

**GEOLOGICAL REPORT ON RECONNAISSANCE SURVEY (G-4 STAGE) FOR GOLD
IN JOJOBERA-ULIHURANG GOLD BLOCK, ARKI BLOCK, KHUNTI DISTRICT,
JHARKHAND
(F. No.: 23/559/2025-NMET/891)**



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झारखंड के, खूंटी जिले के जोजोबेरा-उलिहुरांग क्षेत्र 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 खूंटी जिले के जोजोबेरा-उलिहुरांग क्षेत्र में स्वर्ण खनिज की संभावना का आकलन करने के लिए G-4 स्तर (Reconnaissance Survey) का सर्वेक्षण किया गया। यह क्षेत्र सर्वे ऑफ इंडिया टोपोग्राफी संख्या 73F/9 (OSM No. F45H9) के अंतर्गत आता है। इस अध्ययन का मुख्य उद्देश्य क्षेत्र में सोने के खनिजीकरण की संभावना का पता लगाना तथा खनिजीकरण को नियंत्रित करने वाले भूतात्विक, संरचनात्मक और हाइड्रोथर्मल कारकों को समझना था। लगभग 10.61 वर्ग किलोमीटर क्षेत्र में स्थित लोबो, लेबेद, हरुआ, कोरवा, जोजोडीह, डोरिया और बारुबेरा गांवों को शामिल करते हुए 1:12,500 पैमाने पर विस्तृत भूतात्विक मानचित्रण किया गया। सर्वेक्षण के दौरान सोने की जांच के लिए 180 शैल नमूने एकत्र किए गए। हालांकि, स्थानीय समस्याओं और अन्य फील्ड बाधाओं के कारण स्ट्रीम सेडिमेंट सैंपलिंग, ट्रेचिंग और ड्रिलिंग जैसे प्रस्तावित कार्य नहीं किए जा सके।

भूतात्विक आधार पर यह अध्ययन क्षेत्र नॉर्थ सिंहभूम मोबाइल बेल्ट (NSMB) का हिस्सा है, जो प्राचीन ज्वालामुखीय एवं अवसादी/रूपांतरित शैलों का क्षेत्र है। यहां मुख्य रूप से क्लोराइट फिलाइट, कार्बनयुक्त फिलाइट, एम्फीबोलाइट, क्वार्ट्ज शिराएं इत्यादि शैल पाई गईं। क्लोराइट फिलाइट सबसे अधिक पाई जाने वाली शैल है, जिसका रंग हरा-धूसर होता है और इसमें स्पष्ट परतें एवं विदलन दिखाई देते हैं। एम्फीबोलाइट अलग-अलग स्थानों पर बहिर्गत तथा अंतःप्रवेशी निकायों के रूप में मिलता है। क्वार्ट्ज शिराएं दूधिया सफेद से धूमिल धूसर रंग की हैं और दरारों, भ्रंशों तथा शीयर जोनों के साथ विकसित हुई हैं। इनके साथ सिलिसीकरण, लौहकरण तथा हल्का सल्फाइड खनिजीकरण भी देखा गया।

संरचनात्मक एवं हाइड्रोथर्मल विशेषताएँ क्षेत्र में मुख्य रूप से उत्तर-पश्चिम से दक्षिण-पूर्व (NW-SE) दिशा में फैली हुई परतें, शीयर जोन तथा दरारें पाई गईं, जो क्षेत्र में हुए विभिन्न विवर्तनिक परिवर्तनों को दर्शाती हैं। शैलें निम्न से मध्यम श्रेणी के रूपांतरण से प्रभावित हैं। इनमें क्लोराइट, सेरिसाइट, एम्फीबोल तथा परिवर्तित फेल्डस्पार जैसे खनिज पाए गए। जहां क्वार्ट्ज शिराएं, ब्रेसिएशन, लौहकरण तथा हल्का सल्फाइड प्रसार देखा गया। कुछ स्थानों पर धूमिल क्वार्ट्ज शिराओं और परिवर्तित फिलाइट में सल्फाइड खनिज मिले, जो सीमित हाइड्रोथर्मल गतिविधि का संकेत देते हैं। लेकिन ये खनिजीकृत क्षेत्र संकरे, असतत और अनियमित रूप से फैले हुए पाए गए।

180 शैल नमूनों के भू-रासायनिक विश्लेषण परिणामों में सोने की मात्रा सामान्यतः बहुत कम पाई गई, जो 0.01 ppm से 0.22 ppm के बीच रही। अधिकांश नमूनों में सोने की मात्रा 0.04 ppm से 0.10 ppm के बीच थी। केवल कुछ अलग-अलग नमूनों में अपेक्षाकृत अधिक मान प्राप्त हुए जिसमें 0.18 ppm, 0.19 ppm, 0.22 ppm वाले उच्च मान क्लोराइट फिलाइट तथा क्वार्ट्ज शिराओं वाले क्षेत्रों से प्राप्त हुए।

शैल नमूनों के रासायनिक विश्लेषण परिणाम से पता चलता है कि क्षेत्र में सोने की मात्रा छिटपुट और स्थानीय स्तर पर ही मौजूद है तथा इसकी कोई निरंतरता नहीं है। अध्ययन के दौरान कोई बड़ा हाइड्रोथर्मल परिवर्तन क्षेत्र, महत्वपूर्ण सल्फाइड

समृद्धि या व्यापक खनिजीकृत संरचना नहीं मिली। क्वार्ट्ज शिराएं और सल्फाइड की उपस्थिति केवल छोटे स्तर की हाइड्रोथर्मल घटनाओं को दर्शाती हैं, न कि ऐसे बड़े खनिजीकरण तंत्र को जो आर्थिक रूप से लाभकारी सोने के भंडार बना सके।

भूतात्विक, संरचनात्मक और भू-रासायनिक आंकड़ों के आधार पर अध्ययन क्षेत्र में आर्थिक दृष्टि से महत्वपूर्ण सोना खनिजीकरण का कोई प्रमाण नहीं मिला। सोने की कम मात्रा, खनिजीकृत क्षेत्रों की असतत प्रकृति तथा सीमित सल्फाइड खनिजीकरण से स्पष्ट होता है कि वर्तमान स्तर पर क्षेत्र में स्वर्ण खनिज की संभावना कम है। इसके अतिरिक्त, स्थानीय समस्याओं के कारण विस्तृत अन्वेषण कार्य (जैसे ट्रेचिंग और ड्रिलिंग) नहीं हो सके, जिससे क्षेत्र की खनिज संभावनाओं का पूर्ण आकलन भी संभव नहीं हो पाया। अतः वर्तमान G-4 स्तर की जांच के आधार पर यह क्षेत्र सोने की आगे की विस्तृत खोज के लिए आशाजनक नहीं माना जाता है।

वर्तमान जी-4 स्तर के अन्वेषण के दौरान संकलित भूवैज्ञानिक, संरचनात्मक एवं भू-रासायनिक आँकड़ों के समेकित विश्लेषण के आधार पर अध्ययन क्षेत्र में आर्थिक दृष्टि से महत्वपूर्ण स्वर्ण खनिजीकरण के पर्याप्त साक्ष्य प्राप्त नहीं हुए हैं। विश्लेषित शैल नमूनों में प्राप्त स्वर्ण मान सामान्यतः निम्न स्तर के हैं तथा स्वर्ण युक्त क्षेत्र सीमित विस्तार एवं असतत (Discontinuous) प्रकृति के हैं। साथ ही, सल्फाइड खनिजीकरण भी अल्प एवं स्थानीय रूप से ही परिलक्षित हुआ है।

तथापि, क्षेत्र की स्वर्ण संभाव्यता को वर्तमान चरण में अंतिम रूप से कम अथवा नगण्य नहीं माना जा सकता, क्योंकि स्थानीय परिस्थितियों एवं अन्य क्षेत्रीय बाधाओं के कारण ट्रेचिंग, ड्रिलिंग तथा स्ट्रीम सेडिमेंट सर्वेक्षण जैसे महत्वपूर्ण अन्वेषण कार्य संपादित नहीं किए जा सके। फलस्वरूप, उपलब्ध आँकड़े क्षेत्र में स्थानीय अथवा आवृत (Concealed) स्वर्ण खनिजीकरण की संभावनाओं को पूर्णतः निरस्त करने के लिए पर्याप्त नहीं हैं।



RECONNAISSANCE SURVEY (G-4 STAGE) FOR GOLD IN JOJOBERA-ULIHURANG GOLD BLOCK, ARKI BLOCK, KHUNTI DISTRICT, JHARKHAND CHAPTER-1: SUMMARY

During the Field Season 2025–26, a Reconnaissance Survey (G-4 stage) for gold was carried out in the Jojobera–Ulihurnag area, covering parts of Khunti District, Jharkhand, within Survey of India Toposheet No. 73F/9 (OSM No. F45H9). The primary objective of the investigation was to evaluate the gold mineralization potential of the area and to understand the lithological, structural, and hydrothermal controls influencing mineralization within the North Singhbhum Mobile Belt (NSMB). An area of approximately 10.61 sq. km encompassing the villages of Lobo, Lebed, Harua, Korwa, Jojodih, Doriya and Barubera was covered through large-scale geological mapping on a scale of 1:12,500. During the course of field investigations, 180 bedrock samples were collected for gold (Au) analysis. However, due to field constraints and local issues, several proposed exploration activities, including stream sediment sampling, trenching and drilling could not be undertaken during the field season.

Geologically, the study area forms part of the North Singhbhum Mobile Belt, a Palaeo- to Mesoproterozoic volcano-sedimentary and metasedimentary terrain situated between the Singhbhum Craton to the south and the Chhotanagpur Gneissic Complex to the north. The lithological assemblage exposed within the mapped area comprises chlorite phyllite, carbonaceous phyllite, amphibolite, and quartz veins. Chlorite phyllite constitutes the dominant rock type and is characterized by its greenish-grey colour, well-developed foliation, schistosity, and pronounced cleavage. Amphibolite is exposed as isolated outcrops and intrusive bodies within the metasedimentary sequence. Quartz veins, varying from milky white to smoky grey in colour, occur along fractures, joints, and shear planes and are commonly associated with silicification, ferruginisation, and minor sulphide mineralization.

Structurally, the area is characterized by prominent NW–SE trending foliations, shear zones, and fracture systems, reflecting multiple phases of deformation related to the tectonic evolution of the NSMB. The rocks have undergone low- to medium-grade metamorphism, as evidenced by mineral assemblages comprising chlorite, sericite, amphibole, and altered



feldspar. Field observations indicate that hydrothermal activity was predominantly localized along structurally weak zones marked by quartz veining, brecciation, ferruginisation, and sporadic sulphide dissemination. Minor occurrences of sulfide minerals were observed within smoky quartz veins and altered phyllitic rocks, suggesting localized hydrothermal fluid activity. However, these mineralized zones were found to be narrow, discontinuous, and irregularly distributed across the study area.

Geochemical analysis of 180 bedrock samples revealed generally low gold values ranging from 0.01 to a maximum of 0.22 ppm. Most of the analyzed samples recorded gold concentrations between 0.04 ppm and 0.10 ppm. Only a few isolated samples collected from chlorite phyllite and quartz vein-hosted zones yielded comparatively elevated values of 0.18 ppm, 0.19 ppm and 0.22 ppm.

The analytical results reveal a sporadic and localized distribution of gold values with no discernible spatial continuity. No extensive hydrothermal alteration zone, or substantial sulphide enrichment was identified during the investigation. Furthermore, the absence of laterally continuous mineralized structures and the weak nature of hydrothermal manifestations suggest that the area has experienced only limited and localized mineralizing processes. The observed quartz veining and sulphide occurrences appear to represent small-scale hydrothermal events rather than a significant mineralizing system capable of hosting economically viable gold deposits.

Based on the geological, structural and geochemical data generated during the present G-4 stage investigation, no significant evidence of gold mineralization has been established in the mapped area. The gold values obtained are generally low, and the mineralized zones are discontinuous with limited sulphide mineralization. However, the gold potential of the area cannot be considered conclusively poor, as trenching, drilling, stream sediment survey could not be undertaken due to local constraints. Therefore, the available data are not sufficient to completely rule out the possibility of localized or concealed gold mineralization. The low gold values obtained during the present investigation should be considered in view of the limited exploration carried out. Accordingly, the gold potential of the area remains inconclusive at the present stage of exploration.



