

**RECONNAISSANCE SURVEY (G4) FOR GOLD IN PARTS OF HURUNGDAH AREA,
RANCHI, KHUNTI & SARAIKELA-KHARSAWAN DISTRICTS, JHARKHAND
(F.NO: 23/610/2025-NMET/1042)**



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झारखंड के राँची, खूंटी तथा सरायकेला-खरसावां जिले के हुरुंगदाह क्षेत्र के एक भाग में स्वर्ण खनिज के लिए प्राथमिक सर्वेक्षण का अंतिम प्रतिवेदन (चरण: जी-4)

अध्याय-1 : सारांश

वर्ष 2025-2026 के भूतात्विक क्षेत्र भ्रमण के दौरान, झारखंड के राँची, खूंटी एवं सरायकेला-खरसावां जिलों के अंतर्गत स्थित हुरुंगदाह क्षेत्र के एक भाग में स्वर्ण एवं सहवर्ती खनिजों के लिए टोही सर्वेक्षण (G-4 चरण) कार्य किया गया। यह क्षेत्र भारतीय सर्वेक्षण विभाग के स्थलाकृति मानचित्र संख्या 73F/9 (OSM No. F45H9) के अंतर्गत आता है। इस भूतात्विक अन्वेषण का उद्देश्य क्षेत्र में स्वर्ण खनिजीकरण की संभावनाओं का मूल्यांकन करना तथा उत्तर सिंहभूम मोबाइल बेल्ट (NSMB) में खनिजीकरण को नियंत्रित करने वाले शैलवैज्ञानिक एवं संरचनात्मक कारकों का अध्ययन करना था। क्षेत्र के विस्तृत भूतात्विक अन्वेषण हेतु कुल 16.57 वर्ग कि.मी. क्षेत्र प्रस्तावित था, किन्तु स्थानीय व्यवधानों के कारण केवल 2.31 वर्ग कि.मी. क्षेत्र, विशेषकर बदानी घाटी एवं उसके आसपास, का 1:12,500 स्केल पर विस्तृत भूतात्विक मानचित्रण किया जा सका। अन्वेषण के दौरान कुल 30 बेडरॉक नमूने एकत्रित कर स्वर्ण (Au) के लिए विश्लेषित किए गए। अन्य प्रस्तावित अन्वेषण गतिविधियाँ जैसे ट्रेचिंग, ड्रिलिंग, भू-भौतिकीय सर्वेक्षण, स्ट्रीम सेडिमेंट सैम्पलिंग तथा विस्तृत प्रयोगशाला अध्ययन फील्ड सीजन के दौरान सम्पन्न नहीं किए जा सके।

भूतात्विक आधार पर यह क्षेत्र उत्तर सिंहभूम मोबाइल बेल्ट का भाग है, जो पैलियोप्रोटोरोजोइक से मीसोप्रोटोरोजोइक काल का ज्वालामुखीय-परिवर्तित अवसादी भूभाग है तथा दक्षिण में सिंहभूम क्रेटोन एवं उत्तर में छोटानागपुर नीस कॉम्प्लेक्स के मध्य स्थित है। मानचित्रित क्षेत्र में प्रमुख रूप से क्लोराइट फिलाइट, कार्बोनेसियस फिलाइट, एम्फिबोलाइट तथा क्वार्ट्ज शिराओं का अनावरण पाया गया। क्लोराइट फिलाइट प्रमुख शैल इकाई है, जो सुविकसित फोलिएशन, शिस्टोसिटी तथा हरा-ग्रे रंग से युक्त है, जबकि कार्बोनेसियस फिलाइट लौहयुक्त एवं अभ्रकीय बैंडों के रूप में क्वार्ट्जाइटिक क्षितिजों के साथ पाई जाती है। एम्फिबोलाइट परिवर्तित अवसादी अनुक्रम के भीतर पृथक बहिर्गतियों एवं अंतःक्षेपी निकायों के रूप में विद्यमान है। क्वार्ट्ज शिराएँ, जो दुग्ध-सफेद एवं धूमिल रंग की हैं, भ्रंशों, संधियों तथा शियर जोनों के साथ पाई गईं तथा सामान्यतः सिलिसीकरण, लौहकरण एवं अल्प सल्फाइड खनिजीकरण से संबद्ध हैं। संरचनात्मक रूप से क्षेत्र में प्रमुखतः उत्तर-पश्चिम – दक्षिण-पूर्व प्रवृत्ति की फोलिएशन एवं शियर जोन विकसित हैं, जो NSMB के टेक्टोनिक विकास से संबंधित बहु-चरणीय विकृति को प्रदर्शित करते हैं।

क्षेत्र की शैलें निम्न से मध्यम श्रेणी के कार्यांतरण से प्रभावित हैं, जिनमें क्लोराइट, सेरिसाइट, एम्फिबोल तथा परिवर्तित फेल्सपार जैसे खनिज संघटन पाए जाते हैं। क्षेत्रीय अवलोकनों से ज्ञात हुआ कि हाइड्रोथर्मल क्रियाएँ मुख्यतः संरचनात्मक रूप से दुर्बल क्षेत्रों तक सीमित हैं, जहाँ क्वार्ट्ज शिराएँ, ब्रेशिएशन, लौहकरण तथा अल्प सल्फाइड प्रसारण विकसित हैं। धूमिल क्वार्ट्ज शिराओं एवं परिवर्तित फिलाइटिक शैलों में कहीं-कहीं पाइराइट एवं चाल्कोपाइराइट की उपस्थिति देखी गई, जो स्थानीयकृत हाइड्रोथर्मल परिवर्तन का संकेत देती है। तथापि, ये खनिजीकृत क्षेत्र असतत, संकीर्ण तथा अनियमित रूप से वितरित पाए गए।

30 बेडरॉक नमूनों के भू-रासायनिक विश्लेषण से सामान्यतः निम्न स्वर्ण मान प्राप्त हुए, जो निम्न 0.01 ppm से लेकर अधिकतम 0.23 ppm तक रहे। अधिकांश नमूनों में स्वर्ण की पृष्ठभूमि सांद्रता 0.03 ppm से 0.09 ppm के मध्य रही, जबकि कार्बोनेसियस फिलाइट एवं क्वार्ट्ज शिरा क्षेत्रों के कुछ पृथक नमूनों में तुलनात्मक रूप से अधिकतम 0.23 ppm तक मान प्राप्त हुए। अन्वेषण के दौरान कोई महत्वपूर्ण अथवा असामान्य स्वर्ण सांद्रता प्राप्त नहीं हुई तथा विश्लेषणात्मक परिणाम किसी निरंतर खनिजीकृत जोन की उपस्थिति का संकेत नहीं देते हैं। निम्न स्वर्ण मानों का अनियमित वितरण, स्थायी भू-रासायनिक विसंगतियों का अभाव तथा पर्याप्त सल्फाइड खनिजीकरण की अनुपस्थिति क्षेत्र में कमजोर एवं स्थानीयकृत हाइड्रोथर्मल क्रियाओं को इंगित करते हैं। वर्तमान अन्वेषण के आधार पर मानचित्रित क्षेत्र में आर्थिक दृष्टि से व्यवहार्य स्वर्ण खनिजीकरण स्थापित नहीं किया जा सका। स्थानीय समस्याओं के कारण सीमित क्षेत्रीय मानचित्रण तथा उत्साहवर्धक न होने वाले विश्लेषणात्मक परिणाम वर्तमान अन्वेषण चरण में क्षेत्र की खनिज संभावनाओं के मूल्यांकन को और सीमित करते हैं।



RECONNAISSANCE SURVEY (G4) FOR GOLD IN PARTS OF HURUNGDAH AREA, RANCHI, KHUNTI & SARAIKELA- KHARSAWAN DISTRICTS, JHARKHAND

CHAPTER-1: SUMMARY

During Field Season 2025–26, reconnaissance survey (G-4 stage) for gold and associated mineralization was carried out over a part of the Hurungdah area covering parts of Ranchi, Khunti and Saraikela-Kharsawan districts, Jharkhand, falling within Survey of India Toposheet No. 73F/9 (OSM No. F45H9). The investigation was undertaken to assess the gold mineralization potential of the area and to understand the lithological and structural controls governing mineralization within the North Singhbhum Mobile Belt (NSMB). An area of 16.57 sq. km was proposed for detailed investigation; however, due to local disturbances, only 2.31 sq. km (13.9%) area in and around the Badani Valley could be covered through large scale geological mapping on 1:12,500 scale. During the course of investigation, a total of 30 bedrock samples were collected and analyzed for gold (Au). Other proposed exploration activities such as trenching, drilling, geophysical survey, stream sediment sampling and detailed laboratory studies could not be undertaken during the field season.

Geologically, the investigation area forms part of the North Singhbhum Mobile Belt, a Palaeo- to Mesoproterozoic volcano meta-sedimentary terrain situated between the Singhbhum Craton in the south and the Chhotanagpur Gneissic Complex in the north. The lithological assemblage exposed in the mapped area comprises chlorite phyllite, carbonaceous phyllite, amphibolite and quartz veins. Chlorite phyllite constitutes the dominant lithology and is characterized by well-developed foliation, schistosity and greenish-grey colouration, whereas carbonaceous phyllite occurs as ferruginous and micaceous bands associated with quartzitic horizons. Amphibolite occurs as isolated outcrops and intrusive bodies within the metasedimentary sequence. Quartz veins, both milky white and smoky in nature, are observed along fractures, joints and shear planes and are commonly associated with silicification, ferruginisation and minor sulphide mineralization. Structurally, the area exhibits predominantly NW–SE trending foliations and sheared zones representing multiple phases of deformation related to the tectonic evolution of the NSMB.

The rocks of the area have undergone low- to medium-grade metamorphism represented by mineral assemblages comprising chlorite, sericite, amphibole and altered feldspar. Field observations indicate that hydrothermal activity within the area is mainly

confined to structurally weak zones marked by quartz veining, brecciation, ferruginisation and minor sulphide dissemination. Occasional occurrences of pyrite and chalcopyrite were noted within smoky quartz veins and altered phyllitic rocks, suggesting localized hydrothermal alteration. However, these mineralized zones were found to be discontinuous, narrow and sporadically distributed within the mapped area.

Geochemical analysis of the 30 bedrock samples revealed generally low gold values ranging from less than 0.01 ppm to a maximum of 0.23 ppm. Most of the samples recorded low background gold concentrations varying between 0.03 ppm and 0.09 ppm, whereas only a few isolated samples from carbonaceous phyllite and quartz vein zones showed comparatively higher values up to 0.23 ppm. No significant or anomalous gold concentration was encountered during the investigation, and the analytical results do not indicate the presence of any laterally continuous mineralized zone. The sporadic distribution of low gold values, absence of persistent geochemical anomalies and lack of substantial sulphide mineralization suggest weak and localized hydrothermal activity in the area. Based on the present investigation, no economically viable gold mineralization could be established within the mapped area. The limited extent of mapping due to local issues and the non-encouraging analytical results further restrict the assessment of the mineral potential of the mapped area at the present stage of exploration.

CHAPTER-2: INTRODUCTION

Gold is a scarce and valuable metal, and its availability within India is particularly limited. The domestic demand for gold in India, driven by cultural, economic, and industrial factors, is predominantly met through imports, which exerts pressure on foreign exchange reserves. In recent years, the demand for gold has shown a consistent upward trend due to its role as a safe-haven asset, investment instrument, and its extensive use in jewellery and technology sectors. Therefore, there is a pressing need to enhance indigenous gold production. This can be achieved through systematic and scientific exploration of new gold-bearing areas, especially those with favourable geological settings and indications of mineralization. Identification and development of economically viable gold deposits will significantly contribute to reducing import dependency and strengthening the national mineral resource base.

The present study was conducted around Badani Valley in parts of the Hurungdah area of Ranchi, Khunti and Saraikela-Kharsawan District, Jharkhand, which lies within the North Singhbhum Mobile Belt (NSMB), a Proterozoic volcano-sedimentary belt known for its favourable mineral potential. The geology of the area is represented by Precambrian rock units including granite gneiss, chlorite phyllite, carbonaceous phyllite, amphibolite, and numerous quartz veins. The block is extensively intersected by quartz and smoky quartz veins, which are widely recognized as evidence of hydrothermal fluid activity and are commonly associated with gold-bearing systems.

Several geological features observed in the area indicate a favourable environment for hydrothermal gold mineralization. These include the presence of quartz veining, silicification, ferruginisation, chloritization, sericitization, and localized sulphide occurrences such as pyrite and chalcopyrite. The veins are mainly emplaced along fractures, joints, and shear zones, suggesting repeated episodes of tectonic deformation and hydrothermal fluid circulation.

Considering these favourable lithological and structural conditions, the area was selected for reconnaissance-stage exploration to evaluate its gold potential. However, the results of geological mapping and geochemical investigations reveal that gold mineralization is limited, scattered, and discontinuous. Gold concentrations recorded from bedrock samples are generally low and irregularly distributed, indicating an absence of economically significant mineralization within the investigated area.

