PROPOSAL FOR PRELIMINARY EXPLORATION FOR BAUXITE AND ASSOCIATED CRITICAL MINERAL AROUND JHARKARWADI BLOCK, SINDHUDURG DISTRICT, MAHARASHTRA

COMMODITY

BAUXITE AND ASSOCIATED CRITICAL MINERAL

BY

BHUSHILP MINES AND MINERALS PVT. LTD.
NAGPUR

Bhushilp Mines and Minerals Private Limited

SUMMARY OF THE BLOCK FOR PRELIMINARY EXPLORATION (G3 STAGE) GENERAL INFORMATION ABOUT THE BLOCK

	Features	Details
	Block ID	Jharkarwadi block
	Exploration Agency	Bhushilp Mines and Minerals Pvt. Ltd.
	Commodity	Bauxite and Associated Critical Mineral
	Mineral Belt	Western Ghats
	Completion Period with entire Time schedule to complete the project	12 months
	Objectives	As per the available geological data the present area is potential for Bauxite/Aluminous laterite a source for critical minerals. The proposed exploration has been formulated to for following objectives. i. Assessment of Bauxite and associate Critical Minerals ii. Estimation of resources of Bauxite and associated Critical minerals iii. Establish the possible prolific zones of concentration of critical minerals in the Bauxite/Laterite profile. iv. To study subsurface continuity of potential zones of Bauxite and associated Critical minerals through drilling in the area.

	Whether the work will be carried out by the proposed agency or through outsourcing and details thereof. Components to be outsourced and name of the outsource agency	Work will be carried out by the agency.		
	Name/ Number of Geoscientists	2 field officers + 1 Hq. based officer		
	Expected Field days (Geology) Geological Party Days	One party of 2 officer for 130 days with drilling unit		
1.	**Location**			
	Point	**Latitude**	**Longitude**	**Area in Sq. km.**
	A	16°26' 38.000" N	73°25' 25.000" E	8.00 Sq. km
	B	16°26' 38.001" N	73°28' 9.987" E	
	C	16°25' 44.994" N	73°28' 10.009" E	
	D	16°25' 45.003" N	73°25' 24.999" E	
	Villages	Jharkarwadi, Dhangarwadi (south of)		
	Tehsil/ Taluk	-		
	District	Sindhudurg		
	State	Maharashtra		
2.	**Area (hectares/ square kilometers)**			
	Block Area	8.00 Sq. km		
	Forest Area	Data Not Available		
	Government Land Area	Data Not Available		
	Private Land Area	Data Not Available		
3.	**Accessibility**			
	Nearest Rail Head	Kankavali		
	Road	National and states road very well connected		
	Airport	Sindhudurg/Mopa, Goa		

4.	**Hydrography**	
	Local Surface Drainage Pattern (Channels)	Area is flat topped, occupied by 1st and higher order streams. The drainage pattern is mainly dendritic. The elevation of the area ranges from 80 to 180m.
	Rivers/ Streams	The Deogad river and its tributaries are flowing in the south of the block from east to west. The area under exploration is devoid of river and major tributaries.
5.	**Climate**	Semi-tropical climate
	Mean Annual Rainfall	The normal annual rainfall over the district varies from 2300 mm to about 3205 mm during the year.
	Temperatures	Temperatures rise to a maximum of 32 °C
6.	**Topography**	
	Toposheet Number	47H/07
	Morphology of the Area	Flat topped topography with Dendritic drainage pattern
7.	**Availability of baseline geosciences data**	
	Geological Map (1:50K/ 25K)	1:25,000/1:50,000 scale
	Geochemical Map	NGCM data available
	Geophysical Map	Not Available

8.	**Justification for taking up Reconnaissance Survey / Regional Exploration**	The area is well known for the occurrence of Bauxite/Aluminous laterite in the western Ghats. Worldwide laterite is targeted for significant occurrence and secondary potential source for **Chromium, Nickel, Cobalt, Titanium, Vanadium, Gallium, Lithium, REE** & so more. The laterite deposits may be named as the occurrence of dominant minerals like- a. Aluminous laterite (Bauxite) b. Ferruginous laterite (Iron ore) c. Manganiferous laterite (Mn ore) d. Nickeliferous laterite (Ni ore) e. Chromium laterite (Chromium ore). The weathering process leaches these metals from the rocks and deposit them in the laterite profile, which can be having thickness in the meters and can be targeted and extracted easily from the profile section. During the laterization process often concentrates these metals with a factor of 3 to 30 times of the metal content (Elias, M. 2002, CODES Special Publi.). The proposed area for preliminary exploration is the part of **"**Reconnaissance survey for bauxite and aluminous laterite in Baparde area, Sindhudurg district, Maharashtra" (stage-G4) by GSI during 2022-23. The Baparde area covering 50 Sq. km and mapped on 1:12,500 scale out of this more than 75% of the area is covered by laterite capping developed over Deccan basalts, which are potential host for critical minerals. During the study of the samples, they are showing presence of Gibbsite as dominant ore mineral with Anatase, Kaolinite and Goethite as minor in abundance. The Bauxite/Aluminous laterite indicating pisolitic, massive, nodular, concretionary grains of gibbsite within aluminous laterite as surface manifestation. From the Baparde area BRS samples are showing (n=27) range of, Al_2O_3 -32.05% to 51.35%, Fe_2O_3- 8.27% to 42.68% and SiO2- 1.26 % to 6.85 %, which classified as bauxite and samples (n=23) range of Al_2O_3 -24.37 % to 39.86 %, Fe_2O_3- 22.46% to 48.87% and SiO_2- 2.03% to 23.3 %, which classified as Aluminous laterite. Whereas, in PTS samples (n=9) range of, Al_2O_3- 36.92 % to 53.32%, Fe_2O_3-11.5% to 35.89% and SiO_2 -1.42 % to 6.19 %, which classified as bauxite and samples (n=16) range of, Al_2O_3 -27.52 % to 49.6 %, Fe_2O_3 - 3.62% to 50.69% and SiO_2- 1.24 % to 36.97%, which classified as Aluminous laterite.

