizon upto banded hematite quartz have been included in Bhamragarh group named after the neighbouring village. The units of this group have striking resemblance to those of the typical Bailadila group. The areal extent of Bhamragarh group is limited and the rock types included under it are conglomerate, grits, quartzite, shales and schists and banded hematite quartzite. The Arewadas are represented by quartzite, sericite quartz schist, banded magnetite-quartzite tremolite-actinolite schist, talc-chlorite schist, migmatite and granite gneiss representing the sedimentary volcanic facies of rocks.

4.2 Details of pervious exploration/investigation

Jain and Pattnaik (1979) documented Quartzite/Banded Magnetite Quartzite assemblage of rocks occurring as thin bands, isolated hillocks are seen as enclaves in the gneissic terrain. Prominent outcrops of these are seen at 2.3 km NNE & 2.6 km NW of Tirkametta, 3 km WNW of Kumarguda, 1.5 km WNW of Hodri, & 2 km S80°W of Palli, 3.5 km N80°W of Bejur, 1 km NE of Rapelli, 1.5 km NE of Rela, 0.8 km S10°E of Malampodur, 1 km N80°W of Gunjur, 1.4 km N25°E of Nelgunda and 4.5 km NW of Tirkametta. These bands vary in width from a few metres to 700 meter and are traceable in length up to a maximum of 4 km. The quartzites have sharp contact with the gneisses. At 3 km N65°W of Bejur, grunerite is seen associated with magnetite quartzites. Across strike the BMQ's grade into hard massive quartzites. Banded iron formation of the Bhamragarh group represents the main iron ore bearing horizon of this area. Other less important horizon is the magnetite quartzite of Arewada group. These are low grade iron ores. The grab sample analysis ranges generally from 28% to 40% Fe and one sample has given 63% Fe content. In the year 1976-77, Aftab Ahsan carried out geological mapping in the area of Toposheet No. 65A/11 and classified the Pre-Cambrian metasediments into older Arewada Group and younger Bhamragarh Group and correlated these with the Bengpals and Bailadilas of Bastar & Jeypore area. According to him the contact between the Arewada and the Bhamragarh is unconformable, marked by conglomerate. The areal extent of Bhamragarh group is limited and the rock types included under it are conglomerate, grits, quartzite, shales and schists and banded hematite quartzite. The Arewadas are represented by quartzite, sericite quartz schist, banded magnetite-quartzite tremolite-actinolite schist, talc-chlorite schist, migmatite and granite gneiss representing the sedimentary volcanic facies of rocks.

Recently, Mr. Subrata Sarkar et al. from M/s Gemco Kati Exploration Private Limited, NPES's Chandrapur explored in Gadchiroli over an area of 440 Sq. km. (In parts of Toposheet-65A/06,07 &10) and reported Iron ore. The 5 G4 reports are available in the public domain of the NMET portal.

CHAPTER-05

Geology of the area

5.1 Arial reconnaissance

The Arewada-Hitapadi Block exhibits a diverse geomorphological and topographical setting. Geomorphologically, the landscape is shaped by an active fluvial system, as evidenced by the meandering river that traverses the block, depositing sediments along its course. The combination of dense forest cover with hilltops indicates differential weathering, where more resistant formations remain prominent. The topography of the block is characterized by varying elevations, with undulating to hilly terrain interspersed with flatter valley areas. Steeper slopes are noticeable near elevated regions, whereas gentler slopes support agricultural and settlement activities. The well-developed drainage network suggests efficient surface water flow, contributing to groundwater recharge in the region.



Figure 2. Above map shows the location of Arewada-Hitapadi Block in satellite imagery.
(Source: Google Earth Pro)

5.2 Regional geological set up and Stratigraphy

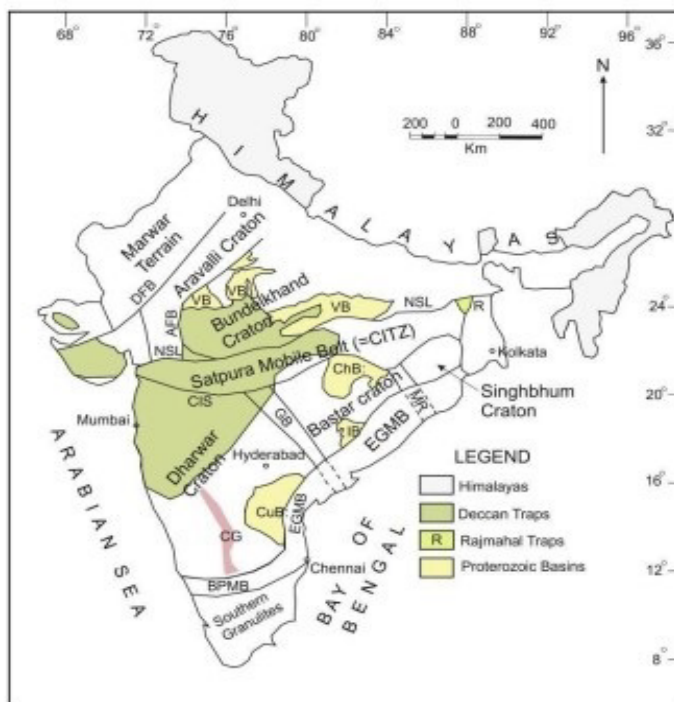
Meta-sedimentaries of the block area bear close lithological and mineralogical similarities with the rocks of Bengpal Series and the Bailadila Series described by Crookshank (1963) in the adjoining Bastar and Jeypore areas and are, therefore, assigned to similar stratigraphic positions. The metasediments show varying grade of metamorphism and also show variation in ferruginous contents and can be sub divided into two groups. One group consists of high grade metamorphites and is low in ferruginous contents as compared to the second group which comprise low grade metasediments having more proportion of ferruginous rocks. The older group included under the Bengpal consists of sillimanite quartzite, pyroxene/amphibole quartzite, quartzite, BMQ, kyanite mica schist, quartz mica schist and pyroxene gneisses. The younger group of rocks included under the Bailadila Group (Surjagarh) is represented by quartzite/banded hematite quartzite, ferruginous shales, quartz sericite schist/phyllite, iron ore, concordant altered ultramafics represented by chlorite schists, etc.

Jain and Pattnaik (1979) documented Quartzite/Banded Magnetite Quartzite assemblage of rocks occurring as thin bands, isolated hillocks are seen has enclaves in the gneissic terrain. Prominent outcrops of these are seen at 2.3 km NNE & 2.6 km NW of Tirkametta, 3 km WNW of Kumarguda, 1.5 km WNW of Hodri, & 2 km S80°W of Palli, 3.5 km N80°W of Bejur, 1 km NE of Rapelli, 1.5 km NE of Rela, 0.8 km S10°E of Malampodur, 1 km N80°W of Gunjur, 1.4 km N25°E of Nelgunda and 4.5 km NW of Tirkametta. These bands vary in width from a few metres to 700 meter and are traceable in length up to a maximum of 4 km. The quartzites have sharp contact with the gneisses. At 3 km N65°W of Bejur, grunerite is seen associated with magnetite quartzites. Across strike the BMQ's grade into hard massive quartzites. Banded iron formation of the Bhamragarh group represents the main iron ore bearing horizon of this area. Other less important horizon is the magnetite quartzite of Arewada group. These are low grade iron ores. The grab sample analysis ranges generally from 28% to 40% Fe and one sample has given 63% Fe content.

The structural, lithological and stratigraphical similarities between the Arewada and Bhamragarh groups of rocks on the one hand and the Bengpal and Bailadila groups of rocks on the other hand are so striking that these have to be considered to represent the NW continuity of the Bastar rocks. The rocks of older Arewada group are repeatedly folded and have suffered varying degrees of metamorphism corresponding to the polyphase deformations. Syntectonic granitisation and migmatization have changed the original composition of the rocks to a very large extent, rendering the understanding of structural history very difficult. The Arewada Group of rocks are highly folded and metamorphosed with extensive development of migmatites. The Arewada Group of rocks shows effects of regional metamorphism based on mineral assemblages of rocks indicating upper amphibolite grade metamorphism. The Bhamragarh Group of rocks show low grade metamorphism reaching the Green Schist facies of metamorphism.

Geologically, the Gadchiroli district presents a variety of stratigraphic units. The rock types encountered belong to Bengpal Group of Archean age and Bailadila Group of Paleo-Proterozoic age. The Bengpal Group comprises the meta-sedimentaries represented by quartzite (pyritiferous, micaceous and pyroxene bearing), Banded Magnetite quartzite (BMQ), magnetite quartzite, quartzite, quartz mica schist, amphibolite/hornblende schist, talc, actinolite, tremolite, anthophyllite schist, ultrabasics, occurring as enclaves in gneissic and migmatitic rocks. These rocks are later intruded by dolerite, Ultramafite and gabbroic dykes. The rocks of the area are highly deformed and bear evidences of poly phases of folding. The BMQ enclaves occurring as long linear hillocks within the gneisses in large scale, is a new finding through this G4 exploration from this area.

Banded Iron occurs as continuous mineralized ore body (MOB) in the east which is faulted and band is displaced at many places as discrete single band. MOB in other part is of same characteristics and showing parallel displaced



Generalized tectonic map of Indian subcontinent: Precambrian Cratons, Mobile Belts and Lineaments. AFB = Aravalli Fold Belt, DFB = Delhi Fold Belt, EGMB = Eastern Ghats Mobile Belt, SMB = Satpura Mobile Belt, NSL = Narmada-Son Lineament, CIS = Central Indian Suture and BPMP = Bhavani–Palghat Mobile Belt. Proterozoic Rifts and Basins include IB = Indravati Basin, ChB = Chhattisgarh Basin, GB = Godavari Basin; MR = Mahandi Rift; CuB = Cuddapah Basin, VB = Vindhyan Basin. CG = Closepet Granite (after from Rao and Reddy, 2002 and Meert et al., 2010).

First systematic geological mapping in this area within the Toposheet No-65A/06 & 65A/10 was carried out by during 1977-78 (In parts of Toposheet-65A/07) by GSI [S.K. Pattanaik & S.K. Sengupta vide Acc.No-CR-013642] comprises metasediments, metabasics, magnetite's and gneisses belonging to the Archean Bengpal Group of rocks.

Subsequently, the mapping was carried out by H.P. Saxena et.al within the Toposheet No-65A/06, during F.S1978-79 depicts the extensive granitic activity concomitant with the major folding episodes have granitized a vast thickness of Bengpal meta-sediments and the associated metabasics leading to the formation of a variety of migmatites and gneisses.

The rocks of Bailadila Group exposed in the area is a store house of vast resources of iron ore within BHQ are located in the Surjagarh, Damkodwadvi and Bhamragarh Hill Ranges. Wurera hill in the Surjagarh hill range being developed by M/s Lloyd Metals, is the only mining activity prevailing in the district, with a prove reserve of 180 MT (Source: Lloyd Metal website).

The current block is about 35 km south of Wurera mine, where magnetite iron ore bearing lithology is BMQ and ferruginous Quartzite occurring as enclaves within Archean Bengpal Group overlain by the Bailadila Group of Paleo-Proterozoic age. The general trend of the MOB is NE-SW almost sub-vertical.

The iron ore deposit of this area is genetically related to leaching and supergene enrichment of iron oxides from parent rock BHQ. It occurs in varied physical forms from massive to soft ore surrounded by float ores in the lower slopes upto ground level at places.

5.3. Structure and metamorphism

The terrain is undulating, with structurally deformed topography characterized by the NE-SW trending strike ridge. Fold axis is trending NE-SW with antiformal hinge zone closures are toward west and east. Later Strike parallel Fault disrupts the anti-form limbs and are displaced. Cross faulting trending N-S is observed with displaced beddings in one limb. Drainage parallel Lineaments (Linear features seen on field as depicted on Space born image which are inferred Faults, Fractures) are mapped out.

Available field evidences about structural features, the metasedimentary sequence and the metabasics have undergone extensive migmatization in different periods of their geological history. The area has undergone three phases of folding; the first two being tight upright types while the third one is broad and open type. Regional strike of the rocks coincides with that of the tight fold axis i.e., NE-SW with south easterly dips. A number of basic intrusive and quartz veins which are emplaced in NE-SW direction also exhibit the same structural trend. A series of normal faults mostly north south slip are evident in the area effecting the dislocation and shifting of bands along fault plane.

The Bengal Group of rocks has witnessed polyphase metamorphism comprising regional, thermal and cataclastic types. Although it is very difficult to establish the phases of metamorphism in a chronological order. The earliest of these metamorphic phases seems to be regional one resulting in the formation of para schists, BMQ and sillimanite bearing quartzites and schists. The Bengal Group of rocks bear evidences of this regional metamorphism in the amphibolite facies. The Bailadila Group of rocks are characteristically low-grade ones falling in the green schist facies. Chlorite-actinolite schists, chlorite-sericite phyllite are typical of these greenschist rocks.

In different structural elements observed in the area are: -

Planer Features:

Bedding Plane: (So):

In the area, bedding plane is marked by colour banding and/or compositional banding in quartzites, BMQ and boundaries of two different lithounits, such as schists and quartzites. The contact of different litho units as phyllites and quartzites are also taken as representing the bedding. The bedding shows wide variation in their strike and attitude due to folding. In the Arewada hill range, the quartzite beds show normally NE-SW strike with a dip of about (+)75° towards SE, (sub-vertical). In the Dubbaguda hill range, the quartzite/BMQ beds also trending NE-SW strike with moderate to steep dip towards SE. Disposition of lava flows within the metasediments is also taken as primary banding.

Foliation (S1):

The schistose rocks show a dominant foliation which runs parallel to the adjacent lithological contacts and is taken as the bedding plane schistosity or foliation. The Bedding foliation trending in NW-SE direction with 50° to 70° dip towards SW are seen in the area.

Axial plane foliation (S-2):

This planar structure is poorly developed and is seen mostly in the hinge regions of mesoscopic folds. The development of this foliation plane is well exemplified in overturned to almost isoclinal folds of BMQ. It is parallel to sub-parallel with the bedding and cuts it at an acute angle in the limb portions of folds. It trends almost in direction with steep dips towards south.

Gneissosity:

Gneissosity has been imparted in rocks such as granites, granite gneisses, migmatites and streaky gneiss. Gneissose structure has resulted out of alternate layers of mica and quartzo-feldspathic minerals in granite gneiss, while it is the result of quartz streaky and biotite in streaky gneisses and felspar augens in augen gneiss. All these gneissic bands conform to the original foliation striking NE-SW.

Lineations:

Fold axes lineations:

This is the most dominant linear element displayed in most of the rock units. The lineation plunges Northernly to North-easterly with an amount varying from 5° to 20°. However, near Medapalli village, the lineation plunges towards NNE to NE, with a very low amount varying from 10° to 15°.

Fracture cleavages:

The quartzite hills occurring NE and NW of Dobaguda show good development of fracture cleavages. These are very closely spaced and impersistent in nature. At most places these are parallel to sub parallel with the holding bedding Joints. These also show wide variation in their strike and attitude due to folding.

Joints:

At the bank of Pamulgautami river near the Ranipodur village, large exposure of granite is exposed having strike NNW-SSE and granite shows mural joints. The trend of the joints are N20E, N55E, N80E and the granite is intruded by mafic dyke of approx. 10- 15m width where the strike, dip and dip direction are N70°E, 80°, N20°W. Joints are developed in all the rock types but are more prominent in gneisses and migmatites, granites and andesitic flows. The main joint sets are as follows:

- (1) NNE-SSW to NE-SW with sub-vertical dips towards NW or SE.
- (2) NNW-SSE to NW-SE with sub-vertical dips towards SW or NE
- (3) E-W joints with sub-vertical to vertical dips.

5.4: Nature of host rock and mineralization:

The magnetite ore bodies (MOB) are occurring as enclaves within gneisses and migmatite of Archean Bengpal Group associated with schistose and metasedimentaries & meta-volcanics. MOB's are of different dimension and width occurring as detached and isolated bodies due to Maily series of faulting. Lithologically, the area is covered with Granite-gneiss, metabasic schist, BMQ, ferruginous Quartzite. The MOB's are followed downwards by steep slopes and are mostly covered with float of iron ore. The strike of the iron ore zone is NE to SW and dip of the iron ore body is from 60 degree to almost vertical.

Phyllite:

It is brown to reddish brown/purple in colour and dense with prominent bedding and cleavage but incipient foliation. Weathered outcrops are porous and have marked low specific gravity giving an appearance of leaching out of some crystalline metallic (probably Haematite) constituents from it.

Quartzite:

Varies in colour from milky white to smoky grey. It is fine grained and show multiple sets of joints.

Banded Magnetite Quartzite (BMQ):

It is exposed in higher altitudes forming an east west stretch, comprises of alternate bands of steel grey Haematite and brownish/whitish quartzite. The BMQ shows a typical laminated form with laminae of fine grained almost cherty-silica alternating with dense purple ferruginous material. The thickness of laminae varies from 2 to 5 mm. The laminae show intense micro-folds and consequent pinch and swell structure.

It is apparent that the iron ore has been developed because of leaching of silica and enrichment of iron content in BHQ through Supergene enrichment mechanism.

Iron ore mineralization:

The present investigations have been taken up in this part through NMET funding. The area is potential in view of Magnetite & Haematite Ore mineralization with an average Fe(T) content of (+15) % & (+45) % respectively. The rock types encountered belong to Bengpal Group of Archean age and Bailadila Group of Paleo-Proterozoic age. The Bengpal Group comprises the meta-sedimentaries represented by quartzite (pyritiferous, micaceous and pyroxene bearing), Banded Magnetite quartzite (BMQ), magnetite quartzite, quartzite, quartz mica schist, amphibolite/hornblende schist, talc, actinolite, tremolite, anthophyllite schist, ultrabasics, occurring as enclaves in gneissic and migmatitic rocks. These rocks are later intruded by dolerite, Ultramafite and gabbroic dykes. The rocks of the area are highly deformed and bear evidences of poly phases of folding. The BMQ enclaves occurring as long linear hillocks within the gneisses in large scale, is a new finding through this G4 exploration from this area.

The Iron mineralized ore bodies (MOB) have been identified ranging in strike length of approx. 4000m with estimated reconnaissance resource of 3.36 mt, considering band width of 8m and depth of 30 m considering Bulk Density of 3g/cc along with float areas where assuming width of 20m, depth of 3m and bulk density of 2g/cc.

CHAPTER-06

Activity during the period (Geoscience investigation)

6.1 Geological mapping

6.1.1 Large scale mapping on 1: 12,500 scale

Systematic geological mapping at a 1:12,500 scale was carried out in the block. The objective of the geological mapping was to conduct regional mapping of the block to identify iron ore bodies (BMQ/BHQ). During the geological mapping, the following lithologies were identified in the block area: garnetiferous quartz schist, granite gneiss, migmatite, hornblende schist, quartz sericite schist, granite, and iron ore in the form of banded hematite quartzite and banded magnetite quartzite. The banded iron formation of the Bhamragarh Group represents the main iron ore-bearing horizon in this area, while the magnetite quartzite of the Arewada Group forms another significant iron-bearing unit.

6.1.2 Geological map on 1: 12,500 scale

The geological map (**Plate no-3**) illustrates the distribution of different lithologies in the mapped area. A considerable portion of the area is rugged, hilly, and covered with dense vegetation. The geological map at a 1:12,500 scale has been prepared by plotting lithological outcrops and litho-contacts.

6.1.3 Description of rock types

Garnetiferous Quartz Schist

This lithological unit occupies a major part of the block area. It consists of quartz and garnet. The rock is medium to coarse-grained.

Granite Gneiss/Migmatite

These are among the most widespread lithological units, occupying the plains of the block area. The migmatite here also exhibits characteristics of composite gneiss and quartzo-feldspathic gneiss. Migmatite and, to a great extent, granite gneiss are the products of partial assimilation of pre-existing sedimentary and igneous rocks by a later quartzo-feldspathic influx.

Hornblende Schist

Hornblende schist occupies the southeastern part of the block area. The presence of hornblende imparts a greenish-grey color to the rock. The rock exhibits well-developed schistosity.

Quartz Sericite Schist

This unit is widespread in the area, occupying the plains, while its more quartzitic variants form ridges and hillocks with iron ore. Quartz sericite schist consists mainly of quartz, with minor amounts of sericite and garnet. It has well-developed schistosity. The rock is coarse to medium-grained and, in some places, fine-grained.

Granite

The granite is fairly coarse-grained and consists primarily of quartz and feldspar (both white and biotite varieties), with garnet and muscovite present in some locations. The rock is non-foliated and does not appear to have an intrusive relationship with the country rocks. It crops out in the northwestern part of the block area. The rock is hard, compact, and contains abundant biotite.

Iron Ore

Iron ore occurs in the form of banded hematite quartzite (BHQ) and banded magnetite quartzite (BMQ). The iron ore zone trends in the NE-SW direction within the block area. The banded iron formation of the Bhamragarh Group represents the primary iron ore-bearing horizon, while the magnetite quartzite of the Arewada Group is another significant iron-bearing unit. The strike length of the iron-bearing zone is approximately 4,000 meters, with a width varying from 6 to 16 meters, averaging around 8 meters.

Geochemical analysis of bedrock samples from the iron ore zone indicates Fe content ranging from 8.70% to 48.56%, while SiO₂ content varies between 18.45% and 77.39%, suggesting the siliceous nature of the iron ore rock. Channel sample analysis yielded Fe content ranging from 24.69% to 46.76%.

6.1.4 Whole rock analysis of bed rock samples (BRS)

The iron ore zone was sampled and analyzed for its major oxides. Approximately three samples yielded an Fe content of more than 40%. Around 21 samples fell within the Fe content range of 30% to 40%, while about 18 samples had Fe content ranging from 10% to 30%. **(Annexure-1)**

Approximately three samples yielded an Fe content of more than 40%. Samples such as 24-12-18-1A (48.56%), 24-12-22-M (42.06%), and 24-12-19-M (42.79%) exhibit relatively high iron content. About 21 samples fall into this category, with Fe content ranging from 30% to 40%. Only the sample no 24-12-21-XII exhibit relatively low iron content which is 8.70%. The Fe content in bedrock samples ranging from 8.70% (Sample ID: 24-12-21-XII) to 48.56% (Sample ID: 24-12-18-1A), with SiO₂ values between 18.45% and 73.45%, indicate a siliceous nature of iron-bearing formations. As well as Titanium oxide (TiO₂) ranges upto 0.25% in primary BRS. The Fe₂O₃ content in the bedrock samples varies significantly, ranging from 12.44% to 69.43%, indicating a wide spectrum of iron enrichment. Overall, the BRS geochemical results indicate that the iron ore is of low to medium grade. However, these ores can be upgraded to an Fe content of 60% and above through appropriate mineral processing technology. While the ICP-MS analysis shows that the Fe, Nb, Ti & V content in the BRS range between 8546 to 319724 ppm, upto 10ppm, 925 to 6824 ppm & 16 to 334 ppm respectively.

The results of major oxides as well as ICP-MS analysis are provided in the **Annexure-1 & 4**

6.1.5 Channel Sampling

The geochemical analysis represents channel samples collected from iron ore bearing zones (**Table 5**). The results indicate the geochemical characteristics of the iron ore bearing zone, which is primarily composed of iron oxides (Fe and Fe_2O_3) and silica (SiO_2), with minor contributions from other oxides. The Fe_2O_3 values range from **35.31% (Sample ID-24-12-21-ai) to 66.85% (Sample ID-24-12-21-iii)**, confirming the dominance of iron oxides, characteristic of iron ore rich formations. Some samples show exceptionally high Fe_2O_3 values (>60%), suggesting high-grade iron mineralization. The SiO_2 content varies significantly from **21.58% (Sample ID-24-12-21-ai) to 59.27% (Sample ID-24-12-21-iii)**, indicating heterogeneous iron-silica banding. Higher silica values correspond to quartz-rich bands, whereas lower values indicate iron-rich zones.

Channel sampling was carried out to determine the geochemical characteristics of the outcropping iron ore bands. The results of channel samples are provided in the **annexure-2**.

6.1.6 Laterite Sampling

The Fe content in the laterite samples ranges from 10.19% (**Sample ID-24-12-23-C**) to 25.87% (**Sample ID-24-12-27-B7**) which are analyzed by WD-XRF methodology. While the analysis of two samples (**Sample ID-27-12-24-i & 27-12-24-A15**) shows that the Fe, Al, Sn, Mo, Ti & V content in the laterite range between 130291 to 184453 ppm, 38919 to 53898 ppm, 50 to 101 ppm, 1.38 to 2.38 ppm, 1324 to 1556 ppm & 232 to 304 ppm respectively through ICP-MS. The results of major oxides as well as ICP-MS analysis are provided in the **Annexure-3 & 5**

6.1.7 Stream sediments Sampling

The ICP-MS analysis shows that Fe, Mo, Nb, W, V & Ti contents in the stream sediment samples may range between 48629 to 201959 ppm, upto 12.56 ppm, 6 to 31 ppm, upto 0.71, 129 to 328 ppm & 5561 to 25582 ppm respectively. The results of ICP-MS analysis are provided in the **Annexure-6**.

6.1.8 Structure

The general structural trend of the terrain follows a NE-SW direction, primarily influenced by the bedding planes. A pediment zone, associated with denudational hills, is present, featuring bands of Banded Iron Formation (BIF). Additionally, the area is marked by the presence of small intrusions and quartz veins.

6.1.9 Metamorphism

The metasedimentary sequence and metabasics in the area have undergone extensive migmatization during various periods of their geological history. The metamorphic history of the Benggal Group of rocks is complex and consists of polyphase metamorphism, including regional, thermal, and cataclastic metamorphism. Although the exact chronological order of these phases is difficult to establish, the regional metamorphism appears to be the earliest phase. This regional metamorphism has resulted in the formation of para-schists, Banded Mica Quartzites (BMQ), and sillimanite-bearing quartzites and schists, all of which show evidence of amphibolite facies metamorphism.

6.1.10 Sampling

Sampling was carried out along with the field geological mapping to characterize various rock types present in block area, along with the identified iron ore zone. About 50 BRS samples were collected. Those samples were characterized for major oxides, major, minor and trace elements. Few samples were analyzed using petrographic and X-ray diffraction methods.

6.1.11 X-Ray diffraction study

In Arewada-Hitapadi block, about 7 samples of different outcrops were analyzed to determine mineral composition using characteristics X-ray patterns. Except two samples (sample ID: 19-12-24-10 and sample ID: 24-12-24-23), all remaining five samples yielded hematite mineral, along with quartz, muscovite, kaolinite, dickite and goethite mineral phases. X-ray diffraction results further corroborate the presence of banded hematite quartzite in block area.

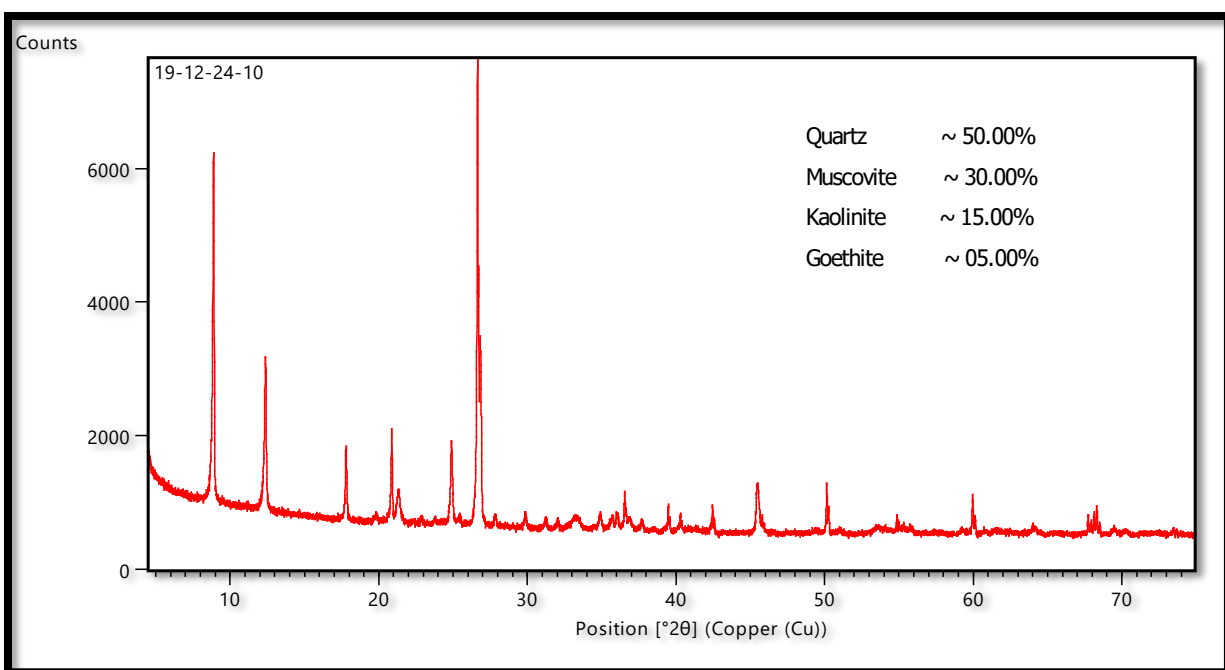


Figure 3. X-ray diffractogram of sample ID: 19-12-24-10.