Even though no economic gold deposit has been identified, the study has provided important geological and geochemical data on the lithological framework, structural features, and alteration patterns of this part of the North Singhbhum Mobile Belt. The information generated will be useful for improving exploration strategies and planning future mineral exploration activities in the region.

2.1 Acknowledgement

The authors express their sincere gratitude to the Ministry of Mines, Government of India, and the National Mineral Exploration and Development Trust (NMEDT) for approval of the exploration project and for providing financial assistance for its successful execution.

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2.2 Details of the project

JEMCL, Ranchi has proposed exploration for gold in the Hurungdah Block, Ranchi, Khunti & Saraikela - Kharsawan Districts, Jharkhand based on available baseline geoscientific data supplemented by preliminary field investigations and sampling. The exploration programme was submitted to the 27th Jharkhand State Geological Programming Board Meeting held on 29.09.2023, where it was unanimously approved by the Programming Board comprising representatives from GSI, DMG, Government of Jharkhand, MECL, CMPDI and other stakeholder organizations.

Reconnaissance Survey (G-4 stage) for gold was proposed over an area of 16.57 sq. km within the Hurungdah Gold Block, located across Ranchi, Khunti and Saraikela-Kharsawan districts, Jharkhand. This block has been allotted to JEMCL by NMEDT. In line with this allotment, JEMCL prepared a proposal for regional exploration and submitted it for approval to the Technical Committee of NMEDT. The proposal was evaluated during the 6th meeting of TCC-II of NMEDT held on 27th and 28th February 2025 at NMEDT, New Delhi. Subsequently, the NMEDT-EC approved the proposal in its 41st Executive Committee meeting held on 11th March 2025, and the project was formally sanctioned on 19th March 2025.

On the recommendation of the Technical-cum-Cost Committee (TCC) of NMEDT, the Executive Committee (EC), in its 41st meeting held on 11th March 2025, has approved the mineral exploration project titled “Reconnaissance Survey (G-4 stage) for Gold in Hurungdah area Ranchi, Khunti and Saraikela- Kharsawan Districts, Jharkhand” having F. No. 23/610/2025-NMET/1042 to be executed by JEMCL. The project pertains to exploration for gold at the G-4 (Reconnaissance) stage and is scheduled to be completed within a duration of 10 months, i.e., up to 18.01.2026. The total approved cost of the project, including GST, is ₹2,15,52,594/-.

2.3 Investigating agency

Jharkhand Exploration and Mining Corporation Limited (JEMCL) has conducted this exploration program in pursuance of F. No. 23/610/2025-NMET/1042 with Date of Approval: 19.03.2025 and Date of Commencement: 21.03.2025.

2.4 Objectives of investigation

I. Geological Mapping and Topographical Survey of the Study Area:

This objective involves carrying out systematic surface geological mapping at a 1:12,500 scale to understand the lithology, structural framework and distribution of mineralization within the Hurungdah Gold Block. The mapping will be supported by detailed topographical surveys to generate accurate contour and terrain data. Block boundaries will be precisely demarcated using DGPS or Total Station techniques for spatial accuracy.

II. Assessment of Gold Mineralization at G-4 Stage of Exploration:

At the G-4 (reconnaissance) stage, the aim is to evaluate the gold potential of the block through preliminary investigations. This includes exploratory scout drilling to determine the vertical and lateral extent of mineralized zones. The data generated will be used for initial resource estimation in accordance with UNFC norms and the Minerals (Evidence of Mineral Contents) Rules, 2015 and its amendments.

III. Laboratory Studies and Characterization of Mineralization:

This objective focuses on conducting detailed laboratory investigations, including petrological studies and chemical analyses, to determine the grade, composition, and characteristics of gold mineralization. These studies will help in understanding ore-forming processes and support further exploration planning.

IV. Delineation of Potential Zones for Further Exploration:

Based on geological mapping, drilling and analytical results, promising zones will be identified for follow-up exploration. Where surface sampling yields positive indications, additional studies will be undertaken to establish the continuity of mineralization at shallow depths and to define targets for advanced exploration stages.

2.5 Basis for taking up investigation

The basis for taking up the present investigation is established through available geological, geochemical data from the region and adjoining area. The regional geological map prepared by the Geological Survey of India highlights the distribution of lithological units favourable for gold mineralization in the area. The occurrence of gold is further indicated by traditional gold panning activities carried out by local inhabitants along the Karkari River.



Exploration for gold has previously been undertaken by the Geological Survey of India in the Pundidiri-Puntru Block, located about 28 km from the proposed area, suggesting a favourable mineralized belt. In addition, established gold occurrences such as the Lawa Gold Mines (formerly operated by M/s. Manmohan Industries Pvt. Ltd.) and the Parasi Gold Block, situated approximately 104 km and 42 km away respectively, further support the gold potential of the region.

Considering the favourable geological set-up and available analytical data, the proposed area appears prospective for gold. Accordingly, G4 level exploration is envisaged to delineate targets and formulate a strategy for subsequent detailed exploration (G3/G2 levels), which will ultimately facilitate the State Government in the auction of the block. In this context, investigation under the G4 level of exploration through the National Mineral Exploration and development (NMEDT) Trust has been proposed in the area by Jharkhand Exploration and Mining Corporation Limited, Ranchi.

2.6 Nature and quantum of the work

The block has been allocated to Jharkhand Exploration and Mining Corporation Limited (JEMCL) for the exploration of gold at the G4 stage, with funding support from NMEDT. As per the approved programme, an area of 16.57 sq. km. has been proposed for detailed geological mapping on a scale of 1: 12,500. However, about 2.31 sq. km. area out of 16.57 sq. km. targeted area mapping has been successfully completed. Under the sampling programme, 30 bed rock samples have been collected. However, no sampling could be carried out for trench samples (66 nos.), stream sediment samples (25 nos.), and drill core samples (150 nos.). Thus, the overall sampling work remains partially completed, limited to bedrock sampling. Surveying activities have not been carried out. Similarly, the proposed trenching work and drilling operations have not been executed. Laboratory studies also remain largely incomplete. While gold analysis by AAS method has been carried out for 30 bed rock samples. Other chemical analysis including trace and REE analysis (ICP-MS) and check sample analysis have not been conducted. Petrographic studies have not been attempted. The exploration programme is limited to partial geological mapping and bedrock sampling. The work carried out so far provides preliminary insight into the mineralization potential of the area, while further detailed investigations are required for comprehensive evaluation and delineation of mineralized zones.

A summary of the quantum of work carried out during this exploration is provided in Table-1:

TABLE-1: Summary of the proposed quantum of work and actual work done in the block.				
Sl. No.	Item of Work	Unit	Target	Achievement
1	Geological Mapping (1:12,500 scale)	Km ²	16.57	2.31
2	Surveying:			
	a) Topographic survey for contour map preparation (1:12,500 scale)	Km ²	16.57	Not Carried Out
	b) Borehole Fixation and determination of co-ordinates & reduced level of the boreholes and corner points by DGPS/Total Station.	Nos.	11	Not Carried Out
3	Sampling:			
	a) Bed rock/soil samples	Nos.	-	30
	b) Trench samples	Nos.	66	Not Carried Out
	c) Stream sediment samples	Nos.	25	Not Carried Out
	d) Drill core samples	m.	150	Not Carried Out
4	Trenching	Cu. m.	67	Not Carried Out
5	Drilling (coring)	m.	1000	Not Carried Out
6	Drill Core Preservation	m.	500	Not Carried Out
7	Laboratory Studies			
	a) Chemical Analysis:			
	i) 5% of total bore-hole samples for trace and REE analysis under 34 element package analysis through ICP-MS.	Nos.	25	Not Carried Out
	ii) Check samples Internal (5%) and External (10%)- Trace and REE analysis under 34 element package analysis by ICP-MS for bedrock, drill core, soil, and stream sediment samples.	Nos.	3	Not Carried Out
	iii) Gold analysis by AAS (Atomic Absorption Spectrometry) method for bed rock, drill core, soil, trench and stream sediment samples.	Nos.	241	Not Carried Out
	iv) Check samples Internal (5%) and External (10%)- for Gold analysis by AAS method of bed rock, drill core, soil, trench and stream sediment samples.		24	Not Carried Out
8	b) Petrographic Studies			
	i) Preparation of thin section	Nos.	10	
	ii) Study of thin section	Nos.	10	
	iii) Preparation of polish section	Nos.	10	
	iv) Study of Polish section	Nos.	10	
	v) Digital photomicrography	Nos.	10	Not Carried Out
8	Report Preparation	Nos.	1	1

2.7 Personnel involved

TABLE-2: List of the personnel involved.

Responsibility Assigned	Personnel of JEMCL Involved
Managing Director	Shri Varun Ranjan, (IAS)
GM (Exploration)	Shri Vijay Kumar Ojha
Overall Co-ordination	Shri Keshaw Kumar Pathak, Sr. Geologist, JEMCL Shri Sanjeev Kumar, Sr. Geologist, JEMCL
Geological Report Preparation & Documentation	Shri Biswajit Kundu, Geologist, JEMCL Shri Sohan Tudu, Geologist, JEMCL Shri Om Prakash Kumar, Geologist, JEMCL Shri Sandeep Kumar Mahato, Geologist, JEMCL
Field Geologist	Shri Biswajit Kundu, Geologist, JEMCL Shri Sohan Tudu, Geologist, JEMCL Shri Om Prakash Kumar, Geologist, JEMCL Shri Sandeep Kumar Mahato, Geologist, JEMCL
Office Geologist	Shri Biswajit Kundu, Geologist, JEMCL Shri Sohan Tudu, Geologist, JEMCL Shri Om Prakash Kumar, Geologist, JEMCL Shri Sandeep Kumar Mahato, Geologist, JEMCL
ArcGIS	Shri Devishthkant Sudeep, GIS Expert, JEMCL
Survey	Shri Vivek Raj, Surveyor, JEMCL



2.8 Modes of operation of different work component and associated agencies

Geological Mapping (Reconnaissance Survey) on 1:12,500 scale and bedrock sampling work was conducted by the in-house strength of Jharkhand Exploration and Mining Corporation Limited. Geochemical analyses were carried out by Lucid Laboratories private limited, Hyderabad.

CHAPTER-3: PROPERTY DESCRIPTION

3.1 Village, district and state details

The exploration area lies within three districts of the Jharkhand state respectively Ranchi, Khunti and Saraikela Kharsawan (Figure-3.1). The villages located within the study area are Sinjani, Badani (Tehsil: Erki) Chatamsal, Rabo, Kitadih, and Burudih (Tehsil: Tamar), along with Atra (Tehsil: Kuchai).

3.2 Concerned toposheet

The proposed G-4 level exploration block for gold is located in Survey of India OSM number F45H9 (toposheet no. 73F/9) (Figure-3.3) and covers an area of approximately 16.57 sq. km.

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

TABLE-3: Geo-coordinates of the corner points of the block		
Corner Points	Latitude	Longitude
A	22° 55' 27.33" N	85° 33' 34.47" E
B	22° 56' 43.28" N	85° 35' 39.14" E
C	22° 54' 51.73" N	85° 35' 36.47" E
D	22° 53' 12.41" N	85° 35' 34.09" E
E	22° 52' 50.30" N	85° 35' 01.51" E
F	22° 53' 18.25" N	85° 34' 15.00" E

3.4 Land use/cover

The designated area covering an area of 16.57 sq. km in and around Ranchi, Khunti and Saraikela Kharsawan District, Jharkhand, is predominantly covered under forest land. As per available records, almost 75% of the block area (16.57 sq. km) falls within forest cover, indicating dense to moderately dense vegetation across the region and rest is agricultural land. Further, the overall land of the block is classified as Khuntkatti land, which represents a traditional community-based land tenure system prevalent in the region. The land cover is mainly characterized by mixed forest comprising Sal-dominated vegetation along with other

associated species, shrubs, and undergrowth. Due to the forested nature of the area, agricultural land and habitation are either absent or very minimal within the block boundary. Any human settlement, if present, is confined to the peripheral areas near villages. The terrain of the area is undulating, which supports natural drainage and seasonal nalas, further influencing the vegetation pattern. Open land, barren patches or rocky exposures may occur locally, especially along ridges, hill slopes, and stream sections, which are important from a geological mapping and sampling perspective.

Overall, the land use of the block is primarily forest land under Khuntkatti tenure, and the land cover is dominated by natural vegetation with minor localized exposures suitable for agricultural purpose.

3.5 Forest Type

The entire exploration area is densely covered with vegetation, which can broadly be classified under tropical dry deciduous and mixed forest types. The forest cover is characterized by moderate to high canopy density with seasonal variations in foliage. During the dry season, a significant proportion of trees shed their leaves, typical of tropical dry deciduous forests, while the mixed forest patches retain partial greenery throughout the year.