CHAPTER-2: INTRODUCTION

Gold occupies a unique position among mineral commodities owing to its enduring economic, cultural, and historical significance. In India, gold has been an integral component of social traditions, religious practices, and financial security for centuries, symbolizing wealth, prosperity, and stability. Beyond its cultural importance, gold continues to serve as a strategic asset, a reliable store of value, and an important investment instrument in the global economy. Its applications in electronics, medicine, and other industrial sectors further contribute to its growing demand worldwide.

Despite its importance and sustained demand, India has not witnessed the discovery of any major gold or base metal deposits during the last three decades. Concurrently, domestic gold production has shown a declining trend, while consumption has continued to increase substantially, resulting in a significant dependence on imports. This growing demand–supply gap places considerable pressure on the country's foreign exchange reserves and highlights the need for strengthening indigenous mineral resources. In recent years, advances in exploration methodologies, analytical techniques, mining technology, and operational efficiency have improved the economic viability of developing smaller and spatially clustered mineralized zones. Consequently, systematic and scientific exploration of prospective geological terrains has assumed greater importance in identifying new mineral resources and augmenting the national reserve base.

The present investigation was undertaken in the Jojobera–Ulihurnag area of Khunti District, Jharkhand, which forms part of the North Singhbhum Mobile Belt (NSMB), a well-known Proterozoic volcano-sedimentary and metasedimentary belt recognized for its mineral potential. The area is characterized by Precambrian rock formations comprising granite gneiss, chlorite phyllite, carbonaceous phyllite, amphibolite, and quartz veins. Such lithological assemblages, particularly when associated with shear zones, fractures, foliations, and hydrothermal alteration, are widely regarded as favourable hosts for structurally controlled gold mineralization in many parts of the world.

The study area exhibits several geological features commonly associated with hydrothermal gold systems. These include extensive development of milky and smoky quartz

veins, silicification, ferruginisation, chloritization, sericitization, and localized sulphide mineralization represented by pyrite and chalcopyrite. The quartz veins occur along structurally weak zones such as fractures, joints, and shear planes and vary from thin veinlets to prominent lodes. Such features indicate that the area has undergone multiple phases of deformation and hydrothermal activity, creating a geological environment that is permissive for gold mineralization.

In view of these favourable lithological, structural, and alteration characteristics, the area was considered worthy of reconnaissance-level investigation to assess its gold potential. However, the results of geological mapping and geochemical studies indicate that gold mineralization within the area is weak, localized, and discontinuous in nature. Gold values obtained from bedrock samples are generally low and sporadically distributed. Although the geological setting demonstrates several attributes favourable for the occurrence of gold, the exploration data generated during the present investigation do not support the presence of economically viable gold mineralization within the study area.

Nevertheless, the investigation has contributed valuable geological and geochemical information regarding the distribution of lithological units, structural controls, hydrothermal alteration patterns within this segment of the North Singhbhum Mobile Belt. Such information will be useful for refining exploration models and guiding future mineral exploration programmes 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.

The authors are very much thankful to the Managing Director, Jharkhand Exploration and Mining Corporation Limited (JEMCL), Shri Varun Ranjan, (IAS), for his constant encouragement, administrative support, and guidance during the course of the exploration programme. The authors also acknowledge with thanks the guidance and supervision of Shri Vijay Kumar Ojha, General Manager (Exploration), JEMCL, in planning and monitoring of the exploration activities.



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The authors place on records their appreciation for the support and cooperation extended by all colleagues of Jharkhand Exploration and Mining Corporation Limited, who directly or indirectly contributed to the successful completion of the exploration programme at the Jojobera-Ulihurang Block, Khunti District, Jharkhand.

2.2 Details of the project

JEMCL, Ranchi has proposed exploration for gold in the Jojobera–Ulihurang area of Khunti District 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.

The Reconnaissance Survey (G4 stage) for gold covers an area of 10.61 sq. km within the Jojobera–Ulihurang Gold Block, located in Arki Block of Khunti District, 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 NMET. The proposal was evaluated during the 3rd meeting of TCC-II of NMEDT held on 22nd and 23rd October 2024 at NMEDT, New Delhi. Subsequently, the NMEDT–EC approved the proposal in its 39th Executive Committee meeting held on 24th January 2025, and the project was formally sanctioned on 24th February 2025.

On the recommendation of the Technical-cum-Cost Committee (TCC) of NMET, the Executive Committee (EC), in its 39th meeting held on 24th January, 2025, has approved the

mineral exploration project titled “Reconnaissance (G4 Stage) for Gold in Jojobera–Ulihurang Block, Arki Block, Khunti District, Jharkhand” having F. No. 23/559/2025-NMET/891 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 23.12.2025. The total approved cost of the project, including GST, is ₹1,13,32,210/-.

2.3 Investigating agency

Jharkhand Exploration and Mining Corporation Limited (JEMCL), Ranchi, Jharkhand, is the investigating agency and conducted the exploration programme for the project titled “Reconnaissance (G4 Stage) for Gold in Jojobera–Ulihurang Block, Arki Block, Khunti District, Jharkhand”, bearing F. No. 23/559/2025-NMET/891. The project was formally sanctioned on 24th February, 2025, and JEMCL has been entrusted with the responsibility of carrying out the mineral exploration work in accordance with the approved scheme and guidelines of NMET.

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 Jojobera-Ulihurang 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, and exploratory evidences from the region and adjoining areas. The regional geological map prepared by GSI indicates the presence and distribution of lithologies favourable for gold mineralization. Field indications such as gold panning activities by local residents along the Karkari River further suggest the possible occurrence of placer and primary gold mineralization in and around the area.

Previous exploration work carried out by GSI in the nearby Pundidiri–Puntru block, located about 20 km from the proposed area, has established encouraging results. Analytical data from surface samples, including those collected from old pits, indicate gold values ranging from 0.05 ppm to 1.84 ppm. Moreover, the occurrence of known gold prospects such as Lawa Gold Mines (approximately 90 km away) and Parasi Gold Block (about 32 km away) further strengthens the mineral potential of the region. Additional geochemical data from adjoining areas like Parasi and Pundidiri show higher gold values ranging from 0.5 ppm to 1.84 ppm, indicating a strong possibility of continuity of mineralization.

Geologically, the area forms part of the volcano-meta-sedimentary sequences situated between the Singhbhum Craton in the south and the Chhotanagpur Gneissic Complex in the north. This sequence belongs to the Paleo- to Meso-Proterozoic age and has undergone low to medium grade metamorphism. The area lies within the North Singhbhum Mobile Belt (NSMB), a significant litho-stratigraphic domain trending E–W with a convexity towards the

north. The contact between the Singhbhum Group and the Chhotanagpur Gneissic Complex is marked by the Tamar–Porapahar Shear Zone (TPSZ), which trends ENE–WSW and is known to host gold and associated sulphide mineralization.

Previous studies by GSI and other geoscientists have reported gold occurrences associated with sulphide mineralization within quartz veins, brecciated quartzite, and tuffaceous phyllite in this belt. The lithological assemblage of the area comprises mica schist, chlorite schist, quartz-sericite schist, phyllite, granites, mafic rocks, quartz veins (including smoky quartz), pegmatite veins, and subordinate chert bands, which are conducive for hydrothermal mineralization.

In view of the favourable geological setting, supporting analytical data, and proximity to known gold-bearing zones, the proposed area is considered prospective for gold mineralization. Therefore, G4 level exploration has been proposed to delineate potential mineralized zones and to formulate a strategy for subsequent detailed exploration (G3/G2 level), which will ultimately assist the State Government in the systematic development and auction of the block. Accordingly, Jharkhand Exploration and Mining Corporation Limited (JEMCL), Ranchi, has proposed to undertake the investigation under NMEDT.

2.6 Nature and quantum of the work

The block has been allotted to Jharkhand Exploration and Mining Corporation Limited (JEMCL) for exploration of gold minerals under G4 level, funded through NMEDT. As per the approved programme, an area of 10.61 km² has been covered through detailed geological mapping on a scale of 1: 12,500, and the entire targeted mapping has been successfully completed.

Under the sampling programme, against a target of 265 bedrock/soil samples, a total of 180 samples has been collected. However, no sampling could be carried out for trench samples (100 nos.), stream sediment samples (40 nos.), and drill core samples (60 nos.). Thus, the overall sampling work remains partially completed, with only bedrock sampling contributing to the achievement.



Surveying activities, including borehole fixation and determination of reduced levels and coordinates of boreholes and trench points over 10.61 km² using DGPS, as well as fixation of scout boreholes (2 nos.) and corner points (6 nos.), have not been carried out. Similarly, the proposed trenching work of 200.00 cubic meters up to 2 m depth has not been undertaken.

Under drilling operations, the planned 400 meters of hard rock drilling and drill core preservation (40 m) have not been executed. Laboratory studies also remain largely incomplete. While gold analysis by AAS method has been carried out for 180 samples against a target of 465 samples, other chemical analyses including trace and REE analysis (ICP-MS) and check sample analysis have not been conducted. Petrographic studies, including preparation and study of thin and polished sections along with digital photomicrography, have also not been carried out.

Overall, the exploration programme has primarily been limited to geological mapping and partial bedrock sampling. The remaining activities, including surveying, trenching, drilling, detailed laboratory investigations, and associated studies, are yet to be undertaken. 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	10.61	10.61
2	Surveying:			
	a) Topographic survey for contour map preparation (1:12,500 scale)	Km ²	10.61	Not Carried Out
	b) Borehole Fixation and determination of co-ordinates & reduced level of the boreholes and corner points by DGPS/Total Station.	Nos.	08	Not Carried Out
3	Sampling:			
	a) Bed rock/soil samples	Nos.	265	180
	b) Trench samples	Nos.	100	Not Carried Out
	c) Stream sediment samples	Nos.	40	Not Carried Out
	d) Drill core samples	m.	60	Not Carried Out
4	Trenching	Cu. m.	200	Not Carried Out
5	Drilling (coring)	m.	400	Not Carried Out
6	Drill Core Preservation	m.	40	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.	20	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.	2	Not Carried Out
	iii) Gold analysis by AAS (Atomic Absorption Spectrometry) method for bed rock, drill core, soil, trench and stream sediment samples.	Nos.	465	Not Carried Out
8	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.		47	Not Carried Out
	b) Petrographic Studies			
	i) Preparation of thin section	Nos.	20	
	ii) Study of thin section	Nos.	20	
	iii) Preparation of polish section	Nos.	10	
	iv) Study of Polish section	Nos.	10	
	v) Digital photomicrography	Nos.	20	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 1:12500 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 under investigation is situated in the Khunti District of the state of Jharkhand (Figure-3.1). The study area encompasses the villages of Lobo, Lebed, Harua, Korwa, Jojodih, Doriya, and Barubera, which fall under Arki Tehsil in Khunti District, Jharkhand.

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 10.61 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° 58' 32.20"	85° 34' 0.35"
B	22° 57' 53.35"	85° 34' 38.79"
C	22° 57' 7.71"	85° 33' 56.44"
D	22° 56' 19.43"	85° 31' 47.05"
E	22° 57' 22.79"	85° 31' 13.24"
F	22° 57' 44.71"	85° 32' 46.95"

3.4 Land use/cover

The G-4 exploration block covering an area of 10.61 sq. km in and around Jojobera-Ulihurang villages of Khunti District, Jharkhand, is predominantly covered under forest land. As per available records, almost 70% of the block area (10.61 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 Arki block falls under the Tamar Forest Range of the Khunti Forest Division, Jharkhand, and forms part of a well-defined forested region of the state. The Tamar Range is the largest range in the division, having a total demarcated forest area of about 19,404.18 hectares, and Arki constitutes one of its important beats.

The forests in this area are classified as Tropical Moist Deciduous Forest, which is characteristic of the Chotanagpur Plateau region. The vegetation is predominantly dense and is mainly composed of Sal (*Shorea robusta*) as the dominant species. Other associated tree species commonly found in the area include Palash (*Butea monosperma*), Mahua (*Madhuca longifolia*), Kendu/Tendu, Kusum, and Ber, many of which hold economic and traditional importance, including use in lac cultivation and local livelihoods.

Ecologically, the area is significant due to the presence of Sarna (sacred groves), which are culturally protected forest patches maintained by local tribal communities for religious practices and biodiversity conservation. These groves play an important role in preserving native flora and maintaining ecological balance.