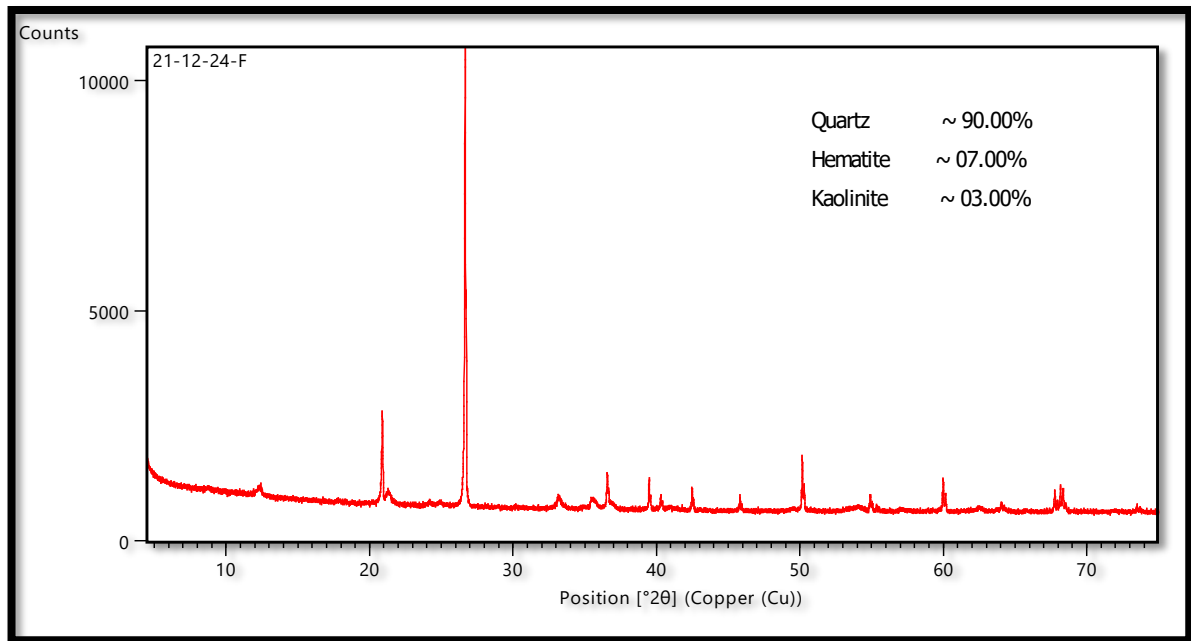


Figure 4. X-ray diffractogram of sample ID: 21-12-24-f.

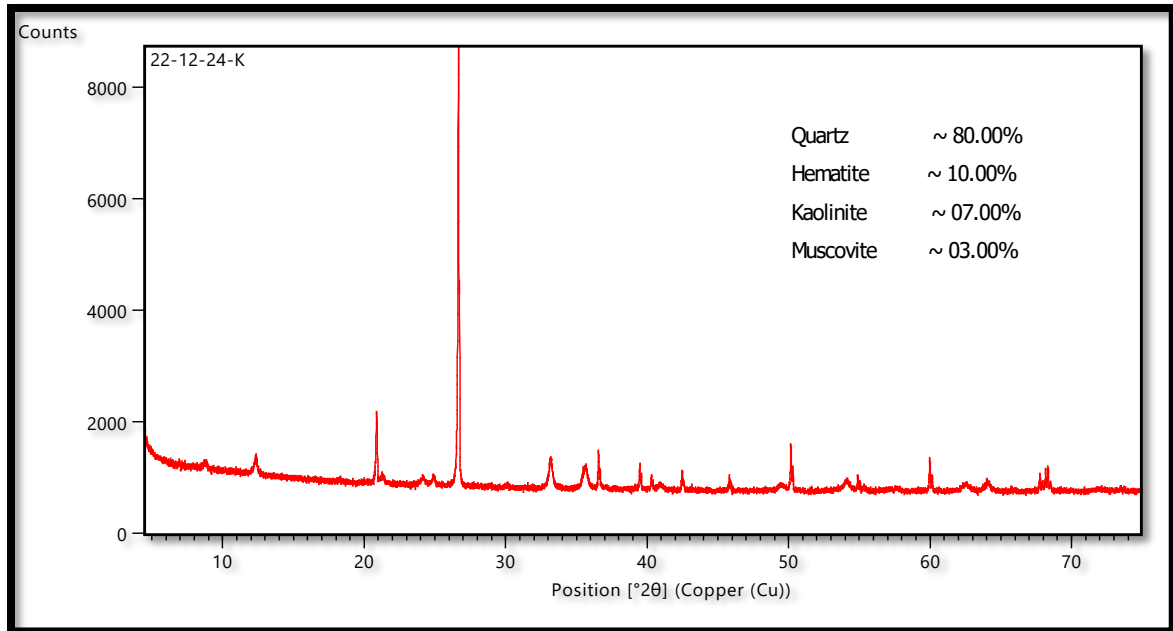


Figure 5. X-ray diffractogram of sample ID: 22-12-24-K.

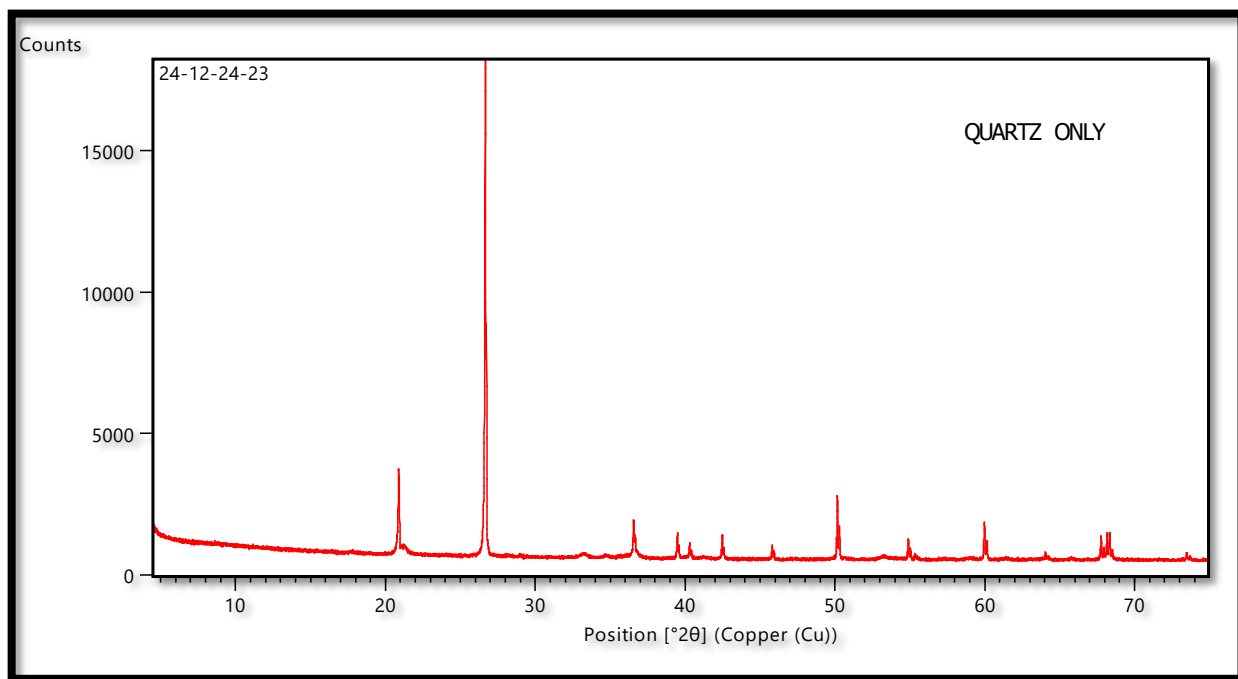


Figure 6. X-ray diffractogram of sample ID: 24-12-24-23.

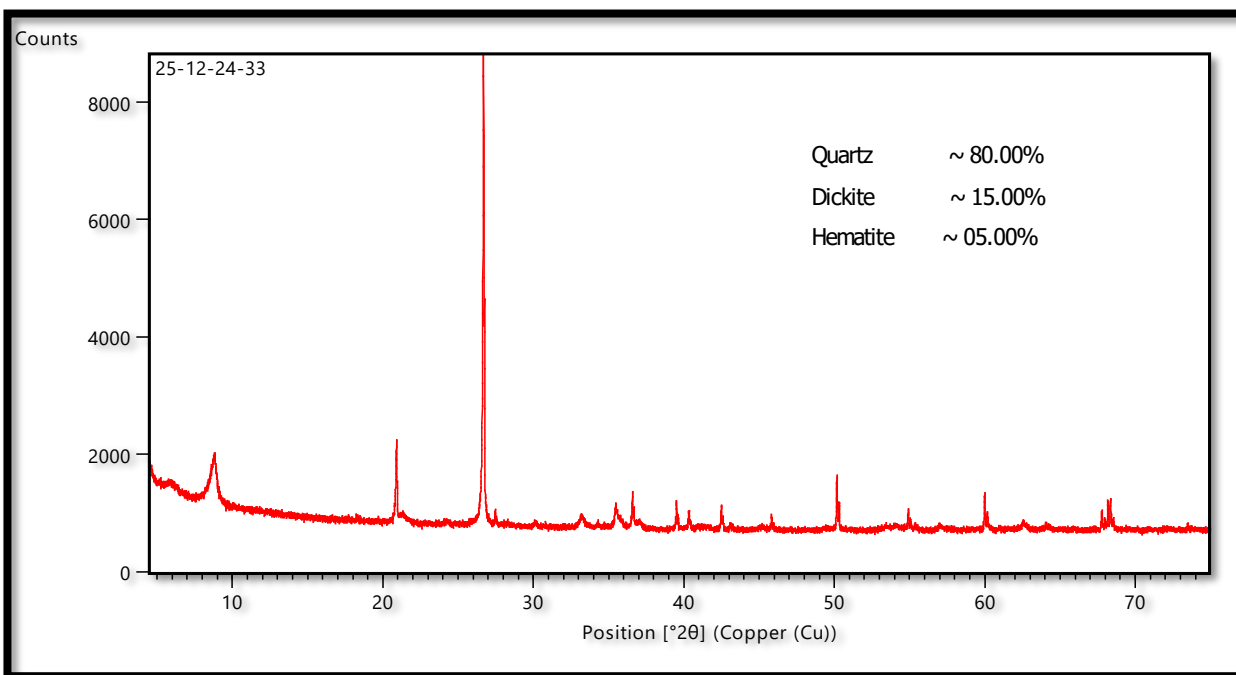


Figure 7. X-ray diffractogram of sample ID: 24-12-24-33.

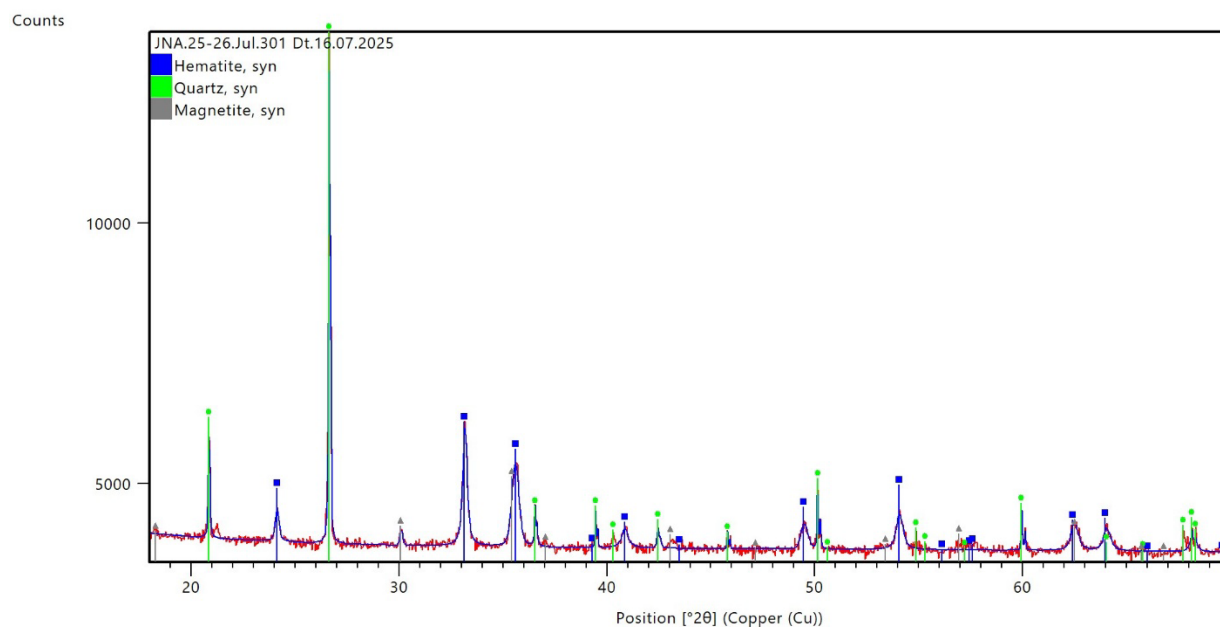


Figure 8. X-ray diffractogram of sample ID: 18-12-24-02.

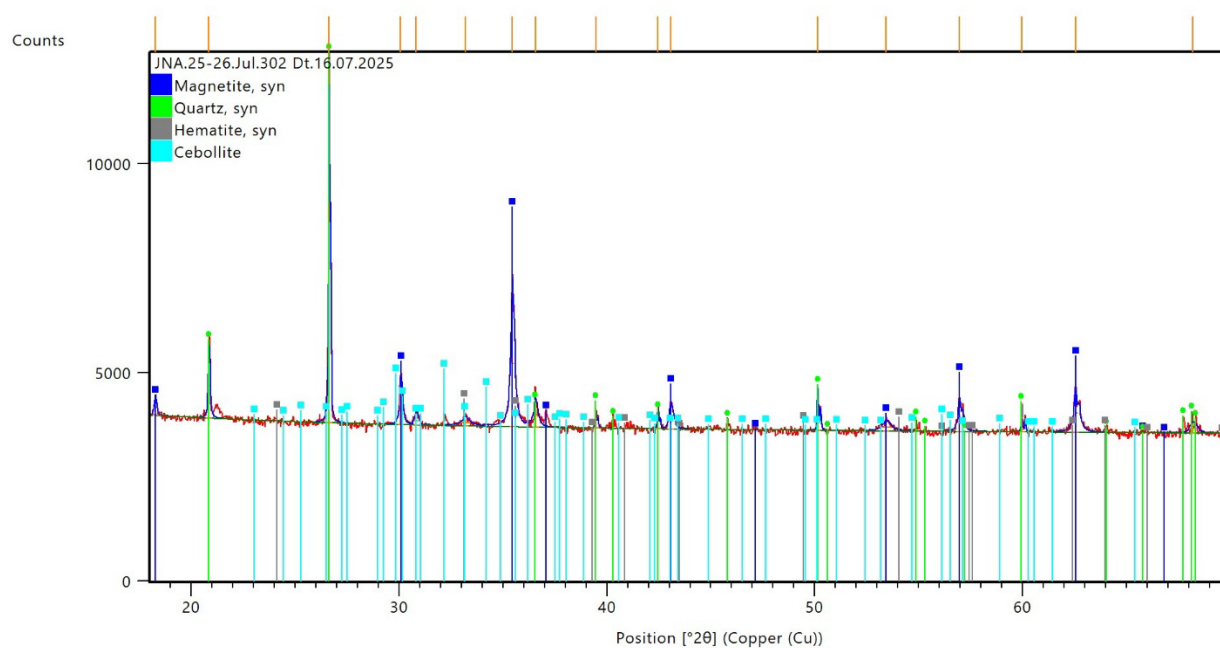


Figure 9. X-ray diffractogram of sample ID: 22-12-24-R

6.1.12 Petrographic analysis of BRS samples

About 5 samples from different lithologies were analyzed at the GSI laboratory, Central Region, Nagpur, using the thin section petrographic technique. Thin section petrography was utilized to supplement XRD and other geochemical data to characterize the various lithologies of the block area in detail.

BRS No.	13-12-24-03
Physical properties	Megascopic studies of the hand specimen indicate that the rock is fine to medium grained with yellowish to brown color. The rock is hard and compact. Observation with hand lens indicate the present of quartz grains showing vitreous luster. (Figure 10)
Petrographic study	Microscopic studies under transmitted light indicate that the rock is extremely very fine grained in nature with microcrystalline to cryptocrystalline matrix. At places the coarse-grained crystalline quartz in the form of aggregates and thin veins is noticed in the fine-grained matrix. The matrix consists of very fine grained quartzo-feldspathic material, phyllosilicates represented by very fine flakes of chloritized biotite and sericite and minor amounts of carbonate and subordinate iron oxides. The presence of fine grained quartzo-feldspathic material along with sericite is observed when observed under high magnification.
Name of the rock	Very fine grained silicified microcrystalline rock consists of ferruginous quartz-mica-schist/phyllite



Figure 10. Photograph of sample no.13-12-24-03.

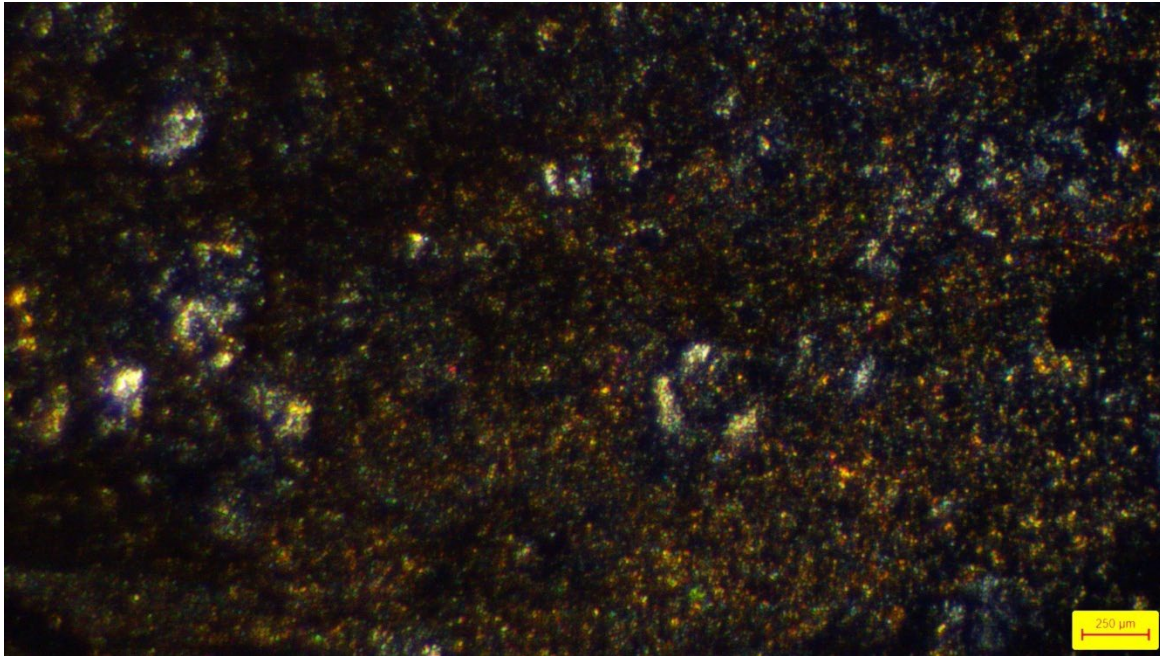


Figure 11: Photomicrograph under XeD showing the fine-grained matrix. (2.5X). Note the presence of fine-grained sericite material in the matrix.

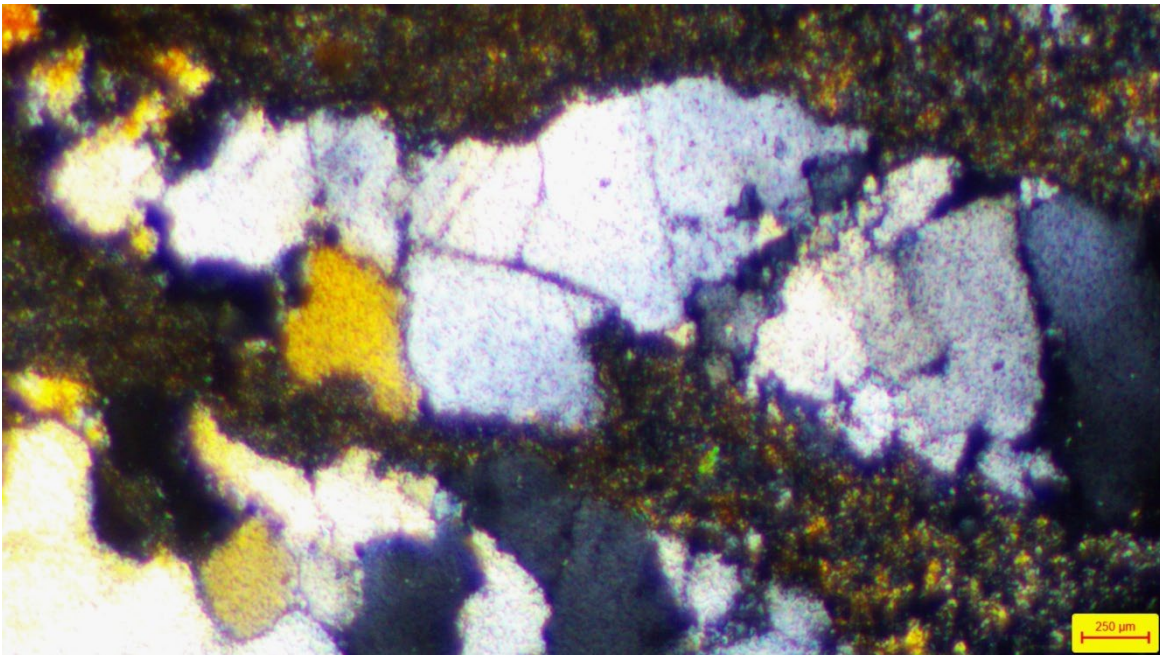


Figure 12: Photomicrograph under XeD showing coarse grained quartz in fine grained matrix (2.5X)

BRS No.	17-12-24-08A
Physical properties	<p>Megascopic studies of the hand specimen reveal that the rock is medium to coarse grained and grayish in color. The rock shows crystalline nature when observed with hand lens. The rock is moderately hard and compact. The sample submitted is weathered in nature.</p> <p>(Figure-13)</p>
Petrographic study	<p>Microscopic studies under transmitted light reveal that the rock composed of quartz, K-feldspar and plagioclase feldspar, while epidote is noticed as accessory phase. K-feldspar and plagioclase feldspar occur in subequal proportion. Microcline showing cross hatched twinning is noticed as subhedral inclusions at places within the plagioclase indicating a magmatic origin to the granite. Quartz is anhedral in nature and is recrystallized at places indicating that the rock is subjected to feeble deformation. Quartz grains show wavy extinction. Epidote exhibits variegated interference colors under crossed nicols. Overall texture exhibited by rock is hypidiomorphic. Antiperthite texture is also noticed in the rock wherein minute subhedral blebs of K-feldspar (microcline) are noticed in twinned plagioclase.</p>
Name of the rock	Granite

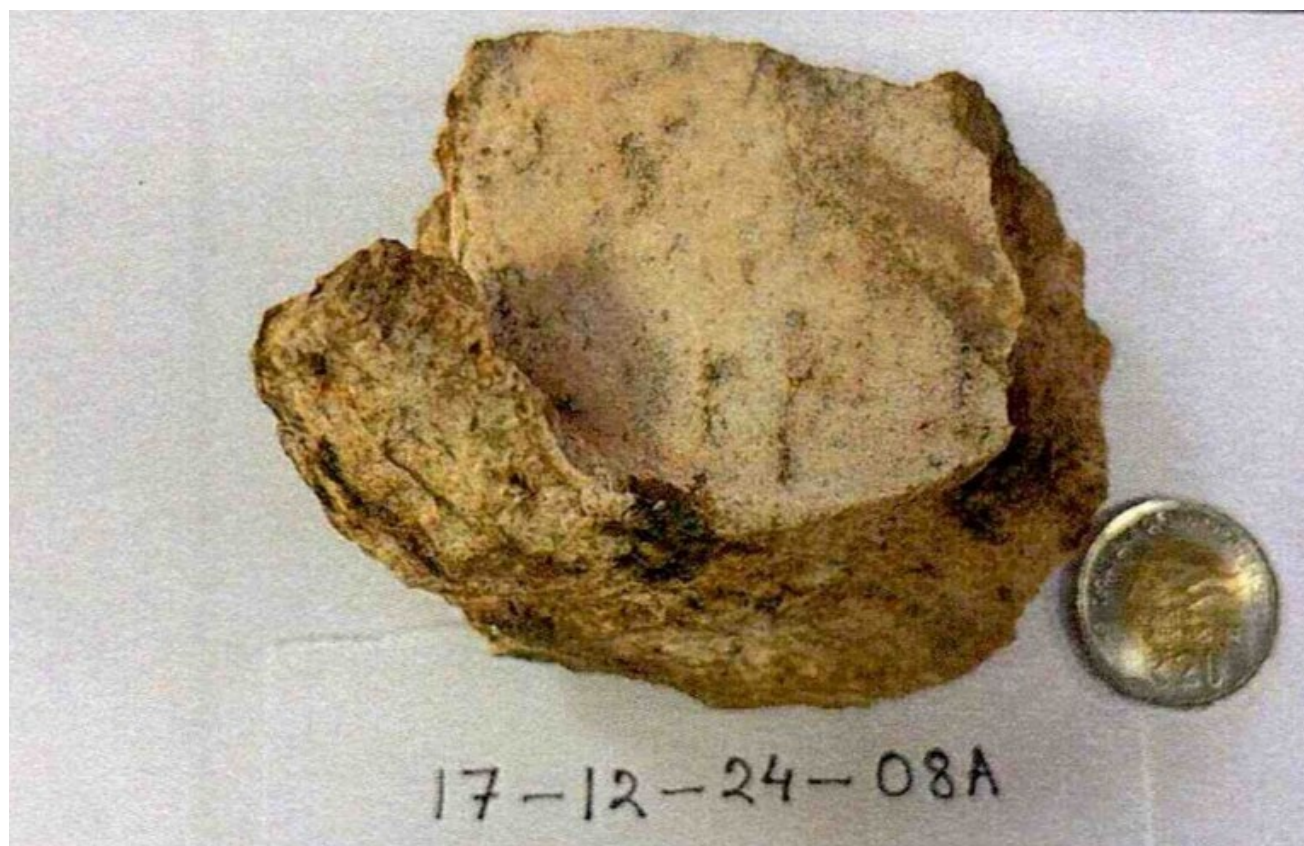


Figure 13: Photograph of sample no. 17-12-24-08A.

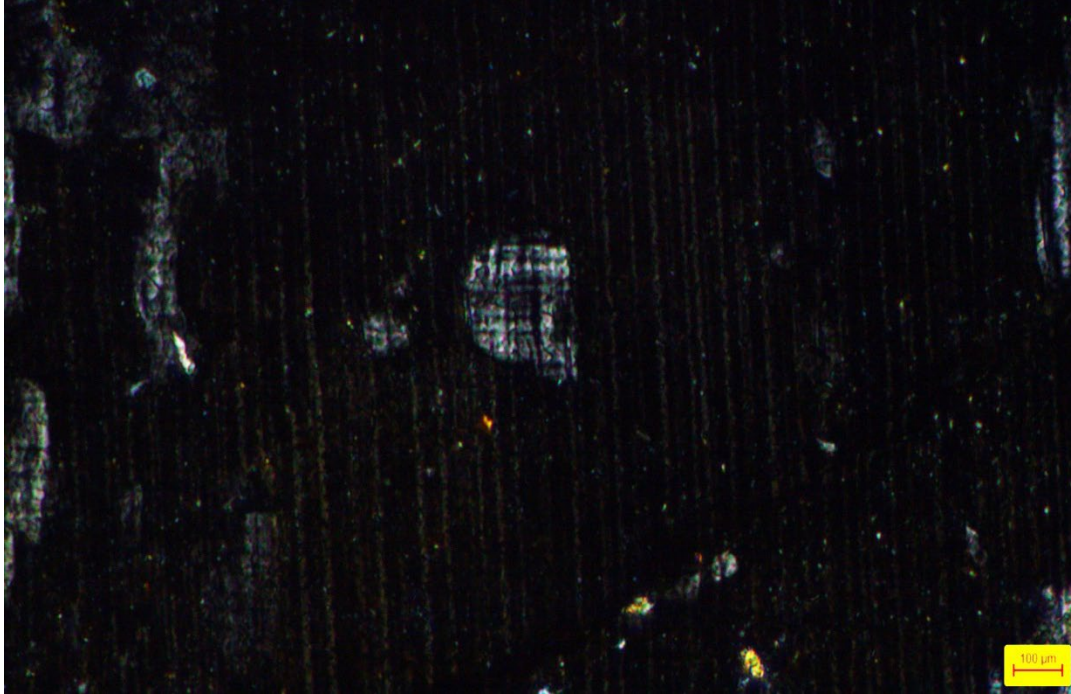


Figure 14: Photomicrograph under XeD showing subhedral blebs of microcline in twinned plagioclase (2.5X). Note the cross hatched twinning in the microcline and lamellar twinning in plagioclase

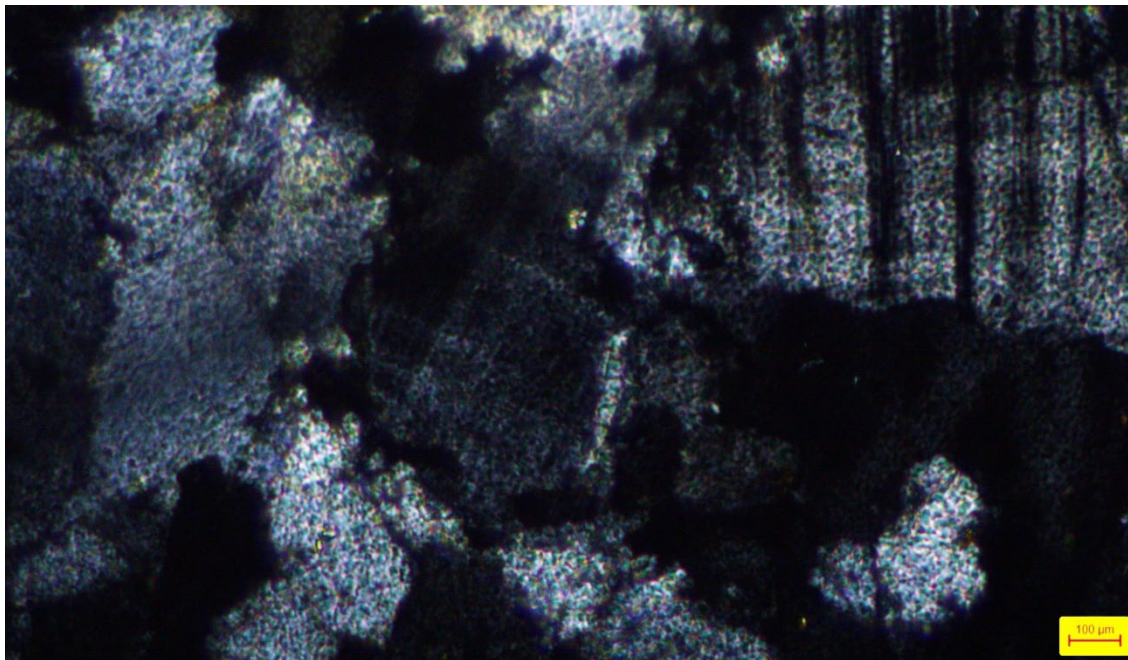


Figure 15: Photomicrograph under XeD showing cross hatched twinning in the microcline

BRS No.	21-12-24-03
Physical properties	Megascopic observations indicate that the rock is fine grained and reddish in color. The rock gives a reddish-brown streak indicating the presence of iron oxide as the dominant mineral in the rock. The rock is oxidized, soft and friable. (Figure-16)
Petrographic study	Microscopic studies under transmitted light reveal that the rock is mainly composed of reddish brown fine ferruginous material with subordinate grained quartzo-feldspathic grains. In plane polarised light it is observed that the reddish-brown Fe-oxide occurs as a network around the fine grained quartzo-feldspathic minerals. Under crossed nicols the quartzo-feldspathic exhibit anisotropic nature, while the ferruginous material is opaque in nature. When observed under high magnification in plane polarised light fine flakes of brownish biotite is also noticed. Reddish brown ferruginous material is the dominant component in the rock.
Name of the rock	Fine grained Ferruginous shale.