The dominant vegetation comprises species such as Sal (*Shorea robusta*), Mahua (*Madhuca indica*), Kusum (*Schleichera oleosa*), and Palash (*Butea monosperma*), along with bamboo clumps and various shrubs and grasses. These forests are interspersed with secondary growth and degraded patches due to anthropogenic activities like fuelwood collection, grazing, and shifting cultivation.

The undergrowth is generally thick, consisting of bushes, climbers and seasonal herbs, which restrict visibility and accessibility in several parts of the area. The forest not only supports biodiversity but also serves as a vital source of livelihood for the local tribal communities, providing minor forest produce such as tendu leaves, lac, fruits, and medicinal plants.

Overall, the vegetation cover plays a significant role in soil conservation, micro-climatic regulation and ecological balance of the region, while also posing challenges to exploration activities due to difficult terrain and limited accessibility.

3.6 Land Status (Freehold/Leasehold Details)

The proposed exploration block comprises a combination of forest land, Khuntkati land, and freehold land. A significant portion of the block falls under notified forest land, which is governed by the provisions of the Indian Forest Act 1927 and Forest Conservation Act 1980. Any exploration activity within such forest areas is subject to prior statutory clearances from the competent authorities.

Part of the area is classified as Khuntkatti land, which is a traditional community land tenure system prevalent in the Chotanagpur region, particularly among the Munda tribes. Under this system, land is held collectively by tribal communities with hereditary rights, and its governance is guided by customary laws and provisions of the Chotanagpur Tenancy Act 1908. Utilization of such land requires due consultation and consent of the concerned community and adherence to legal provisions.

The remaining portion of the block comprises freehold land, which is privately owned by individuals or entities with clear title and ownership rights. Exploration activities in such areas may be undertaken after obtaining consent from landowners and fulfilling necessary legal and compensation requirements.

3.7 Location

The Hurungdah exploration area is situated in Khunti, Ranchi, Saraikela-Kharsawan District in the state of Jharkhand. Geographically, the Exploration area lies between latitudes 22° 56' 43.28" N and 22° 52' 50.30" N and longitudes 85° 35' 39.14" E and 85° 33' 34.47" E. The proposed block encompasses parts of the Sinjani, Badani and Atra villages and forms part of the South-Central Jharkhand mineral belt and is located in the north western part of Survey of India Toposheet No. 73F/9 and Open Series Map number F45H9 (Figure-3.3). The region is characterized by undulating terrain typical of the Chotanagpur Plateau and falls within a known mineralized zone, making it favourable for systematic mineral exploration.

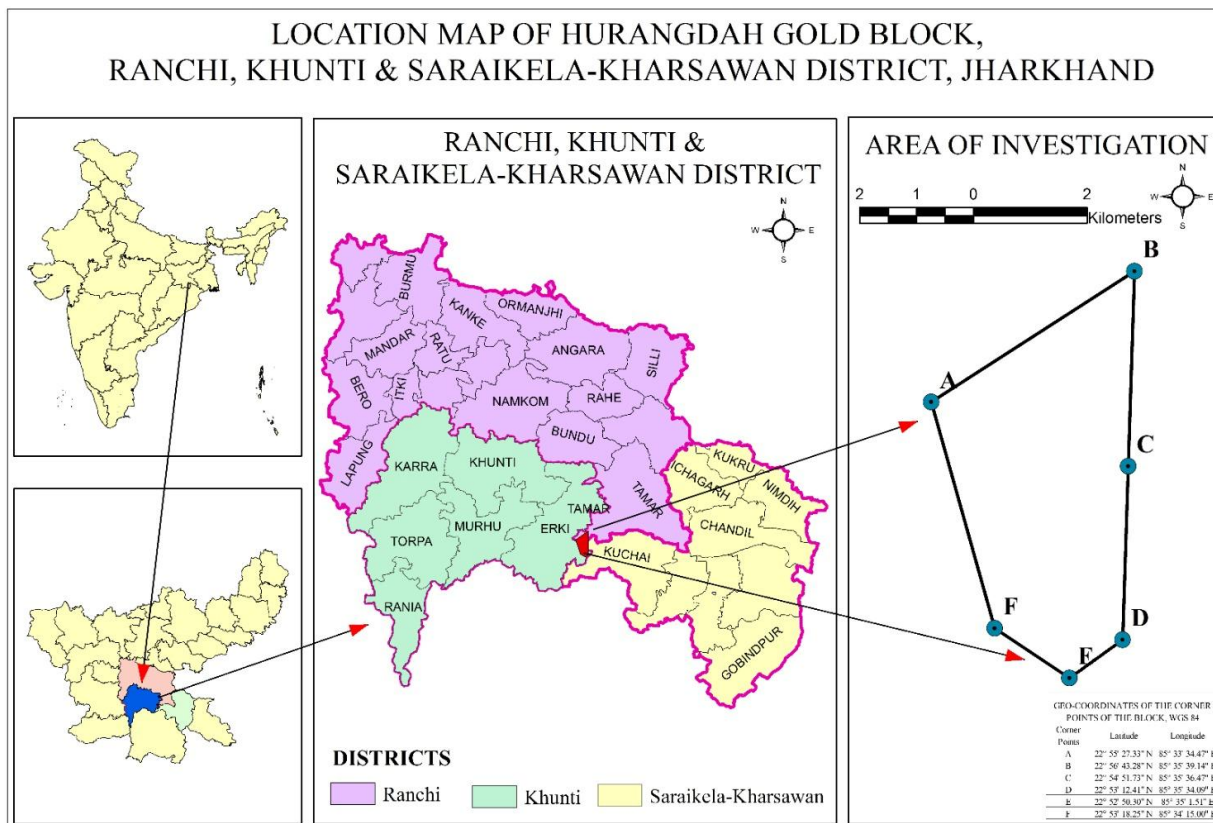


Figure- 3.1: Location map of the study area in and around Hurungdah, Khunti, Ranchi, Saraikela-Kharsawan District, Jharkhand.

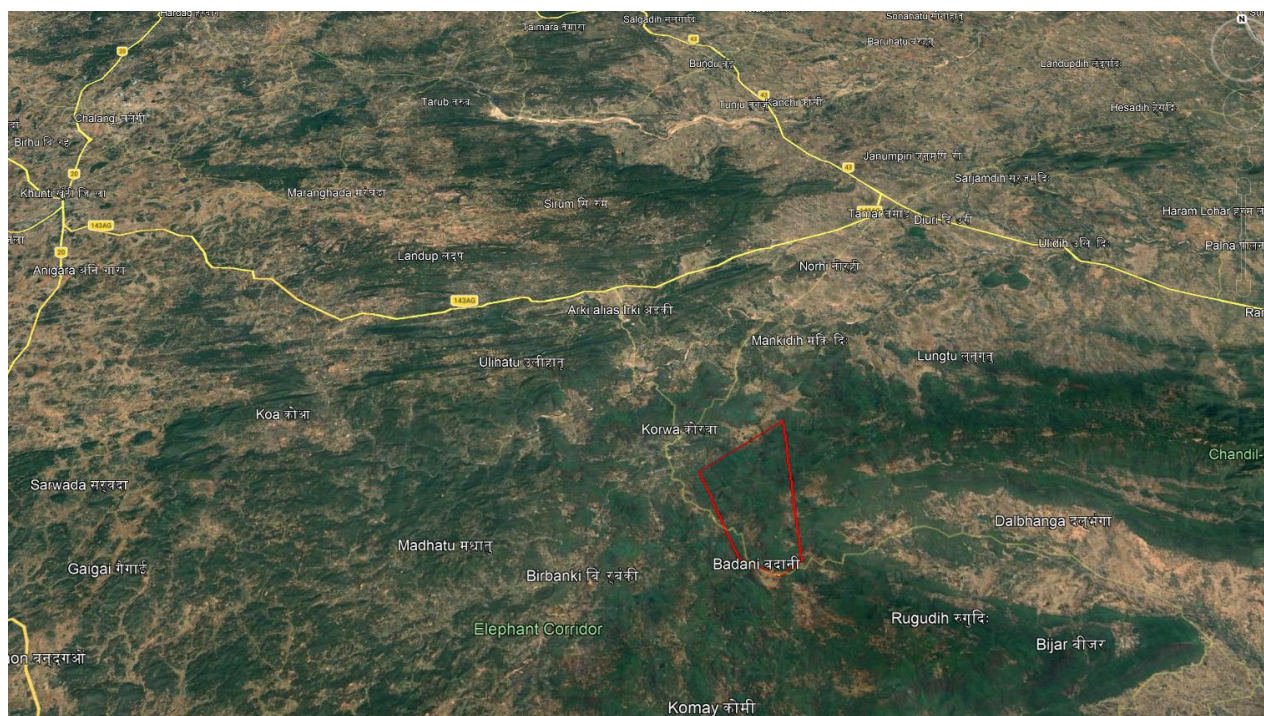


Figure- 3.2: Large Scale Mapping (LSM) area, in and around Hurungdah, Khunti, Ranchi, Saraikela-Kharsawan District, Jharkhand, shown on Google Earth imagery.

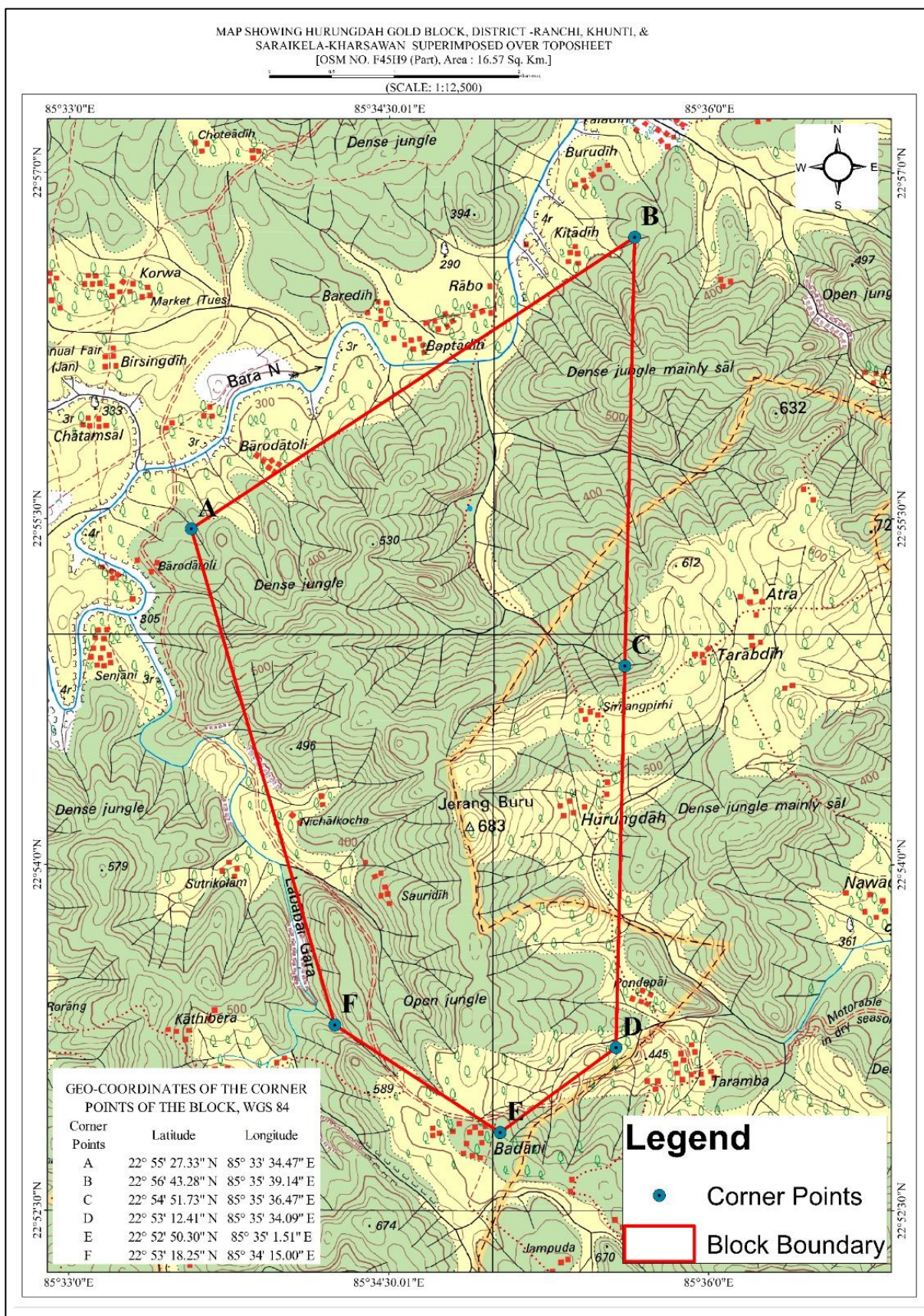


Figure- 3.3: Block boundary of the study area superimposed on survey of India toposheet number 73F/9.

