GEOLOGICAL REPORT ON RECONNAISSANCE SURVEY (G4) FOR BAUXITE, Ga, V, Ti & REE

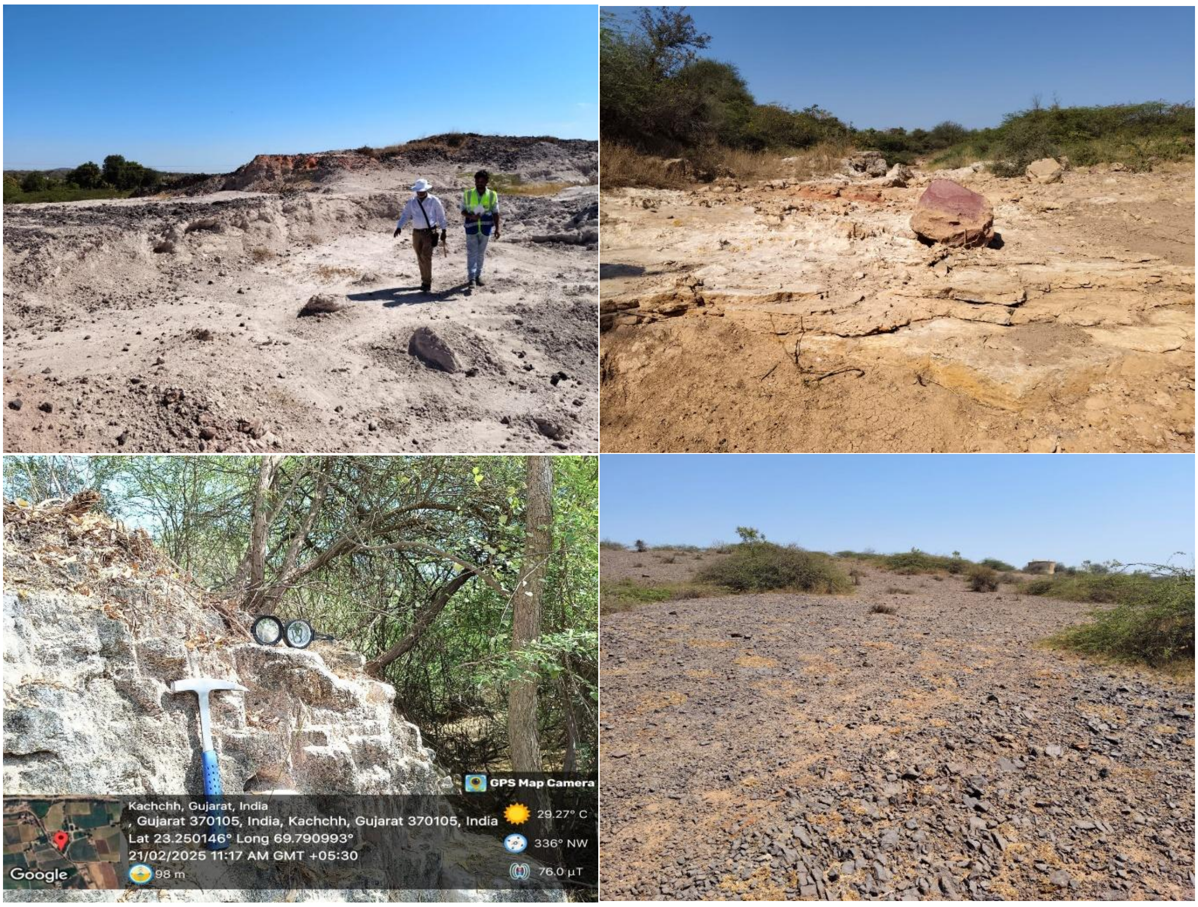
IN

LAKHOND AREA

DISTRICT – KACHCHH, STATE – GUJARAT

(Under NMEDT Programme)

TEXT, ANNEXURE AND PLATES



CRITICAL MINERAL TRACKERS

(NOTIFIED PRIVATE EXPLORATION AGENCY)

May – 2026

CERTIFICATION

This is to certify that geological report has been prepared in respect of GEOLOGICAL REPORT ON **"Reconnaissance Survey (G4) For Bauxite, Ga, V, Ti & REE in Lakhond Area, District- Kutchchh, Gujarat"** by CRITICAL MINERAL TRACKERS on behalf of National Mineral Exploration and Development Trust (NMEDT). 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