Figure 16. Photograph of sample no. 21-12-24-03

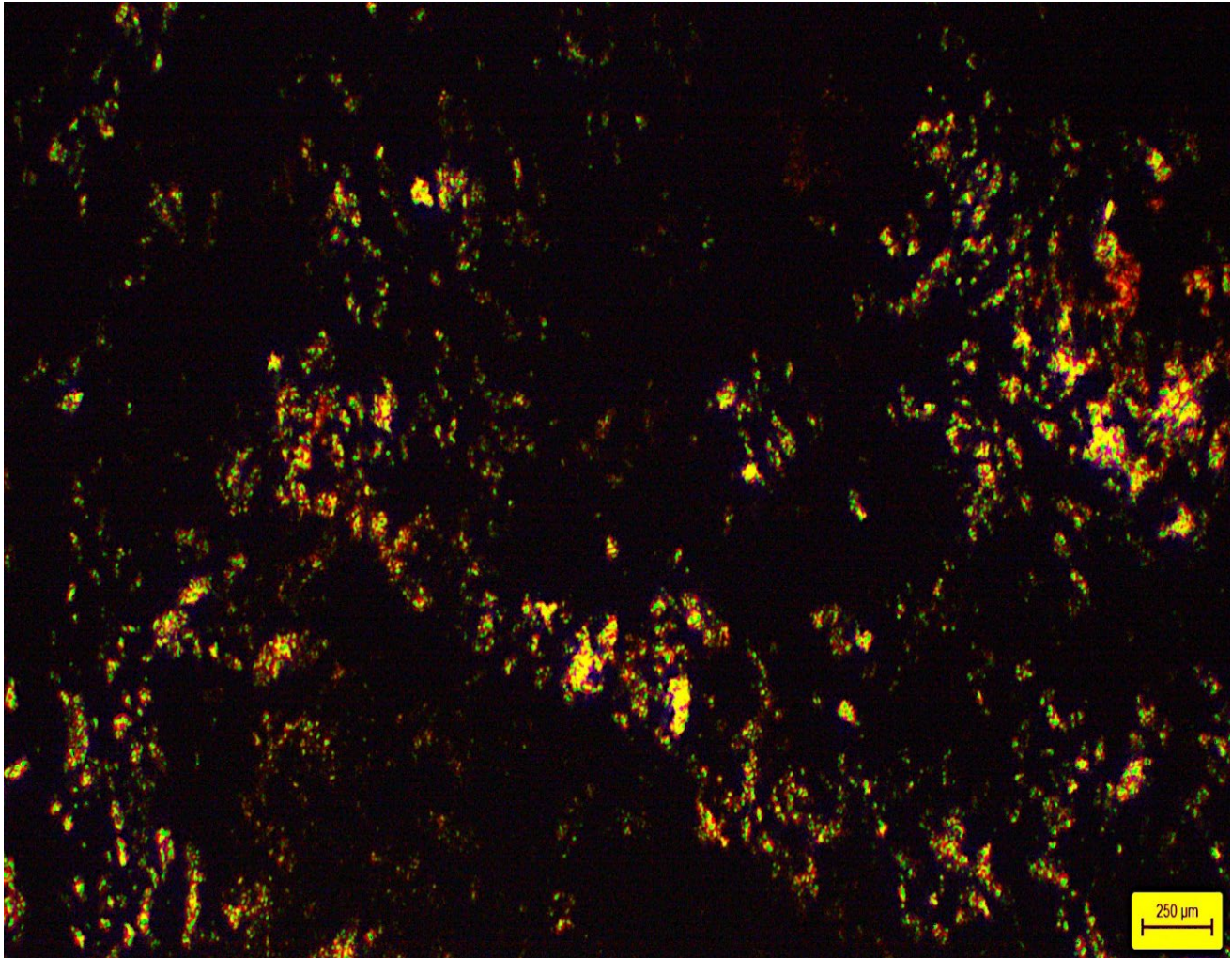


Figure 17: Photomicrograph showing the presence of ferruginous material as the dominant component in the rock. Note the presence of subordinate quartz-feldspathic material that is colorless in plane polarised light (2.5X)

BRS No.	19-12-24-09
Physical properties	Megascopic observations indicate that the rock is fine grained and brown to pinkish brown in color. The rock gives feeble brownish streak indicating oxidation and presence of iron oxides. Development of crude planar fabric is noticed giving rise to the appearance of phyllite. The rock is moderately hard and compact. (Figure-18)
Petrographic study	Microscopic studies under transmitted light reveal that the rock is predominantly composed of reddish-brown ferruginous material. The rock is finely banded in nature. In between the ferruginous rich bands, presence of minute grains of quartz along with feldspar is noticed. When observed under high magnification rare flakes of muscovite is also noticed in the rock. Muscovite is colorless in plane polarised light and exhibits anisotropic nature and high order interference colors under crossed nicols. The ferruginous material is isotropic under crossed nicols.
Name of the rock	Fine grained phyllitic rock with ferruginous material



Figure 18. Photograph of sample no. 19-12-24-09

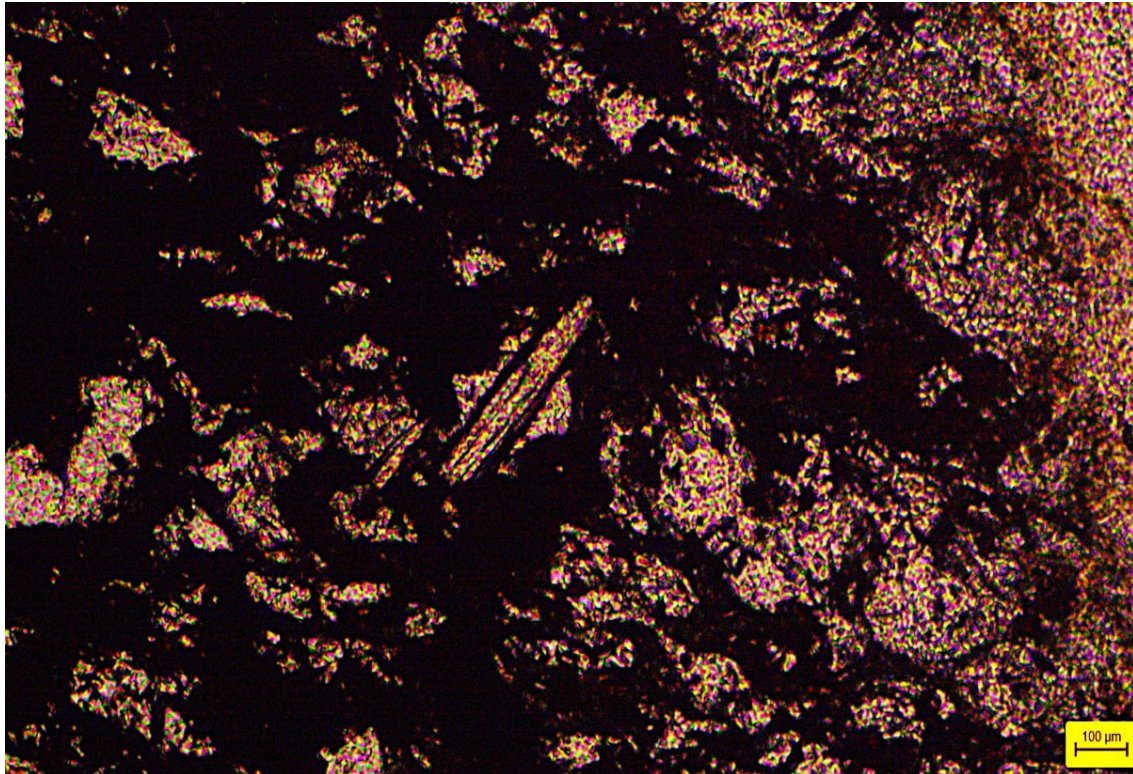


Figure 19: Photomicrograph under PPL showing dark colored Fe oxide along with flakes of muscovite (5X)

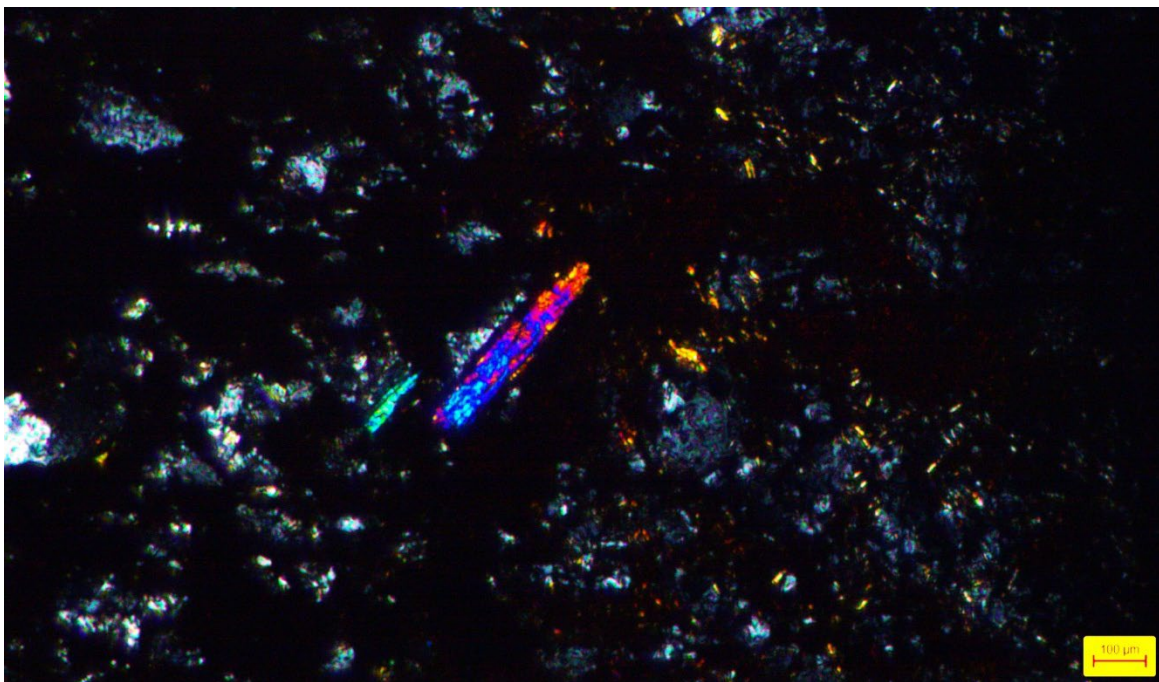


Figure 20: Photomicrograph under crossed nicols showing the anisotropic nature of muscovite flakes within the dark colored Fe oxide (5X)

BRS No.	14-12-24-13
Physical properties	Megascopic observations indicate that the rock is greyish in color. Development of strong planar fabric is noticed in the hand specimen indicating the deformed nature of the rock. The rock is hard and compact. (Figure-21)
Petrographic study	Microscopic studies under transmitted light reveal that the rock is highly deformed and mylonitised in nature. Mineralogically the rock is essentially composed of quartz and feldspar with subordinate biotite and muscovite. The K-feldspar is microcline. Presence of feldspar and quartz porphyroclasts that show alignment and stretching indicate that the rock is subjected to intensive deformation. Muscovite is also noticed as fine, flaky material. Minute grains of epidote that are anisotropic under crossed nicols are seen around feldspar porphyroclasts. Development of mylonitic fabric is conspicuously noticed in the rock indicating deformation in ductile domain.
Name of the rock	Sheared granite

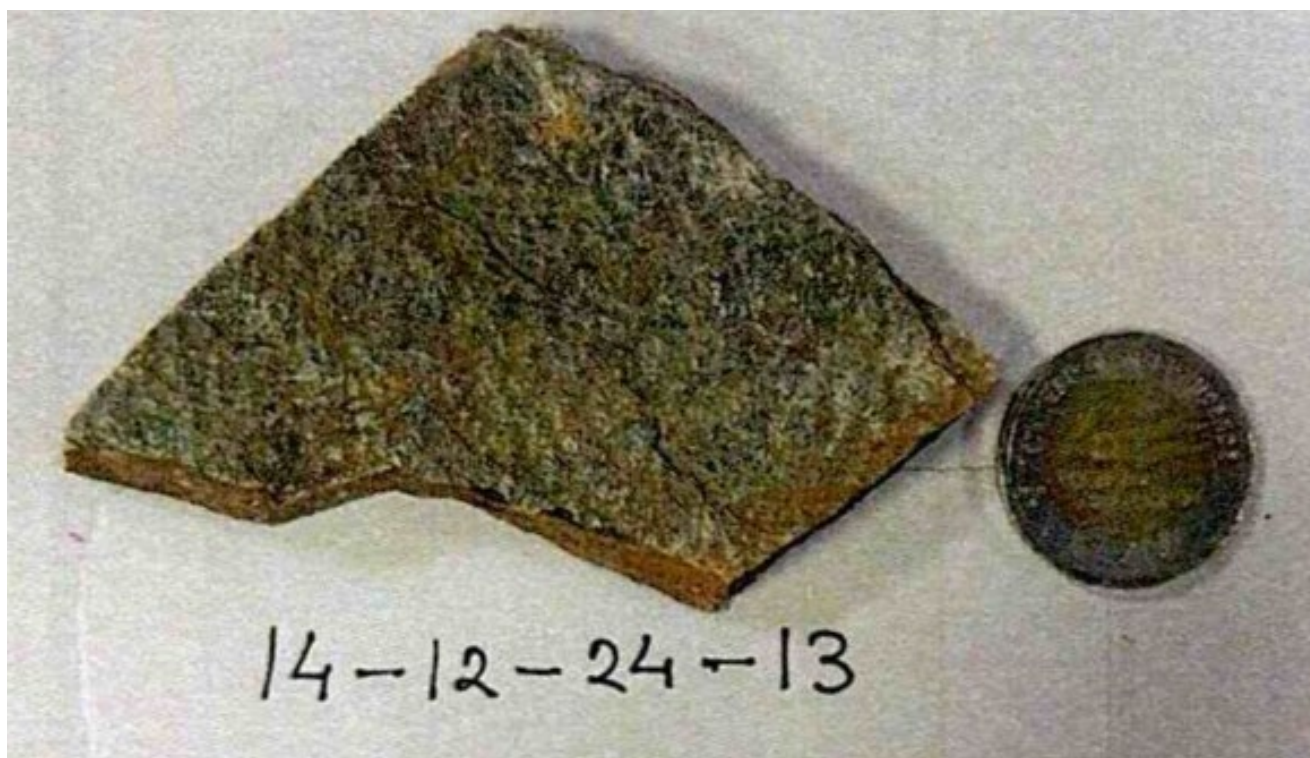


Figure 21: Photograph of sample no. 14-12-24-13.

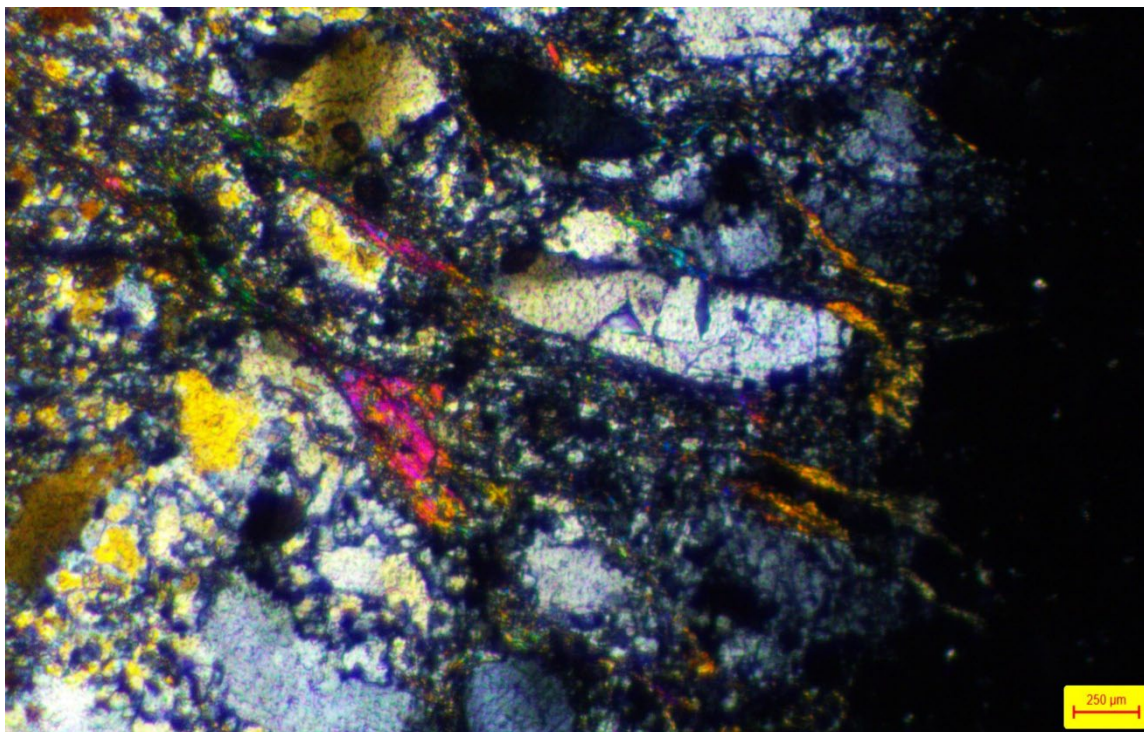


Figure 22: Photomicrograph under crossed nicols showing the elongated porphyroclasts of feldspar defining the deformational fabric. Note the flaky muscovite aligned along the mylonitised fabric (2.5X).

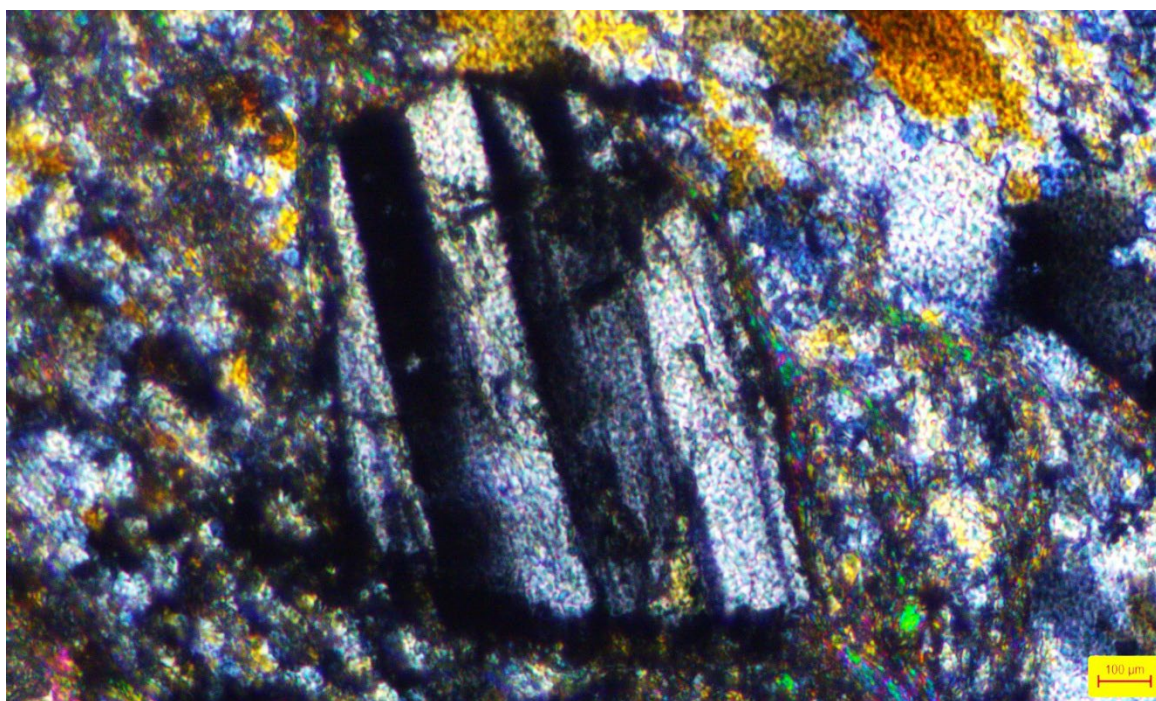


Figure 23: Photomicrograph under XeD showing porphyroclast of feldspar with epidote. Note the presence of variegated interference colors exhibited by the epidote around the feldspar porphyroclast (5X).

6.1.13 Ore micrographic study of BRS samples

Out of seven iron ore samples, five were analyzed at the GSI laboratory, Central Region, Nagpur whereas two are analysed in the JNARDDC, Nagpur using the polished section petrographic technique.

BRS No.	19-12-24-10
Physical properties	Megascopic studies indicate that the rock is reddish to pale yellowish in color. The sample gives to a reddish streak indicating the presence of Fe oxides. The sample is not susceptible to magnet. The sample submitted is oxidized in nature and is moderately hard. Development of feeble structural fabric is noticed in the hand specimen indicating the deformed nature of the rock. The rock is hard laminated ore. (Figure.24)
Petrographic study	Petrographic studies of the rock stub under reflected light indicate the presence of grayish colored Fe oxides ore mineral phases resembling hematite and goethite. Under crossed nicols the Fe oxide shows anisotropic nature indicating the presence of hematite in the rock. The reddish streak of the rock substantiates the observation. The Fe oxides occur as discontinuous layers in between the gangue material in the rock. The aligned nature of the Fe oxides indicate that the rock is deformed. The Fe oxides is relatively less abundant than the gangue material in the rock. (Figure.23).
Name of the rock	Fe oxide bearing rock.

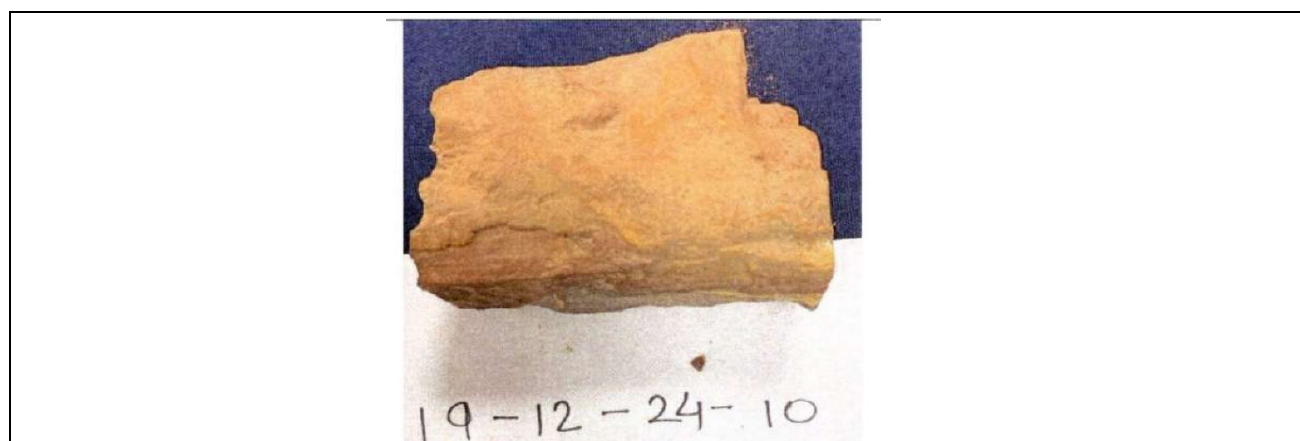


Figure. 24: Photographs of the hand specimen showing the yellowish coloured nature of the rock.

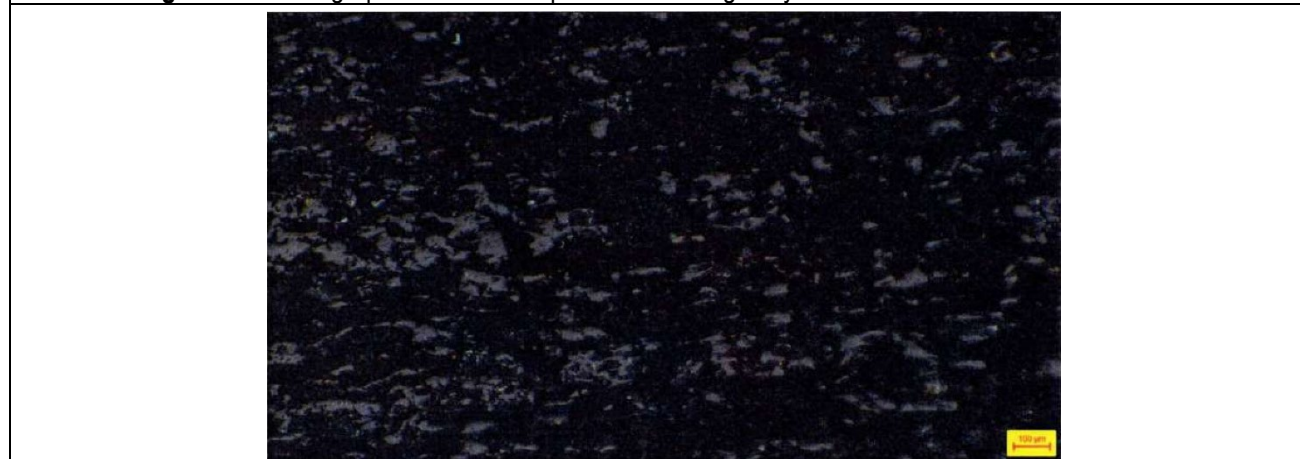


Figure. 25: Photomicrograph under reflected light showing Fe oxide and gangue material 5X.

BRS No.	21-12-24-f
Physical properties	In hand specimen the rock is yellowish to greyish yellow in color and oxidized in nature. The rock gives a dark grey colored streak. <i>The rock is massive looking and is susceptible to hand magnet indicating the presence of ferrimagnetic iron oxide mineral phases.</i> The rock is moderately hard and compact in nature which is also categorized as massive laminated ore. (Figure-26).
Petrographic study	Petrographic studies under reflected light indicate the presence of magnetite as a major oxide ore mineral in the sample. Magnetite is greyish in color in plane polarised reflected light and under crossed nicols it is isotropic. Magnetite occurs as anhedral to subhedral grains amidst the gangue material and is uniformly distributed in the rock. The abundance of magnetite and gangue is in sub equal proportion in the rock. At places it is observed that the magnetite is martitised along the margins of the grains. (Figure-27)
Name of the rock	The sample is identified as massive Magnetite Ore.