3.8 Accessibility

The Hurungdah Gold Block is moderately well accessible through a combination of rail, road, and air transport facilities, facilitating the movement of manpower, machinery, and exploration materials. The nearest railway station is Ranchi Railway Station, located approximately 85 km from the block area, while the nearest airport is Birsa Munda Airport at Ranchi, situated about 90 km away, providing connectivity to major metropolitan cities.

In terms of road connectivity, NH-143AG passes at a distance of about 10 km from the area, serving as a major access route. From the highway, the block is approachable via a network of secondary and unmetalled (kaccha) roads. Although these interior roads may be affected during the monsoon season, overall accessibility remains reasonably good for field operations.

Locally, the area is accessed through rural roads and forest tracks across undulating terrain with forested patches and seasonal streams, where light vehicles and occasionally four-wheel drive vehicles are required to reach specific locations within the block.

3.9 Climate and vegetation

The area experiences humid subtropical climate, typical of the Chotanagpur Plateau region of Jharkhand, with well-defined summer, monsoon, and winter seasons. The area receives the majority of its rainfall during the southwest monsoon period (June to September). The average annual rainfall ranges between about 1,100 and 1,400 mm, with July and August being the wettest months. Rainfall outside the monsoon season is generally low and sporadic.

Summer extends from March to June and is characterized by hot and dry conditions, with maximum temperatures commonly reaching 38-40°C during May and early June. The onset of the monsoon brings some moderation in temperature, although humidity levels remain high. Winter prevails from December to February and is mild to cool, with minimum temperatures generally around 10-12°C and pleasant daytime conditions. Overall, the climate is favourable for agricultural activities and allows field-based exploration work for most of the year, except during periods of peak monsoon rainfall.

3.10 Flora and fauna

The block lies in Khunti, Ranchi, Saraikela-Kharsawan District is characterized by a rich and diverse flora and fauna, reflecting the ecological setting of the Chotanagpur Plateau. Nearly 75% of the area is covered by moderate to dense forest, comprising both natural and mixed vegetation. The forest flora includes important tree species such as Sal (*Shorea robusta*), which dominates the hill ranges and higher elevations, along with Neem (*Melia indica*), Palas (*Butea monosperma*), Mahua (*Madhuca longifolia*), Kendu (*Diospyros melanoxylon*), Chironji (*Buchanania lanzan*), Simul (*Bombax ceiba*), and extensive growth of Bamboo (*Dendrocalamus strictus*). The undergrowth consists of shrubs, bushes, grasses and cactus, forming a multilayered vegetation cover. In contrast, the central and northern parts of the block, particularly around villages such as Lebed, Hurwa, Lobo, Jojodih, and Dorya, are relatively flat alluvial tracts largely utilized for agriculture.

The region supports a variety of faunal species typical of forest–agricultural landscapes. Commonly observed wildlife includes elephants, which occasionally move through forest corridors, as well as wild boar, hare, jackal, and peacock. The avian population is diverse, with species such as jungle fowl, pigeons, parrots, doves, and other small birds frequently sighted. The coexistence of forested areas, cultivated land, and water sources provides suitable habitats for both terrestrial and avian fauna, contributing to the overall ecological significance of the block.

3.11 Geomorphology

The area exhibits gentle undulating to rugged dissected topography which is lithologically as well as structurally controlled. There is N-S trending high ridges in the central and NE-SW in northern portion of the block. The highest peak is in the mapped area having a height of 600 m from mean sea level. The rest of the area is undulating terrain with average height of around 460 m from mean sea level. The hillock zones and adjoining foothill areas form part of the extended terrain of the Dalma Hill ranges, whereas the lower-lying tracts are predominantly used for agriculture, supporting crop and vegetable cultivation by the local population. Basic infrastructure, including power transmission lines, is present within the block, and local manpower is available for field activities throughout most of the year, except during the harvesting season.

The Bara River governs the principal drainage system of the block, flowing in a west to east direction. The drainage within the block is characterized by predominantly intermittent streams and streamlets, which exhibit a well-developed dendritic drainage pattern over the major part of the area. These drainage channels constitute a part of the tributary network of the Subarnarekha River.

Power line is passing through the area. Manpower is available in the area for attending the work for the whole year except during harvesting season. The major part of the area is under cultivation of crops and vegetables by the local people.

3.12 LOCAL INFRASTRUCTURE

The proposed gold exploration block is distributed over Arki Block of Khunti District, Tamar Block of Ranchi District, and Kuchai Block of Saraikela-Kharsawan District. The area falls within a predominantly forest-covered, tribal-dominated terrain characterized by undulating to rugged topography, structurally controlled hill ranges, and dissected plateaus. Settlements are sparse and dispersed, governed under multiple Gram Panchayats.

Accessibility to the block is moderate. The area is reasonably well connected by a network of pakka roads linking major villages and adjoining towns; however, interior parts of the block, particularly within forested and hilly terrain, are accessible mainly through kaccha roads, forest tracks, and footpaths. These internal approaches are prone to seasonal constraints and become difficult during monsoon due to poor drainage and slippery conditions. Public transport facilities are limited and largely confined to main approach roads.

Infrastructure facilities such as electricity and potable water are available but unevenly distributed. Electrification has reached a majority of revenue villages; however, the supply is irregular and subject to frequent interruptions. Drinking water is primarily sourced from dug wells, tube wells, and hand pumps, with negligible piped water supply schemes. Telecommunication facilities are present but exhibit weak and inconsistent network coverage in remote and forested sectors.

The social infrastructure comprises primary and middle-level educational institutions within accessible village clusters, whereas higher educational facilities are located outside the block area, mainly in district headquarters. Healthcare facilities include Community Health

Centres (CHCs), Primary Health Centres (PHCs), and sub-centres catering to the rural population, with advanced medical support available at district-level hospitals.

The socio-economic profile of the area is predominantly agrarian, supplemented by forest-based activities and unskilled labour. Local manpower is available for deployment in exploration activities such as bedrock sampling, although availability may be seasonally affected during peak agricultural periods. Basic logistics, including supply of construction materials, fuel, and daily provisions, can be mobilized from nearby market centres and block headquarters.

Overall, the area possesses basic infrastructural support with moderate accessibility, limited but functional utilities, and adequate availability of local manpower. With appropriate logistical planning, phased mobilization, and consideration of seasonal constraints, the area is suitable for systematic mineral exploration activities up to advanced stages

3.13 Population (as per Census 2011)

As per the Census of India 2011, the proposed exploration area spans across Arki CD Block of Khunti District, Tamar CD Block of Ranchi District, and Kuchai CD Block of Saraikela-Kharsawan District. The combined population of these blocks is predominantly rural and tribal in character. Arki CD Block has a total population of 80,589, Tamar CD Block 132,672, and Kuchai CD Block 64,320, aggregating to approximately 277,581 persons within the broader study region.

The demographic composition across the three blocks indicates a balanced gender distribution. Arki Block comprises 40,473 males and 40,116 females (sex ratio: 991), Tamar Block approximately 66,000 males and 66,600 females (sex ratio ~1009), and Kuchai Block about 32,500 males and 31,800 females (sex ratio ~978). The cumulative sex ratio across the study area remains favourable. The 0–6 years population is significant in all three blocks, estimated at 13,379 in Arki, ~18,000-19,000 in Tamar, and ~9,000-10,000 in Kuchai, indicating a substantial young population base.

The social composition is overwhelmingly tribal. In Arki Block, Scheduled Tribes constitute 63,804 persons (80%), while Tamar and Kuchai Blocks also show a strong tribal presence of approximately 56-58% and 70-75%, respectively. Scheduled Castes account for about 5-7% across the region, with the remaining population comprising OBCs and other

communities. The major tribal groups inhabiting the area include Santhal, Munda, Oraon, Ho, Kharia, Bhuiya, Bhumij and Kurmi communities, each with distinct socio-cultural and livelihood characteristics.

Settlement patterns across the region are rural, scattered and low-density, with Arki Block alone comprising 16 Gram Panchayats and 128 revenue villages, including Sinjani, Badani. Similar dispersed habitation is observed in Tamar's Chatamsal, Rabo, Kitadih and Burudih village and Atra village of Kuchai Blocks, often influenced by terrain, forest cover, and traditional land-use practices.

The economic structure is predominantly agrarian and forest-based, with most households dependent on subsistence agriculture under rain-fed conditions. Major crops include paddy, maize, millets, pulses and oilseeds. Minor Forest Produce (MFP) forms a critical component of the local economy, including lac (lah), mahua flowers, sal seeds, tendu leaves, bamboo, and fuelwood. The region, particularly Khunti District, is notable for lac production, contributing significantly to the state's output. Non-agricultural employment opportunities are limited, resulting in dependence on seasonal labour and occasional migration, especially among younger population groups.

Despite the presence of substantial natural resources, the region faces developmental constraints such as low industrialization, inadequate irrigation facilities, and limited access to healthcare, sanitation, electricity and communication infrastructure. These factors influence livelihood patterns and socio-economic stability.

Socio-culturally, the area is characterized by a strong tribal heritage, with traditional governance systems, community cohesion, and deep-rooted dependence on land and forest resources. These aspects play a crucial role in land use, community interaction, and acceptance of developmental activities.

Overall, the combined area of Arki, Tamar, and Kuchai Blocks represents a rural, tribal-dominated socio-economic environment with dispersed settlements, resource-dependent livelihoods, and limited infrastructure. These demographic and socio-economic conditions are important considerations for planning, manpower mobilization, community engagement, and logistical execution of mineral exploration activities in the region.

3.14 Archaeological / Historical sites

The proposed exploration area covering Arki Block, Tamar Block and Kuchai Block, does not fall within any notified Archaeological Survey of India (ASI) protected monuments or officially recognized heritage sites of national importance.

However, the broader region of Jharkhand is known for its rich tribal cultural heritage and scattered traditional sites of local significance, including sacred groves (Sarna), burial grounds, and community worship places associated with indigenous tribes such as Munda, Ho and Santhal. These sites are generally not formally documented but hold socio-cultural importance and may occur in proximity to village settlements.

With respect to wildlife and protected areas, the exploration block does not lie within any notified National Park or Wildlife Sanctuary. Nevertheless, parts of the wider region fall within the ecological influence zone of Dalma Wildlife Sanctuary, located in the adjoining district of East Singhbhum. The sanctuary is known for its forested terrain and elephant habitat, and occasional wildlife movement corridors may extend towards nearby forest tracts, particularly in the Kuchai region.

No Biosphere Reserves or Eco-Sensitive Zones of national significance are reported within the immediate project area. The forest cover within the block is primarily reserved and protected forest land, supporting local biodiversity but not falling under strictly protected conservation categories.

In conclusion, the area is free from major archaeological, historical or legally protected ecological constraints, though due consideration should be given to local tribal cultural sites and forest ecology during planning and execution of exploration activities.

3.15 Environment

The exploration area is located in the south-central part of Jharkhand. The physiography of the districts is largely undulating, characterized by hills, plateaus, river systems and extensive forest cover, which enrich its natural landscape.

The three districts Ranchi, Khunti and Saraikela-Kharsawan are part of the mineral-bearing Chotanagpur Plateau. While large-scale mining is limited in Ranchi and Khunti, Saraikela-Kharsawan shows relatively higher mineral potential due to its proximity to the

Singhbhum mineralized belt. The region overall holds good potential for industrial minerals and construction materials, with scope for further detailed exploration.

The economic structure of the study area shows regional variation. Ranchi district has a diversified economy dominated by the service and industrial sectors. Khunti district is primarily agrarian with limited industrialization. Saraikela–Kharsawan district exhibits a balanced economy with strong industrial growth supported by agriculture. Overall, the region demonstrates significant potential for economic development, particularly in mineral-based industries and allied sectors.

CHAPTER-4: PREVIOUS WORK

In Jharkhand, commercial extraction of gold was carried out from Kunderkocha, Lawa, Maysera, Pahardia and Sonapet areas for long. These areas are also famous for having numerous gold panning sites from ancient times and the locals are engaged in panning activities, especially during the rainy seasons in the local river and nalas.

As per available information, the Maysera area, Saraikela-Kharsawan district was under the leasehold of “Garadih Properties Development Limited” and “Maysera Mining and Development Limited” under British management in 1934. The property extended over 44 sq. km. It represents large old workings with a length of 243 m. The auriferous quartz veins occur in the form of a lens over a length of 30 m down to a depth of 23 m.

Dunn (1924) cited some of the important gold occurrences in Manbhum and Singhbhum districts.

Previously, numerous geoscientists of GSI, as well as geologists from Singhbhum regions, have reported occurrences of gold in association with sulphide mineralization hosted with smoky quartz veins, brecciated quartzite, schist, and phyllite (Gupta and Basu, 1984; Bose and Prasad, 1986; Chandra and Mukherjee, 1993; Chandra and Nim, 1993; Chandra, 1993).

