

COMMODITY: BAUXITE AND ASSOCIATED CRITICAL MINERAL

**PRELIMINARY EXPLORATION FOR BAUXITE AND ASSOCIATED CRITICAL MINERAL IN
NANDRUKH BLOCK, SINDHUDURG, DISTRICT, MAHARASHTRA.**

**BY
GEOLOGICAL SURVEY OF INDIA
SU: MAHARASHTRA
CENTRAL REGION, PUNE**

**PLACE: PUNE
DATE: JUNE 2026**

Summary of the Block for G3 Level Exploration

GENERAL INFORMATION ABOUT THE BLOCK

Feature	Details
Block ID	NANDRUKH BLOCK (M2ASMIF-MEP/NC/CR/SU-MH-PUN/2026/199776)
Exploration Agency	Geological Survey of India, Central Region, Nagpur
Commodity	Bauxite and associated critical mineral
Mineral Belt / Geological Domain	Low level laterites occurring at coastal lowlands (0-120 m above MSL) located due immediate east of the Arabian Sea
Block Area	5 sq km
Completion Period	One year
Objectives	To establish the subsurface continuity and to estimate the resource of bauxite and associated critical minerals
Projected Outcome	Preliminary exploration data for resource estimation and further handover of the report.
Personnel	Two geoscientists
Expected Field Days	Officer-1: 100 days; Officer-2: 100 days; Supervisory Officer: 7 days
Toposheet / Degree Sheet	47H12, 47H08
District / State	Sindhudurg / Maharashtra

1. Location

BLOCK

Cardinal Points	Latitude	Longitude
A	16° 04' 35"N	73° 29' 48"E
B	16° 05' 33"N	73° 29' 48"E
C	16° 05' 33"N	73° 31' 25"E
D	16° 04' 35"N	73° 31' 25"E
Tehsil/Taluk	Malvan	
District	Sindhudurg	
State	Maharashtra	

2. Area

Block Area	5 sq km
Forest Area	Nil
Government Land Area	Data not available
Private Land Area	Data not available

3. Accessibility

Nearest town	Malvan town, about 6 km to the south west and Kudal 28 km to the south east.
District headquarters	Oras, about 28 km East of Nandrukh Block
Nearest Rail head	Kudal about 28km northeast of Nandrukh Block
Nearest Airport	Sindhudurg Airport, Chipi Airport Rd, Chipi, Maharashtra, 23 km south of Nandrukh Block

4. Hydrography: Small seasonal streams and dam

5. Climate: sub tropical

6. Topography: plateau top stable land and valley.

7. Availability of baseline geoscience data

Geological map	Large-scale geological mapping and earlier G4 investigations by GSI in and around the block
Geochemical data	NGCM data available
Geophysical data	NIL

8. Justification for taking up G3 level exploration

G4 investigation for bauxite and associated critical mineral carried out by Chaurasia and Parida in Anganewadi block. Out of 100 BRS, 36 BRS are classified as bauxite in which value of SiO₂ ranges from 2.27% to 6.94% with an average 4.95%, value of Al₂O₃ ranges from 36.67% to 53.83% with an average 46.77%, TiO₂ ranges from 1.92% to 4.72% with an average of 3.07%, Gallium (Ga) varies from 46ppm to 82ppm with an average of 66ppm while Vanadium (V) content spans from 299ppm to 1818ppm with an average 669.87ppm. Out of 50 PTS, 23 are classified as bauxite in which SiO₂ value ranging from 3.48% to 6.76% with an average 4.45 %, Al₂O₃ value ranging from 34.17% to 58.68% with an average 51.30%, TiO₂ value ranges from 2.37 % to 4.52 with an average 3.06 %, Gallium (Ga) ranges from 61ppm and 77ppm with an average 69ppm and Vanadium (V) ranges from 171ppm to 2288ppm with an average 569 ppm. On the basis of above value, 25.93

