GEOLOGICAL REPORT ON RECONNAISSANCE SURVEY (G4) FOR BAUXITE, Ga, V, Ti & REE IN NADAPA AREA (6.20 Sq. Km) KACHCHH DISTRICT, GUJARAT

(Under NMEDT Programme)

TEXT, ANNEXURE AND PLATES

CRITICAL MINERAL TRACKERS

(NOTIFIED PRIVATE EXPLORATION AGENCY)

March – 2026

Register office: CRITICAL MINERAL TRACKERS, 306, Concourse Building, Ameerpet, Hyderabad, Telangana - 500016.

CERTIFICATION

This is to certify that geological report has been prepared in respect of Reconnaissance Survey (G-4) for Bauxite, Ga, V, Ti and REE in NADAPA AREA, District Kachchh, State: Gujarat by Critical Mineral Tackers (CMT), Hyderabad on behalf of National Mineral Exploration Trust (NMET). The report has been prepared in accordance with the Minerals (Evidence of Mineral Contents) Rule 2015 specified under Mineral Auction Rule, 2015 and amended up to 2021.

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CHAPTER - I

सारांश

नडापा क्षेत्र, जिला कच्छ, गुजरात में 6.20 वर्ग किमी क्षेत्रफल में, टोपोशीट संख्या 41E/15 के अंतर्गत, "नडापा क्षेत्र, जिला कच्छ, गुजरात में बॉक्साइट, Ga, V, Ti एवं REE के लिए पुनर्सर्वेक्षण (G4)" शीर्षक NMEDT परियोजना के अंतर्गत सर्वेक्षण कार्य संपन्न किया गया। यह परियोजना NMEDT कार्यक्रम के अंतर्गत Critical Mineral Trackers Pvt. Limited को फाइल सं. 23/569/2025-NMET/849 दिनांक 10 फरवरी 2025 द्वारा प्रदान की गई। तत्पश्चात संशोधित आदेश फाइल सं. 23/570/2025-NMET/901 दिनांक 24 फरवरी 2025 द्वारा Critical Mineral Trackers (An NPEA Company) के नाम जारी किया गया। Critical Mineral Trackers द्वारा 14 फरवरी 2025 से 30 अप्रैल 2025 के बीच 1:12,500 मापनी पर विस्तृत भू-वैज्ञानिक मानचित्रण, गड्ढा (Pitting) एवं ट्रेंचिंग कार्य संपन्न किए गए।

नडापा क्षेत्र 6.20 वर्ग किमी में विस्तृत है और यह सर्वे ऑफ इंडिया टोपोशीट संख्या 41E/15 में स्थित है। यह 23.31999°N से 23.34371°N अक्षांश तथा 69.89864°E से 69.93013°E देशांतर के मध्य स्थित है। यह प्रशासनिक रूप से भुज तहसील, जिला कच्छ, गुजरात के अंतर्गत आता है। क्षेत्र की ऊँचाई लगभग 112 मीटर से 146 मीटर के मध्य है (DGPS सर्वेक्षण के अनुसार)।

कार्डिनल बिंदु	डिग्री दशमलव में भौगोलिक निर्देशांक प्रणाली (डब्ल्यूजीएस 1984)		यूटीएम निर्देशांक (डब्ल्यूजीएस 1984-जोन 42 उत्तर)			क्षेत्रफल (वर्ग किमी))
	अक्षांश	देशांतर	ऊँचाई (मी)	नाथिंग (मी)	पूरब (मी)	
A	23.33271300	69.90214122	112.601	2580639.366	592227.296	6.20
B	23.32067572	69.89864439	146.246	2579304.447	591818.067	
C	23.31999622	69.93013017	136.272	2579249.557	595097.873	
D	23.34371217	69.92674692	136.913	2581873.036	594735.121	

यह क्षेत्र सड़क एवं रेल मार्ग से सुगम है। यह 8 किमी लंबे संपर्क मार्ग द्वारा भुज–भचाऊ राज्य राजमार्ग (SH-42) से जुड़ा है। SH-42 आगे चलकर कुकमा के समीप (लगभग 17 किमी पश्चिम) राष्ट्रीय राजमार्ग 341 (अंजार–भुज मार्ग) से जुड़ता है। निकटतम रेलवे स्टेशन रतनाल है, जो लगभग 18 किमी दक्षिण में गांधिधाम–भुज रेलवे लाइन पर स्थित है। भुज हवाई अड्डा लगभग 40 किमी दूरी पर स्थित है।

6.20 वर्ग किमी क्षेत्र में G4 स्तर का अन्वेषण बॉक्साइट एवं संबंधित महत्वपूर्ण खनिजों (Ga, V, Ti एवं REE) की संभाव्यता के मूल्यांकन हेतु किया गया। 1:12,500 मापनी पर किए गए भूवैज्ञानिक मानचित्रण से स्पष्ट हुआ कि क्षेत्र में केवल दो शैल-इकाइयाँ उपस्थित हैं:

- पुरानी कट्रोल संरचना (Late Jurassic से Early Cretaceous)
- युवा भुज संरचना (Early Cretaceous)

अध्ययन क्षेत्र का लगभग 3/4 भाग भुज संरचना से आच्छादित है।

यह संरचना मुख्यतः उत्तरी भाग के पेडीप्लेन क्षेत्र में पाई जाती है। इसमें गुलाबी-भूरे कठोर लौहयुक्त बलुआ पत्थर, पीले-सफेद सिल्टस्टोन, पीले-भूरे अभ्रकीय शेल तथा पीले से गुलाबी कैल्केरियस बलुआ पत्थर सम्मिलित हैं। ये बलुआ पत्थर सामान्यतः कैल्केरियस एवं फेल्सपैथिक प्रकृति के होते हैं।

इनमें मैक्रो जीवाश्मों का अभाव है तथा लेंसाकार स्तरण, रिप्पल मार्क्स एवं मड क्रैक्स जैसे अवसादी लक्षण मिलते हैं, जो उथले समुद्री निक्षेपण वातावरण का संकेत देते हैं।

भुज संरचना कट्रोल संरचना के ऊपर स्थित है और मुख्यतः दक्षिणी भाग में पाई जाती है। यह मध्य भाग में रिज एवं पेडीमेंट रूप में प्रदर्शित होती है। इसमें शीर्ष पर कठोर लौहयुक्त ग्रिट्टी फेल्सपैथिक बलुआ पत्थर, उसके नीचे भूरे शेल, सिल्टस्टोन, भुरभुरे मृत्तिका युक्त बलुआ पत्थर तथा चिकनी मिट्टी की परतें/लेंस पाए जाते हैं।

सिल्टस्टोन एवं चिकनी मिट्टी की परतों में पादप जीवाश्म पाए गए हैं। क्रॉस-बेडिंग, रिप्पल मार्क्स एवं बुरोज जैसे प्राथमिक अवसादी संरचनाएँ यह दर्शाती हैं कि भुज संरचना का निक्षेपण नदीय से डेल्टाई वातावरण में हुआ।

दोनों संरचनाओं में N80°E–S80°W की क्षेत्रीय संरचनात्मक प्रवृत्ति पाई जाती है तथा परतों का झुकाव सामान्यतः 5° से 10° दक्षिण एवं दक्षिण-पूर्व दिशा में है।

विस्तृत मानचित्रण के पश्चात अप्रैल 2025 में 20 गड्ढे (1×1×1 मी., कुल 20 घन मी.) एवं 5 ट्रेंच (10×1×1 मी., कुल 50 घन मी.) JCB मशीन द्वारा खोदे गए। गड्ढों से 20 तथा ट्रेंच से 50 प्रतिनिधि नमूने एकत्र किए गए। कुल 90 नमूनों का प्रमुख ऑक्साइडों हेतु तथा 15 नमूनों का REE हेतु विश्लेषण Lucid Laboratories Pvt. Ltd., हैदराबाद में किया गया। विश्लेषणात्मक परिणामों से स्पष्ट हुआ कि कट्रोल एवं भुज दोनों संरचनाओं में लक्षित तत्वों की सांद्रता समान रूप से निम्न है।

कट्रोल संरचना में:

- Al_2O_3: 0.28–28.81%
- SiO_2: 54.92–73.26%
- TiO_2: 0.39–1.34%
- Ga: 16.33–21.05 ppm
- V: 33.80–103.80 ppm
- कुल REE: 241.65–350.72 ppm
- कुल REE+(Sc+Y): 271.08–381.77 ppm

भुज संरचना में:

- Al_2O_3: 4.83–34.89%
- SiO_2: 44.74–77.97%
- TiO_2: 0.52–2.02%
- Ga: 9.58–31.58 ppm
- V: 15.70–299.18 ppm
- कुल REE: 157.58–338.76 ppm
- कुल REE+(Sc+Y): 176.86–375.99 ppm

लिथोलॉजिकल रूप से ये संरचनाएँ क्लास्टिक अवसादी अनुक्रम हैं। इनमें लैटराइटिक प्रोफाइल, एल्यूमिनस समृद्धि क्षेत्र एवं अनुकूल अपक्षय परिस्थितियों का अभाव है, जो आर्थिक बॉक्साइट निक्षेपों के निर्माण एवं संरक्षण हेतु आवश्यक होते हैं।

पड़ोसी क्षेत्रों में बॉक्साइट खनिजीकरण मातानोमाध संरचना से संबद्ध है, जो इस अध्ययन क्षेत्र में पूर्णतः अनुपस्थित है।

G4 स्तर के अन्वेषण कार्यक्रम से स्पष्ट है कि नडापा क्षेत्र में लैटरिटाइजेशन एवं बॉक्सिटाइजेशन के संकेत अनुपस्थित हैं। सतही एवं उपसतही स्तर पर किसी भी प्रकार की एल्यूमिनस समृद्धि नहीं पाई गई। भू-रासायनिक मान आर्थिक सीमा से निम्न हैं। साथ ही, बॉक्साइट के प्रमुख अधिष्ठान मातानोमाध संरचना का अभाव है।

समेकित भूवैज्ञानिक, संरचनात्मक, उपसतही एवं भू-रासायनिक मूल्यांकन के आधार पर नडापा ब्लॉक में बॉक्साइट अथवा संबंधित महत्वपूर्ण खनिज (Ga, V, Ti, REE) की संभाव्यता नहीं पाई गई।

अतः इस क्षेत्र को अप्रत्याशित (non-prospective) घोषित किया जाता है तथा वर्तमान चरण में आगे किसी अन्वेषण की अनुशंसा नहीं की जाती।

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SUMMARY

Reconnaissance survey of 6.20 sq. km area falling under toposheet number 41E/15 was carried out in Nadapa Area, Kachchh district, Gujarat, as part of the NMEDT project entitled ***"Reconnaissance survey (G4) for Bauxite, Ga, V, Ti & REE in Nadapa area, Kachchh district, Gujarat".*** The project was awarded to Critical Mineral Trackers Pvt Limited under the NMEDT Programme vide File no. 23/569/2025-NMET/849 dated 10th February ,2025 and corrected version in the name of Critical Mineral Trackers (An NPEA company) was issued subsequently vide File no: 23/570/2025-NMET/901 dated 24th February, 2025. Critical Mineral Trackers completed large scale mapping on 1:12500 scale, pitting & trenching works in this area between 14th Feb 2025 to 30th April 2025.

NADAPA Area admeasuring an area of 6.20 sq. km is falling under the Survey of India Toposheet No 41E/15 and bounded by latitudes 23.31999°N to 23.34371 N and longitudes 69.89864°E to 69.93013°E, lies under the administrative boundary of Bhuj tehsil, Kachchh district of Gujarat.

Coordinates & elevation of cardinal points of Nadapa Area,

District: Kachchh, Gujarat (as determined by DGPS Survey)

Cardinal Points	Geographic Coordinate System in Degree Decimal (WGS 1984)		UTM (WGS 1984, Zone 42N)			Area (Sq. Km)
	Latitude(N)	Longitude(E)	Elevation (m)	Northing (m)	Easting (m)	
A	23.33271300	69.90214122	112.601	2580639.366	592227.296	6.20
B	23.32067572	69.89864439	146.246	2579304.447	591818.067	
C	23.31999622	69.93013017	136.272	2579249.557	595097.873	
D	23.34371217	69.92674692	136.913	2581873.036	594735.121	

The study area has good road and rail connectivity. It is linked to the Bhuj–Bhachau State Highway (SH-42) via an 8 km approach road. SH-42 further connects to National Highway 341(Anjar- Bhuj highway) near Kukma, 17 km to the west. The nearest railway station is Ratnal, located 18 km towards south on the Gandhidham–Bhuj line of the Western Railway. Bhuj Airport is also accessible, situated about 40 km from the block.

The G4 exploration carried out over 6.20 sq. km in the Nadapa area, Kachchh district, aimed to assess the potential for bauxite and associated critical minerals (Ga, V, Ti and REE). Geological mapping on a 1:12500 scale established the presence of only two litho-units older Katrol Formation (late Jurassic to early cretaceous) and younger Bhuj Formation (early cretaceous). Bhuj formation occupies 3/4th of the study area

The Katrol Formation is occupied by Pediplain area towards north and comprises predominantly of pinkish brown hard ferruginous sandstone, yellowish-white siltstones, yellowish-brown micaceous shales, and yellowish to pinkish calcareous sandstones. The sandstones are typically calcareous and often feldspathic. These units generally lack macrofossils, and shows lenticular bedding, Ripple marks and Mud cracks. These features indicate deposition was under shallow marine environment.

The Bhuj Formation overlies the Katrol Formation and occurs predominantly toward the south side. They are represented by ridge & pediment in the central part and covered by rock outcrops and thorny bushes. They are composed of hard, resistant ferruginous gritty feldspathic sand stone on the top followed by brown shales, siltstones, friable argillaceous sandstones often micaceous and clay beds/lenses. Siltstones and clay beds contain plant fossils. The observed lithological variability, together with well-preserved primary sedimentary structures such as cross-bedding, ripple marks, burrows indicates that the Bhuj Formation was deposited in a fluvial to deltaic depositional environment.

Both formations exhibit a regional structural trend of N80°E–S80°W, with local variations in NE–SW orientation. The strata generally dip 5° to 10° towards the south and southeast.

After completion of large-scale mapping, Pitting and trenching was carried out in April,2025 and excavated 20 pits of 1*1*1m size (Total 20Cu.m) and 5 trenches of 10*1*1m size (50Cu.m) using JCB and collected 20 representative samples from pits and 50 samples from trenches. All 90 samples were analyzed for major oxides and 15 samples for REE at Lucid Laboratories Pvt Ltd, Hyderabad.

The analytical results indicate uniformly low concentration of targeted elements in both Katrol and Bhuj formations.

In Katrol formation, Al2O3 values varies from 0.28 to 28.81%, SiO2 (54.92-73.26%,) TiO2(0.39-1.34%), Gallium (16.33-21.05ppm) ,Vanadium (33.80-103.80 ppm) Total REE (241.65-350.72ppm) and TREE+(Sc+Y):271.08-381.77ppm, whereas in Bhuj formation also the concentration of Al2O3 ranges from 4.83-34.89%, SiO2 (44.74-77.97%), TiO2 (0.52-2.02%),Gallium (9.58-31.58ppm),Vanadium (15.70-299.18) , Total REE(157.58-338.76ppm) and TREE+(Sc+Y):176.86-375.99ppm.

Lithologically, these formations represent clastic sedimentary sequences. Such litho-units lack the lateritic profiles, aluminous enrichment zones, and favorable weathering conditions required for the formation and preservation of economic bauxite deposits. In contrast, neighboring bauxite bearing regions are associated with the Matanomadh Formation, which hosts lateritic bauxite horizons. This formation is completely absent within the study area.

The G4 exploration program in the Nadapa area indicates absence of lateritisation and bauxitisation signatures. No surface or subsurface indication of aluminous enrichment are found within the study area. Geochemical values are below economic threshold levels. Absence of the Matanomadh Formation, the principal host of bauxite in adjoining areas.

Based on the integrated geological, structural, subsurface, and geochemical evaluation, the Nadapa block does not exhibit potential for bauxite or associated critical mineral (Ga, V, Ti, REE) mineralization.

The area is therefore considered non-prospective, and no further exploration is recommended at this stage.

CHAPTER – II

2.0 INTRODUCTION

The Bhuj–Kachchh region of Gujarat hosts lateritic and sedimentary bauxite deposits within the Matanomadh-Bhuj stratigraphic intervals. Published studies and exploration results indicate that such bauxite–laterite systems are globally significant hosts of strategic trace elements including gallium (Ga), rare-earth elements (REE) and in specific mineral phases, vanadium (V) and titanium (Ti). Given the strategic importance of these commodities and the potential for low-cost identification of enriched horizons, a G4 reconnaissance stage is both necessary and justified.

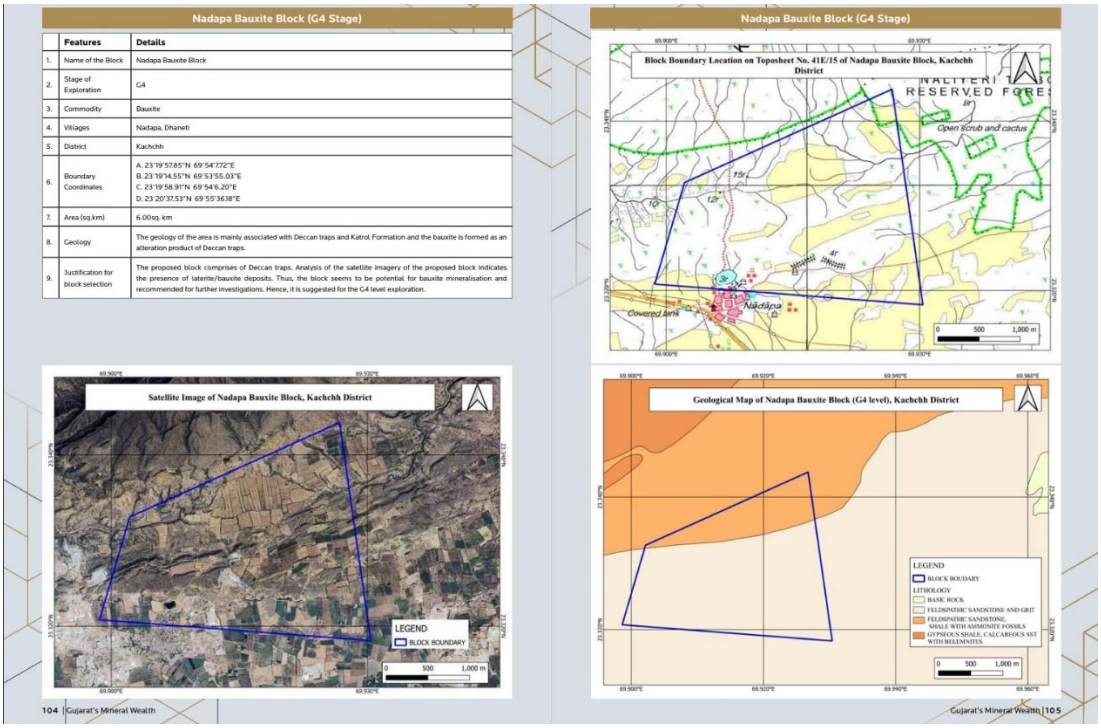
The bauxite occurrences of the Bhuj region are developed as lateritic caps and ferricrete horizons overlying Cretaceous–Paleogene sedimentary formations. Lateritic bauxite systems are known to enrich Gallium (Ga) within gibbsite/boehmite phases, while REE enrichment commonly occurs in Fe–Mn oxides, clay-rich basal zones or accessory minerals such as monazite/xenotime. Vanadium(V) and Titanium (TiO_2) may concentrate in heavy-mineral fractions (ilmenite, anatase) or Fe-rich profiles. The region's extensive low-grade bauxite makes it a suitable target for reconnaissance-level resource screening.

Considering important parameters such as resource/ reserve position in the country, production, import dependency, use for future technology/ clean energy, requirement of fertilizer minerals in an agrarian economy, the Committee has identified a set of 30 critical minerals. These are Antimony, Beryllium, Bismuth, Cobalt, Copper, **Gallium**, Germanium, Graphite, Hafnium, Indium, Lithium, Molybdenum, Niobium, Nickel, PGE, Phosphorous, Potash, **REE**, Rhenium, Silicon, Strontium, Tantalum, Tellurium, Tin, **Titanium**, Tungsten, **Vanadium**, Zirconium, Selenium and Cadmium. (Critical Minerals for India, Report of the Committee on Identification of Critical Minerals, Ministry of Mines, June 2023)

Keeping in view that Gallium, Vanadium, Titanium and REE being a listed critical mineral, the present exploration program may be justified for the above minerals, besides bauxite/laterite.

The Commissioner of Geology & Mining (CGM), Gandhinagar, Gujarat organized one day workshop titled "Gujarat Mineral Wealth: A responsible exploration and development Paradigm" on 17th August, 2024.Critical Mineral Trackers (CMT), an NPEA (Notified private exploration agency) company from Hyderabad had participated in this workshop and expressed interest in certain blocks for exploration. Accordingly, The CGM has granted" ***No objection certificate*** for "Reconnaissance (G4) survey for bauxite exploration in NADAPA Area, Kachchh district, Gujarat to Critical mineral trackers vide email dated 11th November,2024. The block boundary coordinates with geology, structure and justification for taking up this block were provided by the CGM, Gandhinagar, Gujarat & given in **Fig No:1**

Details of block boundary, geology, structure, satellite image and justification provided by CGM (Commissioner of Geology and Mining), Gujarat.



Nadapa Bauxite Block (G4 Stage)

	Features	Details
1.	Name of the Block	Nadapa Bauxite Block
2.	Stage of Exploration	G4
3.	Commodity	Bauxite
4.	Villages	Nadapa, Dhaneti
5.	District	Kachchh
6.	Boundary Coordinates	A. 23°19'57.65"N 69°54'7.72"E B. 23°19'14.55"N 69°53'55.03"E C. 23°19'58.91"N 69°54'6.20"E D. 23°20'37.53"N 69°55'3638"E
7.	Area (sq.km)	6.00sq. km
8.	Geology	The geology of the area is mainly associated with Deccan traps and Katrol Formation and the bauxite is formed as an alteration product of Deccan traps.
9.	Justification for block selection	The proposed block comprises of Deccan traps. Analysis of the satellite imagery of the proposed block indicates the presence of laterite/bauxite deposits. Thus, the block seems to be potential for bauxite mineralisation and recommended for further investigations. Hence, it is suggested for the G4 level exploration.

Nadapa Bauxite Block (G4 Stage)

Block Boundary Location on Toposheet No. 41E/15 of Nadapa Bauxite Block, Kachchh District

Satellite Image of Nadapa Bauxite Block, Kachchh District

Geological Map of Nadapa Bauxite Block (G4 level), Kachchh District

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Fig No: 1

In the outset, CMT has conducted a few field traverses in Nadapa block during 3rd week of November,2024 and collected representative samples and analysed at Lucid laboratories Pvt Ltd, Hyderabad (NABL accredited). Subsequently CMT has prepared a proposal titled "Proposal for Bauxite exploration in NADAPA Block, Kachchh District, Gujarat State, Reconnaissance Survey (G4 Stage) under NMET falling under toposheet no; 41E/15, incorporated the analytical results of selected samples and submitted to The

Director, National Mineral Exploration Trust (NMET), Ministry of mines on 12th December, 2024 in the designated proforma for necessary sanction/approval. TCC-II, NMET has evaluated the proposal in 4th TCC-II meeting held on 26th &27th December ,2024 and opined that the area has potential for Ga, V, Ti and REE besides bauxite and accordingly the proposal was modified as ***"Reconnaissance Survey (G4) for Bauxite, Ga, V, Ti and REE in Nadapa area, Kachchh District, Gujarat*** and submitted to EC, NMET for approval.

The Executive Committee (EC), NMET approved the proposal in its 39th meeting held on 24th January ,2025 with an estimated cost of Rs 53,72,568/- and communicated to M/s Critical Mineral Trackers Pvt Limited vide file no: 23/569/2025-NMET/849 dated 10th February ,2025 and corrected version in the name of Critical Mineral Trackers was issued subsequently vide File no: 23/570/2025-NMET/901 dated 24th February, 2025.

Accordingly, Critical Mineral Trackers initiated field work on 14th Fenruary,2025 and completed large scale mapping in an area of 6.2Sq.km, pitting, trenching and sampling works by 30th April,2025. After completion of LSM and interpretation of analytical results of pit and trench samples (90 no's) as received from Lucid laboratories pvt limited, Hyderabad, review was done by 9th TCC-II on 29th May. During the review meeting, TCC-II did not recommend drilling work in this block since the values of Al203, Ga, V, Ti and REE are not encouraging and asked CMT to submit the report. Accordingly, CMT has prepared the geological report and submitted in March-2026

2.1 Details of project

"NADAPA Area" admeasuring an area of 6.20 sq. km is bounded by latitudes 23.31999°N to 23.34371 N and longitudes 69.89864°E to 69.93013°E, lies under the administrative boundary of Bhuj tehsil, Kachchh district of Gujarat. Bhuj is the nearest town and district head-quarter located 35 km towards west. Nadapa village lies at the southern boundary and partially within the study area. But within the block is accessible by cart tracks/ foot tracks by 4*4 vehicle. About 4 China clay processing plants are located within the block.

The Nadapa Area is falling under the Survey of India Toposheet No 41E/15. The coordinates of the cardinal points of the block boundary as determined by DGPS Survey are given below in Table No. 2.1

Table 2.1 Coordinates & elevation of cardinal points of Nadapa area, District: Kachchh, Gujarat (as determined by DGPS Survey)

Cardinal Points	Geographic Coordinate System in Degree Decimal (WGS 1984)		UTM (WGS 1984, Zone 42N)			Area (Sq. Km)
	Latitude(N)	Longitude(E)	Elevation (m)	Northing (m)	Easting (m)	
A	23.33271300	69.90214122	112.601	2580639.366	592227.296	6.20
B	23.32067572	69.89864439	146.246	2579304.447	591818.067	
C	23.31999622	69.93013017	136.272	2579249.557	595097.873	
D	23.34371217	69.92674692	136.913	2581873.036	594735.121	

2.2 Details of investigating agency are given in the following table 2.2

Table 2.2 Details of Exploration Agency

(a) Name:	**CRITICAL MINERAL TRACKERS** **(An NPEA company)** (Ministry of Mines, Govt. of India) HYDERABAD
(b) Address:	#306, Concourse Building, Opp Lal Bungalow, Ameerpet, Hyderabad, Pin Code – 500016. And CMT Geo Solution center, No E5, 3rd Floor, Technology Research Park, Indian Institute of Technology, Hyderabad, Kandi, Sanga Reddy – 502 284

(c) Contact Mobile No:	+914031531932
(d) E-Mail id:	criticalmineraltrackers@gmail.com director.ops@criticalmineraltrackers.co.in enquiry@criticalmineraltrackers.co.in
(e) Qualification:	Professionals with M.Sc. / MSc Tech (Geology) Qualification
(f) Experience:	Senior Professionals with experience +30 years and young geologists of 2 to 3years experience.
Date of Accreditation granted by QCI - NABET	May 20,2024
Date of Expiry of Accreditation	May 15,2027
Date of Notification Under the Proviso to section 4(1) of the MMDR Act	SONO 2379(E) 20.06.2024
Date of Expiry of Notification	19.06.2027
Category of the Exploration Agency (Category A Or B) under Notification	A

2.3 Objectives of investigation

Nadapa Area was proposed for G-4 level of exploration for Bauxite, Ga, V, Ti and REE. The exploration has been carried out as per Minerals (Evidence of Mineral contents) Amendment Rules,2021 to achieve the following objectives. To carry out Geological & Structural mapping on 1:12500 scale for identification of Bauxite, Ga, V, Ti & REE bearing formation (host rock) with the structural features to identify the surface manifestation and lateral disposition of the mineralized zones.

2.4 Basis for taking up investigation

As per the compilation of Commissioner of Geology and Mining (CGM), Gandhinagar on mineral resources of Gujarat, identified the NADAPA Area as a potential block for exploration of Bauxite and other associated minerals based on geology, Geophysics, geochemistry and satellite image studies. CGM has awarded this work to Critical mineral trackers (CMT). CMT has undertaken pre-field work during 3rd week of November 2024 and analysed 3 samples for Bauxite &Titanium. The Al2O3 values varies from 17.01% to 40.91% but the respective SiO2(6.24-49.83% and Fe2O3(16.78-32.71%) values are high and TiO2 varies from 0.77 to 1.60%.CMT has prepared a proposal based on these results and submitted to NMET on 12th December .During the review of proposal, TCC-II has opined that this area may be potential for Gallium, Vanadium and REE besides bauxite during 4th TCC-II meeting held on 26th & 27th December,2024 and hence included them in the project for investigation.

2.5 Details of nature and quantum of work proposed vs achievement are given below:

Table 2.3: Summarized Table showing Component wise proposed quantum Vs. Quantum Achieved

Sl. No.	Item of Work	Unit	Target	Achievement
1	**Geological Mapping** (on 1:12,500 Scale)	Sq. km	6.20	6.20
2	**Exploratory Mining**			
a	Excavation of pits (20 nos), size: 1*1*1	Cu.m	20	20
	Pit samples collected	Nos	20	20
b	Excavation of Trenches (5 nos), Size 10*1*1	Cu.m	50	50
	Trench samples (14*5=70) collected	Nos	70	70
3	**DGPS survey (4 block boundary points & 4 Borehole points)**	points	8	4(boundary points only)
4	Scout drilling: 4 boreholes of 30m depth each (4*30=120m)	meters	120	Not recommended

Sl. No.	Item of Work	Unit	Target	Achievement
				drilling in the review meeting held on 29th May (9th TCC-II)
a	Construction of borehole pillar	nos	4	-do-
b	Compensation for 4 Bhs	nos	4	-do-
c	Drill core preservation in GI boxes	meters	120	-do-
5	**Laboratory Studies**			
	Major oxides by XRF (Trench-70, pit-20, BH-40 =130 + 13 check samples)	Nos	143	90+9check=99 (40 samples are earmarked for drill core samples)
	REE 14 Elements by ICPMS 33+ 3 check	Nos	36	15+1 check
6	Combined determination of THA, MHA a Reactive silica	Nos	4	1
7	Preparation of polished thin sections	Nos	10	3 *
8	Complete petrographic//ore2qw3456790-[21-microscopic / mineragraphic studies	`	10	3 *
9	XRD Mineral phase analysis	Nos	4	3
10	Report Preparation (5 Hard copies with a soft copy)	Nos.	1	5

2.6 Details of mode of operation of different work components

Table 2.4 Mode of operation of different work components and associated agency

Sr. No	Work component	Agency
1	Large scale Geological mapping (1:12,500 scale)	CMT (In house)
2	Pitting, trenching, sampling	CMT (In house)
3	DGPS Survey	CMT (In house)
4	Chemical Analysis	Lucid laboratories Pvt Ltd, Hyderabad (NABL accredited lab))
5	XRD and check sample analysis	Shiva Analyticals India Pvt Ltd, Bengaluru (NABL accredited lab)
6	Polished thin section & complete petrographic studies.	Petrology division, GSI,Southern Region Hyderabad

2.7 Table 2.5: Details of personnel associated with the exploration work of Nadapa area, District: Kachchh, Gujarat

1	**Overall Planning, Co-ordination & Overall supervision**	S.Uma maheswara rao, Principal investigator & Technical Area Expert S.Rama murthy, Technical area Expert
3	**Project management & Field Operation**	S.Uma maheswara rao Technical Area Expert
		V.Santhosh (Geologist) & TM
		B. Mahesh, (Geologist) & TM
5	**Chemical Laboratory**	LUCID Laboratories Private Limited, Hyderabad
		(NABL Accredited laboratory)
6	**Petrological Laboratory** **GSI, Hyderabad**	Dr. K. Krishnapriya Basak, Director, GSI, petrology division, southern region, Hyderabad
8	**Data Processing & Documentation**	S.Uma maheswara rao
		S. Rama Murthy
		Mr B. Mahesh (Geologist) & TM
		Mr. V. Siva Kumar (Geologist) & TM
9	**Reprography & Printing**	Mr. B. Mahesh (Geologist) & TM
		Mr. V. Siva Kumar (Geologist) & TM

CHAPTER – III

3.0 Property Description

3.1 Location

NADAPA Block admeasuring an area of 6.20 sq. km is bounded by latitudes 23.31999°N to 23.34371° N and longitudes 69.89864°E to 69.93013°E, lies under the administrative boundary of Bhuj tehsil, Kachchh district of Gujarat. Bhuj is the nearest town and district head-quarter located 35 km towards west. Nadapa village lies at the southern boundary and partially within the study area. About 4 china clay processing plants are located within the block. The location map of the block is furnished on Fig No-2 as well as Plate No-I.

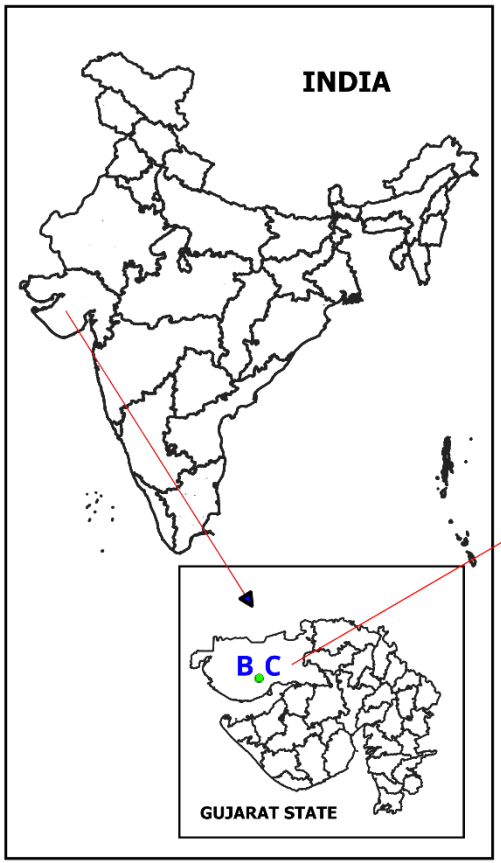
The Block is falling under the Survey of India Toposheet No 41E/15. The coordinates of the cardinal points of the block boundary and elevation as determined by DGPS survey are given below in Table No. 3.1 and also in Annexure No: 1

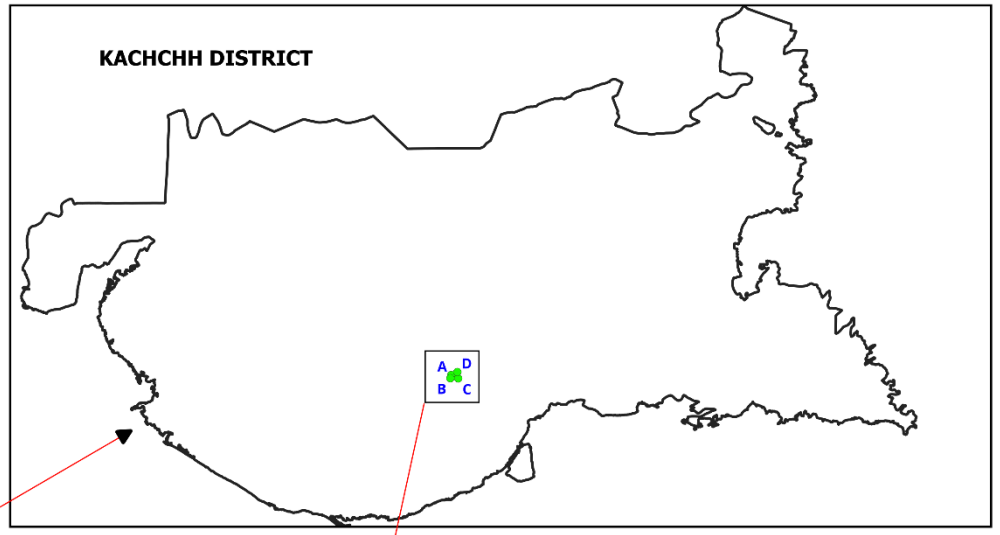
Table 3.1: Details of coordinates and elevation of 4 cardinal points and two temporary benchmarks as determined by DGPS Survey

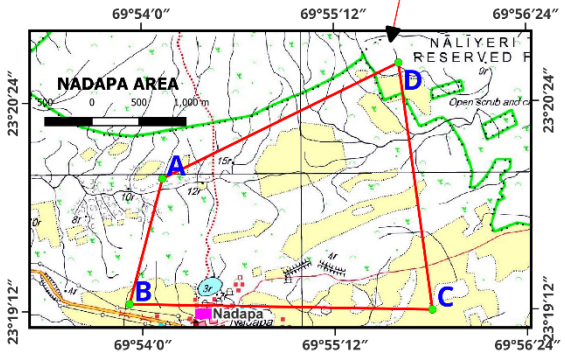
Cardinal Points	Geographic Coordinate System in Degree Decimal (WGS 1984)		UTM (WGS 1984, Zone 42N)			Area (Sq. Km)
	Latitude(N)	Longitude(E)	Elevation (m)	Northing (m)	Easting (m)	
A	23.33271300	69.90214122	112.601	2580639.366	592227.296	6.20
B	23.32067572	69.89864439	146.246	2579304.447	591818.067	
C	23.31999622	69.93013017	136.272	2579249.557	595097.873	
D	23.34371217	69.92674692	136.913	2581873.036	594735.121	
*TBM-1	23.32535850	69.90689125	163.132	2579828.157	592718.031	
*TBM-2	23.32518869	69.90710933	162.493	2579809.497	592740.447	

Note: *TBM-1 & 2: temporary bench marks established in the block

LOCATION MAP OF RECONNAISSANCE SURVEY (G4) FOR BAUXITE, Ga, V, Ti & REE IN NADAPA AREA, KACHCHH DISTRICT, GUJARAT







Nadapa Block			
Boundary Points	Coordinates		Area (sp.km)
	Latitude	Longitude	
A	23°19'57.7668"	69°54'07.7084"	6.20
B	23°19'14.4326"	69°53'55.1198"	
C	23°19'11.9864"	69°55'48.4686"	
D	23°20'37.3638"	69°55'36.2889"	

Fig No: 2

3.2 Accessibility

Nadapa block has good road and rail connectivity. It is linked to the Bhuj–Bachau State Highway (SH-42) via an 8 km approach road. SH-42 further connects to National Highway 341(Anjar-Bhuj highway) near Kukma, 17 km to the west. The nearest railway station is Ratnal, located 18 km towards south on the Gandhidham–Bhuj line of the Western Railway. Bhuj Airport is also accessible, situated about 40 km from the block but within the block, access is limited to cart tracks and foot tracks which are navigable using 4*4 vehicle.

3.3 Climate

Bhuj experiences an arid to semi-arid climate, characterised by hot summers, mild and pleasant winters, and scanty but concentrated monsoonal rainfall. The summer season extends from March to May, during which high temperatures are commonly recorded. The monsoon season begins in June and continues until September, contributing the major share of the annual rainfall. The winter season, from November to February, is generally cool, dry, and pleasant.

Maximum Temperature: 37.8ºC (April)*

Minimum Temperature: 13.1º C (January)*

Average annual Rainfall: 483.00mm (1994-2024) **

*As per IMD data from 1991-2021 from https://en.climate-data.org

** As per Gujarat state disaster management Authority, http://www.gsdma.org

3.4 Cadastral Details and Land Status

The block encompasses the Cadastral Survey Numbers falling within the revenue limits of Nadapa village (Toposheet No. 41 E/15). The land use pattern within the investigated area is predominantly characterized as Government Waste Land, Barren Rocky terrain, and Agricultural land. A significant portion of the area comprises fallow land utilized for seasonal grazing. There are four small China clay processing plants present within the study area

3.5 Land Use & Land Cover pattern

CMT has prepared a Land Use/Land Cover (LULC) map of the study area based on Google imagery tonal & textural characters and constitutes a part of Toposheet No. 41E/15. Individual land use/land cover units were digitised, classified, and appropriately labelled.

The majority of the area (55.4%) is occupied by barren land, represented by an east–west trending central ridge and the surrounding pediment areas, characterised by rocky outcrops and sparse vegetation dominated by thorny babul trees. Agricultural land (36.4%) includes both cultivated and fallow fields, where major crops such as castor, bajra, jowar, wheat, groundnut and vegetables are grown. A few patches of pomegranate plantation were also identified and classified under the plantation category. Nadapa Lake, located near the village, along with a small nala at the northern boundary, were mapped under the water-bodies category. Within the block, four China clay processing plants and a small portion of Nadapa village (northern part) were recorded and classified as habitations/infrastructure (7.4%). The residue generated from the China clay processing plants, after separation of the clay and glass-sand fractions, is being disposed of on the surrounding barren lands. Such waste dumps are observed near western part of the area. There is an area of 0.079Sq.km forest land located in the NE corner of the study area is falling under Naliyeri Timbo Reserved Forest. The Land Use/Land Cover map of the study area prepared by CMT falling in T.S. 41E/15, is provided in Fig. No. 3.

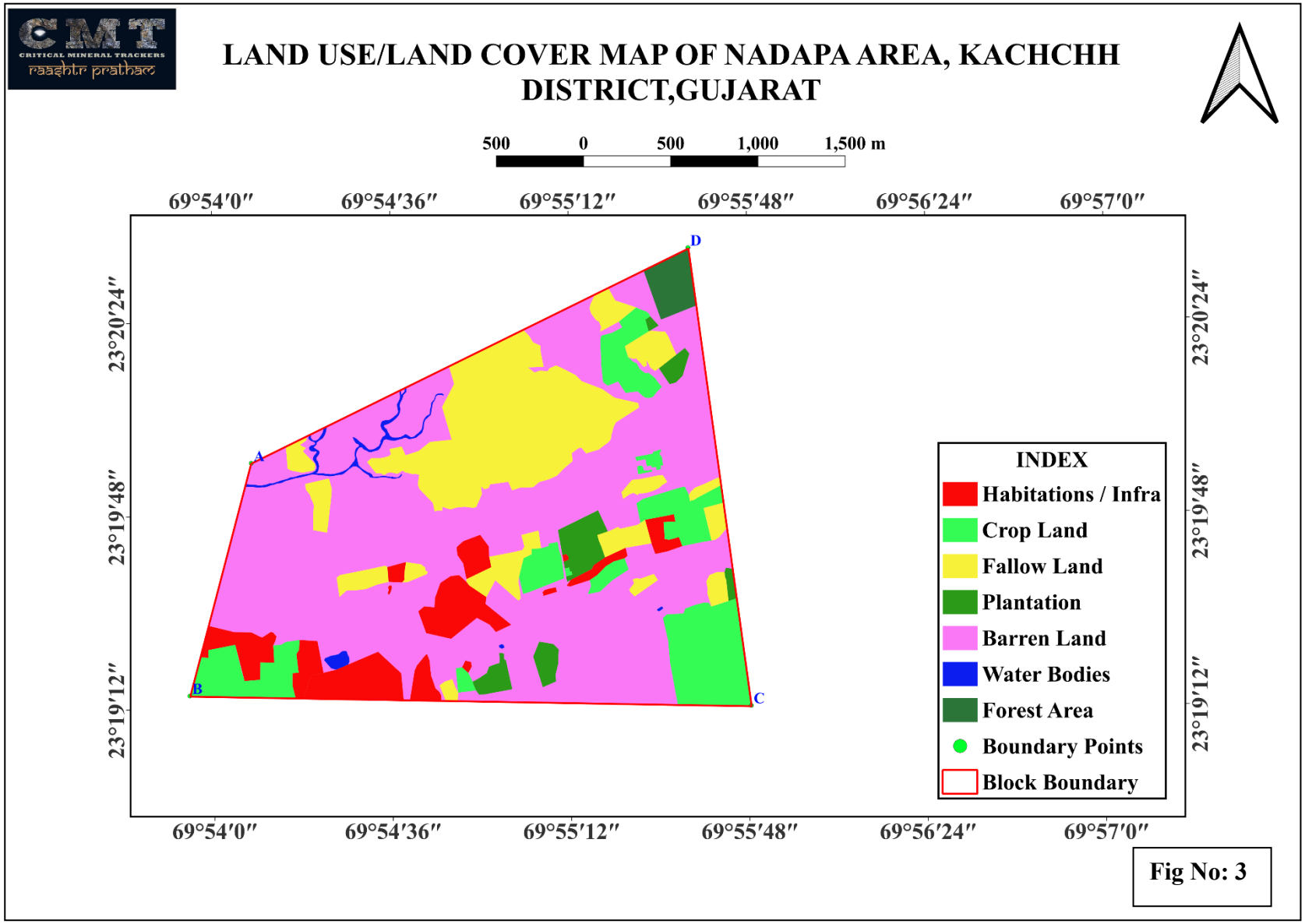

LAND USE/LAND COVER MAP OF NADAPA AREA, KACHCHH DISTRICT,GUJARAT
500 0 500 1,000 1,500 m
69°54′0″
69°54′36″
69°55′12″
69°55′48″
69°56′24″
69°57′0″
23°20′24″
23°19′48″
23°19′12″
A
B
C
D
INDEX
Habitations / Infra
Crop Land
Fallow Land
Plantation
Barren Land
Water Bodies
Forest Area
Boundary Points
Block Boundary

Fig No: 3

3.6 Forests, sanctuaries, national park and wild life sanctuaries

Nadapa area covers very small area of 0.079Sq.km under Naliyeri Timbo Reserved Forest in the north-eastern corner of the study area with a variety of trees and plants including neem, banyan, gulmohar, sal, babul, peepal and Aam(mango) The block doesn't have any sanctuaries, national park and wild life sanctuaries within 10km radius.

3.7 Flora and Fauna within and nearby

Bhuj lies within an arid to semi-arid climatic zone. Its proximity to the Great Rann of Kachchh in the north and the Arabian Sea in the south contributes to a distinct ecological diversity. The dry, hilly terrain supports characteristic vegetation such as peepal, imli, gugal, vad, babul, and various cactus species.

The region hosts a wide range of reptiles, mammals, and aquatic fauna. Common reptiles include the crocodile, spiny-tailed lizard, Kutch rock gecko, black cobra, sand boa, and python. Prominent mammals found in Bhuj and surrounding areas include nilgai, wild boar, chinkara, Indian wolf, and jackal. The Kutch region (Little Raan of Kutch) is also well known for sustaining a significant population of the Indian Wild Ass, a flagship species of the area.

3.8 Geomorphology

The study area is characterised by a central denudational ridge trending N80°E–S80°W, exhibiting a gentle slope towards the south and a steep slope towards the north. The maximum elevation along the ridge reaches approximately 166 m in the central–western part of the block, gradually decreasing to 142–147 m towards the south and 120–138 m towards the northern flank. The lowest elevation, around 114 m, occurs near the north-western boundary along the nala. Overall, the general slope of the terrain is towards the north and northwest. Central ridge and surrounding pediment areas are covered by rocky outcrops and Acacia trees & other thorny bushes. Agricultural activities are found in the Pediplain areas where crops like castor, bajra, jowar, wheat, groundnut and vegetables are grown. Topographic map of the study area is prepared from SRTM data and is given below in Fig no: 4 and enclosed at plate no: XI

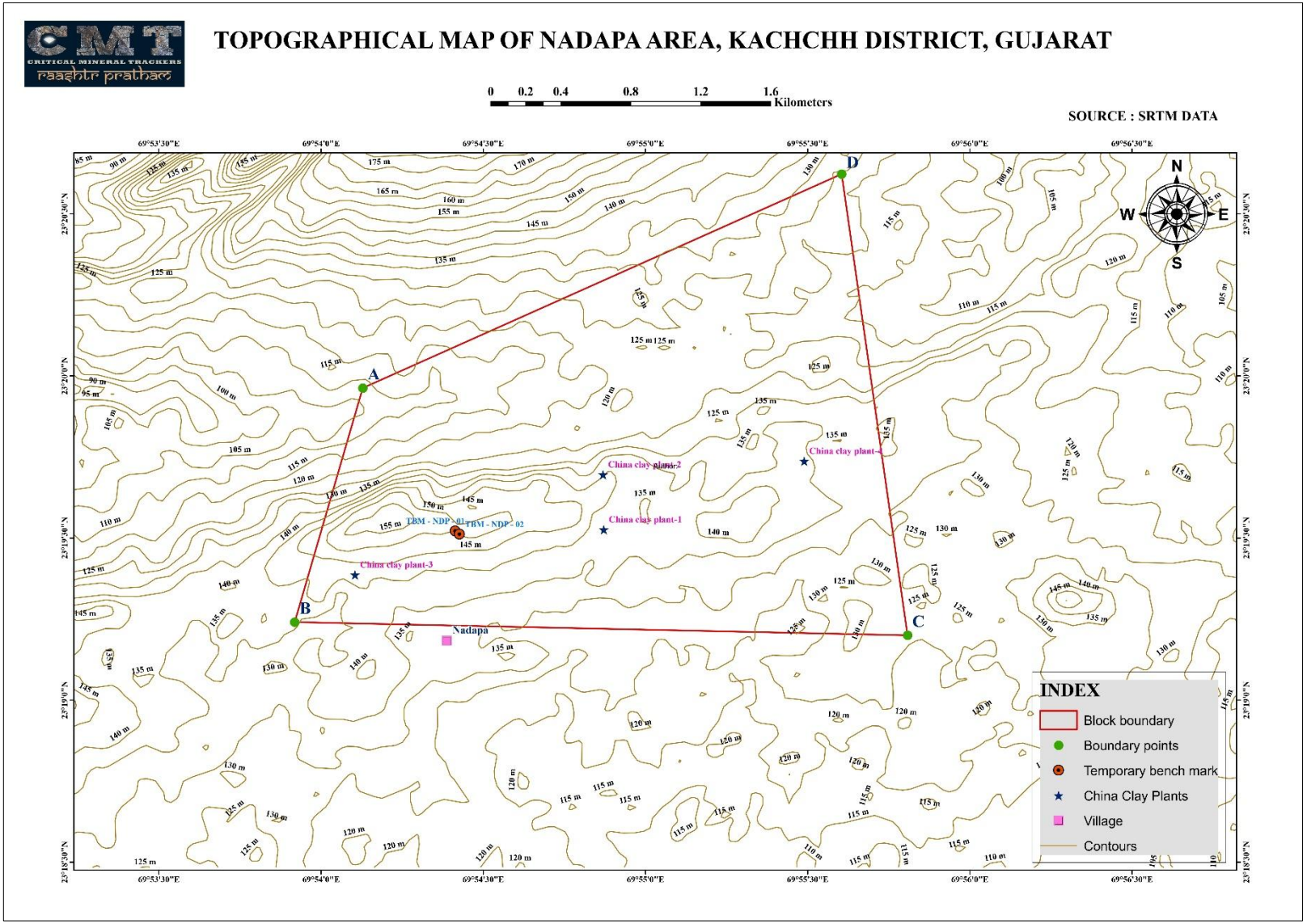

TOPOGRAPHICAL MAP OF NADAPA AREA, KACHCHH DISTRICT, GUJARAT
0 0.2 0.4 0.8 1.2 1.6
Kilometers
SOURCE : SRTM DATA
A
B
C
D
China clay plant-1
China clay plant-2
China clay plant-3
China clay plant-4
TBM - NDP - 01
TBM - NDP - 02
Nadapa
N
S
E
W
INDEX
Block boundary
Boundary points
Temporary bench mark
China Clay Plants
Village
Contours

Fig No: 4

3.9 Local infra structure:

Nadapa village is located at the southern boundary of study area. Bhuj is the nearest town and district head-quarter located 35 km towards west. Primary health centre facility is available near Dhaneti village located 8km south of Nadapa.

The Nadapa Area is well connected by road/rail and Air But within the block is accessible by cart tracks/ foot tracks by 4*4 vehicle.

Within the study area, four China clay processing plants are present. These units source China clay from external locations, crush and process the material, and separate it into clay and silica-sand fractions. The remaining residue is disposed of on the adjacent barren lands.

In addition, a cluster of China clay mines and processing plants is located approximately 3.5 km south of Nadapa village (outside the study area), on both sides of the link road connecting Nadapa to SH-42. These small clay mines are located along Gaj formation of Miocene age. Around 10 to 15 operational mines and plants are actively engaged in China clay mining and processing in this area. Prominent operators include:

1. Sandhya Minichem Industries
2. Shree Ram White Clay
3. Sarv Shakti China Clay
4. Kaolin India Pvt. Ltd.
5. Shree Ram Mintech Pvt. Ltd.
6. Shiv Mines
7. Gayatri Kaoline
8.. S.S. China Clay
9. Shree Ram Clay
10. Shree Ram Alumina Products
11. Purusharthi Minerals
12. Umia Minerals

The China clay (kaolinitic clay) produced from this region is widely utilised in ceramics, refractories, paints, pigments, paper, and other industrial applications, reflecting its economic importance.

3.10 Population

Nadapa is a medium size village located in Bhuj Taluka of Kachchh district, Gujarat with total 399 families residing. The Nadapa village has population of 1651 of which 822 are males while 829 are females as per Population Census 2011.

In Nadapa village population of children with age 0-6 is 309 which makes up 18.72 % of total population of village. Average Sex Ratio of Nadapa village is 1009 which is higher than Gujarat state average of 919. Child Sex Ratio for the Nadapa as per census is 1033, higher than Gujarat average of 890.

Nadapa village has lower literacy rate compared to Gujarat. In 2011, literacy rate of Nadapa village was 58.64 % compared to 78.03 % of Gujarat. In Nadapa Male literacy stands at 68.36 % while female literacy rate was 48.96 %. As per constitution of India and Panchyati Raaj Act, Nadapa village is administrated by Sarpanch (Head of Village) who is elected representative of village.

3.11 Socio Demographic profile

Kachchh district of Gujarat is the largest district in India, covering an area of 45,674 sq. km. As per the 2011 Census, the district had a total population of 20,92,371, comprising 10,96,737 males and 9,95,634 females, resulting in a sex ratio of 908 females per 1,000 males. The child sex ratio of the district stands at 921, which is comparatively higher than the overall sex ratio.

The district records a literacy rate of 70.6%. The population density is 46 persons per sq. km, significantly lower than the state average of 308 persons per sq. km, reflecting the sparsely populated nature of the region. About 34.82% of the population resides in urban areas, while the remaining 65.18% lives in rural regions.

The main language spoken in the Kachchh district kachchhi and Gujarati. Other languages are Hindi, Sindhi and Marwari.

3.12 Historical / Archaeological Site

There are no such historical/archaeological monuments present in the Nadapa Area.

CHAPTER – IV

4.0 PREVIOUS WORK

Ghevariya et al mapped the adjoining area of the Nadapa block and delineated Mesozoic rocks belonging to Chari (Jumara), Katrol (Jhuran) and Bhuj Formations. As per them, Deccan Trap is represented by interstratified volcano sedimentary sequence and lava flows; Tertiary Formations are represented by Madh, Mandaviya and Antarjal Formations and Quaternary is represented by grapestone and Miliolite limestone. B.K. Sahu et al mapped the area during 2004-2005 to study the structural set up, paleo seismicity and geomorphic changes due to 2001 Bhuj earthquake in the area, strip mapping along KMF with a width of 5 km was done for 300 Sq km on 1:25000 scale

Specialized Thematic Mapping of Inter- Trappean beds of Anjar Volcanics, in an around Anjar, Kachchh District, Gujarat, with Special Investigation on Sedimentology and Vertebrate Palaeontology was carried out by Shreya Basu et al during FS 2021-22. They too reported occurrence of laterite/bauxite in association with lithounits belonging to Matanomadh Formation and Anjar volcanics in the area.