1.0 सारांश

भूवैज्ञानिक प्रतिवेदन में गुजरात के कच्छ जिले के लाखोंड क्षेत्र में एनएमईडीटी (NMEDT) कार्यक्रम के अंतर्गत किए गए G4 स्तर के टोही सर्वेक्षण के परिणाम प्रस्तुत किए गए हैं। यह जांच क्रिटिकल मिनरल ट्रैकर्स द्वारा बॉक्साइट तथा उससे संबद्ध महत्वपूर्ण खनिजों जैसे गैलियम (Ga), वैनाडियम (V), टाइटेनियम (Ti) और रेयर अर्थ एलिमेंट्स (REE) की संभावनाओं का आकलन करने के उद्देश्य से की गई थी। अध्ययन की शुरुआत उपग्रह चित्रों, पूर्व भूवैज्ञानिक अध्ययनों तथा सीमित नमूना विश्लेषण से प्राप्त प्रारंभिक संकेतों के आधार पर की गई, जिनसे संभावित लैटराइटिक एवं बॉक्साइटिक उपस्थिति का अनुमान हुआ था।

अध्ययन क्षेत्र लगभग **6.12** वर्ग किलोमीटर में फैला हुआ है और भुज के निकट स्थित है। क्षेत्र को क्षेत्रीय स्तर पर अच्छी संपर्क सुविधा प्राप्त है, हालांकि आंतरिक पहुंच सीमित है। भू-आकृतिक दृष्टि से यह क्षेत्र पेडीप्लेन, अवशिष्ट पहाड़ियों तथा अर्ध-शुष्क जलवायु से युक्त है। भूमि उपयोग मुख्यतः कृषि आधारित है, जबकि कुछ स्थानों पर चट्टानी उभार तथा चीन क्ले प्रसंस्करण जैसी स्थानीय औद्योगिक गतिविधियाँ भी पाई जाती हैं। क्षेत्र की भू-आकृति और जलनिकासी प्रणाली, विशेषकर नालों की उपस्थिति, अवसाद पुनर्वितरण और स्थानीय भू-रासायनिक असामान्यताओं में महत्वपूर्ण भूमिका निभाती है।

भूवैज्ञानिक रूप से यह क्षेत्र कच्छ बेसिन का हिस्सा है, जिसमें मेसोज़ोइक से सेनोज़ोइक काल की अवसादी श्रृंखलाएँ स्थानीय रूप से डेक्कन ट्रैप ज्वालामुखीय चट्टानों से आच्छादित हैं। अध्ययन क्षेत्र में मुख्य रूप से भुज संरचना (क्रिटेशियस) तथा सन्धन संरचना (प्लायोसीन) उजागर होती हैं, जबकि पूर्वी भाग में गज तथा मातानोमाध संरचनाओं की अल्प उपस्थिति देखी जाती है। ये संरचनाएँ मुख्यतः बलुआ पत्थर, सिल्टस्टोन, चिकनी मिट्टी तथा शेल से निर्मित हैं, जिनका निक्षेपण नदीय से सीमांत समुद्री परिवेश में हुआ था। महत्वपूर्ण रूप से, इन शैलवैज्ञानिक विशेषताओं से यह स्पष्ट होता है कि यहाँ सुविकसित लैटराइटिक प्रोफाइल का अभाव है, जो महत्वपूर्ण बॉक्साइट निक्षेपों के निर्माण के लिए आवश्यक होते हैं।

अन्वेषण कार्यक्रम के अंतर्गत **1:12,500** पैमाने पर विस्तृत भूवैज्ञानिक मानचित्रण, पिटिंग, ट्रेंचिंग, नमूना संग्रहण, प्रयोगशाला विश्लेषण तथा सीमित स्काउट ड्रिलिंग की गई। सतही और अधस्तलीय परिस्थितियों को समझने हेतु कुल 20 गड्ढे (पिट), 5 ट्रेंच तथा 4 बोरहोल निष्पादित किए गए। प्रमुख ऑक्साइडों एवं REE सहित सूक्ष्म तत्वों के भू-रासायनिक विश्लेषण के लिए XRF और ICP-MS जैसी मानक प्रयोगशाला तकनीकों का उपयोग किया गया।

पिट एवं ट्रेंच नमूनों के रासायनिक विश्लेषण का सारांश

भुज संरचना

Al_2O_3 का मान 0.10% से 39.34% तक तथा औसत 22.22% पाया गया। गैलियम (Ga) का मान 13.1 से 50.85 ppm तथा औसत 30.33 ppm रहा। वैनाडियम (V) का मान 53.40 से 502.08 ppm तथा औसत 243.98 ppm रहा। टाइटेनियम (Ti) का मान 0.52% से 9.59% तथा औसत