The forest also supports a variety of wildlife, and the region is known for the presence and movement of wild animals, including elephants, indicating a healthy and diverse forest ecosystem.

3.6 Land Status (Freehold/Leasehold Details)

The proposed exploration block comprises a mix of forest land, Khuntkatti land, and freehold land. A substantial part of the block falls within notified forest areas and is therefore governed by the provisions of the Indian Forest Act, 1927 and the Forest (Conservation) Act, 1980. Consequently, any exploration activities proposed within the forest land shall be undertaken only after obtaining the requisite statutory clearances and approvals from the competent authorities.

A portion of the block is recorded as Khuntkatti land, a traditional community-based landholding system prevalent in the Chotanagpur region, particularly among the Munda tribal communities. Under this customary tenure system, land is collectively owned and managed by the community with hereditary rights recognized under the provisions of the Chotanagpur Tenancy Act, 1908. Any exploration work in such areas shall require consultation with the concerned community and compliance with the applicable legal and customary provisions.

The remaining area consists of freehold land held under private ownership with clear title rights. Exploration activities in these areas may be carried out after obtaining consent from the respective landowners and fulfilling all applicable legal, compensation, and procedural requirements.

At present, the proposed block is free from any existing mining lease or mineral concession and has been allocated to Jharkhand Exploration and Mining Corporation Limited (JEMCL) for G-4 level reconnaissance exploration under the National Mineral Exploration and Development Trust (NMEDT) programme.

3.7 Location

The Jojobera–Ulihurang exploration area is situated in Arki Tehsil of Khunti District in the state of Jharkhand. Geographically, the area lies between latitudes 22°56′19.43″ N and

22°58'32.20" N, and longitudes 85°31'13.24" E and 85°34'38.79" E. The proposed block encompasses parts of the Jojobera and Ulihurang villages and forms part of the south-central Jharkhand mineral belt. 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.

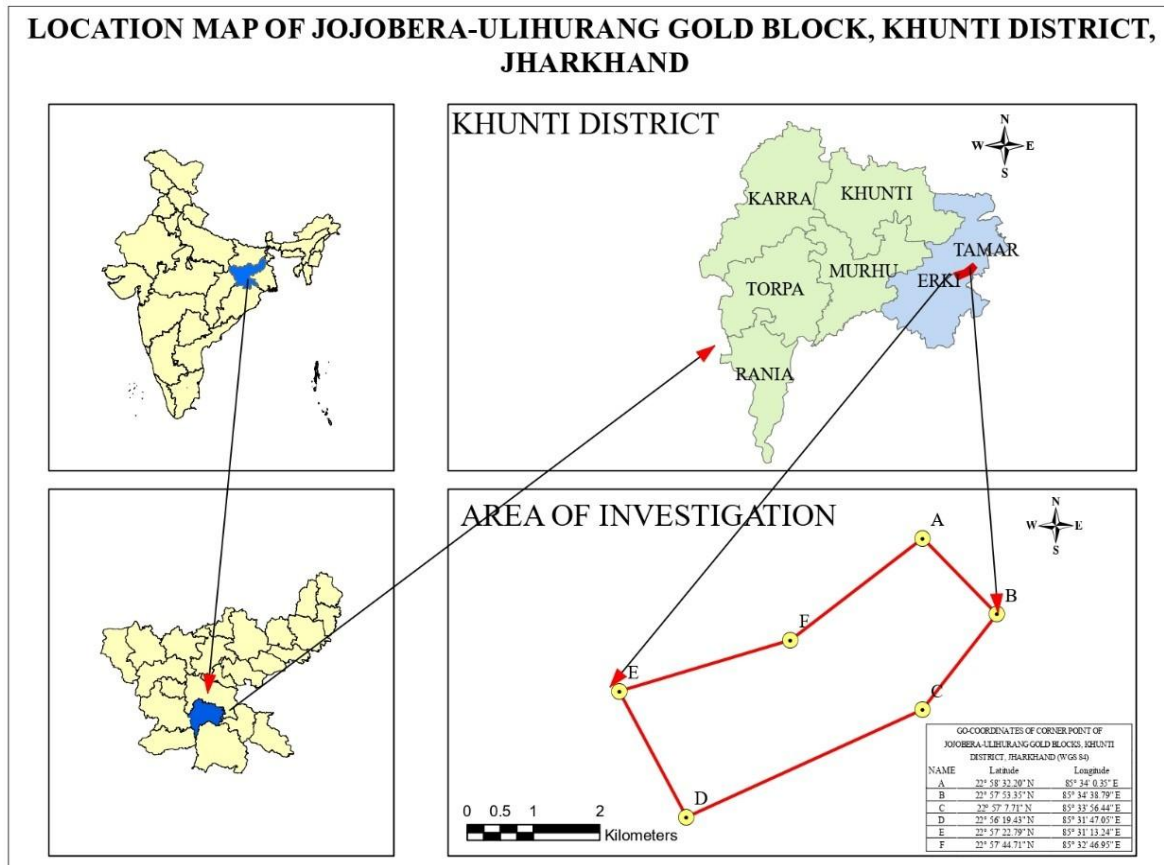


Figure- 3.1: Location map of Jojobera-Ulihurang Gold Block, Khunti District, Jharkhand.



Figure- 3.2: Large Scale Mapping (LSM) area, of Jojobera-Ulihurang Gold Block, Khunti District, Jharkhand, shown on Google Earth imagery.

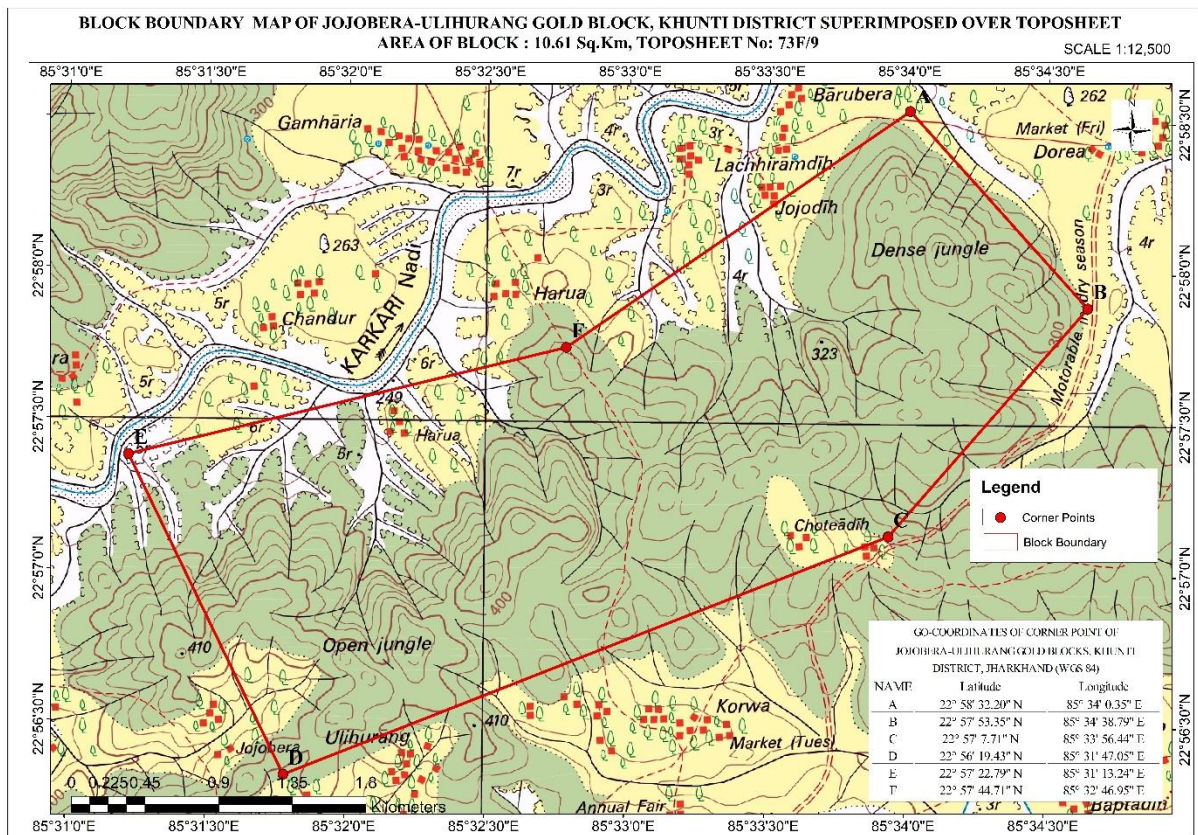


Figure- 3.3: Block boundary of the study area superimposed on survey of India toposheet number 73F/9.

3.8 Accessibility

The project area is reasonably well connected by rail, road, and air. The nearest major railhead is Ranchi Railway Station, located approximately 70 km from the exploration area, providing connectivity to major cities and industrial centers. Road access to the site is facilitated by National Highway-43, which passes at a distance of about 10 km from the block; the area is further approachable through a network of state highways and village roads linking the surrounding settlements. Air connectivity is available through Birsa Munda Airport, Ranchi, situated at a distance of about 75 km from the project area. Overall, the existing transportation infrastructure ensures adequate accessibility for movement of manpower, equipment, and exploration materials.

3.9 Climate

The Arki Block of Khunti District experiences a 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 favorable 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 of Khunti District is characterized by a rich and diverse flora and fauna, reflecting the ecological setting of the Chotanagpur Plateau. Nearly 70% 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 Arki Block.

3.11 Geomorphology

The area exhibits a varied geomorphological setting, ranging from gently undulating plains to rugged and dissected terrain, largely controlled by the underlying lithology and structural framework. Prominent Northeast–Southwest trending ridge are observed in the central part of the block, forming distinct physiographic features. The highest elevation, reaching about 491 m above mean sea level, while the minimum elevation in the area is around 262 m, with an average elevation of approximately 367 m above mean sea level. The hillock zones and adjoining foothill regions form part of the extended terrain of the Dalma Hill ranges, whereas the relatively low-lying areas are utilized for agricultural activities, including crop and vegetable cultivation by the local inhabitants.

The drainage system of the area is well developed and is primarily controlled by the Karkari River, which flows from west to east in the northern part the block and acts as the main drainage channel. Several minor streams and seasonal nalas originate from the elevated



ridges and merge into the Karkari River, forming a dendritic drainage pattern. This pattern indicates uniform lithological conditions and the influence of local relief. The overall drainage forms part of the Subarnarekha River basin, with surface runoff being predominantly seasonal and more active during the monsoon period.

3.12 LOCAL INFRASTRUCTURE

The proposed gold exploration block falls within Arki Block of Khunti District, which is a rural administrative region comprising about 128 villages and 16 Gram Panchayat areas with a population of around 78,000–80,000. The infrastructure of the area is basic but functional, typical of forest-dominated tribal regions.

Road connectivity in the block is relatively good at the village level, with most villages connected by pucca (paved) roads, enabling access to the exploration area. However, internal connectivity within forest and hilly terrain is mainly through kutchha tracks and footpaths, which may become difficult during monsoon seasons. Public transport facilities are limited, with only a few villages having access to bus services and very minimal availability of private transport such as taxis or vans.

Electricity and drinking water facilities are available but unevenly distributed. Only a limited number of villages have regular electricity supply, while drinking water is mainly sourced from wells and hand pumps, with very few villages having piped water systems. Mobile network connectivity exists in some parts of the block, though coverage remains weak in dense forest and remote areas.

In terms of social infrastructure, the block has primary and middle schools in many villages, though higher education facilities are scarce. Healthcare facilities include a Community Health Centre at Arki, along with several primary health centres and sub-centres distributed across the block.

The local economy is primarily agrarian, with a large portion of the population engaged in agriculture and allied activities. As a result, local manpower is readily available for exploration work, except during peak agricultural seasons. Essential goods and logistical support can be arranged from nearby villages and local market centres.

Overall, the area has basic rural infrastructure with adequate road access, limited utilities, and available manpower, which is sufficient for carrying out mineral exploration activities with proper logistical planning.

3.13 Population (as per Census 2011)

As per the Census of India 2011, the Arki CD Block of Khunti District, Jharkhand, has a total population of 80,589, and the entire population is rural in nature. The block comprises 16 Gram Panchayats and 128 revenue villages, including villages such as Lobo, Lebed, Harua, Korwa, Jojodih, Doriya, and Barubera, which fall in and around the block area under Arki Tehsil.