The proposed Nadapa area was not explored previously for bauxite, gallium (Ga), vanadium (V), titanium (Ti), or rare-earth elements (REE) by any exploration Agency. But CGM, Gujarat has investigated in the neighbouring region near Kukma, by pitting, trenching & drilling and reported pocket type of bauxite deposit with an estimated resource of estimated 2342 tons. The results of the chemical analysis of samples show an average Al_2O_3 to be 51.29% and average SiO_2 to be 4.78%.

Geovale Services Pvt. Ltd (an NPEA company) obtained the original KGCMP dataset directly from CGM office and carried out a detailed interpretation. Their analysis revealed exceptionally high REE concentrations, with the maximum ∑LREE value of 37,959 ppm and ∑HREE value of 1,965 ppm, based on 182 stream-sediment samples collected within Survey of India Toposheet no 41E/12. These high-grade anomalies are predominantly located along the structurally disturbed Katrol Hill Fault zone and the Median High region located south of Bhuj town.

The geochemical anomalies and associated spatial patterns were presented by Geovale in the document titled “Proposal for REE Exploration in Bhuj Clay Prospect Block”,

submitted to the National Mineral Exploration Trust (NMET) in August 2023, may be forming a basis for subsequent G4-level exploration for REE in Kachchh area. This could be the reason for giving REE investigation in the present Nadapa area also.

Register office: CRITICAL MINERAL TRACKERS, 306, Concourse Building,
Ameerpet, Hyderabad, Telangana - 500016.

CHAPTER - V

5.0 GEOLOGY

5.1 Regional Geology

The proposed Nadapa block forms part of the Kachchh basin, which has been an important site for the deposition of Mesozoic and Cenozoic sediments. These rocks range in age from middle Jurassic to Pliocene. Mesozoics of Kachchh have attained significance on account of its rich fossil record of marine Jurassics in India and are bordered by deccan traps in the south and by saline marsh of the Rann of Kachchh, in the north. The Mesozoic sediments have been classified into Pachham formation of middle Jurassic, the Chari Formation of Middle to late Jurassic, the Katrol Formation of late Jurassic to early Cretaceous and the Bhuj Formation of early Cretaceous period by Waagen et al (1873) subsequently modified by Rajnath (1932), Biswas,ONGC (1971), Krishnan (1982) and Geariya et al,GSI (1984a,1984b) and Ghevariya and Srikarni,GSI (1991) from time to time. The general strike is East-West and with gentle to moderate dipping towards south. SE and SW. Regional geological map of Kachchh basin (part) is given in Fig no:5 and also enclosed on plate no: II.

Pachcham (Jhurio) formation: Pachham comprises of intercalated sequence of siltstone, shale, marl, claystone, Coralline limestone, calcareous sandstone, grey and pink limestone and attained 400m thickness.

Chari (Jumara) formation: Pachhham formation is overlain by rocks of Chari formation. Chari formation is exposed as inliers and lenses along the axis of east-west trending domal anticline ridge (South of Main land fault). They comprise of 350m thick sequence of fossiliferous shale, golden Oolite, fossiliferous limestone, calcareous sandstone, calc and ferruginous nodules

Katrol Formation: Chari formations are overlain by about 400m thick intercalated sequence of gypseous shale with repeated sequence of calcareous sandstone and shales, constituting the Katrol formation.

Bhuj Formation: Bhuj formation conformably overlies the rocks of Katrol and comprises of friable feldspathic, ferruginous sandstone showing graded bedding, cross-bedding, ironstone, clays with many upper Gondwana plant fossils. They have attained

a maximum thickness of 1000m in the western mainland Kachchh. They are further divided into Lower & Upper member based on lithology & fossil content.

Deccan Trap: The rocks of Bhuj formation are overlain by Deccan lava flows. Deccan trap is restricted to Kachchh mainland bordering Mesozoic highlands extending from Lakhpat in the west to Anjar in the east. Six major flows have been recorded from late cretaceous to Palaeocene age near Anjar. Several inter-trappean beds are recorded interstratified with deccan lava flows (Ghevariya &Srikarni, GSI,1987,1990) in Anjar. They attained maximum width of 10km near Anjar and tapering westward. The hard and compact, Deccan trap are be being quarried for road metal in the area near Kukma, Ratnal, Syedpur and Anjar.

Matanomadh Formation: The laterites of the region occur as a narrow, elongated belt running parallel to the Tertiary formations, situated between the underlying Deccan Trap basalts and the overlying younger Tertiary rocks. They are the product of in-situ decomposition of pyroclastic material generated during the Deccan volcanic episode (Shasrabudhe,GSI), which led to the geochemical segregation of silica, alumina, and iron. The laterite horizon is generally 3–4 m thick and consists of porous, pitted, clayey material displaying red, yellow, brown, grey, and mottled colour variations, with considerable textural diversity (P. K. Patel,CGM,Gujarat).

Khari Nadi Formation: Khari Nadi formation overlies the Matanomadh formation and composed of khaki colour gypseous clay with hard marl bands packed with fossils and belongs to oligo-Miocene age.

Gaj Formation: It occurs as an elongated, narrow patch between older Bhuj formation on the north side and younger Sandhan formation on the south. Gaj formation comprises white sandy clay, siltstone and sandstone. Lenticular bodies of white aluminous clays are found at the contact between Mesozoic rocks and Palaeocene rocks at number of places. Such pockets are locally quarried and are being marketed as “China clay”. Prominent China clay deposits are located in south of Nadapa village, north of Ratnal near Ukhamora and Khokra villages and used widely in ceramic, refractory, paints, pigments industries.

Sandhan Formation: Sandhan formation belongs to Pliocene age and comprises of calcarenite, conglomerate, friable sandstone and clay of yellow, pink, brown and variegated colours.

Holocene: Holocene deposits of Kachchh belongs to two categories namely

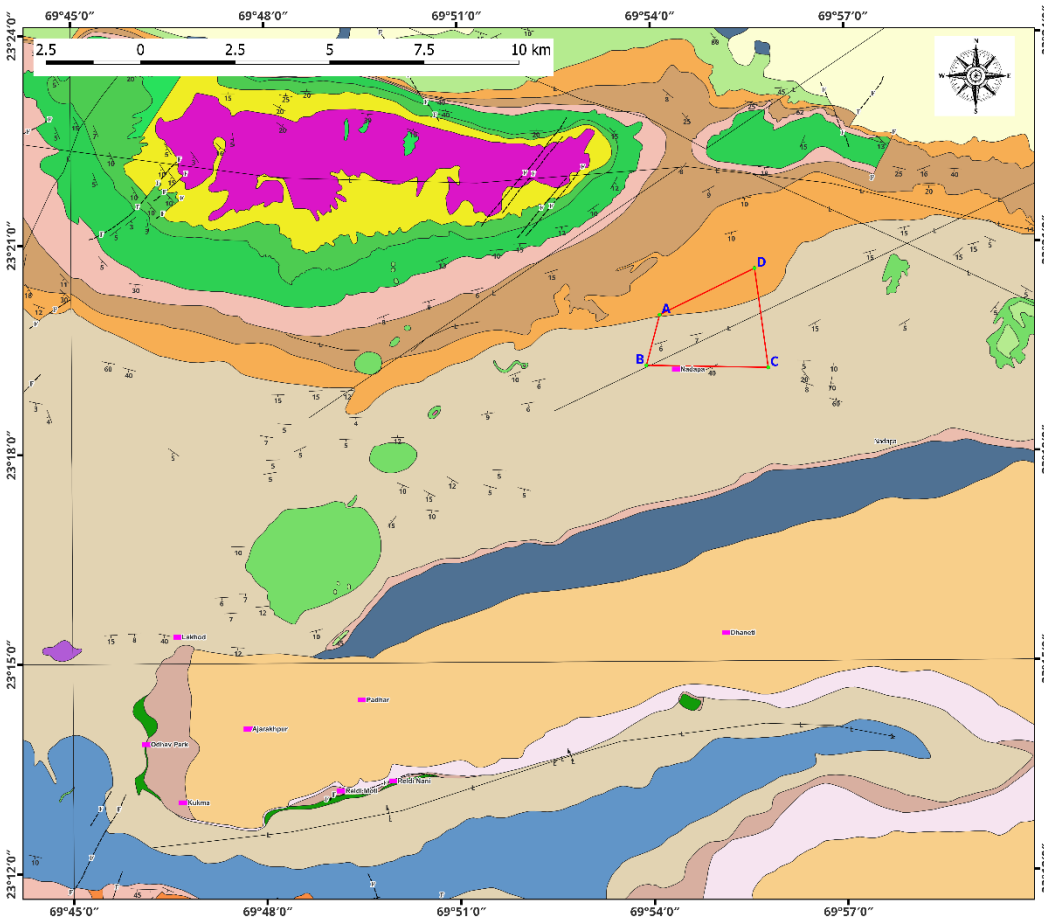
1.Sediments of the Rann in the north and 2. Coastal mud flats and sandy beaches in the south.

Table 5.1: Generalised stratigraphic succession of Kachchh mainland basin

(after Bhukosh, GSI)

Age	***Group***	***Sub-group***	***Formation***	***Lithology***
Holocene			Rann	Aeolian sand, clay, marl
Pliocene			Sandhan	Calcarenite, conglomerate, sandstone & clay
miocene			Gaj	Fossiliferous limestone, marl, clay
Oligo-miocene			Khari Nadi	Variegated Gyps shale, siltstone, fossil, marl
palaeocene			Matanomadh	Laterite/ bauxite with clay
Late cretaceous-palaeocene	Kachchh	Deccan trap	Anjar volcanics	Basalt (unclassified)
Early cretaceous			Bhuj	Ferruginous, feldspathic sandstone, siltstone, shale, clay, plant fossils
Late Jurassic to early cretaceous			Katrol (Jhuran)	Feldspathic sandstone, shale with ammonite, calcareous sandstone, limestone, siltstone
Middle to late jurassic			Chari (Jumara)	Calc gritty sandstone, gypseous shale, marl, Oolitic Limestone
Middle jurassic			Pachcham (Jhurio)	Shale with micaceous sandstone, limestone
			Basement not exposed	

REGIONAL GEOLOGICAL MAP OF KACHCHH BASIN (PART) WITH LOCATION OF NADAPA AREA, KACHCHH DISTRICT, GUJARAT



LEGEND

LITHOLOGY	FORMATION	GROUP	SUB GROUP	AGE
AEOLIAN SAND, CLAY, MARL	RANN			HOLOCENE
CALCARENITE,CONGLOMERATE, SANDSTONE AND CLAY	SANDHAN			PLIOCENE
FOSSILIFEROUS LIMESTONE, MARL, CLAY	GAJ			MIOCENE
VARIEGATED GYPS SHALE, CLAY,SILTSTONE,FOSSIL.MARL	KHARI NADI			OLIGOCENE-MIOCENE
LATERITE/BAUXITE WITH CLAY	MATANOMADH			PALAEOCENE
LATERITE				
BASIC ROCK	ANJAR VOLCANIC	KACHCHH	DECCAN TRAP	LATE CRETACEOUS-PALAEOCENE
BASALT (UNCLASSIFIED)				
OLIVINE BASALT				
FELDSPATHIC SANDSTONE AND GRIT	BHUJ			EARLY CRETACEOUS
FERRUGINOUS SANDSTONE AND GRIT				
FERRU & FELDSPATHIC SST, SILTSTONE,PLANT FOSSIL				
SANDSTONE, SHALE, CLAY, CONGLOMERATE				
FELDSPATHIC SANDSTONE, SHALE WITH AMMONITE FOSSILS	KATROL			LATE JURASSIC-EARLY CRETACEOUS
FOSSILIFEROUS CALC SST. LIMESTONE, SILTSTONE&CONG				
GYPSEOUS SHALE, CALCAREOUS SST WITH BELEMNITES				
SHALE WITH SANDSTONE	CHARI			MIDDLE LATE JURASSIC
CALCAREOUS GRITTY SANDSTONE				
GYPSEOUS SHALE, MARL, OOLITIC LIMESTONE				
FELDSPATHIC SANDSTONE WITH CORALLINE LIMESTONE	PACHCHHAM			MIDDLE JURASSIC
SHALE WITH MICACEOUS SANDSTONE				
LIMESTONE				

STRUCTURAL INDEX
Fault
Lineament Form
Beddings

INDEX
Block boundary points
Block boundary
Villages

SOURCE BY : BHUKOSH, GSI.

Fig No: 5

5.2 Regional Structure:

The Kachchh basin is a western margin peri-cratonic rift basin (basin formed at the boundary of continental crust and oceanic crust) of India bounded by Nagar Parkar uplift in the north and Kathiawar uplift (Saurashtra horst) in the south respectively along Nagar Parkar (NPF) and North Kathiawar faults (NKF) (**Fig No: 6**). The Radhanpur – Barmer basement arch limits the rift extension to the east. The rift is open to the west, merging with the continental shelf. The graben between them (NPF & NKF) is asymmetric, with a tilt to the south along the North Kathiawar fault accommodating thicker sediments towards the Kathiawar block. The basin is characterised by the development several intra-basinal, sub parallel strike faults forming half grabens. The uplifts are bounded by five parallel faults from north to south. These faults are Nagar Parkar Fault (NPF), Island Belt Fault (IBF), Kachchh Mainland Faul (KMF), Katrol Hill Fault (KHF) and North Kathiawar Faults (NKF). Block tilting along these faults during rift phase extension gave rise to four sub-parallel linear ridges; Nagar Parkar Uplift (NPU), Island Belt Uplift (IBU), Wagad Uplift (WU), and Kachchh Mainland Uplift (KMU). The IBU is broken into four individual uplifts viz. Pachchham (PU), Khadir (KU), Bela (BU) and Chorar (CU), probably by unexposed transverse wrench faults as evidenced by relative displacements and orientations. These uplifts appear as a chain of islands and hence are collectively called "Island Belt". The KMF marks the northern limit of the Kachchh mainland, beyond this fault Banni plain is present with four islands/uplift and Waged uplift.

The Kachchh rift evolved within the Mid-Proterozoic-Aravalli-Delhi fold belt by reactivation of pre-existing faults along the NE-SW trend of the Delhi fold belt that swings to E-W in Kachchh region. The Kachchh rift was initiated during the Late Triassic breakup of the Gondwanaland. The rifting was aborted during Late Cretaceous pre-collision stage of the Indian plate. During post-collision compressive regime of the Indian plate, the Kachchh rift basin became a shear zone with strike-slip movements along sub-parallel rift faults. The Kachchh Mainland Fault along the rift axis became the active principal fault. All these faults determine the instability of this area and is falling under Zone-V under tectonic zonation map of India (B.K. Sahu, P.K. Singh, GSI, progress report for the FS: 2004-05).

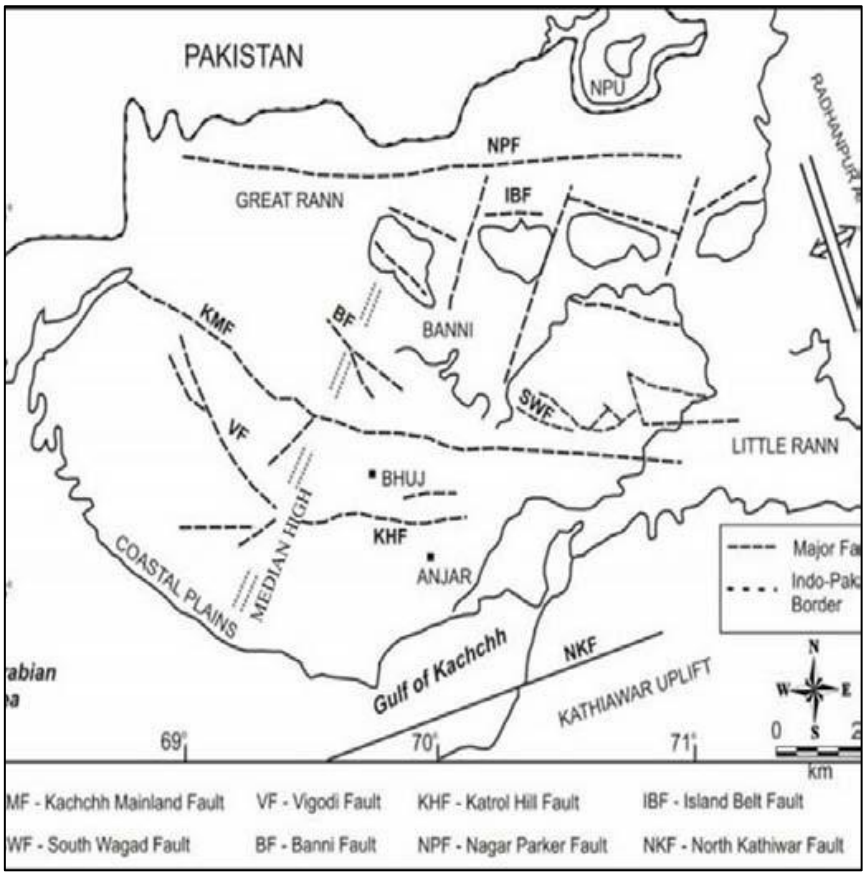


Fig No: 6 Tectonic map of Kachchh (after Shukla, 2011)

5.3 Metamorphism: The area comprises sedimentary rocks only and regional metamorphism is absent in the study area. The litho-units have not undergone significant metamorphic recrystallization.

5.4 Host rock for mineralisation: The Nadapa Area forms a part of the Kachchh Mainland Basin and is represented by two distinct formations—an older Katrol Formation (Late Jurassic to Early Cretaceous) overlain by the younger Bhuj Formation (Early Cretaceous).

Both these formations are devoid of any bauxite enrichment. Furthermore, the Matanomadh (Madh) Formation, which hosts bauxite/laterite in nearby areas, is completely absent in the present study area.

The Katrol Formation comprises compact, yellowish-brown, fine- to medium-grained calcareous sandstone with shale/siltstone intercalations. The Bhuj Formation consists

of brown to reddish, yellowish friable feldspathic sandstone interbedded with laminated siltstone/shale, thin ironstone bands, and grey clay beds that contain plant fossils of the Gondwana Group.

Based on the geochemical analysis of 90 samples collected from pits and trenches within the investigated area, the concentrations of bauxite (Al_2O_3), gallium (Ga), vanadium (V), titanium (TiO_2), and REEs are found to be low and below the threshold required for economic consideration. The obtained values do not indicate any significant enrichment or mineralization of these commodities. Hence, the area does not hold promising potential for bauxite, Ga, V, Ti, or REE mineralization at the explored scale.

Ternary diagram plotting of Al_2O_3–SiO_2–Fe_2O_3 further reveals that all samples fall within the "bauxitic clay" field rather than the true bauxite domain, confirming that the material represents argillaceous sediments enriched in alumina-bearing clays, not of economic bauxite. Thus, despite localized Al_2O_3 enrichment in clay-rich zones, the absence of low silica and lack of laterite development indicate that the conditions necessary for bauxite formation were not attained in the study area.

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CHAPTER – VI

6.0 Activity during the period (Geoscience investigation)

As per NQT Critical Mineral Trackers has undertaken the following activities in an area of 6.20 Sq. Km in **Nadapa area**, Kachchh district, Gujarat from 14 Feb 2025 and completed all field investigations by 30th April,2025.

1. Large scale geological mapping on 1:12500 scale
2. Pitting and Trenching
3. Sample collection & Preparation
4. Chemical analysis
5. Complete Petrography study

6.1 Large scale Geological mapping (1:12,500 scale)

Large scale Geological mapping (LSM) completed in the total area of 6.20 sq. km on 1:12500 scale in the part of Survey of India Toposheet No 41E/15. Survey of India toposheet was used to understand the topography, roads, and drainage of the mapped area and was also used as a base map for the LSM.

For recording precise sample location and to carry out a geological survey, handheld GPS (Garmin 12 H model) has been used. The coordinates had been recorded in geographic coordinate system with WGS 1984 datum. Variation of lithologies along with the structural elements were systematically recorded and prepared the final interpreted geological map is enclosed in Plate No-III, and also given in Fig No:7. Out crop map on 1:12500 scale of the study area is also prepared and enclosed in Plate No-IV and also given in Fig no: 8

Different lithological units belonging to the Bhuj and Katrol formations were systematically documented. These include ferruginous gritty sandstones, fine-grained friable sandstones with mica, siltstones, shales, and grey clay horizons. The attitude of beds was measured using a Brunton compass, and several primary sedimentary structures such as cross-bedding, ripple marks, burrows, ironstone concretions, and clay layers containing plant fossil assemblages were recorded. These features provide insights into the palaeo-environmental conditions and depositional processes operating

during the formation of these units. A detailed description of the lithological assemblages has been given the subsequent paragraphs.

Table 6.1 The generalized stratigraphic succession of Nadapa area

Time scale	Formation	Lithology
Early cretaceous	**Bhuj formation**	**Feldspathic sandstone and gritty** **Ferruginous, feldspathic sandstone, siltstone with plant fossil,** **Sandstone shale, conglomerate**
Late Jurassic to early cretaceous	**Katrol Formation**	**Feldspathic sandstone, shale with ammonite fossils.** **Fossiliferous calc sandstone, limestone, siltstone** **Gypseous shale, Calc sandstone with belemnites**

6.1.1 Description of lithology

Katrol Formation: The Katrol Formation in the study area comprises predominantly of pinkish brown hard ferruginous sandstone, yellowish-white siltstones, yellowish-brown micaceous shales, and yellowish to pinkish calcareous sandstones. The sandstones are typically calcareous and often feldspathic, reflecting a moderate degree of chemical and mechanical weathering of the source area.

A major part of the terrain is covered by soil, though excellent exposures occur along nala sections and road cuttings. Compared to the overlying Bhuj Formation, the Katrol rocks are more compact and moderately hard, which makes them locally suitable for building-stone purposes. Intercalations of sandstone and siltstone are common throughout the sequence. These units generally lack macrofossils, and the bedding architecture often displays lenticular bedding, Ripple marks and Mud cracks. These features indicate deposition under shallow marine environment. Structurally, the formation in the study area exhibits a NE–SW strike, with beds dipping 5°–10° towards the southeast, reflecting regional tilting within the Kachchh Mainland.

Description of various lithological units encountered in Katrol formation

with field photographs

Photo - 1: Near northern boundary of the block. Interbedded sequence of yellowish fine gained sandstone & yellowish-brown siltstone/shale exposed along nala cutting. Fairly hard & compact. **Katrol formation.**

Photo 2: Near northern boundary along steep gorge (1.5km north of Nadapa village). Yellowish-white fine-grained sandstone with iron concretions. General strike is NE-SW and dipping 6° southeasterly. **Katrol Formation.**

Photo 3: NW of the block. There is a narrow and steep gorge of 0.5-2.0m wide & 8-10m height cutting across both Bhuj Formation on the south (gritty sandstone pinkish/yellowish) and Katrol Formation on the north (fine grained yellow calcareous sandstone) with gradational contact. The gorge might be formed due to eroding away of soft siltstones/ clays, leaving hard resistant sandstones on either side as steep walls. **Katrol Formation & Bhuj Formation**

Bhuj Formation: The Bhuj Formation overlies the Katrol Formation and occurs predominantly toward the southern part of the Nadapa area. In the study area, it is prominently represented by a central ridge trending N80°E–S80°W, with strata dipping 5–10° southward. The ridge shows a gentle southerly slope and a relatively steeper northern slope, reflecting asymmetrical structural geometry. The ridge comprises hard, resistant brown ferruginous sandstone, capped at places by a thin lateritic cover (10–20 cm). The basal portions consist of intercalated sandstone, siltstone, and clay beds.

To the south of the ridge, the lithology includes: Ferruginous sandstone, Brown splintery shale, Yellowish-white friable siltstone, thin brown ironstone bands and grey clay horizons containing plant fossil impressions at the lower levels.

To the north of the ridge, the lithology is dominated by: Friable yellowish to pinkish-white fine- to medium-grained feldspathic sandstone/siltstone, often mica-bearing. The observed lithological variability, together with well-preserved primary sedimentary structures such as cross-bedding, ripple marks, burrows indicates that the Bhuj Formation was deposited in a fluvial to deltaic depositional environment, representing shifting channel–bar complexes, floodplain sediments, and marginal deltaic conditions.

Photo 4: 1.3km NE of Nadapa village: section across the central ridge showing thin lateritic cover on the top. Interbedded feldspathic sandstone/siltstone with thin laminae of shale and clay at the bottom. Strike: N80°E-S80°W and dipping 6 °southerly

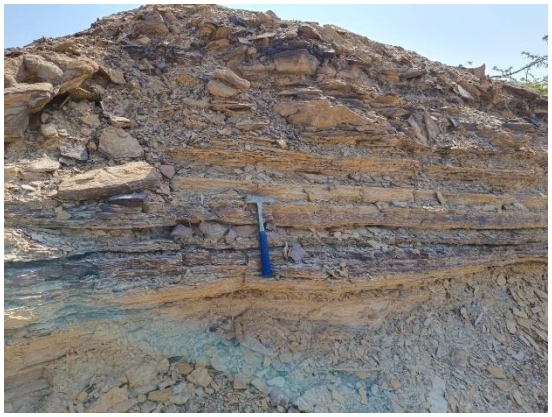
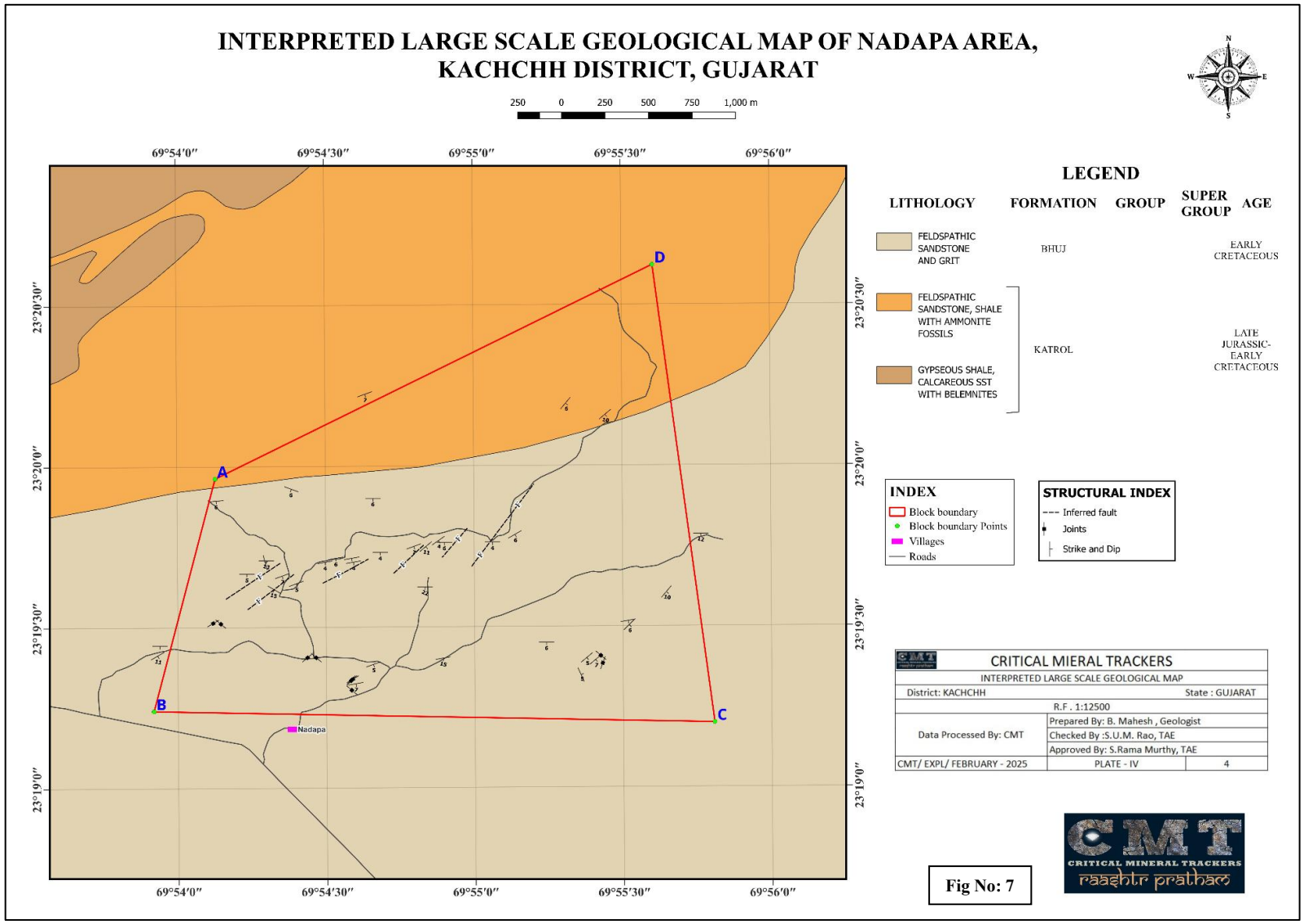


Photo 5: 2.0km NE of Nadapa village: Typical section along south side of the ridge. Splintery shale on the top followed by interbedded siltstone/ shale laminae in the middle and grey clay bed at bottom. Strike: N45°E-S45°W dipping 5° south-easterly	**Photo 6:** 2.2km NE of Nadapa village: Typical topography of pediment area lying south of the ridge represented by ferruginous sandstone, splintery shale (due to joints) on the top followed by friable sandstone
	
Photo 7: 2.30km east of Nadapa village. Hard, compact ferruginous gritty sandstone with lenses of soft clays (eroded away) now leaving void as big as 0.5 to 1m diameter.	**Photo 8:** 1.0 km north of Nadapa village. North side of the ridge. Very fine to fine grained, laminated, friable sandstones interbedded with kaolinized clay and thin shale laminae

Photo 9: 1.5km north of Nadapa village. Good section of strata is exposed along big nala located near northern boundary. Fine grained sandstone interbedded with siltstone/ clay/shale laminae.

Interpreted large scale geological map of Nadapa Area (on 1:12500 scale) is given below in Fig no: 7 and also enclosed on plate no: III

Outcrop map of the study area is given below in Fig no: 8 and also enclosed in plate no:IV.(on 1:12500 scale)


INTERPRETED LARGE SCALE GEOLOGICAL MAP OF NADAPA AREA,
KACHCHH DISTRICT, GUJARAT
250 0 250 500 750 1,000 m
N
W
E
S
69°54'0"
69°54'30"
69°55'0"
69°55'30"
69°56'0"
23°20'30"
23°20'0"
23°19'30"
23°19'0"
A
B
C
D
Nadapa
LEGEND
LITHOLOGY
FORMATION
GROUP
SUPER GROUP
AGE
FELDSPATHIC SANDSTONE AND GRIT
BHUJ
EARLY CRETACEOUS
FELDSPATHIC SANDSTONE, SHALE WITH AMMONITE FOSSILS
GYPSEOUS SHALE, CALCAREOUS SST WITH BELEMNITES
KATROL
LATE JURASSIC-EARLY CRETACEOUS
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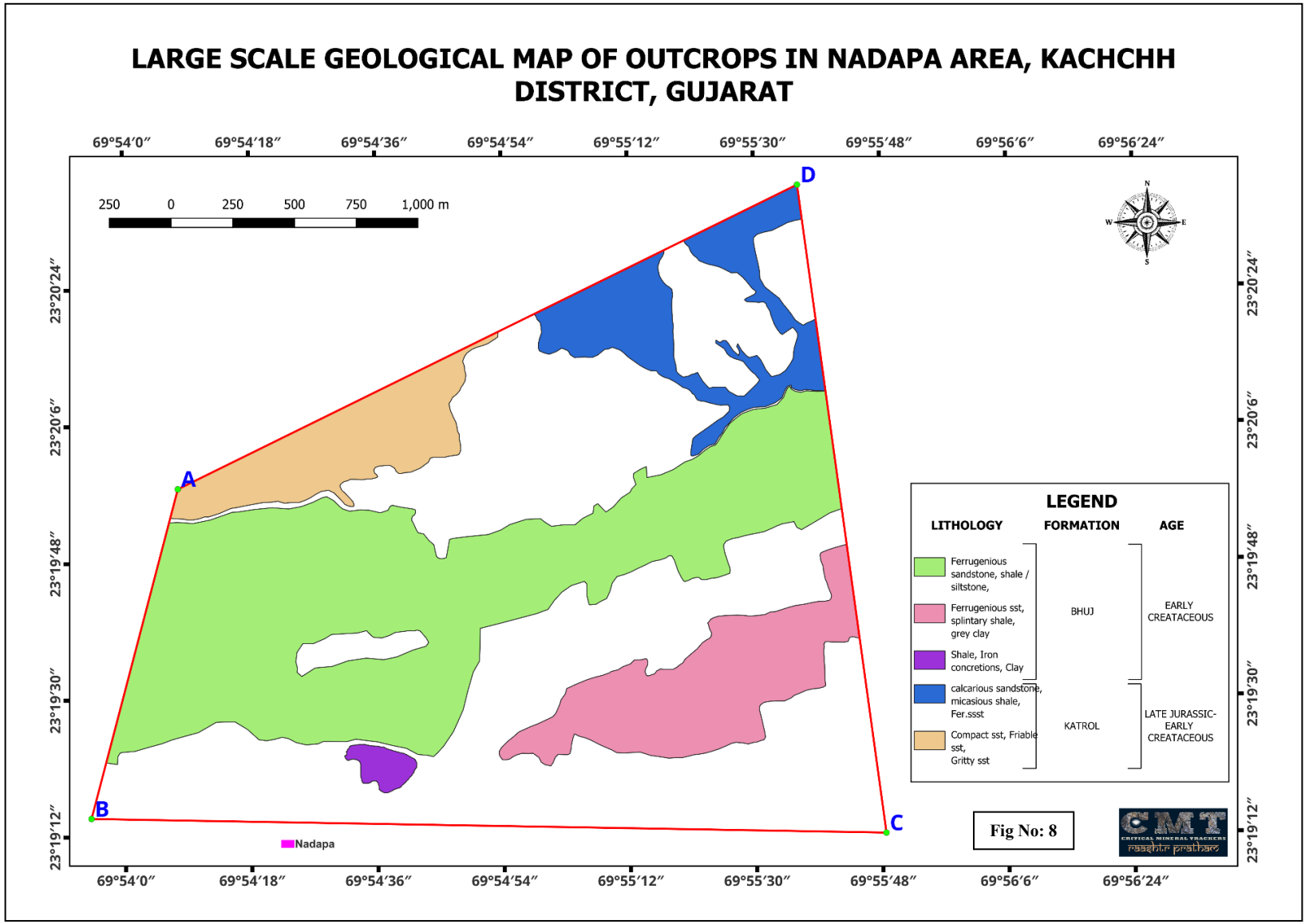
Block boundary
Block boundary Points
Villages
Roads
STRUCTURAL INDEX
Inferred fault
Joints
Strike and Dip
CRITICAL MIERAL TRACKERS
INTERPRETED LARGE SCALE GEOLOGICAL MAP
District: KACHCHH
State : GUJARAT
R.F. 1:12500
Data Processed By: CMT
Prepared By: B. Mahesh , Geologist
Checked By :S.U.M. Rao, TAE
Approved By: S.Rama Murthy, TAE
CMT/ EXPL/ FEBRUARY - 2025
PLATE - IV
4

Fig No: 7


LARGE SCALE GEOLOGICAL MAP OF OUTCROPS IN NADAPA AREA, KACHCHH DISTRICT, GUJARAT
69°54′0″
69°54′18″
69°54′36″
69°54′54″
69°55′12″
69°55′30″
69°55′48″
69°56′6″
69°56′24″
23°20′24″
23°20′6″
23°19′48″
23°19′30″
23°19′12″
250 0 250 500 750 1,000 m
N
S
E
W
A
B
C
D
Nadapa
LEGEND
LITHOLOGY
FORMATION
AGE
Ferrugenious sandstone, shale / siltstone,
Ferrugenious sst, splintary shale, grey clay
Shale, Iron concretions, Clay
calcarious sandstone, micasious shale, Fer.ssst
Compact sst, Friable sst, Gritty sst
BHUJ
KATROL
EARLY CREATACEOUS
LATE JURASSIC-EARLY CREATACEOUS
Fig No: 8

6.1.2 Description of rock types in outcrop map: There are quite good number of outcrops have been exposed in nearly 50% of the study area along the central ridge portion and the adjoining pediment area on either side. Few outcrops are also noticed along the nalas in the NW part and NE part. These outcrops have been systematically demarcated and prepared an outcrop map on 1:12,500 scale and enclosed in plate no: IV and also in Fig no:8 .

Brief description of rock types found in outcrops is given below:

The Formations in the study area comprises predominantly reddish brown, hard ferruginous sandstone, yellowish-white siltstones, yellowish-brown micaceous shales/sandstone, and yellowish to pinkish calcareous sandstones, with occasional clay beds. The litho-units are gradational in nature and often intercalated with one another.

1. **Hard Ferruginous sandstone:** The rocks exposed along the central ridge portion of the study area are composed of pinkish brown coarse to gritty ferruginous feldspathic sandstones on the top followed by yellowish white fine-grained argillaceous sandstones interbedded with thin laminae of brown shales & siltstones and white clay laminae. At few places there is a thin lateritic capping of 10-20cm thick on the top. The feldspar if often kaolinized.
2. **Ferruginous Sandstone, splintery shales, siltstone & clay**: South-eastern part of the study area is occupied by coarse grained Ferruginous sandstone, brown splintery shales (spread on ground as broken fragments due to joints) and siltstones on the top followed by grey clay beds. The siltstones and clays often contain plant fossils.
3. **Splintery shales with ironstone concretions:** In a small area towards south exposed brown splintery shales with ironstone concretions on the top followed by grey clay beds.
4. **Calcareous sandstone and micaceous shale:** Fine to medium grained calcareous sandstone interbedded with shale and clay laminae are exposed along the nalas in the NE part. Sandstones are fairly hard and compact.
5. **Feldspathic gritty sandstone, siltstone, clay laminae**: The outcrops exposed along NW part of the study area along big nala on either side are composed of

coarse grained to gritty feldspathic pinkish brown sandstones, fine grained yellowish white friable sandstone interbedded with white siltstone and clay formations of Bhuj. Fine to medium grained yellowish white calcareous sandstone interbedded with siltstone/ gypseous shales of Katrol formation

6.1.3 Petrographic studies: Ten rock specimens have been sent to petrology division, GSI, southern region, Hyderabad for preparation of thin sections and complete petrographic studies. But they have taken up petrographic studies on 3 specimens only and discarded 7 samples due to soft, friable nature and not suitable for thin section preparation.

Detailed description of the 3 specimens is as follows:

1. **Specimen no: NB/TS/P-14**

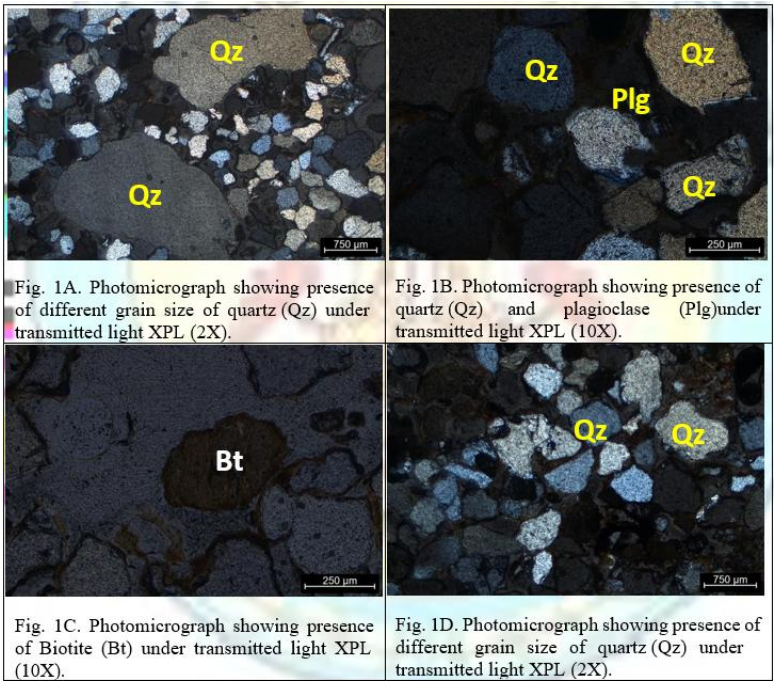


Fig. 1A. Photomicrograph showing presence of different grain size of quartz (Qz) under transmitted light XPL (2X).

Fig. 1B. Photomicrograph showing presence of quartz (Qz) and plagioclase (Plg)under transmitted light XPL (10X).

Fig. 1C. Photomicrograph showing presence of Biotite (Bt) under transmitted light XPL (10X).

Fig. 1D. Photomicrograph showing presence of different grain size of quartz (Qz) under transmitted light XPL (2X).

Photo 10 & 11: medium grained sandstone specimen & corresponding photomicrograph

Microscopic study reveals that the rock displays a medium- to coarse-grained texture, with grain diameters ranging from approximately 250 to 750 micrometers. Grains are poorly sorted, and both angular and subrounded quartz grains coexist, which together indicate rapid deposition or minimal transport. Grain boundaries are irregular, and the grains commonly exhibit point and long contacts, consistent with mechanical

compaction during burial. It predominantly shows quartz grains (Qz), which are abundant.

Quartz is present as sub-rounded to angular grains, indicating moderate transport prior to deposition. The presence of plagioclase feldspar (Plg) is signifying a minor but crucial feldspathic component, possibly derived from nearby igneous or metamorphic source rocks. Biotite (Bt) is observed. Its occurrence, though infrequent (Fig. 1A-1D). The study reveals a minor matrix in the form of fine material occupying the intergranular spaces. The degree of visible cementation appears limited, with quartz overgrowths not clearly observed, suggesting that grain-to-grain contacts dominate over load-supporting cement. The matrix may include clay or altered feldspar, contributing to a minor muddy texture. Overall, the study illustrates a quartz-rich, subarkosic sandstone, characterized by poor sorting and angular grains. Such features are indicative of fluvial or proximal alluvial depositional environments, with limited transport and moderate source rock diversity**.**

Rock/Mineral Name: Based on the mineral and textural characteristics, it is a **Sandstone.**

2. **Specimen no: NB/TS/T5**

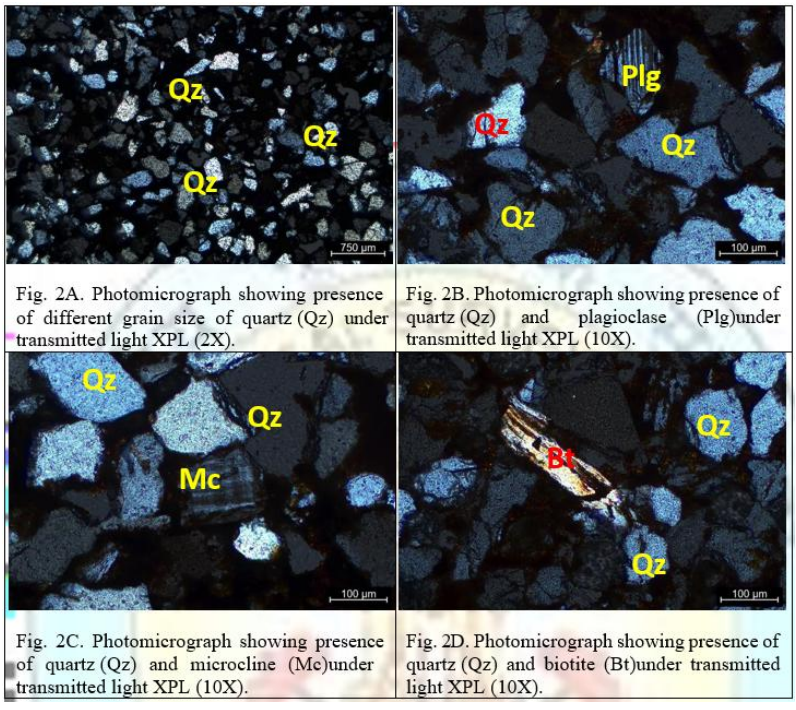


Fig. 2A. Photomicrograph showing presence of different grain size of quartz (Qz) under transmitted light XPL (2X).

Fig. 2B. Photomicrograph showing presence of quartz (Qz) and plagioclase (Plg)under transmitted light XPL (10X).

Fig. 2C. Photomicrograph showing presence of quartz (Qz) and microcline (Mc)under transmitted light XPL (10X).

Fig. 2D. Photomicrograph showing presence of quartz (Qz) and biotite (Bt)under transmitted light XPL (10X).

Photo 12 & 13, fine-grained sandstone specimen and corresponding photomicrograph

Microscopic study reveals that the rock exhibits a medium to fine grain size.The grains display angular to subangular outlines, indicating limited ttransport and deposition relatively close to their source .Poor sorting is observed with variable grain sizes and shapes, suggesting rapid sedementation possibly by fluvial process or short transport mechanism

Quartz (Qz) is overwhelmingly the dominant mineral phase, showcased by its abundance across rock. The presence of multiple quartz grains, with some displaying undulatory extinction typical of detrital quartz. Plagioclase feldspar (Plg) appears minorly and is identifiable by its characteristic polysynthetic twinning, which suggests an input from igneous or metamorphic source terrain. Additionally, microcline (Mc) is noted, recognized by its cross-hatch twinning, reflecting a granitic provenance. Biotite (Bt) is present as elongate laths and contributes accessory (Fig. 2A-2D). The dark areas in the photomicrographs correspond to matrix material, likely composed of fine-grained clay or altered rock fragments, signifying a minor but present muddy fraction. Visible evidence of cementation is limited, with intergranular contacts prevailing, indicating a predominately clastic-supported framework with minimal authigenic growth.

The dominant quartz content, combined with the presence of feldspar (both plagioclase and microcline) and biotite, classifies the sandstone as sub-arkosic to arkosic, suggesting a mixed provenance from felsic igneous and accessory metamorphic sources. Its textural immaturity and mineral diversity indicate deposition close to uplifted and un-weathered continental or metamorphic-igneous terrains, most likely within fluvial or proximal alluvial environments where rapid sediment supply and limited reworking dominate.

Rock/Mineral Name: Based on the mineral and textural characteristics, it is a Sandstone

3. Specimen no: NB/TS/P6

(As received from petrology laboratory, GSI, southern wing, Hyderabad.)

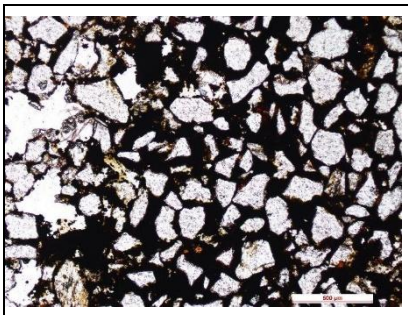


Fig. 3.1 Angular to subangular quartz grains and few micas as detrital material cemented by ferruginous material.

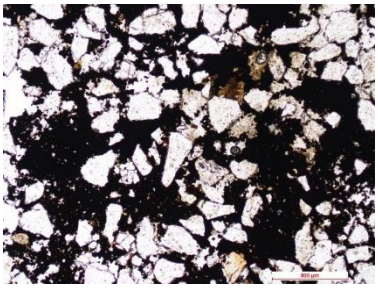


Fig. 3.2 Ferrugenous cement dominated part where angular to subangular quartz grains floated in cement

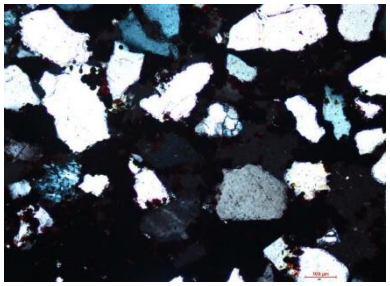


Fig. 3.3 Presence of rock fragment and feldspar indicate less weathering and minimal transport

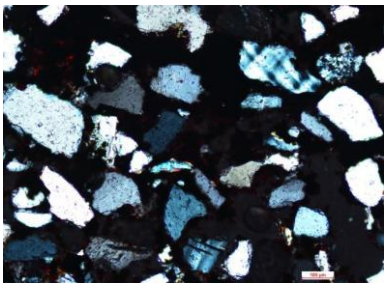


Fig.3.4 Microcline (Mc) and plagioclase (Pl) as frame working mineral indicating igneous provenance.

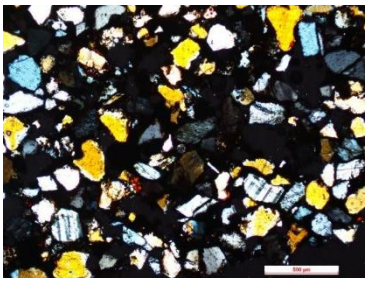


Fig. 3.5 Feldspar and quartz under X polarized light

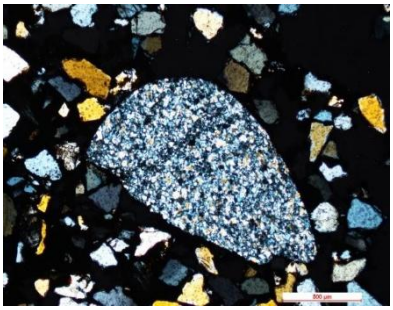


Fig. 3.6 Cherty fragment in quartzose frame working grains

Fig. 3.7 Magnetite as detrital mineral; ferruginous cement; under reflected light

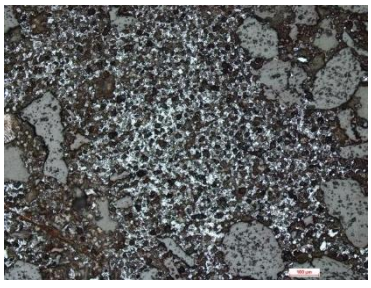


Fig. 3.8 ferruginous and magnetite rich cement; under reflected light

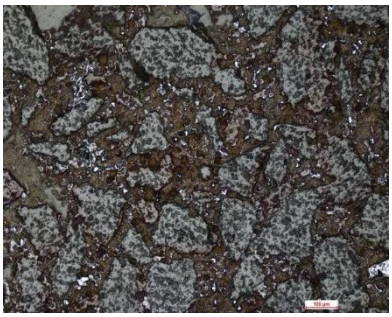
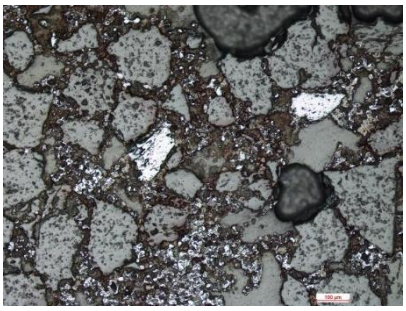
	

Fig. 3.9 Ferruginous cement and the angular quartz grains; under reflected light	Fig. 3.10 Hematite and magnetite as cementing material; detrital magnetite grains along with angular quartz grains

Photo 14 & 15 : Ferruginous sandstone specimen and corresponding photomicrograph

Mineral Assemblage: Quartz + Feldspar + Mica + Rock fragment + Cherty fragment as framework mineral

Cement: Hematite and magnetite,

Name of the rock: Ferruginous sandstone (Bhuj Formation)

Texture: Microscopic study reveals that the rock displays a medium- to coarse-grained texture, with grain diameters ranging from approximately 250 to 750 micrometers. Grains are poorly sorted and are angular to subangular in shape indicating rapid deposition and minimal transport. Grain boundaries are irregular, and the grains commonly exhibit point and long contacts, consistent with mechanical compaction during burial. The rock predominantly consists of quartz grains as framework minerals. Quartz grains are mostly angular, indicating moderate transport prior to deposition. The presence of plagioclase feldspar and microcline is suggestive of igneous source rocks and minimum transportation. Few Mica grains are also present. Two rock fragments of varying size are noted viz., cherty rock fragment and quartzite fragment both indicating metasedimentary provenance. Undulose extinction in quartzite rock fragment also suggest similar provenance.

The rock is extremely cemented by ferruginous material such as hematite and magnetite. At places detrital frame working grains are volumetrically much less than the ferruginous cement and grains are not in contact. Few magnetite occurs as detrital frame working grains.

6.1.4 Structures

The two lithological units present in the study area, namely the Katrol Formation and the Bhuj Formation, exhibit a regional structural trend of N80°E–S80°W, with local variations in NE–SW orientation. The strata generally dip 5° to 10° towards the south and southeast.

The Bhuj Formation shows comparatively steeper dips ranging from 6° to 10°, whereas the older Katrol Formation exhibits gentler dips between 4° and 6°.

Two sets of sub-vertical joins are observed in brown shales towards south. The general trend of Joints is N60°E-S 60°W and N40°W-S40°E. Due to this jointing pattern, the shales were broken into pieces and occur as splintery on the surface

Based on satellite imagery interpretation, six inferred minor faults have been demarcated within the ridge area. The trend of these faults is in NE-SW direction. Minor displacements are observed along these inferred fault traces; however, no clear or recognizable fault-related features viz. fault breccia, silicification etc were identified during field investigations and shown in plate no: III & Fig no:7

The observed lithological variability, together with well-preserved primary sedimentary structures such as cross-bedding, lamination, ripple marks, burrows and plant fossils assemblage indicate that the Bhuj Formation was deposited in a fluvial to deltaic depositional environment.

In contrast, the Katrol formation composed of calcareous sandstones/ siltstones lack of macrofossils, and presence of primary structures viz bedding, Ripple marks, Mud crack indicate that the Katrol formation was deposited under shallow marine environment.

Detailed descriptions of sedimentary structures observed in Katrol and Bhuj formation along with photographic documentation is given below

Photo 16: 1.35 km North side of Nadapa village showing Ripple marks on Yellowish brown shale. **Katrol Formation**

Photo- 17: 2.28 km NE side of Nadapa village showing Burrows and ironstone concretions within the sandstone. **Katrol Formation**

Register office: CRITICAL MINERAL TRACKERS, 306, Concourse Building,
Ameerpet, Hyderabad, Telangana - 500016.

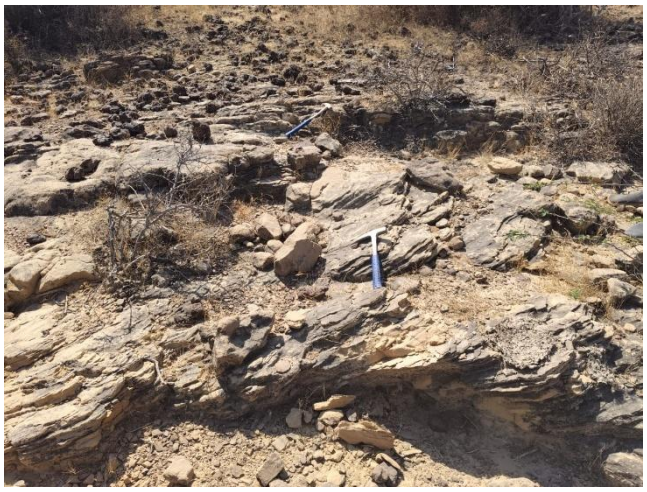


Photo 18: 0.97km North side of Nadapa village showing Cross bedding in fine grained laminated sandstone. **Bhuj Formation**

Photo 19: 0.45km near Nadapa village showing Ripple marks in siltstone**Bhuj Formation**

Photo 20 & 21: 1.0 km NNE of Nadapa village showing burrow structures in the top ferruginous sandstone & lateritic **Bhuj formation**

Photo 22: 1.79 km ENE side of Nadapa village plant fossil (Palmoxylin?) in the shales. 2 sets of joints N60°E-S 60°W and N40°W-S40°E found in **Bhuj Formation**

Photo 24: 1.54 km NE side of Nadapa Village plant fossil Ptylophyllum within grey clay beds of Bhuj Formation

Photo 23: 1.73 km ENE side of Nadapa Village Plant fossils within siltstone.

Bhuj Formation

6.1.5 Metamorphism: The area comprises sedimentary rocks only and regional metamorphism is absent in the study area. The litho-units have not undergone significant metamorphic recrystallization.