sq km area has been demarcated potential for bauxite and associated critical minerals. In Nandrukh block, 7 BRS classified as bauxite in which SiO₂ ranges from 3.13% to 6.41%, Al₂O₃ value ranging from 36.67 % to 51.34%, TiO₂ value ranges from 2.41% to 3.93%, Gallium (Ga) varies from 56ppm to 82ppm while Vanadium (V) content spans from 363ppm to 1818ppm. Similarly, 10 PTS classified as bauxite in which SiO₂ ranges from 3.48% to 4.41%, Al₂O₃ value ranging from 48.41% to 50.15%, TiO₂ value ranges from 2.37% to 2.67%, Gallium (Ga) varies from 61ppm to 72ppm while Vanadium (V) content spans from 448ppm to 624ppm. Brief introduction of the work to be carried out during implementation of the project and methodology: The present item is proposed in southern part of Anganewadi Block in part of toposheet no. 47 H/08 and 12 (Figure1 & 2). The area exposes bauxite and aluminous laterite. In the area bauxite occur as lensoidal and patchy capping over the aluminous laterite. The investigation will comprise DM on 1:4000 scale along with drilling on 400*400 m grid pattern with a proposed 35 vertical borehole up to 15 to 20m dept to establish the subsurface continuity and to estimate the resource of bauxite and associated critical minerals in Nandrukh block. The number of boreholes is tentative and may be change after detailed mapping based on feasibility of the area. The area has Alphonso Mango plantation therefore consent of land owners will be required for drilling. The block boundary of proposed block is given below:- Points Longitude and Latitude A)73° 29' 48"E:16° 04' 35"N, B) 73° 29' 48"E:16° 05' 33"N, C) 73° 31' 25"E :16° 05' 33"N and D) 73° 31' 25"E:16° 04' 35"N

PRELIMINARY EXPLORATION FOR BAUXITE AND ASSOCIATED CRITICAL MINERAL IN NANDRUKH BLOCK, SINDHUDURG DISTRICT, MAHARASHTRA

1.1.0 INTRODUCTION

The present item is proposed in southern part of Anganewadi Block in part of toposheet no. 47 H/08 and 12 (Figure1 & 2). The area exposes bauxite and aluminous laterite. In the area bauxite occur as lensoidal and patchy capping over the aluminous laterite. The investigation will comprise DM on 1:4000 scale along with drilling on 400*400 m grid pattern with a proposed 35 vertical borehole up to 15 to 20m depth **to establish the subsurface continuity and to estimate the resource of bauxite and associated critical minerals** in Nandrukh block. The number of boreholes is tentative and may be change after detailed mapping based on feasibility of the area. The Nandrukh block is bounded by latitudes 16° 04' 35"N to16° 05' 33"N and longitude 73° 29' 48"E to 73° 31' 25"E.

2.1.0 BACKGROUND INFORMATION

During F.S. 2024-25, a G4 investigation for bauxite and associated critical mineral carried out by Chaurasia and Parida in Anganewadi block. Out of 100 BRS, 36 BRS are classified as bauxite in which value of SiO₂ ranges from 2.27% to 6.94% with an average 4.95%, value of Al₂O₃ ranges from 36.67% to 53.83% with an average 46.77%, TiO₂ ranges from 1.92% to 4.72% with an average of 3.07%, Gallium (Ga) varies from 46ppm to 82ppm with an average of 66ppm while Vanadium (V) content spans from 299ppm to 1818ppm with an average 669.87ppm. Out of 50 PTS, 23 are classified as bauxite in which SiO₂ value ranging from 3.48% to 6.76% with an average 4.45 %, Al₂O₃ value ranging from 34.17% to 58.68% with an average 51.30%, TiO₂ value ranges from 2.37 % to 4.52 with an average 3.06 %, Gallium (Ga) ranges from 61ppm and 77ppm with an average 69ppm and Vanadium (V) ranges from 171ppm to 2288ppm with an average 569 ppm. On the basis of above value, 25.93 sq km area has been demarcated potential for bauxite and associated critical minerals. In Nandrukh block, 7 BRS classified as bauxite in which SiO₂ ranges from 3.13% to 6.41%, Al₂O₃ value ranging from 36.67 % to 51.34%, TiO₂ value ranges from 2.41% to 3.93%, Gallium (Ga) varies from 56ppm to 82ppm while Vanadium (V) content spans from 363ppm to 1818ppm. Similarly, 10 PTS classified as bauxite in which SiO₂ ranges from 3.48% to 4.41%, Al₂O₃ value ranging from 48.41% to 50.15%, TiO₂ value ranges from 2.37% to 2.67%, Gallium (Ga) varies from 61ppm to 72ppm while

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3.1.0 LOCATION AND ACCESSIBILITY

The Nandrukh block is situated in southern part of Sindhudurga District of Maharashtra. Nandrukh is a Village in Malvan Taluka in Sindhudurg District of Maharashtra State, India. It belongs to Konkan region. It belongs to Konkan Division. It is located 21 KM towards west from District headquarters Oros. 8 KM from Malvan. 389 KM from State capital Mumbai Nandrukh Pin code is 416605 and postal head office is Chouke. Ghumade (2 KM), Mahan (2 KM) , Anandvhal-karlachavhal (3 KM), Amdos (3 KM) , Kumbharmath (4 KM) are the nearby Villages to Nandrukh. Nandrukh is surrounded by Oras Taluka towards East, Kudal Taluka towards East, Vengurla Taluka towards South, Kankavali Taluka towards North. Devgarh , Sawantwadi , Mapusa , Panaji are the nearby Cities to Nandrukh. It is near to arabian sea. There is a chance of humidity in the weather. Nearest Airport is Sindhudurg Airport, Chipi Airport Rd, Chipi, Maharashtra, 23 km south of Nandrukh Block