Mukherjee et al., 1969 reported that the mineralization in the Lawa area is confined to a shear zone of intense shearing along with the contact of intercalated bands of phyllite and schist with the quartzite. Gold is associated with grey to pale blue-colored quartz veins occurring mainly within the quartzite along the zone of shearing. The total mineral resource estimate is 601673 tonnes @ 3.2 g/t of gold.

Ziauddin and Narayanaswamy (1974) described gold occurrences in parts of Chhotanagpur.

Gupta and Basu (1984) mapped the areas in and around Sonapet valley and brought out the stratigraphy, petrography and structural details in view of gold and associated sulphide mineralization.

Preliminary search for gold by Chandra and Sharan (1998) followed by the search for gold to the north of Sonapet valley by Sharan et al., (2000) led to the identification of phyllite intercalated with quartzite and associated quartz reef around Parasi.

GSI has explored for gold in Lawa area (Lahiri et al., 1971).

Also, investigations for gold in parts of Sonapet valley, erstwhile Paschimi Singhbhum and Ranchi districts, Jharkhand were carried out during the field season (F.S.) 1999-2000 by Sharan and during F.S. 2000-2001 by Sharan and Kurien. This led to identification of ferruginous quartzite, phyllitic quartzite, tuff and associated pyritiferous quartz veins as the prospective host rocks for gold mineralization in the areas around Parasi.

Analysis of geochemical samples showed anomalous gold values (1.66 ppm to 10.27 ppm). This investigation also brought out a shear zone (120 m to 150 m in width and about 700 m in length near Parasi) having some positive indications of gold mineralization in the area.

Similarly, anomalous gold content was also found in the Singhbhum Group of meta-sedimentary rocks/volcano sedimentaries and associated quartz/quartz carbonate veins in Sinduari (975 ppb Au) and Lungtu (100 ppb to 340 ppb Au) areas. During FSP: 2008-10, the exploration work was done by Shashi Ranjan and Das, in which anomalous values of Au, ranging from 50 ppb to 612 ppb, were recorded in mica schist, quartz-chlorite schist, ferruginous-phyllite, banded magnetite quartzite and vein quartz.

Significant gold values were recorded during the investigation for gold carried out at the Parasi area by M/s. MECL in the field season 2007-2009 & 2013 - 2014. Surface manifestations of mineralization can be observed in the form of sulphides (arsenopyrite, pyrite and pyrohotite) disseminated in quartzite and quartz veins.

During STM mapping in the Field Season: 2012-14, in “Nauhri-Rasuri Sereng areas” by GSI, gold values of 60 ppb to 1.85 ppm have been reported from 5 samples of quartz veins and brecciated quartzite.

Further, based on findings of the previous investigation works, a multidisciplinary approach (G4 level exploration) has been attempted during FS: 2015-16 by GSI in and around Pundidiri village and the chemical analysis data of analyzed samples collected from the area shows gold values ranging from 0.05 ppm to 1.84 ppm.

CHAPTER-5: GEOLOGY OF THE AREA

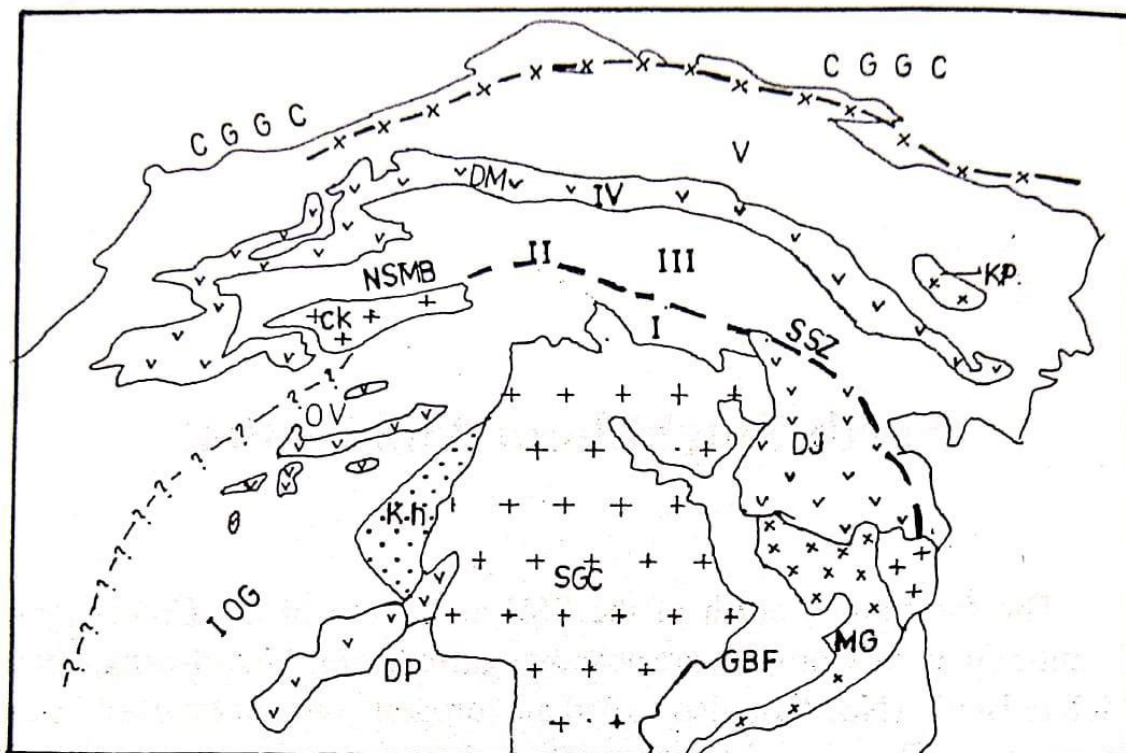
5.1 Regional Geology

The investigation area forms a part of the North Singhbhum Mobile Belt (NSMB), which represents a major curvilinear volcano meta-sedimentary belt of Palaeo- to Mesoproterozoic age developed between the Singhbhum Craton in the south and the Chhotanagpur Gneissic Complex (CGC) in the north. The NSMB is approximately 50 km wide and nearly 200 km long, exhibiting an overall E–W trend with a convexity towards the north. The belt has undergone low- to medium-grade metamorphism and multiple phases of tectonic deformation.

The northern contact of the volcano-sedimentary sequence of the Singhbhum Group with the CGC is marked by the Tamar–Porapahar Shear Zone (TPSZ), while the southern boundary is defined by the Singhbhum Shear Zone (SSZ). The TPSZ extends from Tamar in Ranchi district of Jharkhand to Porapahar in Bankura district of West Bengal through Saraikela-Kharsawan and Purulia districts, maintaining an overall E–W trend. The TPSZ occurs approximately 40 km north of the Singhbhum Shear Zone and, at places, traverses either through the rocks of the Singhbhum Group or the CGC. These shear zones represent major tectonic discontinuities and played a significant role in the structural and metamorphic evolution of the belt.

Regionally, the Singhbhum crustal province has been divided into five litho-stratigraphic domains comprising volcano-sedimentary formations, shear zone rocks and metamorphic assemblages. Domain I include low-grade volcano-sedimentary formations such as Dhanjori and Iron Ore Group rocks fringing the northern margin of the craton. Domain II comprises the tectonised rocks of the Singhbhum Shear Zone. Domain III includes the schistose metasedimentary rocks of the Chaibasa and Dhalbhum Formations, whereas Domain IV consists of the Dalma volcano-sedimentary belt composed predominantly of basic and ultrabasic volcanic rocks with associated pyroclastics and sediments. Domain V includes low- to medium-grade volcano-sedimentary sequences between the Dalma Belt and CGC. The lithological assemblage mainly comprises garnetiferous mica schist, quartzite, phyllite, carbonaceous phyllite, tuffaceous rocks, pyroclastics, agglomerates and pillowed metabasalts.

The Dalma volcanic suite includes tholeiitic, alkali basaltic, andesitic and komatiitic lava flows, indicating extensive volcanic activity, while the presence of pillow structures suggests subaqueous volcanism.



Major geological domains in North Singhbhum Mobile Belt. CGGC - Chota Nagpur Granite Gneiss Complex; CK - Chakradharpur Granite; DJ - Dhanjori Group; DM - Dalma Group; DP - Dangoaposi (Jagannathpur) Volcanics; GBF - Gorumahisani-Badampahar Fm.; IOG - Iron Ore Group; KP - Kuilapal Granite; MG - Mayurbhanj Granite; NSMB - North Singhbhum Mobile Belt; OV - Ongarbira Volcanics; SGC - Singhbhum Granite Complex; SSZ - Singhbhum shear zone.

Figure- 5.1: Regional Geological Map of North Singhbhum Mobile Belt (Mahadevan, 2002)

5.2 Stratigraphic Column

TABLE-4: Generalized Regional Stratigraphic Succession of the Area (After Gupta et al., 1980).			
Stratigraphic Unit	Tectonic Domain	Age	Lithology / Rock Types
Upper Dalma Formation	North Singhbhum Mobile Belt (Paleoproterozoic–Mesoproterozoic)	Dalma Group Volcanics (~1.6 Ga; Sarkar & Saha, 1962)	Gabbro (intrusive), volcanic agglomerate, pillow metabasalts, brecciated quartz veins (intrusive)
Lower Dalma Formation	North Singhbhum Mobile Belt	Dalma Group Volcanics (~1.6 Ga; Sarkar & Saha, 1962)	Metabasalt, gabbro, peridotite, tuffaceous tremolite schist, siliceous tuff, carbonaceous phyllite, mafic–ultramafic volcanic rocks
Dhalbhum Formation (Upper Singhbhum Group / Dhanjori Group)	Singhbhum Group	Proterozoic	Quartzite, purple phyllite, chlorite phyllite
Chaibasa Formation (Lower Singhbhum Group)	Singhbhum Group	Proterozoic	Quartz–mica schist (garnetiferous), quartzite, calc-arenite, amphibolite / hornblende schist, chert bands

5.3 Structure

The regional structural framework of the North Singhbhum Mobile Belt is highly complex and is characterized by major E–W trending tectonic units formed due to repeated compressional and deformational events. The belt broadly consists of three major structural units, namely: (i) a central geo-anticline with an overturned and thrustured southern limb adjoining the Singhbhum Shear Zone, (ii) the Dalma syncline associated with thrusting along its northern limb, and (iii) a northern geo-anticline abutting against the Chhotanagpur Gneissic Complex. The Singhbhum Shear Zone and Tamar–Porapahar Shear Zone constitute the major tectonic discontinuities controlling the structural disposition of the supracrustal sequences.

Structural studies carried out in different parts of the NSMB indicate that the area has undergone at least three phases of deformation. The first phase (F1) produced tight to

isoclinal and rootless folds with axial traces trending N70°W–S70°E to N80°W–S80°E. This deformation phase also generated a penetrative axial plane schistosity (S1) striking WNW–ESE with steep to sub-vertical dips. Owing to later superimposed deformation phases, the F1 structures are only locally preserved.

The second phase of deformation (F2) is the most dominant and widespread structural event in the area and produced open to tight symmetrical as well as asymmetrical folds with variable inter-limb angles and wavelength-to-amplitude ratios. Limb thinning and hinge thickening are common structural features associated with F2 deformation. The F2 phase also resulted in the development of axial plane schistosity (S2), especially within the Dalma Volcanics and associated metasedimentary rocks. The third phase of deformation (F3) generated broad open warps with comparatively gentle folding and vertical axial planes. In addition to folding, multiple joint sets are also developed and represent the principal non-penetrative structural features within the belt.

5.4 Metamorphism

The rocks of the North Singhbhum Mobile Belt have undergone complex polycyclic metamorphism associated with repeated tectonic deformation, crustal reactivation and regional metamorphic events. The metamorphism affected both the metasedimentary and metavolcanic sequences and resulted in widespread recrystallization, foliation development and mineralogical transformation of the rocks.

Metamorphism within the NSMB ranges from low to medium grade, as indicated by the mineral assemblages and metamorphic textures observed in the supracrustal rocks. The Chaibasa metasediments contain garnet, staurolite, kyanite and andalusite-bearing mica schists, indicating progressive regional metamorphism under varying pressure-temperature conditions. The Dhalbhum phyllite represents comparatively lower-grade metamorphic conditions. The metabasic volcanic rocks have largely been transformed into amphibolite, while high magnesian volcanic tuffs are represented by tremolitic schist. Meta-ultramafic rocks occur as concordant bands and lenses within the metasedimentary sequences.

Metamorphic mineral assemblages and paragenetic relationships indicate that the rocks were subjected to low- to medium-pressure regional metamorphism under pressure-temperature conditions ranging approximately between 3–6 kbar and 415°C–600°C. The metamorphism was closely associated with multiple phases of deformation, resulting in the development of schistosity, foliation, mineral lineation and recrystallization textures. The



combined effects of volcanism, sedimentation, tectonism and metamorphism have produced the present complex tectono-metamorphic framework of the North Singhbhum Mobile Belt.