The demographic distribution shows 40,473 males and 40,116 females, resulting in a sex ratio of 991 females per 1000 males, indicating a nearly balanced gender composition. The population in the age group of 0–6 years is 13,379, reflecting a considerable proportion of young population.

The social composition of the block is predominantly tribal, with Scheduled Tribes (ST) constituting 63,804 persons (79.17%) of the total population. Scheduled Castes (SC) account for 4,708 persons (5.84%), while the remaining population belongs to other communities. This highlights the strong tribal presence in the area.

As per district records, a similar dataset indicates a total population of 78,252, comprising 39,330 males and 38,922 females, which may be due to minor variations in administrative reporting.

Overall, the Arki Block is characterized by a completely rural, tribal-dominated population with scattered settlements, which is an important factor in planning and execution of mineral exploration activities in the region.

The tribal population is largely composed of Santhals, Mundas, Oraon, Kharias, Bhuiyas, Bhumij, and Kurmis. The Santhals, the largest of the primitive tribes, are well known for their expertise in cultivating hilly and forested regions. The Kharias are a smaller group who traditionally live deep in the forests and maintain a more traditional lifestyle. The



Bhuiyas and Bhumij are semi-Hinduized tribes, whereas the Kurmis are fully Hindu, comparatively more prosperous, and socially positioned above other tribal groups. Brahmins and other high-caste Hindus constitute a small segment of the population, mainly migrants from Odisha and neighboring regions.

The economy of Khunti is largely agrarian and forest-based, with most households dependent on subsistence agriculture. The main crops include paddy, maize, millets, pulses, and oilseeds, cultivated mostly under rain-fed conditions. Minor forest produce (MFP) plays an important role in local livelihoods; tribal households collect and sell products such as lah, mahua flowers, sal seeds, tendu leaves, and bamboo, which supplement household income. Lac cultivation is particularly significant, with the district contributing nearly 29% of Jharkhand's total lah production. Non-agricultural employment opportunities are limited, and a large portion of the workforce is engaged in seasonal or marginal work.

Despite abundant natural resources, Khunti faces developmental challenges, including limited industrialization, inadequate irrigation, and constrained access to basic infrastructure such as healthcare, sanitation, electricity, and connectivity. These factors, combined with poverty in tribal households, contribute to seasonal migration of labor, particularly among youth seeking employment outside the district.

Socially and culturally, Khunti has a rich tribal heritage, with strong traditions, festivals, and community governance systems that foster cohesion and identity. The tribal population maintains deep connections with land, forests, and ecological resources, which continue to shape socio-economic patterns. Overall, while Khunti possesses significant natural and cultural resources, improvements in education, livelihood diversification, infrastructure, and inclusive development are crucial to enhancing the socio-economic well-being of its people.

3.14 Archaeological, Historical Sites, National Parks

The proposed exploration block in Arki Block of Khunti District, Jharkhand, does not fall within any notified archaeological monument, protected historical site, or national park.



There are no records of any Archaeological Survey of India (ASI) protected monuments within or in the immediate vicinity of the block area.

However, the region holds local cultural and traditional significance, particularly due to the presence of Sarna (sacred groves), which are revered by the tribal communities and serve as traditional worship sites. These groves, although not officially designated as archaeological or historical monuments, are important from an ethnographic and cultural heritage perspective.

The area also lies within the broader Chotanagpur Plateau region, which has historical relevance related to tribal heritage and traditional land-use systems such as the Khuntkatti system.

In terms of protected areas, there are no national parks, wildlife sanctuaries or biosphere reserves located within the block. However, the surrounding forested regions may support wildlife movement, including elephants, and thus possess ecological importance.

Overall, the block area is free from any notified archaeological or protected heritage sites and national parks, but it does have localized cultural significance through tribal traditions and sacred groves.

3.15 Environment

The proposed exploration block in Arki Block, Khunti District, is situated in a forest-dominated region of the Chotanagpur Plateau and is characterized by a relatively undisturbed natural environment. The area is covered by Tropical Moist Deciduous Forest, mainly comprising Sal and associated species such as Mahua, Palash, and Kendu, and falls under Khuntkatti land.

The terrain is undulating with hillocks and seasonal drainage, with the Karkari River acting as the main drainage channel. The region experiences a tropical monsoon climate with seasonal rainfall.



The area supports natural vegetation and wildlife, including elephants, and has minimal human interference. Overall, it represents a moderately sensitive forest ecosystem, suitable for exploration with proper environmental safeguards. Agriculture is predominantly rain-fed due to limited irrigation facilities, while forest resources supplement rural income.

CHAPTER-4: PREVIOUS WORK

Previous Exploration in the adjoining area (Regional area):

- A.** In Jharkhand, commercial extraction of gold was carried out from Kunderkocha, Lawa, Maysera 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.
- B.** 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 occurs in the form of a lens over a length of 30 m down to a depth of 23 m.
- C.** Dunn (1924) cited some of the important gold occurrences in Manbhum and Singhbhum districts.
- D.** 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, schists, and phyllites (Gupta and Basu, 1984; Bose and Prasad, 1986; Chandra and Mukherjee, 1993; Chandra and Nim, 1993; Chandra, 1993 and Sahoo et al., 2010).
- E.** Several geoscientists from the Geological Survey of India have mapped parts of Ranchi district. Systematic geological mapping was carried out by Thiagarajan (1965-66) in Toposheet No 73 A/15, Jha and Sarkar (1966- 67) in Toposheet 73 E/7, Chakrabarty and Sarkar (1967- 68) in 73 E/3, Verma and Dutta (1969- 70 and 1970-71) in toposheets 73 E/2 and 73 A/16.
- F.** 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 Mt@ 3.2 g/t of gold.
- G.** Ziauddin and Narayanaswamy (1974) described gold occurrences in parts of Chhotanagpur.

- H.** 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.
- I.** Preliminary search for gold by Chandra et al., (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.
- J.** GSI has explored for gold in Lawa area (D. Lahiri et al., 1971).
- K.** Also, investigations for gold in parts of Sonapet valley, erstwhile Paschimi Singhbhum and Ranchi districts, Jharkhand were carried out during F.S.1999-2000 by R. R. Sharan and in 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.
- L.** 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 Sri Shashi Ranjan and S.K. 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.
- M.** 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 pyrrhotite) disseminated in quartzite and quartz veins.
- N.** 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.
- O.** 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 this area shows gold values ranging from 0.05 ppm to 1.84 ppm.



Previous Exploration in the Proposed Block Area:

No previous exploration works have been carried out in the proposed mineral block. Keeping this view in mind, JEMCL, Ranchi has proposed exploration for gold in the area based on previously available baseline geoscience data supported with preliminary field investigation and sampling. The exploration programme was then submitted to the “27th Jharkhand State Geological Programming Board Meeting” held on 29.09.2023 in which the exploration programme in the proposed area was unanimously approved by the programming board.

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 comprises a thick succession of metavolcanic and metasedimentary rocks that have 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.

According to earlier studies (Sarkar et al., 1992; Gupta and Basu, 1999), the NSMB is divided into five main litho-stratigraphic units:

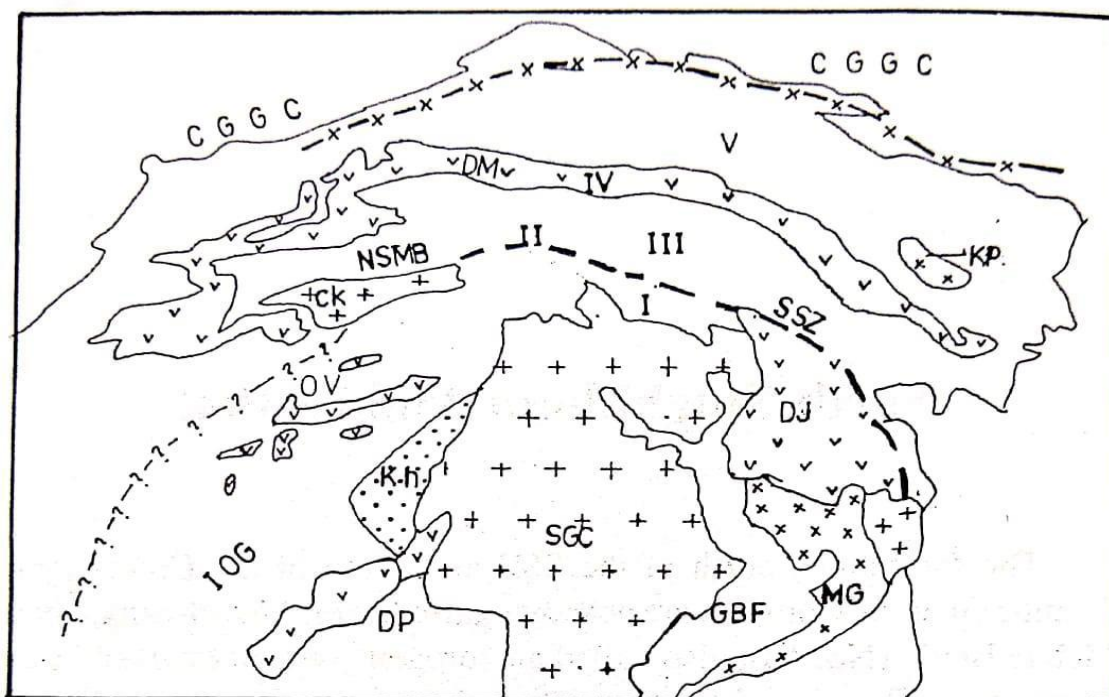
- I. A volcano-sedimentary belt consisting of the Iron Ore Group and Dhanjori rocks, surrounding the Archean craton to the north and bounded by the Singhbhum Shear Zone.
- II. Rocks associated with the Singhbhum Shear Zone (SSZ).
- III. Chaibhasa and Dhalbhum formations occurring between the Singhbhum Shear Zone and the Dalma Volcanics.

IV. The Dalma volcano-sedimentary belt, made up of low-grade metamorphosed basic and ultrabasic volcanic rocks.

V. A low- to medium-grade volcano-sedimentary belt lying between the Dalma Volcanics and the Chhotanagpur Gneissic Complex (CGC).

The study area belongs to the volcano-sedimentary belt located between the Dalma Volcanics and the Chhotanagpur Gneissic Complex (CGC) and is mainly represented by rocks of the Dalma and Singhbhum Groups.

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, T. M., 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 phyllites represent comparatively lower-grade metamorphic conditions. The metabasic volcanic rocks have largely been transformed into amphibolites, while high magnesian volcanic tuffs are represented by tremolitic schists. 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

As part of the approved National Mineral Exploration and Development Trust (NMEDT) programme, large-scale geological mapping on a scale of 1:12,500 was undertaken in the North Singhbhum Mobile Belt (NSMB), covering areas in and around Jojobera–Ulihurang villages, including Lobo, Lebed, Harua, Korwa, Jojodih, Doriya, and Barubera, under Arki Tehsil, Khunti District, Jharkhand. An area of 10.61 sq. km was initially earmarked for detailed geological mapping.

The present investigation area is situated in the northwestern part of Survey of India Toposheet No. 73F/9 and Open Series Map (OSM) No. F45H9 (Figure 3.3). It is bounded by latitudes 22°56'19.43" N to 22°58'32.20" N and longitudes 85°31'13.24" E to 85°34'38.79" E, and falls within Khunti District, Jharkhand.

During the course of field investigations, the mapping programme encountered frequent interruptions from local inhabitants. On several occasions, the field team faced challenging situations, including opposition and threats that hindered field activities. Repeated efforts were made to engage with local communities through Gram Sabha meetings and consultations to facilitate the smooth execution of the programme. However, persistent resistance from sections of the local population resulted in considerable delays in the progress of the mapping work. Despite these constraints, the entire targeted area of 10.61 sq. km was successfully mapped.

The mapped area comprises a roughly rectangular tract characterized by varied topography. Parts of the area consist of relatively flat terrain adjoining hilly regions, whereas other sectors are occupied by elevated, forest-covered hill ranges. Field investigations commenced in April 2025 and were completed in November 2025.