4.1.0 PHYSIOGRAPHY, DRAINAGE AND CLIMATE

The area features undulating plains, lateritic plateaus (locally called Sadas), and small hillocks. Since Malvan is a coastal town, Nandrukh sits at a low elevation but is surrounded by the typical "Khazan" lands (low-lying coastal wetlands) and rocky outcrops. The region is dominated by Precambrian rocks and Deccan Traps, often covered by thick layers of Laterite (Jambha) stone. This lateritic crust is porous and highly acidic, which dictates the local vegetation and land use. The nearby Malvan coast is famous for its submerged rocky reefs and islands (like the one housing Sindhudurg Fort), which protect the mainland from direct wave impact to some extent.

The drainage system in and around Nandrukh is governed by the short, west-flowing rivers characteristic of the Konkan region. The area is primarily drained by the Gad River (to the north) and the Karli River (to the south). These rivers originate in the Western Ghats and flow rapidly toward the Arabian Sea. The pattern is typically dendritic to rectangular, heavily influenced by the structural joints and faults in the hard rock basement. Because Nandrukh is close to the coast, many local streams and nalas are estuarine in nature. They experience tidal fluctuations, leading to the formation of mangroves and salt marshes in the low-lying basins. Seasonality: The drainage is highly seasonal; streams are torrential during the monsoon but often dry up or turn into sluggish pools during the summer months.

The climate is Tropical Humid, largely influenced by its proximity to the Arabian Sea and the barrier of the Western Ghats. Temperatures are relatively stable throughout the year. Summers (March–May): Warm and very humid, with temperatures ranging from 28°C to 34°C. Winters (December–February): Pleasant and dry, with temperatures rarely dipping below 16°C. This region receives heavy to very heavy rainfall during the

South-West Monsoon (June to September). Malvan and surrounding areas typically record between 2,500 mm and 3,500 mm of rain annually. High humidity is a constant feature, often staying above 70% year-round, which can make the heat feel more intense than the thermometer suggests.

5.1.0 PREVIOUS WORK

The Jawaharlal Nehru Aluminium Research Development and Design Centre (JNARDDC) in association with GSI, CR had carried out random sampling of bauxite horizons in low level and high-level laterites of Maharashtra in the past and reported encouraging Al_2O_3 values in their report (JNARDDC, 1999). Following these preliminary findings, GSI carried out a number of investigations of G4 to G2 stages in parts of toposheet nos. 47H/6, 47H/07 & 47H/10 (Bhatia & Katti, 2008; Bhatia & Eshwara, 2010; Kishore, 2009; Bhatia, 2010; Saha & Eshwara, 2005; Fulzele et al. 12 and Bhatia et al. 2012) and established bauxite resources in Ghodepaiwadi, Hamdara, Nanar, Kumbhawade, alambewadi and Katta- Kalvi on the basis of analytical data of Al_2O_3 , Fe_2O_3 , TiO_2 , SiO_2 and LOI (in %). An item on mineral prognostication of laterite belt in degree sheet 47 H was carried out during FS 2015-17 (Tare et al. 2017). They had demarcated five favourable blocks for G4 stage investigation of bauxite. On the basis of the project, GSI carried out G4 investigations in degree sheet 47 H (Bhaise & Rahman, 2020, Vhatkar & Rahman, 2022, Vhatkar & Suryavanshi, 2023, Gautam 2023, Rahman 202), Tare and Panda 2024 and Gautam and Bhagat, 2024) and demarcated potential area for bauxite and associated critical minerals. Bhaise, et al., 2022, carried out G3 stage exploration in Kudopi block in collaboration with DGM Maharashtra. During F.S. 2024-25, a G4 investigation for bauxite and associated critical mineral carried out by Chaurasia and Parida in Anganewadi block. Out of 100 BRS, 36 BRS are classified as bauxite which value of SiO_2 ranges from 2.27% to 6.94% with an average 4.95%, value of Al_2O_3 ranges from 36.67% to 53.83% with an average 46.77%, TiO_2 ranges from 1.92% to 4.72% with an average of 3.07%, Gallium (Ga) varies from 46ppm to 82ppm with an average of 66ppm while Vanadium (V) content spans from 299ppm to 1818ppm with an average 669.87ppm. Out of 50 PTS, 23 are classified as bauxite in which SiO_2 value ranging from 3.48% to 6.76% with an average 4.45 %, Al_2O_3 value ranging from 34.17% to 58.68% with an average 51.30%, TiO_2 value ranges from 2.37 % to 4.52 with an average 3.06 %, Gallium (Ga) ranges from 61ppm and 77ppm with an average 69ppm and Vanadium (V) ranges from 171ppm to 2288ppm with an average 569 ppm. On the basis of above value, 25.93 sq km area has been demarcated potential for bauxite and associated critical minerals. In Nandruk block, 7 BRS classified as bauxite in which SiO_2 ranges from 3.13% to 6.41%, Al_2O_3 value ranging from 36.67 % to 51.34%, TiO_2 value ranges from 2.41% to 3.93%, Gallium (Ga) varies from 56ppm to 82ppm while Vanadium (V) content spans from 363ppm to 1818ppm. Similarly, 10 PTS classified as bauxite in which SiO_2 ranges from 3.48% to 4.41%, Al_2O_3 value ranging from 48.41% to 50.15%, TiO_2 value ranges from 2.37% to 2.67%, Gallium (Ga) varies from 61ppm to 72ppm while Vanadium (V) content spans from 448ppm to 624ppm.