CAPTER-6: GEOSCIENCE INVESTIGATION

6.1 Geological mapping

An area of 2.31 sq. km out of 16.57 Sq.km was covered through Large Scale Mapping on 1:12,500 scale in and around Badani valley situated in southern and southwestern parts of Hurungdah Gold Block for the investigation of Gold. The area of present investigation falls on the north western part of Survey of India toposheet number 73F/9 and Open Series Map number F45H9 (Figure-3.3) bounded by Latitude: 22° 52' 50.30" N to 22° 56' 43.28" N & longitude: 85° 33' 34.47" E to 85° 35' 39.14" E lying in Ranchi, Khunti and Saraikela-Kharsawan District of Jharkhand.

Structural parameters such as strike and dip of rock formations, bedding, schistosity, lineation, joints and folds were carefully measured in the field. All the observations and readings recorded during fieldwork were later plotted and compiled to prepare the geological map, which is presented as (Figure-6.1).

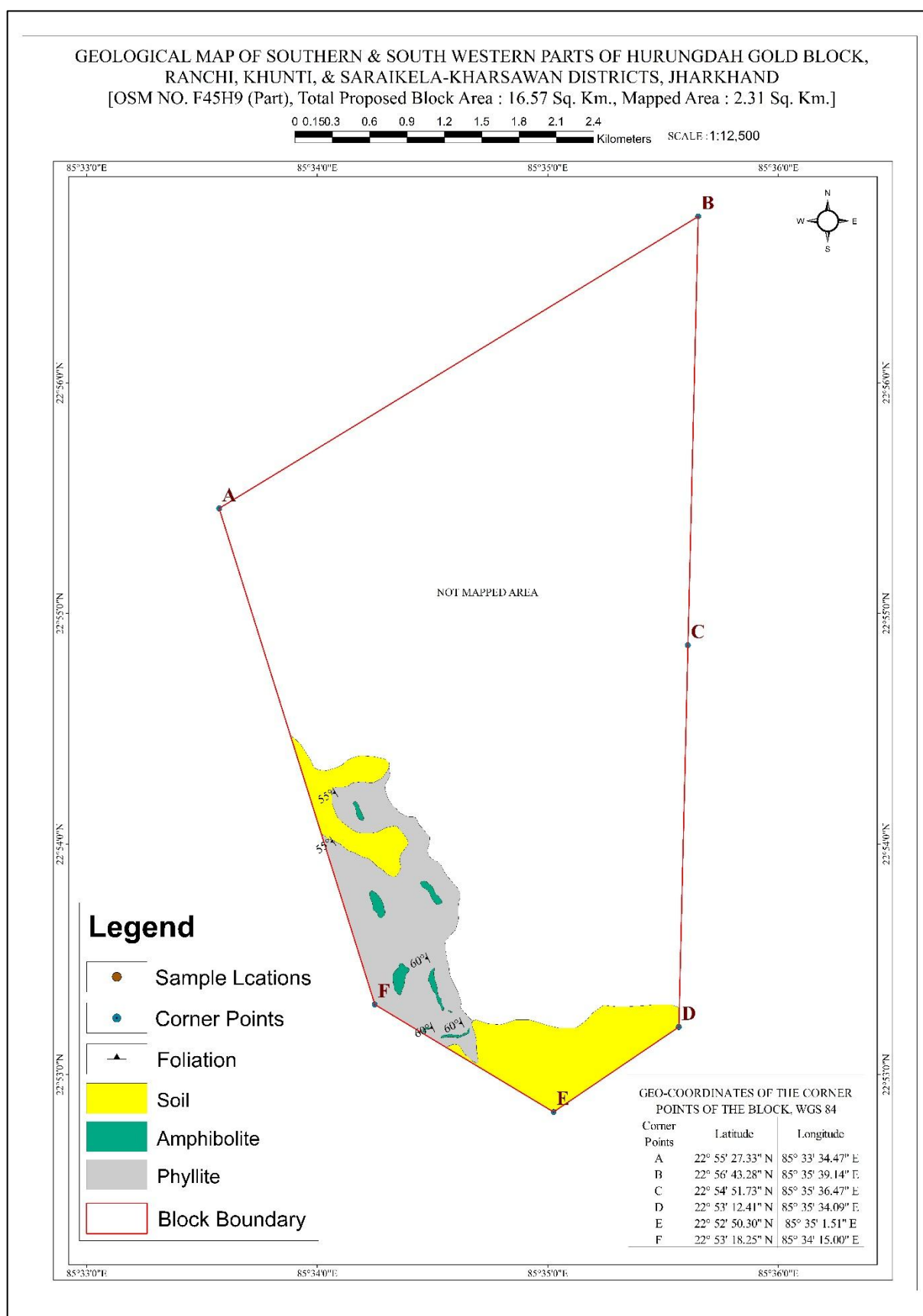


Figure- 6.1: Geological map of Southern and Southwestern parts of Hurungdah Gold Block, Ranchi, Khunti and Saraikela-Kharsawan Districts, Jharkhand.

6.1.1 Description of the lithological units

The geological mapping reveals the presence of the following litho-units:

Chlorite Phyllite

This is the dominant lithology in the study area and is represented by grey colour on the geological map, indicating its distinct lithological identity within the mapped area.

Megascopically, the rock exhibits a greenish-grey to purplish colour, depending upon the relative abundance of chlorite and associated mineral constituents. It is fine- to medium-grained in nature, with individual mineral grains generally not distinguishable to the naked eye. The rock is well foliated and displays prominent schistosity, imparting a characteristic foliated texture that enables splitting along closely spaced planar surfaces. Freshly broken surfaces commonly show a distinct phyllitic sheen.

The schistosity developed within the rock is attributed to low-grade metamorphism, during which platy minerals such as chlorite and sericite become aligned in a preferred orientation under directed pressure. The rock predominantly contains quartz, sericite, and chlorite, which together impart an overall khaki green to greenish appearance in the field (Figure-6.2), forming the basis for its nomenclature.

The foliation and schistosity planes may also act as favourable conduits for fluid movement and therefore play an important role in structural control and potential mineralization within the area. The general trend of the lithounits varies from N40°W–S40°E to N20°W–S20°E, with moderate dips towards the southwest.

Carbonaceous Phyllite

The rock is grey to black in colour and shows well-developed foliation. When rubbed, it leaves a black powder on the fingers. The carbonaceous phyllite is ferruginous and micaceous and is commonly associated with thin bands of quartzite. It mainly consists of carbonaceous matter along with quartz, sericite mica, and chlorite (Figure-6.3). The broken surfaces of the rock appear platy. At some places, the rock shows a spotted appearance due to surface bleaching. Due to its limited exposure, it is not mappable on 1:12,500 scale.



Figure- 6.2: Exposure of chlorite phyllite near Badani village.



Figure- 6.3: Greyish color carbonaceous phyllite near Badani village.

Amphibolite

This lithological unit is represented by green-coloured patches on the geological map, distinguishing it from the surrounding rock types. In the field, it is exposed in the form of isolated outcrops as well as scattered boulders at ground level, indicating discontinuous surface exposure and possible structural or erosional control over its distribution.

The rock is intrusive in nature, occurring within metasedimentary formations. Its emplacement appears to be broadly concordant with the general strike of the foliation of the host rocks, suggesting that the intrusion may have taken place along pre-existing planes of weakness such as foliation or bedding planes.

Petrographically, the unit is composed predominantly of amphibole minerals along with altered plagioclase feldspar, indicating a mafic composition and subsequent alteration processes. The rock is coarse-grained, allowing mineral constituents to be identified megascopically, and typically exhibits a dark green colour characteristic of amphibole-rich lithologies (Figure-6.4.A and Figure-6.4.B).

Structurally, the rock shows faint foliation. Thin bands and lenses of amphibolite are also observed, which display intrusive relationships with the surrounding phyllite units. These relationships highlight multiple phases of deformation and intrusion, and suggest that the unit plays an important role in understanding the structural and metamorphic evolution of the area.



Figure- 6.4.A: Field photograph of greenish color amphibolite.



Figure- 6.4.B: Exposure of amphibolite.

Quartz Veins

During the geological mapping, two types of quartz veins, namely milky white quartz veins (Figure-6.5.A) and smoky quartz veins (Figure-6.5.B), were encountered within the study area. Although the quartz veins are not clearly visible within the limited extent of the small mapped area. These quartz veins generally occur as thin, irregular, and discontinuous bodies rather than forming large quartz reefs. They are commonly developed along fractures, joints, and shear planes within the host rocks and often occur in a scattered manner.

The quartz veins are typically milky white, hard, compact, and crystalline in nature, composed predominantly of coarse to medium-grained quartz. In several places, they are associated with silicification and sulphide mineralization along structurally weak zones.

Smoky quartz veins, on the other hand, are dark grey to smoky coloured siliceous veins occurring along fractures and shear planes within the metamorphic rocks. The smoky appearance is mainly due to irradiated quartz and minor mineral inclusions. These veins are generally hard, compact, crystalline, and occur as discontinuous veins and veinlets.

The veins are commonly associated with carbonaceous phyllite and chlorite phyllite, which provide favourable lithological and structural conditions for their emplacement. The carbonaceous nature of the phyllite indicates the presence of organic matter, while the chlorite-rich composition reflects low-grade metamorphic conditions. Hydrothermal fluids migrating through structurally weak zones precipitated silica, resulting in the formation of quartz veins.

In many places, the veins exhibit lensoidal character with pinching and swelling along strike and show considerable variation in thickness over short distances. Their discontinuous nature and structural control indicate a close genetic relationship with hydrothermal activity and mineralization processes, particularly in sulphide and gold mineralization.

Due to their limited lateral extent, discontinuous nature, and poor exposure, these quartz veins cannot be individually delineated or plotted as separate mappable units at a scale of 1:12,500.



Figure- 6.5.A: Field photograph of milky white quartz vein.

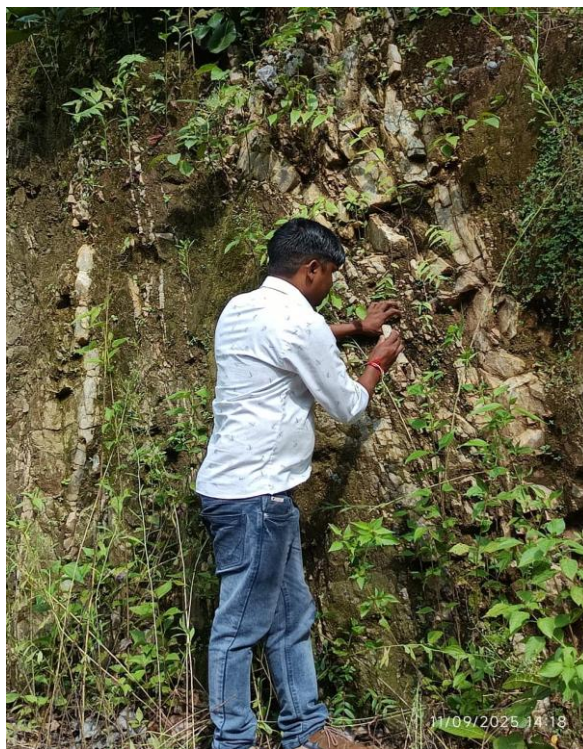


Fig- 6.5.B: Outcrop of smoky quartz vein.

Volcanic Agglomerate

The agglomerate is composed of angular basaltic fragments, and at places amygdaloidal basalt fragments are also present, all enclosed within a basaltic matrix. Two main types of volcanic agglomerate are found in the area, namely schistose agglomerate and massive agglomerate.

In the schistose agglomerate, the rock fragments are highly stretched and elliptical in shape (Figure-6.6.A) due to deformation, whereas in the massive agglomerate, the fragments are mostly angular to sub-rounded and sometimes square-shaped (Figure-6.6.B).

The original glassy material present within the volcanic fragments has undergone alteration and devitrification, which is commonly associated with silicification. In some places, pyroxene minerals have been altered into chlorite and actinolite due to deuteric alteration processes. Plagioclase feldspar also shows alteration features such as saussuritization and kaolinization. Because of these alteration processes and the presence of glassy material, the rock fragments often appear cloudy or turbid in nature.

Due to their limited extent and discontinuous exposure, the volcanic agglomerate are not mappable at a scale of 1:12,500.



Figure- 6.6.A: Field photograph of volcanic agglomerate with elliptical shape clast.



Figure- 6.6.B: Outcrop of volcanic agglomerate with angular to subrounded clast.

Soil / Lateritic Cover

This unit is depicted as yellow-coloured patches on the geological map, indicating its widespread but discontinuous distribution within the study area. It represents a weathered mantle developed in situ over the underlying bedrock, particularly above phyllite and amphibolite lithologies.