		The block is showing presence of critical minerals in bauxite namely- V -205 to 1042ppm, Ga-38 to 85 ppm in BRS and V-250 to 1086 ppm, Ga- 51 to 88 ppm in PTS. Whereas, critical minerals in aluminous laterite namely- V-603 to 1710 ppm, Ga- 35 to 68 ppm in BRS and V-172 to 1046 ppm and Ga-in 27 to 79 ppm PTS. The Total REE varies from 58.33 ppm to 301.11 ppm and Li value varies from <5 ppm to 10 ppm. The present area under exploration covering the Jharkarwadi area of southern parts of Baparde area covering an area of 6 Sq. km. The area mainly consisting Bauxite cover with small area of Aluminous laterite in the fringe areas. The area proposed for exploration having six BRS samples and one PTS sample location of Bauxite/Aluminous laterite in and around (very close proximity) of the block. The BRS samples are showing (n=8) range of, Al_2O_3-40% to 51.2%, Fe_2O_3- 8.27% to 29.06% and SiO_2- 2.81 % to 6.36 %, and Critical minerals ranging -V-404 to 955 ppm, Ga- 38 to 69 ppm, Cr- 375 to 1027 ppm. The PTS sample is showing (n=2), Al_2O_3- 48.72% to 51.69%, Fe_2O_3- 12.18% to 17.86% and SiO_2- 1.42% to 1.56 % and Critical minerals ranging -V-250- 439 ppm, Ga- 62- 67 ppm, Cr- 368- 759 ppm. Based on the previous work, the present preliminary exploration at G3 level has been prepared. The drilling in the area on regular grid pattern at 400X400m borehole spacing with 20 to 25m depth, geological mapping with surface and profile sampling will be helpful in assessing the mineralization of the Bauxite/Aluminous Laterite with occurrence of critical minerals. The proposed work will be helpful to estimate the resources of Bauxite/Aluminous Laterite with the presence of critical mineral at G3 stage of exploration in the area. The work will be helpful in delineation of mineralized area in 3D as well as potentiality of the area.

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1 INTRODUCTION

Preamble

a) The Critical minerals are those minerals that are essential for economic development and national security. The lack of availability of these minerals or concentration of extraction or processing in a few geographical locations may lead to supply chain vulnerabilities and even disruption of supplies. The future global economy will be underpinned by technologies that depend on minerals such as lithium, graphite, cobalt, titanium, and rare earth elements. These are essential for the advancement of many sectors, including high-tech electronics, telecommunications, transport, and defence and vital to power the global transition to a low carbon emissions economy, and the renewable energy technologies that will be required to meet the 'Net Zero' commitments of an increasing number of countries around the world.

b) The Indian economy has undergone a transformative process of New Age reforms in the last decade. These diverse policies converge toward improving the country's economy, overall efficiency and realizing its growth potential. The use of technology, in particular digital technology, underpins the reforms. They are also vital to power the global transition to a low-emission economy, and the renewable energy technologies, which are increasing in number of countries around the world. There is no energy transition without critical minerals, which is why their supply chain resilience has become an increasing priority for major economies. India's future economic prosperity will depend on how well we can use our vast energy and mineral resources to play to our strengths, and shift towards zero emissions.

c) Bauxite/Aluminous laterite is crucial and important for Indian economy. It produces the crucial metal Aluminum for the Indian economy due to its widespread use across various sectors like construction, transportation, packaging, and electricals. It's a vital material in India's push for renewable energy and sustainable development, while also supporting domestic industries and employment. It is also plays a critical role in economical development, industrial growth and transition to a sustainable and low–carbon economy.

2. Background

a) The geological Exploration for Bauxite/Aluminous laterite and critical minerals associated with the bauxite/lateritic capping is on priority by Govt. of India as the potentiality of for holding the critical minerals. The present block is being put up for Preliminary exploration (G3) for Bauxite and associated critical mineral around Jharkarwadi block, Sindhudurg district, Maharashtra. The per previous work Critical Minerals are associated with Bauxite/Aluminous Laterite in Jharkarwadi block, Sindhudurg District, Maharashtra.