6.1.6 Mineralogy of ore zones and ore textures: During large scale geological mapping, no signatures of Bauxite mineralisation are found on the surface because the bauxite bearing Matanomadh formation is completely absent in the study area. Further the geochemical analysis of the samples collected from pits and trenches within the investigated area, the concentrations of bauxite (Al_2O_3), gallium (Ga), vanadium (V), titanium (TiO_2), and REEs are found to be low and below the threshold required for economic consideration. The obtained values do not indicate any significant enrichment or mineralization of these commodities. Hence, the area does not hold promising potential for bauxite, Ga, V, Ti, or REE mineralization at the explored scale. Hence, no ore zones are demarcated.

6.1.7 Pitting and Trenching: After completion of Large-scale geological mapping, Critical mineral trackers has taken up pitting and trenching work and completed 70 pits and 5 trenches during **April, 2025.The** map showing the locations of pit and trench is enclosed in plate no: V and also given in Fig no: 9

6.1.7.1 Pitting

Pitting during the present exploration work was undertaken to obtain fresh representative samples from a depth of 1 meter. A total of 20 pits were excavated using a JCB, each measuring 1.0 m × 1.0 m × 1.0 m, resulting in an individual volume of 1.0 m^3 and a cumulative excavated volume of 20 m^3. The pits provided fresh exposures of subsurface lithology and allowed for systematic sampling for subsequent geochemical analysis. Lithological map of pits on 1:100 scale is enclosed in plate no: VII and Assay plan of pits on 1:100 scale is shown in plant no: IX. Analytical results of major oxides, Vanadium, and REE, Gallium of pits are given in Annexure: II, III, IV

Table No: 6.2 The location of Pits (measured by GPS)

Sr No	Pit No	Coordinate in Degree Decimal Datum WGS-1984		No of samples collected
		Latitude	Longitude	
1	P1/NB/2025	23.324488	69.917695	1
2	P2/NB/2025	23.323288	69.923733	1
3	P3/NB/2025	23.326912	69.92718	1
4	P4/NB/2025	23.328038	69.928047	1
5	P5/NB/2025	23.32558	69.906665	1
6	P6/NB/2025	23.328445	69.90643	1
7	P7/NB/2025	23.328882	69.910428	1
8	P8/NB/2025	23.32948	69.914093	1
9	P9/NB/2025	23.329812	69.916072	1
10	P10/NB/2025	23.331522	69.918707	1
11	P11/NB/2025	23.339875	69.925592	1
12	P12/NB/2025	23.334688	69.912072	1
13	P13/NB/2025	23.330597	69.904402	1
14	P14/NB/2025	23.321163	69.910602	1
15	P15/NB/2025	23.329158	69.917623	1
16	P16/NB/2025	23.333752	69.916712	1
17	P17/NB/2025	23.322903	69.91055	1
18	P18/NB/2025	23.33154	69.902135	1
19	P19/NB/2025	23.32382	69.90106	1
20	P20/NB/2025	23.32283	69.90741	1

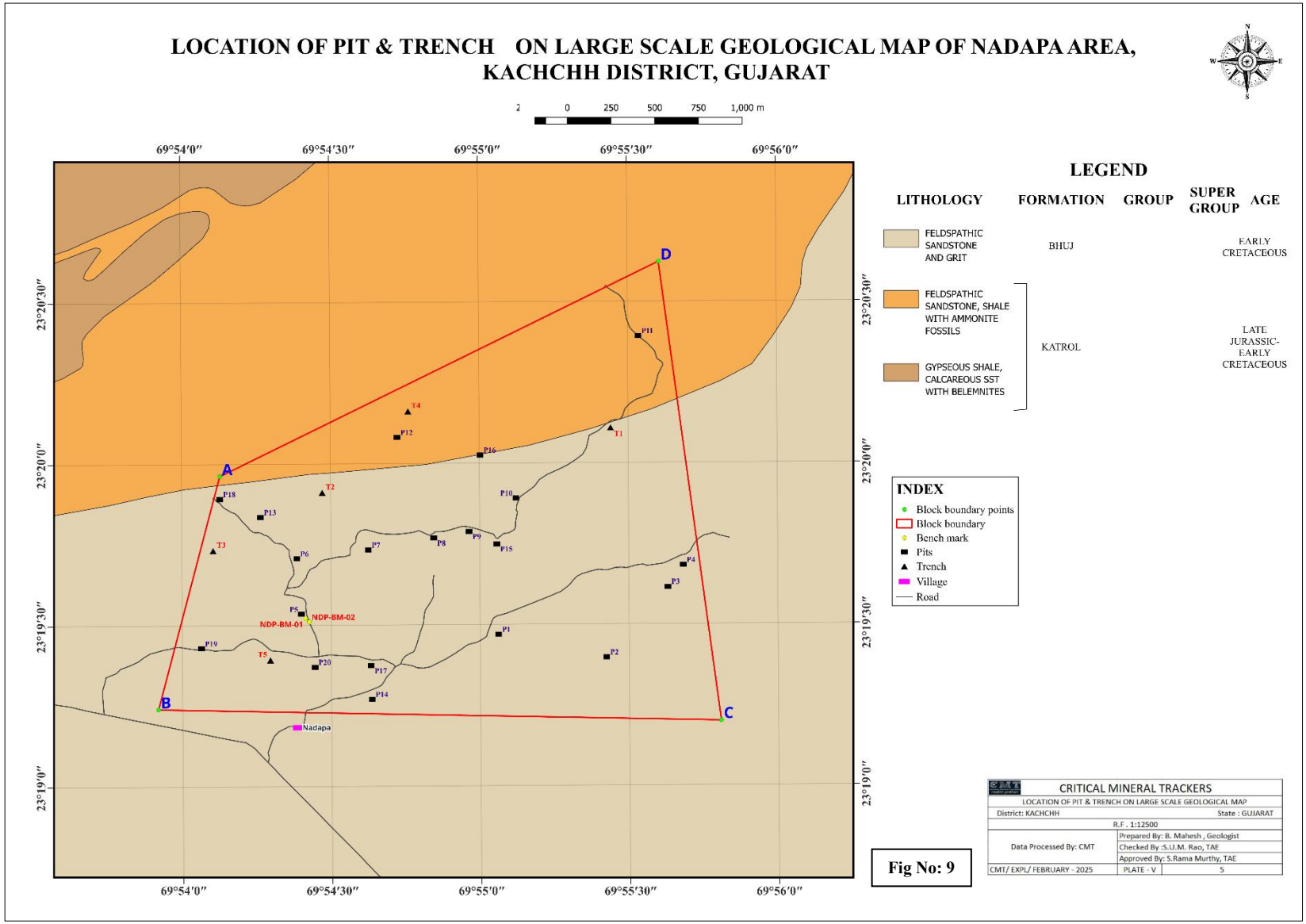
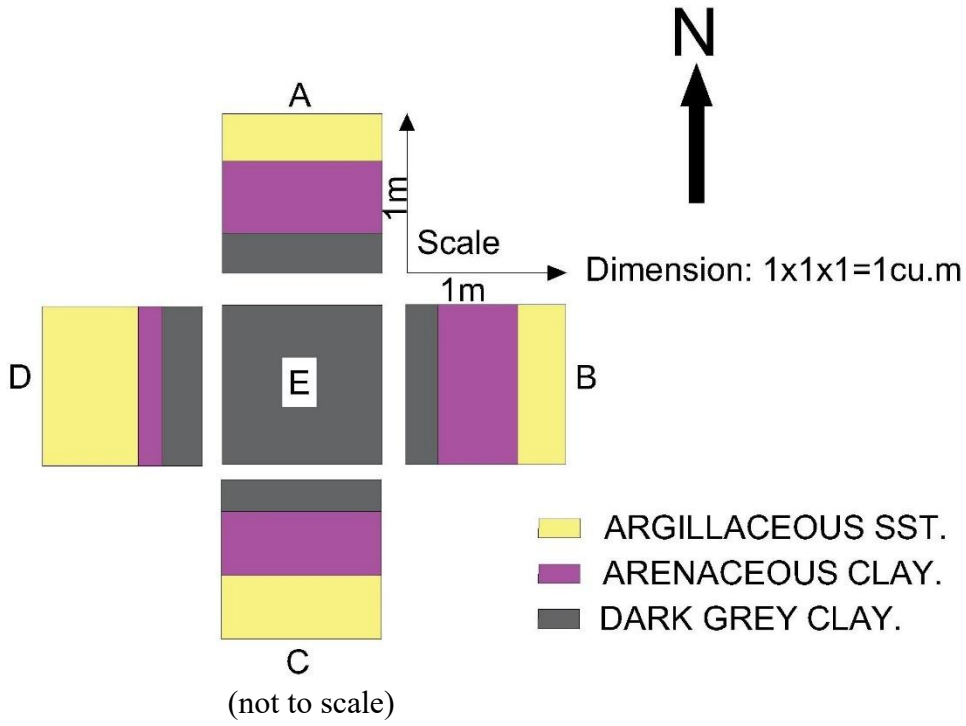

LOCATION OF PIT & TRENCH ON LARGE SCALE GEOLOGICAL MAP OF NADAPA AREA, KACHCHH DISTRICT, GUJARAT
2 0 250 500 750 1,000 m
69°54′0″
69°54′30″
69°55′0″
69°55′30″
69°56′0″
23°20′30″
23°20′0″
23°19′30″
23°19′0″
A
B
C
D
P1
P2
P3
P4
P5
P6
P7
P8
P9
P10
P11
P12
P13
P14
P15
P16
P17
P18
P19
P20
T1
T2
T3
T4
T5
NDP-BM-01
NDP-BM-02
Nadapa
LEGEND
LITHOLOGY
FORMATION
GROUP
SUPER GROUP
AGE
FELDSPATHIC SANDSTONE AND GRIT
BHUJ
EARLY CRETACEOUS
FELDSPATHIC SANDSTONE, SHALE WITH AMMONITE FOSSILS
GYPSEOUS SHALE, CALCAREOUS SST WITH BELEMNITES
KATROL
LATE JURASSIC-EARLY CRETACEOUS
INDEX
Block boundary points
Block boundary
Bench mark
Pits
Trench
Village
Road
CRITICAL MINERAL TRACKERS
LOCATION OF PIT & TRENCH ON LARGE SCALE GEOLOGICAL MAP
District: KACHCHH
State : GUJARAT
R.F. : 1:12500
Data Processed By: CMT
Prepared By: B. Mahesh , Geologist
Checked By :S.U.M. Rao, TAE
Approved By: S.Rama Murthy, TAE
CMT/ EXPL/ FEBRUARY - 2025
PLATE - V
5

Fig No: 9

Photo No.-25: Image showing Pit in the study area

(Size 1*1*1m)

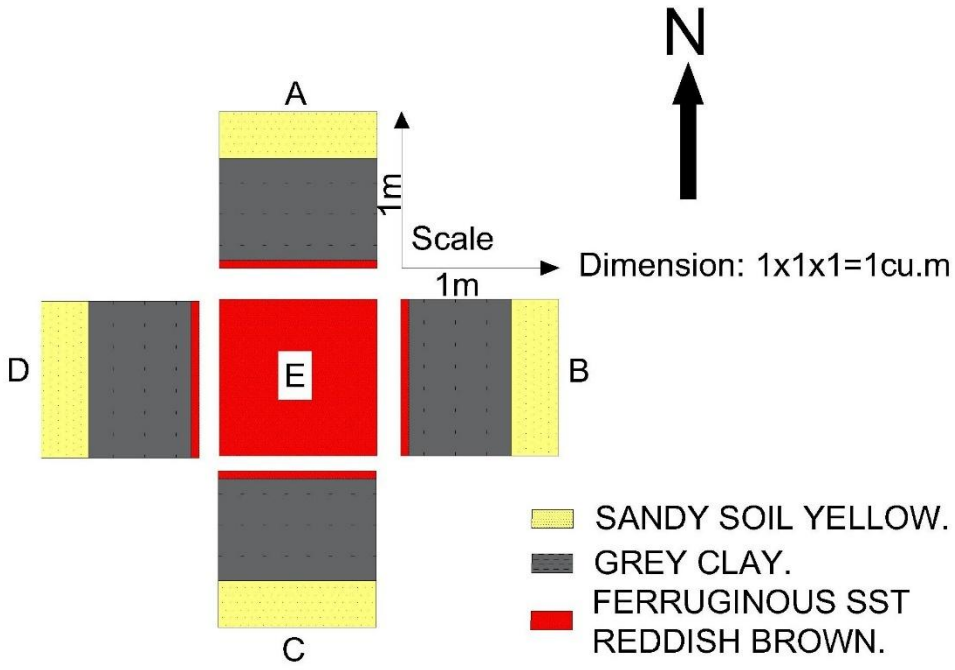
Brief description of pit profile (lithology) is given below for 20 pits



(not to scale)

Detailed Lithology of Pit no: P1/NB/2025

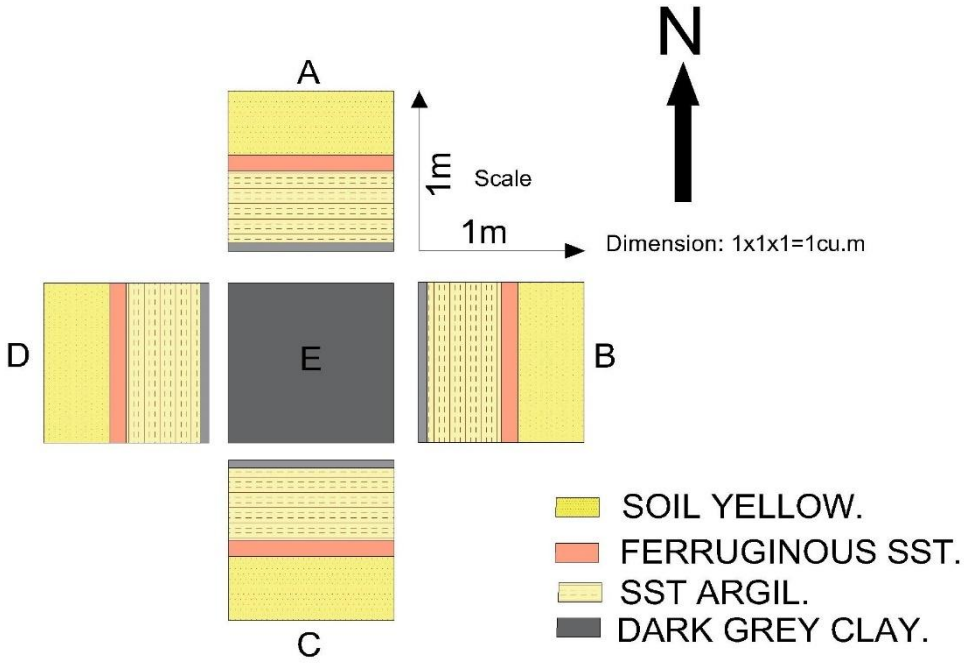
Name of the investigation: Bauxite, Ga, V, Ti & REE.	Date of start: 16/04/2025
Pit no: P1/NB/2025	Date of closer: 16/04/2025
Location: 23.324488°N 69.917695°E	Elevation: 130m
Pit top measurement: a. Length: 1m b. Breadth: 1m	Pit bottom measurement: a. Length: 1m b. Breadth: 1m c. Depth: 1m
Recorded by: V. Santosh & B. Mahesh, Geologists	
Lithology details: Argil. SST Yellowish white, Clay arenaceous Pinkish white & Dark grey Clay (Bhuj formation).	
Structural details: Bedding & lamination	
Log of pit: A, B, C, D are side section and E plan view is bottom of the pit.	
Sample no: P1/NB/2025 Representative sample was collected from bottom E of Dark grey Clay.	



(not to scale)

Detailed Lithology of Pit no: P2/NB/2025

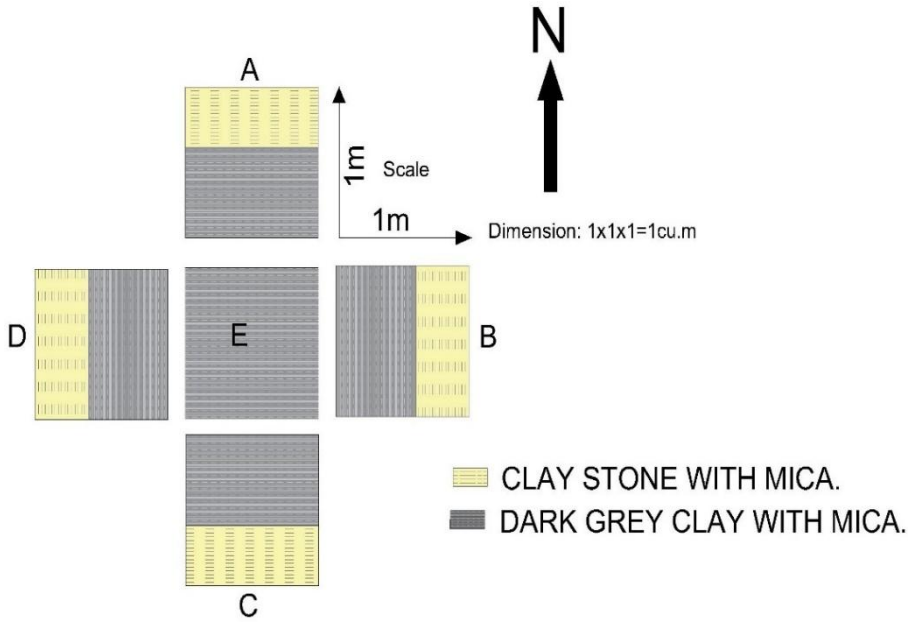
Name of the investigation: Bauxite, Ga, V, Ti & REE.	Date of start: 16/04/2025
Pit no: P2/NB/2025	Date of closer: 16/04/2025
Location: 23.323288°N 69.923733°E	Elevation: 121m
Pit top measurement: a. Length: 1m b. Breadth: 1m	Pit bottom measurement: a. Length: 1m b. Breadth: 1m c. Depth: 1m
Recorded by: V. Santosh & B. Mahesh, Geologists	
Lithology details: Grey clay, Ferruginous SST. Reddish brown (Bhuj formation).	
Structural details: Bedding & lamination	
Log of pit: A, B, C, D are side section and E plan view is bottom of the pit.	
Sample no: P2/NB/2025, Representative sample was collected from bottom E of ferruginous sandstone.	



(not to scale)

Detailed Lithology of Pit no: P3/NB/2025

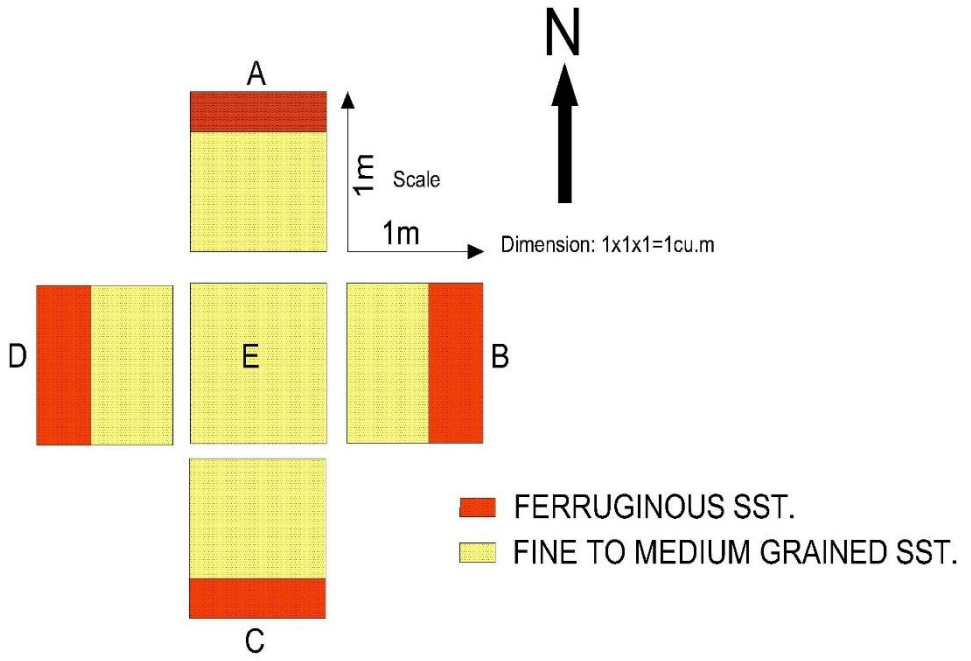
Name of the investigation: Bauxite, Ga, V, Ti & REE.	Date of start: 16/04/2025
Pit no: P3/NB/2025	Date of closer: 16/04/2025
Location: 23.326912°N 69.927180°E	Elevation: 124m
Pit top measurement: a. Length: 1m b. Breadth: 1m	Pit bottom measurement: a. Length: 1m b. Breadth: 1m c. Depth: 1m
Recorded by: V. Santosh & B. Mahesh, Geologists	
Lithology details: Ferruginous SST., SST argil, Dark grey clay (Bhuj formation).	
Structural details: Bedding & lamination	
Log of pit: A, B, C, D are side section and E plan view is bottom of the pit.	
Sample no: P3/NB/2025, representative sample was collected from bottom E of Dark grey Clay.	



(not to scale)

Detailed Lithology of Pit no: P4/NB/2025

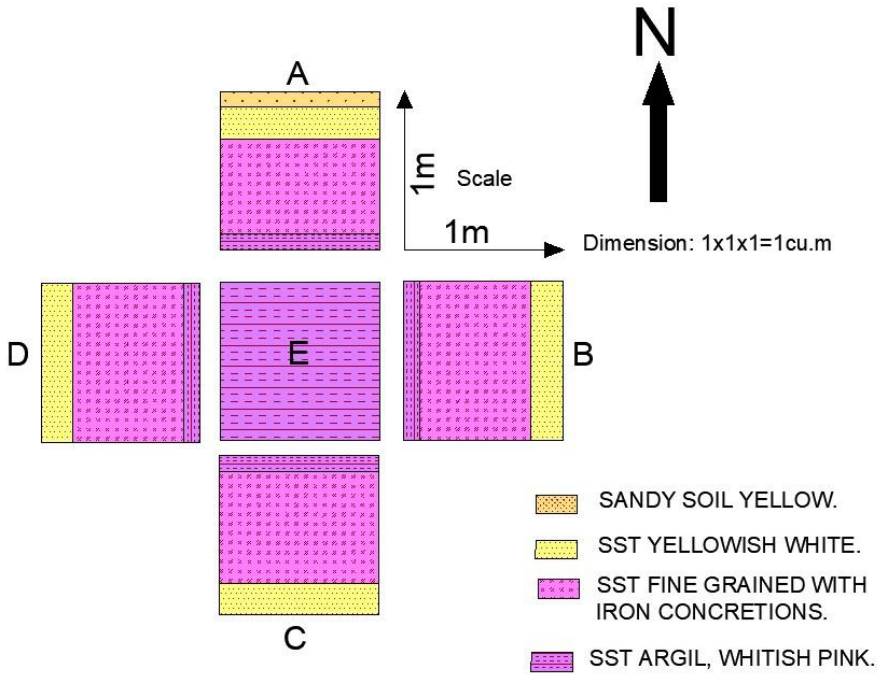
Name of the investigation: Bauxite, Ga, V, Ti & REE.	Date of start: 16/04/2025
Pit no: P4/NB/2025	Date of closer: 16/04/2025
Location: 23.328038°N 69.928047°E	Elevation: 124m
Pit top measurement: a. Length: 1m b. Breadth: 1m	Pit bottom measurement: a. Length: 1m b. Breadth: 1m c. Depth: 1m
Recorded by: V. Santosh & B. Mahesh, Geologists	
Lithology details: Clay stone with mica, Dark grey clay with micaceous interbedded with pink clay bands (Bhuj formation).	
Structural details: Bedding & lamination	
Log of pit: A, B, C, D are side section and E plan view is bottom of the pit.	
Sample no: P4/NB/2025, representative sample was collected from bottom E of Dark grey Clay with mica.	



(not to scale)

Detailed Lithology of Pit no: P5/NB/2025

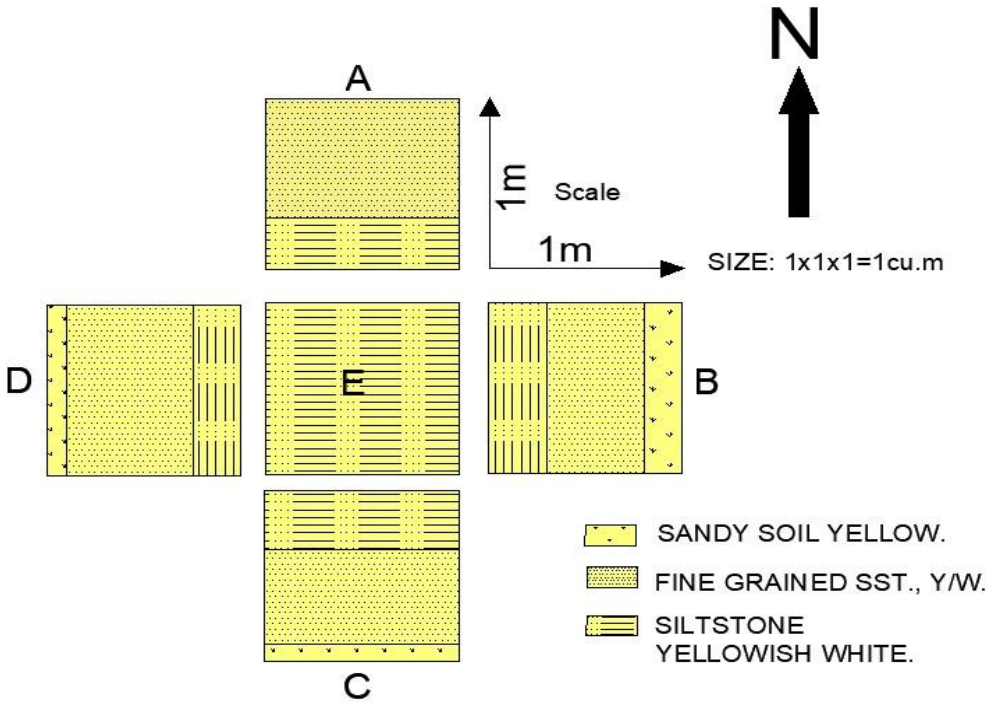
Name of the investigation: Bauxite, Ga, V, Ti & REE.	Date of start: 17/04/2025
Pit no: P5/NB/2025	Date of closer: 17/04/2025
Location: 23.325580°N 69.906665°E	Elevation: 146m
Pit top measurement: a. Length: 1m b. Breadth: 1m	Pit bottom measurement: a. Length: 1m b. Breadth: 1m c. Depth: 1m
Recorded by: V. Santosh & B. Mahesh, Geologists	
Lithology details: Ferruginous SST., Fine to medium grained SST micaceous yellow (Bhuj formation).	
Structural details: Bedding & lamination	
Log of pit: A, B, C, D are side section and E plan view is bottom of the pit.	
Sample no: P5/NB/2025, representative sample was collected from bottom E of fine to medium grained Sandstone	



(not to scale)

Detailed Lithology of Pit no: P6/NB/2025

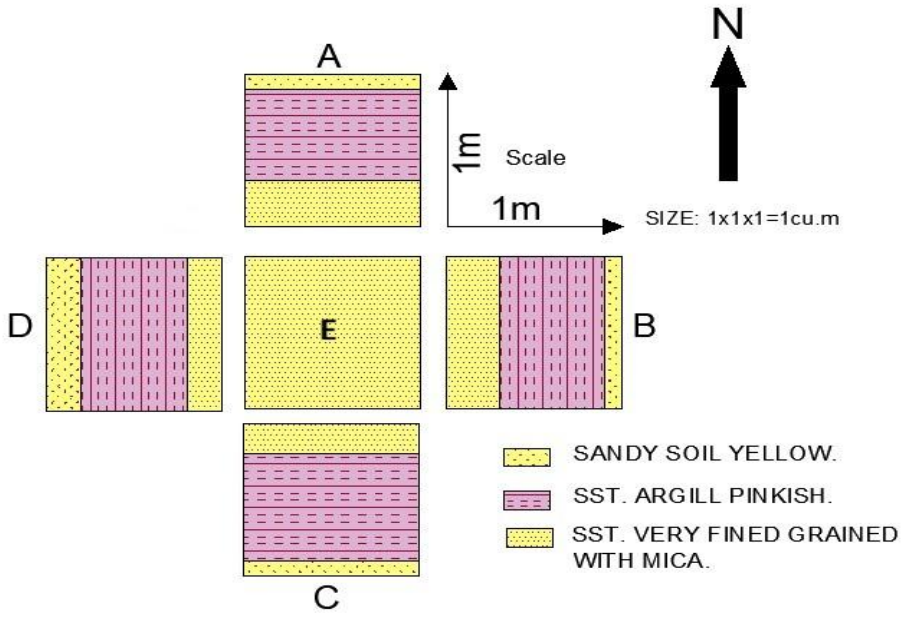
Name of the investigation: Bauxite, Ga, V, Ti & REE.	Date of start: 17/04/2025
Pit no: P6/NB/2025	Date of closer: 17/04/2025
Location: 23.328445°N 69.906430°E	Elevation: 126m
Pit top measurement: a. Length: 1m b. Breadth: 1m	Pit bottom measurement: a. Length: 1m b. Breadth: 1m c. Depth: 1m
Recorded by: V. Santosh & B. Mahesh, Geologists	
Lithology details: Fine grained sandstone Y/W, SST. Fine grained with iron concretions, SST. Argillaceous whitish pink. (Bhuj formation).	
Structural details: Bedding & lamination	
Log of pit: A, B, C, D are side section and E plan view is bottom of the pit.	
Sample no: P6/NB/2025, Representative sample was collected from bottom E of Argillaceous sandstone.	



(not to scale)

Detailed Lithology of Pit no: P7/NB/2025

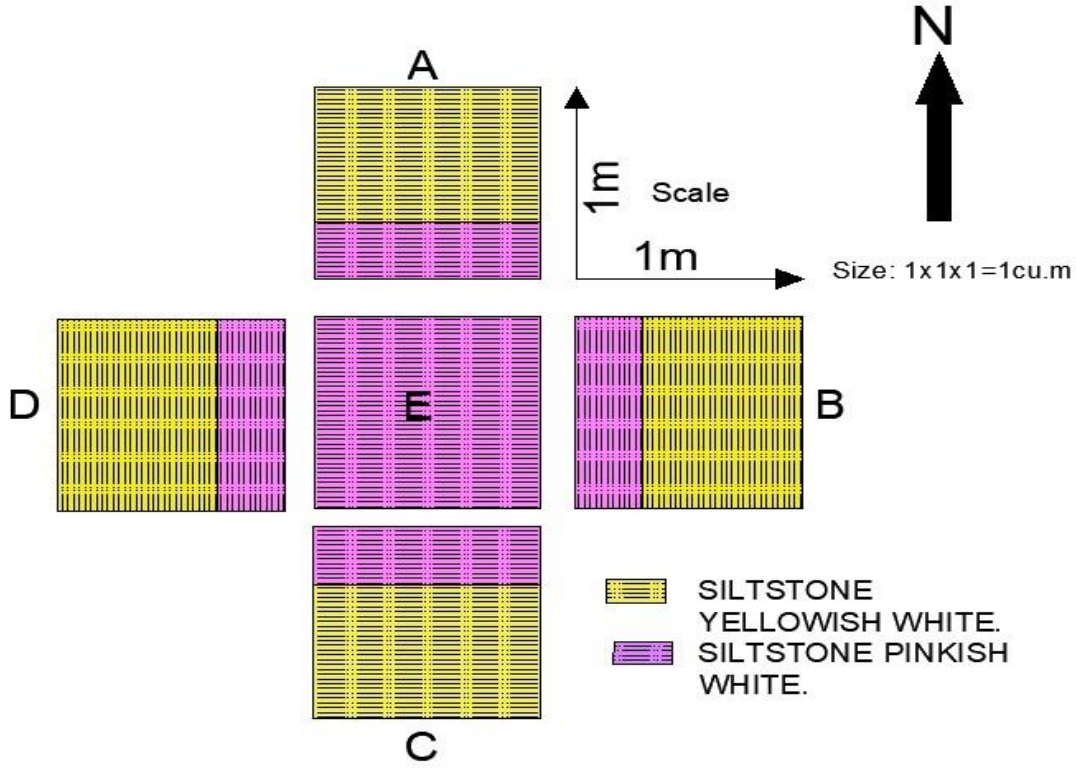
Name of the investigation: Bauxite, Ga, V, Ti & REE.	Date of start: 17/04/2025
Pit no: P7/NB/2025	Date of closer: 17/04/2025
Location: 23.328882°N 69.910428°E	Elevation: 125m
Pit top measurement: a. Length: 1m b. Breadth: 1m	Pit bottom measurement: a. Length: 1m b. Breadth: 1m c. Depth: 1m
Recorded by: V. Santosh & B. Mahesh, Geologists	
Lithology details: Fine grained sandstone yellowish white, Siltstone yellowish white friable (Bhuj formation).	
Structural details: Bedding & lamination	
Log of pit: A, B, C, D are side section and E plan view is bottom of the pit.	
Sample no: P7/NB/2025 representative sample was collected from bottom E of siltstone yellowish white	



(not to scale)

Detailed Lithology of Pit no: P8/NB/2025

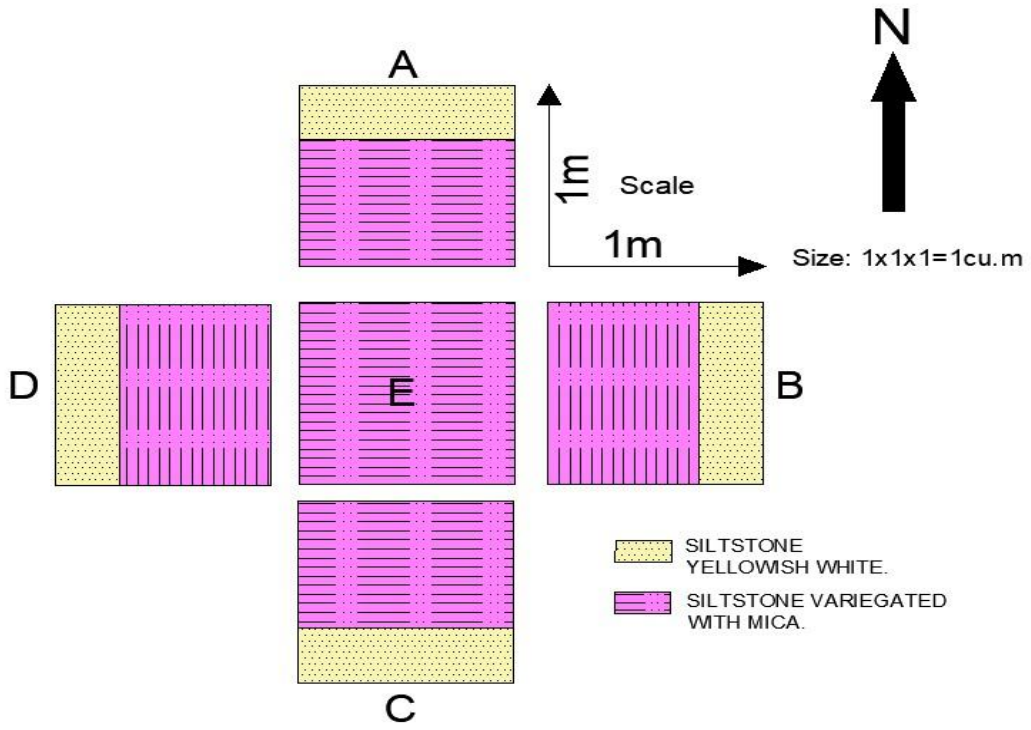
Name of the investigation: Bauxite, Ga, V, Ti & REE.	Date of start: 17/04/2025
Pit no: P8/NB/2025	Date of closer: 17/04/2025
Location: 23.329480°N 69.914093°E	Elevation: 125m
Pit top measurement: a. Length: 1m b. Breadth: 1m	Pit bottom measurement: a. Length: 1m b. Breadth: 1m c. Depth: 1m
Recorded by: V. Santosh & B. Mahesh, Geologists	
Lithology details: argillaceous sandstone pinkish white friable, very fine-grained sandstone with mica whitish yellow & friable (Bhuj formation).	
Structural details: Bedding & lamination	
Log of pit: A, B, C, D are side section and E plan view is bottom of the pit.	
Sample no: P8/NB/2025 Representative sample was collected from bottom E of very fine-grained sandstone.	



(not to scale)

Detailed Lithology of Pit no: P9/NB/2025

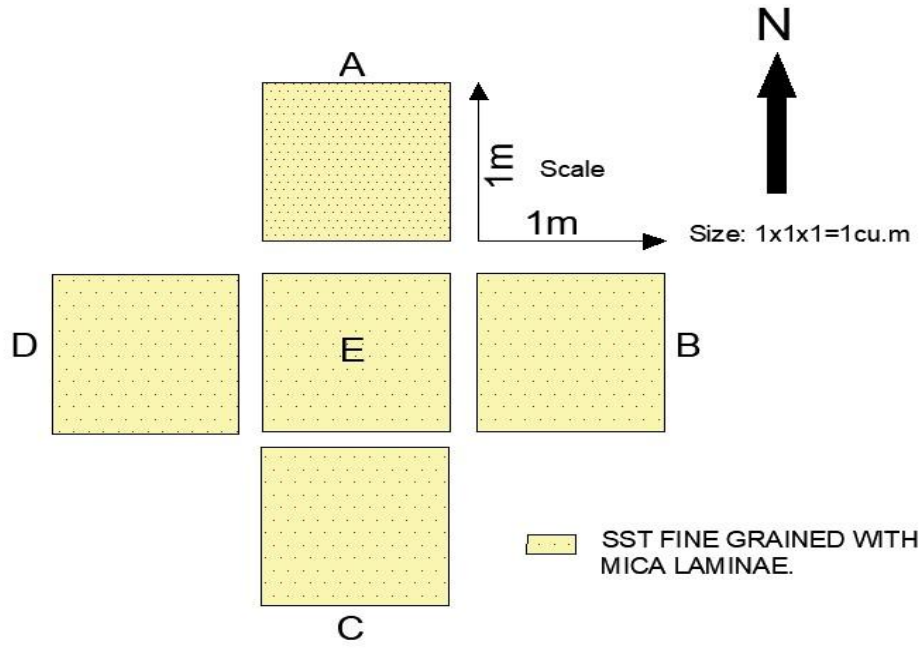
Name of the investigation: Bauxite, Ga, V, Ti & REE.	Date of start: 17/04/2025
Pit no: P9/NB/2025	Date of closer: 17/04/2025
Location: 23.329812°N 69.916072°E	Elevation: 122m
Pit top measurement: a. Length: 1m b. Breadth: 1m	Pit bottom measurement: a. Length: 1m b. Breadth: 1m c. Depth: 1m
Recorded by: V. Santosh & B. Mahesh, Geologists	
Lithology details: Siltstone yellow friable, Siltstone whitish pink friable (Bhuj formation).	
Structural details: Bedding & lamination	
Log of pit: A, B, C, D are side section and E plan view is bottom of the pit.	
Sample no: P9/NB/2025, representative sample was collected from bottom E of siltstone pinkish white	



(not to scale)

Detailed Lithology of Pit no: P10/NB/2025

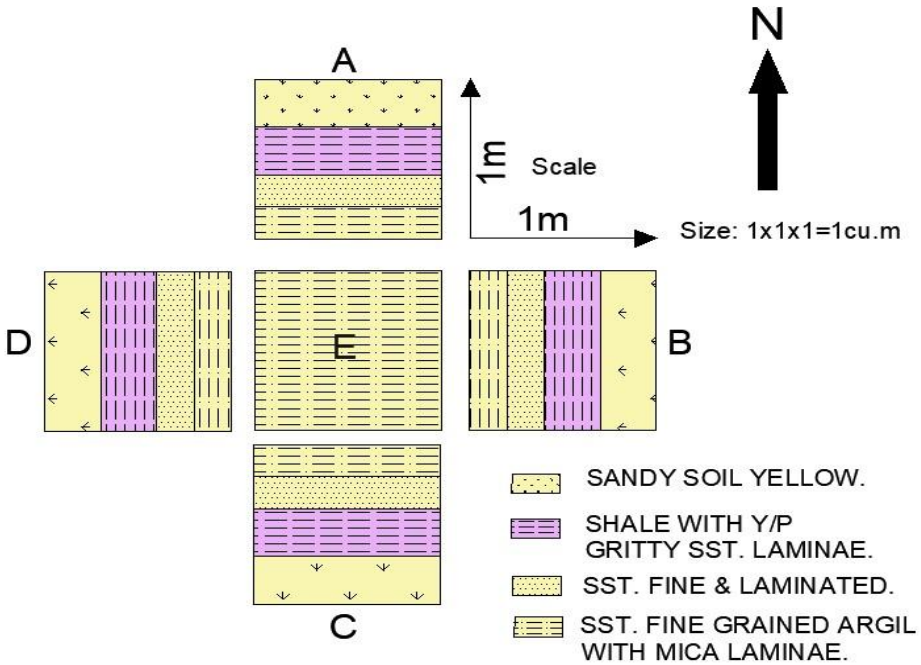
Name of the investigation: Bauxite, Ga, V, Ti & REE.	Date of start: 17/04/2025
Pit no: P10/NB/2025	Date of closer: 17/04/2025
Location: 23.331522°N 69.918707°Eg	Elevation: 116m
Pit top measurement: a. Length: 1m b. Breadth: 1m	Pit bottom measurement: a. Length: 1m b. Breadth: 1m c. Depth: 1m
Recorded by: V. Santosh & B. Mahesh, Geologists	
Lithology details: Siltstone yellow, siltstone Variegated with mica (Bhuj formation).	
Structural details: Bedding & lamination	
Log of pit: A, B, C, D are side section and E plan view is bottom of the pit.	
Sample no: P10/NB/2025, representative sample was collected from bottom E of siltstone variegated	



(not to scale)

Detailed Lithology of Pit no: P11/NB/2025

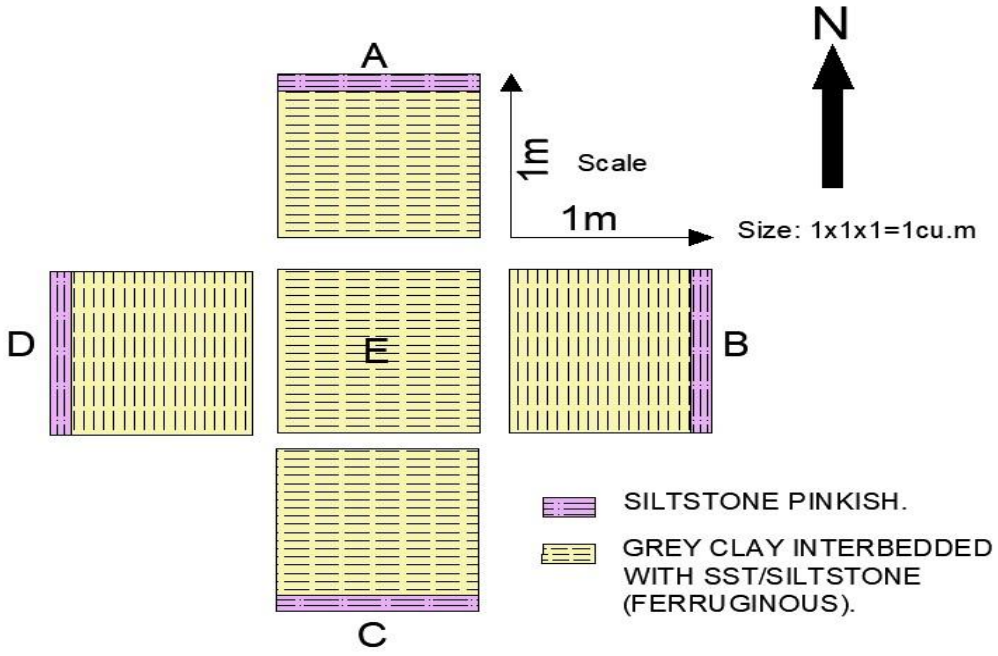
Name of the investigation: Bauxite, Ga, V, Ti & REE.	Date of start: 18/04/2025
Pit no: P11/NB/2025	Date of closer: 18/04/2025
Location: 23.339875°N 69.925592°E	Elevation: 110m
Pit top measurement: a. Length: 1m b. Breadth: 1m	Pit bottom measurement: a. Length: 1m b. Breadth: 1m c. Depth: 1m
Recorded by: V. Santosh & Shiva Kumar Geologists	
Lithology details: SST. fine grained argil. with mica laminae & Calcareous in nature (Katrol formation).	
Structural details Bedding & lamination	
Log of pit: A, B, C, D are side section and E plan view is bottom of the pit.	
Sample no: P11/NB/2025, representative sample was collected from bottom E of fine-grained argillaceous sandstone with mica	



(Not to scale)

Detailed Lithology of Pit no: P12/NB/2025

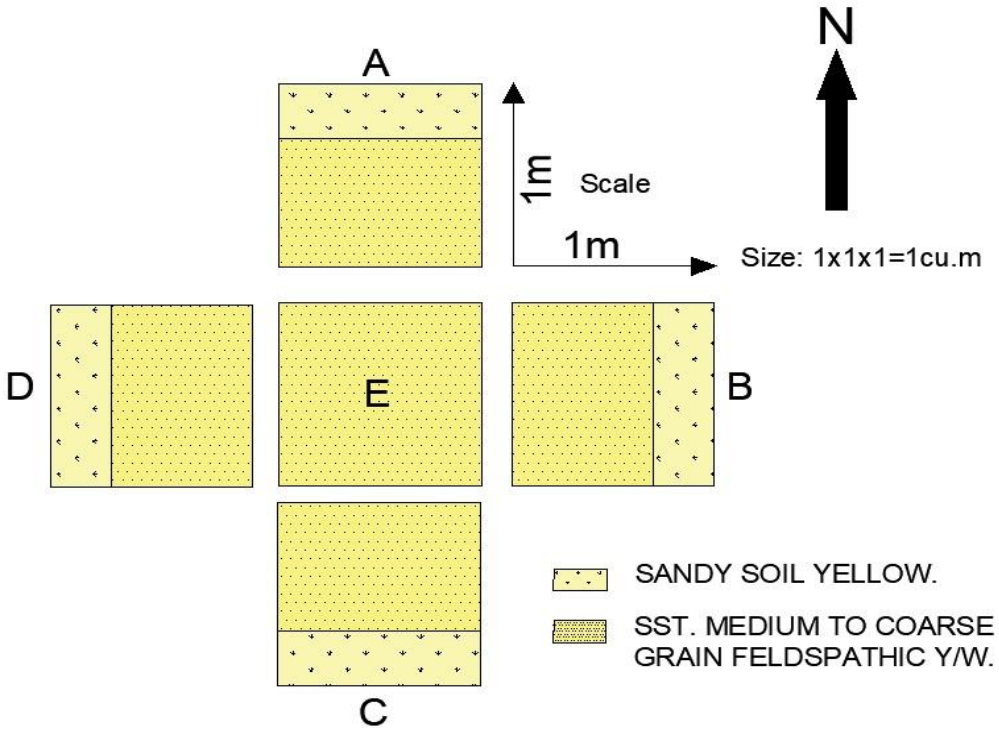
Name of the investigation: Bauxite, Ga, V, Ti & REE.	Date of start: 19/04/2025
Pit no: P12/NB/2025	Date of closer: 19/04/2025
Location: 23.334688°N 69.912072°E	Elevation: 114m
Pit top measurement: a. Length: 1m b. Breadth: 1m	Pit bottom measurement: a. Length: 1m b. Breadth: 1m c. Depth: 1m
Recorded by: V. Santosh & Shiva Kumar, Geologists	
Lithology details: Shale yellow interbedded with pink SST, fine grained laminated sandstone, Fine grained argillaceous sandstone Yellowish white with grey clay intercalations. Calcareous in nature (Katrol formation)	
Structural details: Bedding & lamination	
Log of pit: A, B, C, D are side section and E plan view is bottom of the pit.	
Sample no: P12/NB/2025, representative sample was collected from bottom E of fine-grained argillaceous sandstone	



(not to scale)

Detailed Lithology of Pit no: P13/NB/2025

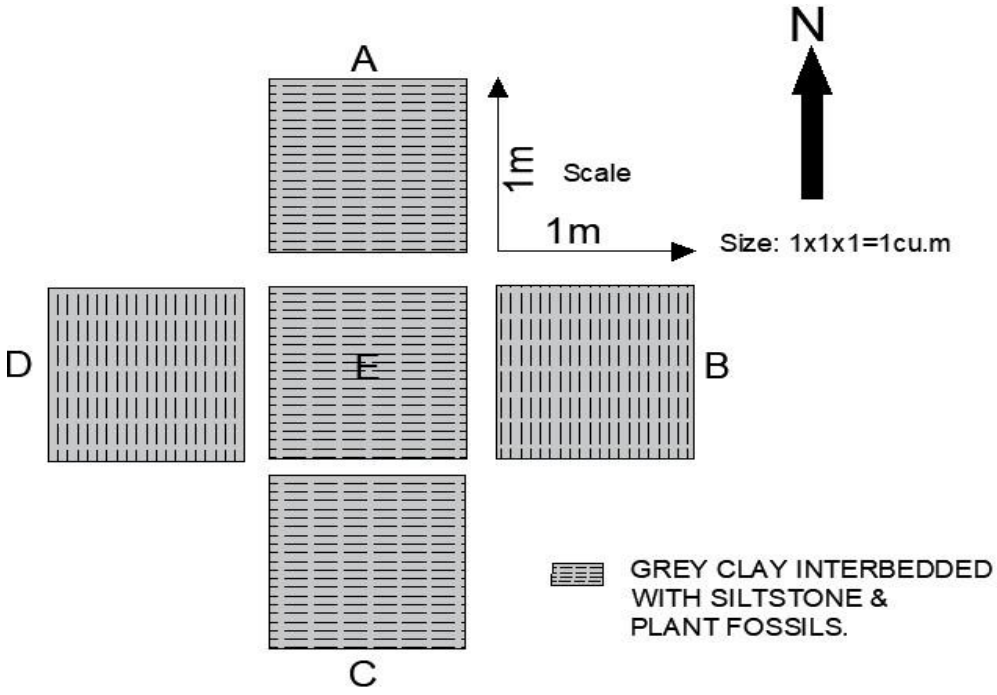
Name of the investigation: Bauxite, Ga, V, Ti & REE.	Date of start: 19/04/2025
Pit no: P13/NB/2025	Date of closer: 19/04/2025
Location: 23.330597°N 69.904402°E	Elevation: 107m
Pit top measurement: a. Length: 1m b. Breadth: 1m	Pit bottom measurement: a. Length: 1m b. Breadth: 1m c. Depth: 1m
Recorded by: V. Santosh & V. Shiva Kumar, Geologists	
Lithology details: Siltstone pinkish, Dark grey clay interbedded with siltstone yellowish pink (Bhuj formation)	
Structural details: Bedding.	
Log of pit: A, B, C, D are side section and E plan view is bottom of the pit.	
Sample no: P13/NB/2025, representative sample was collected from bottom E of grey Clay interbedded with siltstone	



(not to scale)

Detailed Lithology of Pit no: P14/NB/2025

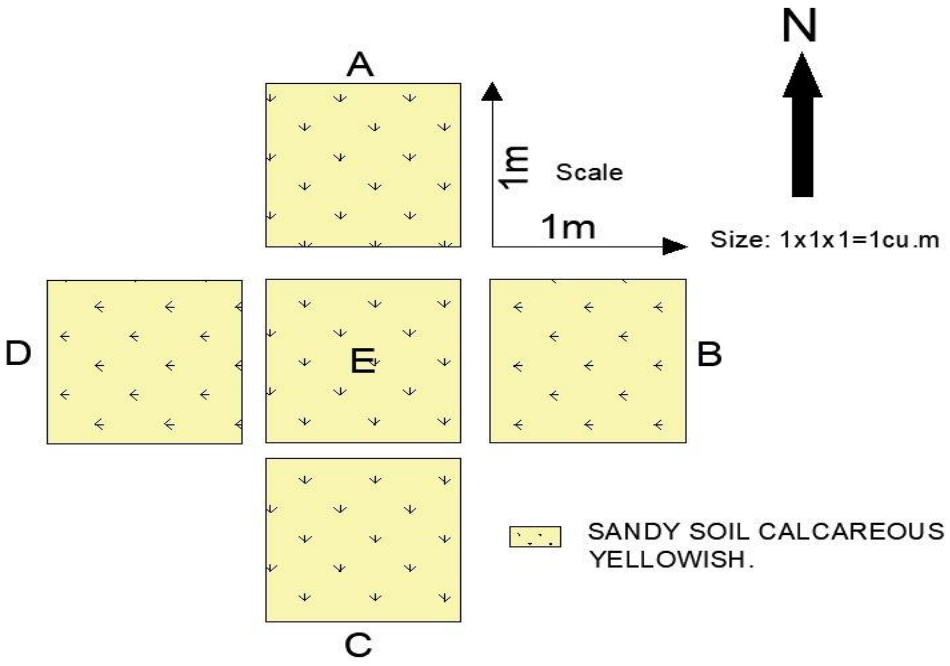
Name of the investigation: Bauxite, Ga, V, Ti & REE.	Date of start: 20/04/2025
Pit no: P14/NB/2025	Date of closer: 20/04/2025
Location: 23.321163°N 69.910602°E	Elevation: 127m
Pit top measurement: a. Length: 1m b. Breadth: 1m	Pit bottom measurement: a. Length: 1m b. Breadth: 1m c. Depth: 1m
Recorded by: V. Santosh & V.S. Kumar, Geologists	
Lithology details: Medium to coarse grained feldspathic sandstone yellowish white.	
Structural details: Bedding & lamination	
Log of pit: A, B, C, D are side section and E plan view is bottom of the pit.	
Sample no: P14/NB/2025, representative sample was collected from bottom E of feldspathic sandstone (Bhuj formation)	



(not to scale)