The material is typically yellowish to reddish in colour, reflecting varying degrees of oxidation and weathering intensity. It is generally loose to semi-consolidated in nature and may range from soil to lateritic or saprolitic material, depending on the extent of chemical alteration. The development of this unit is primarily controlled by climatic conditions and the susceptibility of the parent rock to weathering.

In several parts of the mapped area, this weathered horizon forms the dominant surface expression, effectively masking the primary bedrock lithology beneath. As a result, direct observation of the underlying rocks is limited in these zones, and geological interpretation often relies on indirect evidence such as float material, residual boulders etc.

This unit is significant not only from a geomorphological perspective but also in terms of exploration, as it may host residual or supergene mineral concentrations derived from the parent rock.

6.1.2 Petrographic studies

Petrographic studies were not carried out.

6.1.3 Petrochemical studies

Petrographic studies were not carried out.

6.1.4 Structure

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

Foliation

Foliations developed in phyllite (Figure-6.7) represents the primary planar fabric controlling lithological alignment. Generally trending NW–SE with 50° to 60° towards southwest.

Folding

The lithological units exhibit gentle to moderate folding, with fold axes broadly aligned parallel to the regional foliation trend (NW–SE). Tight minor folds observed within the phyllite suggest the influence of multiple phases of deformation.



Figure- 6.7: Well developed foliation in phyllite.



Figure- 6.8: Stretched grain within agglomerate indicate the shear direction.

Shear Zones

Shear zones are zones of intense deformation developed due to tectonic stress and displacement within rocks. These zones are characterized by several structural and alteration features indicating brittle to ductile deformation. In the study area, shear zones are identified by the stretching or elongation of clasts, intense fracturing, silicification, and development of quartz veins.

Stretching or elongation of clasts, particularly within volcanic agglomerates (Figure- 6.8), indicates deformation under shear stress, where the clasts become flattened and aligned parallel to the shear direction. Intense fracturing and jointing are also common, resulting from repeated tectonic movements and brittle deformation.

Silicification is observed along the shear zones due to the circulation of silica-rich hydrothermal fluids through fractures and planes of weakness, making the rocks hard and compact. Quartz veins commonly occur along these zones as veinlets or massive veins formed by the precipitation of silica from hydrothermal fluids. These quartz veins are often aligned parallel to the shear fabric and may indicate favourable zones for mineralization.

Joints and Fractures

Two dominant joint sets observed: NW–SE (parallel to foliation), NE–SW (cross-cutting) These fractures act as conduits for hydrothermal fluids.

6.1.5 Metamorphism

The rocks of the study area have experienced regional metamorphism ranging from the greenschist facies to amphibolite facies.

The greenschist facies metamorphism is identified by the presence of mineral assemblages such as actinolite, tremolite, chlorite, biotite and albite, which are mainly observed in phyllite.

In contrast, the amphibolite facies metamorphism is characterized by minerals like amphibole, plagioclase, clinopyroxene, chlorite, quartz, biotite, epidote and opaque minerals. The epidote present in the rocks is generally formed as a weathering or alteration product of plagioclase and muscovite.

6.1.6 Mineralogy of the ore zones and ore textures

During detailed geological mapping, no indication of gold (Au) mineralization was observed within the study area. The exposed lithological units, comprising phyllite, quartz veins, smoky quartz veins, and amphibolite, do not show any occurrence of native gold or diagnostic gold-bearing mineral assemblages.

Locally, weak surface manifestations such as ferruginisation, silicification, gossanous staining, and minor brecciation are present along fractures and quartz veins. These features are, however, of limited extent and intensity, and do not exhibit any clear spatial or genetic relationship with auriferous mineralization. Sulphide minerals occur only as sparse disseminations and thin stringers without any visible enrichment.

Although regional geological investigations by the Geological Survey of India have suggested the possibility of gold and base metal mineralization in comparable lithological settings in the surrounding areas, no such mineralization is evident within the present study area.

On the basis of surface geological observations, the study area does not exhibit any significant gold mineralization.

6.1.7 Trenching and pitting

Pitting and trenching could not be carried out, as the exploration activities were disrupted due to local opposition.

6.1.8 Sampling

A total of 30 bedrock samples were collected from the block area covering approximately 2.31 sq. km out of the total 16.57 sq. km area and analyzed for gold (Au). The locations of all sampling points were recorded using a handheld GPS, and the megascopic characteristics of the rocks were documented during field investigations. Each sample was carefully packed and properly labelled to ensure accurate identification and traceability.

Special emphasis was given to the collection of samples from chlorite phyllite, carbonaceous phyllite, quartz veins and smoky quartz veins, as these lithologies were identified as favourable host rocks for mineralization by earlier investigations carried out by the Geological Survey of India, particularly by Banerjee and Thiagarajan (1967). In addition, samples were also collected from other lithological units wherever indications of mineralization were observed or anticipated.

The collected rock samples were crushed and pulverized to a particle size of (-) 200 mesh. The sample quantity was subsequently reduced through progressive coning and quartering to obtain a representative portion of approximately 100 grams. The representative samples were sent to M/S Lucid Laboratory Pvt. Ltd for chemical analysis of gold by the AAS (Atomic Absorption Spectroscopy) method, while the remaining material was preserved as duplicate samples for future reference and verification.

No soil or stream sediment samples could be collected during the course of investigation due to local disturbances and operational constraints in the area.

6.1.9 Discussion

Out of the 30 analysed bedrock samples, the gold (Au) concentration ranges from less than 0.01 ppm to 0.23 ppm. Among these, only one sample recorded the highest gold value of 0.23 ppm, which was obtained from carbonaceous phyllite.

A generalized elemental distribution of gold in different rock types is summarized in table-5.

TABLE-5: Generalized elemental distribution of gold in different rock types.		
Rock Type	Minimum (ppm)	Maximum (ppm)
Quartz vein	0.07	0.07
Carbon phyllite	0.03	0.23
Chlorite Phyllite	0.05	0.09
Amphibolite	0.01	0.17

6.1.10 Ore zones

Due to the limited extent of geological mapping carried out within the block area and the generally low gold values obtained from the analyzed bedrock samples, no potential ore zone could be delineated. The analytical results indicate only sporadic and low-grade gold mineralization, without any significant concentration or continuity that could suggest the presence of an economically viable ore body. Therefore, based on the available geological, structural, and geochemical data generated during the current phase of exploration, no definite mineralized zone has been identified within the study area.

6.2 Geophysical Exploration

No geophysical exploration has been carried out in the area.

6.3 Geochemical Exploration

The bedrock sampling programme was carried out with special emphasis on identifying zones of hydrothermal alteration and visible sulphide mineralization, which are considered favourable indicators for gold mineralization. During field investigation, evidences of hydrothermal alteration were mainly observed within brecciated quartz veins and silicified zones. Therefore, these litho-units were preferentially targeted for detailed geochemical sampling to assess their gold potential. In addition, representative samples from other litho-units such as carbonaceous phyllite, chlorite phyllite, amphibolite, and associated rocks were also collected to understand the overall geochemical characteristics of the area.

The procedure adopted for collection of bedrock samples is described below:

1. Before collecting the in-situ rock samples, the exposed rock surfaces were thoroughly cleaned using a wire brush in order to remove weathered material, soil cover, and surface contamination. This ensured that only fresh and representative material was sampled.
2. Rock samples measuring approximately 20 cm × 10 cm were then extracted from the outcrops with the help of a geological hammer and chisel. Care was taken to obtain samples directly from fresh exposures wherever possible.
3. Only fresh, hard, and unweathered bedrock samples were collected for geochemical analysis so as to minimize the influence of secondary alteration and weathering effects on analytical results.
4. The collected samples were carefully packed in clean plastic bags to prevent contamination, mixing, or loss of material during transportation and handling.
5. Each sample bag was properly labeled and tagged with sample number, location details, and lithological information for accurate identification and record maintenance.

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

The integration of geological, geophysical and geochemical datasets constitutes a vital component of modern mineral exploration. With most surface-exposed mineral deposits already discovered and exploited, current exploration strategies are increasingly focused on identifying concealed and deeper-seated mineralization. The occurrence and localization of mineralization are primarily controlled by lithology and structural features such as faults, fractures and shear zones.

Mineralized zones often produce detectable geochemical signatures at the surface, which can be effectively delineated through systematic geochemical sampling. Such studies not only help in determining the concentration and distribution of elements within specific lithological units but also provide insights into the source, mobilization and deposition of mineralizing fluids.

In the present study area, an attempt has been made to integrate geological and geochemical datasets. However, no geophysical survey has been carried out under the current programme. Therefore, the interpretation is based on the correlation of geochemical data with the mapped geological features.

Sampling for gold (Au) mineralization was primarily undertaken in phyllite units hosting multiple quartz vein intrusions, particularly in zones showing evidence of oxidation and sulphide mineralization.

Due to the partial nature of the geological mapping, limited bedrock exposure, irregular distribution of sampling locations within the mapped area and the relatively small number of collected bedrock samples, a systematic and uniformly spaced sampling grid could not be maintained during the investigation.

Consequently, the available dataset was insufficient for preparing reliable gold geochemical contour maps or for delineating any consistent geochemical anomaly patterns within the study area.

CHAPTER-8: MINERAL PROSPECT.

8.1 Surface indication

The presence of mineralization is often reflected by distinctive geological, structural, and alteration characteristics developed within the host rocks. During the course of geological mapping in the Badani Valley area of the Hurungdah Gold Block, a few isolated zones exhibiting brittle–ductile deformation, minor shearing, and localized brecciation were recorded. These features are restricted in extent and do not constitute any major or continuous structural zone capable of hosting significant mineralization.

The broader region encompassing the Hurungdah Gold Block has a well-documented history of mineralization. Gold occurrences associated with meta-sedimentary rocks have been reported from nearby areas such as Lungtu, Parasi, Sindauri, and Ghanshyampur (Toposheet No. 73F/9) and the Parasi block has recently been auctioned for gold exploration. Additionally, studies by Das & Deju (2017) have identified gold-bearing zones in the Ghagri–Asangibera area (Toposheet No. 73F/13), where oxidized quartzite acts as the principal host rock. These regional evidences provide a useful exploration framework; however, the present observations are restricted to the Badani Valley mapping area.

Quartz veins and veinlets intruding phyllitic rocks are exposed at a few locations in the mapped area. Some of these exposures display weak ferruginisation and silicification, suggesting localized hydrothermal alteration and oxidation of trace sulphide minerals. However, the alteration effects are patchy, poorly developed, and lack the continuity generally associated with productive mineralized systems. No prominent gossanous zones or extensive alteration envelopes were identified during the investigation.

Occurrences of sulphide minerals are limited to sparse disseminations and thin veinlets associated with a few quartz veins hosted within chlorite phyllite. Pyrite and chalcopyrite were observed only in minor amounts and at isolated localities. The sulphide occurrences are discontinuous and do not exhibit any appreciable concentration, persistence, or lateral continuity.

The geological evidence gathered during the investigation indicates that hydrothermal activity within the area was limited and localized. Although minor alteration features, quartz veining, and trace sulphide mineralization are present, they do not form any coherent mineralized zone.

8.2 Mode of occurrence

Indicator minerals such as sulphides-primarily pyrite, chalcopyrite and arsenopyrite are observed to be closely associated with brecciated quartz vein occurring within shear zones. In the present mapped area of the Badani Valley, a few localized shear zones have been identified, although their continuity and full extent could not be established due to limited exposure.

In the study area phyllite bodies are intruded by multiple quartz veins and veinlets, most of which are too thin and discontinuous to be represented at the present mapping scale. The quartz veins act as carriers of sulphide mineralization.

The brecciated quartz vein associated with these shear zones exhibit signs of oxidation and hydrothermal alteration, including ferruginisation and silicification. Sulphide mineralization is predominantly confined to quartzite and brecciated zones occurring in close proximity to these shear zones. In some instances, even associated mafic to ultramafic lithologies within these structurally controlled zones show minor sulphide occurrences, indicating the influence of structural controls on mineralization.

Sulphides occur both as fine disseminations within brecciated quartzite and as fillings within vugs and cavities. Overall, the observed features suggest that sulphide mineralization is structurally controlled and related to hydrothermal activity, though its extent remains limited.

8.3 Details of mineralization

Field observations, supported by structural measurements, indicate that mineralization within the mapped area is weak and sparsely developed, being largely confined to hydrothermally altered brecciated quartz veins. These zones exhibit moderate to intense oxidation and occur along localized shear zones displaying a consistent NW–SE trend, with recorded strike values ranging from 145° to 160°. The measured dip angles vary between 50° and 60°, with dip directions predominantly towards 235°-250° (southwest), indicating a moderately to steeply dipping structural regime.