6.1.0 GEOLOGY OF THE AREA

Geologically, the area represents four distinct litho units (Suryanarayana, 1967). These include metasedimentary rocks of Dharwar Supergroup, sedimentary rocks of Kaladgi Supergroup, basalts of Purandargarh Formation belonging to Sahyadri Group of Deccan Trap Supergroup and laterites of enozoic age (Figure 2). Most of the laterites have developed over the Deccan basalts as capping. The area also exposes thin layer of carbonaceous clay of Miocene to Pliocene. Quaternary alluvium is present in few isolated patches having limited areal extent found mainly along the estuarine plain. In Western Maharashtra, laterite occurs between latitudes 15 40' and 18 N. These laterites are further classified into (i) high level laterites capping the submits of hill and plateau (those along the crest of the Western Ghat escarpment and further east over the Deccan Plateau in the elevation range of 750 to 1050 m above MSL) and (ii) low level laterites occurring at coastal lowlands (0-120 m above MSL) located due immediate east of the Arabian Sea.

Joshi et al. (2004) reported occurrence of regolith profiles at three physiographic horizons of Konkan region including the high hills (~1000m) of Western Ghats, the plateau (60-120m) and coastal levels (upto 15m). The studies indicated differential bauxite enrichment and occurrence of high-grade bauxite at all levels including lower levels like at Kumbhawade. The high-level occurrences are blanket type and are known from Satara, Sangli and Kolhapur districts of Maharashtra. Many of them have working mines in them (e.g. near Radhanagri, Gargoti, Udgiri etc.). Low level occurrences are typically lensoidal and pockety in nature. They are located in Sindhudurg, Ratnagiri and Raigad districts and have been exploited only at a few places.

7.1.0 OBJECTIVES OF THE PROPOSED EXPLORATION PROGRAMME

The present exploration programme has been formulated with the following objectives:

- i) To establish the subsurface continuity and to estimate the resource of bauxite and associated critical minerals

8.1.0 PROPOSED SCHEME OF EXPLORATION

The area exposes bauxite and aluminous laterite. In the area bauxite occurs as lensoidal and patchy capping over the aluminous laterite. The investigation will comprise DM on 1:4000 scale along with drilling on 400*400 m grid pattern with a proposed 35 vertical borehole up to 15 to 20m depth for assessment of bauxite and associated critical mineral resource in Nandruk block. The number of boreholes is tentative and may change after detailed mapping based on feasibility of the area. The area has Alphonso Mango plantation therefore consent of land owners will be required for drilling.

9.1.0 QUANTUM OF WORK

Item of Work	Unit	Proposed Quantum
Large Scale Mapping (1:4,000)	Sq km	5
Subsurface exploration: drilling	M	500
Borehole logging	M	500
Core Sampling		500
Core samples (m)	nos.	500 m
Reactive Silica		05 Nos
Petrographic/ Minerographic Studies		
a)PS	nos.	10Nos.
b)PCS		10Nos.
c)ORM/OM		10Nos.
d)XRD		10Nos.
Chemical analysis		
All oxides. Al ₂ O ₃ , Fe ₂ O ₃ , TiO ₂ , SiO ₂ , P ₂ O ₅ , K ₂ O, CaO, MgO, Na ₂ O, MnO, LOI, V, Ga, Sc, Co, Cr, Ni & Zr	nos.	500Nos.
a)CS		10Nos.

Item of Work	Unit	Proposed Quantum
b)PCS c)REE		10 Nos.