Detailed Lithology of Pit no: P15/NB/2025

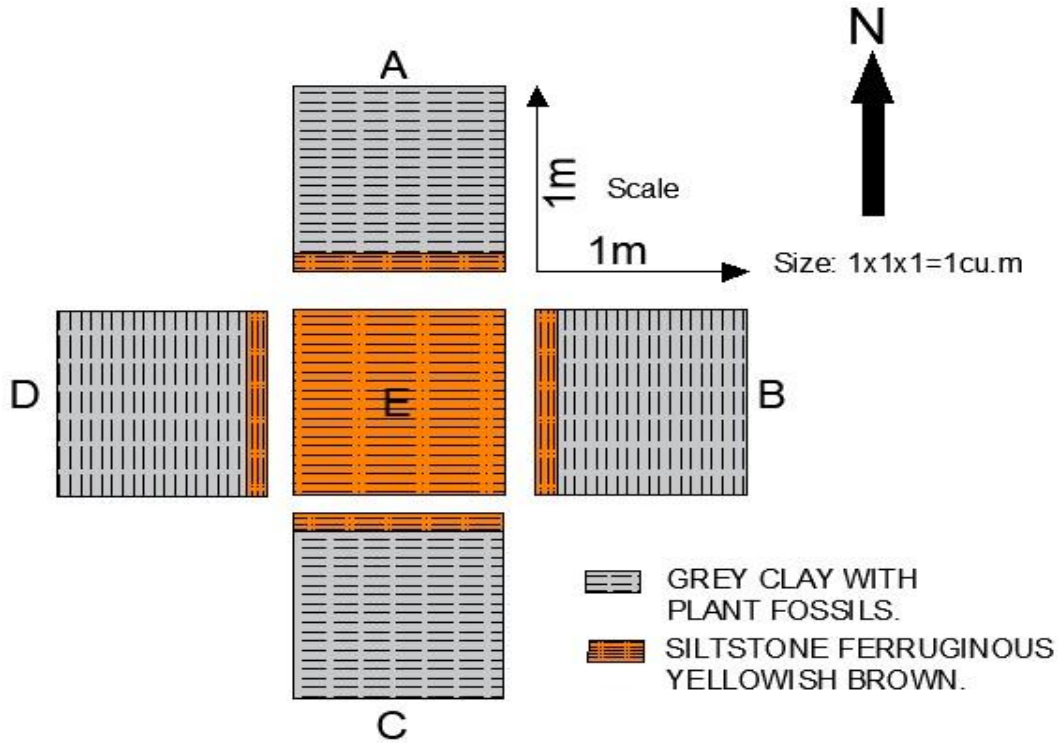
Name of the investigation: Bauxite, Ga, V, Ti & REE.	Date of start: 20/04/2025
Pit no: P15/NB/2025	Date of closer: 20/04/2025
Location: 23.329158°N 69.917623°E	Elevation: 127m
Pit top measurement: a. Length: 1m b. Breadth: 1m	Pit bottom measurement: a. Length: 1m b. Breadth: 1m c. Depth: 1m
Recorded by: V. Santosh & Dr. G. Ravi Kumar, Geologists	
Lithology details: Grey clay interbedded with siltstone and plant fossils (Ptilophyllum).	
Structural details: Bedding.	
Log of pit: A, B, C, D are side section and E plan view is bottom of the pit.	
Sample no: P15/NB/2025, representative sample was collected from bottom E of grey clay with siltstone & plant fossils (Ptilophyllum)-Bhuj formation	



(not to scale)

Detailed Lithology of Pit no: P16/NB/2025

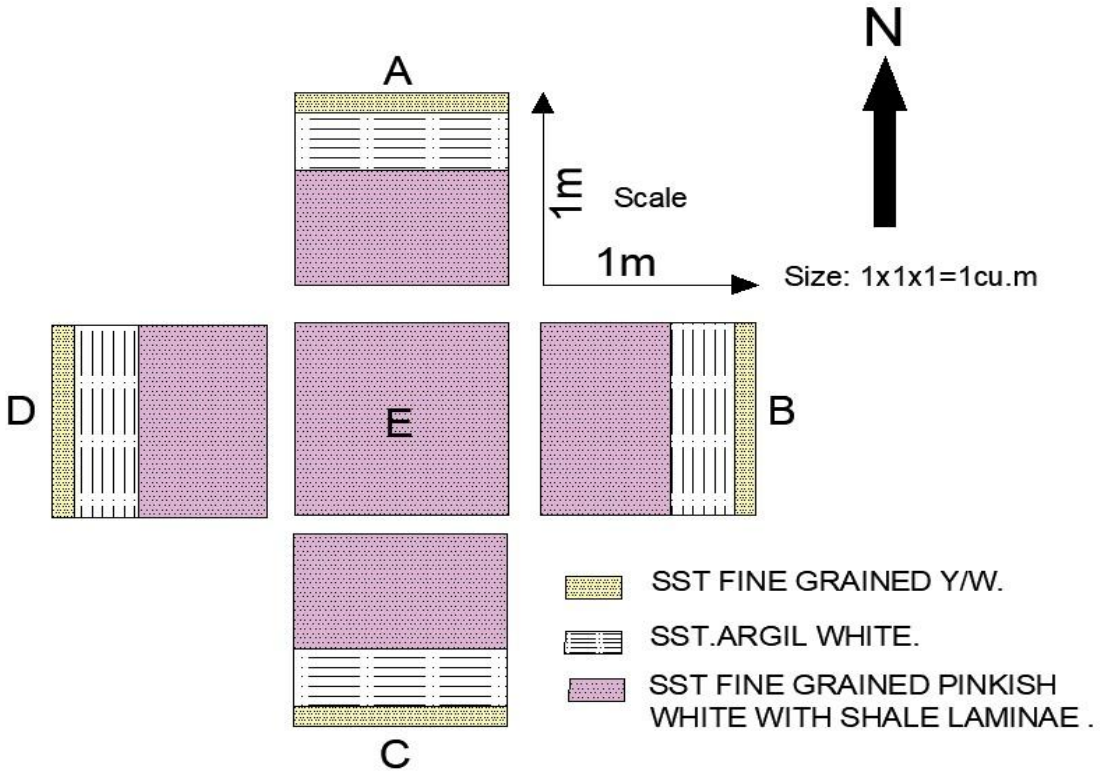
Name of the investigation: Bauxite, Ga, V, Ti & REE.	Date of start: 20/04/2025
Pit no: P16/NB/2025	Date of closer: 20/04/2025
Location: 23.333752°N 69.916712°E	Elevation: 120m
Pit top measurement: a. Length: 1m b. Breadth: 1m	Pit bottom measurement: a. Length: 1m b. Breadth: 1m c. Depth: 1m
Recorded by: V. Santosh & Dr. G. Ravi Kumar, Geologists	
Lithology details: Sandy soil Calcareous in nature (Katrol formation).	
Structural details: Bedding.	
Log of pit: A, B, C, D are side section and E plan view is bottom of the pit.	
Sample no: P16/NB/2025, representative sample was collected from bottom E of sandy soil calcareous	



(not to scale)

Detailed Lithology of Pit no: P17/NB/2025

Name of the investigation: Bauxite, Ga, V, Ti & REE.	Date of start: 20/04/2025
Pit no: P17/NB/2025	Date of closer: 16/04/2025
Location: 23.322903°N 69.910550°E	Elevation: 183m
Pit top measurement: a. Length: 1m b. Breadth: 1m	Pit bottom measurement: a. Length: 1m b. Breadth: 1m c. Depth: 1m
Recorded by: V. Santosh & B. Mahesh, Geologists	
Lithology details: Pinkish grey clay with plant fossils & siltstone hard ferruginous yellowish brown (Bhuj formation).	
Structural details: Bedding & lamination	
Log of pit: A, B, C, D are side section and E plan view is bottom of the pit.	
Sample no: P17/NB/2025, representative sample was collected from bottom E of siltstone ferruginous	

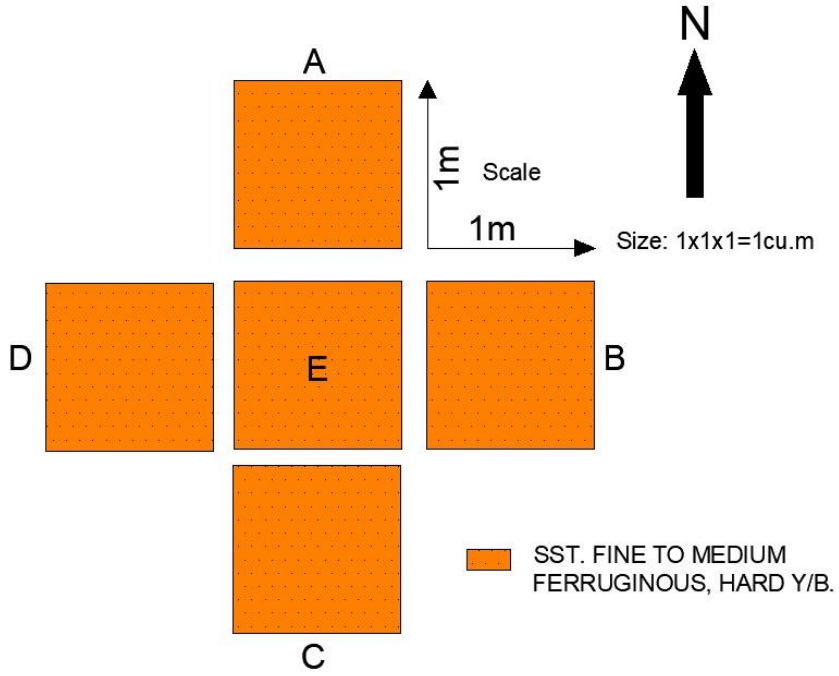


(not to scale)

Detailed Lithology of Pit no: P18/NB/2025

Name of the investigation: Bauxite, Ga, V, Ti & REE.	Date of start: 21/04/2025
Pit no: P18/NB/2025	Date of closer: 20/04/2025
Location: 23.331540°N 69.902135°E	Elevation: 93m
Pit top measurement: a. Length: 1m b. Breadth: 1m	Pit bottom measurement: a. Length: 1m b. Breadth: 1m c. Depth: 1m
Recorded by: V. Santosh & Dr. G. Ravi Kumar, Geologists	
Lithology details: Fine grained yellowish white sandstone, white argillaceous SST., fine grained argillaceous sandstone Pinkish white (Bhuj formation)	
Structural details: Bedding & lamination	

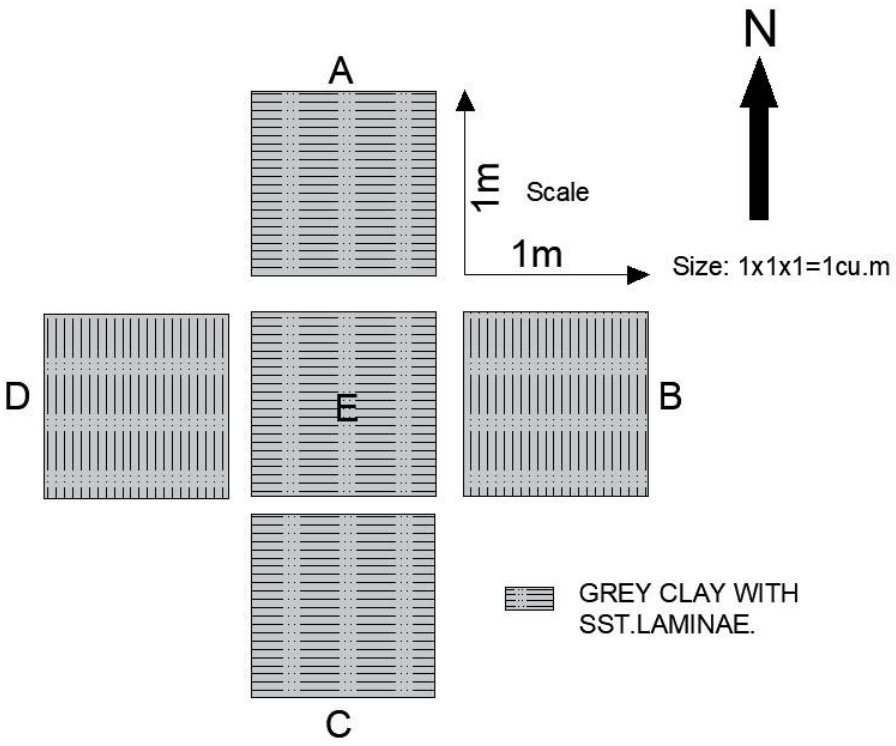
Log of pit: A, B, C, D are side section and E plan view is bottom of the pit.
Sample no: P19/NB/2025, representative sample was collected from bottom E of fine to medium grained ferruginous sandstone.



(not to scale)

Detailed Lithology of Pit no: P19/NB/2025

Name of the investigation: Bauxite, Ga, V, Ti & REE.	Date of start: 22/04/2025
Pit no: P19/NB/2025	Date of closer: 22/04/2025
Location: 23.32382°N 69.90106°E	Elevation: 141m
Pit top measurement: a. Length: 1m b. Breadth: 1m	Pit bottom measurement: a. Length: 1m b. Breadth: 1m c. Depth: 1m
Recorded by: V. Santosh & Dr. G. Ravi Kumar, Geologists	
Lithology details: Yellowish brown fine-grained ferruginous SST., hard and compact (Bhuj formation)	
Structural details: Bedding.	
Log of pit: A, B, C, D are side section and E plan view is bottom of the pit.	
Sample no: P19/NB/2025, representative sample was collected from bottom E of fine to medium grained ferruginous sandstone.	



(not to scale)

Detailed Log of Pit no: P20/NB/2025

Name of the investigation: Bauxite, Ga, V, Ti & REE.	Date of start: 22/04/2025
Pit no: P20/NB/2025	Date of closer: 22/04/2025
Location: 23.32283°N 69.90741°E	Elevation: 134m
Pit top measurement: a. Length: 1m b. Breadth: 1m	Pit bottom measurement: a. Length: 1m b. Breadth: 1m c. Depth: 1m
Recorded by: V. Santosh & Dr G. Ravi Kumar, Geologists	
Lithology details: Grey clay with thin SST. Laminae.	
Structural details: Bedding & lamination	
Log of pit: A, B, C, D are side sections, and E is the plan view is bottom of the pit.	
Sample no: P20/NB/2025, representative sample was collected from bottom E of grey clay with sandstone laminae	

6.1.7.2 Trenching

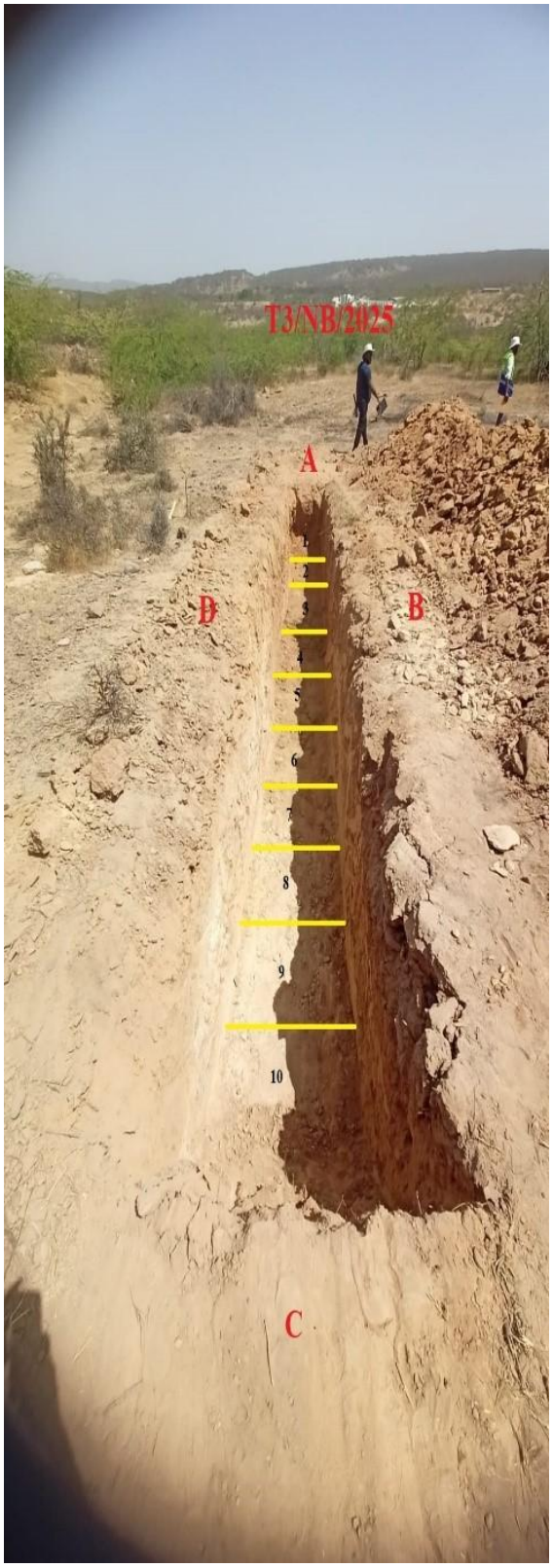
A total of five trenches were excavated in the study area, each measuring 10m in length, 1m in width, and 1m in depth, amounting to a cumulative excavated volume of 50 m^3. After excavation, the trench walls and floor were thoroughly cleaned to expose fresh, undisturbed lithology. From each trench, 10 representative channel samples (marked as T3/NB/2025/1 to 10) were collected systematically from the floor (E) at 1-metre intervals. In addition, four wall samples were obtained—one from each exposed face of the trench—labelled as A, B, C, and D (marked as T3/NB/2025/A, B, C, and D). This sampling approach ensured comprehensive coverage of both lateral and vertical lithological variations within the trench.

Lithological map of trenches on 1:100 scale is enclosed in plate no: VIII and Assay plan of trenches on 1:100 scale is shown in plant no: X. Analytical results of major oxides and REE, Ga of trenches are given in Annexure no: II, III,IV

Table No: 6.3 The location of Pits (measured by GPS)

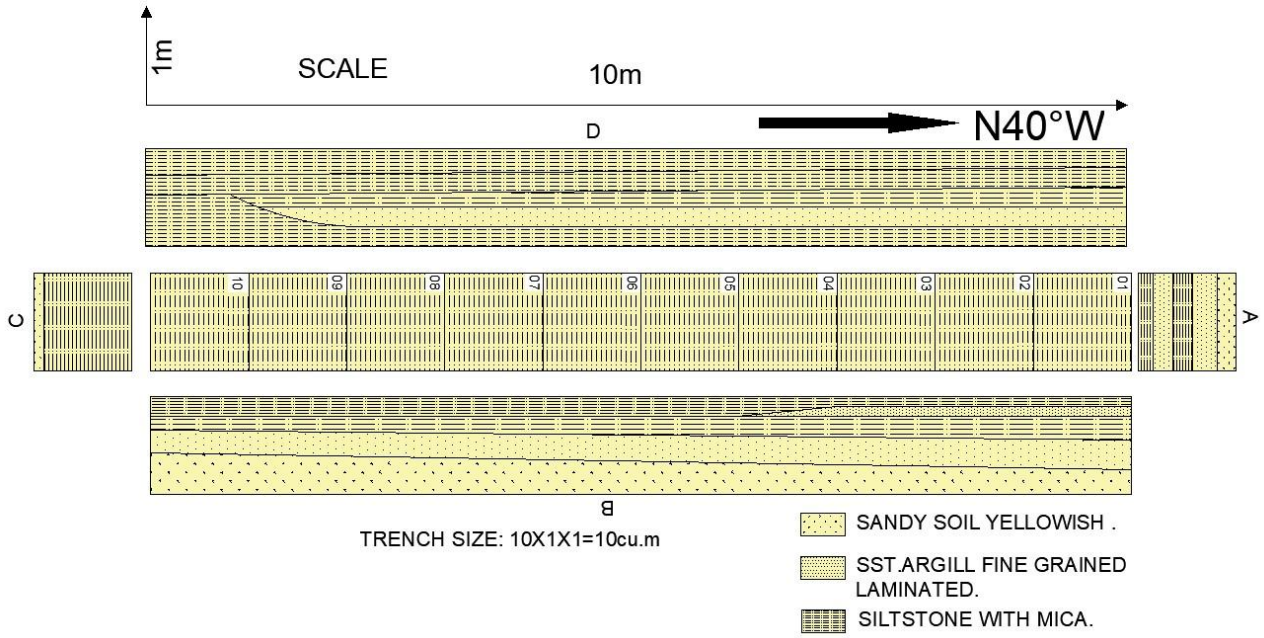
Sr No	Trench No	Coordinate in Degree Decimal Datum WGS-1984		No of Samples Collected
		Latitude	Longitude	
1	T1/NB/2025	23.335140	69.924022	14
2	T2/NB/2025	23.331850	69.907867	14
3	T3/NB/2025	23.328870	69.901747	14
4	T4/NB/2025	23.336027	69.912690	14
5	T5/NB/2025	23.323207	69.904923	14

Photo-26: Image showing trench in the study area (Size 10*1*1m)



Brief description of trench profiles is given below for 5 trenches

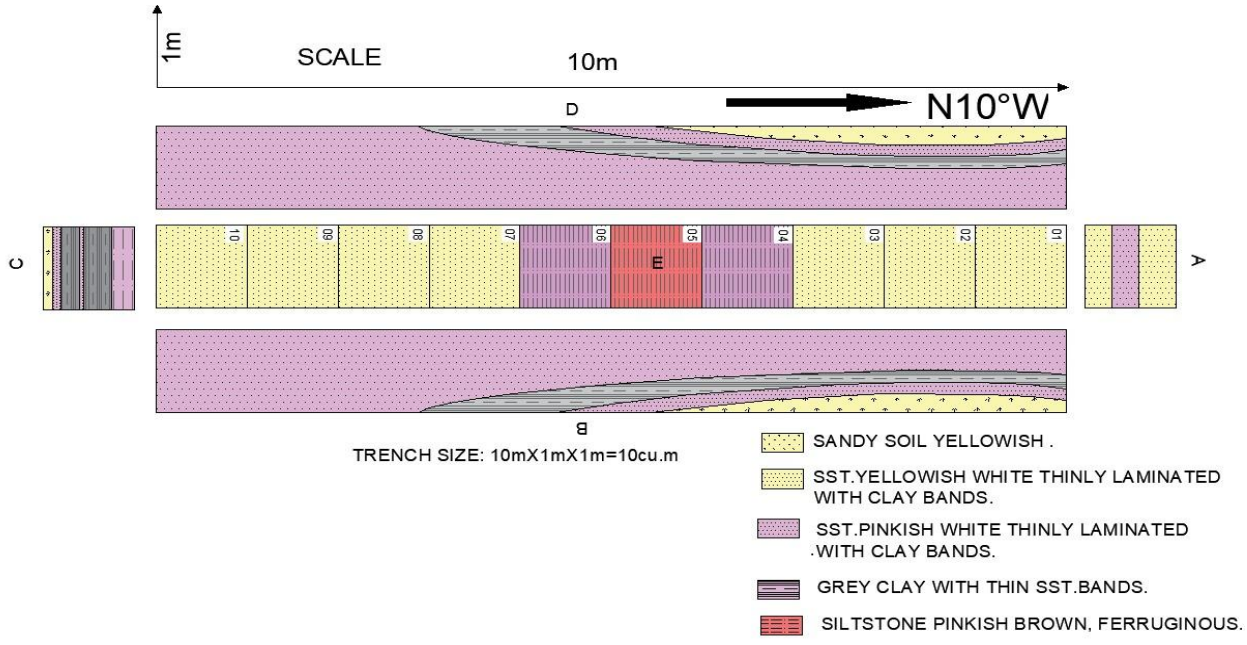
Name of the investigation: Bauxite, Ga, V, Ti, REE	Date of commencement: 18/04/2025
Trench No: T1/NB/2025	Date of completion: 18/04/2025
Location: 23.335140°N, 69.924022°E	Elevation: 165m
a. Length: 10m b. Breadth: 1m c. Depth: 1m volume: (10Cu.m)	
Recorded by: V. Santosh and B. Mahesh	
Lithology details: yellowish white sandstone argillaceous fine grained, siltstone with mica laminae (Bhuj formation)	
Structural details: bedding and lamination	
Log of Trench: Side walls represented by north by A, east by B, South by C and west by D and bottom of the pit by E. long axis direction of trench is marked.	
Samples: 10 representative samples were collected from bottom of E at 1m interval (T1/NB/2025/01 to T1/NB/2025/10 and 4 samples from four side walls. (T1/NB/2025-A, B, C, D respectively). Total 14 samples were collected from this trench.	



(Not to scale)

Detailed Lithology of Trench No: T1/NB/2025

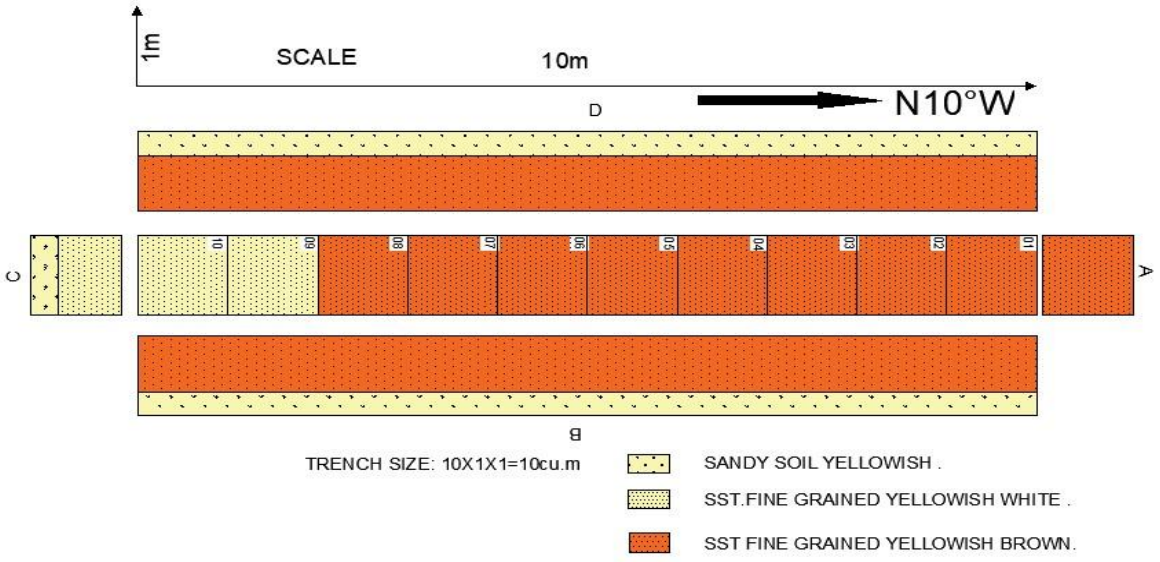
Name of the investigation: Bauxite, Ga, V, Ti, REE	Date of commencement: 19/04/2025
Trench No: T2/NB/2025	Date of completion: 19/04/2025
Location: 23.331850°N, 69.907867°E	Elevation: 108m
a. Length: 10m b. Breadth: 1m c. Depth: 1m volume: (10Cu.m)	
Recorded by: V. Santosh and B. Mahesh	
Lithology details: Sandstone thinly laminated yellowish white/pinkish white interbedded with grey clay and pinkish brown siltstone (Bhuj formation)	
Structural details: bedding and lamination	
Log of Trench: Side walls represented by north by A, east by B, South by C and west by D and bottom of the pit by E. long axis direction of trench is marked.	
Samples: 10 representative samples were collected from bottom of E at 1m interval (T2/NB/2025/01 to T2/NB/2025/10 and 4 samples from four side walls. (T2/NB/2025-A, B, C, D respectively). Total 14 samples were collected from this trench.	



(not to scale)

Detailed Lithology of Trench no: T2/NB/2025

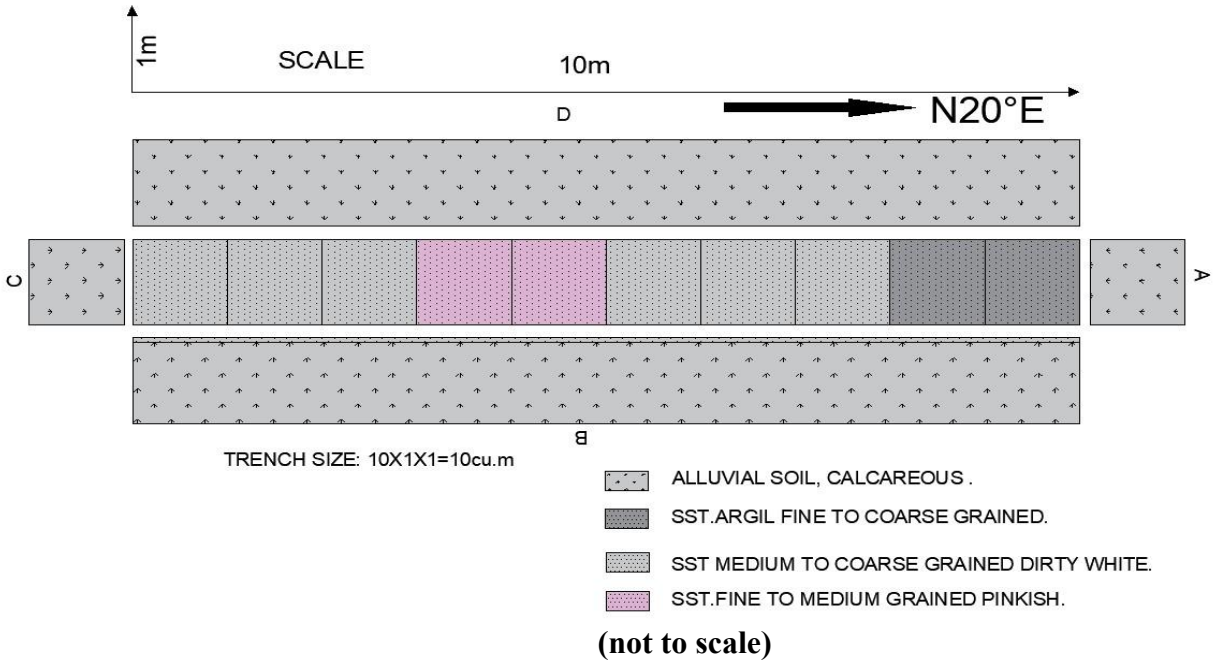
Name of the investigation: Bauxite, Ga, V, Ti, REE	Date of commencement: 21/04/2025
Trench No: T3/NB/2025	Date of completion: 21/04/2025
Location: 23.328870°N, 69.901747°E	Elevation: 111m
a. Length: 10m b. Breadth: 1m c. Depth: 1m volume: (10Cu.m)	
Recorded by: V. Santosh and B. Mahesh	
Lithology details: yellowish white/yellowish-brown fine-grained sandstone (Bhuj formation)	
Structural details: bedding and lamination	
Log of Trench: Side walls represented by north by A, east by B, South by C and west by D and bottom of the pit by E. long axis direction of trench is marked.	
Samples: 10 representative samples were collected from bottom of E at 1m interval (T3/NB/2025/01 to T3/NB/2025/10 and 4 samples from four side walls. (T3/NB/2025-A, B, C, D respectively). Total 14 samples were collected from this trench.	



(not to scale)

Detailed Lithology of Trench no: T3/NB/2025

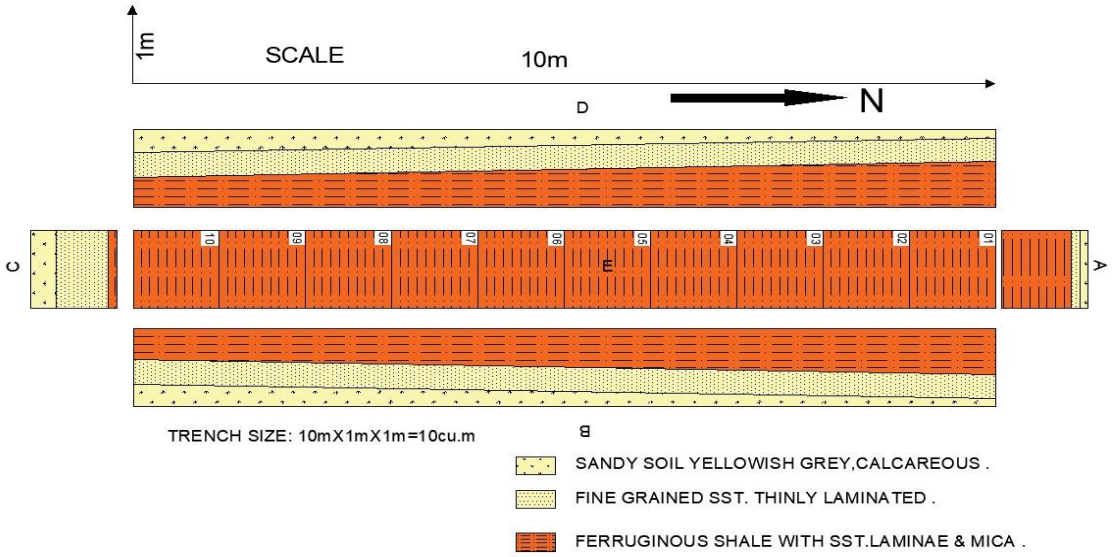
Name of the investigation: Bauxite, Ga, V, Ti, REE	Date of commencement: 21/04/2025
Trench No: T4/NB/2025	Date of completion: 21/04/2025
Location: 23.336027°N, 69.912690°E	Elevation: 122m
a. Length: 10m b. Breadth: 1m c. Depth: 1m volume: (10Cu.m)	
Recorded by: V. Santosh and B. Mahesh	
Lithology details: calcareous fine to coarse grained sandstone dirty white/pinkish in colour (Katrol formation)	
Structural details: bedding and lamination	
Log of Trench: Side walls represented by north by A, east by B, South by C and west by D and bottom of the pit by E. long axis direction of trench is marked.	
Samples: 10 representative samples were collected from bottom of E at 1m interval (T4/NB/2025/01 to T4/NB/2025/10 and 4 samples from four side walls. (T4/NB/2025-A, B, C, D respectively). Total 14 samples were collected from this trench.	



(not to scale)

Detailed Lithology of Trench no: T4/NB/2025

Name of the investigation: Bauxite, Ga, V, Ti, REE	Date of commencement: 22/04/2025
Trench No: T5/NB/2025	Date of completion: 22/04/2025
Location: 23.323207°N, 69.904923°E	Elevation: 141m
a. Length: 10m b. Breadth: 1m c. Depth: 1m volume: (10Cu.m)	
Recorded by: V. Santosh and B. Mahesh	
Lithology details: Fine grained thinly laminated sandstone and ferruginous shale with sst & mica laminae (Bhuj formation)	
Structural details: bedding and lamination	
Log of Trench: Side walls represented by north by A, east by B, South by C and west by D and bottom of the pit by E. long axis direction of trench is marked.	
Samples: 10 representative samples were collected from bottom of E at 1m interval (T5/NB/2025/01 to T5/NB/2025/10 and 4 samples from four side walls. (T5/NB/2025-A, B, C, D respectively). Total 14 samples were collected from this trench.	



(not to scale)

Detailed Lithology of Trench no: T5/NB/2025

6.1.8 Sampling

A total of 20 pit samples and 70 trench samples were collected through systematic pitting and trenching activities within the study area. Sampling methodology adopted for pitting and trenching has been discussed in subsequent paragraphs. Thus, a total of 90 samples were collected systematically from pits and trenches in the study area.

Sample collection

A representative sample (2–3 kg) was collected from the pits and trenches using a pickaxe and spade, placed in a properly labelled sample bag, and assigned a unique sample number written clearly with a permanent marker. The lithological details of all the pits and trenches were systematically recorded.

Sample preparation:

The sample preparation followed a multi-stage crushing, grinding, and sieving protocol

1. **Initial Crushing & Sieving:** Mesh No. 8 (2.36 mm) The entire bulk sample was crushed and sieved. The oversize was further crushed to pass through the mesh no:08 completely. The sieved material of (-8 mesh size) was reduced to 1 kg by Coning and Quartering, ensuring homogeneity.
2. **Second Stage:** Mesh No. 80 (177 μm): The 1 kg sample of -8 mesh size was further crushed, ground, and sieved through 80 no mesh. The sieved fraction was reduced to 500 g by Coning and Quartering.
3. **Final Stage:** Mesh No. 200 (74 μm): The 500 g sample of -80 mesh size was again crushed, ground, and passed completely through mesh No. 200.This -200-mesh fraction constituted the final laboratory sample. From this, 100 g of the prepared lab sample was dispatched to the analytical laboratory, while the remaining portion was stored as a reference sample. At every stage of preparation, strict care was taken to maintain sample integrity and homogeneity, in accordance with NQT guidelines

Appropriateness of grain size

In accordance with the standard sampling procedures, it has also been observed that smaller the particle size, higher the homogeneity of the sample as well as higher the dissolvability during the chemical analysis. As per the standard practice, samples are generally pounded to (-)200 mesh size for analysis of trace element through ICPMS.

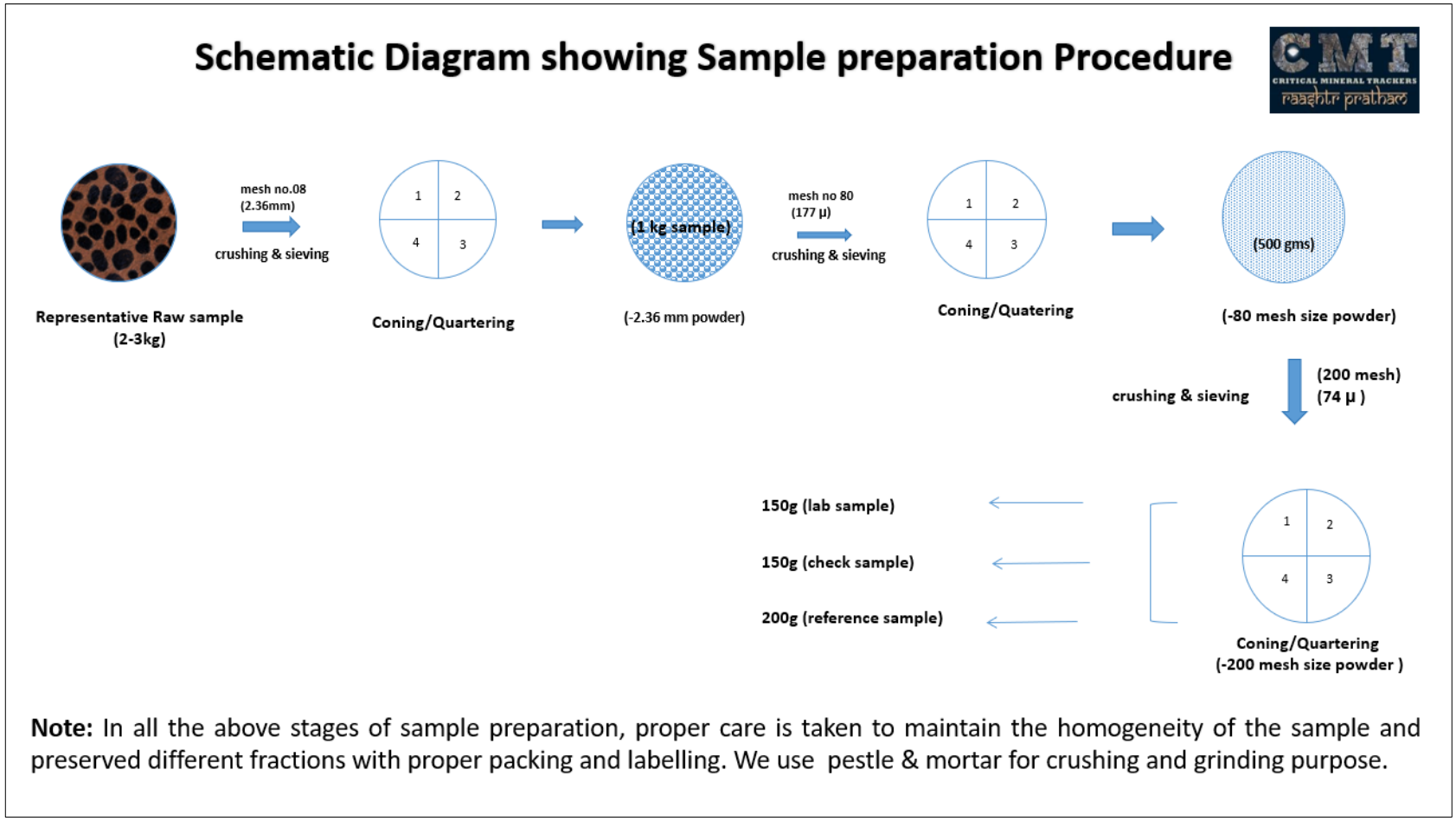

Schematic Diagram showing Sample preparation Procedure
Representative Raw sample
(2-3kg)
mesh no.08
(2.36mm)
crushing & sieving
1
2
4
3
Coning/Quartering
(1 kg sample)
(-2.36 mm powder)
mesh no 80
(177 µ)
crushing & sieving
1
2
4
3
Coning/Quatering
(500 gms)
(-80 mesh size powder)
crushing & sieving
(200 mesh)
(74 µ)
150g (lab sample)
150g (check sample)
200g (reference sample)
1
2
4
3
Coning/Quartering
(-200 mesh size powder)
Note: In all the above stages of sample preparation, proper care is taken to maintain the homogeneity of the sample and preserved different fractions with proper packing and labelling. We use pestle & mortar for crushing and grinding purpose.

Fig No: 10

Photos showing different activities of sample preparation: (Photos: 27 to 33)

Photo No: 27 Sampling shed, CMT, Bhuj-Gujarat

Photo No: 28 Recording the details of sample

Photo No: 29 Crushing and sieving of samples

Photo No: 30 coning and Quartering

Sieves used:

Photo No: 31 Sieve no: 8 mesh (2.36mm)

Photo No: 32 Sieve no: 80 mesh (180 micron)

Photo No: 33 Sieve no: 200 mesh (75 microm) and packing of final sample

6.1.9 Discussion on Geochemistry of pit and trench samples

Geochemistry of pit and trench Samples:

A total of 90 pit and trench samples were analysed for major oxides, including TiO_2 and V, while 15 selected samples were analysed for Rare Earth Elements (14 elements) and Gallium (Ga). The geochemical results indicate that the concentrations of bauxite indicators (Al_2O_3) as well as Ga, V, TiO_2, and REEs are low and fall below the threshold limits required for economic significance. The analysed samples do not display any anomalous enrichment or geochemical signatures suggestive of mineralisation for the targeted commodities. Therefore, the investigated area does not demonstrate favourable potential for bauxite, Ga, V, Ti, or REE mineralization at the scale explored. The spatial distribution of major oxides and REE elements is presented and interpreted in the following sections through major oxide distribution maps and elemental distribution maps.

Al2O3: Aluminium oxide (Al_2O_3) is the major constituent of bauxite; however, the Katrol and Bhuj formations in the study area comprise predominantly sandstone, siltstone, shale, and clay, with no evidence of lateritization or true bauxite horizons. The analysed samples show Al_2O_3 values ranging from 0.28 to 28.81% in the Katrol Formation and 4.83 to 34.89% in the Bhuj Formation. Although some samples display moderately high Al_2O_3, the corresponding SiO_2 contents are also high, indicating that the aluminium is primarily silicate-bound in clay minerals rather than present as gibbsite or boehmite. Higher Al_2O_3 values correlate strongly with grey clay lithologies, reflecting increased proportions of kaolinite, illite, or smectite.

Ternary diagram plotting of Al_2O_3–SiO_2–Fe_2O_3 further reveals that all samples fall within the “bauxitic clay” field rather than the true bauxite domain, confirming that the material represents argillaceous sediments enriched in alumina-bearing clays, not economic bauxite. Thus, despite localized Al_2O_3 enrichment in clay-rich zones, the absence of low silica and lack of laterite development indicate that the conditions necessary for bauxite formation were not attained in the study area.

The analytical results of major oxides and REE as received from laboratory is given below in Annexures: II, III, IV, V

ANNEXURE – II

Statement showing analytical results of major oxides (by XRF) of 20 pit samples in Nadapa Area, Dist: Kachchh, Gujarat

S. No	Lab. No.	Sample No	Lithology	SiO2	Al2O3	Fe2O3	MnO	MgO	CaO	Na2O	K2O	TiO2	P2O5	Loss on Ignition (LOI)	V	Maturity Index = (K2O/(Na2O+K2O))	
				(%)											(ppm)		
1	LL/25-26/001204/01	P1/ND/2025	Arenaceous clay	55.13	22.85	3.75	0.01	0.45	0.22	6.11	0.99	0.99	0.05	9.19	103.53	0.14	Immaturity
2	LL/25-26/001204/02	P2/NB/2025	Ferru.sandstone+ clay	54.02	34.05	1.41	0.01	0.60	0.19	0.22	0.64	1.47	0.04	7.18	82.50	0.74	Maturity
3	LL/25-26/001204/03	P3/NB/2025	d.grey clay	51.25	34.89	1.57	0.00	0.62	0.13	0.64	1.19	1.36	0.04	7.97	71.90	0.65	Maturity
4	LL/25-26/001204/04	P4/NB/2025	D.grey clay with mica	56.89	29.95	2.48	0.00	0.74	0.05	0.82	1.67	0.94	0.05	6.25	80.55	0.67	Maturity
5	LL/25-26/001204/05	P5/NB/2025	sandstone fgd-mgd y/w	74.96	14.01	3.67	0.04	0.27	0.44	0.17	2.19	1.3 I	0.04	2.64	52.28	0.93	Maturity
6	LL/25-26/001204/06	P6/NB/2025	Argill.Sst p/w	58.96	17.18	15.38	0.01	0.46	0.22	0.45	1.52	0.88	0.17	4.70	168.10	0.77	Maturity
7	LL/25-26/001204/07	P7/NB/2025	Siltstone friable	66.40	17.56	5.46	0.07	1.04	0.81	0.51	1.96	0.99	0.04	5.03	77.80	0.79	Maturity
8	LL/25-26/001204/08	P8/NB/2025	SST.vfgd+mica	70.77	19.96	2.38	0.01	0.39	0.29	0.46	2.49	0.90	0.02	2.12	15.70	0.84	Maturity
9	LL/25-26/001204/09	P9/NB/2025	Siltstone friable p/w	72.95	10.84	6.58	0.02	0.61	1.45	0.55	1.95	0.98	0.04	3.85	41.50	0.78	Maturity
10	LL/25-26/001204/10	P10/NB/2025	siltstone variegated	60.90	24.03	3.89	0.0 1	0.72	0. 32	1.56	1.77	1.41	0.05	5.07	77.80	0.53	Maturity
11	LL/25-26/001204/25	P11/NB/2025	sst.fgd+mica	66.54	20.83	4.57	0.02	0.42	0.41	0.15	1.52	1.34	0.07	3.96	85.75	0.91	Maturity
12	LL/25-26/001204/40	P12/NB/2025	Argill.Sst fgd +mica	55.40	28.81	2.81	0.03	0.45	0.70	0.23	1.09	1.21	0.04	9.09	83.28	0.83	Maturity
13	LL/25-26/001204/41	P13/NB/2025	grey clay interbeded with siltstone	64.50	17.57	6.44	0.02	1.09	0.2 1	0.41	1.32	0.98	0.06	7. 19	95.35	0.76	Maturity

14	LL/25-26/001204/42	P14/NB/2025	Feldpathic Sst	77.97	13.25	2.15	0.01	0.15	0.17	0.06	0.85	0.52	0.02	4.53	69.10	0.93	Maturity
15	LL/25-26/001204/43	P15/NB/2025	grey clay interbeded with siltstone	61.24	23.41	2.44	0.03	0.91	0.11	0.30	1.17	1.0 1	0.03	9.15	91 .65	0.80	Maturity
16	LL/25-26/001204/44	P16/NB/2025	Calcariuos soil	54.92	0.31	4.60	0.03	1.41	17.76	0.19	0.91	0.39	0.08	19.08	60.20	0.83	Maturity
17	LL/25-26/001204/45	P17/NB/2025	siltstone y/brown	60.98	21.10	3.10	0.03	0.24	0.11	3.74	0.68	1.19	0.03	8.50	108.53	0.15	Immaturity
18	LL/25-26/001204/60	P18/NB/2025	sandstone with shale laminae	70.64	16.15	5.09	0.03	0.23	0.26	0.09	1.28	0.88	0.04	4.99	48.20	0.93	Maturity
19	LL/25-26/001204/89	P19/NB/2025	Hard Ferru.Sst	44.74	9.71	29.97	0.19	0.37	2.03	0.06	0.45	0.74	0.37	11.22	299.18	0.88	Maturity
20	LL/25-26/001204/90	P20/NB/2025	Grey clay+ sst. Laminae	56.11	28.55	2.27	0.03	0.54	0.10	0.35	0.64	1.03	0.03	10.05	101.58	0.65	Maturity

ANNEXURE – III

Statement showing analytical results of major oxides (by XRF) of 70 trench samples in Nadapa Area, Dist: Kachchh, Gujarat

S. No	Lab. No.	Sample No	Lithology	SiO2	Al2O3	Fe2O3	MnO	MgO	CaO	Na2O	K2O	TiO2	P2O5	Loss on Ignition (LOI)	V	Maturity Index = (K2O/(Na2O+K2O))	
				(%)											(ppm)		
1	LL/25-26/001204/11	Tl/NB/2025/01	siltstone with mica	65.86	20.98	3.78	0.02	0.77	0.67	0.38	2.64	0.71	0.03	3.87	30.80	0.87	Matured
2	LL/25-26/001204/12	T1/NB/2025/02	siltstone with mica	59.68	20.88	5.11	0.02	0.92	0.46	0.46	2.45	0.80	0.03	8.92	41.40	0.84	Matured
3	LL/25-26/001204/13	Tl/NB/2025/03	siltstone with mica	68.99	18.41	3.72	0.02	0.70	0.49	0.37	2.52	0.80	0.03	3.67	31.90	0.87	Matured
4	LL/25-26/001204/14	TI/NB/2025/04	siltstone with mica	70.24	19.10	2.78	0.01	0.64	0.19	0.41	2.78	0.70	0.03	3.0 I	23.80	0.87	Matured
5	LL/25-26/001204/15	Tl/NB/2025/05	siltstone with mica	69.42	20.94	2.14	0.01	0.58	0.1 I	0.30	2.74	0.87	0.03	2.65	25.50	0.90	Matured
6	LL/25-26/001204/16	Tl/NB/2025/06	siltstone with mica	68.86	21.65	2.07	0.02	0.57	0.29	0.34	2.78	0.74	0.03	2.54	22.70	0.89	Matured
7	LL/25-26/001204/17	Tl/NB/2025/07	siltstone with mica	68.34	20.82	2.00	0.01	0.73	0.77	0.42	2.54	1.01	0.04	3.13	26.80	0.86	Matured
8	LL/25-26/001204/18	Tl/NB/2025/08	siltstone with mica	68.77	19.32	2.07	0.01	0.87	1.09	0.43	2.42	0.88	0.04	3.89	29.60	0.85	Matured
9	LL/25-26/001204/19	TI/NB/2025/09	siltstone with mica	57.08	20.04	6.35	0.02	1.41	2.63	0.88	2.09	0.58	0.03	8.59	43.40	0.70	Matured
10	LL/25-26/001204/20	TI/NB/2025/10	siltstone with mica	50.08	20.57	12.45	0.03	1.71	2.08	0.99	1.75	0.87	0.05	9.22	76.80	0.64	Matured
11	LL/25-26/001204/21	TI/NB/2025/A	sandstone+siltstone interbeded with mica	63.82	23.92	2.93	0.02	0.78	0.78	0.30	2.66	0.63	0.03	3.80	28.70	0.90	Matured

12	LL/25-26/001204/22	TI/NB/2025/B	sandstone+siltstone interbeded with mica	63.24	20.35	4.96	0.02	1.15	1.13	0.45	2.15	0.85	0.04	5.53	50.90	0.83	Matured
13	LL/25-26/001204/23	TI/NB/2025/C	sandstone+siltstone interbeded with mica	62.01	20.10	4.74	0.01	1 .41	0.78	1.42	2.00	1.00	0.05	6.23	64.80	0.58	Matured
14	LL/25-26/001204/24	T1/NB/2025/D	sandstone+siltstone interbeded with mica	61.95	22.86	3.54	0.01	1.16	1.25	0.42	2.17	0.88	0.04	5.53	51.30	0.84	Matured
	Lab. No.	**Sample No**	**Lithology**	**SiO2**	**Al2O3**	**Fe2O3**	**MnO**	**MgO**	**CaO**	**Na2O**	**K2O**	**TiO2**	**P2O5**	**Loss on Ignition (LOI)**	**V**	**Maturity Index = (K2O/(Na2O+K2O))**	
		TRENCH - 2		**(%)**											**(ppm)**		
15	LL/25-26/001204/26	T2/NB/2025/01	sandstone+ clay laminae thinly laminated	64.98	19.02	4.10	0.01	1.24	0.41	1.31	1.58	1.61	0.07	5.48	108.40	0.55	Matured
16	LL/25-26/001204/27	T2/NB/2025/02	sandstone+ clay laminae thinly laminated	65.39	20.97	4.09	0.02	0.93	0.44	0.81	1.88	1.24	0.06	4.09	56.30	0.70	Matured
17	LL/25-26/001204/28	T2/NB/2025/03	sandstone+ clay laminae thinly laminated	62.66	4.83	18.66	0.07	0.59	4. 19	0.24	1.58	0.91	0.13	5.94	76.90	0.87	Matured
18	LL/25-26/001204/29	T2/NB/2025/04	siltstone pinkish brown	63.51	5.05	18.12	0.07	0.60	3.72	0.28	1.54	0.85	0.13	6.05	67.10	0.85	Matured
19	LL/25-26/001204/30	T2/NB/2025/05	siltstone ferruginous	65.80	18.75	5.33	0.02	0.75	1.41	0.49	1.96	1.33	0.07	3.77	40.50	0.80	Matured
20	LL/25-26/001204/31	T2/NB/2025/06	siltstone pinkish brown	56.06	25.04	5.18	0.01	0.99	0.23	0.49	1.52	1.84	0.07	8.38	125.30	0.76	Matured

21	LL/25-26/001204/32	T2/NB/2025/07	sandstone+ clay laminae thinly laminated	57.98	20.80	6.96	0.02	1.05	1.01	0.37	1.28	1.09	0.06	9. 10	109.30	0.78	Matured
22	LL/25-26/001204/33	T2/NB/2025/08	sandstone+ clay laminae thinly laminated	58.94	19.21	8.56	0.03	0.99	0.70	0.32	1.31	1.23	0.07	8.32	93.70	0.80	Matured
23	LL/25-26/001204/34	T2/NB/2025/09	sandstone+ clay laminae thinly laminated	61.33	23.02	3.86	0.01	0.97	0.11	0.31	1.37	1.46	0.05	7.27	86.00	0.82	Matured
24	LL/25-26/001204/35	T2/NB/2025/10	sandstone+ clay laminae thinly laminated	60.91	21.96	4.71	0.03	1.01	0.21	0.35	1.31	1.52	0.05	7.70	92.30	0.79	Matured
25	LL/25-26/001204/36	T2/NB/2025/A	laminated sandstone	64.95	18.54	4.63	0.02	0.87	0.63	0.15	1.35	1.82	0.05	6.68	78.60	0.90	Matured
26	LL/25-26/001204/37	T2/NB/2025/B	interbanded sandstone +clay	61.99	19.24	5.19	0.02	1.04	1.19	0.36	1.34	1.68	0.06	7.67	82.00	0.79	Matured
27	LL/25-26/001204/38	T2/NB/2025/C	interbanded sandstone +clay	61.13	18.30	8.09	0.03	1.06	0.46	0.32	1.30	1.40	0.06	7.60	93.40	0.80	Matured
28	LL/25-26/001204/39	T2/NB/2025/D	interbanded sandstone +clay	60.24	18.99	6.98	0.03	1.06	1.11	0.33	1.29	1.45	0.06	8.28	87.90	0.80	Matured
	Lab. No.	**Sample No** / **TRENCH - 3**	**Lithology**	**SiO2**	**Al2O3**	**Fe2O3**	**MnO**	**MgO**	**CaO**	**Na2O**	**K2O**	**TiO2**	**P2O5**	**Loss on Ignition (LOI)**	**V**	**Maturity Index = (K2O/(Na2O+K2O))**	
				(%)											**(ppm)**		