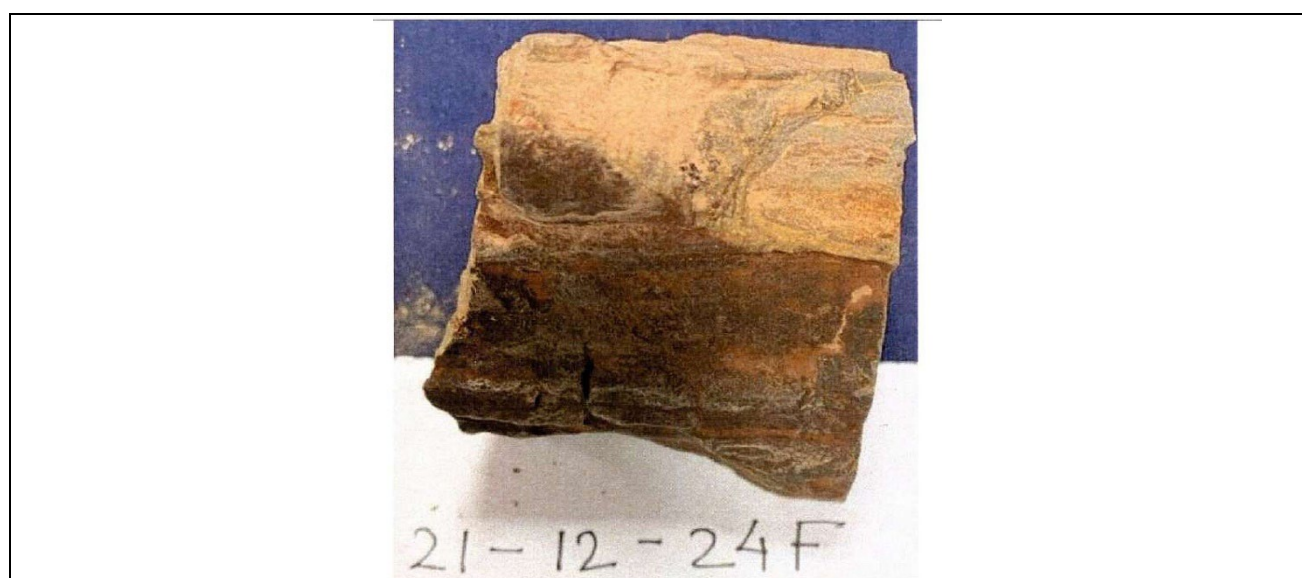


Figure-26: Photographs of the hand specimen showing the yellowish to greyish coloured nature.

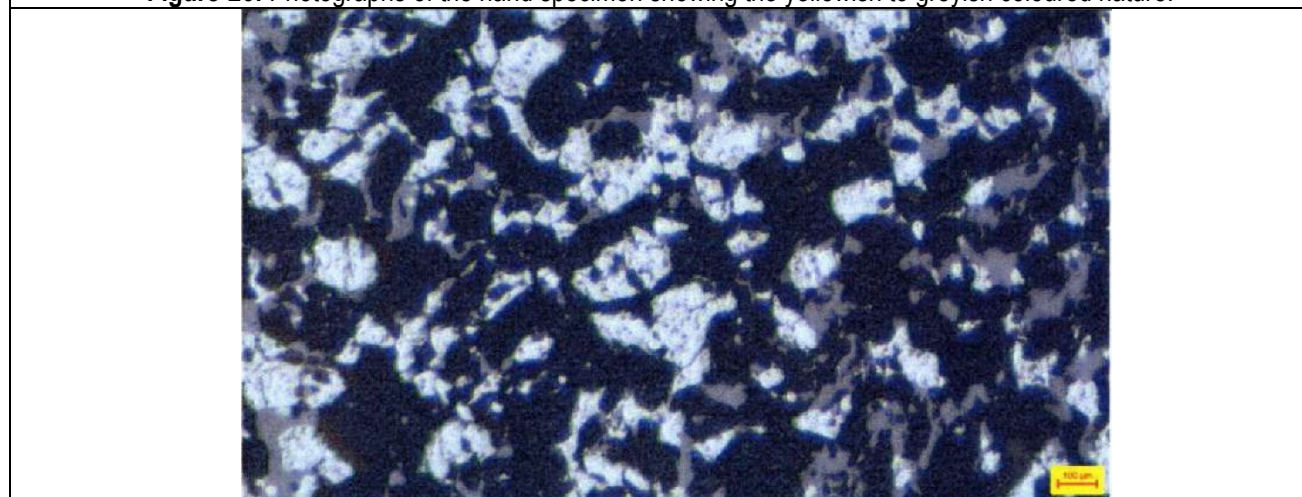


Figure-27: Photomicrograph under reflected light showing the greyish coloured magnetite 5X.

BRS No.	24-12-24-23
Physical properties	Megascopic studies indicate that the is massive looking and reddish brown to pale yellowish in color. At places reddish brown patches are noticed in the sample. <i>The rock gives to reddish brown streak indicating the oxidized nature and presence of Fe oxides.</i> The rock is not susceptible to hand magnet. (Figure-28).
Petrographic study	Petrographic studies of the rock stub under reflected light have been carried out to identify the ore mineral phases in the rock. Studies indicate the presence of greyish Fe oxides. The Fe oxide minerals are hematite and some goethite that are noticed within the gangue. When observed under crossed nicols reflected light the Fe oxide shows anisotropic nature indicating the presence of hematite in the rock. Hematite occurs as anhedral masses at places in the rock. (Figure-29)
Name of the rock	The sample is identified as Hematite-Goethite ore.

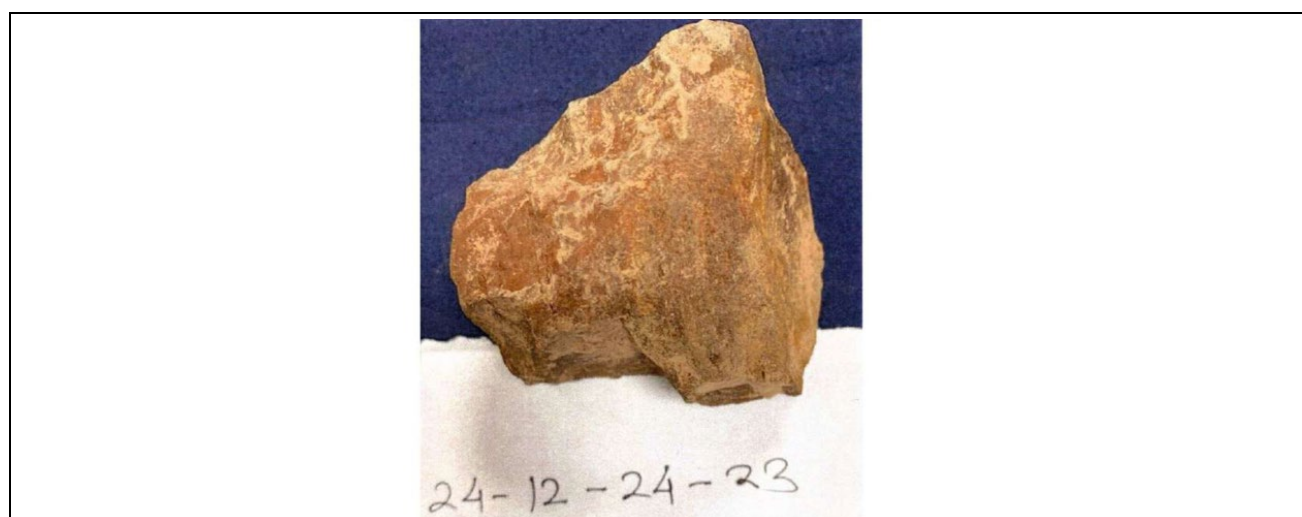


Figure-28: Photographs of the hand specimen showing the yellowish coloured nature of the rock.

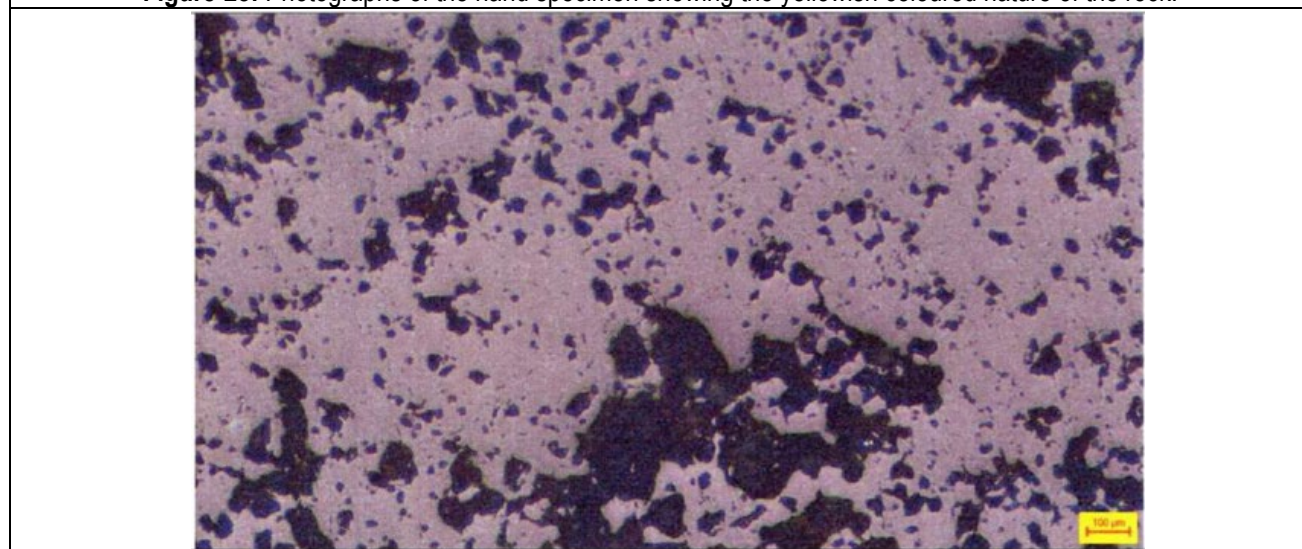


Figure-29: Photomicrograph under reflected light showing Fe oxide and gangue material 5X.

BRS No.	20-12-24-B
Physical properties	In hand specimen the rock is banded in nature and dark grayish to yellowish in color. <i>The metallic dark grey bands that are strongly susceptible to hand magnet indicating the presence of magnetite.</i> In the hand specimen the thickness of the dark colored magnetite rich layers varies from 4 mm to 6 mm, while the thickness of the brownish colored gangue material varies from 1 to 2 mm. The magnetic susceptibility of the dark grey bands indicates the presence of ferrimagnetic mineral phases in the rock. The rock is Hard Laminated Ore. (Figure-30)
Petrographic study	Petrographic studies have been carried out under reflected light to identify the ore minerals present in the sample. Studies indicate the presence of magnetite as the main Fe oxide phase that is noticed as grayish layers in the rock. Magnetite occurs as grayish bands in color under reflected light. In the sample the magnetite bands are thicker than the gangue material. The photomicrograph indicates that the ore mineral i.e. magnetite is predominant in the rock. Reflected light studies also indicate that at places it is observe that magnetite is martitised. (Figure-31)
Name of the rock	The sample is identified as Banded Magnetite rock.

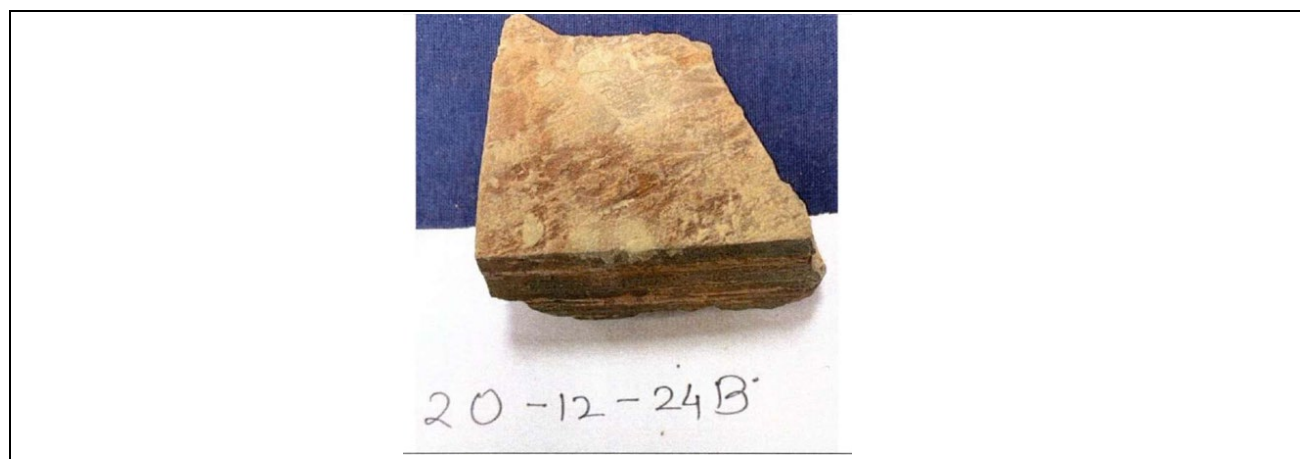


Figure-30: Photographs of the hand specimen showing the yellowish coloured nature of the rock.

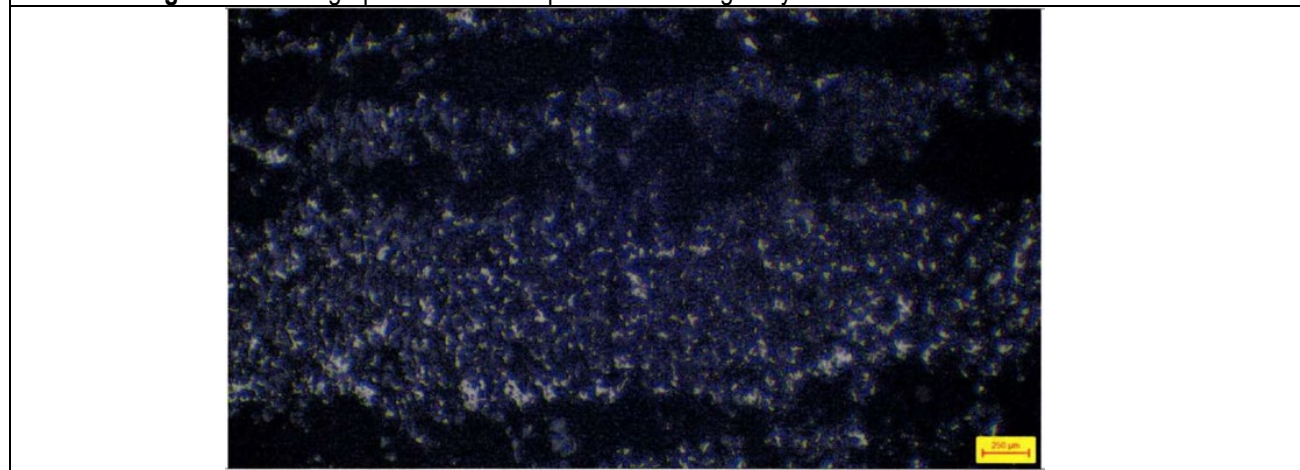


Figure-31: Photomicrograph under reflected light showing the banded nature of the rock. The grey-coloured layers are made of magnetite 2.5X.

BRS No.	25-12-24-33
Physical properties	Megascopic studies of the hand specimen of the rock indicate reddish brown to yellowish grey in color. <i>The rock gives rise to a dark grayish streak.</i> The rock is moderately hard, massive looking and is <i>strongly susceptible to hand magnet indicating the ferrimagnetic nature.</i> (Figure-32).
Petrographic study	Petrographic studies of the rock stub under reflected light indicate the presence of magnetite as a major Fe oxide ore mineral in the sample. Magnetite is greyish in color in plane polarised reflected light. Under crossed nicols magnetite is isotropic in nature. Magnetite occurs mostly as subhedral grains that are more or less uniformly distributed in the rock. The dark grey streak substantiates the presence of magnetite in the rock. At places it is noticed that magnetite is oxidized due to martitisation. (Figure-33)
Name of the rock	The sample is identified as a Magnetite Ore.

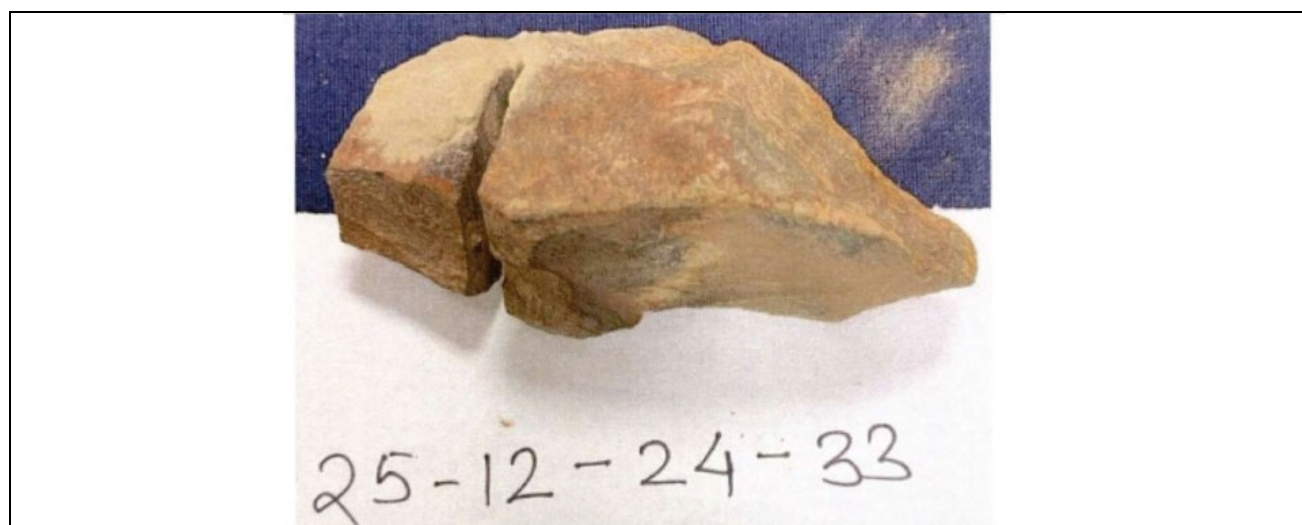


Figure-32: Photographs of the hand specimen showing the yellowish coloured nature of the rock.

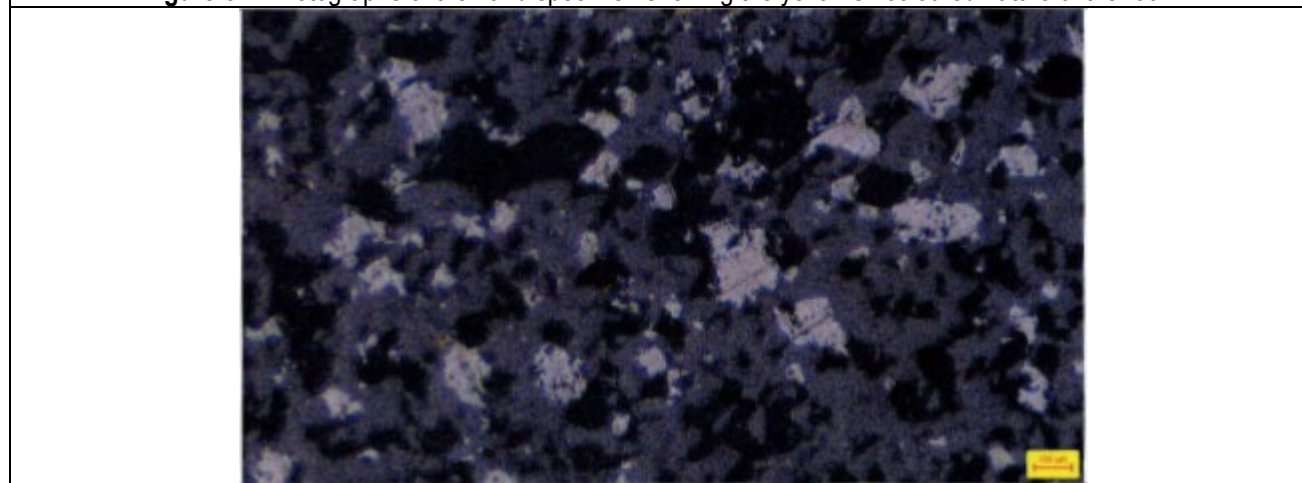


Figure-33: Photomicrograph under reflected light showing the grayish coloured magnetite amidst the gangue 5X.

BRS No.	18-12-24-02
Physical properties	Megascopically, the sample is massive, dark to light grey in colour with metallic luster. <i>The rock gives rise to a dark grayish streak.</i> The rock is moderately hard, massive looking and is <i>strongly susceptible to hand magnet indicating the ferrimagnetic nature.</i> (Figure-34)
Petrographic study	Petrographic studies of the rock stub under reflected light indicate the presence of magnetite, hematite and quartzite as a major Fe oxide ore mineral in the sample. It exhibits a medium-grain texture with subhedral to anhedral shape. The studies indicate that the sample may comprise magnetite, hematite and quartzite as dominant minerals associated with gangue minerals such as goethite and limonite.
Name of the rock	The sample is identified as Hard Laminated Magnetite Ore.



Figure-34: Photographs of the hand specimen showing dark to light grey coloured nature of the rock.

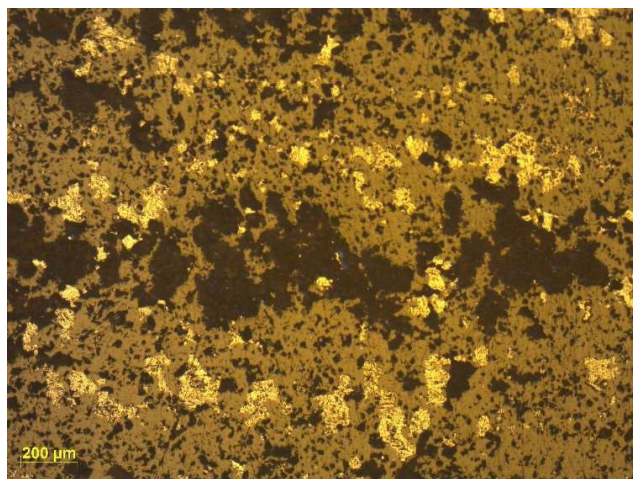


Figure-35: Photomicrograph showing the presence of magnetite, hematite and quartzite.

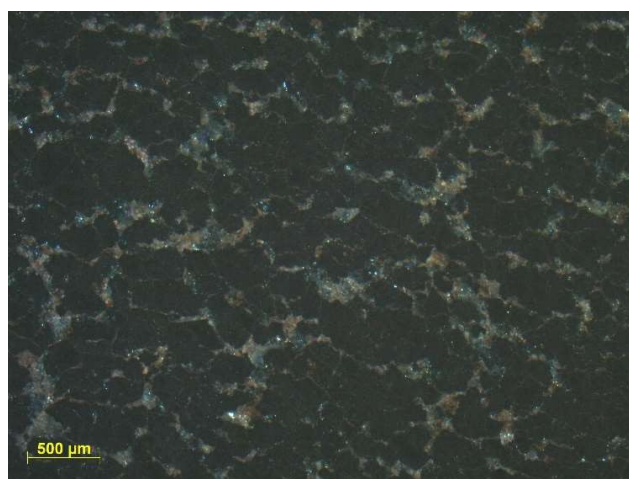


Figure-36: Photomicrograph showing intergrowth of hematite and quartz within magnetite minerals.

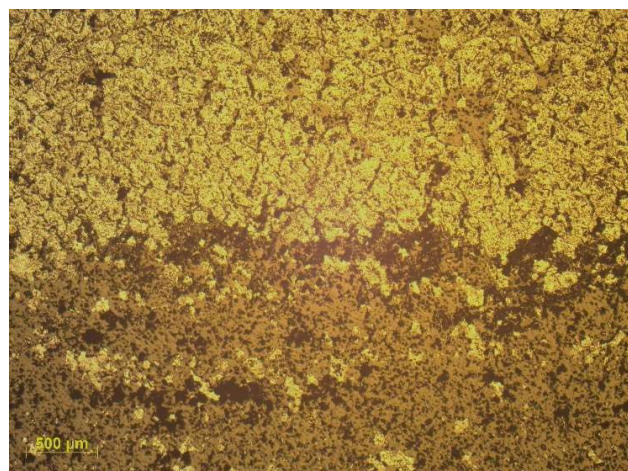


Figure-37: Photomicrograph showing a band of iron and silica-bearing minerals.

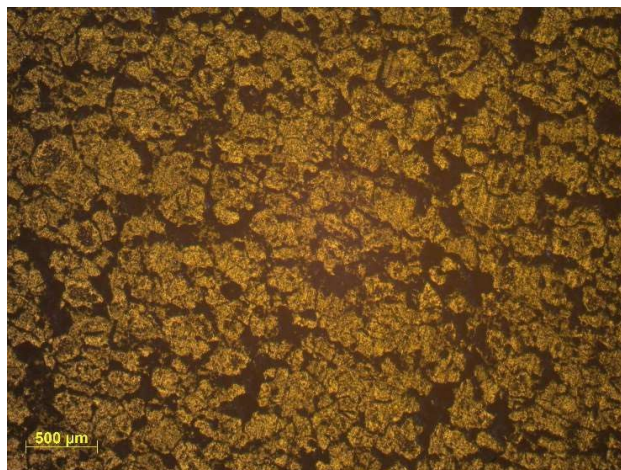


Figure-38: Photomicrograph showing magnetite within hematite mass in association with quartz mineral.

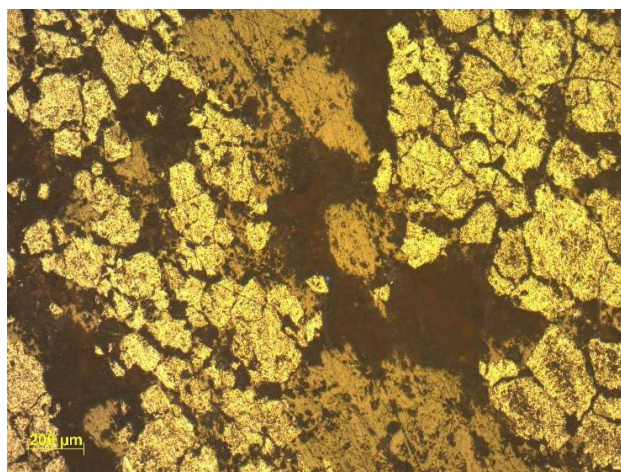


Figure-39: The texture in the photo is due to **conversion of Magnetite to Hematite** called **martitisation**.

BRS No.	22-12-24-R
Physical properties	Megascopically, the sample is grey in colour, showing alternate dark brown and light coloured shiny bands. <i>The metallic dark grey bands that are strongly susceptible to hand magnet indicating the presence of magnetite.</i> In the hand specimen the thickness of the dark colored magnetite rich layers varies from 4 mm to 6 mm, while the thickness of the brownish colored gangue material varies from 1 to 2 mm. The magnetic susceptibility of the dark grey bands indicates the presence of ferrimagnetic mineral phases in the rock. (Figure-40)
Petrographic study	Petrographic studies of the rock stub under reflected light indicate the presence of magnetite, hematite and quartzite as a major Fe oxide ore mineral in the sample. Under the microscope, magnetite appeared predominantly as a greyish-white cementing mineral with an irregular texture and indistinct boundaries. Photomicrographs of the iron ore samples displaying the representative mineral composition and textures may be made of magnetite, hematite and quartz. Studies indicate the presence of magnetite as the main Fe oxide phase that is noticed as grayish layers in the rock. Magnetite occurs as greyish bands in color under reflected light. In the sample the magnetite bands are thicker than the gangue material.
Name of the rock	The sample is identified as Banded Magnetite Rock .



Figure-40: Photographs of the hand specimen showing dark to light grey coloured nature of the rock.

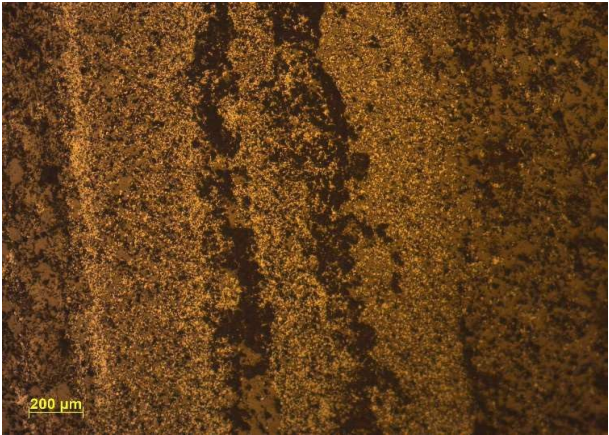
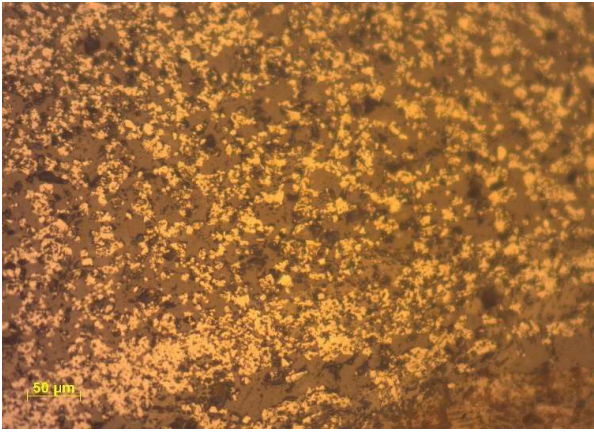
	
Figure-41: Alternate opaque quartz and light yellow magnetitic bands.	Figure-42: Photomicrograph showing disseminated crystals of hematite and magnetite.



Figure-43: Alternate bands showing subangular Quartz embedded within iron oxide (Magnetite) minerals .

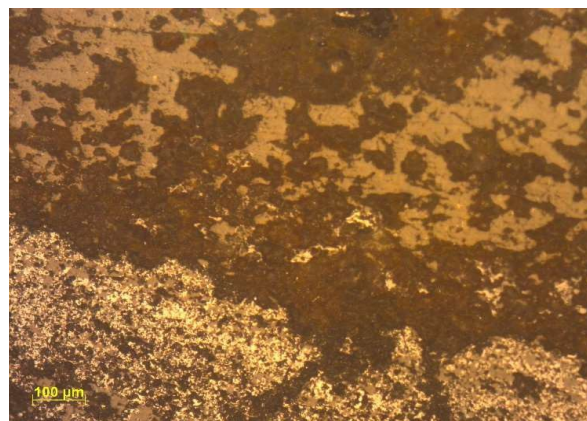


Figure-44: Photomicrograph showing dispersion of fine-grained hematite along with quartz, magnetite and gangue minerals.