During the fieldwork, detailed measurements of structural parameters including strike and dip of rock formations, bedding planes, schistosity, lineation, joints, and fold structures were systematically recorded. All geological observations and structural data collected during the investigation were subsequently compiled, analyzed, and plotted to prepare the geological map of the area, which is presented in (Figure-6.1).

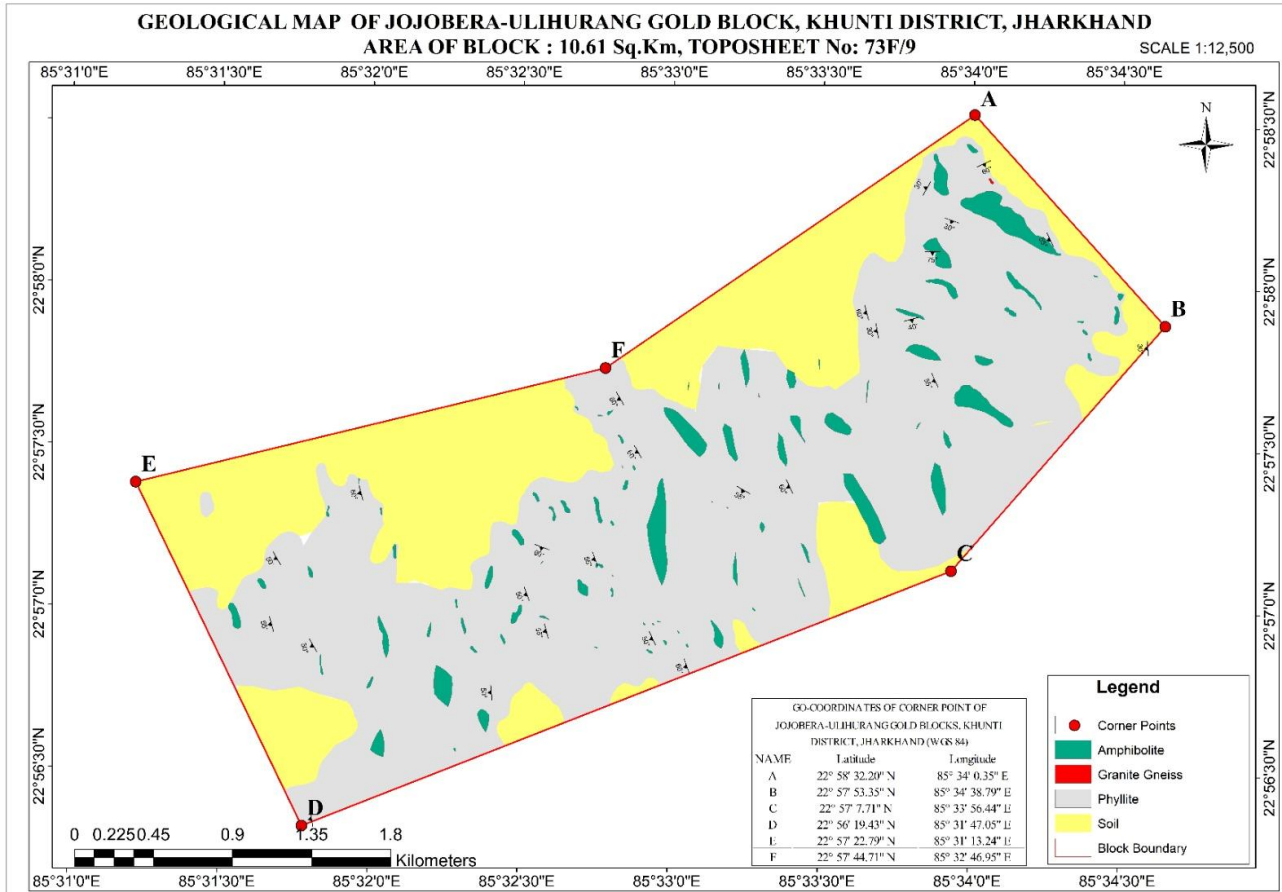


Figure- 6.1: Geological Map of Jojobera-Ulihurang Gold Block, Khunti district, Jharkhand.

6.1.1 Description of the lithological units

Based on geological mapping, the following lithological units have been recognized within the area under investigation:

Chlorite Phyllite

This lithological unit constitutes the dominant rock type within the study area and is depicted in grey on the geological map, reflecting its distinctive lithological character across the mapped terrain.

Megascopically, the rock ranges in colour from greenish-grey to purplish, depending on the proportion of chlorite and other associated mineral constituents present. It is fine- to medium-grained, with individual mineral grains generally too small to be identified with the naked eye. The rock exhibits a well-developed foliation and pronounced schistosity, giving it a characteristic foliated fabric and enabling it to split readily along closely spaced planar surfaces. Freshly exposed surfaces commonly display a noticeable phyllitic lustre.

The schistosity observed in the rock is a product of low-grade metamorphic processes, during which platy minerals such as chlorite and sericite become preferentially aligned under the influence of directed stress. Quartz, sericite, and chlorite form the principal mineral assemblage, collectively imparting a khaki-green to greenish colour in the field (Figure-6.2), which forms the basis of the rock's nomenclature.

The foliation and schistosity planes may serve as favourable pathways for fluid circulation and thus exert significant structural control on alteration and potential mineralization within the area. The lithological units generally strike between N70°W–S70°E and N10°W–S10°E, with moderate dips towards the southwest.

Carbonaceous Phyllite

The rock is dark grey to black in colour and exhibits a well-developed foliation. A characteristic feature of this lithology is that it leaves a black residue on the fingers when rubbed, indicating the presence of abundant carbonaceous material. The carbonaceous phyllite is ferruginous and micaceous in nature and is frequently found in association with

thin quartz vein. Its mineralogical composition is dominated by carbonaceous matter, accompanied by quartz, sericite mica, and chlorite (Figure-6.3).

Freshly broken surfaces display a distinctly platy character, reflecting the strong development of foliation. In certain locations, the rock exhibits a spotted appearance resulting from localized surface bleaching. Owing to its restricted and discontinuous exposure, this lithological unit cannot be delineated separately on a geological map at a scale of 1:12,500.



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



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

Amphibolite

This lithological unit is depicted by green-coloured patches on the geological map, making it readily distinguishable from the adjacent rock formations. In the field, it occurs as isolated outcrops and scattered boulders, reflecting its discontinuous surface distribution and suggesting possible structural or erosional influences on its present-day exposure.

The unit is interpreted as an intrusive body emplaced within the metasedimentary sequence. Its occurrence is broadly concordant with the regional foliation trend of the host

rocks, indicating that the magma may have intruded along pre-existing planes of weakness such as foliation surfaces or bedding planes.

The rock is coarse-grained in texture, with individual mineral grains readily visible in hand specimen, and typically exhibits a dark green colour characteristic of amphibole-rich lithologies (Figure-6.4.A and Figure-6.4.B).

The unit displays a weak to moderate foliation, which may have developed either during emplacement under deformational conditions or as a result of subsequent metamorphic overprinting. Thin bands and lensoid bodies of amphibolite are also observed intruding the surrounding phyllitic rocks. These intrusive relationships provide evidence for multiple episodes of magmatism and deformation and contribute significantly to the understanding of the structural framework and metamorphic history of the area.



Figure- 6.4.A: Field photograph depicting fresh greenish amphibolite.



Figure- 6.4.B: Exposure of amphibolite.

Quartz Veins

During the course of geological mapping, two varieties of quartz veins were identified within the study area: milky white quartz veins (Figure-6.5A) and smoky quartz veins



(Figure-6.5B). Although these veins are not distinctly represented within the limited extent of the mapped area, their occurrence is inferred to be widespread based on regional geological evidence and field observations. The quartz veins generally occur as thin, irregular, and discontinuous bodies rather than as extensive, persistent lodes. They are typically emplaced along fractures, joints, and shear zones within the host rocks and are distributed sporadically throughout the area.

The milky white quartz veins are hard, compact, and crystalline in nature, consisting predominantly of medium- to coarse-grained quartz. In several localities, these veins are associated with silicification and sulphide mineralization developed along structurally weak zones. The smoky quartz veins, in contrast, are characterized by their dark grey to smoky colour and occur along fractures and shear planes within the metamorphic sequence. Their distinctive colour is attributed primarily to irradiation effects in quartz, along with the presence of minor mineral inclusions. Similar to the milky quartz veins, they are hard, compact, crystalline, and typically occur as discontinuous veins and veinlets.

These quartz veins are commonly associated with carbonaceous phyllite and chlorite phyllite, both of which provide favourable lithological and structural environments for vein emplacement. The carbonaceous phyllites indicate the presence of organic-rich material, whereas the chlorite-rich phyllites reflect low-grade metamorphic conditions that are conducive to hydrothermal fluid circulation. Silica-bearing hydrothermal fluids migrating through fractures and other structurally weak zones precipitated quartz, leading to the formation of these veins.

In many exposures, the veins exhibit a lensoidal morphology marked by pinching and swelling along strike, accompanied by significant variations in thickness over short distances. Their discontinuous geometry and strong structural control suggest a close genetic association with hydrothermal processes and mineralization events, particularly those related to sulphide and gold deposition.

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 showing a milky white quartz vein exposed in the study area.



Fig- 6.5.B: Exposure of smoky quartz vein observed during geological mapping.

Volcanic Agglomerate

The agglomerates exposed in the study area consist predominantly of angular basaltic fragments enclosed within a basaltic matrix. Amygdaloidal basalt fragments are also observed locally. Based on their textural and structural characteristics, the volcanic agglomerates can be broadly classified into two types: schistose agglomerate and massive agglomerate. Owing to their limited areal extent and discontinuous occurrence, these volcanic agglomerate bodies are too small to be delineated separately on a geological map at a scale of 1:12,500.

In the schistose agglomerate, the constituent rock fragments exhibit pronounced deformation and occur as elongated, elliptical clasts (Figure-6.6.A), reflecting the effects of tectonic strain. In contrast, the massive agglomerate contains predominantly angular to sub-rounded fragments, with some clasts displaying a distinctive square or blocky shape (Figure-

6.6.B). These fragments generally retain their primary volcanic characteristics and show comparatively less deformation.



Figure- 6.6.A: Field photograph showing volcanic agglomerate containing elliptical clasts.



Figure- 6.6.B: Angular to sub-rounded clasts within volcanic agglomerate.

Soil / Lateritic Cover

This unit is represented by yellow-coloured patches on the geological map and occurs extensively across the study area, although its distribution is discontinuous in nature. It comprises an in-situ weathering mantle developed over the underlying bedrock, particularly above phyllite and amphibolite lithologies.

The unit is characterized by a yellowish to reddish-brown colour, reflecting varying degrees of chemical weathering and oxidation. It consists of loose to semi-consolidated material and ranges from residual soil to saprolite and lateritic weathering products, depending upon the intensity and duration of weathering. The formation and thickness of the

weathered mantle are largely controlled by climatic conditions, topography, drainage characteristics, and the weathering susceptibility of the parent rock.

In many parts of the area, the weathered cover constitutes the dominant surficial deposit and obscures the underlying bedrock, thereby restricting direct geological observations. Consequently, lithological interpretation in such areas is often based on indirect indicators such as float fragments, residual boulders, occasional rock exposures, and geomorphological features. The weathered mantle is of considerable geological significance, as it records prolonged weathering processes and may serve as a favourable repository for residual and supergene mineral enrichment derived from the underlying bedrock. Its presence therefore has important implications for both geomorphological studies and mineral exploration activities within the area.

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

Foliation is the most prominent planar structural feature observed in the study area and is well developed in the phyllite units (Figure-6.7). It represents the primary metamorphic fabric and controls the alignment of minerals as well as the overall lithological disposition. The foliation generally strikes in a NW–SE direction and dips moderately to steeply (50°–75°) towards the southwest.

Folding

The lithological units exhibit gentle to moderate folding, with fold axes broadly parallel to the regional foliation trend (NW–SE). The presence of tight minor folds within the phyllite indicates the effect of multiple phases of deformation, suggesting a polyphase tectonic history in the area.



Figure- 6.7: Exposure of phyllite exhibiting prominent foliation planes.



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 undergone regional metamorphism ranging from greenschist to amphibolite facies conditions. Greenschist facies metamorphism is indicated by mineral assemblages such as actinolite, tremolite, chlorite, biotite, and albite, predominantly observed in phyllitic lithologies.