29	LL/25-26/001204/46	T3/NB/2025/01	sandstone yellowish brown	57.96	21.02	9.69	0.09	0.60	0.33	0.06	1.18	0.79	0.08	8.01	57.40	0.95	Matured
30	LL/25-26/001204/47	T3/NB/2025/02	sandstone yellowish brown	54.39	23.13	10.40	0.08	0.68	0.24	0.06	1.11	0.83	0.06	8.73	84.00	0.95	Matured
31	LL/25-26/001204/48	T3/NB/2025/03	sandstone yellowish brown	53.37	24.48	8.85	0.07	0.70	0.28	0.05	1.15	0.88	0.04	9.88	99.70	0.96	Matured
32	LL/25-26/001204/48	T3/NB/2025/04	sandstone yellowish brown	50.30	24.54	11.26	0.09	0.78	0.55	0.06	1.06	1.05	0.04	10.06	89.40	0.95	Matured
33	LL/25-26/001204/50	T3/NB/2025/05	sandstone yellowish brown	55.39	20.17	12.95	0.1 I	0.68	0.26	0.07	1.21	0. 87	0.06	8.06	85.50	0.95	Matured
34	LL/25-26/001204/51	T3/NB/2025/06	sandstone yellowish brown	56.77	17.70	13.60	0.12	0.55	0.76	0.15	1.30	1.01	0.04	7.70	93.90	0.90	Matured
35	LL/25-26/001204/52	T3/NB/2025/07	sandstone yellowish brown	65.72	12.59	12.03	0.08	0.37	0.38	0.10	1.37	0.90	0.03	6.22	60.90	0.93	Matured
36	LL/25-26/001204/53	T3/NB/2025/08	sandstone yellowish brown	57.90	22.11	4.91	0.04	0.64	2.11	0.11	1.57	1.46	0.03	8.79	76.50	0.93	Matured
37	LL/25-26/001204/54	T3/NB/2025/09	sandstone yellowish white	56.99	24.13	5.25	0.05	0.57	1.15	0.10	1.55	1.07	0.03	8.87	64.80	0.94	Matured
38	LL/25-26/001204/55	T3/NB/2025/10	sandstone yellowish white	59.81	23.21	3.96	0.03	0.49	1.09	0.09	1.71	2.02	0.03	7.48	63.80	0.95	Matured
39	LL/25-26/001204/56	T3/NB/2025/A	sandstone yellowish brown	60.23	18.99	9.46	0.07	0.65	0.29	0.09	1.38	1.29	0.08	7.18	89.40	0.94	Matured
40	LL/25-26/001204/57	T3/NB/2025/B	sandstone yellowish brown	54.90	22.92	8.55	0.07	0.67	0.81	0.08	1.35	1.43	0.04	8.97	85.60	0.94	Matured

41	LL/25-26/001204/58	T3/NB/2025/C	sandstone yellowish white	59.24	23.20	4.57	0.05	0.69	1.33	0.08	1.46	1.66	0.04	7.41	63.70	0.95	Matured
42	LL/25-26/001204/59	T3/NB/2025/D	sandstone yellowish brown	59.64	22.77	6.14	0.06	0.61	1.08	0.09	1.77	1.36	0.07	6.27	71.80	0.95	Matured
	Lab. No.	**Sample No**	**Lithology**	**SiO2**	**Al2O3**	**Fe2O3**	**MnO**	**MgO**	**CaO**	**Na2O**	**K2O**	**TiO2**	**P2O5**	**Loss on Ignition (LOI)**	**V**	**Maturity Index = (K2O/(Na2O+K2O))**	
		TRENCH - 4		**(%)**											**(ppm)**		
43	LL/25-26/001204/61	T4/NB/2025/01	sandstone Argil.	63.68	0.65	14.12	0.03	1.06	8.88	0.21	1.28	0.47	0.09	9.31	86.20	0.86	Matured
44	LL/25-26/001204/62	T4/NB/2025/02	sandstone Argil.	62.67	1.29	15.95	0.03	1.16	6.79	0.25	1.33	0.48	0.08	9.67	103.80	0.84	Matured
45	LL/25-26/001204/63	T4/NB/2025/03	sandstone mgd-cgd	69.00	2.49	7.36	0.02	1.19	7.33	0.21	1.46	0.53	0.08	10.18	61.90	0.87	Matured
46	LL/25-26/001204/64	T4/NB/2025/04	sandstone mgd-cgd	65.34	4.64	6.49	0.02	1.08	8.63	0.20	1.59	0.45	0.07	11.28	60.50	0.89	Matured
47	LL/25-26/001204/65	T4/NB/2025/05	sandstone mgd-cgd	57.60	4.71	15.63	0.04	1.04	7.84	0.20	1.32	0.48	0.07	11.00	94.00	0.87	Matured
48	LL/25-26/001204/66	T4/NB/2025/06	sandstone fgd-mgd	58.15	0.41	16.09	0.05	0.77	10.08	0.17	1.04	0.41	0.05	12.55	84.60	0.86	Matured
49	LL/25-26/001204/67	T4/NB/2025/07	sandstone fgd-mgd	73.26	1.00	11.17	0.04	0.89	3.84	0.16	1.47	0.83	0.06	7.16	70.30	0.90	Matured
50	LL/25-26/001204/68	T4/NB/2025/08	sandstone mgd-cgd	69.01	0.35	7.37	0.02	0.94	9.10	0.12	1.09	0.44	0.07	11.34	33.80	0.90	Matured
51	LL/25-26/001204/69	T4/NB/2025/09	sandstone mgd-cgd	68.61	0.28	5.81	0.03	1.50	9.91	0.17	1.1	0.61	0.12	11.58	42.40	0.87	Matured
52	LL/25-26/001204/70	T4/NB/2025/10	sandstone mgd-cgd	69.93	0.31	8.67	0.03	0.98	7.52	0.15	1.13	0.86	0.07	10.12	50.70	0.88	Matured
53	LL/25-26/001204/71	T4/NB/2025/A	Alluvial soil calcarious	58.96	0.32	9.64	0.03	1.71	13.86	0.23	1.01	0.48	0.10	13.35	67.30	0.81	Matured

54	LL/25-26/001204/72	T4/NB/2025/B	Alluvial soil calcarious	62.01	0.29	6.61	0.04	1.78	14.02	0.35	0.92	0.53	0.10	13.26	37.10	0.72	Matured
55	LL/25-26/001204/73	T4/NB/2025/C	Alluvial soil calcarious	63.81	1.39	6.17	0.04	1.62	11.57	0.27	1.12	0.90	0.09	12.72	62.20	0.81	Matured
56	LL/25-26/001204/74	T4/NB/2025/D	Alluvial soil calcarious	69.33	0.41	5.38	0.03	1.66	1 1.39	0.32	0.96	0.52	0.10	9.74	39.80	0.75	Matured
	Lab. No.	**Sample No**	**Lithology**	**SiO2**	**Al2O3**	**Fe2O3**	**MnO**	**MgO**	**CaO**	**Na2O**	**K2O**	**TiO2**	**P2O5**	**Loss on Ignition (LOI)**	**V**	**Maturity Index = (K2O/(Na2O+K2O))**	
		TRENCH - 5		**(%)**											**(ppm)**		
57	LL/25-26/001204/75	T5/NB/2025/01	sandstone Argil.	54.82	13.92	20.70	0.10	0.21	0.48	0.08	1.20	0.67	0.02	7.48	51.80	0.94	Matured
58	LL/25-26/001204/76	T5/NB/2025/02	sandstone Argil.	46.38	16.94	18.80	0.07	0.42	3.86	0.09	1.02	0.69	0.03	11.50	60.90	0.92	Matured
59	LL/25-26/001204/77	T5/NB/2025/03	sandstone mgd-cgd	51.78	9.84	25.05	0.18	0.26	1.64	0.08	1.10	0.55	0.02	9.36	49.10	0.93	Matured
60	LL/25-26/001204/78	T5/NB/2025/04	sandstone mgd-cgd	53.61	9.99	25.97	0.21	0.19	0.33	0.08	1.16	0.56	0.02	7.70	54.78	0.94	Matured
61	LL/25-26/001204/79	T5/NB/2025/05	sandstone mgd-cgd	46.31	24.46	16.81	0.04	0.31	0.35	0.07	1.09	0.98	0.02	9.30	82.20	0.94	Matured
62	LL/25-26/001204/80	T5/NB/2025/06	sandstone fgd-mgd	44.84	23.94	16.91	0.05	0.33	1.34	0.07	1.11	0.96	0.02	10.27	82.40	0.94	Matured
63	LL/25-26/001204/81	T5/NB/2025/07	sandstone fgd-mgd	51.00	16.55	21.57	0.09	0.22	0.17	0.08	1.33	0.72	0.02	8.17	65.00	0.94	Matured
64	LL/25-26/001204/82	T5/NB/2025/08	sandstone mgd-cgd	49.81	15.27	23.14	0.09	0.29	0.74	0.08	1.13	0.60	0.02	8.73	93.60	0.93	Matured
65	LL/25-26/001204/83	T5/NB/2025/09	sandstone mgd-cgd	57.97	12.10	19.02	0.08	0.45	0.88	0.08	1.01	0.61	0.03	7.55	64.60	0.93	Matured
66	LL/25-26/001204/84	T5/NB/2025/10	sandstone mgd-cgd	55.86	19.77	13.00	0.04	0.45	0.42	0.08	1.05	0.95	0.03	8.04	81.0	0.93	Matured
67	LL/25-26/001204/85	T5/NB/2025/A	Alluvial soil calcarious	53.04	17.18	7.93	0.03	0.68	6.10	0.12	0.91	0.89	0.07	12.87	61.00	0.88	Matured

68	LL/25-26/001204/86	T5/NB/2025/B	Alluvial soil calcarious	56.06	27.94	2.31	0.01	0.63	1.37	0.09	0.91	1.31	0.04	9.27	66.10	0.91	Matured
69	LL/25-26/001204/87	T5/NB/2025/C	Alluvial soil calcarious	59.78	27.00	1.94	0.01	0.67	0.61	0.07	0.83	0.88	0.03	7.96	78.05	0.92	Matured
70	LL/25-26/001204/88	T5/NB/2025/D	Alluvial soil calcarious	58.61	26.49	2.16	0.01	0.66	1.04	0.08	0.87	1.27	0.03	8.66	63.20	0.92	Matured

ANNEXURE – IV

Statement showing analytical values of REE, Ga from Pit & Trenches samples in Nadapa Area, Kachchh dist, Gujarat

S.No.	Lab.No.	Sample No	Litholoyg	Formation	La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Total REE	Sc	Y	Total REE + (Sc+Y)	Th	U	Ga
					(ppm)																					
1	LL/25-26/001204/01	PI/NB/2025	Arenaceous clay	Bhuj	36.05	73.85	9.50	69.25	—	5.23	1.48	7.30	<1.0	3.30	<1.0	6.55	<1.0	2.95	<1.0	215.46	15.43	23.23	254.12	21.58	<1.0	26.65
2	LL/25-26/001204/04	P4/NB/2025	D.grey clay with mica	Bhuj	36.85	79.05	9.98	68.38	—	5.50	1.25	6.33	<1.0	2.35	<1.0	5.45	<1.0	2.80	<1.0	217.94	10.93	17.93	246.80	51.93	<1.0	17.23
3	LL/25-26/001204/05	P5/NB/2025	sandstone fgd-mgd y/w	Bhuj	26.98	59.73	7.70	61.80	—	3.60	<1.0	5.78	<1.0	<1.0	<1.0	6.40	<1.0	2.88	<1.0	174.87	5.70	11.53	192.10	37.70	1.75	9.58
4	LL/25-26/001204/07	P7/NB/2025	Siltstone friable	Bhuj	31.90	63.90	10.18	63.18	—	4.50	1.05	8.48	<1.0	1.55	<1.0	5.40	<1.0	4.15	<l.0	194.29	9.25	15.93	219.47	35.50	7.85	17.35
5	LL/25-26/001204/25	P11/NB/2025	sst.fgd+mica	Katrol	59.85	134.75	16.18	103.43	—	9.55	1.10	11.48	<1.0	3.28	<1.0	7.55	<1.0	3.55	<l.0	350.72	8.85	22.20	381.77	100.05	<l.0	16.33
6	LL/25-26/001204/32	T2/NB/2025/07	sandstone+ clay laminae thinly laminated	Bhuj	30.48	64.98	10.05	66.53	—	4.88	1.15	8.70	<1.0	1.85	<1.0	6.05	<1.0	3.05	<1.0	197.72	9.03	16.65	223.40	42.00	8.38	17.53
7	LL/25-26/001204/J0	P12/NB/2025	Argill.Sst fgd +mica	Katrol	40.35	83.60	11.18	79.30	—	5.68	1.15	7.43	<1.0	2.20	<1.0	6.93	<1.0	3.83	<1.0	241.65	10.60	18.83	271.08	49.05	<1.0	21.05
g	LL/25-26/001204/41	P13/NB/2025	grey clay interbeded with siltstone	Bhuj	27.70	57.50	10.85	60.70	—	4.63	1.13	10.13	<1.0	1.95	<1.0	5.60	<1.0	3.35	1.10	184.64	12.00	18.33	214.97	42.28	18.80	20.78
9	LL/25-26/001204/43	P15/NB/2025	grey clay interbeded with siltstone	Bhuj	40.83	78.20	, 10.35	72.88	—	5.70	1.45	7.40	<1.0	2.35	<1.0	6.00	<l.0	3.43	<1.0	218.24	12.08	19.08	249.40	33.73	<1.0	24.33
10	LL/25-26/001204/45	P17/NB/2025	siltstone y/brown	Bhuj	49.25	98.60	12.50	84.75	—	7.13	1.70	9.25	<1.0	3.50	<1.0	7.38	<l.0	4.18	<1.0	278.24	15.63	24.88	318.75	38.23	<1.0	25.80
11	LL/25-26/001204/54	T3/NB/2025/09	sandstone yellowish white	Bhuj	28.30	59.08	6.13	62.58	—	3.68	<1.0	5.65	<1.0	<1.0	<1.0	5.33	<1.0	2.73	<1.0	173.48	6.58	11.38	191.44	43.78	<1.0	11.53
12	LL/25-26/001204/78	T5/NB/2025/04	sandstone mgd-cgd	Bhuj	18.15	36.73	22.68	36.90	—	4.33	<1.0	24.65	<1.0	0.93	<1.0	3.08	<1.0	7.03	3.10	157.58	5.03	14.25	176.86	86.40	131.95	18.60
13	LL/25-26/001204/87	T5/NB/2025/C	Alluvial soil calcarious	Bhuj	41.60	83.20	10.35	72.63	—	6.63	1.98	7.28	<1.0	3.80	<1.0	5.93	<1.0	3.15	<1.0	236.55	11.23	22.33	270.11	32.05	<1.0	17.95
14	LL/25-26/001204/89	P19/NB/2025	Hard Ferru.Sst	Bhuj	46.88	96.53	48.55	64.38	—	11.70	2.25	44.55	<1.0	3.68	<1.0	5.58	<1.0	9.23	5.43	338.76	11.90	25.33	375.99	129.03	245.10	31.58
15	LL/25-26/001204/90	P20/NB/2025	Grey clay+ sst.laminae	Bhuj	51.35	99.08	12.53	82.38	—	7.38	1.75	8.75	<1.0	3.85	<1.0	6.80	<1.0	3.50	<1.0	277.37	15.53	26.28	319.18	26.88	<1.0	23.63

ANNEXURE – V

Statement showing analytical results of major oxides (by XRF) of Katrol formation in Nadapa Area, Dist: Kachchh, Gujarat

S. No	Lab. No.	Sample No	Lithology	SiO2	Al2O3	Fe2O3	MnO	MgO	CaO	Na2O	K2O	TiO2	P2O5	Loss on Ignition (LOI)	V	Maturity Index = (K2O/(Na2O+K2O))	
				(%)											(ppm)		
1	LL/25-26/001204/25	P11/NB/2025	sst.fgd+mica	66.54	20.83	4.57	0.02	0.42	0.41	0.15	1.52	1.34	0.07	3.96	85.75	0.91	Maturity
2	LL/25-26/001204/40	P12/NB/2025	Argill.Sst fgd +mica	55.40	28.81	2.81	0.03	0.45	0.70	0.23	1.09	1.21	0.04	9.09	83.28	0.83	Maturity
3	LL/25-26/001204/44	P16/NB/2025	Calcariuos soil	54.92	0.31	4.60	0.03	1.41	17.76	0.19	0.91	0.39	0.08	19.08	60.20	0.83	Maturity
	TRENCH NO - 4																
4	LL/25-26/001204/61	T4/NB/2025/01	sandstone Argil.	63.68	0.65	14.12	0.03	1.06	8.88	0.21	1.28	0.47	0.09	9.31	86.20	0.86	Matured
5	LL/25-26/001204/62	T4/NB/2025/02	sandstone Argil.	62.67	1.29	15.95	0.03	1.16	6.79	0.25	1.33	0.48	0.08	9.67	103.80	0.84	Matured
6	LL/25-26/001204/63	T4/NB/2025/03	sandstone mgd-cgd	69.00	2.49	7.36	0.02	1.19	7.33	0.21	1.46	0.53	0.08	10.18	61.90	0.87	Matured
7	LL/25-26/001204/64	T4/NB/2025/04	sandstone mgd-cgd	65.34	4.64	6.49	0.02	1.08	8.63	0.20	1.59	0.45	0.07	11.28	60.50	0.89	Matured
8	LL/25-26/001204/65	T4/NB/2025/05	sandstone mgd-cgd	57.60	4.71	15.63	0.04	1.04	7.84	0.20	1.32	0.48	0.07	11.00	94.00	0.87	Matured
9	LL/25-26/001204/66	T4/NB/2025/06	sandstone fgd-mgd	58.15	0.41	1 6.09	0.05	0.77	10.08	0.17	1.04	0.41	0.05	12.55	84.60	0.86	Matured

10	LL/25-26/001204/67	T4/NB/2025/07	sandstone fgd-mgd	73.26	1.00	11.17	0.04	0.89	3.84	0.16	1.47	0.83	0.06	7.16	70.30	0.90	Matured
11	LL/25-26/001204/68	T4/NB/2025/08	sandstone mgd-cgd	69.01	0.35	7.37	0.02	0.94	9.10	0.12	1.09	0.44	0.07	11.34	33.80	0.90	Matured
12	LL/25-26/001204/69	T4/NB/2025/09	sandstone mgd-cgd	68.61	0.28	5.81	0.03	1.50	9.91	0.17	1.1	0.61	0.12	11.58	42.40	0.87	Matured
13	LL/25-26/001204/70	T4/NB/2025/10	sandstone mgd-cgd	69.93	0.31	8.67	0.03	0.98	7.52	0.15	1.13	0.86	0.07	10.12	50.70	0.88	Matured
14	LL/25-26/001204/71	T4/NB/2025/A	Alluvial soil calcarious	58.96	0.32	9.64	0.03	1.71	13.86	0.23	1.01	0.48	0.10	13.35	67.30	0.81	Matured
15	LL/25-26/001204/72	T4/NB/2025/B	Alluvial soil calcarious	62.01	0.29	6.61	0.04	1.78	14.02	0.35	0.92	0.53	0.10	13.26	37.10	0.72	Matured
16	LL/25-26/001204/73	T4/NB/2025/C	Alluvial soil calcarious	63.81	1.39	6.17	0.04	1.62	11.57	0.27	1.12	0.90	0.09	12.72	62.20	0.81	Matured
17	LL/25-26/001204/74	T4/NB/2025/D	Alluvial soil calcarious	69.33	0.41	5.38	0.03	1.66	11.39	0.32	0.96	0.52	0.10	9.74	39.80	0.75	Matured

ANNEXURE – VI

Statement showing analytical results of major oxides (by XRF) of Bhuj formation in Nadapa Area, Dist: Kachchh, Gujarat

S. No	Lab. No.	Sample No	Lithology	SiO2	Al2O3	Fe2O3	MnO	MgO	CaO	Na2O	K2O	TiO2	P2O5	Loss on Ignition (LOI)	V	Maturity Index = (K2O/(Na2O+K2O))	
				(%)											(ppm)		
1	LL/25-26/001204/01	P1/ND/2025	Arenaceous clay	55.13	22.85	3.75	0.01	0.45	0.22	6.11	0.99	0.99	0.05	9.19	103.53	0.14	Immaturity
2	LL/25-26/001204/02	P2/NB/2025	Ferru.sandstone+ clay	54.02	34.05	1.41	0.01	0.60	0.19	0.22	0.64	1.47	0.04	7.18	82.50	0.74	Maturity
3	LL/25-26/001204/03	P3/NB/2025	d.grey clay	51.25	34.89	1.57	0.00	0.62	0.13	0.64	1.19	1.36	0.04	7.97	71.90	0.65	Maturity
4	LL/25-26/001204/04	P4/NB/2025	D.grey clay with mica	56.89	29.95	2.48	0.00	0.74	0.05	0.82	1.67	0.94	0.05	6.25	80.55	0.67	Maturity
5	LL/25-26/001204/05	P5/NB/2025	sandstone fgd-mgd y/w	74.96	14.01	3.67	0.04	0.27	0.44	0.17	2.19	1.3 I	0.04	2.64	52.28	0.93	Maturity
6	LL/25-26/001204/06	P6/NB/2025	Argill.Sst p/w	58.96	17.18	15.38	0.01	0.46	0.22	0.45	1.52	0.88	0.17	4.70	168.10	0.77	Maturity
7	LL/25-26/001204/07	P7/NB/2025	Siltstone friable	66.40	17.56	5.46	0.07	1.04	0.81	0.51	1.96	0.99	0.04	5.03	77.80	0.79	Maturity
8	LL/25-26/001204/08	P8/NB/2025	SST.vfgd+mica	70.77	19.96	2.38	0.01	0.39	0.29	0.46	2.49	0.90	0.02	2.12	15.70	0.84	Maturity
9	LL/25-26/001204/09	P9/NB/2025	Siltstone friable p/w	72.95	10.84	6.58	0.02	0.61	1.45	0.55	1.95	0.98	0.04	3.85	41.50	0.78	Maturity

10	LL/25-26/001204/10	P10/NB/2025	siltstone variegated	60.90	24.03	3.89	0.0 1	0.72	0. 32	1.56	1.77	1.41	0.05	5.07	77.80	0.53	Maturity
11	LL/25-26/001204/41	P13/NB/2025	grey clay interbeded with siltstone	64.50	17.57	6.44	0.02	1.09	0.2 1	0.41	1.32	0.98	0.06	7. 19	95.35	0.76	Maturity
12	LL/25-26/001204/42	P14/NB/2025	Feldpathic Sst	77.97	13.25	2.15	0.01	0.15	0.17	0.06	0.85	0.52	0.02	4.53	69.10	0.93	Maturity
13	LL/25-26/001204/43	P15/NB/2025	grey clay interbeded with siltstone	61.24	23.41	2.44	0.03	0.91	0.11	0.30	1.17	1.0 1	0.03	9.15	91 .65	0.80	Maturity
14	LL/25-26/001204/45	P17/NB/2025	siltstone y/brown	60.98	21.10	3.10	0.03	0.24	0.11	3.74	0.68	1.19	0.03	8.50	108.53	0.15	Immaturity
15	LL/25-26/001204/60	P I 8/NB/2025	sandstone with shale laminae	70.64	16.15	5.09	0.03	0.23	0.26	0.09	1.28	0.88	0.04	4.99	48.20	0.93	Maturity
16	LL/25-26/001204/89	P19/NB/2025	Hard Ferru.Sst	44.74	9.71	29.97	0.19	0.37	2.03	0.06	0.45	0.74	0.37	11.22	299.18	0.88	Maturity
17	LL/25-26/001204/90	P20/NB/2025	Grey clay+ sst. Laminae	56.11	28.55	2.27	0.03	0.54	0.10	0.35	0.64	1.03	0.03	10.05	101.58	0.65	Maturity
	Lab. No.	**Sample No**	**Lithology**	**SiO2**	**Al2O3**	**Fe2O3**	**MnO**	**MgO**	**CaO**	**Na2O**	**K2O**	**TiO2**	**P2O5**	**Loss on Ignition (LOI)**	**V**	**Maturity Index = (K2O/(Na2O+K2O))**	
		TRENCH - 1		**(%)**											**(ppm)**		
18	LL/25-26/001204/11	Tl/NB/2025/01	siltstone with mica	65.86	20.98	3.78	0.02	0.77	0.67	0.38	2.64	0.71	0.03	3.87	30.80	0.87	Matured
19	LL/25-26/001204/12	T1/NB/2025/02	siltstone with mica	59.68	20.88	5.11	0.02	0.92	0.46	0.46	2.45	0.80	0.03	8.92	41.40	0.84	Matured

20	LL/25-26/001204/13	Tl/NB/2025/03	siltstone with mica	68.99	18.41	3.72	0.02	0.70	0.49	0.37	2.52	0.80	0.03	3.67	31.90	0.87	Matured
21	LL/25-26/001204/14	TI/NB/2025/04	siltstone with mica	70.24	19.10	2.78	0.01	0.64	0.19	0.41	2.78	0.70	0.03	3.0 I	23.80	0.87	Matured
22	LL/25-26/001204/15	Tl/NB/2025/05	siltstone with mica	69.42	20.94	2.14	0.01	0.58	0.1 I	0.30	2.74	0.87	0.03	2.65	25.50	0.90	Matured
23	LL/25-26/001204/16	Tl/NB/2025/06	siltstone with mica	68.86	21.65	2.07	0.02	0.57	0.29	0.34	2.78	0.74	0.03	2.54	22.70	0.89	Matured
24	LL/25-26/001204/17	Tl/NB/2025/07	siltstone with mica	68.34	20.82	2.00	0.01	0.73	0.77	0.42	2.54	1.01	0.04	3.13	26.80	0.86	Matured
25	LL/25-26/001204/18	Tl/NB/2025/08	siltstone with mica	68.77	19.32	2.07	0.01	0.87	1.09	0.43	2.42	0.88	0.04	3.89	29.60	0.85	Matured
26	LL/25-26/001204/19	TI/NB/2025/09	siltstone with mica	57.08	20.04	6.35	0.02	1.41	2.63	0.88	2.09	0.58	0.03	8.59	43.40	0.70	Matured
27	LL/25-26/001204/20	TI/NB/2025/10	siltstone with mica	50.08	20.57	12.45	0.03	1.71	2.08	0.99	1.75	0.87	0.05	9.22	76.80	0.64	Matured
28	LL/25-26/001204/21	TI/NB/2025/A	sandstone+siltstone interbeded with mica	63.82	23.92	2.93	0.02	0.78	0.78	0.30	2.66	0.63	0.03	3.80	28.70	0.90	Matured
29	LL/25-26/001204/22	TI/NB/2025/B	sandstone+siltstone interbeded with mica	63.24	20.35	4.96	0.02	1.15	1.13	0.45	2.15	0.85	0.04	5.53	50.90	0.83	Matured
30	LL/25-26/001204/23	TI/NB/2025/C	sandstone+siltstone interbeded with mica	62.01	20.10	4.74	0.01	1 .41	0.78	1.42	2.00	1.00	0.05	6.23	64.80	0.58	Matured
31	LL/25-26/001204/24	T1/NB/2025/D	sandstone+siltstone interbeded with mica	61.95	22.86	3.54	0.01	1.16	1.25	0.42	2.17	0.88	0.04	5.53	51.30	0.84	Matured

	Lab. No.	Sample No	Lithology	SiO2	Al2O3	Fe2O3	MnO	MgO	CaO	Na2O	K2O	TiO2	P2O5	Loss on Ignition (LOI)	V	Maturity Index = (K2O/(Na2O+K2O))	
		TRENCH - 2		(%)											(ppm)		
32	LL/25-26/001204/26	T2/NB/2025/01	sandstone+ clay laminae thinly laminated	64.98	19.02	4.10	0.01	1.24	0.41	1.31	1.58	1.61	0.07	5.48	108.40	0.55	Matured
33	LL/25-26/001204/27	T2/NB/2025/02	sandstone+ clay laminae thinly laminated	65.39	20.97	4.09	0.02	0.93	0.44	0.81	1.88	1.24	0.06	4.09	56.30	0.70	Matured
34	LL/25-26/001204/28	T2/NB/2025/03	sandstone+ clay laminae thinly laminated	62.66	4.83	18.66	0.07	0.59	4. 19	0.24	1.58	0.91	0.13	5.94	76.90	0.87	Matured
35	LL/25-26/001204/29	T2/NB/2025/04	siltstone pinkish brown	63.51	5.05	18.12	0.07	0.60	3.72	0.28	1.54	0.85	0.13	6.05	67.10	0.85	Matured
36	LL/25-26/001204/30	T2/NB/2025/05	siltstone ferruginous	65.80	18.75	5.33	0.02	0.75	1.41	0.49	1.96	1.33	0.07	3.77	40.50	0.80	Matured
37	LL/25-26/001204/31	T2/NB/2025/06	siltstone pinkish brown	56.06	25.04	5.18	0.01	0.99	0.23	0.49	1.52	1.84	0.07	8.38	125.30	0.76	Matured
38	LL/25-26/001204/32	T2/NB/2025/07	sandstone+ clay laminae thinly laminated	57.98	20.80	6.96	0.02	1.05	1.01	0.37	1.28	1.09	0.06	9. 10	109.30	0.78	Matured
39	LL/25-26/001204/33	T2/NB/2025/08	sandstone+ clay laminae thinly laminated	58.94	19.21	8.56	0.03	0.99	0.70	0.32	1.31	1.23	0.07	8.32	93.70	0.80	Matured

40	LL/25-26/001204/34	T2/NB/2025/09	sandstone+ clay laminae thinly laminated	61.33	23.02	3.86	0.01	0.97	0.11	0.31	1.37	1.46	0.05	7.27	86.00	0.82	Matured
41	LL/25-26/001204/35	T2/NB/2025/10	sandstone+ clay laminae thinly laminated	60.91	21.96	4.71	0.03	1.01	0.21	0.35	1.31	1.52	0.05	7.70	92.30	0.79	Matured
42	LL/25-26/001204/36	T2/NB/2025/A	laminated sandstone	64.95	18.54	4.63	0.02	0.87	0.63	0.15	1.35	1.82	0.05	6.68	78.60	0.90	Matured
43	LL/25-26/001204/37	T2/NB/2025/B	interbanded sandstone +clay	61.99	19.24	5.19	0.02	1.04	1.19	0.36	1.34	1.68	0.06	7.67	82.00	0.79	Matured
44	LL/25-26/001204/38	T2/NB/2025/C	interbanded sandstone +clay	61.13	18.30	8.09	0.03	1.06	0.46	0.32	1.30	1.40	0.06	7.60	93.40	0.80	Matured
45	LL/25-26/001204/39	T2/NB/2025/D	interbanded sandstone +clay	60.24	18.99	6.98	0.03	1.06	1.11	0.33	1.29	1.45	0.06	8.28	87.90	0.80	Matured
	Lab. No.	**Sample No**	**Lithology**	**SiO2**	**Al2O3**	**Fe2O3**	**MnO**	**MgO**	**CaO**	**Na2O**	**K2O**	**TiO2**	**P2O5**	**Loss on Ignition (LOI)**	**V**	**Maturity Index = (K2O/(Na2O+K2O))**	
		TRENCH - 3		**(%)**											**(ppm)**		
46	LL/25-26/001204/46	T3/NB/2025/01	sandstone yellowish brown	57.96	21.02	9.69	0.09	0.60	0.33	0.06	1.18	0.79	0.08	8.01	57.40	0.95	Matured
47	LL/25-26/001204/47	T3/NB/2025/02	sandstone yellowish brown	54.39	23.13	10.40	0.08	0.68	0.24	0.06	1.11	0.83	0.06	8.73	84.00	0.95	Matured
48	LL/25-26/001204/48	T3/NB/2025/03	sandstone yellowish brown	53.37	24.48	8.85	0.07	0.70	0.28	0.05	1.15	0.88	0.04	9.88	99.70	0.96	Matured

49	LL/25-26/001204/48	T3/NB/2025/04	sandstone yellowish brown	50.30	24.54	11.26	0.09	0.78	0.55	0.06	1.06	1.05	0.04	10.06	89.40	0.95	Matured
50	LL/25-26/001204/50	T3/NB/2025/05	sandstone yellowish brown	55.39	20.17	12.95	0.1 I	0.68	0.26	0.07	1.21	0. 87	0.06	8.06	85.50	0.95	Matured
51	LL/25-26/001204/51	T3/NB/2025/06	sandstone yellowish brown	56.77	17.70	13.60	0.12	0.55	0.76	0.15	1.30	1.01	0.04	7.70	93.90	0.90	Matured
52	LL/25-26/001204/52	T3/NB/2025/07	sandstone yellowish brown	65.72	12.59	12.03	0.08	0.37	0.38	0.10	1.37	0.90	0.03	6.22	60.90	0.93	Matured
53	LL/25-26/001204/53	T3/NB/2025/08	sandstone yellowish brown	57.90	22.11	4.91	0.04	0.64	2.11	0.11	1.57	1.46	0.03	8.79	76.50	0.93	Matured
54	LL/25-26/001204/54	T3/NB/2025/09	sandstone yellowish white	56.99	24.13	5.25	0.05	0.57	1.15	0.10	1.55	1.07	0.03	8.87	64.80	0.94	Matured
55	LL/25-26/001204/55	T3/NB/2025/10	sandstone yellowish white	59.81	23.21	3.96	0.03	0.49	1.09	0.09	1.71	2.02	0.03	7.48	63.80	0.95	Matured
56	LL/25-26/001204/56	T3/NB/2025/A	sandstone yellowish brown	60.23	18.99	9.46	0.07	0.65	0.29	0.09	1.38	1.29	0.08	7.18	89.40	0.94	Matured
57	LL/25-26/001204/57	T3/NB/2025/B	sandstone yellowish brown	54.90	22.92	8.55	0.07	0.67	0.81	0.08	1.35	1.43	0.04	8.97	85.60	0.94	Matured
58	LL/25-26/001204/58	T3/NB/2025/C	sandstone yellowish white	59.24	23.20	4.57	0.05	0.69	1.33	0.08	1.46	1.66	0.04	7.41	63.70	0.95	Matured
59	LL/25-26/001204/59	T3/NB/2025/D	sandstone yellowish brown	59.64	22.77	6.14	0.06	0.61	1.08	0.09	1.77	1.36	0.07	6.27	71.80	0.95	Matured
	Lab. No.	**Sample No**	**Lithology**	**SiO2**	**Al2O3**	**Fe2O3**	**MnO**	**MgO**	**CaO**	**Na2O**	**K2O**	**TiO2**	**P2O5**	**Loss on Ignition (LOI)**	**V**	**Maturity Index = (K2O/(Na2O+K2O))**	

		TRENCH - 5		(%)										(ppm)		
60	LL/25-26/001204/75	T5/NB/2025/01	sandstone Argil.	54.82	13.92	20.70	0.10	0.21	0.48	0.08	1.20	0.67	0.02	7.48	51.80	0.94	Matured
61	LL/25-26/001204/76	T5/NB/2025/02	sandstone Argil.	46.38	16.94	18.80	0.07	0.42	3.86	0.09	1.02	0.69	0.03	11.50	60.90	0.92	Matured
62	LL/25-26/001204/77	T5/NB/2025/03	sandstone mgd-cgd	51.78	9.84	25.05	0.18	0.26	1.64	0.08	1.10	0.55	0.02	9.36	49.10	0.93	Matured
63	LL/25-26/001204/78	T5/NB/2025/04	sandstone mgd-cgd	53.61	9.99	25.97	0.21	0.19	0.33	0.08	1.16	0.56	0.02	7.70	54.78	0.94	Matured
64	LL/25-26/001204/79	T5/NB/2025/05	sandstone mgd-cgd	46.31	24.46	16.81	0.04	0.31	0.35	0.07	1.09	0.98	0.02	9.30	82.20	0.94	Matured
65	LL/25-26/001204/80	T5/NB/2025/06	sandstone fgd-mgd	44.84	23.94	16.91	0.05	0.33	1.34	0.07	1.11	0.96	0.02	10.27	82.40	0.94	Matured
66	LL/25-26/001204/81	T5/NB/2025/07	sandstone fgd-mgd	51.00	16.55	21.57	0.09	0.22	0.17	0.08	1.33	0.72	0.02	8.17	65.00	0.94	Matured
67	LL/25-26/001204/82	T5/NB/2025/08	sandstone mgd-cgd	49.81	15.27	23.14	0.09	0.29	0.74	0.08	1.13	0.60	0.02	8.73	93.60	0.93	Matured
68	LL/25-26/001204/83	T5/NB/2025/09	sandstone mgd-cgd	57.97	12.10	19.02	0.08	0.45	0.88	0.08	1.01	0.61	0.03	7.55	64.60	0.93	Matured
69	LL/25-26/001204/84	T5/NB/2025/10	sandstone mgd-cgd	55.86	19.77	13.00	0.04	0.45	0.42	0.08	1.05	0.95	0.03	8.04	81.0	0.93	Matured
70	LL/25-26/001204/85	T5/NB/2025/A	Alluvial soil calcarious	53.04	17.18	7.93	0.03	0.68	6.10	0.12	0.91	0.89	0.07	12.87	61.00	0.88	Matured
71	LL/25-26/001204/86	T5/NB/2025/B	Alluvial soil calcarious	56.06	27.94	2.31	0.01	0.63	1.37	0.09	0.91	1.31	0.04	9.27	66.10	0.91	Matured

72	LL/25-26/001204/87	T5/NB/2025/C	Alluvial soil calcarious	59.78	27.00	1.94	0.01	0.67	0.61	0.07	0.83	0.88	0.03	7.96	78.05	0.92	Matured
73	LL/25-26/001204/88	T5/NB/2025/D	Alluvial soil calcarious	58.61	26.49	2.16	0.01	0.66	1.04	0.08	0.87	1.27	0.03	8.66	63.20	0.92	Matured

ANNEXURE – VII

Statement showing analytical values of REE, Ga, V, Ti from Pit & Trenches samples of Katrol formation in Nadapa Area, Kachchh dist, Gujarat

S.No.	Lab.No.	Sample No	Lithology	La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Total REE	Sc	Y	Total REE + (Sc+Y)	Th	U	Ga
				(ppm)																					
5	LL/25-26/001204/25	P11/NB/2025	sst.fgd+mica	59.85	134.75	16.18	103.43	—	9.55	1.10	11.48	<1.0	3.28	<1.0	7.55	<1.0	3.55	<1.0	**350.72**	8.85	22.20	**381.77**	100.05	<1.0	16.33
7	LL/25-26/001204/J0	P12/NB/2025	Argill.Sst fgd +mica	40.35	83.60	11.18	79.30	—	5.68	1.15	7.43	<1.0	2.20	<1.0	6.93	<1.0	3.83	<1.0	**241.65**	10.60	18.83	**271.08**	49.05	<1.0	21.05
			AVERAGE	50.10	109.18	13.68	91.37	—	7.62	1.13	9.46	<1.0	2.74	<1.0	7.24	<1.0	3.69	<1.1	**296.19**	9.73	20.52	**326.43**	74.55	<1.1	18.69
			MIN	40.35	83.60	11.18	79.30	—	5.68	1.10	7.43	<1.0	2.20	<1.0	6.93	<1.0	3.55	<1.2	**241.65**	8.85	18.83	**271.08**	49.05	<1.2	16.33
			MAX	59.85	134.75	16.18	103.43	—	9.55	1.15	11.48	<1.0	3.28	<1.0	7.55	<1.0	3.83	<1.2	**350.72**	10.60	22.20	**381.77**	100.05	<1.2	21.05

ANNEXURE – VIII

Statement showing analytical values of REE, Ga of Bhuj formation in Nadapa Area, Kachchh dist., Gujarat

S.No.	Lab.No.	Sample No	Lithology	La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Total REE	Sc	Y	Total REE + (Sc+Y)	Th	U	Ga
				(ppm)																					
1	LL/25-26/001204/01	PI/NB/2025	Arenaceous clay	36.05	73.85	9.50	69.25	—	5.23	1.48	7.30	<1.0	3.30	<1.0	6.55	<1.0	2.95	<1.0	**215.46**	15.43	23.23	**254.12**	21.58	<1.0	26.65
2	LL/25-26/001204/04	P4/NB/2025	D.grey clay with mica	36.85	79.05	9.98	68.38	—	5.50	1.25	6.33	<1.0	2.35	<1.0	5.45	<1.0	2.80	<1.0	**217.94**	10.93	17.93	**246.80**	51.93	<1.0	17.23
3	LL/25-26/001204/05	P5/NB/2025	sandstone fgd-mgd y/w	26.98	59.73	7.70	61.80	—	3.60	<1.0	5.78	<1.0	<1.0	<1.0	6.40	<1.0	2.88	<1.0	**174.87**	5.70	11.53	**192.10**	37.70	1.75	9.58
4	LL/25-26/001204/07	P7/NB/2025	Siltstone friable	31.90	63.90	10.18	63.18	—	4.50	1.05	8.48	<1.0	1.55	<1.0	5.40	<1.0	4.15	<I.0	**194.29**	9.25	15.93	**219.47**	35.50	7.85	17.35
6	LL/25-26/001204/32	T2/NB/2025/07	sandstone+ clay laminae thinly laminated	30.48	64.98	10.05	66.53	—	4.88	1.15	8.70	<1.0	1.85	<1.0	6.05	<1.0	3.05	<1.0	**197.72**	9.03	16.65	**223.40**	42.00	8.38	17.53
g	LL/25-26/001204/41	P13/NB/2025	grey clay interbeded with siltstone	27.70	57.50	10.85	60.70	—	4.63	1.13	10.13	<1.0	1.95	<1.0	5.60	<1.0	3.35	1.10	**184.64**	12.00	18.33	**214.97**	42.28	18.80	20.78
9	LL/25-26/001204/43	P15/NB/2025	grey clay interbeded with siltstone	40.83	78.20	10.4	72.88	—	5.70	1.45	7.40	<1.0	2.35	<1.0	6.00	<l.0	3.43	<1.0	**218.24**	12.08	19.08	**249.40**	33.73	<1.0	24.33
10	LL/25-26/001204/45	P17/NB/2025	siltstone y/brown	49.25	98.60	12.50	84.75	—	7.13	1.70	9.25	<1.0	3.50	<1.0	7.38	<l.0	4.18	<1.0	**278.24**	15.63	24.88	**318.75**	38.23	<1.0	25.80

11	LL/25-26/001204/54	T3/NB/2025/09	sandstone yellowish white	28.30	59.08	6.13	62.58	—	3.68	<1.0	5.65	<1.0	<1.0	<1.0	5.33	<1.0	2.73	<1.0	**173.48**	6.58	11.38	**191.44**	43.78	<1.0	11.53
12	LL/25-26/001204/78	T5/NB/2025/04	sandstone mgd-cgd	18.15	36.73	22.68	36.90	—	4.33	<1.0	24.65	<1.0	0.93	<1.0	3.08	<1.0	7.03	3.10	**157.58**	5.03	14.25	**176.86**	86.40	131.95	18.60
13	LL/25-26/001204/87	T5/NB/2025/C	Alluvial soil calcarious	41.60	83.20	10.35	72.63	—	6.63	1.98	7.28	<1.0	3.80	<1.0	5.93	<1.0	3.15	<1.0	**236.55**	11.23	22.33	**270.11**	32.05	<1.0	17.95
14	LL/25-26/001204/89	P19/NB/2025	Hard Ferru.Sst	46.88	96.53	48.55	64.38	—	11.70	2.25	44.55	<1.0	3.68	<1.0	5.58	<1.0	9.23	5.43	**338.76**	11.90	25.33	**375.99**	129.03	245.10	31.58
15	LL/25-26/001204/90	P20/NB/2025	Grey clay+ sst. Laminae	51.35	99.08	12.53	82.38	—	7.38	1.75	8.75	<1.0	3.85	<1.0	6.80	<1.0	3.50	<1.0	**277.37**	15.53	26.28	**319.18**	26.88	<1.0	23.63

AVERAGE	35.87	73.11	13.95	66.64	—	5.76	1.52	11.87	<1.0	2.65	<1.0	5.81	<1.0	4.03	3.21	**220.40**	10.79	19.01	**250.20**	47.78	68.97	20.20
MIN	18.15	36.73	6.13	36.90	—	3.60	1.05	5.65	<1.0	0.93	<1.0	3.08	<1.0	2.73	1.10	**157.58**	5.03	11.38	**176.86**	21.58	1.75	9.58
MAX	51.35	99.08	48.55	84.75	—	11.70	2.25	44.55	<1.0	3.85	<1.0	7.38	<1.0	9.23	5.43	**338.76**	15.63	26.28	**375.99**	129.03	245.10	31.58

ANNEXURE – IX

Analytical results of THA, MHA and Reactive silica in NADAPA area, Kachchh dist., Gujarat					
S.no	Lab code	Sample no	%THA	%MHA	% Reactive SiO2
1	1204/89	P19/NB/2025	7.15	1.48	43.66

The analytical results show relatively very high values of reactive silica (43.66%) and low values of Trihydrate alumina and monohydrate alumina values. For Bauxite the reactive silica should be ≤ 5 %.

Detailed description of geochemistry of Katrol and Bhuj formations is given below:

Geochemistry of Katrol Formation:

Three pits (P11, P12, P16) and one trench (T4) were excavated and collected 3 samples from pits and 14 samples from Trench. All samples were analyzed for Major oxides including TiO,2 Vanadium and 2 samples for REE and Gallium. The results are listed in the following table No – 6.4 and also given in Annexure – V.

Table No: 6.4

Summarized table showing range of major oxides in Katrol formation

Oxides (%)/ Element (ppm)	Minimum value	Maximum values	Mean value
SiO2 (%)	54.92	73.26	64.01
Al2O3(%)	0.28	28.81	4.03
Fe2O3(%)	2.81	15.95	8.27
MnO (%)	0.02	0.05	0.03
MgO (%)	0.42	1.78	1.16
CaO (%)	0.41	17.76	8.64
Na2O (%)	0.12	0.35	0.21
K2O (%)	0.91	1.59	1.20
TiO2 (%)	0.39	1.34	0.64
P2O5 (%)	0.04	0.12	0.08
LOI (%)	3.96	19.08	10.91
V (ppm)	33.80	103.80	66.11

Analytical results from 17 pit and trench samples reveal low Al_2O_3 and high SiO_2 contents consistent with sandstone/siltstone and soil composition of Katrol formation which lack the chemical signatures needed for lateritic/bauxitic enrichment. The Matanomadh (Madh) Formation which is known to host bauxite/laterite in nearby areas, is completely absent in the present study area.

Further Two samples were analyzed for REE, Ga and the analytical results are furnished below in Table no: 6.5 and also given in Annexure – VII.

Table No: 6.5

Summarized table showing range of REE, Ga in Katrol formation

REE (ppm)	Minimum value(ppm)	Maximum value (ppm)	Mean Value (ppm)
Lanthanum (La)	40.35	59.85	50.10
Cerium (Ce)	83.6	134.75	109.18
Praseodymium (Pr)	11.18	16.18	13.68
Neodymium (Nd)	79.3	103.43	91.37
Promethium (Pm)	-	-	-
Samarium (Sm)	5.68	9.55	7.62
Europium (Eu)	1.1	1.15	1.13
Gadolinium (Gd)	7.43	11.48	9.46
Terbium (Tb)	<0.1	<0.1	<0.1
Dysprosium (Dy)	2.2	3.28	2.74
Holmium (Ho)	<0.1	<0.1	<0.1
Erbium (Er)	6.93	7.55	7.24
Thulium (Tm)	<0.1	<0.1	<0.1
Ytterbium (Yb)	3.55	3.83	3.69
Lutetium (Lu)	<0.1	<0.1	<0.1
Total REE	**241.65**	**350.72**	**296.19**
Scandium (Sc)	8.85	10.60	9.73
Yttrium(Y)	18.83	22.20	20.52
(TREE+Sc+Y)	**271.08**	**381.77**	**326.43**
Gallium (Ga)	16.33	21.05	18.69
Uranium (U)	<0.1	<0.1	<0.1
Thorium (Th)	49.05	100.05	74.55

REE and Ga values from two samples of Katrol formation yielded unencouraging values indicating insufficient concentrations for economic interest. Katrol sandstone/siltstones are basically quartzo-feldspathic in composition with high SiO2 but no elevated Al2O3 or REE and Gallium.

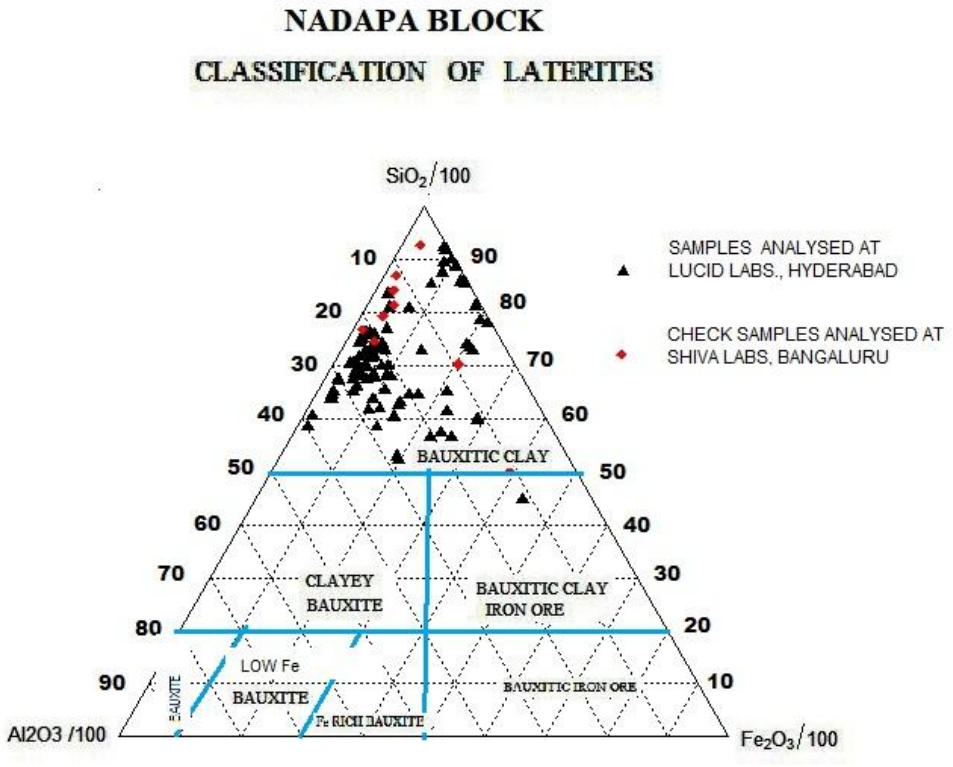
Geochemistry of Bhuj Formation: A total of 17 pits (P1 to P10, P13 to P15 and P17 to P20) and 4 trenches (T1, T2, T3 and T5) were excavated within the Bhuj Formation to assess its geochemical characteristics. From these workings, 17 representative samples were collected from the pits (one from each pit floor), and 56 samples were collected from the trenches (14 samples from each trench), amounting to 73 samples in total. All the samples were analyzed for major oxides (SiO_2, Al_2O_3, Fe_2O_3, CaO, MgO, Na_2O, K_2O, MnO, P_2O_5, TiO_2) and Vanadium (V), Titanium (Ti). Additionally, 13 selected samples were subjected to detailed determination of Rare Earth Elements (REE) and Gallium (Ga) concentrations. The analytical results of major, trace, and REE–Ga geochemistry are presented in Table no 6.6 and also in Annexure - VI

Table no 6.6 Summarized table showing range of major oxides in Bhuj formation

Oxides (%)/ Element (ppm)	Minimum value	Maximum values	Mean value
SiO2 (%)	44.74	77.97	59.90
Al2O3(%)	4.83	34.89	20.01
Fe2O3(%)	1.41	29.97	8.07
MnO (%)	0.00	0.21	0.04
MgO (%)	0.15	1.71	0.68
CaO (%)	0.05	6.10	0.88
Na2O (%)	0.05	3.74	0.37
K2O (%)	0.45	2.78	1.53
TiO2(%)	0.52	2.03	1.05
P2O5(%)	0.02	0.37	0.05
LOI (%)	2.12	12.87	7.11
V(ppm)	15.70	299.18	73.33

Al2O3, SiO2, Fe2O3and TiO2 values from the dark grey clays, siltstones, and argillaceous sandstones of Bhuj and Katrol formations aligns well with characteristics of the "Bauxitic clay category" in laterite classification. In this classification, lateritic materials are typically categorized based on their chemical composition and mineralogy, with a Ternary plot often used highlighting aluminium oxide (Al2O3), silica (SiO2), and iron oxide (Fe2O3) as key components. The "Bauxitic clay" category is characterized by relatively low alumina (Al2O3) content with high silica (SiO2) values, consistent with observations of Al2O3 ranging 4.83-34.89% and relatively high SiO2(range 44.74-77.97%). The average TiO2 value of 1.05% (range 0.52-2.02%) also fits within expected ranges for such lateritic materials. Hence, the plotting geochemical data and Ternary diagram results indicate that the sampled materials from Bhuj and Katrol formations are best classified as "Bauxitic clay", reflecting intense weathering concentration of aluminium oxides with significant silica presence and characteristic TiO2 content seen in lateritic soils and clays. Ternary plot of Classification of laterites is given below in

Fig no: 11



Ternary plot (Fig no: 11)

Further 13 samples were analyzed for REE, Ga and the analytical results are furnished in Table no: 6.7 and also given in Annexure – VIII.

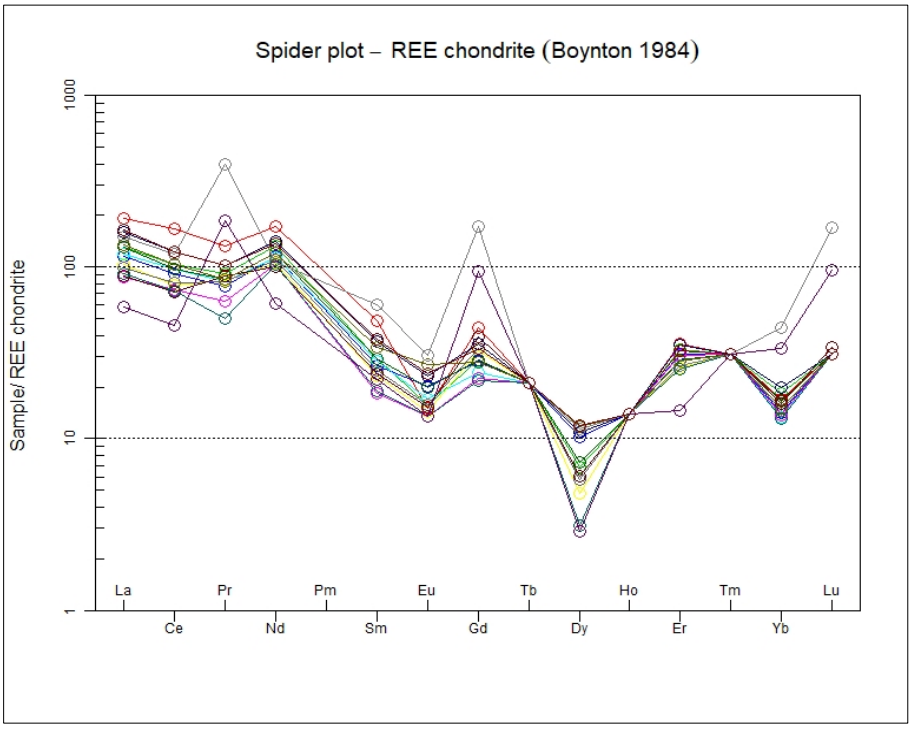
Table 6.7 Summarized table showing range of REE, Ga in Bhuj Formation

REE (ppm)	**Minimum value(ppm)**	**Maximum value (ppm)**	**Mean Value (ppm)**
Lanthanum (La)	18.15	51.35	35.87
Cerium (Ce)	36.73	99.08	73.11
Praseodymium (Pr)	6.13	48.55	14.25
Neodymium (Nd)	36.90	84.75	66.64
Promethium (Pm)	-	-	-
Samarium (Sm)	3.60	11.70	5.76
Europium (Eu)	1.05	2.25	1.52
Gadolinium (Gd)	5.65	44.55	11.87
Terbium (Tb)	<0.10	<0.10	<0.10
Dysprosium (Dy)	0.93	3.85	2.65
Holmium (Ho)	<0.10	<0.10	<0.10
Erbium (Er)	3.08	7.38	5.81
Thulium (Tm)	<0.10	<0.10	<0.10
Ytterbium (Yb)	2.73	9.23	4.03
Lutetium (Lu)	1.10	5.43	3.21
Total REE	**157.58**	**338.76**	**220.40**
Scandium (Sc)	5.03	15.63	10.79
Yttrium(Y)	11.38	26.28	19.01
TREE+(Sc+Y)	**176.86**	**375.99**	**250.20**
Gallium (Ga)	9.58	31.58	20.20
Uranium (U)	1.75	245.10	68.97
Thorium (Th)	21.58	129.03	47.78

REE and Ga values from 13 samples of Bhuj Formation and 2 samples from Katrol Formation yielded unencouraging values indicating insufficient concentrations for economic interest. Bhuj sandstone/siltstones are basically quartzo-feldspathic in composition with high SiO2 but no elevated Al2O3 or REE and Gallium.