3. Location and Accessibility

The proposed Jharkarwadi block lies in the Sindhudurg District (Toposheet No 47H/7) of Maharashtra State. The Kankavali is located in the South-east of the block and can access by the train or road. The block area is in the 55 km (apx.) north-west of the Kankavali town. Block area is connected by roads and train by Kankavali. Most of the villages in the area are connected to each other. The nearest rail head is Kankavali and Mopa (Goa) and Sindhudurg is nearest airport from the block.

4. Physiography, Drainage and Vegetation

a) The area covered by flat top plateau with valleys and moderately undulating hilly terrain with escarpments of the Western Ghat. The elevation of the top is ranging from 80 to 180m from the MSL.

b) The Devgad River and its tributaries are flowing in the southern part of the block from east to west. The rest area is occupied by the flat top laterite cover no major tributaries are in the block area.

c) In spite of the heavy rains during monsoon, the water nowhere gets stagnated and the area becomes dry in a very short period.

d) The area gets very heavy rains of nearly 6000 mm per year during June to September monsoon months. The summer months are hot with maximum temperature rising to 38ºC and the winters are moderate with minimum temperature falling to 12ºC.

5. Regional Geological setup

Regionally the area is occupied by the Deccan Basalts. The general geological sequence of rocks in this area is as below:

Laterite : Pliocene – Pleistocene (?)

Plastic clays : Miocene – Pliocene (?)

Deccan Basalts : Upper Cretaceous to Lower Eocene

Proterozoic : Sandstone limestone and shales of Kaladgi Group.

The Kaladgi Group of rocks are covered by Deccan basalt flows in the area under study and their inliers are occurring about 20km north east of Rajapur town. The sub-rounded pebbles of quartzite are also seen on the plateau tops. Basalt occupies the base of the plateaux and is exposed in the valleys. Lithomarge zone is generally concealed under the talus and scree material and debris of laterite along the slopes of the plateaux. It is generally ferruginous in its upper zone and siliceous in the lower zone grading into saprolite zone. It has various shades of pink, yellow and grey colour. At places, near the upper laterite, caving is observed predominantly in limonitic clayey material. The laterite is often light brown to brick red in colour which forms flat topped plateaux bordered by escarpments. At places, well developed joints are seen in the laterites parallel and normal to the scarps of the plateaux which cause headward erosion along the margins dislodging blocks of laterite down the slopes. These laterites occur at different altitudes which may be due to the original westward gradient of the Deccan basalt or the neotectonic activity on block faulting during the lateritisation processes. The slopes of the plateaux are often covered with talus material making it difficult to make out the exact thickness of the laterite. The Tertiary clays are not exposed on the surface but present generally below 10m of the surface level. Along the slopes of the plateaux also, these are concealed under talus material.

6. Geology of the Block

The block area mainly covered by the Lateritic capping with the Deccan basalt in the valley part. The top cover is hard and limonitic in nature. The Bauxite deposit occurs as impersistant lenses and pockets in the laterite capping. It is pink in colour and breaks with sub-conchoidal fracture in massive and hard variety. Pisolitic, massive, brecciated and nodular types of bauxite are observed.

7. Mineral potentiality based on geology, geophysics, ground geochemistry etc.

The area mineralogy of bauxite/aluminous laterite revealed that the gibbsite is dominant among the goethite, hematite, anatase and kaolinite, and traces of quartz, anatase, hematite and goethite. The Gibbsite is the main aluminous mineral contributing to the Al_2O_3 content to bauxite. Silica is contributed by kaolinite disseminated in these bauxites. Hematite and goethite are the essential iron minerals. Anatase contributes to the titania content.

Plagioclase, pyroxene, ilmenite and glass constitute the predominant minerals of the bed rock basalt. These are pseudomorphically replaced /decomposed to form Kaolinite, goethite, hematite and pseudo-rutile in the saprolite zone. The transition from saprolite to lithomarge clay zone is marked by the predominance of gibbsite, which is formed by desilication of kaolinite under severe leaching conditions.

8. Previous Work

The proposed block is south-western part of GSI's Baparde area explored during the FS: 2022-23 under the titled "Reconnaissance survey for bauxite and Aluminous laterite in Baparde area, Sindhudurg District, Maharashtra (Stage-G4)". The work has identified the zones/area of the Bauxite and Aluminous laterite as outcome of the work.

9. Observation and Recommendations of previous work

The previous work under G4 stage identify the potential areas for Bauxite and Aluminous Laterite. An area of 18 Sq. km in and around Kavtalwadi, Dhangarwadi and **Jharkarwadi-**Mandewadi in northeastern, central and southern part of Baparde area is recommended for next stage of exploration i.e. G3 stage.

10. Scope for proposed exploration

The proposed Preliminary exploration work at G3 stage (as per UNFC) exploration having the detailed mapping for 8.00 Sq. km (DM at 1:4000), Drilling in 44 boreholes on regular grid pattern at 400X400m spacing with 20 to 25m depth, geological logging, core sampling, Surface sampling, chemical sample analysis and geological report preparation.