Amphibolite facies metamorphism is represented by assemblages containing amphibole, plagioclase, clinopyroxene, chlorite, quartz, biotite, epidote, and opaque minerals. Epidote present in the rocks is commonly interpreted as a secondary phase formed through alteration of plagioclase and muscovite.

6.1.6 Mineralogy of the ore zones and ore textures

During the course of detailed geological mapping, no evidence of gold (Au) mineralization was recorded within the study area. The exposed lithological units, including phyllite, quartz veins, smoky quartz veins, and amphibolite, do not exhibit any visible occurrence of native gold or gold-bearing mineral assemblages.

Locally, surface features such as ferruginisation, silicification, gossan development, and minor brecciation are observed along fractures and quartz veins. However, these alteration features are weakly developed and do not show any direct spatial or genetic association with auriferous mineralization in the mapped area. Sulphide minerals, where present, occur only as sparse disseminations and thin veinlets without any indication of economic enrichment.

Although regional studies by the Geological Survey of India have indicated the potential for gold and base metal mineralization in similar lithological settings in the broader

region, such mineralization is not evident within the present study area. This may be attributed to limited exposure, discontinuous outcrops, or the absence of favourable mineralizing structures at the local scale.

Overall, field observations suggest that the study area does not host any significant gold mineralization based on surface geological evidence collected during the present investigation.

6.1.7 Trenching and pitting

The quantum of trenching work was 200 Cum with provision for collection of 100 samples. However, due to unsatisfactory analytical results, the TCC-II Committee, in its 22nd meeting held on 4th and 5th February 2026, recommended pre-closure of the project. Accordingly, no trenching work was carried out.

6.1.8 Sampling

A total of 180 bedrock samples were collected from the block area out of 265 planned bedrock sample locations covering the total area of 10.61 sq. km for analysis of gold (Au). The locations of all sampling points were recorded using a handheld GPS, and the megascopic characteristics of the rocks were systematically documented during field investigations. Each sample was carefully collected, packed, and properly labelled to ensure accurate identification and traceability.

Special emphasis was placed on the collection of samples from chlorite phyllite, carbonaceous phyllite, quartz veins, and smoky quartz veins, as these lithologies have been identified as favourable host rocks for mineralization in earlier investigations by the Geological Survey of India, particularly by Banerjee et al. In addition, samples were also collected from other lithological units wherever signs or possibilities of mineralization were observed.

The collected rock samples were crushed and pulverized to a grain size of (-) 200 mesh. The sample material was then reduced through progressive coning and quartering to obtain a representative sub-sample of approximately 100 g. The representative samples were submitted to M/s Lucid Laboratory Pvt. Ltd. for gold analysis using Atomic Absorption

Spectroscopy (AAS), 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 investigation due to local disturbances and operational constraints in the field area.

6.1.9 Discussion

Out of the 180 analysed bedrock samples, the gold (Au) concentration ranges from less than 0.01 ppm to 0.22 ppm. Among these, only one sample recorded the highest gold value of 0.22 ppm, which was obtained from Chlorite 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	0.01	0.15
Smoky Quartz vein	0.01	0.15
Carbon phyllite	0.03	0.18
Chlorite Phyllite	0.01	0.22
Amphibolite	0.01	0.15

6.1.10 Ore zones

Comprehensive geological mapping of the entire exploration block was completed during the present investigation. Based on the geological, structural, and geochemical data generated from the study, no potential ore zone could be delineated within the block area. The analyzed bedrock samples returned generally low gold values, indicating only sporadic and low-grade gold mineralization. Furthermore, the mineralized occurrences lack the concentration, lateral continuity, and grade required to indicate the presence of an economically viable gold deposit. Consequently, the results of the present exploration programme do not establish any definite mineralized zone or target area warranting delineation as a potential ore body within the investigated block.

6.2 Geophysical Exploration

No geophysical exploration has been carried out in the area.

6.3 Geochemical Exploration

The bedrock sampling programme was undertaken with a primary focus on locating areas exhibiting hydrothermal alteration and sulphide mineralization, as these features are commonly associated with favourable conditions for gold deposition. Field observations revealed that hydrothermal alteration is predominantly confined to brecciated quartz veins and silicified zones within the study area. Consequently, these lithological units were selected as priority targets for detailed geochemical sampling to evaluate their potential for hosting gold mineralization. Additionally, representative bedrock samples were collected from other rock types, including carbonaceous phyllite, chlorite phyllite, amphibolite, and associated lithologies, in order to establish the geochemical signature and mineralization characteristics of the area as a whole.

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, geochemical, and geophysical datasets forms a fundamental component of modern mineral exploration. As most near-surface mineral deposits have already been discovered and exploited, contemporary exploration efforts are increasingly directed towards locating concealed and deeper-seated mineralization. The occurrence and localization of mineral deposits are largely controlled by lithological characteristics and structural features such as faults, fractures, shear zones, and other zones of crustal weakness.

Mineralized zones commonly generate geochemical signatures that can be detected through systematic geochemical sampling. Such investigations aid in understanding the distribution and concentration of elements within different lithological units and provide valuable insights into the processes responsible for the generation, transport, and deposition of mineralizing fluids.

In the present study, detailed geological mapping of the entire exploration block was completed and integrated with the available geochemical data. No geophysical survey was undertaken under the current programme.

Although detailed geological mapping of the entire exploration block and systematic collection of 180 bedrock samples were completed during the present investigation, the analytical results revealed generally low and sporadic gold values throughout the study area. The geochemical data do not indicate any significant or laterally continuous enrichment of gold that could be considered indicative of a mineralized zone. Consequently, no well-defined geochemical anomaly could be delineated from the available dataset. In view of the poor analytical results and the absence of significant or continuous geochemical enrichment patterns, preparation of gold geochemical contour maps has not been undertaken at the present stage of exploration, as such maps would not provide any meaningful interpretation of mineralization trends within the study area.

CHAPTER-8: MINERAL PROSPECT.

8.1 Surface indication

Mineralized zones commonly impart characteristic geological, structural, and alteration signatures to the host rocks, and preliminary indications of mineralization may often be observed at the surface. During the present investigation within the Jojobera–Ulihurang Gold Block, covering the areas around Jojobera, Ulihurang, Lobo, Lebed, Harua, Korwa, and Jojodih villages, a few localized zones exhibiting brittle–ductile deformation, minor brecciation, and weak hydrothermal alteration were identified. These features are restricted to small and isolated exposures and do not form any extensive or continuous structural corridor.

Localized silicification, ferruginisation, and minor quartz veining were observed at a few locations. However, these alteration features are weakly developed and limited in extent. Although such features may indicate past hydrothermal activity, no direct evidence of significant mineralization was observed during the field investigation.

The regional geological setting is known to host gold occurrences in adjacent areas such as Lungtu, Parasi, Sindauri, Ghanshyampur, and the Ghagri–Asangibera sector. Nevertheless, the geological features observed within the present study area do not show any comparable degree of alteration, sulphide concentration, or structural preparation that would suggest the presence of a significant gold-bearing system.

Within the mapped area, phyllite units intruded by quartz veins and smoky quartz vein occur at a few locations. Some of these exposures exhibit minor ferruginisation and silicification, which may reflect oxidation of trace sulphide minerals. However, no substantial gossan development, sulphide-rich zones, or persistent alteration halos were encountered during the investigation.

Sulphide mineralization, where present, is restricted to sparse disseminations and thin veinlets of pyrite and chalcopyrite within isolated smoky quartz veins and quartz vein. These occurrences are highly localized, discontinuous, and insignificant in terms of both abundance and spatial extent. Furthermore, the analytical results obtained from the bedrock samples do not indicate any appreciable gold enrichment associated with these occurrences.



The integration of geological mapping and geochemical data suggests that the observed alteration zones, quartz veins, and minor sulphide occurrences are sporadic and lack continuity. No significant mineralized zone, ore shoot, or geochemical anomaly could be delineated within the study area. Consequently, the present investigation does not provide evidence for economically significant gold mineralization within the Jojobera–Ulihurang Gold Block.

8.2 Mode of occurrence

Indicator sulphide minerals, mainly pyrite and chalcopyrite, were observed sporadically in association with a few brecciated quartz veins occurring within localized shear zones. However, these occurrences are restricted to isolated outcrops and do not constitute any extensive or continuous mineralized zone. No significant concentration of sulphides was encountered during the course of geological mapping.

Phyllite units within the study area are intruded by multiple quartz veins and veinlets of varying dimensions. Most of these veins are thin, discontinuous, and limited in lateral extent, rendering them unsuitable for representation at the present mapping scale. Although a few quartz veins contain traces of sulphide minerals, the observed mineralization is weak and sporadic in nature.

Localized ferruginisation, silicification, and brecciation were recorded in some quartz vein exposures, indicating limited hydrothermal activity. However, these alteration features are confined to small patches and do not show any significant spatial continuity. Minor sulphide occurrences were also noted in association with quartz veins and adjacent lithologies at a few locations, but their abundance and distribution are insignificant.

Sulphides occur mainly as sparse disseminations and occasional cavity fillings within brecciated quartz veins. Overall, the observed features suggest that sulphide mineralization in the mapped area is structurally controlled and related to hydrothermal activity, though its extent remains limited within the investigated area.

The integrated assessment of geological mapping, structural observations, and geochemical analytical results indicates that the sulphide-bearing quartz veins and alteration zones are localized and discontinuous. Furthermore, the analytical results do not reveal any significant gold enrichment associated with these occurrences. Consequently, no

economically significant mineralized zone or ore-grade concentration could be delineated within the study area during the present investigation.

8.3 Details of mineralization

Field investigations, supported by structural measurements, indicate that mineralization within the mapped area is weakly developed and occurs predominantly within hydrothermally altered brecciated quartz veins. These zones are characterized by moderate to strong oxidation and are associated with localized shear structures exhibiting a consistent NW–SE orientation. Structural measurements record strike values ranging from 110° to 175° , while dip angles vary between 50° and 70° , with dip directions generally towards 200° – 265° (southwest), reflecting a moderately to steeply inclined structural setting.

Sulphide occurrences are sparse and consist mainly of minor pyrite and chalcopyrite present as fine disseminations and occasional thin stringers within narrow quartz veinlets. The quartz veins, which are broadly aligned parallel to the regional foliation and shear fabric, likely served as channels for hydrothermal fluid migration. However, the sulphide content is generally low and discontinuous, indicating limited sulphide enrichment.

The mineralized zones are narrow and lack significant lateral or vertical continuity. The low abundance of sulphides and restricted nature of the mineralization suggest a relatively weak hydrothermal event with limited metal concentration. Although structural controls on mineralization are evident, no significant ore-grade mineralized zones were identified during the course of the investigation.

Hydrothermal alteration associated with mineralization is also weak and localized. The mineralization is interpreted to be structurally controlled, with brittle–ductile shear zones providing pathways for fluid movement. Surface indications such as ferruginisation and brecciation are observed only at isolated locations and are generally poorly developed. Similarly, silicification and carbonatization within phyllitic host rocks occur on a limited scale and do not form extensive alteration zones.

The close spatial relationship between quartz veins, alteration features, and shear zones suggests that hydrothermal processes played a role in the mineralizing system. Nevertheless, the alteration halo is restricted and discontinuous, reflecting a low-intensity hydrothermal regime. Based on field observations, structural analysis, alteration

characteristics, and the low gold values returned from geochemical sampling, the area is considered to possess limited mineralization potential.

8.4 Genesis of mineralization

The occurrence of a few isolated shear zones within the mapped area, showing weak hydrothermal alteration and sparse sulphide mineralization, suggests a possible epigenetic origin for the mineralization. Hydrothermal deposits are commonly classified as either epigenetic or syngenetic depending on their relationship to host rock formation (R. James Weick, 1994). Based on the limited field evidence, the observed mineralization is interpreted to be epigenetic in nature; however, its continuity, extent, and economic significance remain poorly developed and inadequately established.

The shear zone-associated quartz veins contain only minor sulphide mineralization and exhibit some characteristics commonly associated with hydrothermal fluid activity. These veins show evidence of brittle and ductile deformation and are spatially related to the dominant NW–SE trending structural fabric (110°-175° strike, SW dipping) identified during field investigations. Although the quartz veins are considered to have formed through hydrothermal processes, the associated sulphide content is very low and discontinuous. Any comparison with orogenic gold systems remains tentative due to the weak mineralization, restricted alteration, and low gold values recorded in the area.