10.1.0 COST

Summary of the Cost estimates

Sl. No.	Item	Total Estimated Cost (Rs.)	Funding
1	Geology and Survey	0	By GSI
2	Drilling	₹ 27,50,000.00	NMEDT
3	Survey work	0	By GSI
4	Laboratory studies	0	By GSI
5	Geologist at HQ	0	By GSI
	Sub Total (1to 4)	₹ 27,50,000.00	
6	Exploration Report Preparation	0	By GSI
7	Proposal Preparation	0	By GSI
8	Peer review charges	0	By GSI
9	Sub Total (1to8)	₹ 27,50,000.00	By GSI
10	GST18%	₹ 4,95,000.00	
	Total:	₹ 32,45,000.00	
	Rs. In Lakh	32.45	

COST CALCULATION

In case of outsourced								
Item of Work			Unit	SoC-Item -Sl No. NMEDT	Rates as per NMET SoC 2025		Estimated Cost	
							Qty.	Total Amount (Rs)
D. Drilling - OUT SOURCED								
18.a	DRILLING	Drilling in/ Drilling in Soft rock/ Strata: HQ size borehole up to 400m Depth and NQ Size beyond 400m depth in case of NQ size drilling is done before 400m depth, the rate shall decrease by 20%	m	2.2.1.1c	5,500.00	500	₹ 27,50,000.00	
18.b		Drilling in/ Drilling in Hard rock/ Strata: HQ size borehole up to 400m Depth and NQ Size beyond 400m depth in case of NO size	m	2.2.1.1d	10,000.00	0	₹ 0.00	

	DRILLING RELATED EXPENDITURE HEADS	drilling is done before 400m depth, the rate shall decrease by 20%						
18.c		Drilling in/ Drilling in Very Hard rock/ Strata: HQ size borehole up to 400m Depth and NQ Size beyond 400m depth in case of NQ size drilling is done before 400m depth, the rate shall decrease by 20%	m	2.2.1.1e		12,650.00	0	₹ 0.00
18.d		Drilling for Lignite	m	2.2.1.1a		4,783.00	0	₹ 0.00
18.e		Drilling for Coal	m	2.2.1.1b		7,975.00	0	₹ 0.00
18.a		Mechanised Auger Drilling for soft strata up to 30m depth	m	2.2.2.1		4,760.00	0	₹ 0.00
18.b		Hand Auger drilling in soft strata up to 30 m depth	m	2.2.2.2		3,808.00	0	₹ 0.00
18.c		RC Drilling	m	2.2.3		8,870.00	0	₹ 0.00
18.d		Non coring drilling	m	2.2.4		4,000.00	0	₹ 0.00
19	DRILLING RELATED EXPENDITURE HEADS	Borehole Deviation Survey by Multishot survey tool (interval 6m; azimuth and inclination to be recorded)	per shot	2.2.5		330.00	0	₹ 0.00
20		Land / Crop Compensation (in case the BH falls in agricultural Land)	per BH	5.6		30,000.00	0	₹ 0.00
21		Construction of concrete Pillar (12"x12"x30")	per borehole	2.2.7a		2,000.00	0	₹ 0.00
22		Borehole plugging with cement	per borehole	2.2.8		10,000.00	0	₹ 0.00
23		Miscellaneous Charges (Transportation of Drilling Rig, accommodation for Drilling Camp, Camp setting and winding, construction of approach road)	Lumpsum	0	2.2.9.4	For Drilling cost >2 Cr: 10 % of the Drilling Cost with a maximum ceiling of Rs.25 Lkh	2500000	₹ 0.00
24		Drill Core Preservation- One complete BH plus mineralised cores of all the BHs of the block/ prospect to be preserved in GI Core boxes and subsequently transported to the notified core repository.	per m	X		1,590.00	0	₹ 0.00
Total Cost D- outsourced								₹ 27,50,000.00
Total (Drilling)								₹ 27,50,000.00
GST 18%								₹ 4,95,000.00
Total Fund Required inclusive of 18% GST								₹ 32,45,000.00
								~ 0.325 Cr

11.1.0 TIME SCHEDULE

The drilling work component of this programme will be carried out as per time schedule shown below:

[illegible]