11.Block description

The proposed block area falls in Survey of India Toposheet No 47H/07 of Maharashtra and covers 8.00 Sq. km in around villages of Jharkarwadi and Dhangarwadi (south of) Sindhudurg District, Maharashtra.

The block location in toposheet is given in PLATE-I. The Co-ordinates of the corner points of the block area are given in Table below;

Table-1: Co-ordinates of the corner points of the block area

Point	Latitude	Longitude	Area in Sq. km
A	16°26' 38.000" N	73°25' 25.000" E	8.00 Sq. km
B	16°26' 38.001" N	73°28' 9.987" E	
C	16°25' 44.994" N	73°28' 10.009" E	
D	16°25' 45.003" N	73°25' 24.999" E	

12. Planned Methodology

The proposed exploration work is carried out in accordance to the objective mentioned for preliminary exploration (G3) of the area. The Exploration shall be carried out as per Minerals (Evidence of Mineral Contents) Amended Rule-2021. Accordingly, the standard methodology will follow in order to achieve the objectives. The details of different activities to be carried out are presented in subsequent paragraphs.

13.Remote Sensing and Areal Studies

The remote sensing and the areal data will be studied for the entire block of 8.00 Sq. km.

(The data may be provided by GSI).

14.Geological Mapping

The Geological mapping will be carried out for the block area of 8.00 Sq. km area on 1:4000 scale. Rock types, their contact, structural features will be mapped. Identify the borehole location for drilling, petrographic samples and PCS/BRS sampling will be marked on map. The borehole cores will be studied.

15. Sampling

Drilling Core sampling/PCS/Petrological/Ore petrography Sampling:

The samples will be collected during the exploration work, drilling, core sampling, DM, and surface mapping from the outcrops and within the study area which will be total about 1100 and 165 number of check samples and the samples will be analyzed for Major, Minor and trace elements.

16.Laboratory Studies

a. Major/Minor and Trace element analysis:

Analysis of major, Minor and trace elements will be carried out on 25 nos. of rock samples to check the rock types, their variation in chemical composition.

b. Petrological Studies:

The 25 number of petrological/ore microscopy samples will be collected during the geological mapping from various outcrop. The XRD & EPMA studied will also be carried out for their distribution, alteration, enrichment etc.

c. Chemical Analysis:

All the primary samples, Internal (5% of primary samples) and external check samples (10% of primary samples) generated for critical mineral analysis and associated minerals from drill core samples and PCS shall be analysed for major/minor and trace elements.

17. Preparation of Geological Report

After completion of exploration work and receipt of analysis, exploration report at G3 level shall be prepared in hard and soft copy. The final report shall be submitted to NMET after peer review.

18. NQW (Natural of Quantum of Work)

Details of the particular, Quantum and the targets are tabulated below

Table-2: Natural of Quantum of work in Jharkarwadi block

Sr. No.	Item of Work	Unit	Proposed Quantum of work
1	Geological Survey Detailed Mapping (1:4,000)	**Sq. km**	**8.00**
2	**Drilling**		
	Technological Core Drilling	**m**	**1100**
	Geological Borehole logging	**m**	**1100**
	Core sampling	**Nos.**	**1100**
3	Bulk density	**Nos.**	**02**
4	**Chemical Analysis**		
	a. Core Samples (Al_2O_3, Fe_2O_3, TiO_2, SiO_2, V, Ga, Sc, Cr, Co, Ni, Li & LOI)	**Nos.**	**1100**
	a. Check Samples (5% Internal + 10% External)	**Nos.**	**165**
	a. Reactive silica analysis	**Nos.**	**40**
5	**Petrology/Mineralogy study**		
	PS	**Nos.**	**15**
	OM	**Nos.**	**15**
	PCS	**Nos.**	**15**
	XRD	**Nos.**	**15**
6	Report Preparation (Hard copies with one soft copy)	**Nos.**	**01**

19. Manpower Deployment

Final Manpower deployment List will be provided.

20.Justifications

The proposed block is taken up in view of exploration work carried out by GSI during the year 2022-23 for reconnaissance survey for bauxite and Aluminous laterite in Baparde area, Sindhudurg District, Maharashtra (G4). The presence of Bauxite/Aluminous laterite is confirmed by the work carried out. The area under exploration is recommendate for further exploration work. The geological continuity of Bauxite/aluminous laterite with the similar characteristics also established by the geological map of the area. Worldwide laterite is targeted for significant occurrence and secondary potential source for chromium, Nickel, Cobalt, Titanium, Vanadium, Gallium, Lithium, REE & so more. The laterite deposits may be named as the occurrence of dominant minerals like- a. Aluminous laterite (Bauxite) b. Ferruginous laterite (Iron ore) c. Manganiferous laterite (Mn ore) d. Nickeliferous laterite (Ni ore) e. Chromium laterite (Chromium ore). Among this the Aluminous laterite (Bauxite) is very well occurring in the proposed block and as per the know concept it is potential for critical minerals.