The hydrothermal fluids and associated metals may have been mobilized during later stages of deformation and metamorphism and subsequently introduced along structurally favourable zones. However, the limited intensity of alteration and mineralization suggests that the hydrothermal system was weak and ineffective in concentrating significant quantities of metals. This interpretation is supported by:

- I. The occurrence of sparse mineralization within low-grade metamorphic rocks such as phyllite.
- II. The presence of localized brittle–ductile shear zones with limited mineralized development.
- III. Weak and discontinuous hydrothermal alteration, represented by minor silicification, ferruginisation, brecciation, and carbonatization.



IV. Occasional vein textures indicative of fluid activity, but lacking substantial sulphide enrichment or evidence of sustained mineralizing processes.

Overall, the geological, structural, and alteration characteristics observed within the area indicate the presence of a weak shear zone-controlled hydrothermal system. Although hydrothermal activity is evident, the mineralization is poorly developed, discontinuous, and associated with low gold values. Consequently, the area is considered to have very low mineralization potential and does not exhibit the characteristics of a well-developed or economically significant hydrothermal gold system.



CHAPTER-9: EXPLORATION BY SYSTEMATIC DRILLING

A total drilling programme of 400 m was initially proposed for the exploration area. However, no drilling work was undertaken during the present phase of investigation. The decision was based on the results of partial geological mapping, limited and discontinuous bedrock exposures, and unsatisfactory analytical results obtained from the collected bedrock samples, which did not indicate the presence of significant or continuous mineralization. Furthermore, local disturbances in the area posed additional constraints to detailed exploration activities.

In view of the weak geological evidence and poor geochemical results, no promising target zone could be delineated for drilling at the current stage of exploration. Subsequently, the TCC-II in its 22nd meeting held on 4th and 5th February 2026, reviewed the exploration results and recommended pre-closure of the project due to the unsatisfactory analytical outcomes.

Accordingly, the proposed drilling programme of 400 m was not carried out, and the project was recommended for closure without proceeding 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 Jojobera, Ulihurang, Lobo, Lebed, Harua, Korwa, Jojodih, Doriya and Barubera villages of the Jojobera-Ulihurang 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 (110°-175° 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 180 bedrock samples indicates that gold (Au) values range from 0.01 ppm to 0.22 ppm. The majority of samples fall within the range of 0.04 ppm to 0.10 ppm, indicating generally low background values. Only a few isolated samples collected from chlorite phyllite and quartz vein-hosted zones yielded comparatively elevated values of 0.18 ppm, 0.19 ppm and 0.22 ppm.

The distribution of gold values in the mapped area is scattered and does not define any clear or continuous geochemical anomaly. Hydrothermal alteration and sulphide mineralization are present locally, but their intensity and extent are limited. Based on the integrated geological, structural and geochemical data generated during the present G-4 stage investigation, no significant evidence of gold mineralization has been established in the area. However, the gold potential of the area cannot be considered conclusively poor, as trenching, drilling, stream sediment survey could not be undertaken due to local constraints. Therefore, the available data are not sufficient to completely rule out the possibility of localized or concealed gold mineralization. The present investigation indicates weak and localized



mineralization, but the overall gold potential of the area remains inconclusive at the current stage of exploration.

Considering the low gold values obtained from geochemical analysis and the lack of any significant mineralized zone, the TCC-II, in its 22nd meeting held on 4th and 5th February 2026, recommended pre-closure of the project. As a result, no further exploratory activities such as trenching, pitting, drilling, or other subsurface investigations were undertaken.

Recommendation

The investigation carried out in the mapped area has revealed only minor indications of hydrothermal activity in the form of localized alteration and sparse sulphide occurrences within quartz veins and phyllitic host rocks. Gold assay results obtained from bedrock samples are generally low, with only a few isolated samples recording slightly elevated values. The observed mineralization is patchy in distribution, confined to limited structural zones, and does not exhibit the continuity or intensity generally associated with significant gold-bearing systems.

The geological, structural, alteration and geochemical studies indicate that gold mineralization in the area is weak and limited in extent. No significant or continuous gold anomaly or mineralized zone could be established from the available data. Therefore, the area presently indicates limited to low gold potential.

However, this assessment is not conclusive, as trenching, drilling and stream-sediment sampling could not be carried out due to local constraints. Hence, the possibility of concealed or structurally controlled gold mineralization cannot be completely ruled out.

If further investigation is permitted, stream-sediment and soil geochemical sampling, trenching across quartz veins and altered zones, petrographic and ore-microscopic studies, multi-element ICP-MS analysis, proper QA/QC during sampling and analysis, and detailed structural mapping focused on shear-hosted mineralization may be carried out for better assessment of the gold potential of the area.



CHAPTER-12: LOCALITY INDEX

TABLE-6: Locality Index.			
Sl. No.	Village Name	Latitude	Longitude
1	Lobo	22°57'25.92"N	85°31'42.58"E
2	Harua	22°57'32.00"N	85°32'32.71"E
3	Jojodih	22°58'01.10"N	85°33'32.27"E
4	Doriya	22°58'21.59"N	85°34'13.42"E
5	Barubera	22°58'22.62"N	85°33'36.95"E
6	Choteadih	22°57'26.08"N	85°34'01.64"E
7	Ulihurang	22°57'16.69"N	85°33'27.72"E

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Annexure-I: Analytical results of bedrock samples (BRS) collected from different lithology of Jojobera-Ulihurang Block, Khunti district, Jharkhand

Sl. No.	Sample No	Lithology	Latitude	Longitude	Gold (Au) Value (PPM)
1	JEMCL/JU/BRS/1	Smoky Quartz Vein	22.974250	85.566083	0.06
2	JEMCL/JU/BRS/2	Quartz Vein	22.974242	85.566079	0.06
3	JEMCL/JU/BRS/3	Smoky Quartz Vein	22.973884	85.566785	0.06
4	JEMCL/JU/BRS/4	Amphibolite	22.965024	85.574683	0.05
5	JEMCL/JU/BRS/5	Amphibolite	22.966501	85.574821	0.05
6	JEMCL/JU/BRS/6	Chlorite Phyllite	22.972660	85.567491	0.22
7	JEMCL/JU/BRS/7	Amphibolite	22.971262	85.566849	0.08
8	JEMCL/JU/BRS/8	Granite gneiss	22.972134	85.567764	0.08
9	JEMCL/JU/BRS/9	Smoky Quartz Vein	22.970819	85.568218	0.09
10	JEMCL/JU/BRS/10	Quartz Vein	22.970103	85.569469	0.07
11	JEMCL/JU/BRS/11	Quartz Vein	22.969223	85.570891	0.08
12	JEMCL/JU/BRS/12	Chlorite Phyllite	22.969223	85.570891	0.09
13	JEMCL/JU/BRS/13	Quartz Vein	22.972596	85.564936	0.06
14	JEMCL/JU/BRS/14	Quartz Vein	22.972097	85.565475	0.07
15	JEMCL/JU/BRS/15	Smoky Quartz Vein	22.971906	85.565702	0.05
16	JEMCL/JU/BRS/16	Carbon Phyllite	22.971472	85.566066	0.10
17	JEMCL/JU/BRS/17	Smoky Quartz Vein	22.970074	85.567697	0.09
18	JEMCL/JU/BRS/18	Quartz Vein	22.968006	85.568523	0.06
19	JEMCL/JU/BRS/19	Quartz Vein	22.966308	85.569713	0.07
20	JEMCL/JU/BRS/20	Smoky Quartz Vein	22.962565	85.573656	0.07
21	JEMCL/JU/BRS/21	Chlorite Phyllite	22.962951	85.573351	0.02
22	JEMCL/JU/BRS/22	Quartz Vein	22.963354	85.573047	0.06
23	JEMCL/JU/BRS/23	Chlorite Phyllite	22.964015	85.572960	0.01
24	JEMCL/JU/BRS/24	Chlorite Phyllite	22.971027	85.565305	0.05
25	JEMCL/JU/BRS/25	Amphibolite	22.967750	85.565527	0.08
26	JEMCL/JU/BRS/26	Chlorite Phyllite	22.960330	85.570658	0.10
27	JEMCL/JU/BRS/27	Amphibolite	22.959741	85.568894	0.09
28	JEMCL/JU/BRS/28	Amphibolite	22.959818	85.565625	0.05
29	JEMCL/JU/BRS/29	Amphibolite	22.968881	85.563943	0.07
30	JEMCL/JU/BRS/30	Quartz Vein	22.967321	85.564707	0.10



Annexure-I: Analytical results of bedrock samples (BRS) collected from different lithology of Jojobera-Ulihurang Block, Khunti district, Jharkhand

Sl. No.	Sample No	Lithology	Latitude	Longitude	Gold (Au) Value (PPM)
31	JEMCL/JU/BRS/31	Amphibolite	22.966979	85.564468	0.07
32	JEMCL/JU/BRS/32	Quartz Vein	22.966696	85.564501	0.07
33	JEMCL/JU/BRS/33	Chlorite Phyllite	22.964981	85.563375	0.08
34	JEMCL/JU/BRS/34	Chlorite Phyllite	22.965382	85.560740	0.04
35	JEMCL/JU/BRS/35	Chlorite Phyllite	22.964447	85.561341	0.08
36	JEMCL/JU/BRS/36	Quartz Vein	22.963738	85.561782	0.08
37	JEMCL/JU/BRS/37	Amphibolite	22.963420	85.563238	0.07
38	JEMCL/JU/BRS/38	Carbon Phyllite	22.962216	85.565007	0.08
39	JEMCL/JU/BRS/39	Smoky Quartz Vein	22.962099	85.563211	0.08
40	JEMCL/JU/BRS/40	Chlorite Phyllite	22.962915	85.561829	0.08
41	JEMCL/JU/BRS/41	Quartz Vein	22.962986	85.561522	0.08
42	JEMCL/JU/BRS/42	Chlorite Phyllite	22.963430	85.561096	0.08
43	JEMCL/JU/BRS/43	Chlorite Phyllite	22.960386	85.558400	0.08
44	JEMCL/JU/BRS/44	Quartz Vein	22.959993	85.559041	0.09
45	JEMCL/JU/BRS/45	Amphibolite	22.959757	85.559192	0.07
46	JEMCL/JU/BRS/46	Amphibolite	22.960425	85.549658	0.01
47	JEMCL/JU/BRS/47	Amphibolite	22.958544	85.552042	0.06
48	JEMCL/JU/BRS/48	Chlorite Phyllite	22.955244	85.551271	0.10
49	JEMCL/JU/BRS/49	Quartz Vein	22.953646	85.552590	0.04
50	JEMCL/JU/BRS/50	Quartz Vein	22.952628	85.552487	0.06
51	JEMCL/JU/BRS/51	Chlorite Phyllite	22.951636	85.554102	0.06
52	JEMCL/JU/BRS/52	Chlorite Phyllite	22.949726	85.553905	0.08
53	JEMCL/JU/BRS/53	Amphibolite	22.948447	85.552535	0.14
54	JEMCL/JU/BRS/54	Chlorite Phyllite	22.947086	85.550939	0.08
55	JEMCL/JU/BRS/55	Quartz Vein	22.948389	85.550972	0.09
56	JEMCL/JU/BRS/56	Chlorite Phyllite	22.950118	85.551073	0.04
57	JEMCL/JU/BRS/57	Amphibolite	22.952867	85.549872	0.09
58	JEMCL/JU/BRS/58	Quartz Vein	22.955938	85.549750	0.11
59	JEMCL/JU/BRS/59	Amphibolite	22.955897	85.549313	0.13
60	JEMCL/JU/BRS/60	Chlorite Phyllite	22.956325	85.549223	0.07



Annexure-I: Analytical results of bedrock samples (BRS) collected from different lithology of Jojobera-Ulihurang Block, Khunti district, Jharkhand