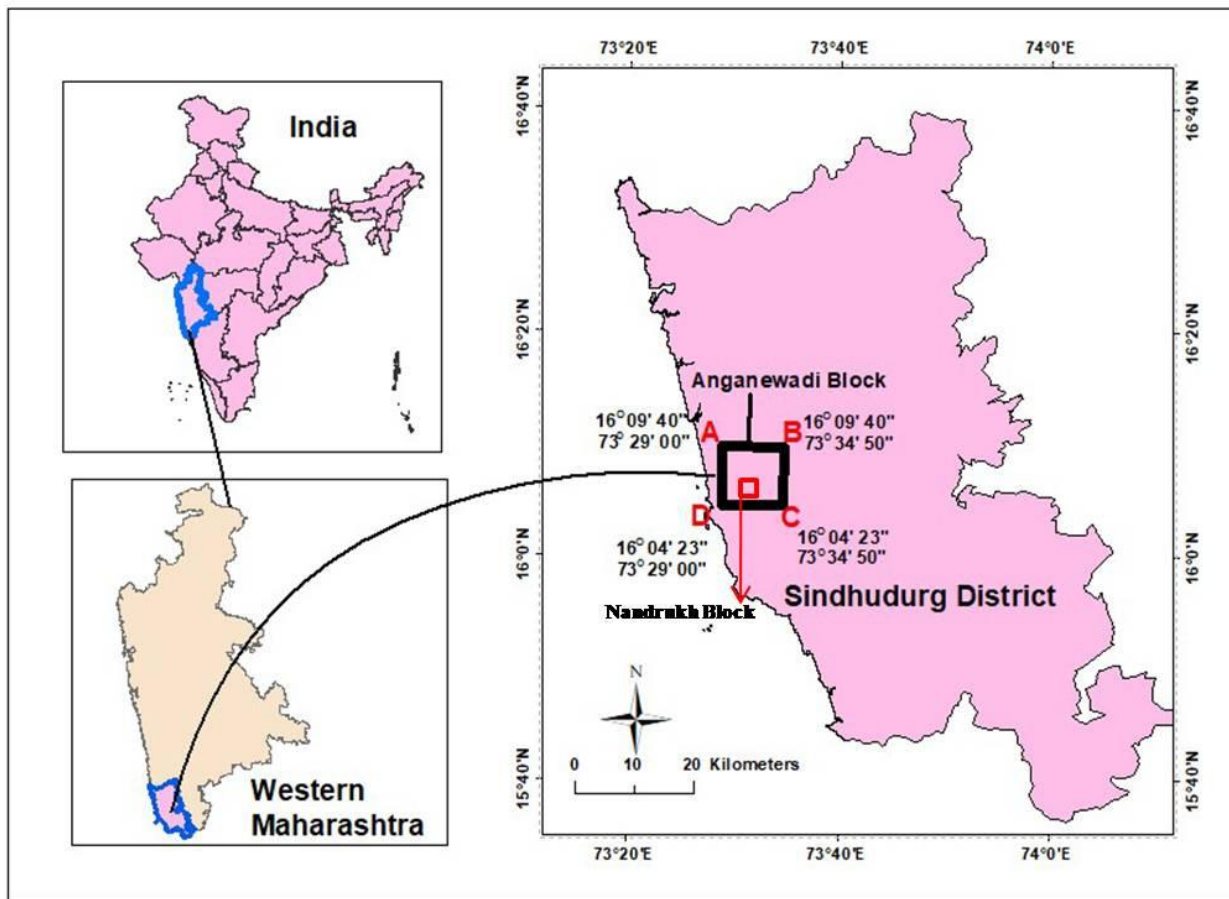


Fig1: Location map of Nandruk block, Sindhudurg District, Maharashtra

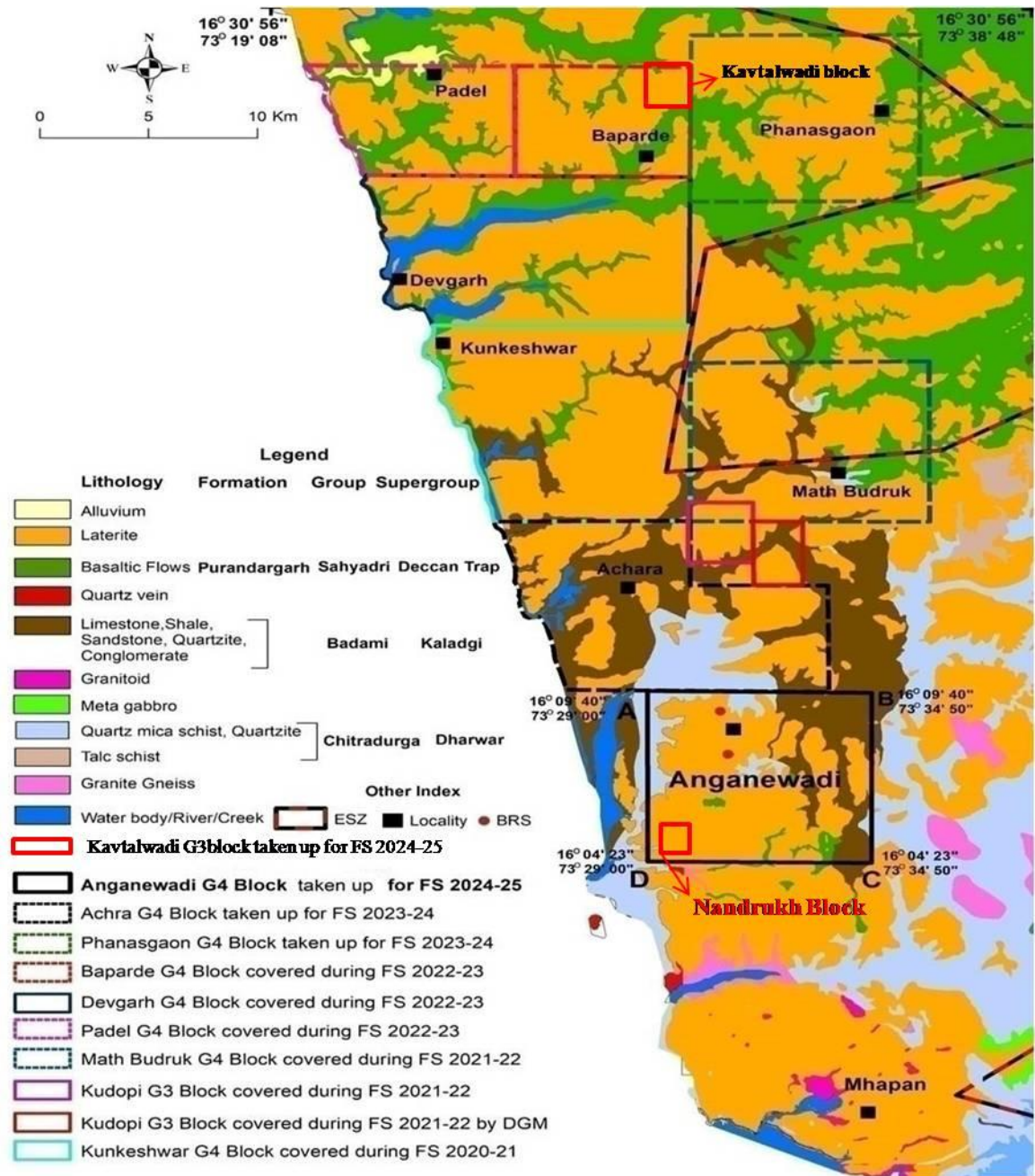


Fig.2. Regional Geological map shows