The present area under exploration covering the Jharkarwadi area of southern parts of Baparde area covering an area of 7.97 Sq. km. The area mainly consisting Bauxite cover with small area of Aluminous laterite in the fringe areas. The area proposed for G3 exploration having eight BRS samples and two PTS sample location of Baparde block (G4) in the Bauxite/Aluminous laterite in and around (very close proximity) of the G3 block. The chemical results showing the promising results. The BRS samples are showing (n=8) range of, Al_2O_3-40% to 51.2%, Fe_2O_3- 8.27% to 29.06% and SiO_2-2.81 % to 6.36 %, and Critical minerals ranging -V-404 to 955 ppm, Ga- 38 to 69 ppm, Cr- 375 to 1027 ppm. The PTS sample is showing (n=2), Al_2O_3- 48.72% to 51.69%, Fe_2O_3- 12.18% to 17.86% and SiO_2- 1.42% to 1.56 % and Critical minerals ranging -V-250- 439 ppm, Ga- 62- 67 ppm, Cr- 368- 759 ppm.

In view of the above the preliminary exploration work proposed in the 8.00 Sq. km block area with 44 boreholes on regular grid pattern at 400X400m. The total 1100 m drilling has proposed with 20 to 25 m depth (apx.) of each borehole. With the help above justification and methodology, exploration for aluminous laterite hosted critical minerals and Bauxite/aluminous laterite will be carry out to establish resources of laterite hosted critical minerals and bauxite/Aluminous laterite under UNFC 333 category, G3 stage.

21.References

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6 Armita Davarpanah et.al, Knowledge-based query system for the critical minerals, https://doi.org/10.1016/j.acags.2024.100167, Applied Computing and Geosciences, Volume 22, June 2024.