6.1.14 Discussion

The geochemical analysis of bedrock samples from the iron ore zone reveals significant variation in the Fe and SiO₂ contents, indicating the presence of both medium and low-grade iron ore. The Fe content ranges from 8.70% to 48.56%, with certain samples like 24-12-18-1A exhibiting relatively higher iron concentrations exceeding 40%. Others show relatively low iron content, suggesting heterogeneous mineralization within the Banded Magnetite Quartzite (BMQ) and Banded Hematite Quartzite (BHQ) formations. X-ray diffraction data indicates the presence of banded hematite quartzite, by the presence of hematite and quartz mineral phases. The presence of Fe₂O₃ values ranging from 12.44% to 69.43% further supports the dominance of iron oxide minerals, with a few samples exhibiting exceptionally high Fe₂O₃ levels, indicative of high-grade mineralization. The silica content, varying from 18.45% to 73.45%, reflects the siliceous nature of the iron ore, with higher values associated with quartz-rich bands. The structural pattern of the terrain, along with the regional and thermal metamorphism, have contributed to the formation of the ore bodies, which extend for a strike length of approximately 4 km and a width of 6 m to 16 m. Overall, the results suggest that the iron ore in the area is of low to medium grade but has the potential to be upgraded to higher grades through suitable processing techniques. The mineralized zone offers significant potential for further exploration and exploitation.

6.1.15 Ore Zones

The iron ore zone is surficially exposed in block area. The mineralized iron ore band extends for a strike length of about 4 km, with a width varying between 6 m and 16 m. Iron ore occurs in the form of banded hematite quartzite (BHQ) and banded magnetite quartzite (BMQ). The iron ore zone trends in the NE-SW direction within the block area. Geochemical analysis of bedrock samples from the iron ore zone indicates Fe content ranging from 8.70% to 48.56%, while SiO₂ content varies between 18.45% and 73.45%, suggesting the siliceous nature of the iron ore rock. Channel sample analysis yielded Fe content ranging from 24.69% to 46.76%. An area of 2 sq. km has been demarcated for iron ore in block area.



CHAPTER-07

Mineral prospect

7.1 Surface indication

Field observations during the mapping of the investigated area indicate that the iron ore-bearing banded hematite quartzite/banded magnetite quartzite bands are primarily located on hilltops. The presence of rolled boulders of iron ore on hill slopes, and hard, resistant linear bands at hillock tops serve as key indicators of iron ore mineralization in the block area.

7.2 Mode of occurrence

Iron ore mineralization in the area is present as a linear BHQ/BMQ zone, trending from NE-SW direction, with moderate to steep dip. The ore bands show swelling and pinching pattern along with variation in Fe%, through entire length.

7.3 Strike length and width of anomalies

The mineralized iron ore band extends for a strike length of about 4 km, with a width varying between 6 m and 16 m. The variation in width along the strike of ore band is due to interference of F1 & F2 fold system. The fold closers show more width than limb.

7.4 Alteration zone

Limonitization are observed along joint planes and fractures, resulting from the oxidation of iron oxides into iron hydroxides. The presence of iron hydroxides, in the form of limonite reduces the Fe% in the mineralized zones.

7.5 Genesis of mineralization

The iron ore mineralization in the investigated area is primarily associated with BHQ/BMQ, occurring as linear bands along hill tops. The genesis of this mineralization can be attributed to the following geological processes:

The genesis of iron ore mineralization in the area involved a combination of sedimentary, metamorphic, and supergene processes. The banded iron formations (BIFs) originated as chemical precipitates in a Precambrian marine environment, where iron and silica were deposited as alternating layers under fluctuating redox conditions. Regional metamorphism and tectonic activity subsequently led to recrystallization, folding, and faulting of the iron-bearing sediments, enhancing the concentration of iron oxides such as hematite and magnetite. Post-metamorphic weathering and oxidation resulted in the alteration of primary iron oxides to secondary minerals like goethite and limonite, causing enrichment in certain zones while leaching led to depletion in others. Fluids circulating along fractures and joints further contributed to iron mobilization and reprecipitation, modifying the mineralogical composition of the ore body. Overall, the mineralization in the area represents a combination of primary sedimentary processes, subsequent metamorphism, structural deformation, and secondary enrichment, forming iron ore deposits.

7.6 General description

The objective of this NMET funded project was to “demarcate the mineralized zone and to assess the potentiality of Iron Ore”, A number of localities with incidence of mineralization’s in the form of bands have been noticed, appeared to be encouraging.

The Iron mineralized ore body (MOB) has been identified ranging in strike length of approx. 4000m with estimated reconnaissance resource of 3.36 mt, considering band width of 8m, and depth of 30 m taking Bulk Density of 3g/cc whereas in the case of float area, the width, depth and bulk density are considered to be 20m, 3m & 2g/cc respectively.

The mineral investigation work involved large scale geological mapping of 27 sq km on 1:12,500 scale and collection and analysis of 31 primary bed rock samples (BRS), 10 channel samples and 9 laterite samples as well as 6 check samples using WD-XRF methodology for major oxides. The study also completes 5 samples each for Petrographic, Minerographic and XRD studies along with the study of 12 samples using ICP-MS. The Fe content in bedrock samples ranging from 8.70% to 48.56%, with SiO₂ values between 18.45% and 73.45%, indicate a siliceous nature of iron-bearing formations and Titanium oxide (TiO₂) ranges upto 0.25% in primary BRS. Channel samples yielded Fe values between 24.69% and 46.76%. The results suggest the presence of low- to medium-grade iron ore, with the potential for beneficiation to enhance its economic value. The Fe content in the laterite samples ranges from 10.19 to 25.87%. While the ICP-MS analysis shows that the Fe, Nb, Ti & V content in the BRS range between 8546 to 319724 ppm, upto 10ppm, 925 to 6824 ppm & 16 to 334 ppm respectively. The Fe, Al, Sn, Mo, Ti & V content in the laterite range between 130291 to 184453 ppm, 38919 to 53898 ppm, 50 to 101 ppm, 1.38 to 2.38 ppm, 1324 to 1556 ppm & 232 to 304 ppm respectively. Whereas in the stream sediments samples; Fe, Mo, Nb, W, V & Ti contents vary between 48629 to 201959 ppm, upto 12.56 ppm, 6 to 31 ppm, upto 0.71, 129 to 328 ppm & 5561 to 25582 ppm respectively. The mineralized zones within the block exhibit a cumulative strike length of approximately 4 km, with an average width of about 8 meters. An area of approximately 3.8 sq km has been delineated with iron ore mineralization.

The details of analytical values are appended in attached annexures.

CHAPTER-08

Resource estimation

8.1 Detailed description of ore zones

The Reconnaissance Survey on G4 level has been accomplished through Large-scale mapping on 1:12,500 scale. The field observations on structural trends of Ore bodies from surface exposures and analytical values of the Geochemical survey has been synthesized the reconnaissance resource was estimated as per UNFC norms and Minerals (Evidence of Mineral Content) Rules-2015 at G-4 level. It is observed that Iron Ore Bands/lenses demarcated in the area, were formed as a result of supergene enrichment of underlying ferruginous formations. The Iron ore bodies viz. massive. Iron ore bodies found in the area, occur as elongated lenticular bodies of variable dimensions both laterally and depth wise. The area clearly depicted lateral continuation of ore bodies at depth. Consequently, based on field observations, the surface width measured ranging from 6 m to 16 m. In the absence of sub-surface geological information, the altitudinal differences of band disposition on the ground based on contour interval, a 30m depth has been assigned for estimation of reconnaissance mineral resource (334). Similarly, the Bulk density of the massive Iron ore has been considered to be of 3.0g/cu.cm The grade of the ore body has been derived out of the weighted average of all the samples of mineralized zone. Finally, an estimated reconnaissance resource of 2.88 mt from a cumulative mineralized ore body (MOB) length of 4000m within an area of 32,000 m² and 9,60,000 volume area (m³) of mineralized zone has been established. MOB to be denoted on Geological Map.

The details of resource estimation are tabulated below.

Table No-04

DIMENSION AND GEOLOGICAL RESOURCE (334) OF MINERALIZED ORE BODIES (MOB) IN AREWADA-HITAPADI BLOCK						
Dimension of ore body				Area of MOB (m²)	Vol. of MOB (m³)	Resource Estimation MOB wise (MT)
Length of MOB (m)	Width Range (m)	Average width (m)	Average Depth (m)			
4,000	6-16	8	30	32,000	9,60,000	2.88
Massive Iron Ore. Bulk Density of 3g/cc has been considered for calculation						

An attempt was also made to estimate resources of float ores spreading over the hill slopes, considering 20m width, 3m depth and 2g/cc bulk density.

Along with this float ore resource is additional estimated to **0.48 mt**, considering 3m depth & 2g/cc bulk density.

Table-05

FLOAT ORE RESOURCE IN AREWADA-HITAPADI BLOCK						
Type	Length(m)	Width(m)	Depth(m)	Area(m ²)	Volume(m ³)	Resource (MT)
Float Ore	4000	20	3	80000	240000	0.48
Bulk Density of 2g/cc has been considered for calculation						

The area is predominantly characterized by Banded Magnetite Quartzite (BMQ) enclaves within the Bengpal Gneisses on a large scale. Martitisation is evident within the Mineralised Ore Body (MOB), where magnetite has undergone alteration to hematite, particularly near and above the water table, as confirmed by XRD and optical microscopy (OM) analyses. The hematite thus formed exhibits weak magnetic properties. The cut-off grade for magnetite is considered at 15%, while for hematite it is 45%. Resource estimation has been carried out for magnetite, as proper quantification between primary magnetite and secondary martitised hematite could not be achieved under the current scope of work (G4 stage). A total of **3.36 million tonnes** of resource has been estimated from both the Iron ore band and float area. However, with G3 stage exploration with drilling may further increase the iron ore resources from the Arewada-Hitapadi block area. The deposit holds potential for consideration under auction, if applicable, within the framework of a Composite License (CL).

CHAPTER-09

Conclusion and Recommendation

9.1 Conclusions

An area of 27 sq km area was geologically mapped in parts of Bhamragarh tehsil, Chandrapur district, Maharashtra in Toposheet No. 65A/07 with PGRS support. Metasedimentary bands such as **banded magnetite quartzite**, cherty quartzites, mica schists/quartz muscovite schist sericitic, phyllite. Banded Magnetite quartzite and ferruginous shales occur as enclaves in the gneissic terrain. These have been classified into Bengpal and Bailadila Groups on the basis of contrasting lithology and grade of metamorphism. The rocks of Bengpal Group comprise high grade metamorphites and are low in ferruginous content as compared to the Bailadila, which comprise low grade metasediments having more iron content. The Bengpal Group thus consists of Quartzite, cherty quartzite/BMQ and mica schist /quartz mica schist.

The rocks of the area are highly deformed into numerous mesoscopic and macroscopic folds and evidences of two phases of folding have been observed. The earlier folds (F1) are open upright and tight isoclinal, plunging towards WNW to WSW and also towards E to ESE. The later folds (F2) are upright and slightly asymmetrical plunging towards SSE or SSW.

The Iron mineralized ore body (MOB) has been identified ranging in strike length of approx. 4000m with estimated reconnaissance resource of 3.36 mt, considering band width of 8m, and depth of 30 m taking Bulk Density of 3g/cc whereas in the float area, the width, depth and bulk density are considered to be 20m, 3m & 2g/cc respectively.

The mineral investigation work involved large scale geological mapping of 27 sq km on 1:12,500 scale and collection and analysis of 31 primary bed rock samples (BRS), 10 channel samples and 9 laterite samples as well as 6 check samples using WD-XRF methodology for major oxides. The study also completes 5 samples each for Petrographic, Minerographic and XRD studies along with the study of 12 samples using ICP-MS. The Fe content in bedrock samples ranging from 8.70% to 48.56%, with SiO₂ values between 18.45% and 73.45%, indicate a siliceous nature of iron-bearing formations and Titanium oxide (TiO₂) ranges upto 0.25% in primary BRS. Channel samples yielded Fe values between 24.69% and 46.76%. The results suggest the presence of low- to medium-grade iron ore, with the potential for beneficiation to enhance its economic value. The Fe content in the laterite samples ranges from 10.19 to 25.87%. While the ICP-MS analysis shows that the Fe, Nb, Ti & V content in the BRS range between 8546 to 319724 ppm, upto 10ppm, 925 to 6824 ppm & 16 to 334 ppm respectively. The Fe, Al, Sn, Mo, Ti & V content in the laterite range between 130291 to 184453 ppm, 38919 to 53898 ppm, 50 to 101 ppm, 1.38 to 2.38 ppm, 1324 to 1556 ppm & 232 to 304 ppm respectively. Whereas in the stream sediments samples; Fe, Mo, Nb, W, V & Ti contents vary between 48629 to 201959 ppm, upto 12.56 ppm, 6 to 31 ppm, upto 0.71, 129 to 328 ppm & 5561 to 25582 ppm respectively. The mineralized zones within the block exhibit a cumulative strike length of approximately 4 km, with an average width of about 8 meters. An area of approximately 3.8 sq km has been delineated with iron ore mineralization. The details of analytical values are appended in attached annexure. (1&2).

Tentatively one CL block has been carved out and proposed for auctioning covering an area of 3.8 Sq. Km.

9.2 Recommendations

The G-4 stage exploration have been carried out in Arewada-Hitapadi block, Gadchiroli District, Maharashtra employing large scale mapping on 1:12,500 scale and rocks/ ore sampling, analysis have given encouraging results for Iron (Magnetite). The area is promising in view of reporting mineralized zone and grade of Iron ore.

1. Based on field data generated through G4, about an area of 3.8 sq. km. can be taken up for auctioning under "CL" by DGM, MS.
2. During our current field work many adjacent areas have been potentially identified for future exploration under G4 for both Haematite and Magnetite ores within the Toposheet areas of 65A/6 & 65A/11. Even adjacent area of Chhattisgarh State that are presumed to be potential for Iron ore exploration.
3. DGM, Maharashtra could consider the block for auction.
4. Trace elements value through stream sediment samples viz. AH-SSS-10 and REE values of one SSS-10 (2610.27ppm TREE) is very significant, need to be looked upon.



Appendix-1 Expenditure

Annexure 9A							
Estimate Cost for Reconnaissance Survey (G-4 stage) for Iron Ore in Arewada – Hitapadi Block (27 sq km), District: Gadchiroli, Maharashtra. Area 27 sq. km, Schedule timeline- 6 months [Review: After 4 Months]							
S. No.	Item of Work *	Unit *	Rates as per NMET SoC 2020-21		Estimated Cost of the Proposal		Remarks
			SoC-Item No. *	Rates as per SoC *	Qty.	Total	
						Amount (Rs)	
						(a*b)	
1A	Geological Mapping Other Geological Work & Surveying						
	Geological mapping, (1:12,500 scale) & Trenching, drilling work	Sq. km			27		
i	a. Charges for Geologist per day (Field) for geological mapping	day	1.2b	11000	40	440000	
ii	b. Labours Charges; Base rate	day	5.7	522	80	41760	Amount will be reimbursed as per the notified rates by the Central Labour Commissioner or respective State Govt. whichever is higher.
	Sub Total- 1A					4,81,760	
1B	Collection of surface samples						
1	BRS, Channel Sampling	Sq. km			27		
3	a. Sampler	per day	1.5.2	5100	8	40,800	

4	c. Labours Charges	day	5.7	522	32	16,704	Amount will be reimbursed as per the notified rates by the Central Labour Commissioner or respective State Govt. whichever is higher.
5	Geophysicist party days (HQ)	per day					
	Sub Total- 1B					57,504	
	Total (1A to 1B)					5,39,264	
	As this is a programme in a Naxalite area					NA	
1C	Charges for Geologist per day (HQ)	day	2a	9000	30	270000	
2	LABORATORY STUDIES						
a	Chemical Analysis						
i)	Geochemical Sampling- Surface samples (Bedrock/Channel /Soil/Stream sediment)						
	a. Au by Fire Assay	Nos	4.1.5a	2380	0	0	
	b. For Ag, Ni, Co, Cr, Cu, Pb, Zn, V, Ti by AAS Method	Nos				0	
	c. ICPMS for 34 Elements	Nos	4.1.14	7731	10	77,310	
ii)	Surface Check samples (10% External)				0		
	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					
vii)	Major Oxide Analysis						

	a) Estimation of major oxides by XRF/whole rock analysis for primary samples (CaO, MgO, SiO ₂ , Al ₂ O ₃ , LOI, Na ₂ O, Fe ₂ O ₃ , MnO, K ₂ O, TiO ₂ , SO ₃ , P ₂ O ₅ , Cr ₂ O ₃ , ZnO, V ₂ O ₅)	per sample	4.1.15a	4200	50	2,10,000	40 BRS + 10 Channel Samples
	check samples	per sample	4.1.15a	4200	5	21,000	4 check sample of BRS
	PCS for whole rock analysis	per sample	4.1.15a	4200	0	0	
3	Physical & Petrological Studies						
i	Preparation of thin section	Nos	4.3.1	2353	5	11,765	
ii	Petrological report of thin section	Nos	4.3.4	4232	5	21,160	
iii	Preparation of polish section	Nos	4.3.2	1549	5	7,745	
iv	Minerographic report of rock sample	Nos	4.3.4	4232	5	21,160	
v	Digital Photographs	Nos	4.3.7	280	5	1,400	
vi	Whole Rock Analysis	Nos					
vii	Sp. Gravity	Nos					
viii	XRD Studies	Nos.	4.5.1	4,000	5	20,000	
	Total 2 & 3					3,91,540	
4	Total COST					12,00,804	
5	Geological Report Preparation	5 Hard copies with a soft	5.2	i		1,50,000	Reimbursement will be made after submission of the final Geological Report in Hard Copies (5 Nos) and the soft

		copy					copy to NMET.
6	Peer review Charges					30,000	
7	Preparation of Exploration Proposal	5 Hard copies with a soft copy	5.1	2% of the Cost or Rs. 5.0 Lakhs whichever is less		24,016	EA will be reimbursed after submission of the Hard Copies and the soft copy of the final proposal along with Maps and Plan as suggested by the TCC-NMET in its meeting while clearing the proposal.
	(5 Hard copies with a soft copy)						
8	Total Estimated Cost without GST					14,04,820	
9	Provision for GST (18% of J)					2,52,868	GST will be reimbursed as per actual and as per notified prescribed rate
10	Total Estimated Cost with GST					16,57,688	
				Rs. In Lakhs	16.58		
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 NMET SoC and Item no. 6 of NMET SoC. In case of execution of the project by NEA on its own, a Certificate 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.						

Appndix-2 References

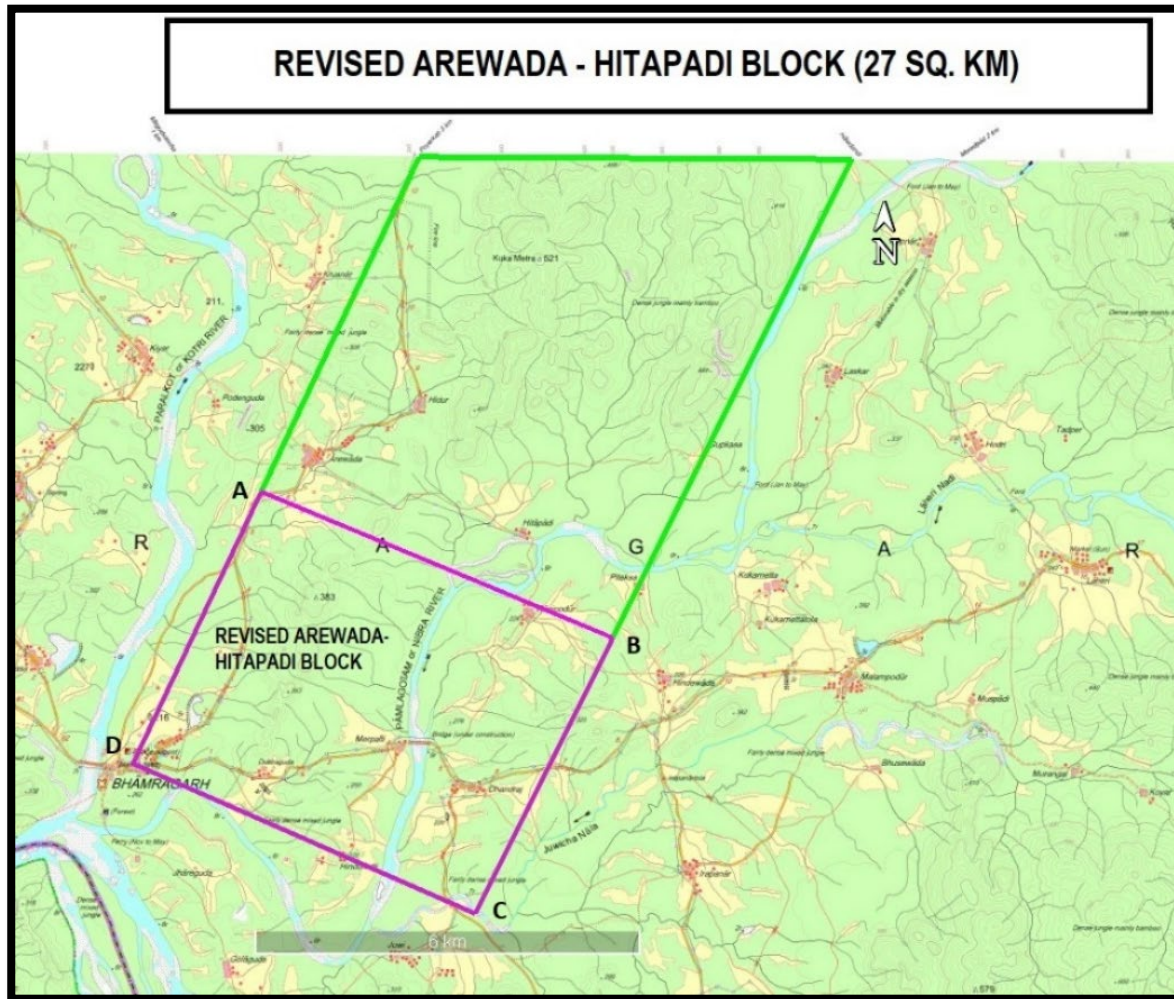
SI	Authors	Title	Year
01	Pascoe. E.H	"A Manual of Geology of India & Burma Vol. I"	1950
02	King, W	The Geology of the Pranhita-Godavari Valley, Mem. Geol Surv. Ind. Vol.18.pt-3.	1981
03	Crookshank, H	Geology of the southern Baster and Jeypore from Bailadila range to Eastern Ghats (Mem. Geological Survey of India Vol. 87)	1963
04	C.N. Chari et.al	DGM, MS has carried out exploration for Iron Ore in Surjagarh area. in parts of Toposheet 65A/06.	Between 1967-1975.
05	H.P. Saxena, S.K. Das, B. Zaheer and S.K. Sengupta	First systematic geological mapping in this area within the Toposheet No-65A/06 & 65A/10 was carried out vide Acc No- CR-014491.	Field Season-1978-79.
06	S.S. Jain & S.K. Pattanaik	The remaining part of the Toposheet 65A/06, 65A/07 & 65A/11 was subsequently mapped vide Acc No- CR-014572.	Field Season - 1978-79.
07	T. Krishnama Chalu & K. Kumaran	Regional Integrated Survey for locating Base metal occurrences by Regional Stream Sediment Survey in the SE extension of the Chamursi-Ghot belt, in parts of Toposheet 65A/02 & 65A/06 was carried out. vide Acc No- CR-015778.	F.S-1978-79.
08	K. Kameswara Rao	A Preliminary appraisal of Sillimanite occurrence near Gundapuri was carried out in parts of Toposheet 65A/06 & 65A/07. vide Acc No- CR-015239.	Field Season- 1980-81
09	Shyamal Kumar Sengupta & Swapan Kumar Das	One more Preliminary appraisal of the newly reported Base metal occurrences in Bhandara and Gadchiroli Districts was carried out in parts of Toposheet 65A/06 & 65A/07 vide Acc No- CR-016829.	Field Season- 1982-83.
10	Pattanaik & Sengupta	Geology of parts of Sironcha Tehsil, Chandrapur District in parts of Toposheet 65A/07 vide Acc No –CR-013642.	Field Season 1977-78.
11	K.Kameswara Rao	On the reported occurrences of Kyanite and Sillimanite around Palli and Kusansur in parts of Toposheet 65A/11, vide Acc No-CR-015779.	Field Season 1979-80
12	S.K.Pattanaik	Regional Stream Sediment Survey between Hetalkasa & Dudepalli in parts of Gadchiroli District, vide Acc No in parts of Toposheet 65A/02 & 65A/07. vide Acc No-CR-017760	Field Season 1982-83
13	Hemmady, A, K, R.,	Geology of parts of Sironcha Tehsil, Chandrapur District in parts of Toposheet 65A/03	Field Season 1967-68
14	R. Raman	Geology of parts of Sironcha Tehsil, Chandrapur District in parts of Toposheet 65A/01	Field Season 1969-70
15	Subrata Sarkar et. al.	Report on reconnaissance Survey (G-4 Stage) for Iron ore in "Marampalli-Jinjaon Block" District-Gadchiroli, Maharashtra (Toposheet No-65A/07, F.S-2023-24)	Field Season 2023-24

Appendix-3 Locality index

S.N.	Locality	Latitude	Longitude	Toposheet No.
1	Arewada	19°27'26.22"N	80°36'47.84"E	65A/11
2	Hitapadi	19°26'50.52"N	80°38'41.82"E	
3	Bhamragarh	19°24'50.00"N	80°35'15.00"E	
4	Ranipodur	19°26'8.34"N	80°38'45.65"E	
5	Dhandraj	19°24'41.28"N	80°38'13.75"E	
6	Dubbaguda	19°24'48.13"N	80°36'24.06"E	
7	Merpalli	19°25'1.17"N	80°37'34.70"E	
8	Hindbhatti	19°24'6.64"N	80°37'7.30"E	

List of plates –

Plate-1: Location of Arewada-Hitapadi Iron Ore block in TS-65A/11



Arewada – Hitapadi Block Coordinates						
LONGITUDE				LATITUDE		
(A)	80°	36'	21.66"	19°	27'	07.82"
(B)	80°	39'	31.69"	19°	25'	54.91"
(C)	80°	38'	19"	19°	23'	36"
(D)	80°	35'	15"	19°	24'	50"

PLOT NO. 34, POSTAL COLONY, BAPAT NAGAR, CHANDRAPUR 442401, MAHARASHTRA.

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Plate-2: Reference map of Arewada-Hitapadi Block with respect to previously concluded NMET funded Block in Gadchiroli District, Maharashtra.