different block along with Nandrukh Block

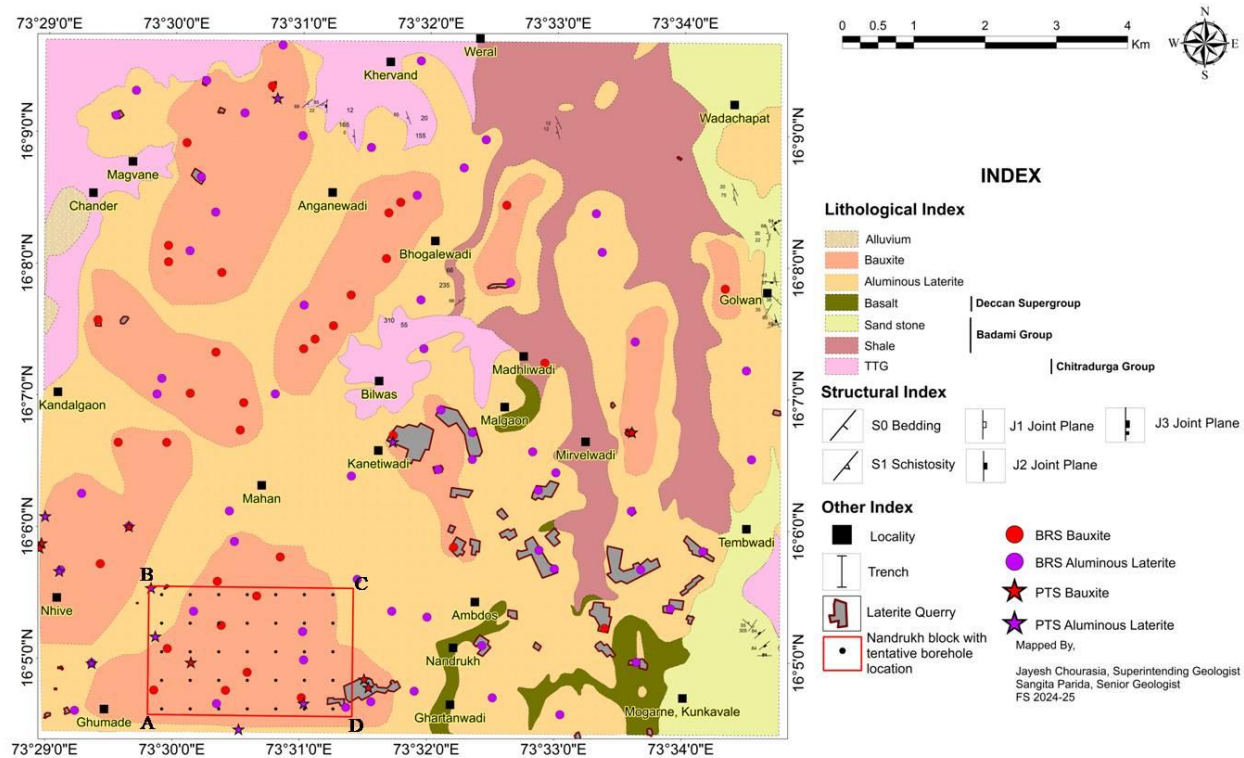


Figure.3 Large Scale Geological Map of Anganewadi area showing Nandrukh Block with tentative borehole location