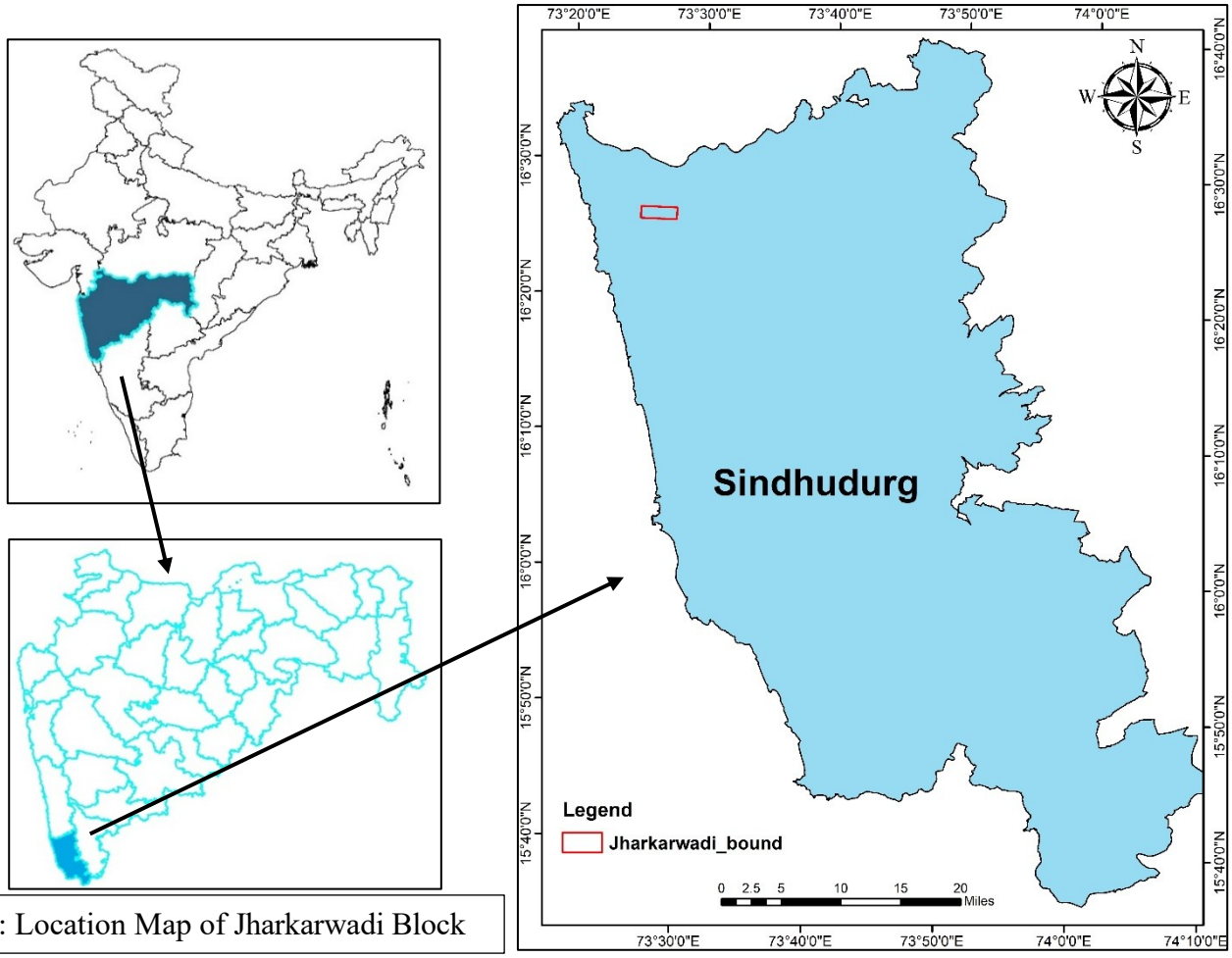

Fig – 1: Location Map of Jharkarwadi Block

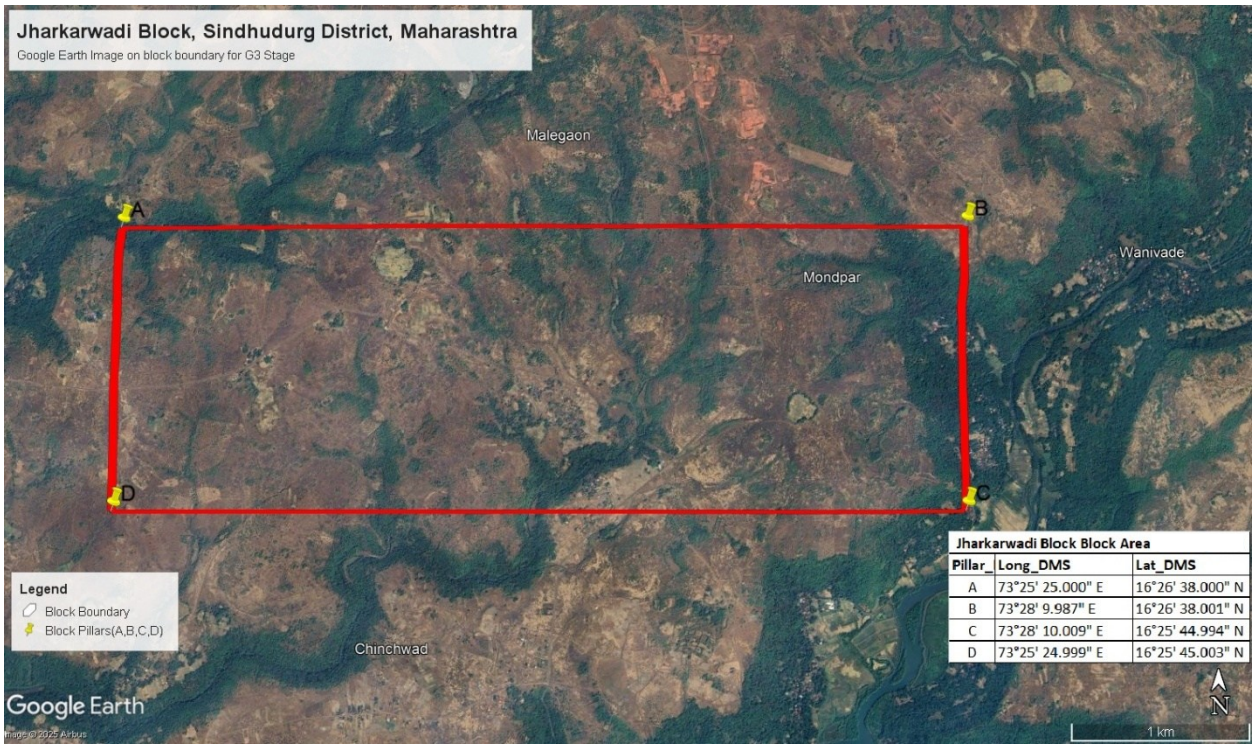

Fig. – 2 : Google earth image