REE values of pit and trench samples from Bhuj formation are plotted in Spider plot in Fig no: 12

Fig no: 12



The chondrite-normalized REE spider plot of Nadapa block sediments exhibits pronounced LREE enrichment with relatively flat HREE patterns and consistent negative Eu anomalies. The sub-parallel nature of the curves suggests a uniform felsic provenance; most likely derived from upper continental crustal sources. The marked depletion in Eu reflects plagioclase fractionation and intense chemical weathering, which, in conjunction with elevated potash content, indicates enrichment of K-bearing minerals such as illite and K-feldspar. These features collectively point towards compositionally mature, recycled sediments deposited in a stable tectonic setting, typical of intracratonic or passive margin environments. Both Katrol and Bhuj formation show high sediment maturity index (K2O%/(Na2O%+K2O%) ranging from 0.72-0.96 indicate felsic source with strong chemical weathering and Low REE values. (Annexure – V and VI)

Table No :6.8

Lithology-wise variation of major Oxides

	Katrol formation			**Bhuj formation**		
Oxides (%)/ Element (ppm)	**Min. value**	**Max. values**	**Mean value**	**Min. value**	**Max. values**	**Mean value**
SiO2 (%)	54.92	73.26	64.01	44.74	77.97	59.90
Al2O3(%)	0.28	28.81	4.03	4.83	34.89	20.01
Fe2O3(%)	2.81	15.95	8.27	1.41	29.97	8.07
MnO (%)	0.02	0.05	0.03	0.00	0.21	0.04
MgO (%)	0.42	1.78	1.16	0.15	1.71	0.68
CaO (%)	0.41	17.76	8.64	0.05	6.10	0.88
Na2O (%)	0.12	0.35	0.21	0.05	3.74	0.37
K2O (%)	0.91	1.59	1.20	0.45	2.78	1.53
TiO2(%)	0.39	1.34	0.64	0.52	2.03	1.05
P2O5(%)	0.04	0.12	0.08	0.02	0.37	0.05
LOI (%)	3.96	19.08	10.91	2.12	12.87	7.11
V(ppm)	33.80	103.80	66.11	15.70	299.18	73.33

Table no: 6.9 Lithology-wise variation of REE and Gallium

REE (ppm)	Katrol formation			Bhuj Formation		
	Min. value (ppm)	Max. value (ppm)	Mean Value (ppm)	Min. value (ppm)	Max. value (ppm)	Mean Value (ppm)
Lanthanum (La)	40.35	59.85	50.10	18.15	51.35	35.87
Cerium (Ce)	83.6	134.75	109.18	36.73	99.08	73.11
Praseodymium (Pr)	11.18	16.18	13.68	6.13	48.55	14.25
Neodymium (Nd)	79.3	103.43	91.37	36.90	84.75	66.64
Promethium (Pm)	-	-	-	-	-	-
Samarium (Sm)	5.68	9.55	7.62	3.60	11.70	5.76
Europium (Eu)	1.1	1.15	1.13	1.05	2.25	1.52
Gadolinium (Gd)	7.43	11.48	9.46	5.65	44.55	11.87
Terbium (Tb)	<0.1	<0.1	<0.1	<0.10	<0.10	<0.10
Dysprosium (Dy)	2.2	3.28	2.74	0.93	3.85	2.65
Holmium (Ho)	<0.1	<0.1	<0.1	<0.10	<0.10	<0.10
Erbium (Er)	6.93	7.55	7.24	3.08	7.38	5.81
Thulium (Tm)	<0.1	<0.1	<0.1	<0.10	<0.10	<0.10
Ytterbium (Yb)	3.55	3.83	3.69	2.73	9.23	4.03
Lutetium (Lu)	<0.1	<0.1	<0.1	1.10	5.43	3.21
Total REE	**241.65**	**350.72**	**296.19**	**157.58**	**338.76**	**220.40**
Scandium (Sc)	8.85	10.60	9.73	5.03	15.63	10.79
Yttrium(Y)	18.83	22.20	20.52	11.38	26.28	19.01
TREE+(Sc+T)	**271.08**	**381.77**	**326.43**	**176.86**	**375.99**	**250.20**
Gallium (Ga)	16.33	21.05	18.69	9.58	31.58	20.20
Uranium (U)	<0.1	<0.1	<0.1	1.75	245.10	68.97
Thorium (Th)	40.35	59.85	50.10	21.58	129.03	47.78

Based on the geochemical analysis of the samples collected from pits and trenches within the investigated area, the concentrations of bauxite (Al_2O_3), gallium (Ga), vanadium (V), titanium (TiO_2), and REEs are found to be low and below the threshold required for economic consideration. The obtained values do not indicate any significant enrichment or mineralization of these commodities. Hence, the area does not hold promising potential for bauxite, Ga, V, Ti, or REE mineralization at the explored scale.

Elemental Distribution maps of Al_2O_3, TiO_2, Gallium, Vanadium and Total REE are prepared based on analytical results and are described in the following paragraphs. For trench samples, average of 14 sample values was taken for plotting purpose.

Distribution maps of Al2O3%, TiO2%, Vanadium(ppm), Gallium(ppm) and Total REE are given below in fig nos: 13,14,15,16 and 17 respectively.

Al2O3: Aluminium oxide (Al_2O_3) is the major constituent of bauxite; however, the Katrol and Bhuj formations in the study area comprise predominantly sandstone, siltstone, shale, and clay, with no evidence of lateritization or true bauxite horizons. The analysed samples show Al_2O_3 values ranging from 0.28 to 28.81% in the Katrol Formation and 4.83 to 34.89% in the Bhuj Formation. Although some samples display moderately high Al_2O_3, the corresponding SiO_2 contents are also high, indicating that the aluminium is primarily silicate-bound in clay minerals rather than present as gibbsite or boehmite. Higher Al_2O_3 values correlate strongly with grey clay lithologies, reflecting increased proportions of kaolinite, illite, or smectite.

DISTRIBUTION MAP OF AL2O3(%) FROM PITS AND TRENCH SAMPLES IN NADAPA AREA (PART OF TOPOSHEET NO: 41 E/15), KACHCHH DISTRICT, GUJARAT

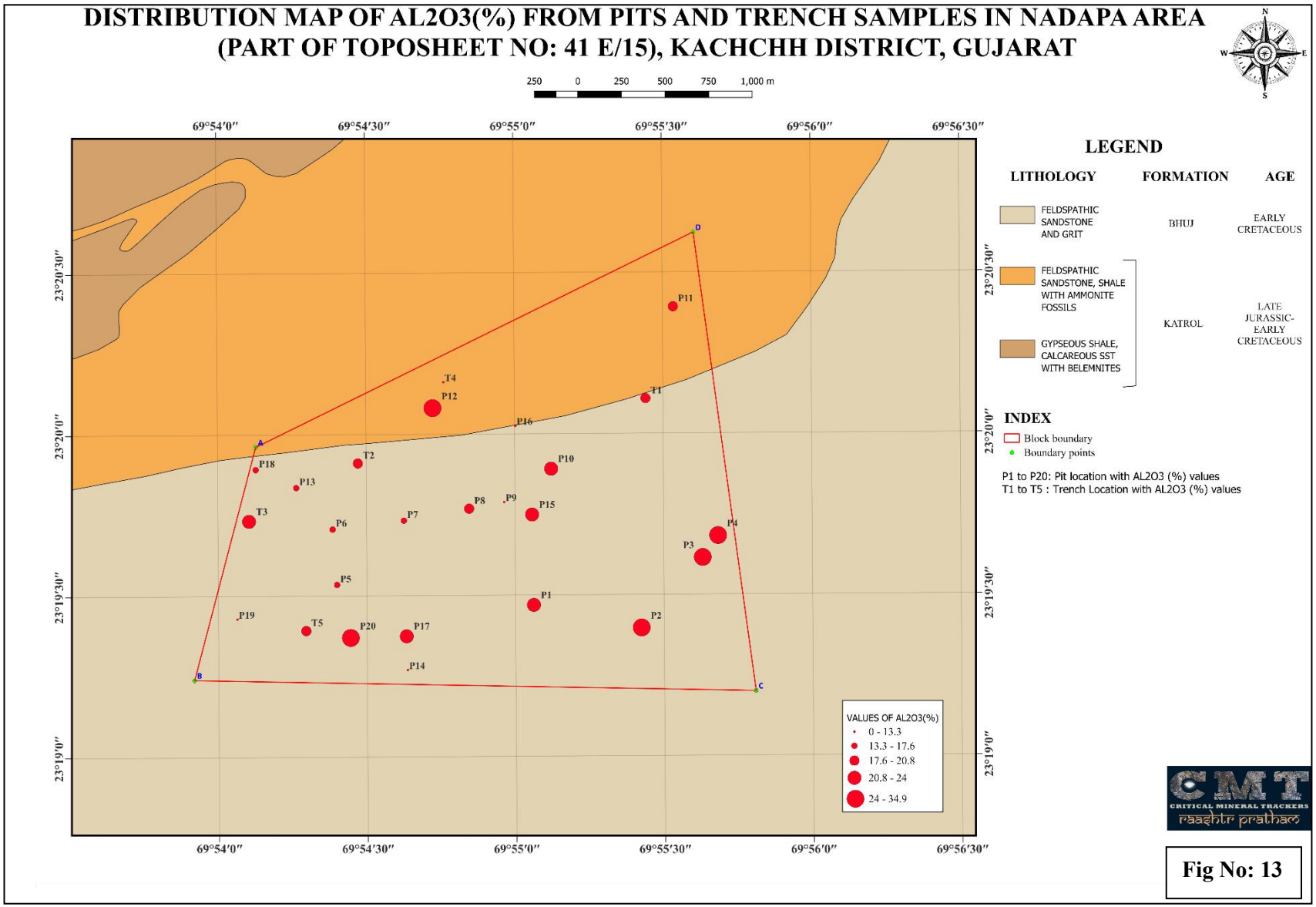


Fig No: 13

TiO2: Titanium, reported as titanium dioxide (TiO_2), shows moderate concentrations across both formations. In the Katrol Formation, TiO_2 values range from 0.39 to 1.34%, while in the Bhuj Formation, they vary from 0.52 to 2.02%. These concentrations fall within the typical range expected for siliciclastic sedimentary rocks, where Ti is commonly associated with heavy minerals such as ilmenite, rutile, and titaniferous magnetite, as well as clay minerals containing structural Ti. Although the values are moderate, they do not indicate any significant Ti enrichment or titanium-bearing mineralization. Instead, the observed TiO_2 levels likely reflect the detrital input from felsic to intermediate provenance sources and the presence of fine-grained clay and ferruginous components within the sedimentary units.

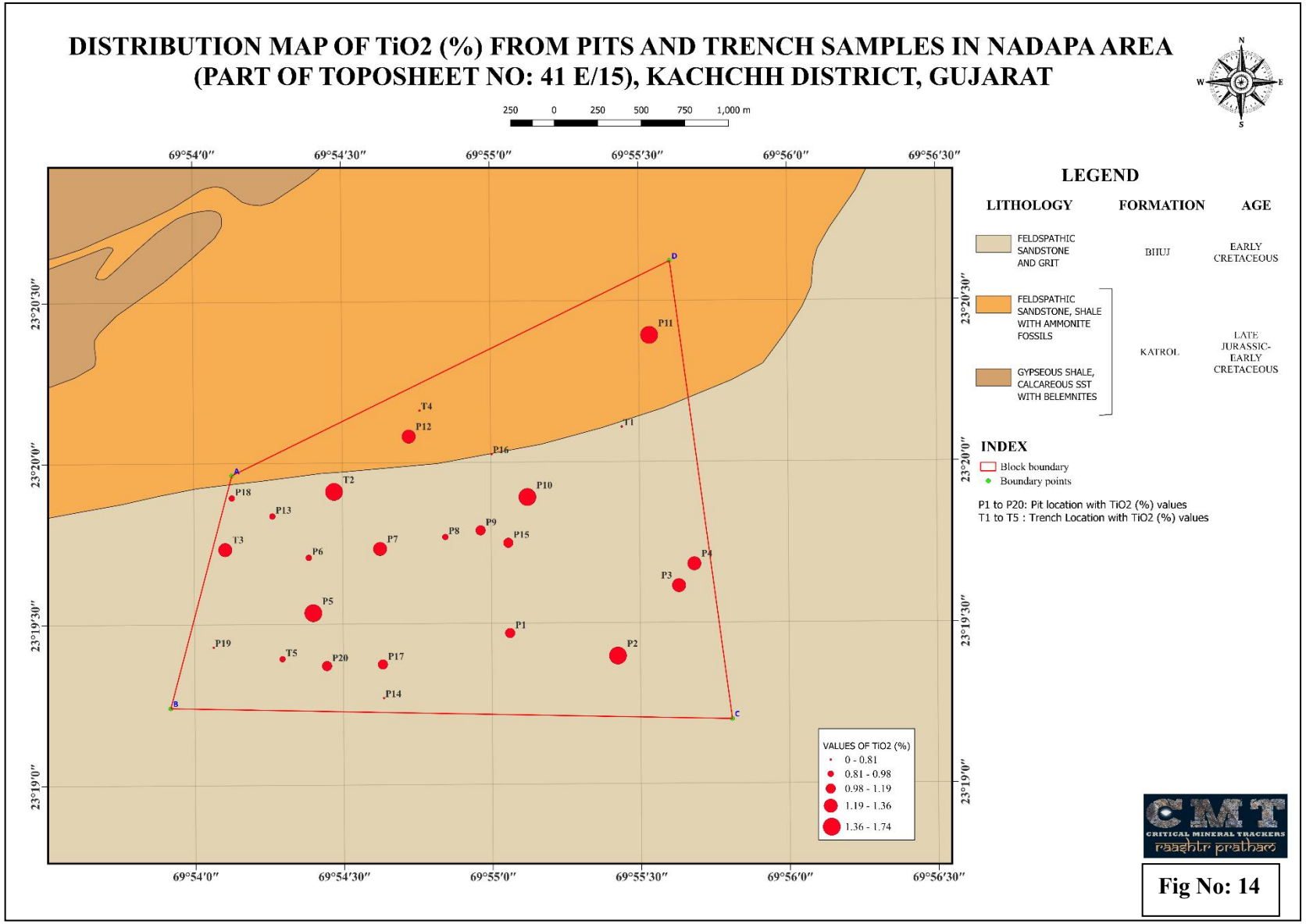

DISTRIBUTION MAP OF TiO2 (%) FROM PITS AND TRENCH SAMPLES IN NADAPA AREA
(PART OF TOPOSHEET NO: 41 E/15), KACHCHH DISTRICT, GUJARAT
250 0 250 500 750 1,000 m
N
W
E
S
69°54'0"
69°54'30"
69°55'0"
69°55'30"
69°56'0"
69°56'30"
23°20'30"
23°20'0"
23°19'30"
23°19'0"
A
B
C
D
P1
P2
P3
P4
P5
P6
P7
P8
P9
P10
P11
P12
P13
P14
P15
P16
P17
P18
P19
P20
T1
T2
T3
T4
T5
LEGEND
LITHOLOGY
FORMATION
AGE
FELDSPATHIC SANDSTONE AND GRIT
BHUJ
EARLY CRETACEOUS
FELDSPATHIC SANDSTONE, SHALE WITH AMMONITE FOSSILS
GYPSEOUS SHALE, CALCAREOUS SST WITH BELEMNITES
KATROL
LATE JURASSIC-EARLY CRETACEOUS
INDEX
Block boundary
Boundary points
P1 to P20: Pit location with TiO2 (%) values
T1 to T5 : Trench Location with TiO2 (%) values
VALUES OF TiO2 (%)
0 - 0.81
0.81 - 0.98
0.98 - 1.19
1.19 - 1.36
1.36 - 1.74

Fig No: 14

Vanadium: Vanadium (V) concentrations in the study area show a modest range. In the Katrol Formation, V varies from 33.80 to 103.80 ppm, while in the Bhuj Formation, it ranges from 15.70 to 299.18 ppm. Although a few samples from the Bhuj Formation exceed the average crustal abundance of ~120 ppm, most values fall within or only slightly above the natural background levels typically observed in siliciclastic sedimentary rocks.

The recorded concentrations therefore do not indicate any significant enrichment or vanadium mineralization, and the values are considered low to marginal from an economic perspective. The observed V content likely reflects the normal geochemical background associated with clay-rich intervals, iron oxide coatings, and detrital minerals, rather than any ore-grade accumulation.

ELEMENTAL DISTRIBUTION MAP OF VANADIUM (V) (ppm) FROM PITS AND TRENCH SAMPLES IN NADAPA AREA (PART OF TOPOSHEET NO: 41 E/15), KACHCHH DISTRICT, GUJARAT

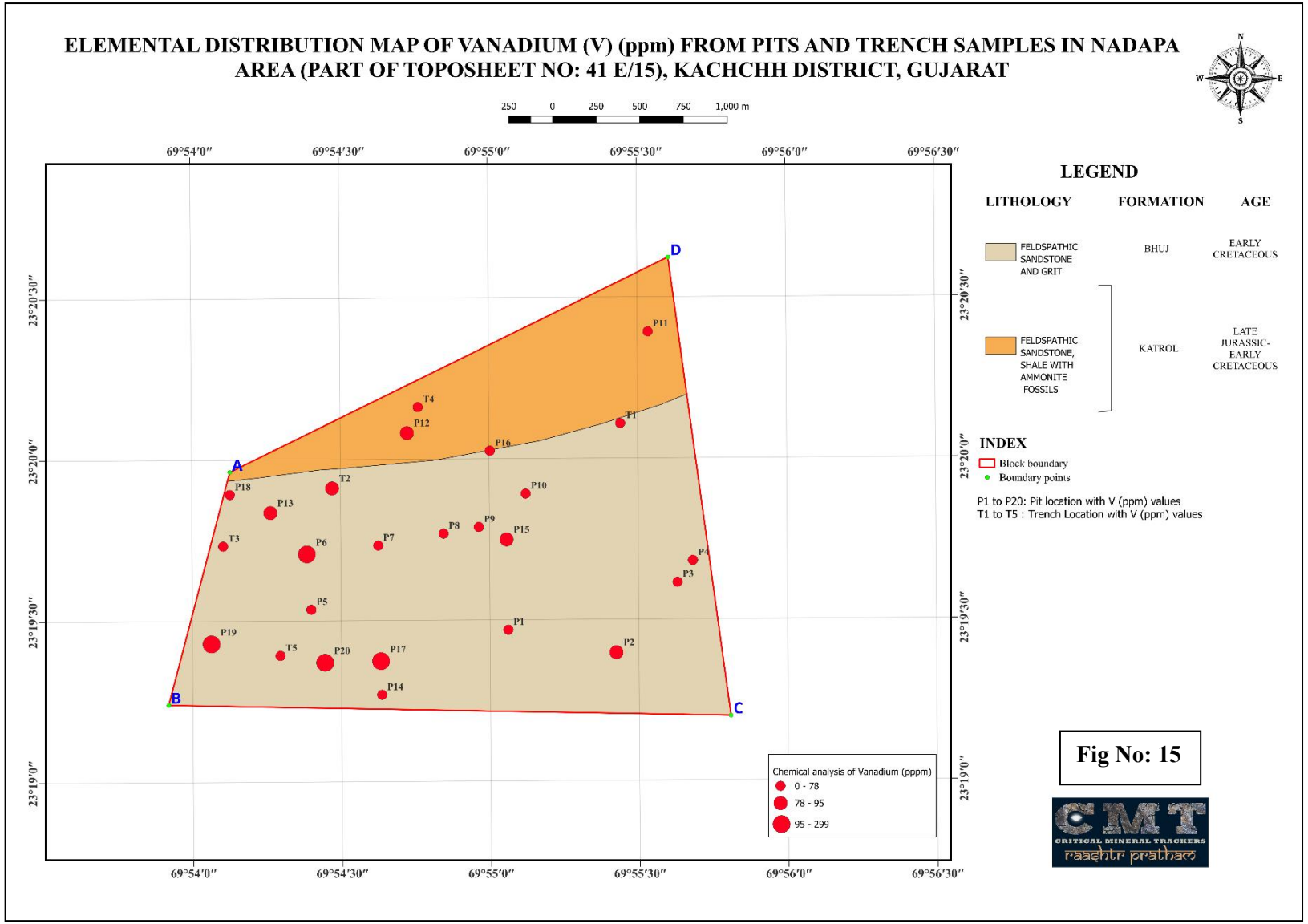
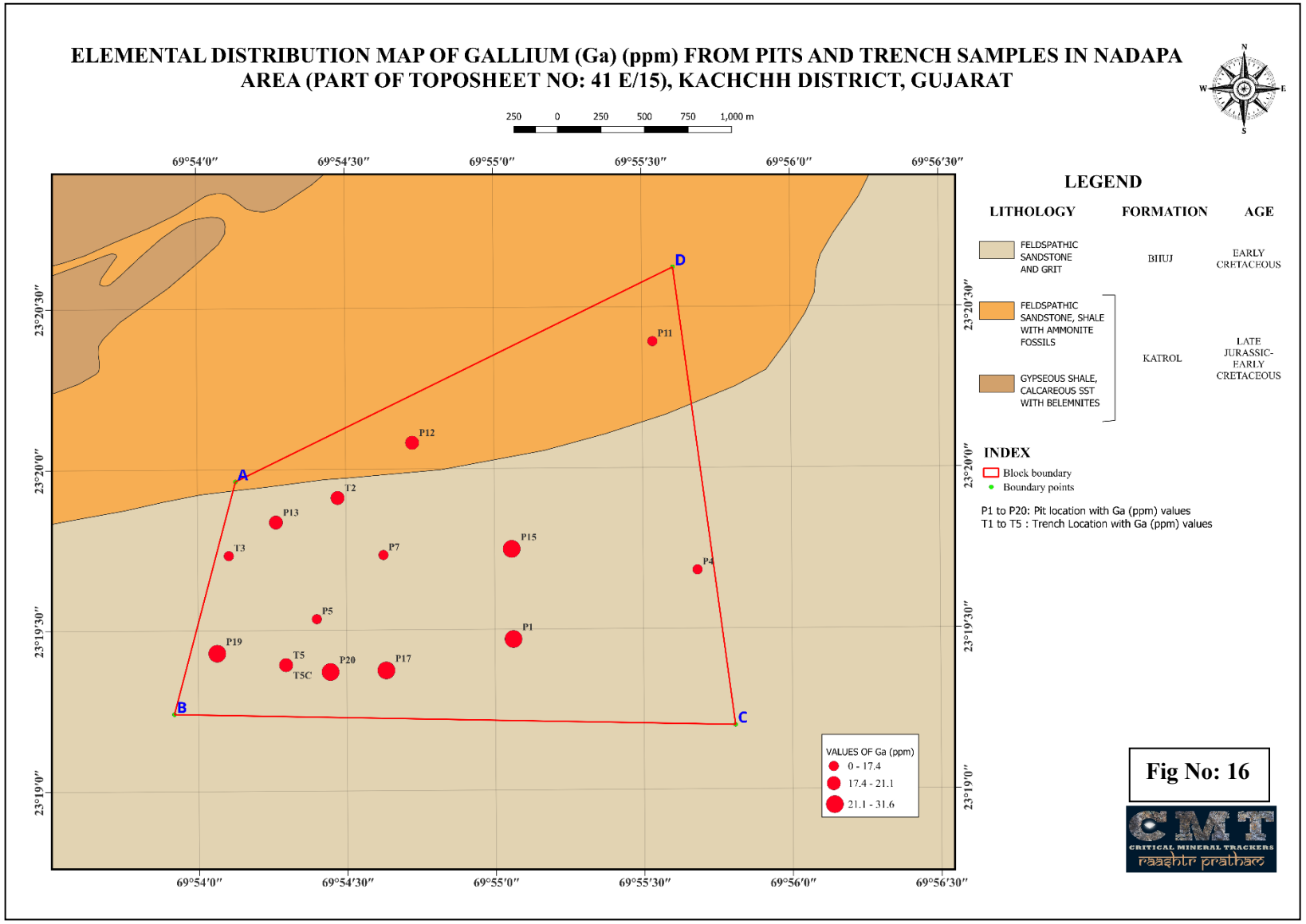


Fig No: 15

Gallium: Gallium (Ga) concentrations in the study area are generally low. In the Katrol Formation, Ga ranges from 16.33 to 21.05 ppm, while in the Bhuj Formation, values vary from 9.58 to 31.58 ppm. Although a few samples marginally exceed the crustal abundance value of ~19 ppm, the majority fall at or below this. These concentrations are considered low and not indicative of any meaningful Gallium enrichment. The Ga present is likely associated with alumino-silicate minerals such as clays and feldspars, reflecting the normal background levels of siliciclastic sediments rather than any economic accumulation. Hence, the Gallium content in both formations is not encouraging from an exploration perspective.



Register office: CRITICAL MINERAL TRACKERS, 306, Concourse Building,
Ameerpet, Hyderabad, Telangana - 500016.

Total REE (∑REE) Distribution:

The Rare Earth Elements (REEs), comprising the fifteen lanthanide elements from atomic number 57 to 71 (La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb and Lu), were summed to derive the Total REE (∑REE) values for each analysed sample. In the Katrol Formation, ∑REE ranges from 241.32 to 350.72 ppm, while in the Bhuj Formation, it varies from 157.58 to 338.76 ppm. Although these concentrations reflect normal REE levels typically associated with felsic-derived siliciclastic sediments, they remain relatively low and do not indicate any significant REE enrichment. The values are well within the background range for clay-rich sandstones and shales and are therefore not encouraging from an economic or mineralization perspective.

ELEMENTAL DISTRIBUTION MAP TOTAL REE FROM PITS AND TRENCH SAMPLES IN NADAPA AREA (PART OF TOPOSHEET NO: 41 E/15), KACHCHH DISTRICT, GUJARAT

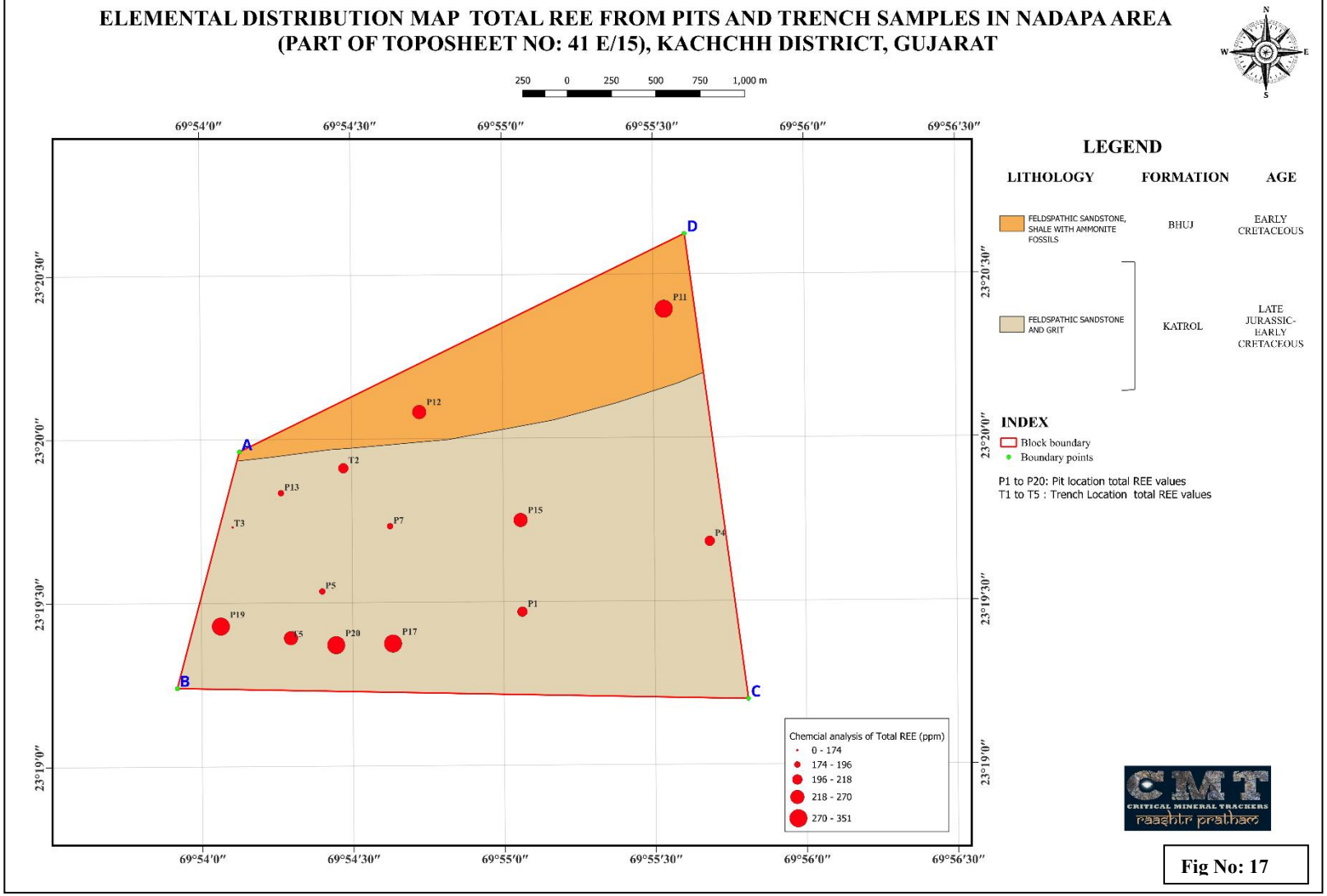


Fig No: 17

6.1.10 Ore Zones: Based on the integrated geological, structural, subsurface, and geochemical evaluation, the Nadapa block does not exhibit any potential ore zones for bauxite or associated critical mineral (Ga, V, Ti, REE) mineralization. The area is therefore considered non-prospective, and no further exploration is recommended at this stage.

6.2 Geophysical Exploration: Geophysical Exploration have not been carried out in the present exploration as it was out of the scope of the approved quantum of work.

6.3 **Geochemical Exploration**: During the present exploration pitting work was undertaken to obtain fresh representative samples from a depth of 1 meter. A total of 20 pits were excavated using a JCB, each measuring 1.0 m × 1.0 m × 1.0 m, resulting in an individual volume of 1.0 m^3 and a cumulative excavated volume of 20 m^3. After cleaning the floor of the pit, one representative sample of 2-3kg was collected from each pit and properly labelled.

Similarly, five trenches were excavated in the study area, each measuring 10m in length, 1m in width, and 1m in depth, amounting to a cumulative excavated volume of 50 m^3. After cleaning the floor of the trench, 10 representative samples were collected at an interval of 1m from bottom of the trench and 4 samples from four walls of trench. So total 14 samples from each trench and total 70 samples from five trenches. Each sample weighs 2-3kg.

All 90 samples were sent to field camp at Padhar village. Each sample was crushed/grinded and passed through 3 different sieves to get final laboratory sample of -200 mesh size. Coning and Quartering was done at each stage to reduce the size of sample without losing the homogeneity of sample. Finally, 90 samples were sent to Lucid laboratories Pvt Ltd, Hyderabad (NABL accredited lab) for analysis for major oxides by XRD, REE (14 elements by ICPMS) and MH, TH and reactive silica. Analytical results were given in Annexure-II, III, IV, V and also enclosed in plate no: IX (Assay value map of pits) and plate no: X (Assay value map of trenches).

Nine check samples were sent to Shiva Analyticals India Pvt Ltd, Bengaluru for major oxides and one sample for REE.

The nature, quality and appropriateness of Chemical analysis: A total 90 Nos of surface samples from pits & trenches have been analysed for major oxides by XRF (SiO_2, $Al2O_3$, $F2O_3$, MnO MgO, Na_2O, K_2O, P_2O_5, TiO_2, and vanadium and 15 samples

for REEs (La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu) and Gallium by ICP-MS instrument at Lucid Laboratories Pvt Ltd (NABL accredited lab) ,Hyderabad. Lucid laboratories Pvt Ltd has used latest equipment for analysis namely WD XRF model Analytical Axios max for major oxides and ICP MS Model: Agilent 7850 for REE and Gallium.

Methodology of Chemical Analyses by ICP-MS: Representative rock/soil samples were dried, crushed, and pulverized to −200 mesh with the help of pestle and mortar and sent to the chemical lab. About 0.1–0.2 g of sample was digested using HF–HNO_3–$HClO_4$ (silicate samples) / aqua regia (soil) and diluted in 1–2% HNO_3. Multi-element analysis was carried out using ICP-MS under optimized operating conditions. Calibration was performed using certified reference standards with internal standards for drift correction. Quality control was ensured through procedural blanks, CRMs, and duplicate analyses. Analytical precision was generally better than ±5%, with detection limits in the ppb range.

Nine check samples were sent to Shiva Analyticals India Pvt Ltd, Bengaluru for major oxides and one sample for REE.

Statistical analysis of geochemical data is given below in table nos:6.10, 6.11

Table No 6.10: Summarised table showing statistical analysis of Primary Vs. External Check sample assay of SiO_2, Al_2O_3, Fe_2O_3, MnO and MgO

Sr. No	Comparison Parameter	SiO2(%)		Al_2O_3 (%)		Fe2O3(%)		MnO (%)		MgO (%)	
		PRIMARY	CHECK	PRIMARY	CHECK	PRIMARY	CHECK	PRIMARY	CHECK	PRIMARY	CHECK
1	No. of sample pairs	9		9		9		9		9	
2	Arithmetic mean	58.83	69.28	17.87	11.99	10.54	8.07	0.06	0.14	0.68	0.29
3	Standard Deviation	9.58	11.83	9.87	4.89	12.32	10.96	0.08	0.05	0.37	0.18
4	Standard error of mean	3.19	3.94	3.29	1.63	4.11	3.65	0.03	0.03	0.12	0.06
5	Variance	91.85	139.90	97.41	23.89	151.88	120.03	0.01	0.00	0.14	0.03

Table No 6.11: Summarised table showing statistical analysis of Primary Vs. External Check sample assay of Cao, Na_2O, K_2O, TiO_2 and P_2O_5

Sr. No	Comparison Parameter	CaO (%)		Na_2O (%)		K_2O (%)		TiO_2(%)		P_2O_5(%)	
		PRIMARY	CHECK	PRIMARY	CHECK	PRIMARY	CHECK	PRIMARY	CHECK	PRIMARY	CHECK
1	No. of sample pairs	9		9		9		9		9	
2	Arithmetic mean	1.48	0.84	0.44	0.15	1.31	2.04	1.25	1.08	0.09	0.11
3	Standard Deviation	2.34	1.01	0.60	0.06	0.52	1.08	0.50	0.33	0.11	0.13
4	Standard error of mean	0.78	0.34	0.20	0.03	0.17	0.36	0.17	0.11	0.04	0.05
5	Variance	5.45	1.03	0.36	0.00	0.27	1.16	0.25	0.11	0.01	0.02

Table No: 6.12 Statement showing analysis of External check samples for major oxides and its comparison with primary samples of Nadapa area, Kachchh district, Gujarat

S.no	Reg No	Primary /check	Sample name	SiO2 (%)	Al2O3 (%)	Fe2O3 (%)	MnO (%)	MgO (%)	CaO (%)	Na2O (%)	K2O (%)	TiO2 (%)	P2O5 (%)	LOI (%)	Total (%)	V (ppm)	Remarks
1	1204/2	Primary sample	P2/NB/2025	54.021	34.051	1.417	0.011	0.603	0.191	0.225	0.642	1.471	0.044	7.18	99.86	82.5	Lucid lab Hyderabad
1	**G2296-19**	**check sample**	**P35/NB/2025**	**68.68**	**19.31**	**1.42**	**<0.05**	**0.32**	**0.15**	**<0.08**	**0.78**	**1.28**	**0.05**	**7.72**	99.71		Shiva Lab Bangalore
2	1204/10	Primary sample	P10/NB/2025	60.901	24.03	3.899	0.012	0.728	0.324	1.568	1.771	1.41	0.055	5.07	99.77	77.8	Lucid lab Hyderabad
2	**G2296-20**	**check sample**	**P36/NB/2025**	**70.77**	**15.11**	**3.26**	**<0.05**	**0.3**	**0.2**	**0.22**	**2.81**	**1.25**	**0.06**	**5.76**	99.74		Shiva Lab Bangalore
3	1204/25	Primary sample	P11/NB/2025	66.543	20.831	4.572	0.02	0.422	0.412	0.158	1.526	1.34	0.071	3.96	99.86	85.75	Lucid lab Hyderabad
3	**G2296-21**	**check sample**	**P37/NB/2025**	**73.48**	**12.76**	**3.99**	**<0.05**	**0.17**	**0.24**	**<0.08**	**2.27**	**1.6**	**0.09**	**4.94**	99.54		Shiva Lab Bangalore
4	1204/89	Primary sample	P19/NB/2025	37.646	9.713	36.973	0.199	0.373	2.031	0.064	0.451	0.74	0.37				Lucid lab Hyderabad
4	**G2296-22**	**check sample**	**P38/NB/2025**	**42.71**	**9.24**	**33.49**	**0.17**	**0.27**	**2**	**<0.08**	**0.59**	**0.8**	**0.41**	**9.83**	99.51		Shiva Lab Bangalore
5	1204/23	Primary sample	T1/NB/2025/C	62.019	20.106	4.743	0.016	1.418	0.783	1.421	2.005	1.006	0.05	6.23	99.8	64.8	Lucid lab Hyderabad
5	**G2296-23**	**check sample**	**T30/NB/2025/C**	**64.44**	**17.85**	**4.05**	**<0.05**	**0.7**	**0.69**	**0.2**	**3.45**	**0.92**	**0.05**	**7.43**	99.78		Shiva Lab Bangalore
6	1204/36	Primary sample	T2/NB/2025/A	64.959	18.545	4.634	0.025	0.873	0.639	0.153	1.359	1.824	0.05	6.68	99.74	78.6	Lucid lab Hyderabad
6	**G2296-24**	**check sample**	**T31/NB/2025/A**	**75.98**	**11.49**	**2.71**	**<0.05**	**0.37**	**0.52**	**0.1**	**2.9**	**1.16**	**0.06**	**4.45**	99.74		Shiva Lab Bangalore

7	1204/55	Primary sample	T3/NB/2025/10	59.81	23.214	3.968	0.039	0.492	1.095	0.09	1.712	2.028	0.037	7.48	99.97	63.8	Lucid lab Hyderabad
7	**G2296-25**	**check sample**	**T32/NB/2025/10**	**79.09**	**10**	**1.84**	**<0.05**	**0.15**	**0.48**	**0.09**	**3.02**	**1.36**	**0.05**	**3.53**	99.61		Shiva Lab Bangalore
8	1204/70	Primary sample	T4/NB/2025/10	69.933	0.316	8.677	0.03	0.988	7.524	0.15	1.134	0.86	0.078	10.12	99.81	50.7	Lucid lab Hyderabad
8	**G2296-26**	**check sample**	**T33/NB/2025/10**	**83.68**	**3.76**	**2.86**	**<0.05**	**0.24**	**3.08**	**0.11**	**1.13**	**0.71**	**<0.05**	**4.06**	99.63		Shiva Lab Bangalore
9	1204/78	Primary sample	T5/NB/2025/04	53.616	9.994	25.975	0.218	0.194	0.336	0.087	1.169	0.56	0.022	7.7	99.87	54.78	Lucid lab Hyderabad
9	**G2296-27**	**check sample**	**T34/NB/2025/04**	**64.68**	**8.33**	**19**	**0.11**	**0.09**	**0.21**	**<0.08**	**1.37**	**0.64**	**<0.05**	**5.29**	99.72		Shiva Lab Bangalore

Table No: 6.13 Statement showing analysis of one External check sample for REE and its comparison with primary sample analysis of Nadapa Area, Kachchh District, Gujarat

Primary /check	*Sample No*	In ppm																				
		La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Total REE	Sc	Y	Th	U	Ga	V	Ti as Tio2 % by mass
Primary sample	P19/NB/2025	46.88	96.53	48.55	64.38	11.7	2.25	44.55	<1.0	3.68	<1.0	5.58	<1.0	9.23	5.43	339	11.9	25.33	129.03	245.1	31.58	299.18	1.47
Check sample	P-38/NB/2025	63.8	130	11.7	40.4	8.66	2.87	11.2	1.17	6.9	1.14	3.63	<0.5	3.2	<0.5	285	13.8	29.7	17.9	4.35	10.6	NA	1.28

6.4 DGPS survey of boundary points

The present exploration for Bauxite, Ga, V, Ti, and REE was carried out at the G-4 stage. To ensure precise documentation of sample locations and geological features, a handheld GPS device (Garmin 12H model) was used for recording the coordinates and elevation of all pit and trench sites, as well as for outcrop mapping across the study area. All spatial data were captured in the UTM coordinate system, referenced to the WGS 1984 datum, enabling accurate integration of field data with GIS-based mapping and interpretation. The Reduced level (RL) was carry forward from Kukma railway station where the MSL value is 122.82m.

The four boundary corner points of the study area were determined using DGPS (E-Survey instruments: E-800 Base and E600-H Rover) to achieve high-precision spatial control. The system provided a static accuracy of Horizontal: 2.5 mm + 0.1 ppm and Vertical: 3.5 mm + 0.4 ppm, while RTK mode offered Horizontal: 8 mm + 1 ppm and Vertical: 15 mm + 1 ppm accuracy. As part of the survey control framework, two temporary benchmarks were established within the study area and designated as NDP-TBM-1 and NDP-TBM-2. These temporary benchmarks may be used as reference points for subsequent mapping and geospatial integration.

Table No: 6.14 The details of coordinates and elevation of 4 cardinal points and Two temporary bench marks as determined by DGPS Survey

Coordinates & elevation of cardinal points of Nadapa area, District: Kachchh, Gujarat (as determined by DGPS Survey)								
Cardinal Points	Geographic Coordinate System in Degree Minutes		Geographic Coordinate System in Degree Decimal		UTM (WGS 1984, Zone 42N)			Area (Sq. Km)
	Latitude(N)	Longitude(E)	Latitude(N)	Longitude(E)	Elevation(m)	Northing (m)	Easting (m)	
A	23°19'57.7668"	69°54'07.7084"	23.332713	69.90214122	112.6	2580639.366	592227.296	6.2
B	23°19'14.4326"	69°53'55.1198"	23.32067572	69.89864439	146.25	2579304.447	591818.067	
C	23°19'11.9864"	69°55'48.4686"	23.31999622	69.93013017	136.27	2579249.557	595097.873	
D	23°20'37.3638"	69°55'36.2889"	23.34371217	69.92674692	136.91	2581873.036	594735.121	
NDP-TBM-1	23°19'31.2906"	69°54'24.8085"	23.3253585	69.90689125	163.132	2579828.157	592718.031	
NDP-TBM-2	23°19'30.6793"	69°54'25.5936"	23.32518869	69.90710933	162.493	2579809.497	592740.447	

- TBM – 1 and 2: Temporary Bench marks established in Nadapa Area.

CHAPTER - VII

7.0 Integration of Geology, geophysics (with available aero geophysical data) and geochemical exploration data and the interpretation:

This chapter is not applicable for stratiform type deposits like bauxite. Shape files in GIS format for the themes like lithology, Oriented structures, Outcrop map, sample locations of pits and trenches are prepared and various elemental distribution maps viz Al2O3, G, V, Tio2 and REE etc have been prepared and discussed in the Chapter 6.

CHAPTER - VII

8.0 Mineral Prospect:

The study area is represented by two major stratigraphic units, namely the Katrol Formation (Late Jurassic to Early Cretaceous) and the Bhuj Formation (Early Cretaceous). Both formations predominantly comprise sandstones, siltstones, shales, and clay beds. Lithologic ally, these formations represent clastic sedimentary sequences deposited in fluvial to deltaic environments. Such litho-units lack the lateritic profiles, aluminous enrichment zones, and favourable weathering conditions required for the formation and preservation of economic bauxite deposits. In contrast, the neighbouring regions where bauxite mineralisation is reported are associated with the Matanomadh Formation, which is known to host lateritic bauxite horizons. This formation is completely absent within the Nadapa study area, eliminating the primary stratigraphic control necessary for bauxite development. Analytical results of pits and trench samples further confirm the absence of economically significant Al_2O_3 enrichment and related critical mineral concentrations.

CHAPTER – 1X

9.0 Exploration by scout drilling

Although drilling was proposed in the NQT, during 9th TCC-II review meeting held on 29th May did not recommend drilling in this block. This decision was based on the unencouraging analytical results obtained from the pit and trench samples, which demonstrated low and non-economic concentrations of the targeted commodities. Therefore, further subsurface exploration through drilling was not considered warranted at this stage.

CHAPTER – X

10.0 Resource Estimation:

Based on the integrated evaluation of geological setting, stratigraphic framework, subsurface investigations, and geochemical data, the Nadapa area does not exhibit any potential for Bauxite mineralization and associated critical minerals (Ga, V, Ti, REE).

CHAPTER – XI

11.0 Conclusion and recommendation

The G4 exploration carried out over 6.2 sq. km in the Nadapa area, Kachchh district, aimed to assess the potential for bauxite and associated critical minerals (Ga, V, Ti and REE). Geological mapping on a 1:12,500 scale established the presence of only two litho-units—Katrol Formation and Bhuj Formation—neither of which is known to host lateritic or bauxitic enrichment in the region. Subsurface exploration through 20 pits and 5 trenches provided representative samples, and geochemical analysis of 90 samples confirmed uniformly low concentrations of the targeted elements.

No signatures of bauxitisation, lateritisation, or favourable stratigraphy were identified, and the Matanomadh (Madh) Formation, which hosts bauxite deposits in neighbouring areas, is completely absent in the study area.

Based on the combined geological, subsurface, and geochemical evidence, the Nadapa Area does not exhibit any potential for bauxite or related critical mineral mineralisation. Thus, the area is considered non-prospective for further exploration at this stage.

CHAPTER – XII

12.0 EXPENDITURE:

The total expenditure incurred for the execution of the project "Reconnaissance survey (G4) for Bauxite, Ga, V, Ti and REE in Nadapa area, Kachchh Dist., Gujarat is Rs35.41 Lakhs (including GST), Rupees thirty-five lakhs forty-one thousand only against the initial approved cost of 53.73 lakhs as detailed below. This has been approved by 26th TCC-II held on 1st & 2nd April,2026 and also in 8th PSC held on 30th April 2026.

Agenda 26.1.2 Reconnaissance Survey (G-4) for Bauxite, Ga, V, Ti & REE in Nadapa area Kachchh District, Gujarat.
[Implementing Agency: M/s Critical mineral trackers (CMT)]

a) The project was recommended in 4th meeting of TCC-II held on 26th and 27th December 2024 and approved in the 39th EC Meeting held on 24th January 2025. The Sanction Order was issued on 10th February 2025 for scheduled timeline of 10 months up to 9th December 2025 with an approved cost of ₹ 53.73/- Lakh (including GST).
b) The project was reviewed in 9th meeting of TCC-II held on 29th & 30th May 2025. During the 9th TCC-II meeting, the agency briefed the Committee on the progress of work in the project and stated that the REE values obtained from chemical analysis were not encouraging. Subsequently, TCC-II advised the agency to complete the project within the stipulated timeline.
c) The project was also reviewed during the 23rd TCC-II meeting held on 16th & 17th February 2026 & 24th TCC-II meeting held on 2nd & 3rd March 2026.
d) M/s Critical Mineral Trackers informed that all work components have been completed, except for the drilling work, which was not undertaken due to low REE values. It was further stated that the peer review of the final Geological Report (GR) has been carried out and all corrections/modifications suggested by the peer reviewer have been incorporated in the final geological report. The agency also requested a timeline extension of 2 months, up to 30th April 2026, for submission of the GR.
e) The committee evaluated the proposed revised cost sheet of the project as the drilling work was not undertaken due to low REE values and recommended the same for approval of PSC. Further, a timeline extension of 2 months, up to 30th April 2026, for submission of the GR was also recommended.

Recommendation TCC-II

i. ***The Committee recommended the proposal for approval by the PSC for revised cost of ₹35.41/- lakh (including GST), against the initial approved cost of ₹53.73/- lakh (including GST), since drilling was not undertaken in the project due to low REE values obtained from chemical analysis.***
ii. ***Timeline extension of 2 months, up to* 30th April 2026*, for submission of the Final Geological Report (GR).***

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Table No: 12.1 Details of actual expenditure incurred for Reconnaissance survey (G4) in Nadapa area, Kachchh Dist., Gujarat.

Annexure-3

Estimated cost of Reconnaissance Survey (G4) for Bauxite, Ga, V, Ti & REE in Nadapa Area Kachchh Gujarat.
Total Area -6.20 sq.km; Completion Time -10 months, Review: 4 months
Exploration Agency – Critical Mineral Trackers, Hyderabad

S.No	Item of Work	Unit	Rates as per NMET SoC		Estimated Cost of the Proposal		Achieved quantum & Expenditure incurred			Remarks
			SoC-Item-Sl No.	Rates as per SOC	Qtm	Total Amount (Rs)	Quantity	Rate	Amount	
A	**Geological Work**									
1	Geological Mapping (1:25,000) & sampling – Geologist field-days	6.20	1.2	11000	160	17,60,000	130	11,000	14,30,000	30 days for drilling
2	Geologists (HQ)days, pre & post field interpretation 15 +20 days	One Geologist Per Day	1.2	9000	35	3,15,000	30	9,000	2,70,000	man days (including Remote sensing studies
3	Pitting-20nos each one size 1*1*1m (1 Cu. m each)	Per Cu. m	2.1.2	3800	20	76,000	20	3,800	76,000	20 cu. m
4	Trenching-5 nos., each one size 10*1*1(10 cu. m each)	Per Cu. m	2.1.1	3300	50	1,65,000	50	3,300	1,65,000	50 cu. m
5	sampler	45 days	1.5.2	5100	23	1,17,300	15	5,100	76,500	man days
6	Labour(2labour) attached to sampler	90 labour days	1.5.2	526	92	48,392	60	526	31,560	labour days
7	Labour (100Field days) per team:2 workers: 100*4 for two geologist team	Per Team of 2 Geologists (2*2=4)	5.7	526	320	1,68,320	260	526	1,36,760	labour days

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		Labour/Field workers								
	Sub-Total -A					**26,50,012**			**21,85,820**	
B	**Survey Work:**									
1	Surveyor: Fixation & connection of boundary points (4nos),4 BH by Total station/DGPS	One surveyor	1.6.2	19,200	8	1,53,600	4	19,200	76,800	4 boundary points
	Sub-total-B					**1,53,600**			**76,800**	
C	**Core Drilling**									
1	Scout drilling(coring) :4 points (each 30m deep) 4*30	Per meter	2.2.1.1b	7,168	120	8,60,160				TCC Advised not to go for drilling
2	Construction of BH pillar (12*12*30)	Per pillar	2.2.2a	2000	0	0	0	0	0	4 pillars
3	**Mob & demob drilling machine & inner BH shifting	Per shifting	lumpsum		0	0	0	0	0	lumpsum
4	Compensation for 4 Bhs		5.6		0	0	0	0	0	4 BHs
5	Drill core preservation in GI boxes	Per meter	5.3	1590	120	1,90,800	0	0	0	120m core
	Subtotal-C					**10,50,960**			**0**	
D	**Laboratory Studies**									
1	Trench Samples (5*5=25nos):by AAS method	First five radicals+2	4.1.7a &7b	4181	0	0	0	0	0	90 samples
2	Pitting Sample: (20*1=20nos)-AAS method	First five radicals+2	4.1.7a &7b	4181	0	0				60 samples
3	Core drilling Samples-4*60=240 Total depth 30m each, samples will be collected at every 0.5m interval. AAS method	First five radicals+2	4.1.7a &7b	4181	0	0	0	0	0	TCC Advised not to go for drilling in the 9th TCC on 29th May 2025
4	XRF-Major oxides		4.1.15a	4200	143	6,00,600	90	4,200	3,78,000	Trench-70, pit-20, Bh-40(130+13

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5	Analysis for REE(14 elements/radicals) by ICP-MS	14 elements/ radicals	4.1.13	5380	36	1,93,680	15	5,380	80,700	33+3check
6	Combined determination of THA, MHA and Reactive silica		4.1.17a	6700	4	26,800	1	6,700	6,700	1 sample
7	Preparation of polished thin section	Per sample	4.3.2	1549	10	15,490	3	3,080	9,240	10 sections have been analysed based on the GSI, SR lab rates
8	Complete petrographic/ore microscopic/mineragraphic studies	per sample	4.3.4	4232	10	42,320				10 sections have been analysed based on the GSI, SR lab rates
9	XRD analysis for identification of minerals(random)	Per sample	4.5.1	4000	4	16,000	3	4,000	12,000	4 samples
11	Check samples Major oxides by XRF	9	4.1.15a	4200			9	1,500	13,500	
12	Check samples REE (14 elements by ICPMS	1	4.1.13	5380			1	2,500	2,500	
	Sub-total-D					**2,51,970**			**5,02,640**	
E	**Surface Geophysical Survey**		**Not recommended**							
1	Electrical resistivity	Per Station								
2	gravity surveys	Per station								
3	Geo Physicist Man days (Field Man-days)									
4	Geo Physicist Man days (HQ)									
	Sub-total-E									
	TOTAL (A+B+C+D)					**41,06,542**			**27,65,260**	
F	**Preparation of Exploration Proposal** (5 Hard copies with a soft copy)		5.1	2% of the project cost subject to a		82,131			55,305	2% of the Project cost.

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				maximum of 5 lakhs						
G	**Geological Report** (5 Hard copies with a soft copy)		5.2	5% of the Project cost		2,05,327			1,50,000	Reconnaissance Survey up to ₹50 lakh: Minimum ₹1.50 lakh or 5% of the total value of work whichever is more.
	operational charges		6.0			86,016			0	
	Tender process cost		2.3			43,008			0	
	peer review					30,000			30,000	
	Additional Copy			1000	0	0				
	Project Cost without GST					**45,53,024**			**30,00,565**	
	18% GST					**8,19,544**			**5,40,102**	
	Total Project Cost					**53,72,568**			**35,40,667**	
	Rs. In Lakhs					**53.73**			**35.41**	

Note:	
1	Strict adherence to the ministry of finance's and GFR guidelines is mandatory. every transaction must adhere to GFR rule-21
2	In case of delay/non-performance, the appropriate action will be taken by competent authority against delinquent agency as per prevailing govt of India rules/guidelines on procurement
3	If any of the project is outsourced, the amount will be reimbursed as per the paragraph 3 of NMET SoC and item no:6 of NMET SoC In case of execution of the project by NEA on its own, a certificate regarding non-outsourcing of any component/project is required
4	Necessary efforts should be made to minimise any adverse impact on the environment during exploration activities
5	Any item of work not mentioned above shall be added as per SoC
6	All the Geological Reports and data are to be uploaded on NGDR as per MERT template by the agency

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CHAPTER – XIII

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The company gratefully acknowledges the financial assistance and guidance provided by National Mineral Exploration and Development Trust (NMEDT) for successful implementation of the project.