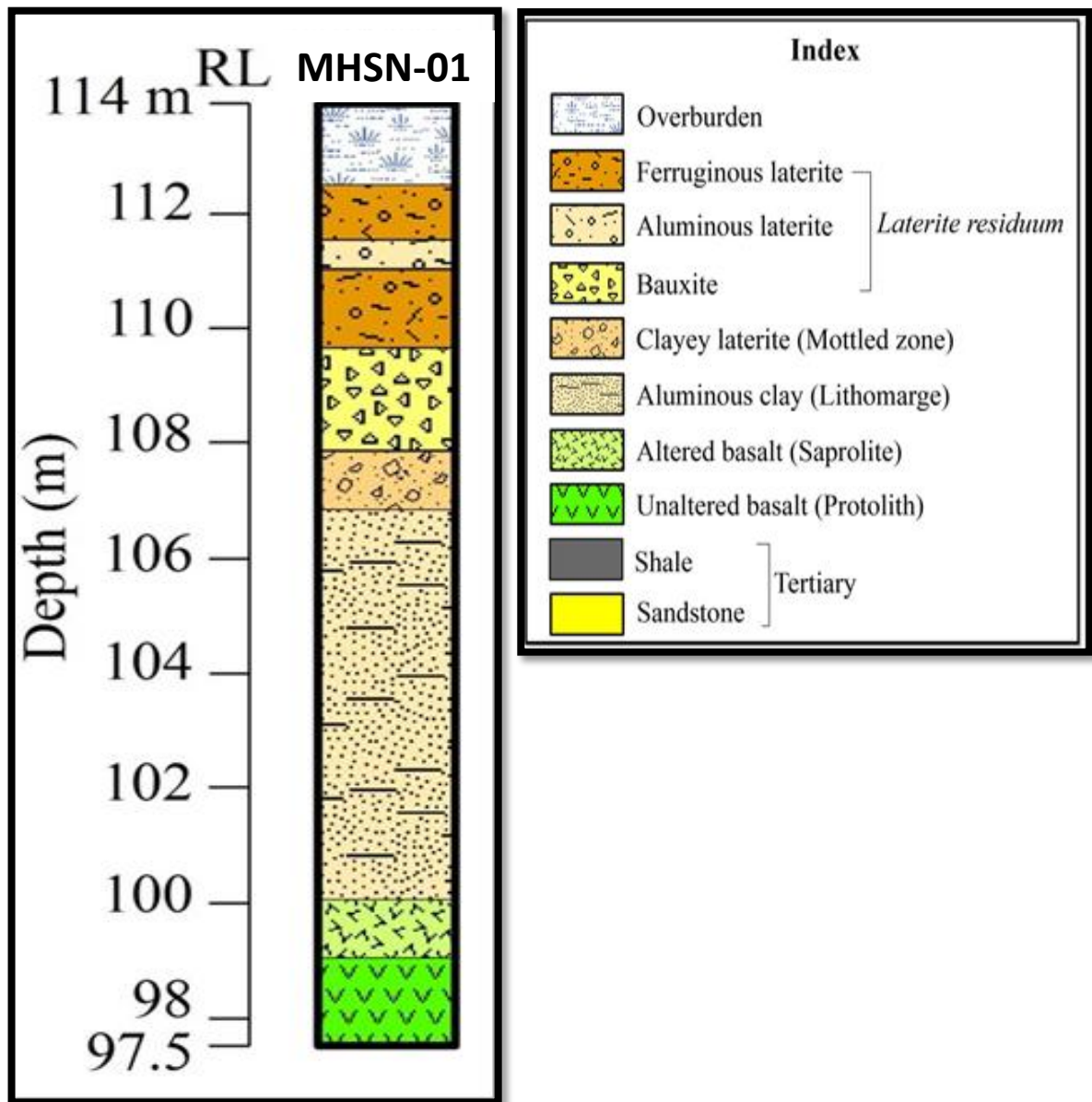


Fig 4. Graphic lithology of proposed borehole MHSN/01, Nandruk Block, Sindhudurg District, Maharashtra.