Sl. No.	Sample No	Lithology	Latitude	Longitude	Gold (Au) Value (PPM)
61	JEMCL/JU/BRS/61	Chlorite Phyllite	22.956555	85.549257	0.09
62	JEMCL/JU/BRS/62	Amphibolite	22.956817	85.549590	0.10
63	JEMCL/JU/BRS/63	Quartz Vein	22.956018	85.547955	0.11
64	JEMCL/JU/BRS/64	Chlorite Phyllite	22.957282	85.547672	0.13
65	JEMCL/JU/BRS/65	Chlorite Phyllite	22.959862	85.547188	0.05
66	JEMCL/JU/BRS/66	Quartz Vein	22.959660	85.546995	0.09
67	JEMCL/JU/BRS/67	Quartz Vein	22.959753	85.546828	0.10
68	JEMCL/JU/BRS/68	Amphibolite	22.960002	85.546563	0.15
69	JEMCL/JU/BRS/69	Quartz Vein	22.960227	85.546637	0.05
70	JEMCL/JU/BRS/70	Smoky Quartz Vein	22.960273	85.546880	0.05
71	JEMCL/JU/BRS/71	Chlorite Phyllite	22.960805	85.547106	0.10
72	JEMCL/JU/BRS/72	Chlorite Phyllite	22.961932	85.545214	0.08
73	JEMCL/JU/BRS/73	Chlorite Phyllite	22.959253	85.530827	0.12
74	JEMCL/JU/BRS/74	Chlorite Phyllite	22.939060	85.530190	0.19
75	JEMCL/JU/BRS/75	Chlorite Phyllite	22.939992	85.529352	0.06
76	JEMCL/JU/BRS/76	Chlorite Phyllite	22.941068	85.530684	0.12
77	JEMCL/JU/BRS/77	Chlorite Phyllite	22.942706	85.531709	0.14
78	JEMCL/JU/BRS/78	Amphibolite	22.943735	85.534076	0.11
79	JEMCL/JU/BRS/79	Chlorite Phyllite	22.941941	85.533588	0.10
80	JEMCL/JU/BRS/80	Chlorite Phyllite	22.940858	85.534743	0.14
81	JEMCL/JU/BRS/81	Smoky Quartz Vein	22.941345	85.532447	0.13
82	JEMCL/JU/BRS/82	Carbon Phyllite	22.940450	85.532505	0.18
83	JEMCL/JU/BRS/83	Smoky Quartz Vein	22.940387	85.531196	0.14
84	JEMCL/JU/BRS/84	Chlorite Phyllite	22.940237	85.531136	0.12
85	JEMCL/JU/BRS/85	Quartz Vein	22.940016	85.530678	0.11
86	JEMCL/JU/BRS/86	Smoky Quartz Vein	22.942378	85.538272	0.12
87	JEMCL/JU/BRS/87	Amphibolite	22.942703	85.538202	0.13
88	JEMCL/JU/BRS/88	Chlorite Phyllite	22.943324	85.536857	0.12
89	JEMCL/JU/BRS/89	Smoky Quartz Vein	22.942797	85.535683	0.15
90	JEMCL/JU/BRS/90	Chlorite Phyllite	22.942564	85.534827	0.15



Annexure-I: Analytical results of bedrock samples (BRS) collected from different lithology of Jojobera-Ulihurang Block, Khunti district, Jharkhand

Sl. No.	Sample No	Lithology	Latitude	Longitude	Gold (Au) Value (PPM)
91	JEMCL/JU/BRS/91	Quartz Vein	22.944068	85.535033	0.11
92	JEMCL/JU/BRS/92	Smoky Quartz Vein	22.944627	85.537230	0.09
93	JEMCL/JU/BRS/93	Chlorite Phyllite	22.945753	85.535510	0.10
94	JEMCL/JU/BRS/94	Smoky Quartz Vein	22.945927	85.534587	0.09
95	JEMCL/JU/BRS/95	Chlorite Phyllite	22.947919	85.534095	0.11
96	JEMCL/JU/BRS/96	Smoky Quartz Vein	22.947184	85.536215	0.10
97	JEMCL/JU/BRS/97	Quartz Vein	22.946265	85.538657	0.12
98	JEMCL/JU/BRS/98	Chlorite Phyllite	22.947245	85.538972	0.10
99	JEMCL/JU/BRS/99	Chlorite Phyllite	22.945669	85.540098	0.11
100	JEMCL/JU/BRS/100	Chlorite Phyllite	22.944997	85.539102	0.13
101	JEMCL/JU/BRS/101	Amphibolite	22.944530	85.539449	0.11
102	JEMCL/JU/BRS/102	Chlorite Phyllite	22.943202	85.539593	0.11
103	JEMCL/JU/BRS/103	Quartz Vein	22.955738	85.551803	0.12
104	JEMCL/JU/BRS/104	Amphibolite	22.955595	85.552360	0.12
105	JEMCL/JU/BRS/105	Amphibolite	22.955317	85.553213	0.11
106	JEMCL/JU/BRS/106	Quartz Vein	22.955473	85.553508	0.15
107	JEMCL/JU/BRS/107	Chlorite Phyllite	22.955773	85.553637	0.12
108	JEMCL/JU/BRS/108	Chlorite Phyllite	22.956442	85.553805	0.11
109	JEMCL/JU/BRS/109	Chlorite Phyllite	22.955808	85.554778	0.12
110	JEMCL/JU/BRS/110	Chlorite Phyllite	22.954905	85.554573	0.10
111	JEMCL/JU/BRS/111	Smoky Quartz Vein	22.954104	85.553557	0.04
112	JEMCL/JU/BRS/112	Chlorite Phyllite	22.953737	85.553122	0.06
113	JEMCL/JU/BRS/113	Smoky Quartz Vein	22.952890	85.552877	0.05
114	JEMCL/JU/BRS/114	Amphibolite	22.949383	85.549542	0.07
115	JEMCL/JU/BRS/115	Quartz Vein	22.949324	85.548475	0.06
116	JEMCL/JU/BRS/116	Chlorite Phyllite	22.949327	85.547408	0.05
117	JEMCL/JU/BRS/117	Quartz Vein	22.949385	85.547307	0.07
118	JEMCL/JU/BRS/118	Amphibolite	22.950690	85.546837	0.08
119	JEMCL/JU/BRS/119	Quartz Vein	22.951633	85.546830	0.06
120	JEMCL/JU/BRS/120	Smoky Quartz Vein	22.952190	85.546080	0.05



Annexure-I: Analytical results of bedrock samples (BRS) collected from different lithology of Jojobera-Ulihurang Block, Khunti district, Jharkhand

Sl. No.	Sample No	Lithology	Latitude	Longitude	Gold (Au) Value (PPM)
121	JEMCL/JU/BRS/121	Smoky Quartz Vein	22.952610	85.545762	0.04
122	JEMCL/JU/BRS/122	Quartz Vein	22.953110	85.545903	0.07
123	JEMCL/JU/BRS/123	Carbon Phyllite	22.954623	85.546983	0.03
124	JEMCL/JU/BRS/124	Smoky Quartz Vein	22.955713	85.547248	0.05
125	JEMCL/JU/BRS/125	Amphibolite	22.957307	85.548003	0.05
126	JEMCL/JU/BRS/126	Chlorite Phyllite	22.955318	85.524043	0.03
127	JEMCL/JU/BRS/127	Chlorite Phyllite	22.952427	85.528119	0.05
128	JEMCL/JU/BRS/128	Amphibolite	22.951782	85.530102	0.04
129	JEMCL/JU/BRS/129	Smoky Quartz Vein	22.949557	85.531028	0.04
130	JEMCL/JU/BRS/130	Chlorite Phyllite	22.947949	85.530192	0.01
131	JEMCL/JU/BRS/131	Quartz Vein	22.949835	85.529184	0.02
132	JEMCL/JU/BRS/132	Chlorite Phyllite	22.949062	85.527855	0.04
133	JEMCL/JU/BRS/133	Quartz Vein	22.950430	85.527844	0.05
134	JEMCL/JU/BRS/134	Amphibolite	22.951205	85.527408	0.03
135	JEMCL/JU/BRS/135	Chlorite Phyllite	22.950762	85.526241	0.09
136	JEMCL/JU/BRS/136	Amphibolite	22.948993	85.526027	0.05
137	JEMCL/JU/BRS/137	Smoky Quartz Vein	22.948416	85.525350	0.04
138	JEMCL/JU/BRS/138	Amphibolite	22.960374	85.544778	0.05
139	JEMCL/JU/BRS/139	Amphibolite	22.959955	85.546212	0.02
140	JEMCL/JU/BRS/140	Quartz Vein	22.959695	85.546825	0.04
141	JEMCL/JU/BRS/141	Chlorite Phyllite	22.958493	85.547248	0.04
142	JEMCL/JU/BRS/142	Smoky Quartz Vein	22.958393	85.547138	0.03
143	JEMCL/JU/BRS/143	Quartz Vein	22.958230	85.547150	0.04
144	JEMCL/JU/BRS/144	Quartz Vein	22.958128	85.547252	0.06
145	JEMCL/JU/BRS/145	Quartz Vein	22.957718	85.547715	0.05
146	JEMCL/JU/BRS/146	Amphibolite	22.957352	85.547362	0.04
147	JEMCL/JU/BRS/147	Chlorite Phyllite	22.956401	85.544671	0.04
148	JEMCL/JU/BRS/148	Amphibolite	22.954525	85.546209	0.03
149	JEMCL/JU/BRS/149	Quartz Vein	22.954595	85.544926	0.05
150	JEMCL/JU/BRS/150	Quartz Vein	22.955867	85.542293	0.04



Annexure-I: Analytical results of bedrock samples (BRS) collected from different lithology of Jojobera-Ulihurang Block, Khunti district, Jharkhand

Sl. No.	Sample No	Lithology	Latitude	Longitude	Gold (Au) Value (PPM)
151	JEMCL/JU/BRS/151	Amphibolite	22.955859	85.542545	0.04
152	JEMCL/JU/BRS/152	Quartz Vein	22.955362	85.543307	0.04
153	JEMCL/JU/BRS/153	Amphibolite	22.954622	85.543553	0.01
154	JEMCL/JU/BRS/154	Quartz Vein	22.953680	85.543313	0.06
155	JEMCL/JU/BRS/155	Chlorite Phyllite	22.953260	85.543058	0.05
156	JEMCL/JU/BRS/156	Smoky Quartz Vein	22.952665	85.542773	0.04
157	JEMCL/JU/BRS/157	Chlorite Phyllite	22.951912	85.542585	0.05
158	JEMCL/JU/BRS/158	Quartz Vein	22.951700	85.542598	0.03
159	JEMCL/JU/BRS/159	Chlorite Phyllite	22.950715	85.542018	0.04
160	JEMCL/JU/BRS/160	Quartz Vein	22.949133	85.541182	0.04
161	JEMCL/JU/BRS/161	Quartz Vein	22.947146	85.540126	0.05
162	JEMCL/JU/BRS/162	Chlorite Phyllite	22.947603	85.539472	0.04
163	JEMCL/JU/BRS/163	Quartz Vein	22.947603	85.539472	0.02
164	JEMCL/JU/BRS/164	Amphibolite	22.949285	85.538507	0.04
165	JEMCL/JU/BRS/165	Chlorite Phyllite	22.950529	85.539442	0.03
166	JEMCL/JU/BRS/166	Amphibolite	22.951681	85.539906	0.03
167	JEMCL/JU/BRS/167	Quartz Vein	22.952874	85.540606	0.03
168	JEMCL/JU/BRS/168	Smoky Quartz Vein	22.948042	85.551745	0.01
169	JEMCL/JU/BRS/169	Amphibolite	22.948852	85.550597	0.01
170	JEMCL/JU/BRS/170	Chlorite Phyllite	22.948595	85.549308	0.02
171	JEMCL/JU/BRS/171	Chlorite Phyllite	22.948287	85.548207	0.02
172	JEMCL/JU/BRS/172	Quartz Vein	22.948267	85.548005	0.02
173	JEMCL/JU/BRS/173	Quartz Vein	22.948245	85.547428	0.02
174	JEMCL/JU/BRS/174	Carbon Phyllite	22.948067	85.545760	0.03
175	JEMCL/JU/BRS/175	Quartz Vein	22.949827	85.546243	0.01
176	JEMCL/JU/BRS/176	Quartz Vein	22.949665	85.544760	0.02
177	JEMCL/JU/BRS/177	Quartz Vein	22.949305	85.543842	0.02
178	JEMCL/JU/BRS/178	Amphibolite	22.949502	85.543330	0.01
179	JEMCL/JU/BRS/179	Amphibolite	22.948632	85.543212	0.01
180	JEMCL/JU/BRS/180	Smoky Quartz Vein	22.948338	85.543478	0.01