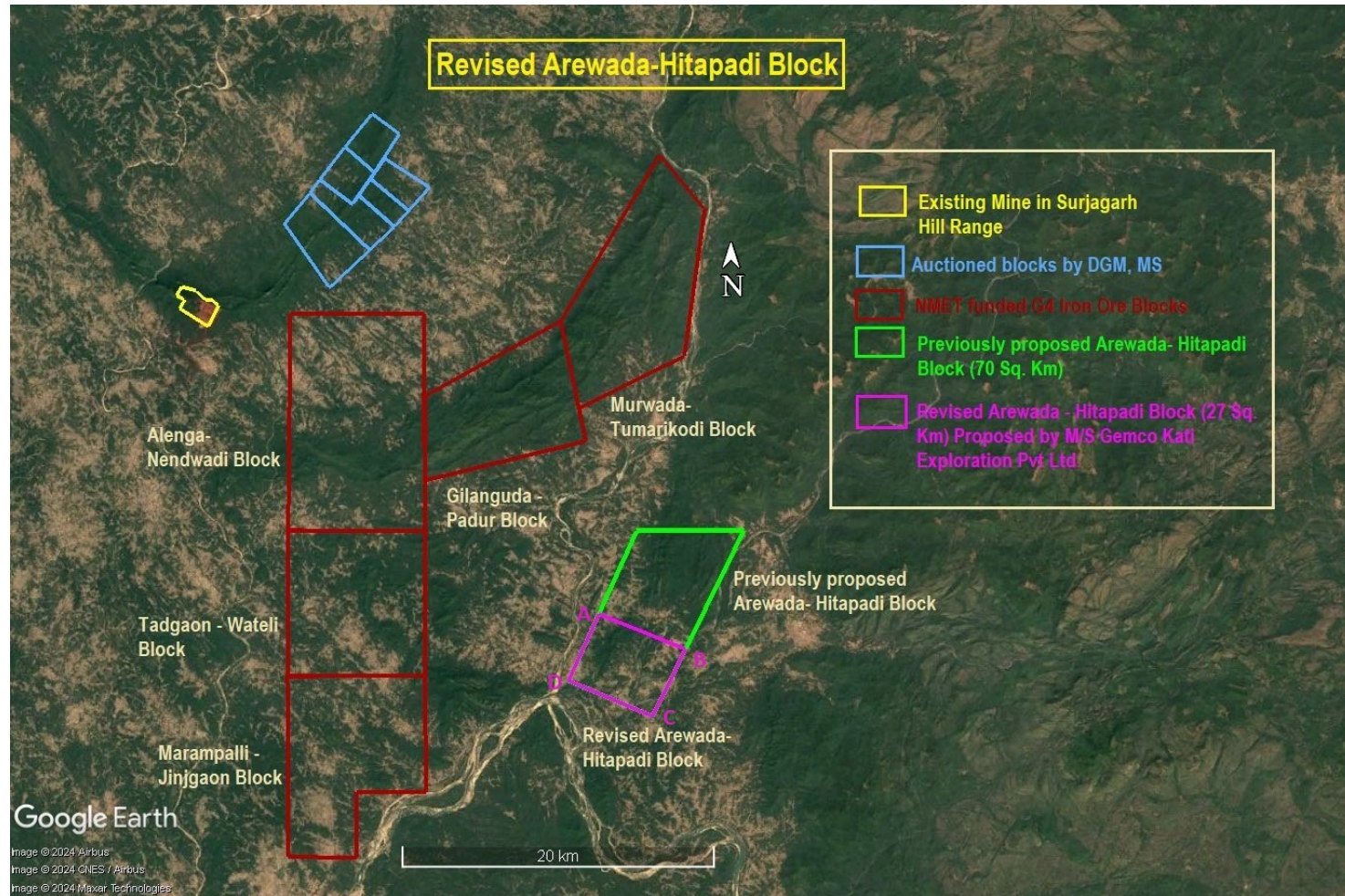


Plate-3

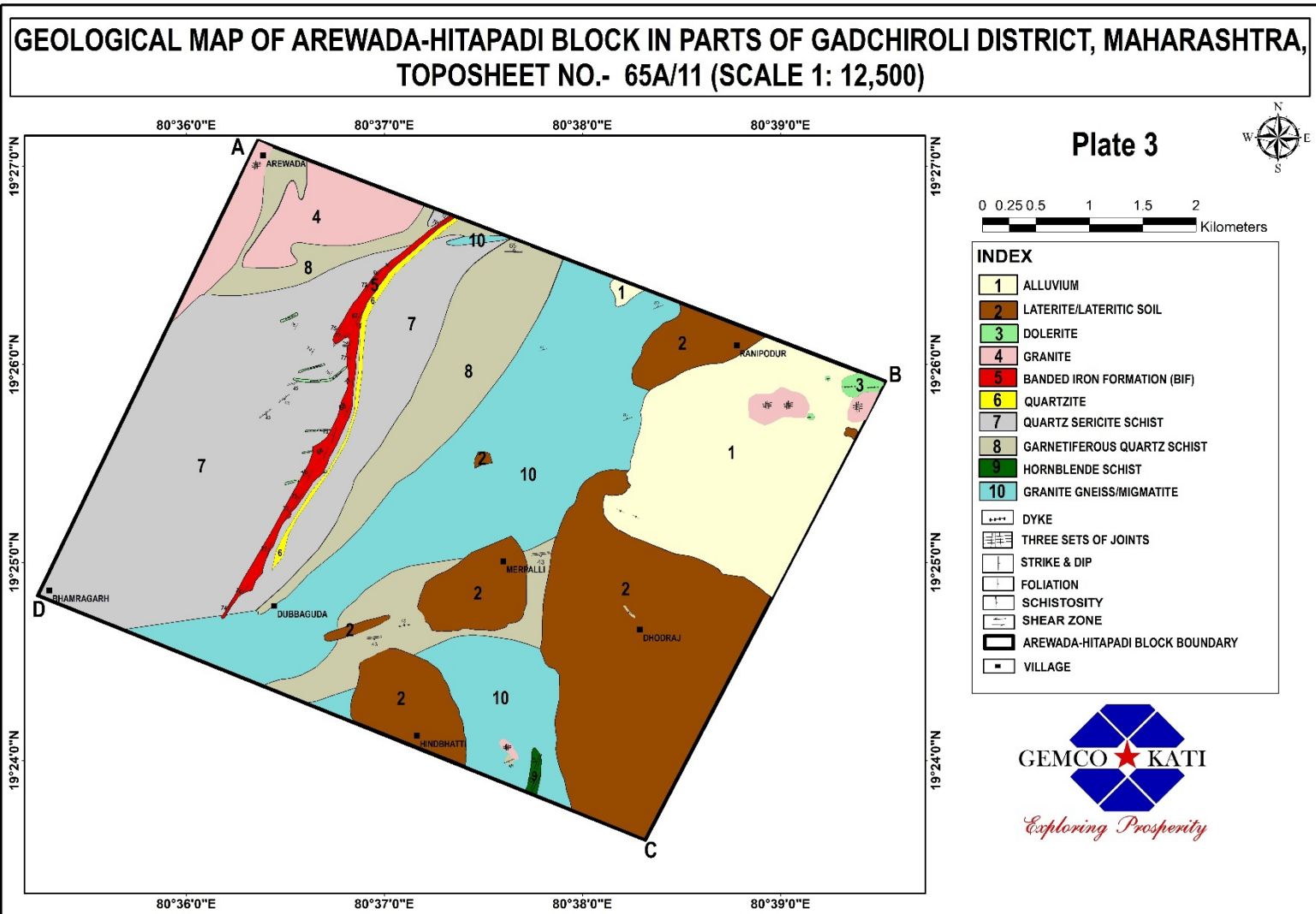


Plate-4

OUTCROP MAP OF AREWADA-HITAPADI BLOCK IN PARTS OF GADCHIROLI DISTRICT, MAHARASHTRA, TOPOSHEET NO.- 65A/11 (SCALE 1: 12,500)

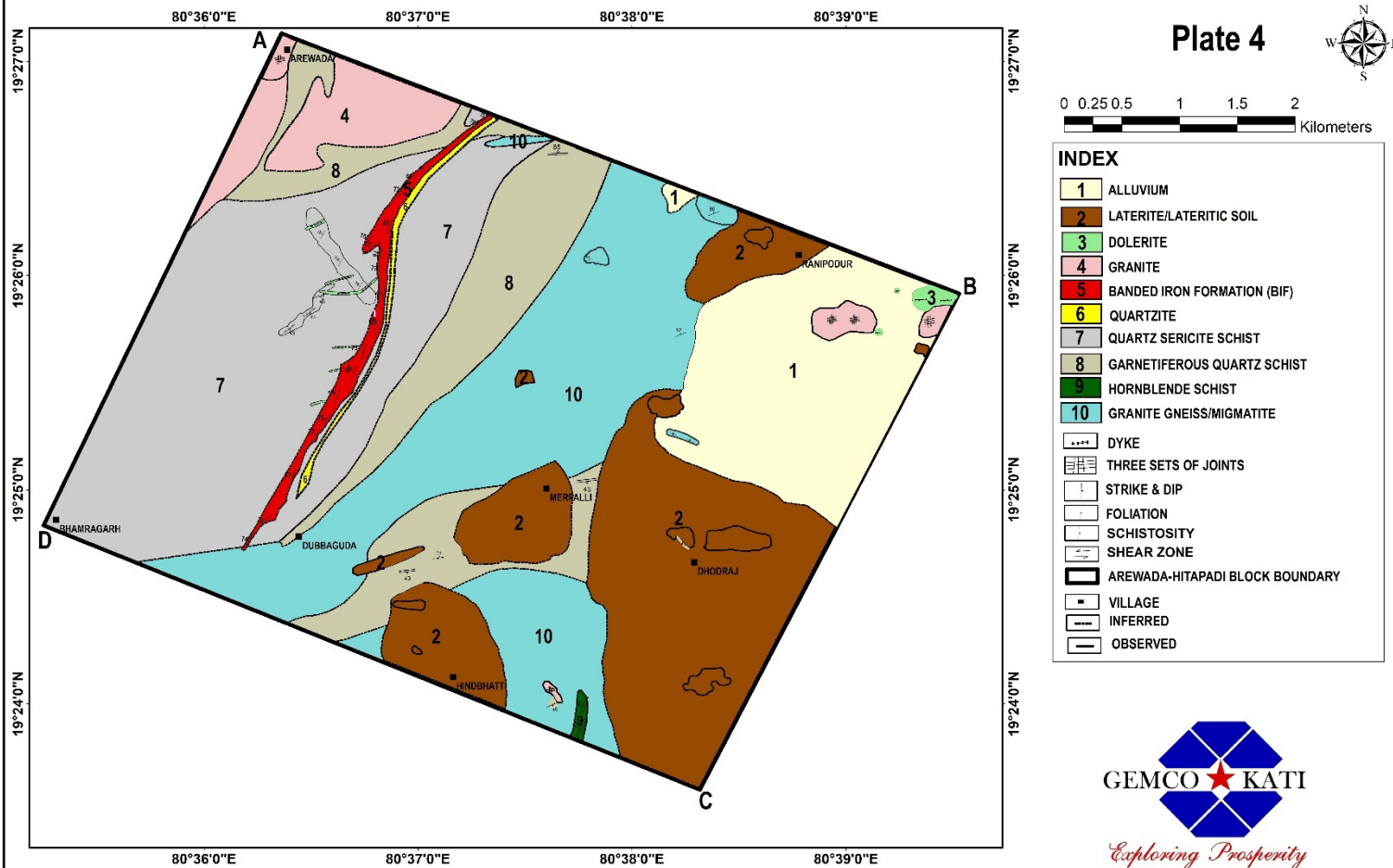


Plate-5

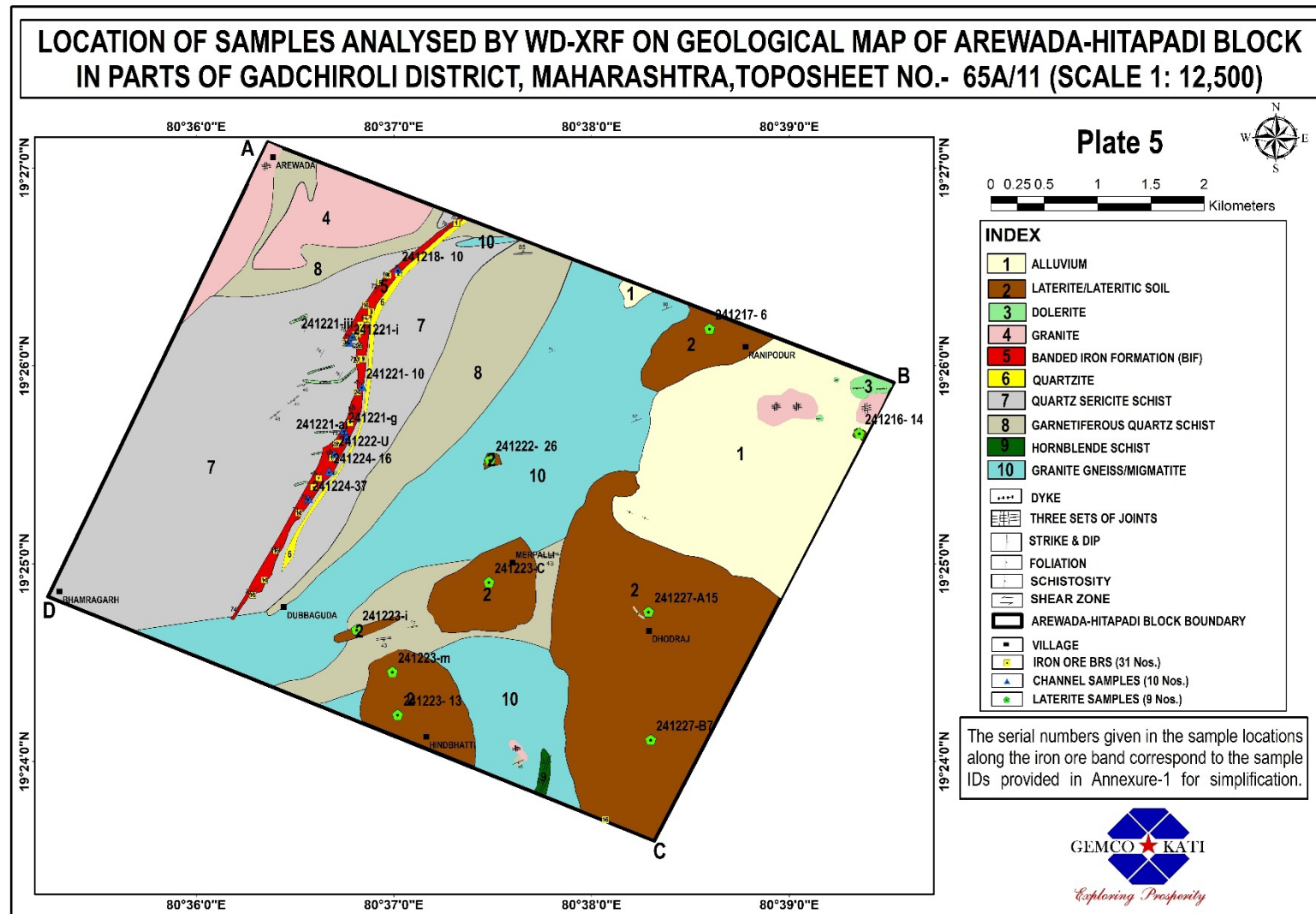


Plate-6

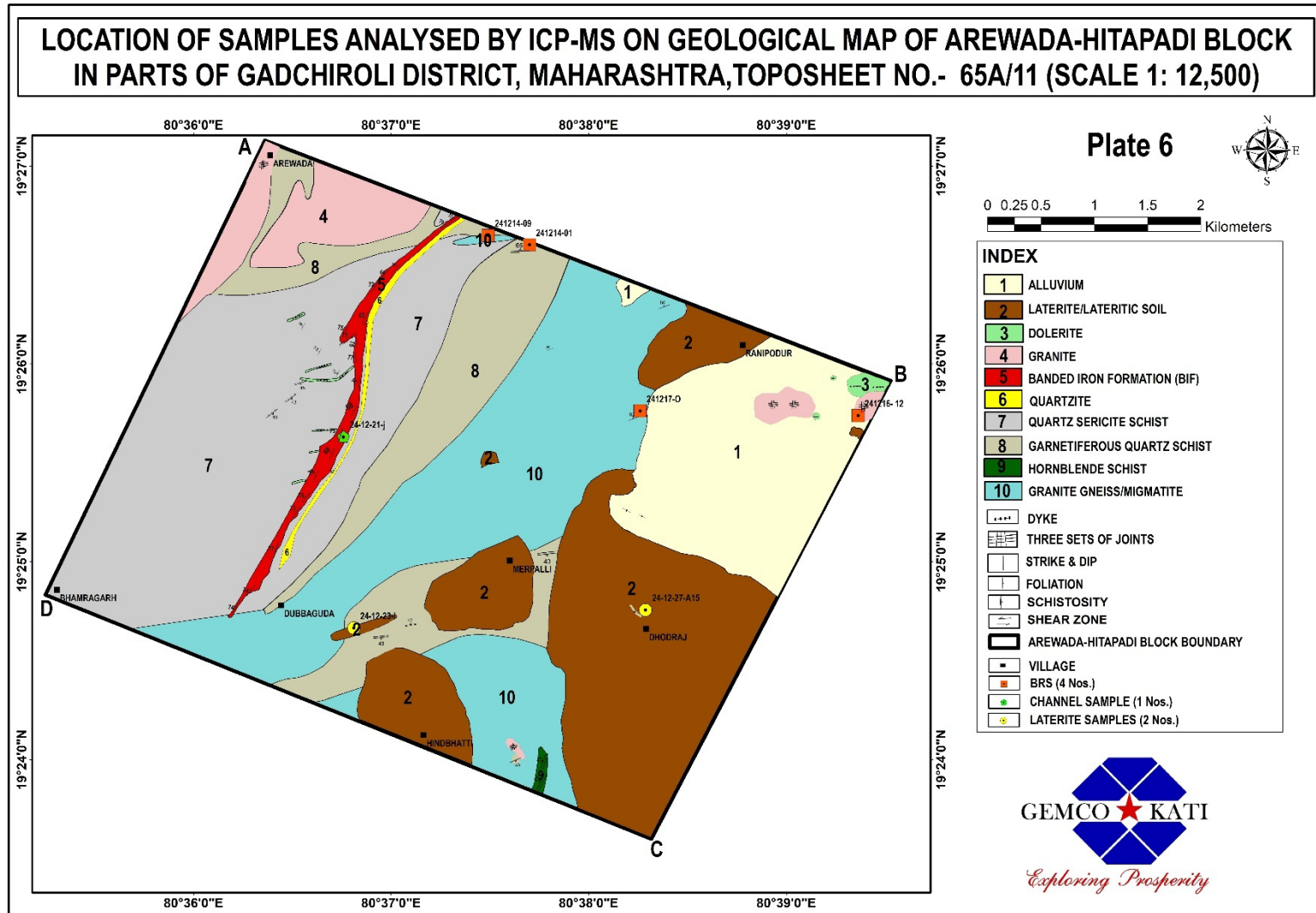


Plate-7

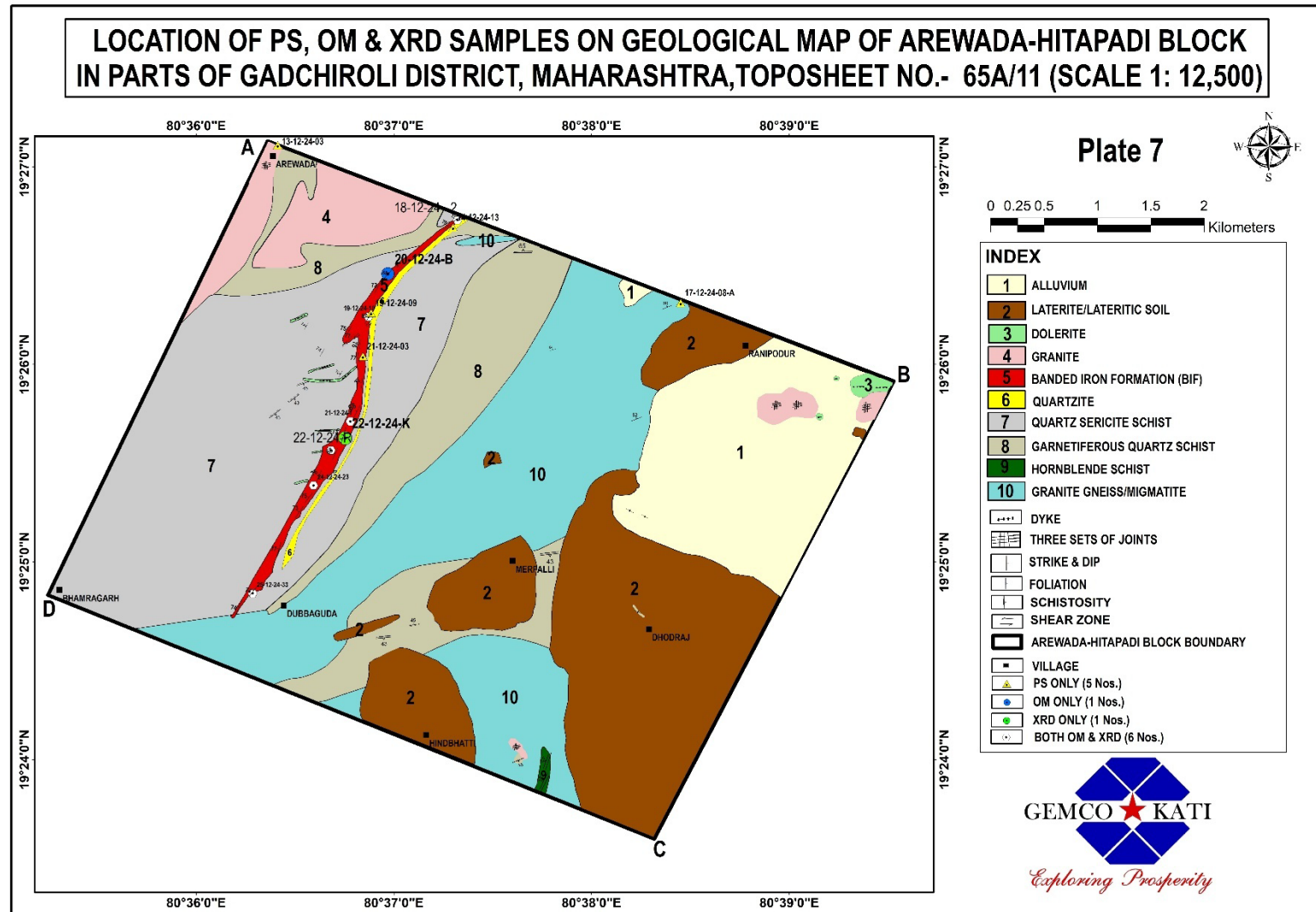


Plate-8

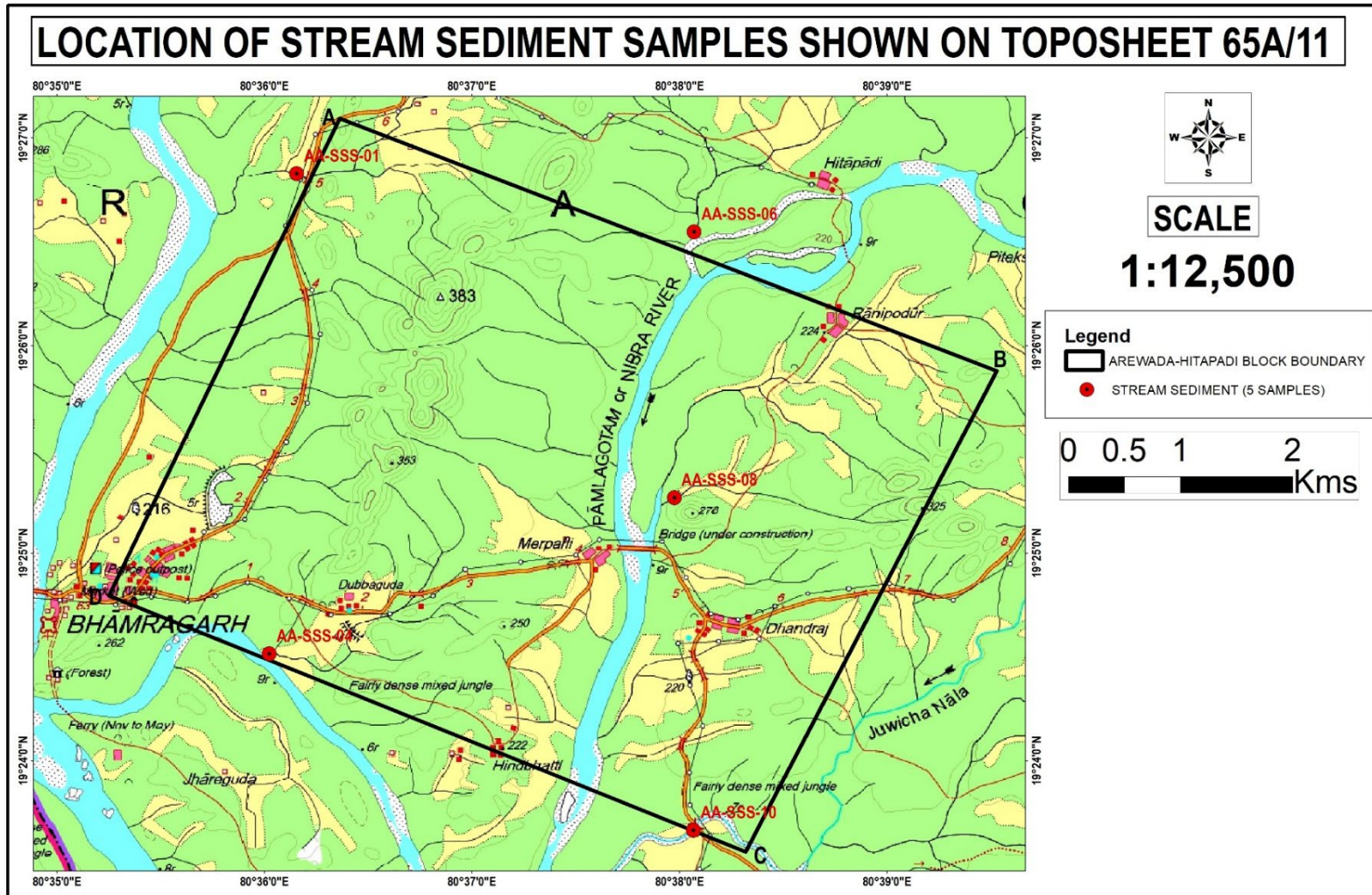
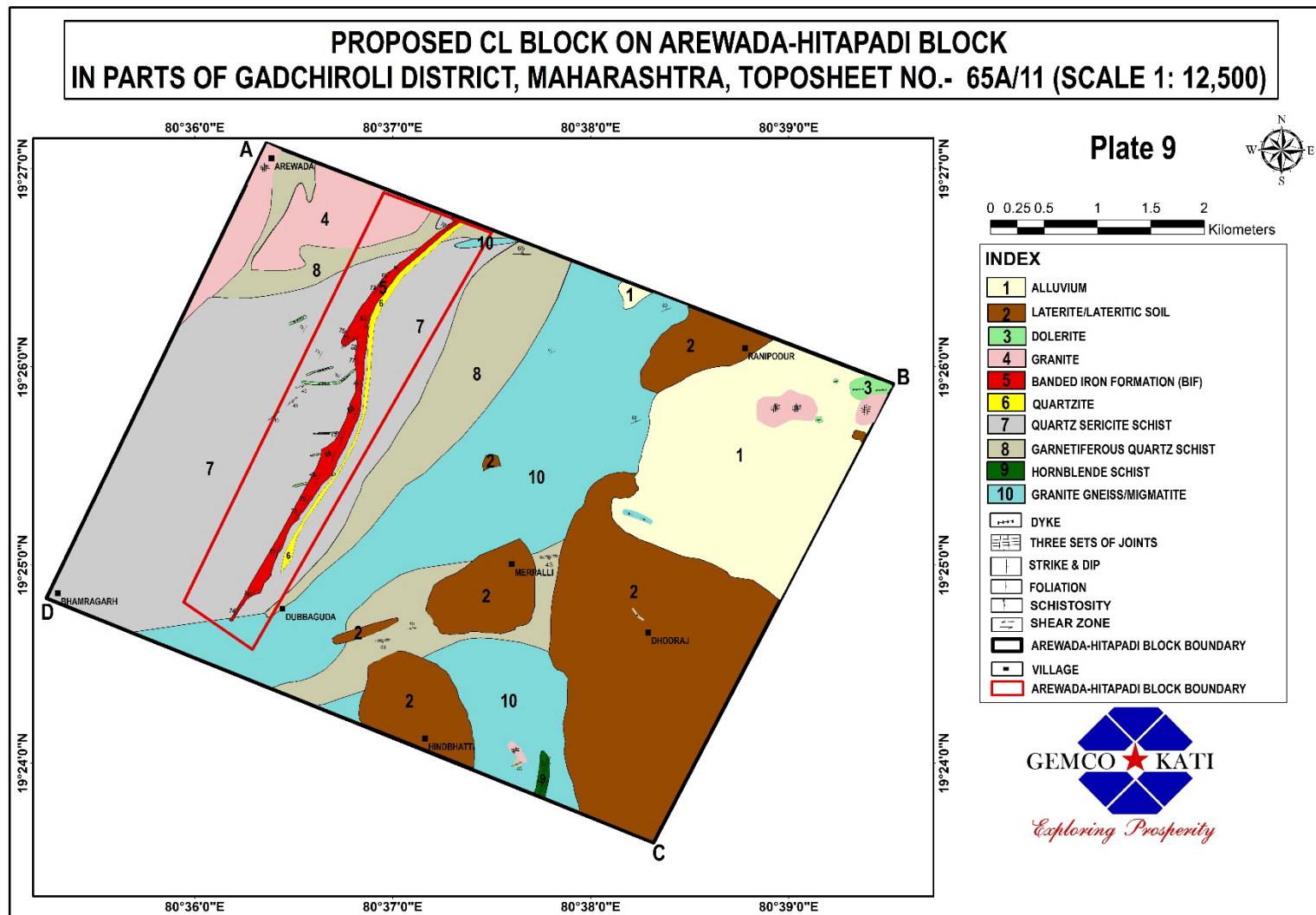


Plate-9



List of annexures: -

Annexure-1: Chemical analysis of Primary Bed rock samples in Percentage (%).