The support and cooperation extended by the local residents of Nadapa village during field investigations are also sincerely appreciated.

CHAPTER – XIV

14.0 LOCALITY INDEX

Location of villages/ factories/Railway stations/Airport around Nadapa Area

Table no: 14.1

Locality	Latitude (Degree decimal)	Longitude (Degree decimal)
Nadapa village	23.318733°	69.906531°
China clay plants within Nadapa area		
China clay plant-1	23.325437°	69.914530°
China clay plant-2	23.328267°	69.914493°
China clay plant-3	23.323118°	69.901743°
China clay plant-4	23.328961°	69.924827°
China clay mines & plants located outside Nadapa Area		
Sree Ram group of China clay plants	23.286319°	69.920692°
Bhuj Airport	23.275506°	69.663865°
Bhuj city	23.242572°	69.664388°
Bhuj Railway station	23.265908°	69.678027°
BKT tyre factory	23.246721°	69.861985°
Dhaneti village	23.256210°	69.919325°
Kukma village	23.216733°	69.777743°
Padhar village	23.240591°	69.824396°
Ratnal Railway station	23.185004°	69.903495°
Suzlon wind mill factory	23.246120°	69.845665°

kLIST OF ANNEXURES

ANNEXURE – X

Statement showing details of 90 Pit & Trench sample analysis of Major oxides in Nadapa area, Kachchh district, Gujarat, (as received from Lucid laboratory, Hyderabad)

TEST RESULTS OF BAUXITE SAMPLES

LUCID Laboratories Pvt. Ltd. Testing to the Core

Issued to:
The Director,
Critical Mineral trackers,
 # Con course No 406,7-1-58/cc/406,
opp Lal Bungalow,Green lands ,Hyderabad-500016.

Report No : LL/25-26/001204 (1-90)
Report Issue Date : 29.05.2025
Date of Receipt of Sample : 02.05.2025
Date of Starting of Analysis : 05.05.2025
Date of Completing of Analysis : 29.05.2025

Sample Particulars: Bauxite Samples.
Block Name : Nadapa,
Sample Qty : 500g x 90 N
Customer Ref Letter: CMT/Lucid/01/2025 Dated: 30.04.2025
Test Parameters: Silica as SiO2, Aluminium as Al2O3, Iron as Fe2O3, Manganese as MnO, Magnesium as MgO ,Calcium as CaO, Sodium as Na2O, Potassium as K_2O, Titanium as TiO2,Phosphorus as P2O5,Vanadium as V ,Loss on Ignition.

Sl.No	Lab. No.	Sample No	Silica as SiO_2 (% by mass)	Aluminium as Al_2O_3 (% by mass)	Iron as Fe_2O_3 (% by mass)	Manganese as MnO (% by mass)	Magnesium as MgO (% by mass)	Calcium as CaO (% by mass)	Sodium as Na_2O (% by mass)	Potassium as K_2O (% by mass)	Titanium as TiO_2 (% by mass)	Phosphorus as P_2O_5 (% by mass)	Vanadium as V (ppm)	Loss on Ignition (LOI) (% by mass)
01	LL/25-26/001204/01	P1/NB/2025	55.13	22.85	3.75	0.01	0.45	0.22	6.11	0.99	0.99	0.05	103.53	9.19
02	LL/25-26/001204/02	P2/NB/2025	54.02	34.05	1.41	0.01	0.60	0.19	0.22	0.64	1.47	0.04	82.50	7.18
03	LL/25-26/001204/03	P3/NB/2025	51.25	34.89	1.57	0.00	0.62	0.13	0.64	1.19	1.36	0.04	71.90	7.97
04	LL/25-26/001204/04	P4/NB/2025	56.89	29.95	2.48	0.00	0.74	0.05	0.82	1.67	0.94	0.05	80.55	6.25
05	LL/25-26/001204/05	P5/NB/2025	74.96	14.01	3.67	0.04	0.27	0.44	0.17	2.19	1.31	0.04	52.28	2.64
06	LL/25-26/001204/06	P6/NB/2025	58.96	17.18	15.38	0.01	0.46	0.22	0.45	1.52	0.88	0.17	168.10	4.70
07	LL/25-26/001204/07	P7/NB/2025	66.40	17.56	5.46	0.07	1.04	0.81	0.51	1.96	0.99	0.04	77.80	5.03
08	LL/25-26/001204/08	P8/NB/2025	70.77	19.96	2.38	0.01	0.39	0.29	0.46	2.49	0.90	0.02	15.70	2.12
09	LL/25-26/001204/09	P9/NB/2025	72.95	10.84	6.58	0.02	0.61	1.45	0.55	1.95	0.98	0.04	41.50	3.85
10	LL/25-26/001204/10	P10/NB/2025	60.90	24.03	3.89	0.01	0.72	0.32	1.56	1.77	1.41	0.05	77.80	5.07
11	LL/25-26/001204/11	T1/NB/2025/01	65.86	20.98	3.78	0.02	0.77	0.67	0.38	2.64	0.71	0.03	30.80	3.87
12	LL/25-26/001204/12	T1/NB/2025/02	59.68	20.88	5.11	0.02	0.92	0.46	0.46	2.45	0.80	0.03	41.40	8.92
13	LL/25-26/001204/13	T1/NB/2025/03	68.99	18.41	3.72	0.02	0.70	0.49	0.37	2.52	0.80	0.03	31.90	3.67
14	LL/25-26/001204/14	T1/NB/2025/04	70.24	19.10	2.78	0.01	0.64	0.19	0.41	2.78	0.70	0.03	23.80	3.01
15	LL/25-26/001204/15	T1/NB/2025/05	69.42	20.94	2.14	0.01	0.58	0.11	0.30	2.74	0.87	0.03	25.50	2.65
16	LL/25-26/001204/16	T1/NB/2025/06	68.86	21.65	2.07	0.02	0.57	0.29	0.34	2.78	0.74	0.03	22.70	2.54
17	LL/25-26/001204/17	T1/NB/2025/07	68.34	20.82	2.00	0.01	0.73	0.77	0.42	2.54	1.01	0.04	26.80	3.13
18	LL/25-26/001204/18	T1/NB/2025/08	68.77	19.32	2.07	0.01	0.87	1.09	0.43	2.42	0.88	0.04	29.60	3.89
19	LL/25-26/001204/19	T1/NB/2025/09	57.08	20.04	6.35	0.02	1.41	2.63	0.88	2.09	0.58	0.03	43.40	8.59
20	LL/25-26/001204/20	T1/NB/2025/10	50.08	20.57	12.45	0.03	1.71	2.08	0.99	1.75	0.87	0.05	76.80	9.22
21	LL/25-26/001204/21	T1/NB/2025/A	63.82	23.92	2.93	0.02	0.78	0.78	0.30	2.66	0.63	0.03	28.70	3.80
22	LL/25-26/001204/22	T1/NB/2025/B	63.24	20.35	4.96	0.02	1.15	1.13	0.45	2.15	0.85	0.04	50.90	5.53
23	LL/25-26/001204/23	T1/NB/2025/C	62.01	20.10	4.74	0.01	1.41	0.78	1.42	2.00	1.00	0.05	64.80	6.23

Test method: SOP-OM-03,**Instrument Used :** WD-XRF
Note: The above results are expressed on dry basis.

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Reviewed by

Dr.R.Krishna Moorthy
AUTHORISED SIGNATORY

Lucid Laboratories Pvt. Ltd.
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E-mail: info@lucidlabsindia.com, website : www.lucidlabsindia.com **CIN No. : U24239TG2004PTC042390**

LUCID Laboratories Pvt. Ltd.
Testing to the Core

TEST RESULTS OF BAUXITE SAMPLES

Issued to:
The Director,
Critical Mineral trackers,
 # Con course No 406,7-1-58/cc/406,
opp Lal Bungalow,Green lands ,Hyderabad-500016.

Report No : LL/25-26/001204 (1-90)
Report Issue Date : 29.05.2025
Date of Receipt of Sample : 02.05.2025
Date of Starting of Analysis : 05.05.2025
Date of Completing of Analysis : 29.05.2025

Sample Particulars: Bauxite Samples.
Block Name : Nadapa,
Sample Qty : 500g x 90 N
Customer Ref Letter: CMT/Lucid/01/2025 Dated: 30.04.2025
Test Parameters: Silica as SiO2, Aluminium as Al2O3, Iron as Fe2O3, Manganese as MnO, Magnesium as MgO ,Calcium as CaO, Sodium as Na2O, Potassium as K_2O, Titanium as TiO2,Phosphorus as P2O5,Vanadium as V ,Loss on Ignition.

Sl.No	Lab. No.	Sample No	Silica as SiO_2 (% by mass)	Aluminium as Al_2O_3 (% by mass)	Iron as Fe_2O_3 (% by mass)	Manganese as MnO (% by mass)	Magnesium as MgO (% by mass)	Calcium as CaO (% by mass)	Sodium as Na_2O (% by mass)	Potassium as K_2O (% by mass)	Titanium as TiO_2 (% by mass)	Phosphorus as P_2O_5 (% by mass)	Vanadium as V (ppm)	Loss on Ignition (LOI) (% by mass)
24	LL/25-26/001204/24	T1/NB/2025/D	61.95	22.86	3.54	0.01	1.16	1.25	0.42	2.17	0.88	0.04	51.30	5.53
25	LL/25-26/001204/25	P11/NB/2025	66.54	20.83	4.57	0.02	0.42	0.41	0.15	1.52	1.34	0.07	85.75	3.96
26	LL/25-26/001204/26	T2/NB/2025/01	64.98	19.02	4.10	0.01	1.24	0.41	1.31	1.58	1.61	0.07	108.40	5.48
27	LL/25-26/001204/27	T2/NB/2025/02	65.39	20.97	4.09	0.02	0.93	0.44	0.81	1.88	1.24	0.06	56.30	4.09
28	LL/25-26/001204/28	T2/NB/2025/03	62.66	4.83	18.66	0.07	0.59	4.19	0.24	1.58	0.91	0.13	76.90	5.94
29	LL/25-26/001204/29	T2/NB/2025/04	63.51	5.05	18.12	0.07	0.60	3.72	0.28	1.54	0.85	0.13	67.10	6.05
30	LL/25-26/001204/30	T2/NB/2025/05	65.80	18.75	5.33	0.02	0.75	1.41	0.49	1.96	1.33	0.07	40.50	3.77
31	LL/25-26/001204/31	T2/NB/2025/06	56.06	25.04	5.18	0.01	0.99	0.23	0.49	1.52	1.84	0.07	125.30	8.38
32	LL/25-26/001204/32	T2/NB/2025/07	57.98	20.80	6.96	0.02	1.05	1.01	0.37	1.28	1.09	0.06	109.30	9.10
33	LL/25-26/001204/33	T2/NB/2025/08	58.94	19.21	8.56	0.03	0.99	0.70	0.32	1.31	1.23	0.07	93.70	8.32
34	LL/25-26/001204/34	T2/NB/2025/09	61.33	23.02	3.86	0.01	0.97	0.11	0.31	1.37	1.46	0.05	86.00	7.27
35	LL/25-26/001204/35	T2/NB/2025/10	60.91	21.96	4.71	0.03	1.01	0.21	0.35	1.31	1.52	0.05	92.30	7.70
36	LL/25-26/001204/36	T2/NB/2025/A	64.95	18.54	4.63	0.02	0.87	0.63	0.15	1.35	1.82	0.05	78.60	6.68
37	LL/25-26/001204/37	T2/NB/2025/B	61.99	19.24	5.19	0.02	1.04	1.19	0.36	1.34	1.68	0.06	82.00	7.67
38	LL/25-26/001204/38	T2/NB/2025/C	61.13	18.30	8.09	0.03	1.06	0.46	0.32	1.30	1.40	0.06	93.40	7.60
39	LL/25-26/001204/39	T2/NB/2025/D	60.24	18.99	6.98	0.03	1.06	1.11	0.33	1.29	1.45	0.06	87.90	8.28
40	LL/25-26/001204/40	P12/NB/2025	55.40	28.81	2.81	0.03	0.45	0.70	0.23	1.09	1.21	0.04	83.28	9.09
41	LL/25-26/001204/41	P13/NB/2025	64.50	17.57	6.44	0.02	1.09	0.21	0.41	1.32	0.98	0.06	95.35	7.19
42	LL/25-26/001204/42	P14/NB/2025	77.97	13.25	2.15	0.01	0.15	0.17	0.06	0.85	0.52	0.02	69.10	4.53
43	LL/25-26/001204/43	P15/NB/2025	61.24	23.41	2.44	0.03	0.91	0.11	0.30	1.17	1.01	0.03	91.65	9.15
44	LL/25-26/001204/44	P16/NB/2025	54.92	0.31	4.60	0.03	1.41	17.76	0.19	0.91	0.39	0.08	60.20	19.08
45	LL/25-26/001204/45	P17/NB/2025	60.98	21.10	3.10	0.03	0.24	0.11	3.74	0.68	1.19	0.03	108.53	8.50
46	LL/25-26/001204/46	T3/NB/2025/01	57.96	21.02	9.69	0.09	0.60	0.33	0.06	1.18	0.79	0.08	57.40	8.01

Test method: SOP-OM-03,**Instrument Used :** WD-XRF
Note: The above results are expressed on dry basis.

Reviewed by

Dr.R.Krishna Moorthy
AUTHORISED SIGNATORY

Page No. 2/4

Lucid Laboratories Pvt. Ltd.
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E-mail: info@lucidlabsindia.com, website : www.lucidlabsindia.com **CIN No. : U24239TG2004PTC042390**

TEST RESULTS OF BAUXITE SAMPLES

LUCID Laboratories Pvt. Ltd.
Testing to the Core

Issued to:
The Director,
Critical Mineral trackers,
 # Con course No 406,7-1-58/cc/406,
opp Lal Bungalow,Green lands ,Hyderabad-500016.

Report No : LL/25-26/001204 (1-90)
Report Issue Date : 29.05.2025
Date of Receipt of Sample : 02.05.2025
Date of Starting of Analysis : 05.05.2025
Date of Completing of Analysis : 29.05.2025

Sample Particulars: Bauxite Samples.
Block Name : Nadapa,
Sample Qty : 500g x 90 N
Customer Ref Letter: CMT/Lucid/01/2025 Dated: 30.04.2025
Test Parameters: Silica as SiO2, Aluminium as Al2O3, Iron as Fe2O3, Manganese as MnO, Magnesium as MgO ,Calcium as CaO, Sodium as Na2O, Potassium as K_2O, Titanium as TiO2,Phosphorus as P2O5,Vanadium as V ,Loss on Ignition.

Sl.No	Lab. No.	Sample No	Silica as SiO_2 (% by mass)	Aluminium as Al_2O_3 (% by mass)	Iron as Fe_2O_3 (% by mass)	Manganese as MnO (% by mass)	Magnesium as MgO (% by mass)	Calcium as CaO (% by mass)	Sodium as Na_2O (% by mass)	Potassium as K_2O (% by mass)	Titanium as TiO_2 (% by mass)	Phosphorus as P_2O_5 (% by mass)	Vanadium as V (ppm)	Loss on Ignition (LOI) (% by mass)
47	LL/25-26/001204/47	T3/NB/2025/02	54.39	23.13	10.40	0.08	0.68	0.24	0.06	1.11	0.83	0.06	84.00	8.73
48	LL/25-26/001204/48	T3/NB/2025/03	53.37	24.48	8.85	0.07	0.70	0.28	0.05	1.15	0.88	0.04	99.70	9.88
49	LL/25-26/001204/49	T3/NB/2025/04	50.30	24.54	11.26	0.09	0.78	0.55	0.06	1.06	1.05	0.04	89.40	10.06
50	LL/25-26/001204/50	T3/NB/2025/05	55.39	20.17	12.95	0.11	0.68	0.26	0.07	1.21	0.87	0.06	85.50	8.06
51	LL/25-26/001204/51	T3/NB/2025/06	56.77	17.70	13.60	0.12	0.55	0.76	0.15	1.30	1.01	0.04	93.90	7.70
52	LL/25-26/001204/52	T3/NB/2025/07	65.72	12.59	12.03	0.08	0.37	0.38	0.10	1.37	0.90	0.03	60.90	6.22
53	LL/25-26/001204/53	T3/NB/2025/08	57.90	22.11	4.91	0.04	0.64	2.11	0.11	1.57	1.46	0.03	76.50	8.79
54	LL/25-26/001204/54	T3/NB/2025/09	56.99	24.13	5.25	0.05	0.57	1.15	0.10	1.55	1.07	0.03	64.80	8.87
55	LL/25-26/001204/55	T3/NB/2025/10	59.81	23.21	3.96	0.03	0.49	1.09	0.09	1.71	2.02	0.03	63.80	7.48
56	LL/25-26/001204/56	T3/NB/2025/A	60.23	18.99	9.46	0.07	0.65	0.29	0.09	1.38	1.29	0.08	89.40	7.18
57	LL/25-26/001204/57	T3/NB/2025/B	54.90	22.92	8.55	0.07	0.67	0.81	0.08	1.35	1.43	0.04	85.60	8.97
58	LL/25-26/001204/58	T3/NB/2025/C	59.24	23.20	4.57	0.05	0.69	1.33	0.08	1.46	1.66	0.04	63.70	7.41
59	LL/25-26/001204/59	T3/NB/2025/D	59.64	22.77	6.14	0.06	0.61	1.08	0.09	1.77	1.36	0.07	71.80	6.27
60	LL/25-26/001204/60	P18/NB/2025	70.64	16.15	5.09	0.03	0.23	0.26	0.09	1.28	0.88	0.04	48.20	4.99
61	LL/25-26/001204/61	T4/NB/2025/01	63.68	0.65	14.12	0.03	1.06	8.88	0.21	1.28	0.47	0.09	86.20	9.31
62	LL/25-26/001204/62	T4/NB/2025/02	62.67	1.29	15.95	0.03	1.16	6.79	0.25	1.33	0.48	0.08	103.80	9.67
63	LL/25-26/001204/63	T4/NB/2025/03	69.00	2.49	7.36	0.02	1.19	7.33	0.21	1.46	0.53	0.08	61.90	10.18
64	LL/25-26/001204/64	T4/NB/2025/04	65.34	4.64	6.49	0.02	1.08	8.63	0.20	1.59	0.45	0.07	60.50	11.28
65	LL/25-26/001204/65	T4/NB/2025/05	57.60	4.71	15.63	0.04	1.04	7.84	0.20	1.32	0.48	0.07	94.00	11.00
66	LL/25-26/001204/66	T4/NB/2025/06	58.15	0.41	16.09	0.05	0.77	10.08	0.17	1.04	0.41	0.05	84.60	12.55
67	LL/25-26/001204/67	T4/NB/2025/07	73.26	1.00	11.17	0.04	0.89	3.84	0.16	1.47	0.83	0.06	70.30	7.16
68	LL/25-26/001204/68	T4/NB/2025/08	69.01	0.35	7.37	0.02	0.94	9.10	0.12	1.09	0.44	0.07	33.80	11.34
69	LL/25-26/001204/69	T4/NB/2025/09	68.61	0.28	5.81	0.03	1.50	9.91	0.17	1.10	0.61	0.12	42.40	11.58

Test method: SOP-OM-03,**Instrument Used :** WD-XRF
Note: The above results are expressed on dry basis.

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Page No. 3/4

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E-mail: info@lucidlabsindia.com, website : www.lucidlabsindia.com **CIN No. : U24239TG2004PTC042390**

TEST RESULTS OF BAUXITE SAMPLES

LUCID Laboratories Pvt. Ltd.
Testing to the Core

Issued to:
The Director,
Critical Mineral trackers,
 # Con course No 406,7-1-58/cc/406,
opp Lal Bungalow,Green lands ,Hyderabad-500016.

Report No : LL/25-26/001204 (1-90)
Report Issue Date : 29.05.2025
Date of Receipt of Sample : 02.05.2025
Date of Starting of Analysis : 05.05.2025
Date of Completing of Analysis : 29.05.2025

Sample Particulars: Bauxite Samples.
Block Name : Nadapa,
Sample Qty : 500g x 90 N

Customer Ref Letter: CMT/Lucid/01/2025 Dated: 30.04.2025

Test Parameters: Silica as SiO2, Aluminium as Al2O3, Iron as Fe2O3, Manganese as MnO, Magnesium as MgO ,Calcium as CaO, Sodium as Na2O, Potassium as K_2O, Titanium as TiO2,Phosphorus as P2O5,Vanadium as V ,Loss on Ignition.

Sl.No	Lab. No.	Sample No	Silica as SiO_2 (% by mass)	Aluminium as Al_2O_3 (% by mass)	Iron as Fe_2O_3 (% by mass)	Manganese as MnO (% by mass)	Magnesium as MgO (% by mass)	Calcium as CaO (% by mass)	Sodium as Na_2O (% by mass)	Potassium as K_2O (% by mass)	Titanium as TiO_2 (% by mass)	Phosphorus as P_2O_5 (% by mass)	Vanadium as V (ppm)	Loss on Ignition (LOI) (% by mass)
70	LL/25-26/001204/70	T4/NB/2025/10	69.93	0.31	8.67	0.03	0.98	7.52	0.15	1.13	0.86	0.07	50.70	10.12
71	LL/25-26/001204/71	T4/NB/2025/A	58.96	0.32	9.64	0.03	1.71	13.86	0.23	1.01	0.48	0.10	67.30	13.35
72	LL/25-26/001204/72	T4/NB/2025/B	62.01	0.29	6.61	0.04	1.78	14.02	0.35	0.92	0.53	0.10	37.10	13.26
73	LL/25-26/001204/73	T4/NB/2025/C	63.81	1.39	6.17	0.04	1.62	11.57	0.27	1.12	0.90	0.09	62.20	12.72
74	LL/25-26/001204/74	T4/NB/2025/D	69.33	0.41	5.38	0.03	1.66	11.39	0.32	0.96	0.52	0.10	39.80	9.74
75	LL/25-26/001204/75	T5/NB/2025/01	54.82	13.92	20.70	0.10	0.21	0.48	0.08	1.20	0.67	0.02	51.80	7.48
76	LL/25-26/001204/76	T5/NB/2025/02	46.38	16.94	18.80	0.07	0.42	3.86	0.09	1.02	0.69	0.03	60.90	11.50
77	LL/25-26/001204/77	T5/NB/2025/03	51.78	9.84	25.05	0.18	0.26	1.64	0.08	1.10	0.55	0.02	49.10	9.36
78	LL/25-26/001204/78	T5/NB/2025/04	53.61	9.99	25.97	0.21	0.19	0.33	0.08	1.16	0.56	0.02	54.78	7.70
79	LL/25-26/001204/79	T5/NB/2025/05	46.31	24.46	16.81	0.04	0.31	0.35	0.07	1.09	0.98	0.02	82.20	9.30
80	LL/25-26/001204/80	T5/NB/2025/06	44.84	23.94	16.91	0.05	0.33	1.34	0.07	1.11	0.96	0.02	82.40	10.27
81	LL/25-26/001204/81	T5/NB/2025/07	51.00	16.55	21.57	0.09	0.22	0.17	0.08	1.33	0.72	0.02	65.00	8.17
82	LL/25-26/001204/82	T5/NB/2025/08	49.81	15.27	23.14	0.09	0.29	0.74	0.08	1.13	0.60	0.02	93.60	8.73
83	LL/25-26/001204/83	T5/NB/2025/09	57.97	12.10	19.02	0.08	0.45	0.88	0.08	1.01	0.61	0.03	64.60	7.55
84	LL/25-26/001204/84	T5/NB/2025/10	55.86	19.77	13.00	0.04	0.45	0.42	0.08	1.05	0.95	0.03	81.0	8.04
85	LL/25-26/001204/85	T5/NB/2025/A	53.04	17.18	7.93	0.03	0.68	6.10	0.12	0.91	0.89	0.07	61.00	12.87
86	LL/25-26/001204/86	T5/NB/2025/B	56.06	27.94	2.31	0.01	0.63	1.37	0.09	0.91	1.31	0.04	66.10	9.27
87	LL/25-26/001204/87	T5/NB/2025/C	59.78	27.00	1.94	0.01	0.67	0.61	0.07	0.83	0.88	0.03	78.05	7.96
88	LL/25-26/001204/88	T5/NB/2025/D	58.61	26.49	2.16	0.01	0.66	1.04	0.08	0.87	1.27	0.03	63.20	8.66
89	LL/25-26/001204/89	P19/NB/2025	44.74	9.71	29.97	0.19	0.37	2.03	0.06	0.45	0.74	0.37	299.18	11.22
90	LL/25-26/001204/90	P20/NB/2025	56.11	28.55	2.27	0.03	0.54	0.10	0.35	0.64	1.03	0.03	101.58	10.05

Test method: SOP-OM-03,**Instrument Used :** WD-XRF
Note: The above results are expressed on dry basis.

Reviewed by

Dr.R.Krishna Moorthy
AUTHORISED SIGNATORY

Page No. 4/4

Lucid Laboratories Pvt. Ltd.
Plot No. 3, IDA, Balanagar, Hyderabad - 500 037, Telangana, INDIA, Ph : .040-69042222/10 Lines
E-mail: info@lucidlabsindia.com, website : www.lucidlabsindia.com **CIN No. : U24239TG2004PTC042390**

ANNEXURE – XI

Statement showing details of 15 Pit & Trench sample analysis of REE, Ga in Nadapa area, Kachchh district, Gujarat, (as received from Lucid laboratory, Hyderabad.)

TEST RESULTS OF BAUXITE SAMPLES

LUCID Laboratories Pvt. Ltd.
Testing to the Core

Issued to:
The Director,
Critical Mineral trackers,
 # Con course No 406,7-1-58/cc/406,
opp Lal Bungalow,Green lands ,Hyderabad-500016, INDIA.

Report No : LL/25-26/001204 (1-15)
Report Issue Date : 29.05.2025
Date of Receipt of Sample : 02.05.2025
Date of Starting of Analysis : 03.05.2025
Date of Completing of Analysis : 29.05.2025

Customer Ref Letter: CMT/Lucid/01/2025 Dated: 30.04.2025

Sample Particulars: Bauxite Samples.
Block Name : Nadapa,
Sample Qty : 500g x 15 N
Test Parameters: Rare Earth Elements & Gallium

Sl.No	Lab. No.	Sample No	Cerium as Ce (ppm)	Dysprosium as Dy (ppm)	Erbium as Er (ppm)	Europium as E (ppm)	Gadolinium as Gd (ppm)	Holomium as Ho (ppm)	Lanthanum as La (ppm)	Lutetium as Lu (ppm)	Neodymium as Nd (ppm)	Prasedymium as Pr (ppm)	Samerium as Sm (ppm)	Scandium as Sc (ppm)	Terbium as Tb (ppm)	Thorium as Th (ppm)	Thulium as Tm (ppm)	Yttrerbium as Yb (ppm)	Yttrium as Y (ppm)	Uranium as U (ppm)	Gallium as Ga (ppm)
1	LL/25-26/001204/01	P1/NB/2025	73.85	3.30	6.55	1.48	7.30	<1.0	36.05	<1.0	69.25	9.50	5.23	15.43	<1.0	21.58	<1.0	2.95	23.23	<1.0	26.65
2	LL/25-26/001204/04	P4/NB/2025	79.05	2.35	5.45	1.25	6.33	<1.0	36.85	<1.0	68.38	9.98	5.50	10.93	<1.0	51.93	<1.0	2.80	17.93	<1.0	17.23
3	LL/25-26/001204/05	P5/NB/2025	59.73	<1.0	6.40	<1.0	5.78	<1.0	26.98	<1.0	61.80	7.70	3.60	5.70	<1.0	37.70	<1.0	2.88	11.53	1.75	9.58
4	LL/25-26/001204/07	P7/NB/2025	63.90	1.55	5.40	1.05	8.48	<1.0	31.90	<1.0	63.18	10.18	4.50	9.25	<1.0	35.50	<1.0	4.15	15.93	7.85	17.35
5	LL/25-26/001204/25	P11/NB/2025	134.75	3.28	7.55	1.10	11.48	<1.0	59.85	<1.0	103.43	16.18	9.55	8.85	<1.0	100.05	<1.0	3.55	22.20	<1.0	16.33
6	LL/25-26/001204/32	T2/NB/2025/07	64.98	1.85	6.05	1.15	8.70	<1.0	30.48	<1.0	66.53	10.05	4.88	9.03	<1.0	42.00	<1.0	3.05	16.65	8.38	17.53
7	LL/25-26/001204/40	P12/NB/2025	83.60	2.20	6.93	1.15	7.43	<1.0	40.35	<1.0	79.30	11.18	5.68	10.60	<1.0	49.05	<1.0	3.83	18.83	<1.0	21.05
8	LL/25-26/001204/41	P13/NB/2025	57.50	1.95	5.60	1.13	10.13	<1.0	27.70	1.10	60.70	10.85	4.63	12.00	<1.0	42.28	<1.0	3.35	18.33	18.80	20.78
9	LL/25-26/001204/43	P15/NB/2025	78.20	2.35	6.00	1.45	7.40	<1.0	40.83	<1.0	72.88	10.35	5.70	12.08	<1.0	33.73	<1.0	3.43	19.08	<1.0	24.33
10	LL/25-26/001204/45	P17/NB/2025	98.60	3.50	7.38	1.70	9.25	<1.0	49.25	<1.0	84.75	12.50	7.13	15.63	<1.0	38.23	<1.0	4.18	24.88	<1.0	25.80
11	LL/25-26/001204/54	T3/NB/2025/09	59.08	<1.0	5.33	<1.0	5.65	<1.0	28.30	<1.0	62.58	6.13	3.68	6.58	<1.0	43.78	<1.0	2.73	11.38	<1.0	11.53
12	LL/25-26/001204/78	T5/NB/2025/04	36.73	0.93	3.08	<1.0	24.65	<1.0	18.15	3.10	36.90	22.68	4.33	5.03	<1.0	86.40	<1.0	7.03	14.25	131.95	18.60
13	LL/25-26/001204/87	T5/NB/2025/C	83.20	3.80	5.93	1.98	7.28	<1.0	41.60	<1.0	72.63	10.35	6.63	11.23	<1.0	32.05	<1.0	3.15	22.33	<1.0	17.95
14	LL/25-26/001204/89	P19/NB/2025	96.53	3.68	5.58	2.25	44.55	<1.0	46.88	5.43	64.38	48.55	11.70	11.90	<1.0	129.03	<1.0	9.23	25.33	245.10	31.58
15	LL/25-26/001204/90	P20/NB/2025	99.08	3.85	6.80	1.75	8.75	<1.0	51.35	<1.0	82.38	12.53	7.38	15.53	<1.0	26.88	<1.0	3.50	26.28	<1.0	23.63

Test Method: SOP OM-08 & OM-12 (Instrument Used:ICP-OES)
Note :The above results are expressed as on dry basis.

Page No. 1/1

Reviewed by

Dr.R.Krishna Moorthy
AUTHORISED SIGNATORY

Lucid Laboratories Pvt. Ltd.
Plot No. 3, IDA, Balanagar, Hyderabad - 500 037, Telangana, INDIA, Ph : .040-69042222/10 Lines
E-mail: info@lucidlabsindia.com, website : www.lucidlabsindia.com **CIN No. : U24239TG2004PTC042390**

ANNEXURE – XII

Analytical results of MHA / THA and Reactive silica in Nadapa area, Kachchh district, Gujarat, (as received from Lucid laboratory, Hyderabad)

LUCID Laboratories Pvt. Ltd.
Testing to the Core

TEST RESULTS OF BAUXITE SAMPLES

Issued to:
The Director,
Critical Mineral trackers,
 # Con course No 406,7-1-58/cc/406,
opp Lal Bungalow,Green lands ,Hyderabad-500016, INDIA.

Report No : LL/25-26/001204 (1)
Report Issue Date : 29.05.2025
Date of Receipt of Sample : 02.05.2025
Date of Starting of Analysis : 03.05.2025
Date of Completing of Analysis : 29.05.2025

Customer Ref Letter: CMT/Lucid/01/2025 Dated: 30.04.2025

Sample Particulars: Bauxite Samples.
Block Name : Nadapa
Sample Qty : 500g x 1 N
Test Parameters: THA+ MHA, Reactive SiO2

SI.No	Lab. No.	Sample No	THA	MHA	Reactive SiO2
			%	%	%
1	LL/25-26/001204/89	P19/NB/2025	7.15	1.48	43.66

Test Method: SOP -OM-03(Reactive SiO2) & THA,MHA by TGA
Note :The above results are expressed as on dry basis.

Reviewed by

Dr.R.Krishna Moorthy
AUTHORISED SIGNATORY

Page 1 of 1

Lucid Laboratories Pvt. Ltd.
Plot No. 3, IDA, Balanagar, Hyderabad - 500 037, Telangana, INDIA, Ph : .040-69042222/10 Lines
E-mail: info@lucidlabsindia.com, website : www.lucidlabsindia.com **CIN No. : U24239TG2004PTC042390**

ANNEXURE – XIII

Statement showing 9 Check sample analysis of Major oxides, (as received from Shiva Analyticals India Pvt. Ltd, Bangalore)

SHIVA
Part of the Cotecna Group

SHIVA ANALYTICALS INDIA PRIVATE LIMITED

Plot No. 24D [P] & 34 D, KIADB Industrial Area, Hoskote,
Bangalore – 562 114. Phone No: 080 -2801 -5333,
Website: www.shivaanalyticals.com

TEST REPORT — Shiva Assay(Majors) G2296

Customer Name	**Critical Mineral Trackers an NPEA , Ministry of Mines, GOI, Concourse No.406, 7-1-58/CC/406, Opp Lal Bungalow, Greenlands, Hyderabad-500016**
Discipline & Group	**Chemical & Ores and Minerals.**
Customer Ref.	**Samples Received by courier**
Commodity	**Geological Rock Powders**
Lab ID	**G2296**
Sample Receipt Date	**25-Aug-25**
Analysis Completion Date	**10-Sep-25**
Date of Reporting	**11-Sep-25**
Sample Count	**28**

S.No	Customer Code	Sample Description	Method	SOP/OM /105	SOP/OM /105	SOP/OM /105	SOP/OM /105	SOP/OM/105	SOP/OM /105	SOP/OM /105	SOP/OM /105	SOP/OM /105	SOP/OM /105	SOP/OM /105	SOP/OM /105	SOP/OM /105	SOP/OM /105	SOP/OM /105	SOP/OM/ 105	SOP/OM/ 103
			LOQ	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.08	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.10
			Units	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
			Lab ID	Al2O3	BaO	CaO	Cr2O3	Fe2O3	K2O	MgO	MnO	Na2O	P2O5	SiO2	SO3	SrO	TiO2	V2O5	LOI	
1.	P35/NB/2025	Powder	G2296-19	19.31	<0.05	0.15	<0.05	1.42	0.78	0.32	<0.05	<0.08	0.05	68.68	<0.05	<0.05	1.28	<0.05	7.72	
2.	P36/NB/2025	Powder	G2296-20	15.11	0.07	0.20	<0.05	3.26	2.81	0.30	<0.05	0.22	0.06	70.77	<0.05	<0.05	1.25	<0.05	5.76	
3.	P36/NB/2025	Powder	G2296-20	15.12	0.08	0.18	<0.05	3.28	2.83	0.28	<0.05	0.25	0.07	70.80	<0.05	<0.05	1.28	<0.05	5.73	
4.	P37/NB/2025	Powder	G2296-21	12.76	0.06	0.24	<0.05	3.99	2.27	0.17	<0.05	<0.08	0.09	73.48	<0.05	<0.05	1.60	<0.05	4.94	
5.	P38/NB/2025	Powder	G2296-22	9.24	0.19	2.00	<0.05	33.49	0.59	0.27	0.17	<0.08	0.41	42.71	<0.05	<0.05	0.80	<0.05	9.83	
6.	T30/NB/2025/C	Powder	G2296-23	17.85	0.09	0.69	<0.05	4.05	3.45	0.70	<0.05	0.20	0.05	64.44	<0.05	<0.05	0.92	<0.05	7.43	
7.	T31/NB/2025/A	Powder	G2296-24	11.49	0.07	0.52	<0.05	2.71	2.90	0.37	<0.05	0.10	0.06	75.98	<0.05	<0.05	1.16	<0.05	4.45	
8.	T32/NB/2025/10	Powder	G2296-25	10.00	0.08	0.48	<0.05	1.84	3.02	0.15	<0.05	0.09	0.05	79.09	0.14	<0.05	1.36	<0.05	3.53	
9.	T33/NB/2025/10	Powder	G2296-26	3.76	<0.05	3.08	<0.05	2.86	1.13	0.24	<0.05	0.11	<0.05	83.68	0.10	<0.05	0.71	<0.05	4.06	
10.	T34/NB/2025/04	Powder	G2296-27	8.33	<0.05	0.21	<0.05	19.00	1.37	0.09	0.11	<0.08	<0.05	64.68	<0.05	<0.05	0.64	<0.05	5.29	

Mr. SATYANARAYANA - Head - ORES & MINERALS - AUTHORIZED SIGNATORY.

** END OF THE REPORT **

Prepared by: Naveen
Verified by: Satyanarayana

Page No.1 of 1

ANNEXURE – XIV

Statement showing one Check sample analysis of REE and Gallium (as received from Shiva Analyticals India Pvt. Ltd, Bangalore)

TEST REPORT

Shiva Assay(REE)_02296

SHIVA ANALYTICALS (INDIA) PRIVATE LIMITED
Plot No. 24D [P] & 34 D, KIADB Industrial Area, Hoskote
Bangalore – 562 114. Phone No: 080 – 2801 5333,
Website: www.shivaanalyticals.com

Customer Name	Critical Mineral Trackers an NPEA , Ministry of Mines, GOI, Concourse NoA06, 7-1-58/CC/406, Opp Lal Bungalow, Greenlands, Hyderabad-500016

Discipline & Group	Chemical & Ores and Minerals.
Customer Ref.	Samples Received by Courier.
Commodity	Geological Rock Powders
Lab ID	G2296
Sample Receipt Date	25-Aug-25
Analysis Completion Date	10-Sep-25
Date of Reporting	11-Sep-25
Sample Count	6

Sl. No.	Customer Code	Sample Description	Method	SOP/OM/052	SOP/OM 1052	SOP/OM/052	SOP/OM/052	SOP/OM/052	SOP/OM/052	SOP/OM/052	SOP/OM/052	SOP/OM/052	SOP/OM/052	SOP/OM/052	SOP/OM/052	SOPQM/052	SOP/OM/052	SOP/OM/052	SOP/OM/052	SOP/OM/052	SOP/OM/052	SOP/OM/052
			Units	PPm(mg/kg)	PP.(mg/kg)	PP.(mg/kg)	PP.(mgi kg)	PPng(mg kg)	PP.O.g/kg)	PP.Ong i kg)	PPm(me kg)	PPmlmg ikg)	Pln(mg i kg)	PP.(IIIg/kg)	P P . O W kg)	PPni(mg kg)	PPf(vPW kg)	PPmlmg/kg)	PPm(mg kg)	Plntmg/kg)	ppo(sog) kg)	ppm(mg/kg)
			LOQ	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
			Lab ID	Ga	Sc	V	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Th	LI
1	P38/NB/2025	Powder	G2296-22	10,6	13.8	29.7	63.8	130	11.7	40.4	8.66	2.87	11.2	1.17	6.90	1.14	3.63	<0.5	3.20	<0.5	17.9	4.35

Abbreviations
LOQ-Limit of Quantification
SOP/OM/052- 4 Acid digestion followed by ICPMS Finish

Authorized Signatory

Mr. SATYANARAYANA - Head ORES,&141NERALS - AUTHORIZED SIGNATORY.

END OF THE REPORT

1. The results listed above pertain only to the tested samples and applicable parameters.2. Samples which are degradable will be disposed immediately after testing and others will be disposed after one **month** from the date of issue **Of test certificate** unless otherwise specified. 3. Total liability of our laboratory is limited to the invoiced amount 4.This report is not to be reproduced either wholly or in part and cannot be used as an evidence in the Court of Law and should not be used many advertising media without prior **written** permission5. In case any reconfirmation of contents of this test certificate is **required,please contact** our office.6. Sampling is not done by us unless otherwise specified.7. Any discrepancy in the Test Certificate should be notified within 30 days.

Prepared by:
Verified by:

Page No.1 of1

ANNEXURE – XV

Detailed Report on complete Petrographic study carried out on three bedrock samples, Nadapa area, Kachchh district, Gujarat (as received from Petrology division GSI, Southern Region, Hyderabad)

भारत सरकार
GOVERNMENT OF INDIA
खान मंत्रालय
MINISTRY OF MINES

शैललकी प्रभाग / Petrology Division
भारतीय भूवैज्ञालनक सवेक्षण / Geological Survey of India
दलक्षण क्षेत्र / Southern Region
बैंडलागुडा / Bandlaguda
हैदराबाद / Hyderabad-500068

No. 2611/TCS/GSI/Pet/EPMA/SR/2025 Date: 26/11/2025

Petrographic report

Sender details

K. Nageswar Rao, Director (G), PR & Cooordination,
Critical mineralTrackers,
Hyderabad

Madam,

Please find the attached petrographic report on submitted samples (3 nos.) for your perusal.

Thanking you,

Yours sincere

K. Basak

(Dr. KRISHNAPRIYA BASAK)

कृष्णप्रिया बसाक / KRISHNAPRIYA BASAK
निदेशक / Director
क्षेत्रीय मुख्यालय / Regional Headquarter
भारतीय भूवैज्ञानिक सर्वेक्षण / Geological Survey of India
दक्षिणी क्षेत्र, हैदराबाद / Southern Region, Hyderabad-500 068

1. Sample code: NB/TS/P14

Microscopic observations:

Microscopic study reveals that the rock displays a medium- to coarse-grained texture, with grain diameters ranging from approximately 250 to 750 micrometers. Grains are poorly sorted, and both angular and subrounded quartz grains coexist, which together indicate rapid deposition or minimal transport. Grain boundaries are irregular, and the grains commonly exhibit point and long contacts, consistent with mechanical compaction during burial. It predominantly shows quartz grains (Qz), which are abundant.

Quartz is present as subrounded to angular grains, indicating moderate transport prior to deposition. The presence of plagioclase feldspar (Plg) is signifying a minor but crucial feldspathic component, possibly derived from nearby igneous or metamorphic source rocks. Biotite (Bt) is observed. Its occurrence, though infrequent (Fig. 1A-1D).

The study reveals a minor matrix in the form of fine material occupying the intergranular spaces. The degree of visible cementation appears limited, with quartz overgrowths not clearly observed, suggesting that grain-to-grain contacts dominate over load-supporting cement. The matrix may include clay or altered feldspar, contributing to a minor muddy texture.

The prevalence of quartz points to a mature sandstone. The small proportion of plagioclase feldspar and biotite suggest limited compositional maturity or proximity to a mixed igneous-metamorphic provenance. Minimal matrix and cement, along with angular grains, indicate limited diagenetic alteration.

Overall, the study illustrates a quartz-rich, subarkosic sandstone, characterized by poor sorting and angular grains. Such features are indicative of fluvial or proximal alluvial depositional environments, with limited transport and moderate source rock diversity.

Rock/Mineral Name: Based on the mineral and textural characteristics, it is a Sandstone.

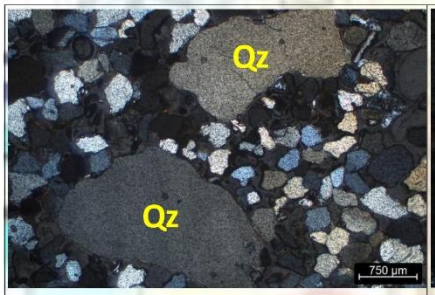

Fig. 1A. Photomicrograph showing presence of different grain size of quartz(Qz) under transmitted light XPL (2X).

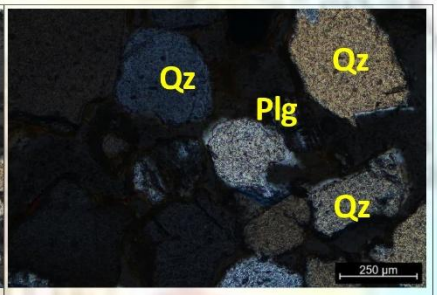

Fig. 2B. Photomicrograph showing presence of quartz(Qz) and plagioclase (Plg)under transmitted light XPL (10X).

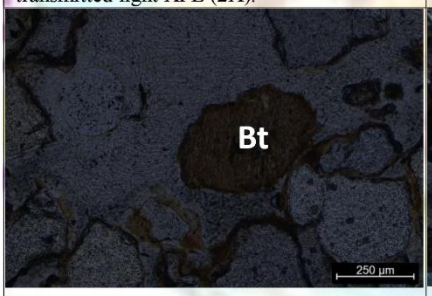

Fig. 1C. Photomicrograph showing presence of Biotite (Bt) under transmitted light XPL (10X).

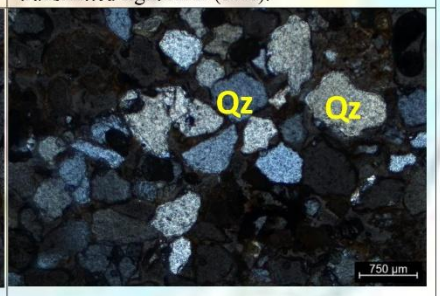

Fig. 1D. Photomicrograph showing presence of different grain size of quartz(Qz) under transmitted light XPL (2X).

2. Sample code: NB/TS/T5

Microscopic observations:

Microscopic study reveals that the rock exhibits a medium to fine grain size. The grains display angular to subangular outlines, indicating limited transport and deposition relatively close to their source. Poor sorting is observed, with variable grain sizes and shapes, suggesting rapid sedimentation possibly by fluvial processes or short transport mechanisms.

Quartz (Qz) is overwhelmingly the dominant mineral phase, showcased by its abundance across rock. The presence of multiple quartz grains, with some displaying undulatory extinction typical of detrital quartz. Plagioclase feldspar (Plg) appears minorly and is identifiable by its characteristic polysynthetic twinning, which suggests an input from igneous or metamorphic source terrain. Additionally, microcline (Mc) is noted, recognized by its cross-hatch twinning, reflecting a granitic provenance. Biotite (Bt) is present as elongate laths and contributes accessory (Fig. 2A-2D).

The dark areas in the photomicrographs correspond to matrix material, likely composed of fine-grained clay or altered rock fragments, signifying a minor but present muddy fraction. Visible evidence of cementation is limited, with intergranular contacts prevailing, indicating a predominately clastic-supported framework with minimal authigenic growth.

The dominant quartz content, combined with the presence of feldspar (both plagioclase and microcline) and biotite, classifies the sandstone as subarkosic to arkosic, suggesting a mixed provenance from felsic igneous and accessory metamorphic sources. Its textural immaturity and mineral diversity indicate deposition close to uplifted and unweathered continental or metamorphic-igneous terrains, most likely within fluvial or proximal alluvial environments where rapid sediment supply and limited reworking dominate.

Rock/Mineral Name: Based on the mineral and textural characteristics, it is a Sandstone.

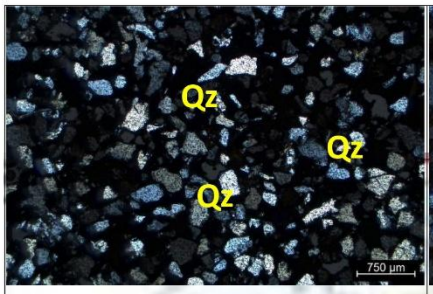

Fig. 2A. Photomicrograph showing presence of different grain size of quartz(Qz) under transmitted light XPL (2X).

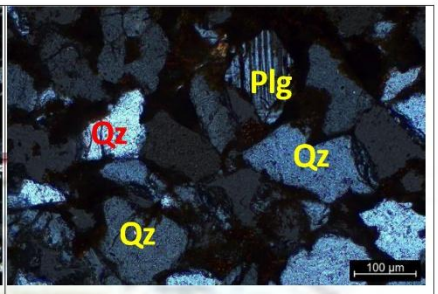

Fig. 2B. Photomicrograph showing presence of quartz(Qz) and plagioclase (Plg)under transmitted light XPL (10X).

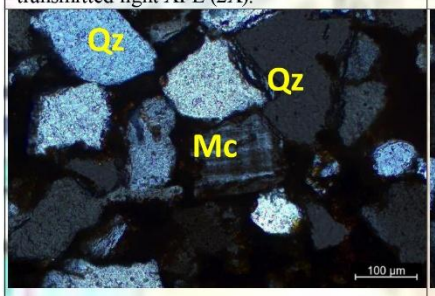

Fig. 2C. Photomicrograph showing presence of quartz (Qz) and microcline (Mc)under transmitted light XPL (10X).

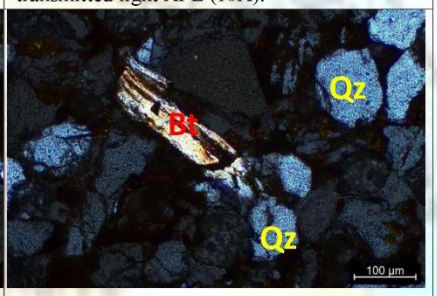

Fig. 2D. Photomicrograph showing presence of quartz (Qz) and biotite (Bt)under transmitted light XPL (10X).

3. Sample no. NB/TS/P-06

Mineral Assemblage: Quartz + Feldspar + Mica + Rock fragment + Cherty fragment as framework mineral

Cement: Hematite and magnetite

Texture: Microscopic study reveals that the rock displays a medium- to coarse-grained texture, with grain diameters ranging from approximately 250 to 750 micrometers. Grains are poorly sorted and are angular to subrangular in shape indicating rapid deposition and minimal transport. Grain boundaries are irregular, and the grains commonly exhibit point and long contacts, consistent with mechanical compaction during burial. The rock predominantly consists of quartz grains as framework minerals. Quartz grains are mostly angular, indicating moderate transport prior to deposition. The presence of plagioclase feldspar and microcline is suggestive of igneous source rocks and minimum transportation. Few Mica grains are also present. Two rock fragments of varying size are noted viz., cherty rock fragment and quartzite fragment both indicating metasedimentary provenance. Undulose extinction in quartzite rock fragment also suggest similar provenance.

The rock is extremely cemented by ferrugious material such as hematite and magnetite. At places detrital frameworking grains are volumetrically much less than the ferruginous cement and grains are not in contact. Few magnetite occur as detrital frameworking grains.

Name of the Rock: Ferruginous sandstone

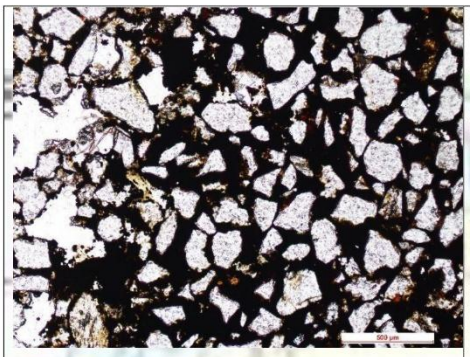

Fig. 3.1 Angular to subangular quartz grains and few mica as detrital material cemented by ferruginous material.

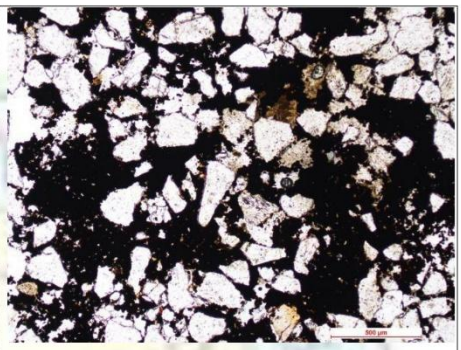

Fig. 3.2 Ferrugenous cement dominated part where angular to subangular quartz grains floated in cement

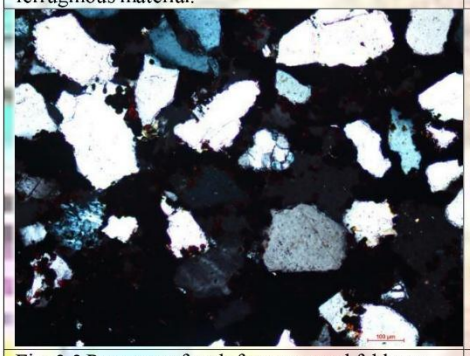

Fig. 3.3 Presence of rock fragment and feldspar indicate less weathering and minimal transport

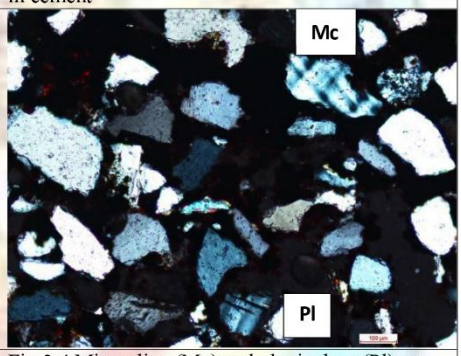

Fig.3.4 Microcline (Mc) and plagioclase (Pl) as frameworking mineral indicating igneous provenance.