Sulphide mineralization is poorly developed and is represented mainly by trace to minor amounts of pyrite and chalcopyrite occurring as fine disseminations and occasional thin stringers within narrow quartz veinlets. The quartz veins, which are broadly parallel to

the foliation and shear fabric, appear to have acted as pathways for hydrothermal fluid movement; however, sulphide concentrations are generally low and discontinuous.

The observed mineralization lacks significant width, continuity, and sulphide abundance, suggesting a weak hydrothermal system with limited metal deposition. Although structural controls are evident, the intensity of mineralization is low, and no substantial ore-grade zones were identified during the present investigation.

Alteration features associated with mineralization are also limited in extent and intensity. The mineralization is interpreted to be structurally controlled and hydrothermal in origin, with brittle–ductile shear zones serving as conduits for fluid circulation. Surface manifestations such as ferruginisation and brecciation are locally developed but are generally weak and sporadic. Hydrothermal alteration, represented by minor silicification and carbonatization within phyllitic units, is restricted and lacks widespread development.

The spatial association of these alteration features with quartz veins and shear zones suggests a genetic relationship with hydrothermal activity; however, the overall alteration footprint is narrow and discontinuous. Combined geological and structural evidence indicates only a low level of hydrothermal mineralizing activity within the mapped area. Consequently, the area exhibits poor mineralization potential based on the current surface observations and analytical results, including the low gold values obtained from collected samples.

8.4 Genesis of mineralization

The occurrence of a few localized shear zones within the mapped area, accompanied by weak hydrothermal alteration and sparse sulphide mineralization, suggests a possible epigenetic origin for the mineralization. Hydrothermal deposits are generally classified as epigenetic or syngenetic depending on their timing relative to host rock formation (Weick, 1994). The field characteristics observed in the Badani Valley area indicate that the mineralization is epigenetic in nature; however, its continuity, intensity, and lateral extent appear to be limited and could not be fully established due to weak surface indications and limited area covered.

The shear zone-related quartz veins hosting minor sulphide mineralization exhibit certain features commonly associated with hydrothermal fluid activity. These veins show evidence of both brittle and ductile deformation and are spatially associated with the dominant NW-SE trending structural fabric (145°-160° strike, SW dipping) recorded during field investigations. The quartz veins are interpreted to have been emplaced by hydrothermal

fluids; however, the associated sulphide mineralization is sparse, discontinuous, and of low intensity. Although some similarities with orogenic gold systems may be inferred, the weak alteration, low sulphide abundance, and poor gold values suggest that the hydrothermal system was not sufficiently robust to generate significant mineral concentrations.

The mineralizing fluids and associated metals were likely mobilized during the later stages of deformation and metamorphism and subsequently introduced along structurally weak zones at shallower crustal levels. Nevertheless, the limited development of alteration and mineralization indicates that metal-bearing fluid flow was either weak, short-lived, or ineffective in producing substantial ore accumulation. This interpretation is supported by:

1. The occurrence of only minor and localized mineralization within low-grade metamorphic rocks such as phyllite.
2. The presence of localized brittle–ductile shear structures with limited sulphide enrichment.
3. Weak and discontinuous hydrothermal alteration, represented by minor silicification, ferruginisation, brecciation, and carbonatization.
4. The occurrence of occasional vein ramification and open-space filling textures, indicating fluid activity but not necessarily significant mineral deposition.

Thus, within the limited mapped area of Badani Valley, the observed geological, structural, and alteration characteristics suggest the presence of a weak shear zone-controlled hydrothermal system. Although hydrothermal processes have affected the area, the resulting mineralization is poorly developed, discontinuous and associated with low gold values. Consequently, the area exhibits low to very low mineralization potential and lacks evidence of any significant or economically viable gold-bearing system based on the present investigation.

CHAPTER-9: EXPLORATION BY SYSTEMATIC DRILLING

A total drilling programme of 1000 m was initially envisaged for the exploration area. However, no drilling operations were undertaken during the present phase of investigation. This decision was based on the findings of geological mapping and the poor analytical results obtained from the collected bedrock samples, which failed to indicate the presence of significant, continuous, or economically viable mineralization within the study area.

Consequently, no prospective target zone could be identified for drilling at the current stage of exploration. In view of the unfavourable geological evidence and unsatisfactory analytical outcomes, TCC-II during its 22nd meeting held on 4th and 5th February 2026, recommended pre-closure of the project.

Accordingly, the proposed drilling programme of 1000 m was not executed, and the project was closed without advancing to the drilling stage.



CHAPTER-10: RESOURCE ESTIMATION

Since exploratory works such as pitting, trenching, and drilling have not been carried out in the investigated area, subsurface continuity, thickness, and extent of mineralization could not be established. Therefore, no mineral resource estimation or reserve calculation has been made at the present stage of exploration.

CHAPTER-11: CONCLUSION AND RECOMMENDATION

Conclusion

The mapped area, confined to the Badani Valley of the Hurungdah Gold Block, comprises lithological units belonging to the Singhbhum Group and the Dalma Group. The Singhbhum Group is represented by amphibolite of the Lower Formation and carbonaceous phyllite, chlorite phyllite and quartzite of the Upper Formation. The Dalma Group includes carbonaceous phyllite, mafic to ultramafic volcanics, brecciated quartz veins, and volcanic agglomerate.

Field investigations indicate that mineralization is structurally controlled and associated with quartz veins within phyllitic units. These veins follow a consistent NW–SE trend (145°-160° strike, SW dipping) and exhibit features such as brecciation, ferruginisation and silicification. Sulphide mineralization, mainly in the form of pyrite and chalcopyrite, occurs as disseminations and veinlets within quartz veins and host rocks.

Geochemical analysis of 30 bedrock samples indicates that gold (Au) values range from 0.01 ppm to 0.23 ppm. The majority of samples fall within the range of 0.03 ppm to 0.09 ppm, indicating generally low background values. A few isolated samples show relatively higher values, such as 0.23 ppm (JEMCL/HU/BRS-10), 0.17 ppm (JEMCL/HU/BRS-14), and 0.11 ppm (JEMCL/HU/BRS-12); however, these are sporadic and lack spatial continuity.

The distribution of gold values is scattered and does not define any coherent or continuous geochemical anomaly zone. Although hydrothermal alteration features and sulphide mineralization are present, their intensity and extent are limited.

Based on the integrated geological, structural, and geochemical data, the study area indicates weak and localized mineralization, which is not sufficient to establish the presence of any significant or economically viable gold.

In view of the poor geochemical results and the absence of encouraging mineralization, the TCC-II, during its 22nd meeting held on 4th and 5th February 2026, recommended pre-closure of the project. Consequently, advanced stages of exploration,

including trenching, pitting, drilling, and other subsurface investigations, were not undertaken.

Recommendation

Quartz veins and phyllitic units exposed within the mapped area exhibit weak and localized hydrothermal alteration with sparse sulphide mineralization. Analytical results obtained from bedrock samples have yielded predominantly low gold values, with a few isolated samples showing marginal gold enrichment. The observed sulphide minerals, mainly pyrite and chalcopyrite, occur sporadically within smoky quartz veins and altered phyllitic units, indicating limited hydrothermal activity along localized structural zones. However, the mineralization is discontinuous, restricted in extent, and lacks significant lateral or vertical continuity.

The geochemical results do not indicate the presence of any persistent or economically significant gold anomaly within the investigated area. Geological mapping, structural studies, and alteration characteristics also fail to delineate any favourable zone for the concentration of gold mineralization. The available evidence suggests that the hydrothermal processes operating were weak and insufficient to generate significant gold enrichment.

Based on the integrated evaluation of geological, structural, alteration, and geochemical data generated, the area is considered to possess low to very low potential for gold mineralization. No promising exploration target has been identified, and no drill-worthy zone has been delineated within the study area.

In view of the poor analytical results, absence of significant gold values, and lack of any economically viable mineralized zone, it is recommended that no further exploration work for gold be undertaken in the investigated area. The investigation may therefore be concluded at the present stage, and the area may be considered unsuitable for advancement to subsequent stages of gold exploration.

CHAPTER-12: LOCALITY INDEX

TABLE-6: Locality Index.

Sl. No.	Village Name	Latitude	Longitude
1	Kitadih	22°56'38.52"N	85°35'23.79"E
2	Rabo	22°56'22.02"N	85°34'58.10"E
3	Baptadih	22°56'20.62"N	85°34'46.78"E
4	Barodatoli	22°55'43.36"N	85°33'59.10"E
5	Sirijangpirhi	22°54'37.95"N	85°35'25.52"E
6	Hurungdah	22°54'15.95"N	85°35'30.59"E
7	Pondepai	22°53'26.14"N	85°35'43.40"E
8	Nichalkocha	22°54'15.23"N	85°34'11.40"E
9	Sauridah	22°53'50.65"N	85°34'29.61"E
10	Badani	22°52'49.79"N	85°34'58.21"E

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Annexure-1: Analytical results of bedrock samples (BRS) collected from the different rock types of Southern and Southwestern parts of Hurungdah Gold Block, Ranchi, Khunti and Saraikela-Kharsawan Districts, Jharkhand.

Sl. No.	Sample No	Lithology	Latitude	Longitude	Gold (Au) Value (PPM)
1	JEMCL/HU/BRS-1	Chlorite Phyllite	22° 54' 02.412"	85° 34' 01.452"	0.09
2	JEMCL/HU/BRS-2	Chlorite Phyllite	22° 53' 53.484"	85° 34' 10.776"	0.07
3	JEMCL/HU/BRS-3	Amphibolite	22° 53' 47.868"	85° 34' 13.980"	0.09
4	JEMCL/HU/BRS-4	Chlorite Phyllite	22° 53' 42.648"	85° 34' 09.480"	0.08
5	JEMCL/HU/BRS-5	Chlorite Phyllite	22° 53' 28.716"	85° 34' 14.700"	0.08
6	JEMCL/HU/BRS-6	Amphibolite	22° 53' 26.448"	85° 34' 19.920"	0.08
7	JEMCL/HU/BRS-7	Amphibolite	22° 53' 20.688"	85° 34' 21.504"	0.08
8	JEMCL/HU/BRS-8	Amphibolite	22° 53' 16.692"	85° 34' 27.192"	0.06
9	JEMCL/HU/BRS-9	Quartz vein	22° 53' 12.912"	85° 34' 24.528"	0.07
10	JEMCL/HU/BRS-10	Carbonaceous Phyllite	22° 53' 13.488"	85° 34' 28.704"	0.23
11	JEMCL/HU/BRS-11	Chlorite Phyllite	22° 53' 11.580"	85° 34' 30.216"	0.09
12	JEMCL/HU/BRS-12	Amphibolite	22° 53' 11.904"	85° 34' 27.552"	0.11
13	JEMCL/HU/BRS-13	Amphibolite	22° 53' 09.672"	85° 34' 32.160"	0.08
14	JEMCL/HU/BRS-14	Amphibolite	22° 53' 09.780"	85° 34' 34.140"	0.17
15	JEMCL/HU/BRS-15	Amphibolite	22° 53' 10.644"	85° 34' 37.956"	0.07
16	JEMCL/HU/BRS-16	Amphibolite	22° 53' 12.120"	85° 34' 39.504"	0.06
17	JEMCL/HU/BRS-17	Chlorite Phyllite	22° 53' 13.560"	85° 34' 37.596"	0.06
18	JEMCL/HU/BRS-18	Amphibolite	22° 53' 16.620"	85° 34' 34.284"	0.07
19	JEMCL/HU/BRS-19	Amphibolite	22° 53' 17.952"	85° 34' 32.628"	0.03
20	JEMCL/HU/BRS-20	Amphibolite	22° 53' 21.120"	85° 34' 30.720"	0.03
21	JEMCL/HU/BRS-21	Amphibolite	22° 53' 24.036"	85° 34' 29.208"	0.07
22	JEMCL/HU/BRS-22	Carbonaceous Phyllite	22° 53' 29.508"	85° 34' 29.316"	0.03
23	JEMCL/HU/BRS-23	Amphibolite	22° 53' 35.700"	85° 34' 26.796"	0.04
24	JEMCL/HU/BRS-24	Amphibolite	22° 53' 44.988"	85° 34' 31.296"	0.04
25	JEMCL/HU/BRS-25	Chlorite Phyllite	22° 53' 53.556"	85° 34' 26.076"	0.08
26	JEMCL/HU/BRS-26	Chlorite Phyllite	22° 54' 03.780"	85° 34' 22.296"	0.05
27	JEMCL/HU/BRS-27	Chlorite Phyllite	22° 54' 04.176"	85° 34' 12.468"	0.06
28	JEMCL/HU/BRS-28	Amphibolite	22° 54' 06.624"	85° 34' 11.604"	0.09
29	JEMCL/HU/BRS-29	Chlorite Phyllite	22° 54' 13.500"	85° 34' 04.692"	0.06
30	JEMCL/HU/BRS-30	Amphibolite	22° 54' 10.512"	85° 34' 09.912"	0.01