WD- XRF (MAJOR OXIDE) - 31 BRS																					
SL. NO	SAMPLE ID	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	24-12-18-1A	19° 26' 43.476"	80° 37' 19.272"	3.65	<0.05	0.07	48.56	69.43	<0.05	<0.05	0.05	<0.08	0.20	<0.05	0.45	<0.05	<0.05	18.45	0.21	<0.05	7.48
2	24-12-19-M	19° 26' 13.56"	80° 36' 51.912"	3.74	<0.05	<0.05	42.79	61.18	0.56	<0.05	<0.05	<0.08	0.16	<0.05	0.37	<0.05	<0.05	28.06	0.17	<0.05	5.74
3	24-12-22-M	19° 25' 36.58"	80° 36' 43.19"	0.61	<0.05	<0.05	41.95	59.97	<0.05	<0.05	<0.05	0.08	<0.05	<0.05	0.08	<0.05	<0.05	38.33	<0.05	<0.05	0.79
4	24-12-25-11	19° 25' 3.9"	80° 36' 24.29"	0.78	<0.05	0.06	37.91	54.20	<0.05	0.06	<0.05	0.08	<0.05	<0.05	0.08	<0.05	<0.05	42.36	0.05	<0.05	2.26
5	24-12-25-23	19° 24' 55.03"	80° 36' 20.72"	2.32	<0.05	<0.05	36.04	51.52	0.49	0.55	<0.05	<0.08	0.06	<0.05	0.14	<0.05	<0.05	43.15	0.14	<0.05	1.53
6	24-12-21-P	19° 26' 2.06"	80° 36' 50.69"	3.02	<0.05	0.14	35.01	50.05	1.38	1.08	<0.05	0.08	0.05	<0.05	0.12	<0.05	<0.05	42.60	0.20	<0.05	1.27
7	24-12-25-33	19° 24' 50.47"	80° 36' 17.13"	2.28	<0.05	0.06	35.00	50.04	0.77	0.76	<0.05	0.08	<0.05	<0.05	0.10	<0.05	<0.05	43.82	0.14	<0.05	1.89
8	24-12-20-M	19° 26' 8.89"	80° 36' 48.05"	0.31	<0.05	<0.05	34.97	49.99	<0.05	<0.05	<0.05	0.08	<0.05	<0.05	<0.05	<0.05	<0.05	47.67	<0.05	<0.05	1.77
9	24-12-19-J	19° 26' 18.27"	80° 36' 51.46"	4.66	<0.05	<0.05	34.92	49.92	1.51	0.22	<0.05	0.08	<0.05	<0.05	0.07	<0.05	<0.05	41.49	0.22	<0.05	1.73
10	24-12-24-40	19° 25' 15.39"	80° 36' 31.20"	1.00	<0.05	<0.05	34.87	49.85	0.07	0.13	0.09	<0.08	<0.05	<0.05	0.08	<0.05	<0.05	46.06	0.06	<0.05	2.49
11	24-12-20-J	19° 26' 10.58"	80° 36' 50.34"	0.45	<0.05	<0.05	34.53	49.37	<0.05	<0.05	<0.05	0.08	<0.05	<0.05	0.11	<0.05	<0.05	48.46	<0.05	<0.05	1.42
12	24-12-19-8	19° 26' 16.34"	80° 36' 53.11"	5.41	<0.05	<0.05	33.85	48.40	1.46	0.23	<0.05	0.08	<0.05	<0.05	<0.05	<0.05	<0.05	41.89	0.25	<0.05	2.13
13	24-12-20-3	19° 26' 9.49"	80° 36' 48.96"	0.27	<0.05	<0.05	33.63	48.07	<0.05	<0.05	<0.05	0.08	0.07	<0.05	0.16	<0.05	<0.05	49.12	<0.05	<0.05	2.16
14	24-12-21-F	19° 26' 6.036"	80° 36' 49.5"	2.68	<0.05	<0.05	33.54	47.96	<0.05	0.08	<0.05	<0.08	0.07	<0.05	0.16	<0.05	<0.05	46.32	0.17	<0.05	2.42
15	24-12-18-9	19° 26' 27.96"	80° 37' 1.35"	3.23	<0.05	<0.05	33.26	47.55	0.08	<0.05	<0.05	0.08	<0.05	<0.05	0.05	<0.05	<0.05	47.55	0.15	<0.05	1.25
16	24-12-19-S	19° 26' 14.172"	80° 36' 51.66"	0.50	<0.05	<0.05	33.17	47.43	<0.05	<0.05	<0.05	0.08	<0.05	<0.05	0.07	<0.05	<0.05	51.09	<0.05	<0.05	0.72

WD- XRF (MAJOR OXIDE) - 31 BRS

SL. NO	SAMPLE ID	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
17	24-12-13-01A	19° 23' 42.38"	80° 38' 4.20"	0.30	<0.05	<0.05	32.88	47.00	<0.05	<0.05	<0.05	0.08	<0.05	<0.05	0.07	<0.05	<0.05	51.29	<0.05	<0.05	1.11
18	24-12-21-F	19° 26' 6.036"	80° 36' 49.5"	0.61	<0.05	<0.05	32.79	46.88	<0.05	<0.05	<0.05	<0.08	0.18	<0.05	0.42	<0.05	<0.05	46.91	<0.05	<0.05	5.00
19	24-12-20-2	19° 26' 12.36"	80° 36' 49.85"	2.50	<0.05	<0.05	32.49	46.45	<0.05	<0.05	<0.05	<0.08	0.23	<0.05	0.52	<0.05	<0.05	45.16	0.13	<0.05	5.04
20	24-12-20B	19° 26' 27.51"	80° 36' 58.21"	3.64	<0.05	<0.05	31.10	44.47	1.18	0.32	<0.05	0.08	0.05	<0.05	0.12	<0.05	<0.05	48.95	0.21	<0.05	0.93
21	24-12-20-C	19° 26' 25.26"	80° 36' 55.78"	1.61	<0.05	<0.05	30.96	44.26	0.55	<0.05	0.06	0.08	<0.05	<0.05	0.11	<0.05	<0.05	51.54	0.11	<0.05	1.54
22	24-12-18-01	19° 26' 43.22"	80° 37' 19.02"	0.27	<0.05	0.14	28.28	40.44	<0.05	<0.05	<0.05	<0.08	<0.05	<0.05	0.06	<0.05	<0.05	56.05	<0.05	<0.05	2.80
23	24-12-24-19	19° 25' 25.91"	80° 36' 37.23"	0.83	<0.05	<0.05	28.14	40.23	<0.05	0.37	0.08	<0.08	<0.05	<0.05	<0.05	<0.05	<0.05	51.88	<0.05	<0.05	6.36
24	24-12-22-O	19° 25' 36.24"	80° 36' 42.42"	1.30	<0.05	0.07	27.78	39.72	0.05	0.32	0.07	<0.08	<0.05	<0.05	0.07	<0.05	<0.05	50.93	0.09	<0.05	7.25
25	24-12-21-K	19° 26' 3.52"	80° 36' 45.20"	0.55	<0.05	<0.05	26.58	38.01	<0.05	<0.05	<0.05	<0.08	0.07	<0.05	0.17	<0.05	<0.05	57.80	<0.05	<0.05	3.26
26	24-12-21-N	19° 26' 1.57"	80° 36' 48.64"	1.63	<0.05	0.07	26.18	37.43	0.77	4.00	0.14	0.08	<0.05	0.18	0.09	0.44	<0.05	52.98	0.11	<0.05	2.24
27	24-12-26-d	19° 26' 7.332"	80° 36' 36.504"	0.32	<0.05	<0.05	25.98	37.14	<0.05	<0.05	<0.05	<0.08	<0.05	0.06	<0.05	0.15	<0.05	58.90	<0.05	<0.05	3.25
28	24-12-22-X	19° 25' 32.07"	80° 36' 41.22"	0.45	<0.05	<0.05	25.31	36.18	<0.05	0.11	<0.05	<0.08	<0.05	<0.05	0.06	<0.05	<0.05	58.87	<0.05	<0.05	4.12
29	24-12-20-04	19° 26' 9.42"	80° 36' 48.27"	0.29	<0.05	<0.05	23.85	34.09	<0.05	<0.05	<0.05	0.08	0.05	<0.05	0.12	<0.05	<0.05	63.30	<0.05	<0.05	2.02
30	24-12-24-23	19° 25' 23.19"	80° 36' 35.56"	0.20	<0.05	<0.05	15.72	22.48	<0.05	0.22	0.08	<0.08	<0.05	<0.05	<0.05	<0.05	<0.05	73.45	<0.05	<0.05	3.35
31	24-12-21-XII	19° 25' 51.97"	80° 36' 48.95"	0.45	<0.05	<0.05	8.70	12.44	<0.05	<0.05	<0.05	0.08	<0.05	<0.05	<0.05	<0.05	<0.05	85.79	<0.05	<0.05	1.01

Annexure-2: Chemical analysis of Primary Channel samples in Percentage (%)

WD- XRF (MAJOR OXIDE) - BRS (Channel sample) 10 Nos.

SL. NO	SAMPLE ID	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	24-12-21-iii	19° 26' 1.87"	80° 36' 40.93"	2.78	<0.05	<0.05	46.76	66.85	<0.05	<0.05	<0.05	<0.08	0.16	<0.05	0.38	<0.05	<0.05	21.58	0.18	<0.05	8.06
2	24-12-22U	19° 25' 33.20"	80° 36' 41.94"	1.05	<0.05	0.71	37.88	54.16	0.24	0.67	0.13	0.08	0.06	0.06	0.13	0.15	<0.05	40.61	0.08	<0.05	1.95
3	24-12-24-16	19° 25' 27.98"	80° 36' 40.34"	2.65	<0.05	<0.05	37.44	53.53	<0.05	<0.05	<0.05	<0.08	0.06	<0.05	0.14	<0.05	<0.05	40.51	0.16	<0.05	2.84
4	24-12-21-j	19° 25' 38.01"	80° 36' 45.57"	2.75	<0.05	0.07	34.67	49.57	0.58	0.57	<0.05	0.08	0.09	<0.05	0.20	<0.05	<0.05	43.69	0.17	<0.05	2.25
5	24-12-21-10	19° 25' 53.69"	80° 36' 50.28"	3.34	<0.05	<0.05	33.84	48.38	0.25	0.24	<0.05	<0.08	<0.05	<0.05	0.09	<0.05	<0.05	44.36	0.21	<0.05	2.96
6	24-12-18-10	19° 26' 29.20"	80° 37' 1.16"	4.12	0.07	<0.05	31.78	45.44	0.09	<0.05	0.57	<0.08	0.07	<0.05	0.15	<0.05	<0.05	45.64	0.21	<0.05	3.51
7	24-12-24-37	19° 25' 19.67"	80° 36' 33.96"	0.55	<0.05	<0.05	28.41	40.62	<0.05	0.16	0.07	<0.08	<0.05	<0.05	0.08	<0.05	<0.05	53.65	<0.05	<0.05	4.63
8	24-12-21-g	19° 25' 40.36"	80° 36' 45.61"	0.79	<0.05	0.09	26.90	38.46	<0.05	0.27	0.15	<0.08	<0.05	<0.05	0.08	<0.05	<0.05	53.69	<0.05	<0.05	6.23
9	24-12-21-i	19° 26' 7.116"	80° 36' 46.44"	0.87	<0.05	<0.05	25.65	36.67	<0.05	<0.05	<0.05	<0.08	<0.05	<0.05	0.11	<0.05	<0.05	59.16	<0.05	<0.05	2.99
10	24-12-21-ai	19° 25' 38.38"	80° 36' 45.61"	1.79	<0.05	<0.05	24.69	35.31	<0.05	<0.05	<0.05	<0.08	0.05	<0.05	0.12	<0.05	<0.05	59.27	0.08	<0.05	3.18

Annexure-3. Chemical analysis of Laterite samples in Percentage (%.)

WD- XRF (MAJOR OXIDE) - laterite 9 Nos.																					
SL. NO	SAMPLE ID	LATITUDE	LONGITUDE	Al2O3	BaO	CaO	Fe	Fe2O3	K2O	MgO	MnO	Na2O	P	S	P2O5	SO3	SrO	SiO2	TiO2	V2O5	LOI
1	24-12-27-B7	19° 24' 6.60"	80° 38' 17.91"	9.71	<0.05	<0.05	25.87	36.98	0.39	0.10	0.20	<0.08	0.12	<0.05	0.28	<0.05	<0.05	42.77	0.58	0.07	8.61
2	24-12-23-13	19° 24' 14.22"	80° 37' 1.12"	12.18	<0.05	<0.05	25.11	35.90	0.51	0.12	0.51	<0.08	0.06	<0.05	0.13	<0.05	<0.05	40.59	0.32	0.07	9.33
3	24-12-27-A15	19° 24' 45.43"	80° 38' 17.27"	10.15	0.07	<0.05	19.95	28.52	0.45	0.11	0.40	<0.08	<0.05	<0.05	0.08	<0.05	<0.05	52.32	0.31	<0.05	7.35
4	24-12-16-14	19° 25' 39.56"	80° 39' 21.21"	16.02	0.06	0.29	19.85	28.38	1.46	1.00	0.72	0.24	0.05	<0.05	0.12	<0.05	<0.05	37.98	2.21	0.08	11.31
5	24-12-23-m	19° 24' 27.23"	80° 36' 59.51"	11.76	0.11	<0.05	17.49	25.00	0.94	0.14	1.01	<0.08	<0.05	<0.05	<0.05	<0.05	<0.05	52.43	0.38	<0.05	7.88
6	24-12-22-26	19° 25' 31.44"	80° 37' 29.14"	9.61	0.09	<0.05	14.51	20.74	1.21	0.16	1.01	<0.08	<0.05	<0.05	<0.05	<0.05	<0.05	59.57	0.33	<0.05	7.00
7	24-12-23-i	19° 24' 39.95"	80° 36' 48.67"	7.34	<0.05	<0.05	14.25	20.37	0.64	0.09	0.16	<0.08	<0.05	<0.05	0.07	0.06	<0.05	65.32	0.25	<0.05	5.48
8	24-12-17-6	19° 26' 11.27"	80° 38' 35.73"	14.36	<0.05	0.13	10.60	15.16	1.17	0.39	0.22	<0.08	<0.05	<0.05	<0.05	<0.05	<0.05	58.51	1.35	<0.05	8.34
9	24-12-23-C	19° 24' 54.43"	80° 37' 28.81"	3.82	<0.05	<0.05	10.19	14.57	0.20	0.05	0.13	<0.08	<0.05	<0.05	<0.05	<0.05	<0.05	77.39	0.18	<0.05	3.39

Annexure-4: ICPMS analysis of Primary Bed Rock samples in (ppm)

ICPMS analysis for REE of 5 Nos. BRS																					
SL.NO	SAMPLE ID	LATITUDE	LONGITUDE	Sc	Y	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	U	Th
1	14-12-24-01	19°26'36.1"N	80°37'42.0" E	5.73	3.91	3.26	10.47	0.76	2.80	0.60	<0.5	0.64	<0.5	0.58	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	2.00
2	17-12-24-O	19°25'45.6"N,	80°38'21.5"E	1.23	11.49	14.54	37.85	2.93	10.15	2.20	<0.5	2.20	<0.5	1.85	<0.5	1.29	<0.5	1.37	<0.5	1.16	9.61
3	14-12-24-09	19°26'15.6"N,	80°36'53.0"E	40.05	28.73	9.20	25.35	2.74	12.20	3.17	1.08	4.08	0.71	4.72	1.02	3.10	<0.5	2.98	<0.5	<0.5	1.76
4	16-12-24-12	19°25'44.4"N,	80°39'21.8"E	3.64	13.50	97.75	143.80	15.18	47.05	6.24	1.39	6.12	0.57	2.45	<0.5	1.20	<0.5	0.80	<0.5	1.36	13.47
5	21-12-24-j	19° 25' 38.01"	80° 36' 45.57"	4.81	5.06	6.81	12.77	1.48	5.60	1.17	<0.5	1.13	<0.5	0.77	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

ICPMS analysis for RM of 5 Nos. BRS													
SL.NO	SAMPLE ID	LATITUDE	LONGITUDE	Sn	Mo	Nb	Rb	Sr	Be	Ta	W	Cs	Li
1	14-12-24-01	19°26'36.1"N	80°37'42.0" E	<50	<0.5	<5	27.86	5	<0.5	<0.5	<0.5	<0.5	<0.5
2	17-12-24-O	19°25'45.6"N,	80°38'21.5"E	<50	<0.5	9	76.93	243	1.51	<0.5	<0.5	<0.5	7.60
3	14-12-24-09	19°26'15.6"N,	80°36'53.0"E	<50	3.52	<5	18.31	130	0.65	4.81	<0.5	<0.5	8.75
4	16-12-24-12	19°25'44.4"N,	80°39'21.8"E	<50	<0.5	10	84.79	468	2.12	7.29	<0.5	1.09	20.49
5	21-12-24-j	19° 25' 38.01"	80° 36' 45.57"	<50	<0.5	8	60.07	7	1.03	<0.5	<0.5	3.34	1.16

ICPMS analysis for Trace elements of 5 Nos. BRS

SL.NO	SAMPLE ID	LATITUDE	LONGITUDE	Ag	Al	As	Ba	Bi	Ca	Cr	Cu	Co	Nb	Ni	P	Pb	Ti	V	Zn	Ga	Zr
1	14-12-24-01	19°26'36.1"N	80°37'42.0" E	<1	18896	<5	48	<5	155	12	<5	4.71	<5	10	<100	<5	1754	44	15	4.71	123
2	17-12-24-O	19°25'45.6"N,	80°38'21.5"E	<1	74877	<5	408	<5	4741	9	7	3.62	9	<5	143	20	925	16	46	19.76	144
3	14-12-24-09	19°26'15.6"N,	80°36'53.0"E	<1	72251	<5	218	<5	65763	76	187	48.92	<5	63	601	7	6824	334	110	17.72	81
4	16-12-24-12	19°25'44.4"N,	80°39'21.8"E	<1	78854	<5	346	<5	19371	77	<5	10.76	10	12	586	18	2795	39	68	19.04	142
5	21-12-24-j	19° 25' 38.01"	80° 36' 45.57"	<1	15246	<5	42	8	1533	28	<5	9.82	8	20	719	19	1022	44	31	3.84	45

ICPMS analysis for Other Elements of 5 Nos. BRS

SL.NO	SAMPLE ID	LATITUDE	LONGITUDE	B	Ca	Fe	K	Mg	Mn	Na	Se	Cd	In	Sb	Te	Tl	Hf	S
1	14-12-24-01	19°26'36.1"N	80°37'42.0" E	<5	155	8546	8714	157	<100	391	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.69	<100
2	17-12-24-O	19°25'45.6"N,	80°38'21.5"E	<5	4741	15550	23183	2589	301	32527	1.79	<0.5	<0.5	<0.5	<0.5	<0.5	7.10	<100
3	14-12-24-09	19°26'15.6"N,	80°36'53.0"E	<5	65763	100548	4355	30883	1527	16509	5.89	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	913
4	16-12-24-12	19°25'44.4"N,	80°39'21.8"E	<5	19371	26740	12779	6120	615	31725	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	7.06	<100
5	21-12-24-j	19° 25' 38.01"	80° 36' 45.57"	<5	1533	319724	3919	3581	368	367	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<100

Annexure-5: ICPMS analysis of Laterite samples in (ppm)

ICPMS analysis for REE of 2 Nos. Laterite																					
SL.NO	SAMPLE ID	LATITUDE	LONGITUDE	Se	Y	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	U	Th
1	27-12-24-A15	19° 24' 45.43"	80° 38' 17.27"	<0.5	5.65	13.27	253.49	2.80	9.31	1.83	0.56	3.41	<0.5	1.32	<0.5	0.72	<0.5	0.66	<0.5	2.12	6.76
2	27-12-24-i	19°24'39.95"N	80°36'48.67"E	<0.5	5.67	11.07	112.55	2.64	9.26	1.83	<0.5	2.02	<0.5	1.34	<0.5	0.70	<0.5	0.68	<0.5	1.70	3.30

ICPMS analysis for RM of 2 Nos. laterite													
SL.NO	SAMPLE ID	LATITUDE	LONGITUDE	Sn	Mo	Nd	Rb	Sr	Be	Ta	W	Cs	Li
1	27-12-24-A15	19° 24' 45.43"	80° 38' 17.27"	101	2.38	9.31	24.25	9	3.01	<0.5	<0.5	0.73	5.38
2	27-12-24-i	19°24'39.95"N	80°36'48.67"E	50	1.38	9.26	24.32	14	1.99	<0.5	<0.5	0.69	6.60

ICPMS analysis for Trace elements of 2 Nos. Laterite																					
SL.NO	SAMPLE ID	LATITUDE	LONGITUDE	Ag	Al	As	Ba	Bi	Ca	Cr	Cu	Co	Nb	Ni	P	Pb	Ti	V	Zn	Ga	Zr
1	27-12-24-A15	19° 24' 45.43"	80° 38' 17.27"	<1	53898	30	804	<5	308	350	71	115.08	<5	56	428	82	1556	304	33	17.13	59
2	27-12-24-i	19°24'39.95"N	80°36'48.67"E	<1	38919	20	372	<5	155	197	77	46.76	<5	54	299	53	1324	232	28	11.73	41

ICPMS analysis for Other Elements of 2 Nos. Laterite																	
SL.NO	SAMPLE ID	LATITUDE	LONGITUDE	B	Ca	Fe	K	Mg	Mn	Na	Se	Cd	In	Sb	Te	Tl	S
1	27-12-24-A15	19° 24' 45.43"	80° 38' 17.27"	<5	308	184453	4008	680	3901	733	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2	27-12-24-i	19°24'39.95"N	80°36'48.67"E	<5	155	130291	6490	642	1974	961	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

Annexure-6: ICPMS (TRACE & REE) analysis of Stream samples (ppm)

ICPMS analysis for REE of 5 Nos. Stream Sediments samples																					
SL.NO	SAMPLE ID	LATITUDE	LONGITUDE	Se	Y	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	U	Th
1	AH-SSS-01	19°26'51.48"N	80°36'12.44"E	0.79	25.29	99.90	148.95	19.04	63.41	10.91	1.43	10.77	1.23	5.53	1.13	3.35	<0.5	2.54	<0.5	9.82	100.46
2	AH-SSS-04	19°24'31.53"N	80°36'0.80"E	0.66	17.67	19.04	34.88	4.04	14.45	3.06	0.96	3.42	0.55	3.18	0.67	1.97	<0.5	2.08	<0.5	2.62	15.58
3	AH-SSS-06	19°26'33.93"N	80°38'5.78"E	<0.5	12.15	22.72	37.96	4.56	16.39	3.16	0.73	3.25	<0.5	2.34	<0.5	1.46	<0.5	1.47	<0.5	2.68	16.80
4	AH-SSS-08	19°25'16.77"N	80°37'58.37"E	<0.5	25.23	131.01	205.18	24.21	78.26	12.13	1.25	12.09	1.30	5.60	0.97	2.92	<0.5	2.85	<0.5	7.38	85.39
5	AH-SSS-10	19°23'41.46"N	80°38'4.14"E	3.14	78.29	723.50	1129.24	135.54	440.83	66.21	3.07	65.15	6.02	21.14	3.27	8.69	0.94	5.81	0.86	24.71	463.02



ICPMS analysis for RM of 5 Nos. Stream Sediments samples													
SL.NO	SAMPLE ID	LATITUDE	LONGITUDE	Sn	Mo	Nd	Rb	Sr	Be	Ta	W	Cs	Li
1	AH-SSS-01	19°26'51.48"N	80°36'12.44"E	<50	<0.5	63.41	45.87	116	3.06	11.67	<0.5	0.78	3.86
2	AH-SSS-04	19°24'31.53"N	80°36'0.80"E	<50	<0.5	14.45	44.97	111	0.69	2.17	<0.5	0.67	5.03
3	AH-SSS-06	19°26'33.93"N	80°38'5.78"E	<50	<0.5	16.39	45.48	81	0.85	1.42	0.71	0.68	5.43
4	AH-SSS-08	19°25'16.77"N	80°37'58.37"E	<50	<0.5	78.26	24.19	68	1.31	5.41	<0.5	0.59	6.58
5	AH-SSS-10	19°23'41.46"N	80°38'4.14"E	<50	12.56	440.83	27.22	93	0.92	7.33	<0.5	0.68	4.75

ICPMS analysis for Trace elements of 5 Nos. Stream Sediments samples																					
SL.NO	SAMPLE ID	LATITUDE	LONGITUDE	Ag	Al	As	Ba	Bi	Ca	Cr	Cu	Co	Nb	Ni	P	Pb	Ti	V	Zn	Ga	Zr
1	AH-SSS-01	19°26'51.48"N	80°36'12.44"E	<1	36086	28	258	<5	6395	213	73	23.54	28	75	791	49	6919	328	51	13.05	178
2	AH-SSS-04	19°24'31.53"N	80°36'0.80"E	<1	36989	6	323	<5	15872	378	36	14.80	11	37	227	236	9139	181	711	11.44	184
3	AH-SSS-06	19°26'33.93"N	80°38'5.78"E	<1	34103	<5	243	<5	7762	116	30	15.26	6	34	266	13	5561	129	24	10.10	115
4	AH-SSS-08	19°25'16.77"N	80°37'58.37"E	<1	37201	9	295	<5	3388	504	62	22.63	19	49	440	39	13377	251	77	13.09	390
5	AH-SSS-10	19°23'41.46"N	80°38'4.14"E	<1	42227	26	180	<5	24199	549	52	29.18	31	79	883	48	25582	322	61	23.73	588

ICPMS analysis for Other Elements of 5 Nos. Stream Sediments samples																		
SL.NO	SAMPLE ID	LATITUDE	LONGITUDE	B	Ca	Fe	K	Mg	Mn	Na	Se	Cd	In	Sb	Te	Tl	Hf	S
1	AH-SSS-01	19°26'51.48"N	80°36'12.44"E	<5	6395	201959	11438	1065	638	5865	0.79	<0.5	<0.5	3.22	<0.5	<0.5	8.33	<100
2	AH-SSS-04	19°24'31.53"N	80°36'0.80"E	<5	15872	55033	10470	2969	782	4163	0.66	0.62	<0.5	25.44	7.17	<0.5	7.96	<100
3	AH-SSS-06	19°26'33.93"N	80°38'5.78"E	<5	7762	48629	10720	1750	470	5977	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	3.82	<100
4	AH-SSS-08	19°25'16.77"N	80°37'58.37"E	<5	3388	103474	8101	877	1373	8269	<0.5	<0.5	<0.5	<0.5	S <0.5	<0.5	12.18	<100
5	AH-SSS-10	19°23'41.46"N	80°38'4.14"E	<5	24199	124451	7497	9995	2068	5238	3.14	<0.5	<0.5	<0.5	<0.5	<0.5	13.79	<100

Annexure-7: Comparison of Primary and Check Samples in Arewada-Hitapadi Block in Percentage (%)

COMPARISON OF PRIMARY AND CHECK SAMPLES IN AREWADA-HITAPADI BLOCK (%)																					
SL. NO	SAMPLE ID	LATITUDE	LONGITUDE	Al2O3	BaO	CaO	Fe	Fe2O3	K2O	MgO	MnO	Na2O	P	S	P2O5	SO3	SrO	SiO2	TiO2	V2O5	LOI
1	24-12-18-01	19° 26' 43.22"	80° 37' 19.02"	0.27	<0.05	0.14	28.28	40.44	<0.05	<0.05	<0.05	<0.08	<0.05	<0.05	0.06	<0.05	<0.05	56.05	<0.05	<0.05	2.80
				0.23			26.17	37.41	0.01	0.06					0.07	0.03		59.33			
2	24-12-19-M	19° 26' 14.75"	80° 36' 53.42"	3.74	<0.05	<0.05	42.79	61.18	0.56	<0.05	<0.05	<0.08	0.16	<0.05	0.37	<0.05	<0.05	28.06	0.17	<0.05	5.74
				3.87			42.25	60.4	0.55	0.11					0.4	0.01		28.81			
3	24-12-21-iii	19° 26' 1.87"	80° 36' 40.93"	2.78	<0.05	<0.05	46.76	66.85	<0.05	<0.05	<0.05	<0.08	0.16	<0.05	0.38	<0.05	<0.05	21.58	0.18	<0.05	8.06
				2.85			46.29	66.17	0.01	0.06					0.4	0.01		22.13			
4	24-12-22-M	19° 26' 13.56"	80° 36' 51.912"	0.61	<0.05	<0.05	41.95	59.97	<0.05	<0.05	<0.05	0.08	<0.05	<0.05	0.08	<0.05	<0.05	38.33	<0.05	<0.05	0.79
				0.52			41.31	59.06	0.01	0.07					0.1	0.01		39.43			
5	24-12-24-19	19° 25' 25.91"	80° 36' 37.23"	0.83	<0.05	<0.05	28.14	40.23	<0.05	0.37	0.08	<0.08	<0.05	<0.05	<0.05	<0.05	<0.05	51.88	<0.05	<0.05	6.36
				0.79			27.15	38.82	0.01	0.45					0.05	0.02		53.31			
6	24-12-27-A15	19° 24' 45.43"	80° 38' 17.27"	10.15	0.07	<0.05	19.95	28.52	0.45	0.11	0.40	<0.08	<0.05	<0.05	0.08	<0.05	<0.05	52.32	0.31	<0.05	7.35
				10.53			19.14	27.37	0.44	0.13					0.09	0.02		53.59			

	Primary samples analysed from Shiva lab		Check Samples analysed from JNARDDC, Nagpur
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Annexure-8: Sample location of PS, OM & XRD analysis

Sample locations of Petrographic study (PS)				
SL.NO	SAMPLE ID	LATITUDE	LONGITUDE	CONCLUSION
1	13-12-24-03	19° 27' 6.52802"	80° 36' 24.72127"	It is identified as very fine grained silicified microcrystalline rock consists of ferruginous Quartz-Mica-Schist/Phyllite.
2	17-12-24-08A	19° 26' 18.68165"	80° 38' 27.0011"	The sample is identified as Granite.
3	21-12-24-03	19° 26' 2.436"	80° 36' 50.58"	The sample is identified as fine-grained ferruginous Shale.
4	19-12-24-09	19° 26' 15.55465"	80° 36' 53.04031"	The sample is identified as fine grained phyllitic rock with ferruginous material.
5	14-12-24-13	19° 26' 41.52264"	80° 37' 17.94072"	The sample is identified as sheared granite.
Sample location of Ore microscopic (OM) study				
SL.NO	SAMPLE ID			CONCLUSION
1	19-12-24-10	19° 26' 14.36672"	80° 36' 52.27139"	The sample is identified as Fe oxide bearing rock.
2	21-12-24-f	19° 25' 42.62761"	80° 36' 46.79662"	The sample is identified as Massive Magnetite Ore.
3	24-12-24-23	19° 25' 23.19312"	80° 36' 35.56368"	The sample is identified as Hematite-Goethite Ore.
4	20-12-24-B	19° 26' 27.5136"	80° 36' 58.212"	The sample is identified as Banded Magnetite rock.
5	25-12-24-33	19° 24' 50.472"	80° 36' 17.136"	The sample is identified as Magnetite Ore.
6	18-12-24-02	19° 26' 43.74413"	80° 37' 19.267"	The sample is identified as Hard Laminated Magnetite Ore.
7	22-12-24-R	19° 25' 33.87828"	80° 36' 40.88945"	The sample is identified as Banded Magnetite Ore.
Sample location of XRD analysis				
SL.NO	SAMPLE ID			CONCLUSION
1	19-12-24-10	19° 26' 14.36672"	80° 36' 52.27139"	Quartz 50%, Muscovite 30%, Kaolinite 15% & Goethite 5%
2	21-12-24-f	19° 25' 42.62761"	80° 36' 46.79662"	Quartz 90%, Hematite 7% & Kaolinite 3%
3	22-12-24-K	19° 25' 37.6572"	80° 36' 45.216"	Quartz 80%, Hematite 10%, Kaolinite 7% & Muscovite 3%
4	24-12-24-23	19° 25' 23.19312"	80° 36' 35.56368"	Quartz Only
5	24-12-24-33	19° 24' 50.472"	80° 36' 17.136"	Quartz 80%, Dickite 15% & Hematite 5%
6	18-12-24-02	19° 26' 43.74413"	80° 37' 19.267"	Magnetite, Hematite, Quartzite
7	22-12-24-R	19° 25' 33.87828"	80° 36' 40.88945"	Magnetite, Hematite, Quartzite

Annexure-9

PEER REVIEWER COMMENTS & COMPLIANCE

A. TEXT PART		
S. N.	Comments/ Suggestions	Action
1	Ch-02 p-7: the total resource of Iron ore till 01-04-2020 is 35284 m. tonnes, pl correct.	Correction Attended.
2	Ch -2.3, p11: Sr.3-to collect petrological and mineralogical samples of selected host rocks to study petrographic characters and chemical composition of rocks respectively.	Correction Attended.
3	Ch.4.2, p-19: the spelling of Arewada group shown as Arewara in some places, make it uniform.	Correction Attended.
4	Ch.5.2, p-21:in first paragraph, instead of first group use lower/older group and for second group use upper/younger.	Correction Attended.
5	Ch .6.1.12, Description of Rock types; i. page 34: BRS no 13-12-24-03 may be ferruginous quartz-mica-schist/phyllite ii. page 38: BRS no.21-12-24-03 may be ferruginous shale.	Correction Attended.
6	Ch. 6.1.1.3 Description of iron ore type:. categorization of iron ore should be mentioned, such as massive, Hard Laminated ore(HLO), Soft laminated ore(SLO), lateritic ore etc as exposed in the block, along with ore minerals. In stead of rock it may be described as ore in the text i. Page-45, BRS no 21-12-24-f – massive magnetite ore ii. Page 46, BRS no.24-12-24-23 -massive hematite ore iii. Page 49, Hard laminated magnetite ore. iv. Page 50, Fig-39 The texture in the photo is due to conversion of Magnetite to Hematite called martitisation .	Correction Attended.