with proposed Jharkarwadi block for G3 exploration

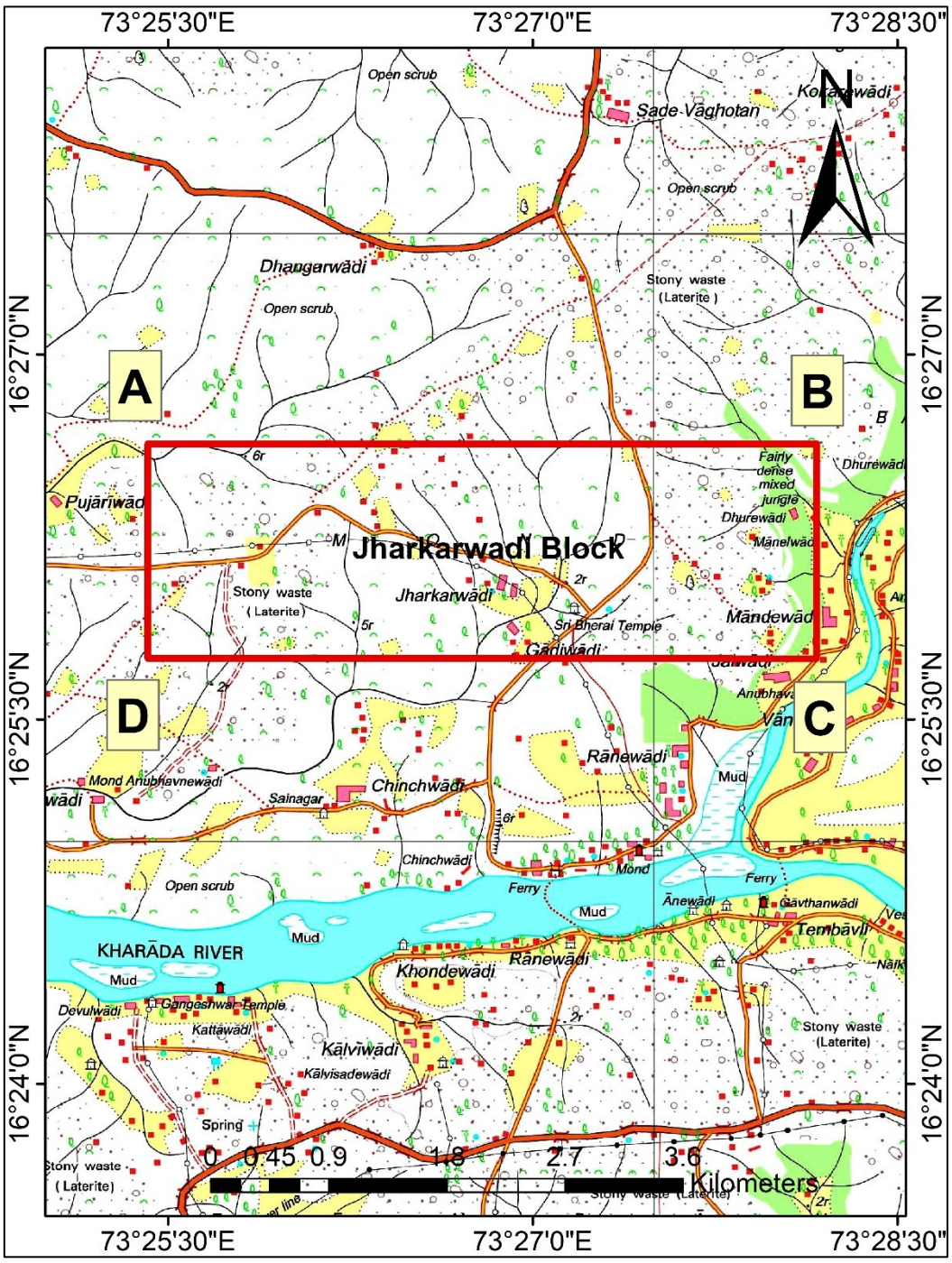

Fig. – 3: Toposheet with proposed Jharkarwadi G3 block boundary.