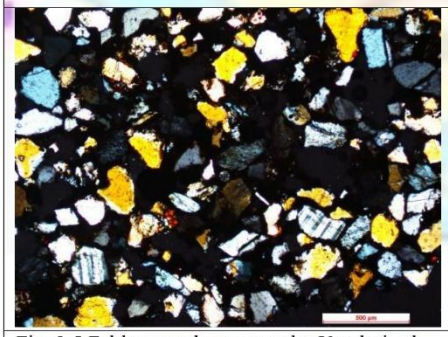

Fig. 3.5 Feldspar and quartz under X polarized light

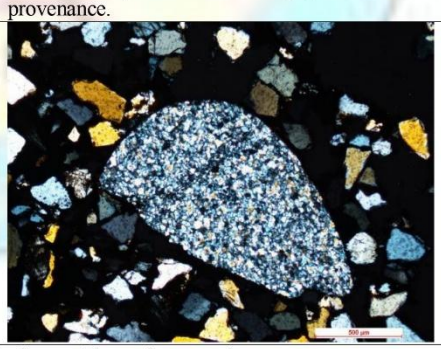

Fig. 3.6 Cherty fragment in quartzose frameworking grains

Fig. 3.7 Magnetite as detrital mineral; ferruginous cement; under reflected light

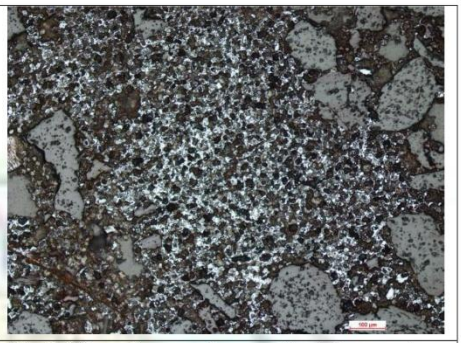

Fig. 3.8 ferruginous and magnetite rich cement; under reflected light

Fig. 3.9 Ferruginous cement and the angular quartz grains; under reflected light

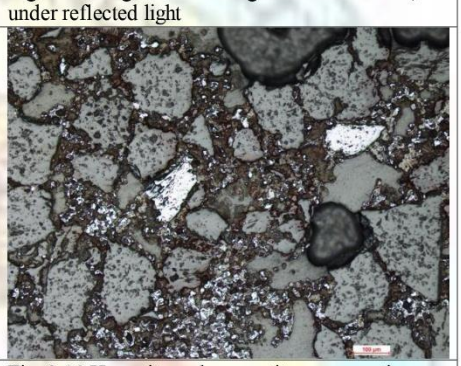

Fig. 3.10 Hematite and magnetite as cementing material; detrital magnetite grains along with angular quartz grains

Studied and Report prepared by:

(Sri Srinavasa Rao Baswani)
Senior Geologist

(Dr. Krishnapriya Basak)
Director

Checked by

(Dr. Krishnapriya Basak)
Director

ANNEXURE – XVI

Statement showing 9 Check sample analysis of Major oxides, (as received form Shiva Analyticals India Pvt. Ltd, Bangalore)

Sample No : P37/NB/2025 (original no : P11/NB/2025)

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SHIVA ANALYTICALS INDIA PRIVATE LIMITED

Customer Name: Mr. K. Nageswara Rao.
Customer Address: Critical Minerals Trackers, Mineral Exploration and Geo Solution, #Concourse, No 406,7-1-58/CC/406, Opp Lal Bungalow, Greenland's, Hyderabad -500016 India.
Customer Ref : P37/NB/2025
Lab ID : G2296-21

Dates of Sample Analysis :05/09/2025
Date of Reporting :08/09/2025

MINERALOGY TEST REPORT

1.60 KW POWDER X RAY DIFRACTOMETER METHOD

INTRODUCTION: X-ray diffraction (XRD) and petrology studies are both valuable techniques used in geology and materials science for analysing minerals and rocks, but they serve different purposes and offer unique advantages. Here's how XRD is superior to petrology studies in certain aspects. XRD excels in identifying crystalline minerals present in a sample. It provides precise information about the crystal structure and lattice parameters of minerals, which can be challenging to ascertain solely through petrological observations. XRD allows for quantitative analysis of mineral phases present in a sample, providing accurate estimates of mineral composition based on peak intensities. Petrology studies, while descriptive, may not always provide quantitative data on mineral abundance. XRD is highly sensitive and can detect trace amounts of minerals present in a sample, even at concentrations as low as a few percent. Powder Diffraction (XRD) Database, contains a comprehensive collection of more than 6000 diffraction patterns for various materials. Researchers use this resource for identifying unknown substances, confirming crystal structures, and conducting material characterization. Shiva Analyticals team has decades of experience on XRD studies. Accurate chemical assay coupled with reliable mineralogy information is vital in resource characterisation.

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Verified by: Satyanarayana

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Sample G2296-21 (P37/NB/2025)

Summary

Sample G2296-21: WDXRF bulk oxides (Bruker S8 Tiger 4 kW) and XRD (Bruker D8 Advance) major phases reconciled. Reported crystallinity = 80.4% and amorphous fraction = 19.6% respectively. XRD major phases (reported as percent of crystalline): Quartz 42.71%, Kaolinite 38.73%, K-feldspar 18.56%. These were converted to absolute wt% of the whole sample (table below) assuming phase% are relative to the crystalline fraction.

WDXRF data

Oxide	Wt % (measured)
SiO2	73.48
Al2O3	12.76
Fe2O3	3.99
TiO2	1.6
K2O	2.27
CaO	0.24
MgO	0.17
P2O5	0.09
LOI	4.94

XRD phases — absolute wt% (scaled to crystallinity)

Mineral phase (reported % of crystalline)	Absolute wt% of sample (calculated)	Representative formula
Quartz (42.71% of crystalline)	34.34	SiO_2
Kaolinite (38.73% of crystalline)	31.14	$Al_2Si_2O_5(OH)_4$
K-feldspar (18.56% of crystalline)	14.92	$KAlSi_3O_8$ (approx.)

Stoichiometric conversions (mineral → oxide equivalents)

Mineral	Formula	Mol. mass (g/mol)	Major oxide wt% (per 100 g mineral)	Notes
Kaolinite	Al2Si2O5(OH)4	258.157	Al2O3: 39.495 ; SiO2: 46.548 ; H2O: 13.957	Contributes Al2O3, SiO2 and structural H2O (LOI).
Quartz	SiO2	60.084	SiO2: 100.00	Pure silica.

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K-feldspar (approx.)	KAlSi3O8	278.328	K2O: 16.922 ; Al2O3: 18.317 ; SiO2: 64.762	Approximate oxide split from KAlSi3O8.

Predicted oxide contributions from crystalline phases (wt% of whole sample)

Oxide	Measured (WDXRF)	From Quartz	From Kaolinite	From K-feldspar	Total predicted (wt%)
SiO2	73.48	34.34	14.49	9.66	58.50
Al2O3	12.76	0.00	12.30	2.73	15.03
K2O	2.27	0.00	0.00	2.53	2.53
Fe2O3	3.99	0.00	0.00	0.00	0.00
TiO2	1.60	0.00	0.00	0.00	0.00
LOI	4.94	0.00	4.35	0.00	4.35

Predicted totals, residuals and inferred amorphous composition

Oxide	Measured (wt%)	Predicted crystalline (wt%)	Residual (Meas – Pred, wt%)
SiO2	73.48	58.50	14.98
Al2O3	12.76	15.03	-2.27
K2O	2.27	2.53	-0.26
Fe2O3	3.99	0.00	3.99
TiO2	1.60	0.00	1.60
LOI	4.94	4.35	0.59

Inferred amorphous fraction = 19.60% of sample. Positive residuals are allocated to this amorphous fraction. Below are residuals normalized to the amorphous mass (i.e., percent of the 19.60% amorphous).

Oxide	Residual (wt% of sample)	Inferred % of amorphous (residual/19.6×100)
SiO2	14.98	76.44
Fe2O3	3.99	20.36
TiO2	1.60	8.16
LOI	0.59	3.03
CaO	0.24	1.22
ZrO2	0.21	1.07
MgO	0.17	0.87
P2O5	0.09	0.46
Na2O	0.08	0.41
BaO	0.06	0.31
SO3	0.05	0.26
PbO	0.04	0.20
Cr2O3	0.01	0.05
MnO	0.01	0.05

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NiO	0.01	0.05
ZnO	0.01	0.05
K2O	-0.26	-0.26
Al2O3	-2.27	-2.27

Interpretation & final justification

• The XRD-identified crystalline phases (quartz, kaolinite, K-feldspar) explain the majority of SiO2 and a substantial part of Al2O3 and K2O. Predicted LOI from kaolinite partially explains measured LOI (measured LOI = 4.94 wt%). Residual LOI and minor oxide mismatches are allocated to the amorphous fraction and minor/trace phases.

• The high SiO2 (73.48 wt%) and dominant quartz (absolute 34.34 wt%) indicate a siliciclastic or sand-rich material with significant feldspar and clay components. Kaolinite (absolute 31.14 wt%) indicates weathering or hydrothermal alteration of feldspars/silicates.

• Probable origin: sedimentary (weathered siliciclastic) or felsic/arkosic detrital source; volcanic origin unlikely as a primary source.

Minor / secondary phases likely present

- Minor amorphous silica (opal or volcanic glass relics) in amorphous fraction
- Iron oxyhydroxide coatings (goethite/ferrihydrite) accounting for Fe2O3 ~3.99%
- Clay-smectite or interstratified clays as subordinate components
- Accessory heavy minerals: zircon (ZrO2 ~0.21%), rutile/ilmenite (TiO2 ~1.60%)
- Feldspar alteration products (sericite, illite) as weathering products

Commercial implications & recommendations

• Commercial uses: high-SiO2 material suitable for silica sand uses (glass, foundry sand) depending on grain size and impurities; kaolinite component useful for ceramics and fillers. K-feldspar indicates potential for ceramic flux applications (glazes).
• Recommendations: particle size analysis, mineral liberation studies, SEM-EDS mapping and Rietveld with an internal standard to refine amorphous content and phase proportions. If silica sand use is intended, evaluate heavy-mineral and iron oxide content for brightness.

Final concise results

• XRD major phases (absolute wt% of sample): Quartz 34.34 wt%, Kaolinite 31.14 wt%, K-feldspar 14.92 wt%. Crystallinity = 80.4%, Amorphous = 19.6%.
• Bulk WDXRF (wt%): SiO2 73.48, Al2O3 12.76, K2O 2.27, Fe2O3 3.99, LOI 4.94.
• Interpretation: sedimentary/weathered siliciclastic material (arkosic to quartz-rich) with potential industrial uses for silica sand, ceramics, and feldspar flux, subject to beneficiation.

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BRUKER D8 ADVANE XRD TEST DATA

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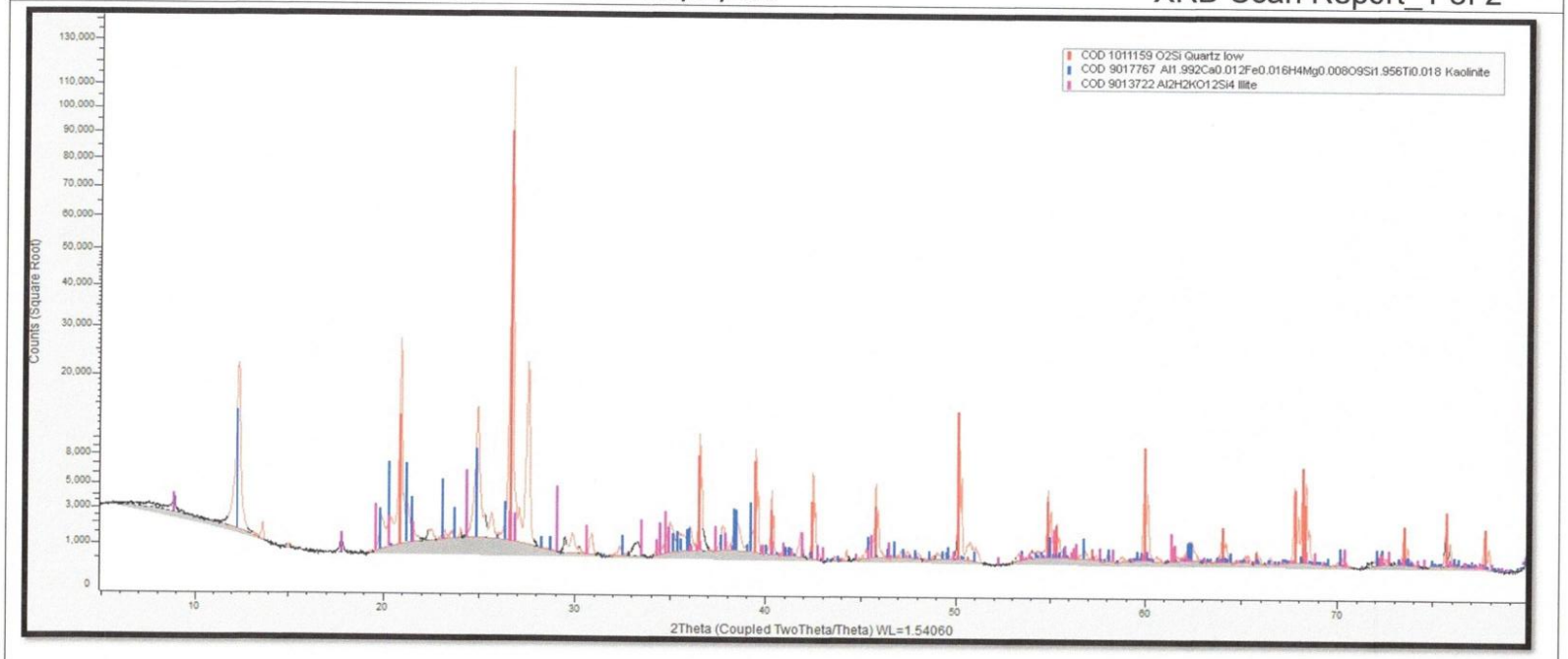

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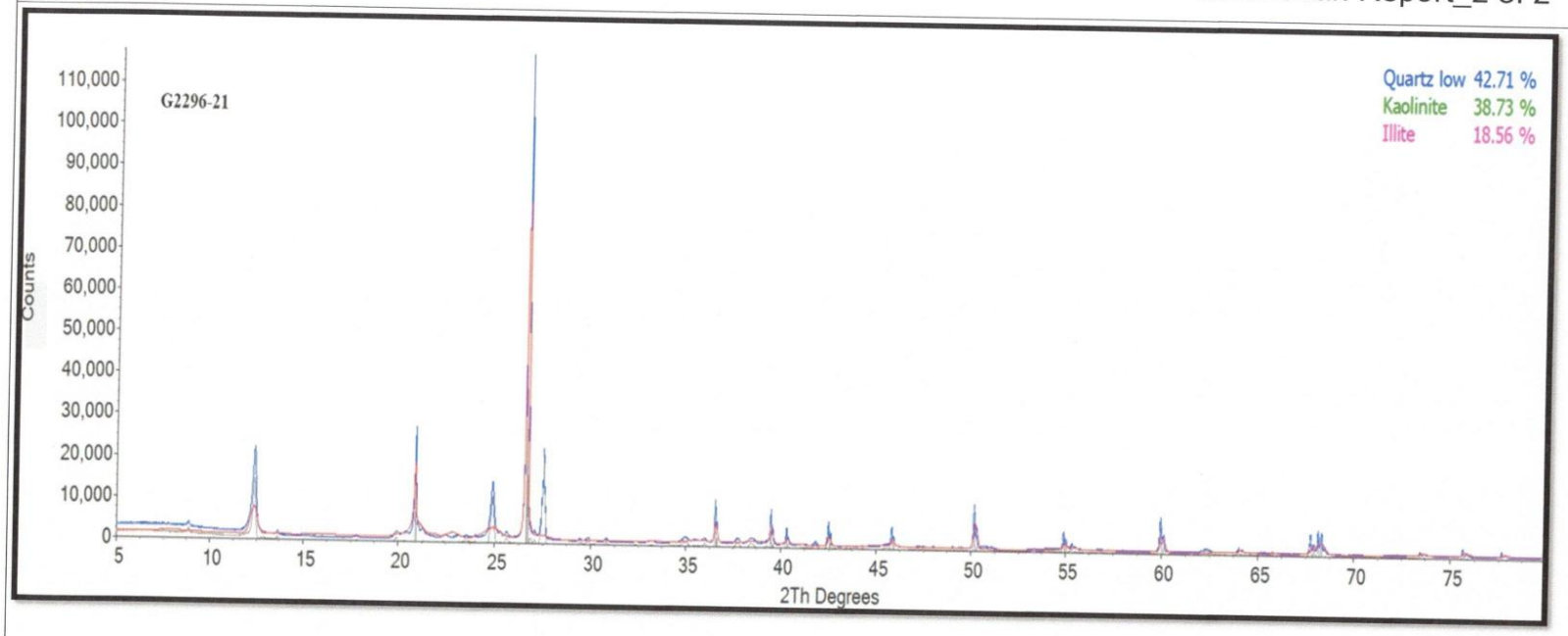
BRUKER D8 ADVANE XRD TEST DATA

G2296-21 P37/NB/2025 XRD Scan Report_2 of 2



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Sample No: P38/NB/2025(Original no: P19/NB/2025)

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Customer Ref : P38/NB/2025
Lab ID : G2296-22

Dates of Sample Analysis :05/09/2025
Date of Reporting :08/09/2025

MINERALOGY TEST REPORT

1.60 KW POWDER X RAY DIFRACTOMETER METHOD

INTRODUCTION: X-ray diffraction (XRD) and petrology studies are both valuable techniques used in geology and materials science for analysing minerals and rocks, but they serve different purposes and offer unique advantages. Here's how XRD is superior to petrology studies in certain aspects. XRD excels in identifying crystalline minerals present in a sample. It provides precise information about the crystal structure and lattice parameters of minerals, which can be challenging to ascertain solely through petrological observations. XRD allows for quantitative analysis of mineral phases present in a sample, providing accurate estimates of mineral composition based on peak intensities. Petrology studies, while descriptive, may not always provide quantitative data on mineral abundance. XRD is highly sensitive and can detect trace amounts of minerals present in a sample, even at concentrations as low as a few percent. Powder Diffraction (XRD) Database, contains a comprehensive collection of more than 6000 diffraction patterns for various materials. Researchers use this resource for identifying unknown substances, confirming crystal structures, and conducting material characterization. Shiva Analyticals team has decades of experience on XRD studies. Accurate chemical assay coupled with reliable mineralogy information is vital in resource characterisation.

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Sample G2296-22 (P38/NB/2025)

Summary

Sample G2296-22: WDXRF (Bruker S8 Tiger 4 kW) bulk oxide dataset reconciled with XRD (Bruker D8 Advance) major phases. Reported crystallinity = 81.60% → inferred amorphous fraction = 18.40%. Major XRD phases (reported as % of crystalline): Goethite 38.0%, Kaolinite 21.5%, Quartz 14.6%, Calcite 18.56% (scaled to crystallinity).

WDXRF data

Oxide	Wt % (measured)
Fe2O3	33.49
SiO2	42.71
Al2O3	9.24
CaO	2.00
TiO2	0.80
K2O	0.59
LOI	9.83

XRD major phases — absolute wt% (scaled to crystallinity)

Mineral phase	Wt % (sample)	Representative formula
Goethite (38.00% of crystalline)	33.46	FeO(OH)
Kaolinite (21.50% of crystalline)	18.93	Al2Si2O5(OH)4
Quartz (14.60% of crystalline)	12.85	SiO2
Calcite (18.56% of crystalline)	16.34	CaCO3

Stoichiometric conversions (mineral → oxide equivalents)

Mineral	Formula	Mol. mass (g/mol)	Major oxide wt% (per 100 g mineral)	Notes
Kaolinite	Al2Si2O5(OH)4	258.157	Al2O3: 39.495 ; SiO2: 46.548 ; H2O: 13.957	Contributes Al2O3, SiO2 and structural H2O (LOI).
Goethite	FeO(OH)	88.851	Fe2O3 equiv: 89.862 ; H2O: 10.138	Hydroxy-iron oxide; contributes Fe2O3 equivalent and LOI.
Calcite	CaCO3	100.086	CaO: 56.029 ; CO2: 43.971	Contributes CaO and CO2 (LOI).
Quartz	SiO2	60.084	SiO2: 100.00	Pure silica.

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Predicted oxide contributions from crystalline phases (wt% of whole sample)

Oxide	Measured (WDXRF)	From Kaolinite	From Goethite	From Calcite	From Quartz
Al2O3	9.24	7.48	0.00	0.00	0.00
SiO2	42.71	8.81	0.00	0.00	12.86
Fe2O3	33.49	0.00	30.07	0.00	0.00
CaO	2.00	0.00	0.00	9.16	0.00
LOI	9.83	0.00	3.39	7.19	0.00
TiO2	0.80	0.00	0.00	0.00	0.00

Predicted totals, residuals and inferred amorphous composition

Oxide	Measured (wt%)	Predicted crystalline (wt%)	Residual (Meas – Pred, wt%)
Al2O3	9.24	7.48	1.76
SiO2	42.71	21.67	21.04
Fe2O3	33.49	30.07	3.42
CaO	2.00	9.16	-7.16
LOI	9.83	13.22	-3.39
TiO2	0.80	0.00	0.80

Inferred amorphous fraction = 18.40% of sample. Positive residuals attributed to amorphous fraction. Residuals normalized to the amorphous mass (percent of the 18.40% amorphous) are below.

Oxide	Residual (wt% of sample)	Inferred % of amorphous (residual/18.4×100)
SiO2	21.04	114.34
Fe2O3	3.42	18.58
Al2O3	1.76	9.58
TiO2	0.80	4.35
K2O	0.59	3.21
P2O5	0.41	2.23
MgO	0.27	1.47
BaO	0.19	1.03
MnO	0.17	0.92
Na2O	0.07	0.38
SO3	0.04	0.22
V2O5	0.04	0.22
SrO	0.03	0.16
ZrO2	0.03	0.16
Cr2O3	0.02	0.11
LOI	-3.39	-3.39
CaO	-7.16	-7.16

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Interpretation, origin assessment & commercial implications

Interpretation:

- The sample is Fe-rich (Fe2O3 = 33.49 wt%) with significant SiO2 (42.71 wt%) and moderate LOI (9.83 wt%).
- Scaled goethite explains a large portion of measured Fe2O3; kaolinite contributes Al2O3 and structural water; calcite explains CaO and part of LOI; quartz contributes to SiO2.

Origin assessment:

- The mineral assemblage (goethite + kaolinite + quartz + calcite) is consistent with a ferruginous weathering profile (laterite/pedogenic horizon) with some carbonate input or mixing. A volcanic or meteoritic origin is unlikely based on mineralogy.

Commercial implications:

- Iron: Fe2O3 ~33.5% — material may be suitable for iron oxide pigment production or as a concentrate after beneficiation; not direct feed for blast-furnace without upgrading.
- Kaolinite: possible use in ceramics/fillers if iron is reduced; requires beneficiation for high-brightness applications.
- Quartz and calcite: potential uses in silica sand and lime markets depending on grain size and purity.

Minor / secondary phases likely present

- Hematite, lepidocrocite or ferrihydrite (fine Fe-phases)
- Anatase/rutile/ilmenite (Ti-bearing phases)
- Amorphous/allophane aluminosilicates in amorphous fraction
- Smectite/interstratified clays as minor components
- Apatite or phosphate minerals (P2O5 ~0.41%)

Final concise results

- Scaled XRD major phases (wt% of sample): Goethite 33.46%, Kaolinite 18.93%, Quartz 12.86%, Calcite 16.34% (sum = 81.60%). Crystallinity = 81.60%, Amorphous = 18.40%.
- Bulk WDXRF (wt%): Fe2O3 33.49, SiO2 42.71, Al2O3 9.24, TiO2 0.80, LOI 9.83.
- Interpretation: ferruginous/regolith material (lateritic/pedogenic) with industrial mineral potential and targetable Fe/Ti heavy minerals after beneficiation.

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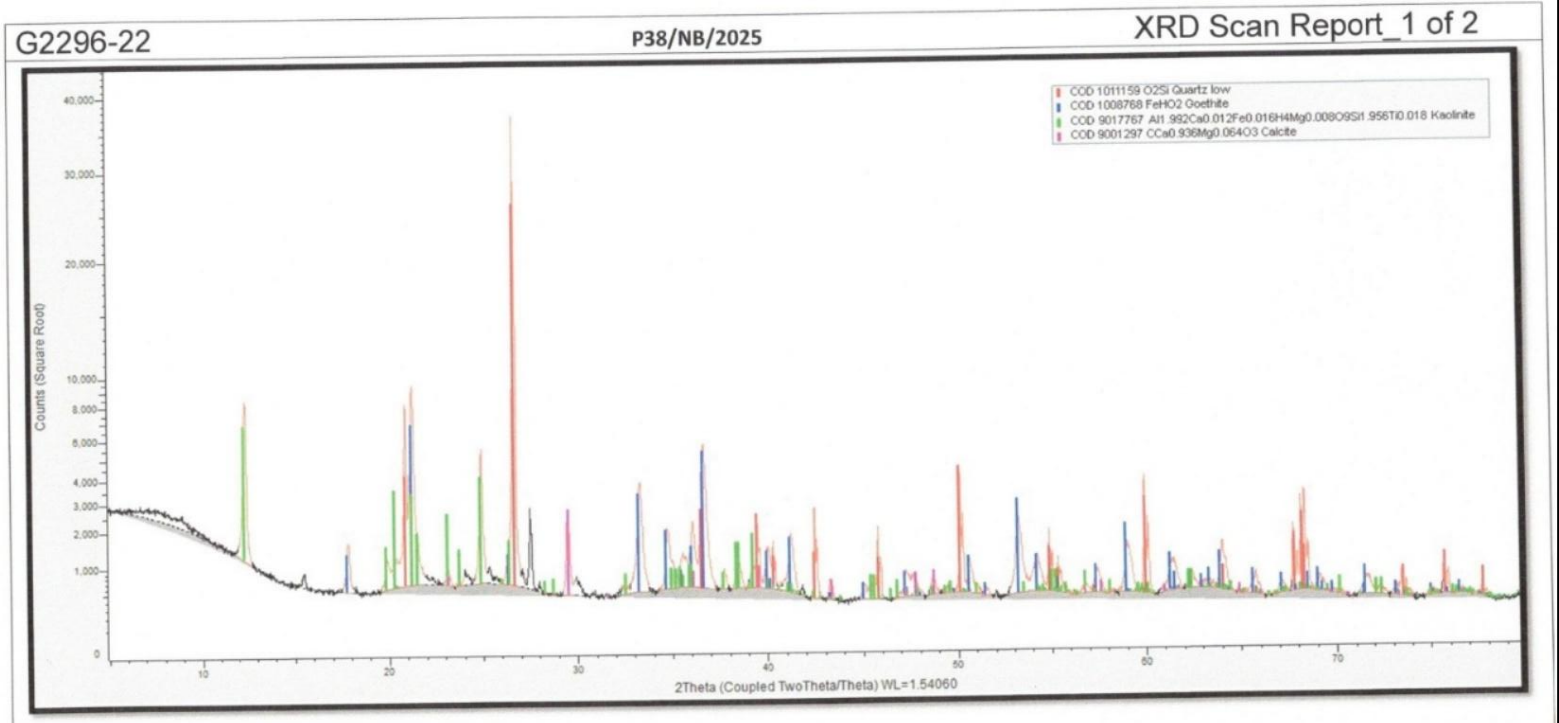
BRUKER D8 ADVANE XRD TEST DATA

G2296-22 P38/NB/2025 XRD Scan Report_1 of 2



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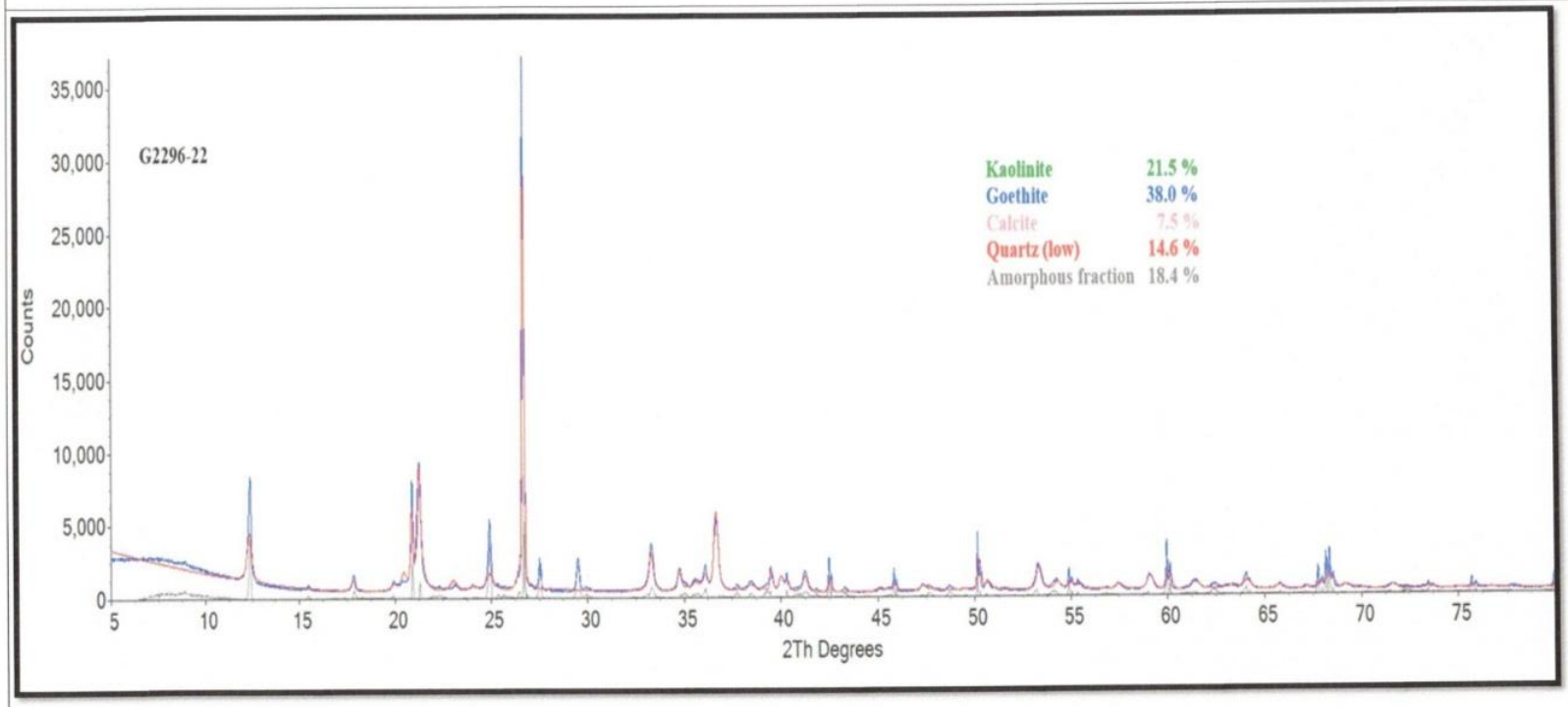
BRUKER D8 ADVANE XRD TEST DATA

G2296-22 P38/NB/2025 XRD Scan Report_2 of 2



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Sample No: T34/NB/2025/04(Original no: T5/NB/2025/04)

SHIVA
Part of the Cotecna Group

SHIVA ANALYTICALS INDIA PRIVATE LIMITED

Customer Name: Mr. K. Nageswara Rao.
Customer Address: Critical Minerals Trackers, Mineral Exploration and Geo Solution, #Concourse, No 406,7-1-58/CC/406, Opp Lal Bungalow, Greenland's, Hyderabad -500016 India.
Customer Ref : T34/NB/2025/04
Lab ID : G2296-27

Dates of Sample Analysis :05/09/2025
Date of Reporting :08/09/2025

MINERALOGY TEST REPORT

1.60 KW POWDER X RAY DIFRACTOMETER METHOD

INTRODUCTION: X-ray diffraction (XRD) and petrology studies are both valuable techniques used in geology and materials science for analysing minerals and rocks, but they serve different purposes and offer unique advantages. Here's how XRD is superior to petrology studies in certain aspects. XRD excels in identifying crystalline minerals present in a sample. It provides precise information about the crystal structure and lattice parameters of minerals, which can be challenging to ascertain solely through petrological observations. XRD allows for quantitative analysis of mineral phases present in a sample, providing accurate estimates of mineral composition based on peak intensities. Petrology studies, while descriptive, may not always provide quantitative data on mineral abundance. XRD is highly sensitive and can detect trace amounts of minerals present in a sample, even at concentrations as low as a few percent. Powder Diffraction (XRD) Database, contains a comprehensive collection of more than 6000 diffraction patterns for various materials. Researchers use this resource for identifying unknown substances, confirming crystal structures, and conducting material characterization. Shiva Analyticals team has decades of experience on XRD studies. Accurate chemical assay coupled with reliable mineralogy information is vital in resource characterisation.

Prepared by: Nagaraj Singh
Verified by: Satyanarayana

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Sample G2296-16 (T34/NB/2025/04)

Expert XRD–XRF Report

Instruments:

- WDXRF: Bruker S8 Tiger Series 2, 4 kW
- XRD: Bruker D8 Advance, 1.6 kW

WDXRF Oxide Composition

Oxide	wt%	Oxide	wt%
Al2O3	8.33	MnO	0.11
BaO	<0.05	Na2O	0.08
CaO	0.21	P2O5	<0.05
Cr2O3	<0.05	SiO2	64.68
Fe2O3	19.00	SO3	<0.05
K2O	1.37	SrO	<0.05
MgO	0.09	TiO2	0.64
V2O5	<0.05	ZrO2	0.05
HfO2	<0.05	PbO	<0.05
CuO	<0.05	ZnO	<0.05
NiO	<0.05	LOI	5.29
Total	**100.00**		

Major XRD Phases

Phase	Formula	wt% (crystalline fraction)	Absolute wt% (normalized to bulk)
Quartz (low)	SiO2	43.45	35.80
Kaolinite	Al2Si2O5(OH)4	21.21	17.49
Goethite	FeO(OH)	17.43	14.37
Vaterite	CaCO3	0.31	0.26
Total crystalline	–	82.40	68.0
Amorphous content	–	17.60	17.6

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Stoichiometric Oxide Contributions from Crystalline Phases

Oxide	From Quartz	From Kaolinite	From Goethite	From Vaterite	Total Predicted	WDXRF Measured	Residual → Amorphous
SiO2	35.80	9.03	0.00	0.00	44.83	64.68	+19.85
Al2O3	0.00	7.47	0.00	0.00	7.47	8.33	+0.86
Fe2O3*	0.00	0.00	14.37	0.00	14.37	19.00	+4.63
CaO	0.00	0.00	0.00	0.15	0.15	0.21	+0.06
CO2 (LOI)	0.00	0.00	0.00	0.11 (in LOI)	0.00	5.29 (total LOI)	0.00
Others (K2O, TiO2, trace oxides)	0.00	0.00	0.00	0.00	0.00	2.24	2.24

*Goethite contributes FeO(OH); converted to Fe2O3 equivalent.

Amorphous Content (17.6%)

Likely constituents of the amorphous fraction:

- Amorphous silica / opaline SiO2 (major, explains excess SiO2).
- Poorly crystalline Fe-oxyhydroxides (ferrihydrite, hydrated goethite).
- Minor alumino-silicate gels / altered kaolinite

Suggested Minor/Secondary Phases

- **Smectite/illite group clays** (not resolved in XRD).
- **Ferrihydrite** (nanocrystalline Fe-oxyhydroxide).
- **Amorphous silica** (opal-A, chalcedony precursor).
- **Accessory Ti/Zr oxides** (rutile, zircon traces suggested by XRF TiO2, ZrO2).

Expert Interpretation & Origin

- High **SiO2 (64.7%)**, **moderate Fe2O3 (19.0%)**, and presence of kaolinite suggest a **lateritic/siliciclastic sedimentary origin**.
- Not meteoritic (absence of Ni/Co-rich phases, chondritic textures).
- Not volcanic glass dominated (but some amorphous SiO2 could reflect secondary silica).
- Most consistent with **weathering of arkosic/sandstone material** enriched in quartz and kaolinite, with iron oxyhydroxide precipitation.

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Potential Commercial Uses

Component	Possible Applications
Quartz (high-purity SiO2)	Glass, ceramics, foundry sand, silica flour
Kaolinite	Ceramics, paper coating, refractories, catalysts
Goethite (iron oxyhydroxide)	Pigments (yellow ochre), precursor to Fe ores
Amorphous silica	Pozzolanic cement additive, fillers, industrial silica
Trace Ti/Zr oxides	Pigments, ceramics, potential Ti/Zr recovery (if concentrated)

Final Justification (Results)

The combined **XRF–XRD analysis** shows that crystalline phases (82.4%) account for the bulk chemistry but leave **~17.6% amorphous fraction**, largely silica- and Fe-rich, consistent with weathering-derived opaline silica and ferrihydrite. The sample represents a **silica-rich, ferruginous clay/quartz mixture** typical of sedimentary–lateritic environments. Potential industrial uses include **ceramics, silica products, and pigment/iron recovery**.

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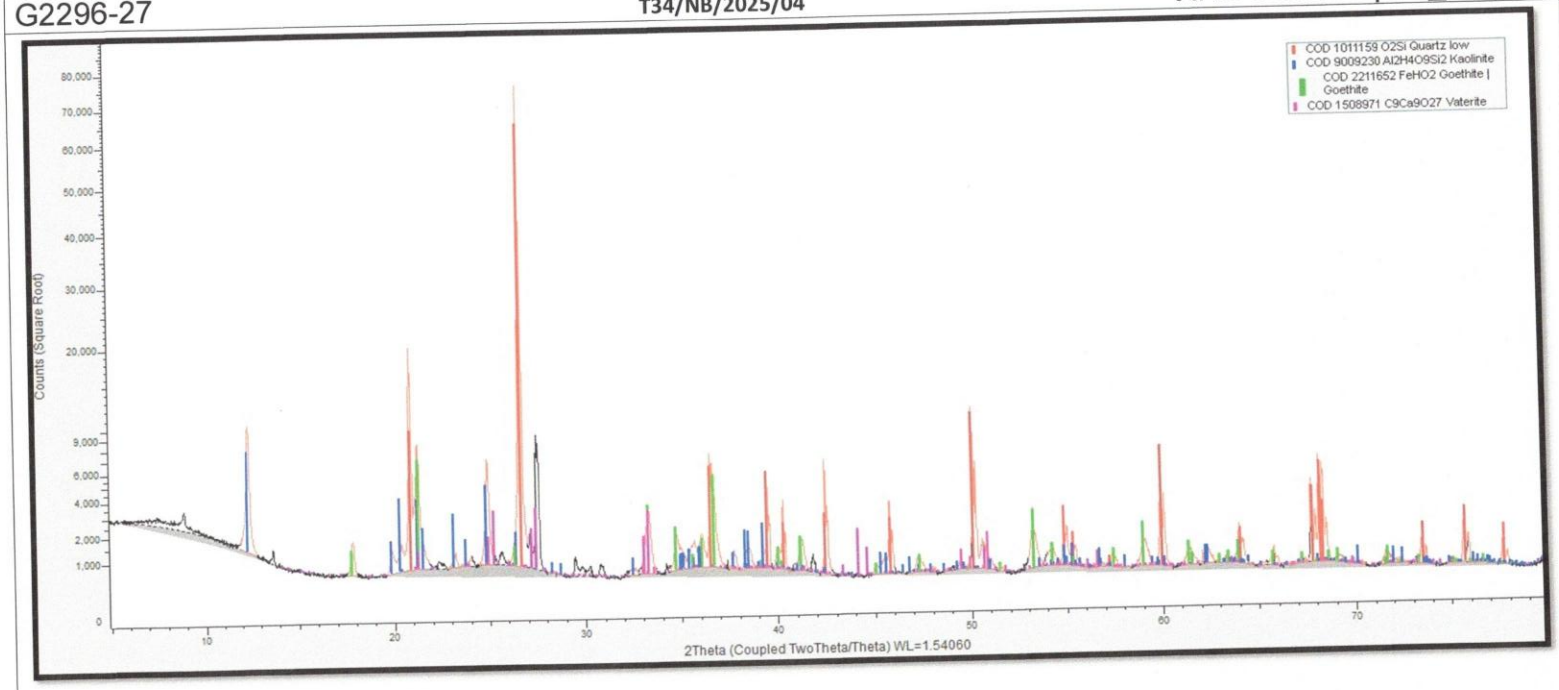
BRUKER D8 ADVANE XRD TEST DATA

G2296-27 T34/NB/2025/04 XRD Scan Report_1 of 2



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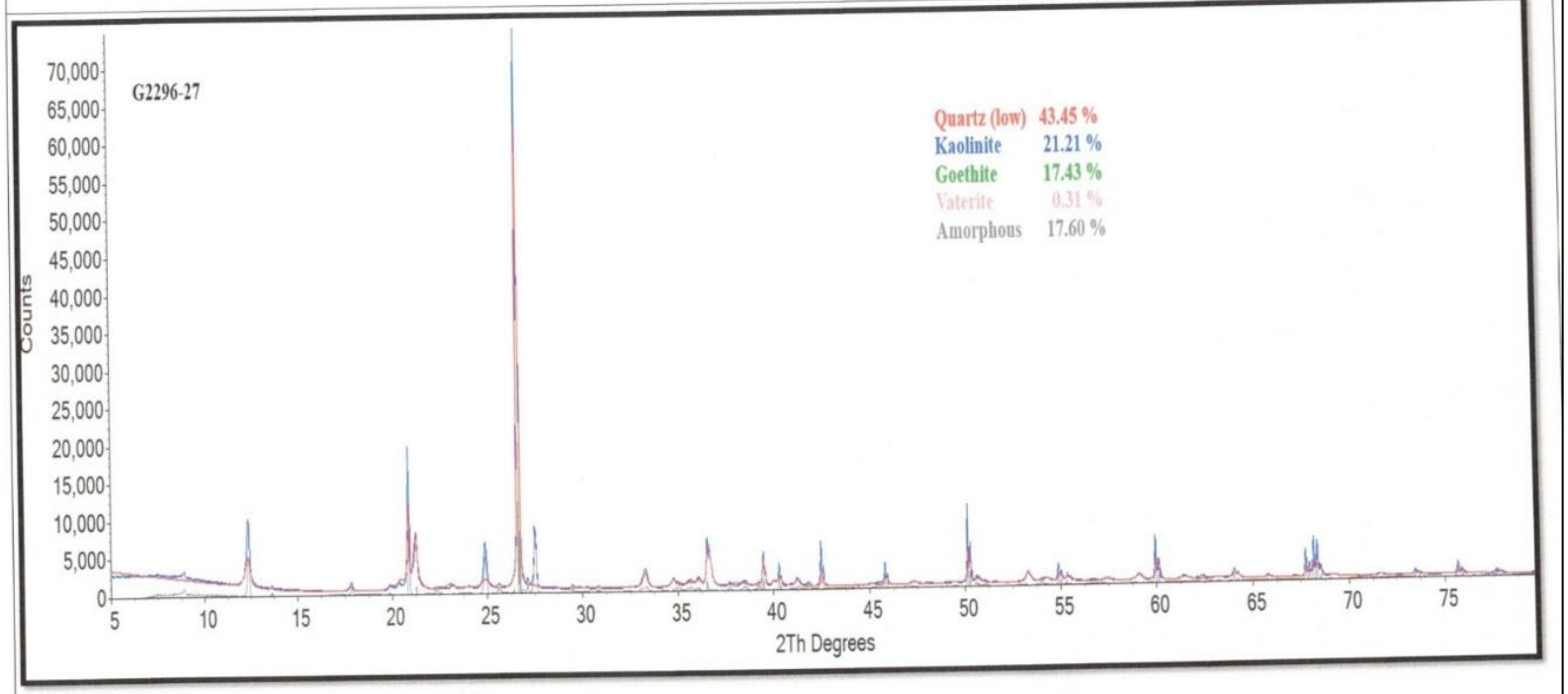
BRUKER D8 ADVANE XRD TEST DATA

G2296-27 T34/NB/2025/04 XRD Scan Report_2 of 2



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ANNEXURE - XVII

Administrative and Financial approval from NMET to carry out exploration work (G4) in Nadapa Area, Dist: Kachchh, Gujarat

Government of India
Ministry of Mines
National Mineral Exploration Trust

File No. 23/570/2025-NMET/ 849 **New Delhi, 10th February, 2025**

OFFICE MEMORANDUM

Subject: Approval of the project "Reconnaissance Survey (G4) for Bauxite, Ga, V, Ti & REE in Nadapa area Kachchh District, Gujarat".

Agency:- M/s Critical Mineral Trackers Pvt. Ltd.

On the recommendation of the Technical-cum-Cost Committee (TCC), the Executive Committee (EC) in its 39th meeting held on 24th January, 2025 approved the mineral exploration project of M/s Critical Mineral Tracker Pvt. Ltd. through NMET fund as per following details:-

S. No	Project/Block Name	Agency	Duration (Months)	Approved Cost (₹ Including GST)
1	Reconnaissance Survey (G4) for Bauxite, Ga, V, Ti & REE in Nadapa area Kachchh District, Gujarat.	M/s Critical Mineral Trackes Pvt. Ltd.	10 months (up to 09.12.2025)	₹53,72,568/-
Total (Rupees Fifty three lakh seventy two thousand five hundred sixty eight only)				**₹53,72,568/-**

2. M/s Critical Mineral Trackers Pvt. Ltd. shall submit progress on monthly basis to NMET Secretariat. The TCC, NMET shall review the progress of project and provide update to the Executive Committee. The timeline is enclosed in **Annexure,** as summarized below:-

•	**Field Mobilization**	1st month (up to 09.02.2025).
•	**Exploration** (Survey, Geophysical mapping, surface drilling, Camp winding)	2nd to 10th month (up to 09.12.2025).
•	**Laboratory Studies**	3rd to 8th month (up to 09.10.2025)
•	**Report Writing with Peer Review and submission to NMET**	09th to 10th month (up to 09.12.2025)

3. M/s Critical Mineral Trackers Pvt. Ltd. shall complete the project as per the above terms.

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

5. Further, as per clause 2.2(viii) of the Office Memorandum no. 6/3/2015-NMET/176 dated 210th June, 2024 regarding Scheme for engagement of Notified Private Exploration Agencies in Mineral Exploration directly through NMET "*In case the NPEA wishes to avail mobilization advance (up to 30% of the approved project cost), the NPEA has to submit a Bank Guarantee (BG, including e-bank guarantee) of equal value of advance to NMET*".

[Geetika Sharma]
Deputy Secretary & HoD, NMET

Copy for information and further necessary action:-

1. M/s Critical Mineral Trackers Pvt. Ltd.
2. I.F. Division, Ministry of Mines, Shastri Bhawan, New Delhi.
3. Executive Committee (EC) Meeting file (F.No.6/2/2015-NMET)
4. Grant-in aid Sanction order file.

Estimate Cost for Reconnaissance Survey (G4) for Bauxite, Ga, V, Ti & REE in Nadapa area Kachchh District, Gujarat							
Name of the Exploration Agency – Critical Mineral Trackers, Hyderabad							
Total Area -6.203sq.km; No of Boreholes- 4, 120m; Completion Time -10 months, Review 4 months							
S. No	**Item of Work**	**Unit**	**Rates as per NMET SoC**		**Estimated Cost of the Proposal**		**Remarks**
			SoC-Item-SI No.	**Rates as per SOC**	**Qtm**	**Total Amount (Rs)**	
A	**Geological Work**						
1	Geological Mapping (1:12500) & sampling – Geologist field-days	6.12	1.2	11000	160	17,60,000	man days
2	Geologists (HQ)days, pre & post field interpretation 15 +20 days	One Geologist Per Day	1.2	9000	35	3,15,000	man days (including Remote sensing studiesman days (including Remote sensing studies
3	Pitting-20nos each one size 1*1*1m (1 Cu.m each)	Per Cu.m	2.1.2	3800	20	76,000	20 cu.m
4	Trenching-5 nos, each one size 10*1*1(10 cu.m each)	Per Cu.m	2.1.1	3300	50	1,65,000	50 cu.m
5	sampler	45 days	1.5.2	5100	23	1,17,300	man days
6	Labour (2 labour) attached to sampler	90 labour days	5.7	526	92	48,392	labour days
7	Labour	Per Team of 2 Geologists (2*2=4) Labour/Field workers	5.7	526	320	1,68,320	labour days
	Sub-Total -A					**26,50,012**	
B	**Survey Work:**						
1	**Surveyor: Fixation & connection of boundary points (4 nos),4 Bh by Total station/DGPS**	One surveyor	1.6.2	19,200	8	**1,53,600**	
	Sub-total-B					**1,53,600**	
C	**Core Drilling - Outsourced**						

1	Scout drilling(coring) :4 points (each 30m deep) 4*30	Per meter	2.2.1.1b	7,168	120	8,60,160	120m, soft rock- MoC rate
2		Per pillar	2.2.7a	2000	0	0	4 pillars
3	**Mob & demob drilling machine & iner BH shifting	Per shifting	lumpsum			0	lumpsum
4	Compensation for 4 Bhs		5.6	20,000	0	0	4 BHs
5	Drill core preservation in GI boxes	Per meter	5.3	1590	120	1,90,800	120m core
	Subtotal-C					**10,50,960**	
D	**Laboratory Studies**						
1	Trench and channel Samples (5*5=25 nos):by AAS method	First five radicals+5	4.1.7a &7b	4181	0	0	90 samples
2	Pitting Sample: (20*1=20 nos)-AAS method	First five radicals+5	4.1.7a &7b	4181	0	0	60 samples
3	Core drilling Samples-4*60=240 Total depth 30m each, samples will be collected at every 5m interval. AAS method	First five radicals+5	4.1.7a &7b	4181	0	0	24 samples
	XRF - Major Oxide		4.1.15a	4200	143	6,00,600	Trench-70, Pit-20, BH-40 (130+13 Check)
4	Analysis for REE (14 elements/radicals) by ICP-MS+Check Samples	14 elements/radicals	4.1.13	5380	36	1,93,680	33+3 check
5	Combined determination of THA, MHA and Reactive silica		4.1.17a	6700	4	26,800	4 samples

6	Preparation of Polished thin section	Per sample	4.3.2	1549	10	15,490	4 sections
7	Complete petrographic/ore microscopic/mineral graphic studies	Per sample	4.3.4	4232	10	42,320	4 sections
8	XRD analysis for identification of minerals(random)	Per sample	4.5.1	4000	4	16,000	4 samples
	Subtotal-D					**2,51,970**	
E	**Surface Geophysical Survey**		**Not recommended**				
1	Electrical resistivity	Per Station					
2	gravity surveys	Per station					
3	Geophysicist Man days						
	(Field Man-days)						
4	Geophysicist Man days (HQ)						
	Subtotal-E						
	TOTAL (A+B+C+D)					**41,06,542**	

	(5 Hard copies with a soft copy)						
G	**Geological Report** (5 Hard copies with a soft copy)		5.2	5% of the Project cost		2,05,327	5% of the Project Cost.
	Operational Charges		6.0			86,016	
	Tender Process Cost		2.3			43,008	
	Peer review					30,000	
	Additional Copy			1000	0	0	
	Project Cost without GST					**45,53,024**	
	18% GST					**8,19,544**	
	Total Project Cost					**53,72,568**	
Note:							
1	**Strict adherence to the Ministry of Finance's and GFR guidelines is mandatory. Every transaction must adhere to GFR rule 21.**						
2	**In case of delay/non- performance, the appropriate action will be taken by competent authority against delinquent agency as per prevailing govt. of India rules/guidelines on procurement.**						
3	**If any part of the project is outsourced, the amount will be reimbursed as per the Paragraph 3 of NMET SoC and Item no. 6 of NMET SoC. In case of execution of the project by NEA on its own, a Certificate regarding non outsourcing of any component/project is required.**						
4	**Necessary efforts should be made to minimize any adverse impact on the environment during exploration activities.**						
5	**Any item of work not mentioned above shall be added as per SoC.**						
6	**All the Geological Reports and data are to be uploaded on NGDR as per MERT template by the agency.**						

Time Schedule/ Action plan for Reconnaissance Survey (G4) for Bauxite, Ga, V, Ti & REE in Nadapa area Kachchh District, Gujarat

S. no	Activity	Unit	Months										
			1	2	3	4		5	6	7	8	9	10
1	Geologist Party Days HQ	Days					Review						
2	Geologist Party Days Field	Days											
3	Sampling (Pitting & Trenching)	Days											
4	Laboratory Studies	Days											
5	Core Drilling	Days											
6	Survey Party Days	Days											
8	Post Field Interpretation	Days											
9	Report Compilation & Submission	Days											

Note: CMT has completed field operations in Nadapa area from 14th Feb – 2025 to 13th Apr – 2026 but the report was submitted in March – 2026 due to delay in receiving petrographic studies and Analytical results of check samples.

LIST OF PLATES (ENCLOSED SEPARATLY)

Plate No	Title	Scale
I	Location Map of Reconnaissance Survey G4 for Bauxite, Ga, V, Ti & REE in Nadapa Area, Dist : Kachchh, Gujarat	Not To Scale
II	Regional Geological Map of Kachchh basin (part) with location of Nadapa Area, Kachchh district, Gujarat	Not To Scale
III	Interpreted Large Scale Geological Map of Nadapa Area, Dist: Kachchh, Gujarat	1:12500
IV	Large Scale Geological Map of outcrops in Nadapa area, Dist: Kachchh, Gujarat	1:12500
V	Location of Pits & Trench on Large Scale Geological Map of Nadapa Area, Dist: Kachchh, Gujarat	1:12500
VI	Land use / Land cover map of Nadapa area, Kachchh district, Gujarat	1:12500
VII	Lithological map of pits in Nadapa area, Kachchh district, Gujarat	1:100
VIII	Lithological map of Trenches in Nadapa area, Kachchh district, Gujarat	1:100
IX	Assay Map of pits Nadapa area, Kachchh district, Gujarat	1:100
X	Assay Map of Trenches Nadapa area, Kachchh district, Gujarat	1:100
XI	Topographical map of Nadapa area, Kachchh district, Gujarat	1:12500

CHAPTER – XV

PEER RIVIEWER COMMENTS

PEER REVIEW COMMENTS PERTAINING TO GEOLOGICAL REPORT ON RECONNAISSANCE SURVEY (G-4 STAGE) FOR BAUXITE, Ga, V, Ti & REE NADAPA AREA (6.20 SQ. KM) DISTRICT- BHUJ, GUJARAT

CRITICAL MINERAL TRACKERS HYDERABAD, TELANGANA

The Geological report is well drafted and have touched every aspect of exploration as sanctioned by NMET. However there are few comments which need to be attended before final submission.

Comments	Peer review comments attempt
1. The present report is not as per the reporting format of NMET, hence Geological report may be re-arranged as per NMET format. The format may be downloaded from https://nmet.gov.in	Re-Arranged the Geological report in NMET format
2. Executive summary of report should be in short and crisp touching every part in brief.	Summary is short and crispy now touching every part in brief
3. It is observed that exploration block Nadapa area mentioned in the report is 6.20 sq km, but at places it is written as 6.21sq km. in cost sheet area mentioned is 6.12 sq km. correct figure may be given.	Corrections done
4. Page no 14 and 40 help of chat GPT/ AI should be avoided/ done cautiously.	Attended
5. Chapter-XI page no 127. Where ever Bench mark is written may be replaced with Temporary Bench mark. Only Survey of India is authorized to put permanent bench marks.	Attended
6. Table 14.1. values in respect of Fe2O3, MnO, MgO, CaO Na2O, K2O, T iO2 and P2O5 are all same which is not possible. Check the table and correct figures may be given.	Corrected
7. Annexures: Chemical analysis of pits and trenches may be presented in Excel format in form of proper Annexures in the report, merely attaching the analytical results as received from laboratory will not serve the purpose.	Chemical analysis of major and REE are shown as separate Annexures
8. Font size of test results attached in the report is too small to see. Bigger font size may be used. May be given in landscape.	Attended
9. Plates: Topographical map of the area with contour values may be given as separate plate.	Topographical map of the area prepared on a 1:12500 scale
10. Lithological map of all pits may be given as plate at suitable scale.	Lithological map of pits prepared on 1:100 Scale plate No: 7
11. Assay plan of all pits may be given as plate at suitable scale.	Assay plan of pits prepared on 1:100 Scale Plate No: 9
12. Lithological map of all trenches may be given as plate at suitable scale.	Lithological map of Trench prepared on 1:100 Scale Plate No: 8

13. Assay plan of all trenches may be given as plate at suitable	Assay plan of pits prepared on 1:100 Scale Plate No: 10
14. The final report should have the following folder Structure, along with Georeff Images, GIS files, Images, Tables and Text in the prescribed schema attached as Annexure-1(As per MERT format of NGDR) so that it can be directly uploaded to NGDR portal.	Attended
i. Text folder should have one single pdf (cover to cover) and one single doc file.	Attended
ii. Table folder should have all the tables and annexures as per the content of the report.	Attended
iii. Image folder should contain all the images, maps/plates and figures, field photographs etc. available in the report.	Attended
iv. GeoRef images folder should have the geotiff files of all the vectorised maps.	Attended
v. GIS files folder should contain the vector files of the plates/maps in gdb format and as per the LSM/DM schema. Only those maps/plates with LSM/ DM scale (1:12,500 or larger) may be prepared as per the provided schema. Other maps with are not related to large scale mapping and detailed mapping, for example location maps, regional scale maps, any other small-scale map etc., may not be digitized as per the schema.	Attended

All suggestions and modifications indicated in the text, text plates, figures, tables, Annexures and plates may be attended : **Attended**

CRITICAL MINERAL TRACKERS 1400 HYDERABAD

S.Uma Maheswara Rao
Technical Area Expert