A. TEXT PART		
S. N.	Comments/ Suggestions	Action
7	Ch-7.2, page 53: the ore bands shows swelling and pinching pattern along with variation in Fe%, through entire length. Pl add.	Correction Attended.
8	Ch-7.3, page 53: The variation in width along strike of ore band is due to interference of F1&F2 fold system. The fold closers shows more width than limb. Pl add.	Correction Attended.

Note: The Hindi version of Executive summery wad added after peer review showing mismatch page no by 2nos. in the report.

B. MAPS/PLATES PART		
S. N.	Comments/ Suggestions	Action
(i)	Colour index in the LSM and other related plates may be modified as per conventional practice i.e for a. Iron ore body- Light red b. Laterite- brown, c. Granite- rose/pink, d. quartzite- yellow e. Basics- light green & f. Hb schist- deep green.	Correction Attended on page no. 67,68,69,70,71 & 73.
(ii)	4 no. plates separately attached should be numbered (3,5,6,7)	Correction attended.
(iii)	For clarity in plate no.5 and to visualise variations in Fe content along Iron ore band, all the primary BRS numbering should done with sl. no, as given in annexure-1 on the coloured symbol.	Correction Attended on page no. 69.
(iv)	<p>Apart from suggestions where ever modifications, marginal corrections made in the hard copy of the text and plates may be attended.</p> <p>Good presentation of geological Map with lithological, petrological and chemical analysis data in the report.</p> <p>In future additional data on structure by close traverses, channel & pit sampling, test drilling are required for establishing ore geometry in the advance stage of exploration/mining.</p>	Corrections attended which were mentioned in the hard copy of Arewada-Hitapadi which was received from peer reviewer dated on 14 th August 2025.

IN-PRINCIPAL APPROVAL FROM DGM, MAHARASHTRA



Government of Maharashtra

Directorate of Geology and Mining, Government of Maharashtra, Nagpur
27, "Khanij Bhavan", Cement Road, Shivaji Nagar, Nagpur-440010.

Email-director@mahadgm.gov.in

Tel. No. 0712-2228788

No.Tech./1842/2023/ 1518

Dated :- 09 MAY 2023

To,

The Principal Secretary (Industries),
Industries, Energy and Labour Department,
Hutatma Rajguru Square, Madam Cama Road,
Mantralaya, Mumbai- 400032.

Sub:- Regarding exploration proposals submitted by M/s Gemcokati
Exploration Pvt. Ltd. to be put forth for sanctioning through National
Mineral Exploration Trust.

Ref:- 1) M/s Gemcokati Exploration Pvt. Ltd. email dated 23/02/2023.
2) This office letter no. Tech./1842/2023/1125, dated 06/04/2023.
3) GSI email dated 11/04/2023.
4) MECL letter no.MECL/EXPL/CO/NGP/2023-24/135,
dated 17/04/2023.

Sir,

With reference to above, this is to inform you that M/s Gemcokati Exploration Pvt. Ltd. an empaneled exploration agency had submitted three proposals of G4 level exploration for Iron ore in parts of Gadchiroli District, under Minerals (Evidence of Mineral Contents) Rules-2015. To avoid repetition of work this office had sent these proposals to GSI, Central Region, Nagpur and MECL, Nagpur to verify whether these areas have been explored by their department previously or not.

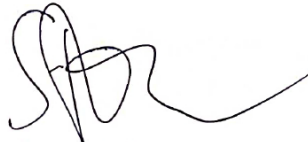
In this connection, GSI and MECL has mentioned that these blocks viz., Arewada-Hitapadi block (70 sq.km.), Gilanguda – padur (80 sq.km.) and Murwada-Tumarikodi (100 sq.km.) do not overlap with that of MECL and GSI explored blocks.

Hence this office propose these blocks for 'in-principle' approval and to forward the same to the National Mineral Exploration Trust for approval and further action.

For your information and further action please.

(Draft approved by DGM)

Yours,



(S.S. Joshi)
Sr. Geologist,

Directorate of Geology and Mining,
Government of Maharashtra, Nagpur.

o/c

MINUTES OF TCC-I

1. Minutes of 53rd TCC

Agenda 53.1.12: Reconnaissance Survey (G-4 Stage) for Iron Ore in Arewada – Hitapadi Block (70 Sq. Km), District: Gadchiroli, Maharashtra.

[Implementing Agency: DGM Maharashtra (M/s. Gemcokati Exploration Pvt. Ltd.)]

- a) It has been conveyed that the Arewada – Hitapadi Block is situated in the southern side of the proposed Gilanguda-Padur block and Murwada-Tumarikodi block and eastern side of the Alenga Nendwadi Block, Tadgaon-Wateli block and Marampalli-Jinjgaon block which were recommended during 52nd TCC meeting.
- b) The committee suggested to submit the proposal after the outcome of the above recommended projects.

Recommendation of TCC:

The committee suggested to submit the proposal after the outcome of the adjacent blocks.

2. Minutes of 67th TCC

Agenda 67.2.6. Reconnaissance Survey (G4) for Iron Ore in Arewada – Hitapadi area, District: Gadchiroli, Maharashtra.

[Implementing Agency: GemcoKati Exploration Pvt. Ltd.]

- a) The area belongs to the Bastar Craton in the Central Indian Peninsular shield and falls in SOI toposheet no. 65A/11.
- b) National Programs such as NGCM, NGPM, STM, and NAGMP have not yet been initiated in this part of Maharashtra. However, GemcoKati informed the committee that 5 G4 blocks have been explored recently in the adjacent Damkodwadi Hill range and further south with NMET funding by GemcoKati Exploration (P) Ltd., marking the first exploration in 40 years by any government or private agency.
- c) During its recent field visit to the proposed area, GemcoKati identified BIF and phyllites at several places, along with enclaves of BMQ. They collected 4 samples and analyzed them for iron ore, with results showing iron values ranging from 27.84% (magnetite) to 49.59% Fe (T). Iron mineralization is associated with Banded Iron Formation (BIF) and ferruginous phyllites. Currently, the operational iron mine at Surjagad is the only exploration activity in the vicinity of the block area.
- d) GemcoKati also noted that a major part of Gadchiroli District is designated as an "Obvious Geological Potential" (OGP) area and remains unexplored.
- e) The committee raised concern over the fact that GemcoKati had already got five items in the same area approved by NMET but could not accomplish all the targets due to forest and local issues. The proposed item has been placed in the same line and area. However, the committee agrees to carry out the item after getting assurance from GemcoKati.
- f) The committee opined that the project will be carried out in two phases. Except for mapping, all other components will be kept on hold. If GemcoKati can furnish a proper map, then the other components will be allowed to proceed.

Recommendation of TCC:

The committee recommends the proposal for the approval of EC for “Reconnaissance Survey (G4) for Iron Ore in Arewada – Hitapadi area, District: Gadchiroli, Maharashtra.” with an estimated cost of Rs. 56.35 lakhs (including GST) within time schedule of 08 months and submission of report as per Annexures 7A & 7B. The item will be reviewed after 04 months.

3. Minutes of 70th TCC-I

Agenda 70.1.11. Reconnaissance Survey (G-4 stage) for Iron Ore in Arewada – Hitapadi Block (27 sq km), District: Gadchiroli, Maharashtra.

[Implementing Agency: Gemcokati Exploration Private Limited]

- a) The area, located within the Bastar Craton in the Central Indian Peninsular Shield on SOI toposheet no. 65A/11, was initially approved by the 37th Executive Committee held on 23rd September 2024. with a condition to modify the block due to pending litigations.
- b) GemcoKati modified the block and presented it at the 70th TCC, where DGM Maharashtra indicated that only around 27 sq km could be considered for work. Subsequently, GemcoKati revised the block.

Recommendation of TCC:

The committee approved the modified block and the revised cost recommended Rs. 16.58 lakhs with 6 months timeline as in Annexure 9A & 9B.

4. Minutes of 73rd TCC-I

Agenda 73.2.5. Reconnaissance Survey (G4) for Iron Ore in Arewada – Hitapadi Block (27 sq km), District: Gadchiroli, Maharashtra.

[Implementing Agency: Gemcokati Exploration Pvt. Ltd.]

- a) Gemcokati Exploration Pvt. Ltd. informed that the project was approved in the 38th EC Meeting held on 29th November, 2024. The OM was issued on 06th January, 2025 with timeline of 06 months (up to 05.07.2025) and approved cost was INR 16,57,688/-.
- b) Gemcokati presented the progress project by enlarging the Geol. Map of the area carried out by GSI.
- c) The TCC-1 advised to present the integrated map, details of sampling & analytical results in next TCC-1 meeting.

Recommendation of TCC-1

The TCC-1 recommended to present the integrated map, details of sampling & analytical results in next TCC-1 meeting.

5. Minutes of 76th TCC-I

Agenda 76.5.9. Reconnaissance Survey (G4) for Iron Ore in Arewada –Hitapadi Block (27 sq km), District: Gadchiroli, Maharashtra

[Implementing Agency: Gemcokati]

- a) Gemcokati informed that the project was approved in the 38th EC Meeting held on 29th November, 2024. The sanction order was issued on 6th January, 2025 with timeline of 06 months (up to 05.07.2025) and approved cost was INR 16,57,688/-.
- b) Gemcokati apprised the house that all the approved quantum targets have been achieved. Mineralized zone in the form of Banded Magnetite Quartzite (BMQ) & Banded Hematite Quartzite (BHQ) having 4km strike length and 6m to 16m width have been delineated on the surface. Iron ore content varies from about 8% to 48% in BRS samples and 25% to 47% in channel samples. An area of 3.8 Sq. km has been proposed for CL block.
- c) Gemcokati requested for submission of report and nomination for peer reviewer.
- d) The Committee was not satisfied with the mapping done and hence suggested to produce quality map. The committee instructed to present the geological map as per the modifications suggested and bring for review in next TCC.

Recommendations of TCC-1:

The TCC-1 suggested that quality of map may be improved and presented in upcoming 77th TCC-I.

6. Minutes of 77th TCC-I

Agenda 77.5.2. Reconnaissance Survey (G4) for Iron Ore in Arewada – Hitapadi area (27 sq km), District: Gadchiroli, Maharashtra [Implementing Agency: Gemcokati Pvt. Ltd.]

- a) Gemcokati Pvt. Ltd. informed that the project was approved in the 38th EC Meeting held on 29th November, 2024. The OM was issued on 6th January, 2025 with approved timeline of 6 months and approved cost of INR 16,57,688/-.
- b) TCC- 1 was apprised that all the quantum of work assigned in the project has been achieved successfully.
- c) Gemcokati Pvt. Ltd. sought nomination of peer reviewer for report submission.
- d) The committee reviewed the work and pointed out that structural data in the map is insufficient and prepared map is not satisfactory.
- e) The committee, after reviewing the work, found the petrographic and ore microscopic studies unsatisfactory, with poorly derived inferences, and emphasized the need for better interpretation of petrographic data. The committee suggested that chemical analysis results be properly depicted on maps.
- f) XRD studies indicated that the samples are primarily of hematite. The committee advised that the overall presentation be improved and the Geological Report resubmitted for review in the upcoming TCC-I meeting.

Recommendations of TCC-1:

The committee did not approve for peer review of the GR. The committee instructed Gemcokati Pvt. Ltd to incorporate the suggestions in report and present again in the next TCC-I meeting.

7. Minutes of 78th TCC-I

Agenda 78.4.19. Reconnaissance Survey (G4) for Iron Ore in Arewada – Hitapadi Block (27 sq km), District Gadchiroli, Maharashtra [Implementing Agency: Gemco Kati Exploration Private Limited]

- a) Gemco Kati Exploration Private Limited informed that the project was approved in the 38th EC Meeting held on 29th November, 2024. The Sanction Order was issued on 06th January, 2025 with timeline of 06 months (up to 05.07.2025) and approved cost was INR 16,57,688/-.
- b) The company apprised the committee about the progress of work and sought nomination for peer review of GR.
- c) The committee was not satisfied with the ore microscopic study carried out.
- d) The agency sought extension of time for submission of Geological Report (GR).
- e) The committee instructed that lab protocols, particularly for XRD analysis, must be strictly followed. It is recommended that geologists from Gemcokati be sent to laboratories where the analyses are being conducted, such as those of AMD, GSI, or NGRI, to ensure proper coordination and quality assurance
- f) The committee agreed for peer review of report subject to inclusion of suggested XRD studies in report.
- g) The committee also instructed agency to come for review in TCC, after peer review of report is completed.

Recommendations of TCC-1:

The TCC recommended a timeline extension of 2 months upto 31.08.2025 for additional analysis and submission of GR.

MINUTES OF EC

1. Minutes of 37th EC

B. Implementing Agency: GemcoKati Exploration Pvt. Ltd.						
9	Reconnaissance Survey (G4) for Iron Ore in Arewada - Hitapadi area, District: Gadchiroli, Maharashtra. <i>Relate with the deliberations made in Discussion point no. (iv). [67th TCC]</i>	Iron Ore	G4	8	30.04	Approved subjected to revision of area and further assessment of cost by TCC.

- iv. DS & HoD, NMET informed the house that the proposal of M/S GemcoKati Pvt. Ltd. pertaining to iron ore exploration in Arewada-Hitapadi block of Maharashtra is a subjudice block. DGM, Maharashtra informed that out of 69 km² proposed by M/s GemcoKati 42 km² area is subjudice but exploration is feasible in the remaining 27 km² area. After discussion, it was decided that the project be approved subjected to obtaining clarification from DG, DGM, Maharashtra about the area that is not in dispute as well as examination of cost for the reduced area by TCC.

[Action: M/sGemcoKati Pvt. Ltd.]

2. Minutes of 38th EC

13	Reconnaissance Survey (G-4 stage) for Iron Ore in Arewada – Hitapadi Block (27 sq km), District: Gadchiroli, Maharashtra. [70th TCC-1]	GemcoKati Exploration Pvt. Ltd.	Iron Ore	G4	6	0.17	Approved
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Letter from DGM, Maharashtra



Director, Geology and Mining, Nagpur
27, Khanij Bhavan, Cement Road, Shivaji Nagar, Nagpur-440010

Email-director@mahadgm.gov.in

Telephone No.0712-2228788

Tech/1726/2019 Subfile/ 3126

Date: 23 SEP 2024

To,

Superintending Geologist,
National Mineral Exploration Trust,
Ministry of Mines, F-114, Shashtri Bhavan, New Delhi-110001
Email: nmet-mines@gov.in

Sub: Regarding Exploration of Iron Ore Blocks in Gadchiroli District by M/s Gemco kati
Ref: - M/s Gemco-Kati Exploration private limited's letter dated 12.03.2024 and 14.03.2024

Respected Sir/Madam,

With reference to above subject, this is to inform you that, Gemco-kati has submitted 19 blocks of Fe Ore of Gadchiroli District for exploration under NMET.

After going through the DGM's past exploration programs and Mahageomin Lab's report, it can be said that, DGM, Maharashtra has not done any exploration in those area but some blocks overlaps with the GSI's exploration program and some overlaps with ESA/ESZ and wild life area. Hence only 04 blocks are available for exploration and if Boundary of Arewada-Hitapadi is changed then also it can be available for Exploration.

Sr.No	Name	Commodity	Overlaps remarks	Availability
1	Karampalli Block	Fe	No overlap with GSI	AVAILABLE
2	Kundum Block	Fe		
3	Wangeturi Block	Fe		
4	Mardkuhi Block	Fe		
5	Arewada-Hitapadi Block	Fe	1.No overlap with GSI 2.Comes under tiger telemetry 3.Overlaps with area previously granted to M/s JSW Steel Ltd	Total 27.76 Sq Km areas can be available if 42.24 Sq km area granted previously under PL to M/s JSW steel Ltd is excluded. The matter is sub-judice and pending in Supreme court.

This is for your kind perusal and further necessary action.

Thank You

Enclosure: As above

Yours,

(Dr. TRK Rao)
Director General

Directorate of Geology and Mining
Government of Maharashtra, Nagpur



Copy to:

Subrata Sarkar, Vice President (Projects and Planning), M/s Gemco Kati Exploration (P)
Ltd, E-77, MIDC Road, Chandrapur-440404 Email : subrata.sarkar@gemcokati.com

(Dr. TRK Rao)
Director General
Directorate of Geology and Mining
Government of Maharashtra, Nagpur



OFFICE OF MEMORANDUM

Government of India
Ministry of Mines
National Mineral Exploration Trust

File No. 23/529/2024-NMET/757

New Delhi, 06th Jan., 2025

OFFICE MEMORANDUM

Subject: Approval of the project "Reconnaissance Survey (G4) for Iron Ore in Arewada-Hitapadi Block (27 Sq km) District Gadchiroli Maharashtra" through NMET fund.

On the recommendation of the Technical-cum-Cost Committee (TCC), the Executive Committee in its 38th meeting held on 29th November, 2024 approved the mineral exploration projects of M/s Gemcokati Exploration Pvt. Ltd through NMET fund as per following details:-

S. No	Project/Block Name	Agency	Duration (Months)	Approved Cost (₹ Including GST)
1	Reconnaissance Survey (G4) for Iron Ore in Arewada- Hitapadi Block (27 Sq km) District Gadchiroli Maharashtra.	M/s Gemcokati Exploration Pvt. Ltd	06 (up to 05.07.2025)	₹16,57,688/-
Total (Rupees Sixteen lakh fifty seven thousand six hundred eighty eight only)				₹16,57,688/-

2. M/s Gemcokati Exploration 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 enclosed in **Annexure**, as summarized below:-

•	Field Mobilization	1st month (05.02.2025)
•	Exploration (Survey, Geophysical mapping, Camp winding)	2nd to 04 th month (up to 05.05.2025).
•	Laboratory Studies	5th month (up to 05.06.2025)
•	Report Writing with Peer Review and submission to NMET	6th month (up to 05.07.2025)

3. M/s Gemcokati Exploration Pvt. Ltd. shall complete the project as per the above terms.

4. The uploading of Geological Report (GR) on NGDR portal is sole responsibility of the exploration agency. The final payment will be made only after receiving the confirmation of the same. The screenshot/acknowledgement of successful uploading of GR is to be submitted to NMET with the final bill.

5. 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 (NPEA) 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.

Yours faithfully,



[Geetika Sharma]
Deputy Secretary & HoD, NMET

Copy for information and further necessary action:-

1. M/s. Gemcokati Exp. Pvt. Ltd., Plot no. 34, Costal Colony, Bapat Nagar, Chandrapur – 442401, Maharashtra.
2. I.F. Division, Ministry of Mines, Shastri Bhawan, New Delhi.
3. Executive Committee (EC) Meeting file (F.No.6/2/2015-NMET)
4. Grant-in aid Sanction order file.



Annexure 9A							
Estimate Cost for Reconnaissance Survey (G-4 stage) for Iron Ore in Arewada – Hitapadi Block (27 sq km), District: Gadchiroli, Maharashtra.							
Area 27 sq. km, Schedule timeline- 6 months					[Review: After 4 Months]		
S. No.	Item of Work *	Unit *	Rates as per NMET SoC 2020-21		Estimated Cost of the Proposal		Remarks
			SoC-Item No. *	Rates as per SoC *	Qty.	Total Amount (Rs)	
				(a)		(b)	
1A	Geological Mapping Other Geological Work & Surveying						
	Geological mapping, (1:12,500 scale) & Trenching , drilling work	Sq. km			27		
i	a. Charges for Geologist per day (Field) for geological mapping	day	1.2b	11000	40	440000	
ii	b. Labours Charges; Base rate	day	5.7	522	80	41760	Amount will be reimbursed as per the notified rates by the Central Labour Commissioner or respective State Govt. whichever is higher.
	Sub Total- 1A					4,81,760	
1B	Collection of surface samples						
1	BRS, Channel Sampling	Sq. km			27		
3	a. Sampler	per day	1.5.2	5100	8	40,800	
4	c. Labours Charges	day	5.7	522	32	16,704	Amount will be reimbursed as per the notified rates by the Central Labour Commissioner or respective State Govt. whichever is higher.
5	Geophysicist party days (HQ)	per day					
	Sub Total- 1B					57,504	

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	Total (1A to 1B)					5,39,264	
	As this is a programme is a naxalite area					NA	
1C	Charges for Geologist per day (HQ)	day	2a	9000	30	270000	
2	LABORATORY STUDIES						
a	Chemical Analysis						
i)	Geochemical Sampling-Surface samples (Bedrock/Channel /Soil/Stream sediment)						
	a. Au by Fire Assay	Nos	4.1.5a	2380	0	0	
	b. For Ag, Ni, Co, Cr, Cu, Pb, Zn, V, Ti by AAS Method	Nos				0	
	c. ICPMS for 34 Elements	Nos	4.1.14	7731	10	77,310	
ii)	Surface Check samples (10% External)				0		
	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					
vii)	Major Oxide Analysis						
	a) Estimation of major oxides by XRF/whole rock analysis for primary samples (CaO, MgO, SiO ₂ , Al ₂ O ₃ , LOI, Na ₂ O, Fe ₂ O ₃ , MnO, K ₂ O, TiO ₂ , SO ₃ , P ₂ O ₅ , Cr ₂ O ₃ , ZnO, V ₂ O ₅)	per sample	4.1.15a	4200	50	2,10,000	40 BRS + 10 Channel Samples
	check samples	per sample	4.1.15a	4200	5	21,000	4 check sample of BRS
	PCS for whole rock analysis	per sample	4.1.15a	4200	0	0	
3	Physical & Petrological Studies						
i	Preparation of thin section	Nos	4.3.1	2353	5	11,765	
ii	Petrological report of thin section	Nos	4.3.4	4232	5	21,160	
iii	Preparation of polish section	Nos	4.3.2	1549	5	7,745	
iv	Minerographic report of rock sample	Nos	4.3.4	4232	5	21,160	
v	Digital Photographs	Nos	4.3.7	280	5	1,400	
vi	Whole Rock Analysis	Nos					
vii	Sp. Gravity	Nos					

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viii	XRD Studies	Nos.	4.5.1	4,000	5	20,000	
	Total 2 & 3					3,91,540	
4	Total COST					12,00,804	
5	Geological Report Preparation	5 Hard copies with a soft copy	5.2	i		1,50,000	Reimbursement will be made after submission of the final Geological Report in Hard Copies (5 Nos) and the soft copy to NMET.
6	Peer review Charges					30,000	
7	Preparation of Exploration Proposal	5 Hard copies with a soft copy	5.1	2% of the Cost or Rs. 5.0 Lakhs whichever is less		24,016	EA will be reimbursed after submission of the Hard Copies and the soft copy of the final proposal along with Maps and Plan as suggested by the TCC-NMET in its meeting while clearing the proposal.
	(5 Hard copies with a soft copy)						
8	Total Estimated Cost without GST					14,04,820	
9	Provision for GST (18% of J)					2,52,868	GST will be reimburse as per actual and as per notified prescribed rate
10	Total Estimated Cost with GST					16,57,688	
				Rs. In Lakhs	16.58		
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 NMET SoC and Item no. 6 of NMET SoC. In case of execusion 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.						

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Annexure 9B								
Time Schedule/ Action plan for Reconnaissance Survey (G-4 stage) for Iron Ore in Arewada – Hitapadi Block (27 sq km), District: Gadchiroli, Maharashtra.								
	Activities	1	2	3	4	REVIEW	5	6
1	Geological mapping							
2	Sampling & Sample preparation							
3	Analytical work							
4	Peer Review							
5	Report Preparation							
6	Submission of Report							

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FIELD PHOTOGRAPHS



Photo-1: Photograph showing outcrop of banded magnetite quartzite. Note the magnet at the lower part of the photograph.



Photo-2: Laterite exposed in the parts of Medpalli area



Photo-3: Photograph showing nearly vertically dipping an exposed outcrop of banded hematite quartzite.



Photo-4a



Photo-4b

Photo-4a & b: In-situ vertically dip iron ore (Magnetite) beds in the parts of Arewada



Photo-5: Channel sampling on the iron ore (Magnetite) bed at Arewada in the block area



Photo-6: Channel sampling on the iron ore (Magnetite) bed at Dobaguda in the block area

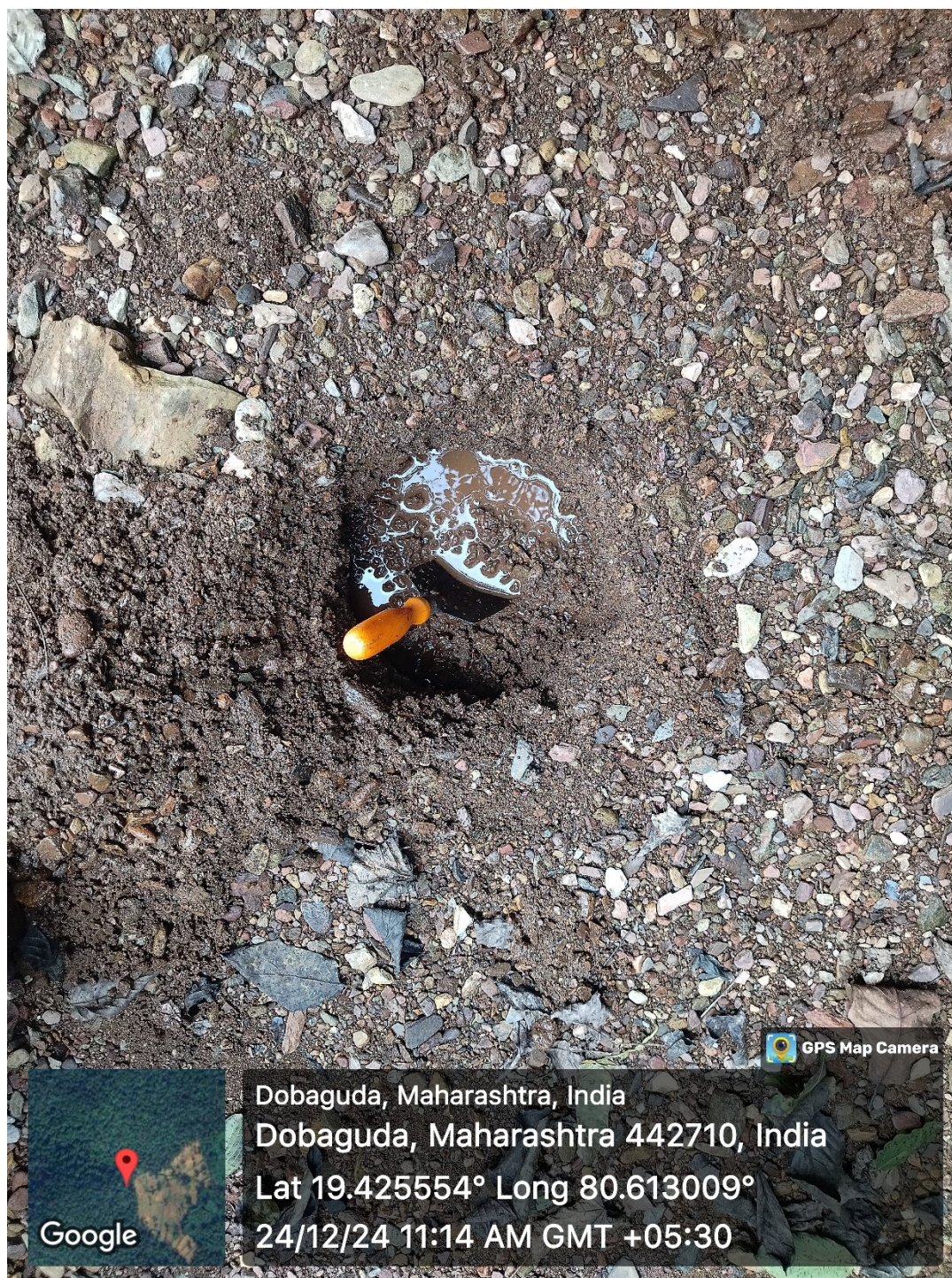


Photo-7: Stream sediments sampling in the nala at Dobaguda in the block area



Photo-8: Laterite exposed area at Ranipodur in the block area.