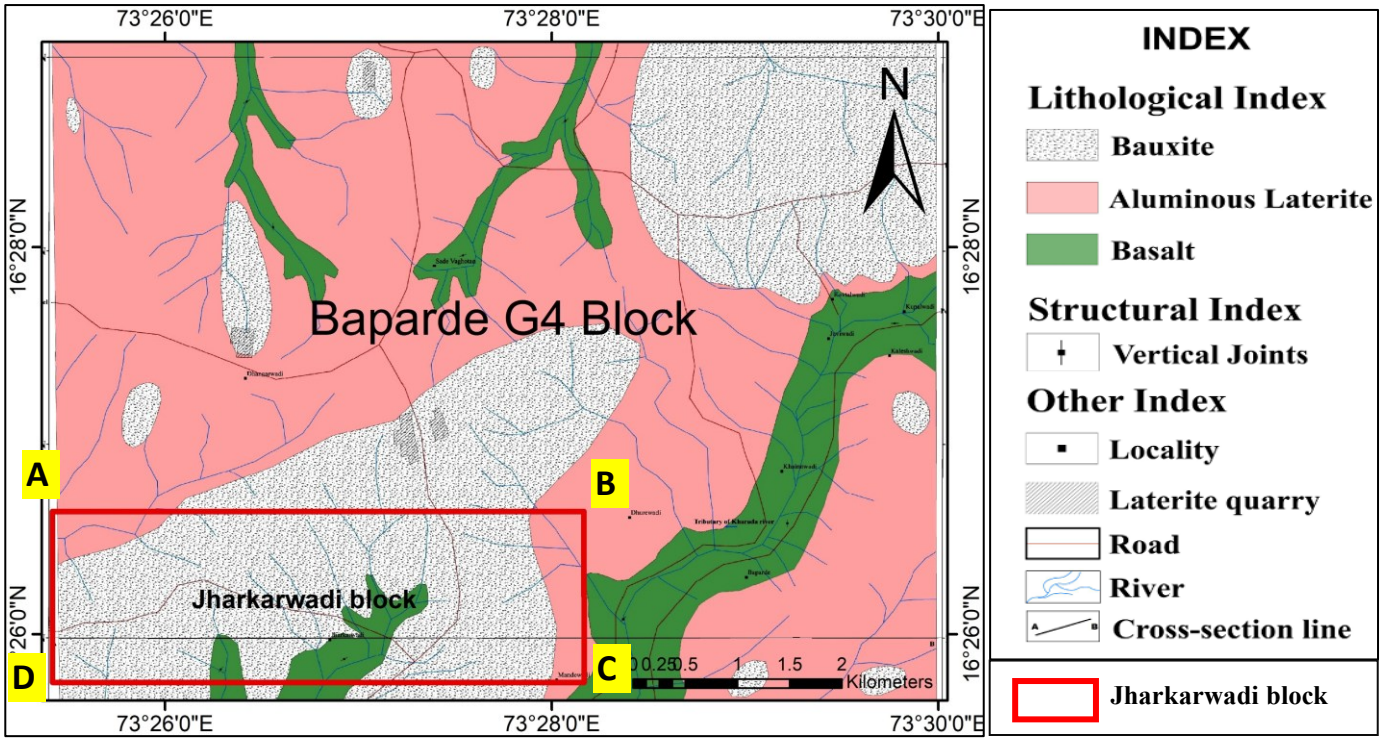

Fig. – 4 : Geological map with proposed Jharkarwadi G3 block boundary.

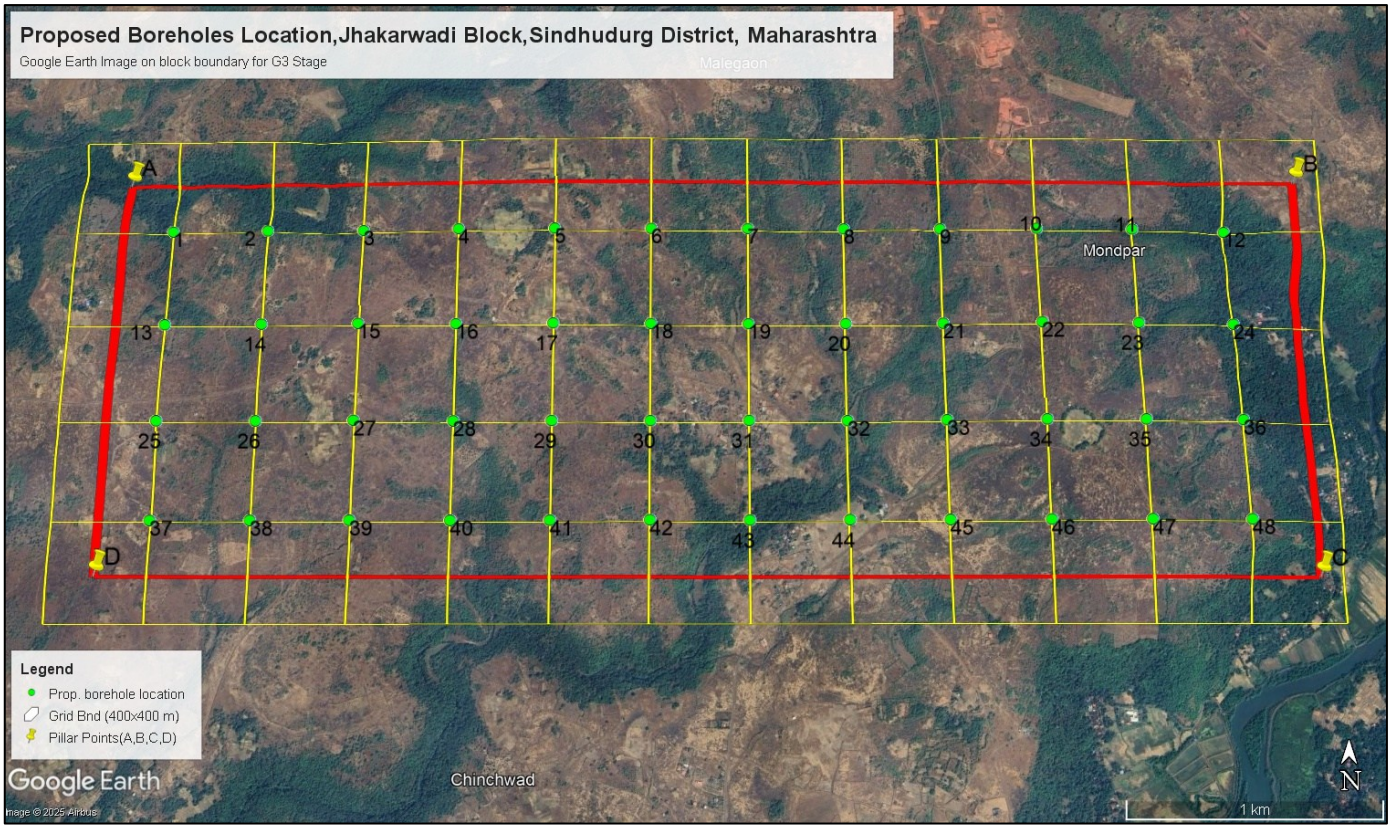

Fig. 5 – Proposed Borehole Locations in proposed Jharkarwadi G3 Block, Sindhudurg.