4.07% पाया गया। कुल रेयर अर्थ एलिमेंट्स (TREE) का मान 217.29 से 1469.62 ppm तथा औसत 679.43 ppm रहा। TREE + Sc + Y का मान 241.50 से 1555.25 ppm तथा औसत 733.18 ppm पाया गया।

मातानोमाध संरचना

Al_2O_3 का मान 28.59% पाया गया। गैलियम (Ga) 41.73 ppm, वैनाडियम (V) 199.78 ppm तथा टाइटेनियम (Ti) 1.48% पाया गया। TREE का मान 504.64 ppm तथा TREE + Sc + Y का मान 554.22 ppm रहा।

गज संरचना

Al_2O_3 का मान 16.31% पाया गया। वैनाडियम (V) 93.7 ppm तथा टाइटेनियम (Ti) 1.69% पाया गया। इस संरचना में गैलियम एवं REE का विश्लेषण नहीं किया गया।

सन्धन संरचना

Al_2O_3 का मान 0.24% से 46.01% तथा औसत 21.91% पाया गया। गैलियम (Ga) का मान 14.68 से 41.48 ppm तथा औसत 28.43 ppm रहा। वैनाडियम (V) का मान 32.5 से 444.00 ppm तथा औसत 180.86 ppm पाया गया। टाइटेनियम (Ti) का मान 0.79% से 4.56% तथा औसत 2.40% रहा। TREE का मान 311.00 से 748.57 ppm तथा औसत 520.39 ppm पाया गया। REE + Sc + Y का मान 375.13 से 795.15 ppm तथा औसत 570.12 ppm रहा।

बोरहोल नमूनों के रासायनिक विश्लेषण का सारांश

LKD–BH–01

Al_2O_3 का मान 16.39% से 36.82% तथा औसत 29.00% पाया गया। Ga का मान 29.00 से 43.1 ppm तथा औसत 35.00 ppm रहा। V का मान 68.60 से 243.70 ppm तथा औसत 161.03 ppm पाया गया। Ti का मान 1.48% से 5.23% तथा औसत 3.53% रहा। TREE का मान 278.7 से 623.6 ppm तथा औसत 448.5 ppm पाया गया। TREE + Sc + Y का मान 307.5 से 661.9 ppm तथा औसत 480.8 ppm रहा।

LKD–BH–02

Al_2O_3 का मान 8.22% से 28.90% तथा औसत 16.53% पाया गया। Ga का मान 17.9 से 40.9 ppm तथा औसत 25.3 ppm रहा। V का मान 126.3 से 506.70 ppm तथा औसत 268.70 ppm पाया गया। Ti का मान 2.37% से 9.87% तथा औसत 5.20% रहा।TREE का मान 329.9 से 636.0 ppm तथा औसत 476.4 ppm पाया गया। TREE + Sc + Y का मान 357.1 से 679.9 ppm तथा औसत 517.1 ppm रहा।

LKD–BH–03

Al_2O_3 का मान 16.59% से 34.51% तथा औसत 26.97% पाया गया। Ga का मान 20.7 से 46.7 ppm तथा औसत 32.8 ppm रहा। V का मान 34.50 से 898.60 ppm तथा औसत 331.29 ppm पाया गया। Ti का मान 0.39% से 4.21% तथा औसत 2.02% रहा। TREE का मान 421.8 से 1187.5 ppm तथा औसत 695.5 ppm पाया गया। TREE + Sc + Y का मान 445.6 से 1217.5 ppm तथा औसत 727.1 ppm रहा।

LKD–BH–04

Al_2O_3 का मान 17.44% से 27.48% तथा औसत 21.79% पाया गया। Ga का मान 14.9 से 31.3 ppm तथा औसत 20.8 ppm रहा। V का मान 95.9 से 366.6 ppm तथा औसत 178.5 ppm पाया गया। Ti का मान 0.55% से 1.45% तथा औसत 1.10% रहा। TREE का मान 226.7 से 504.3 ppm तथा औसत 399.3 ppm पाया गया। TREE + Sc + Y का मान 243.8 से 528.4 ppm तथा औसत 421.6 ppm रहा।

पिट, ट्रेंच और बोरहोल नमूनों के परिणामों से यह स्पष्ट होता है कि Al_2O_3 तथा संबद्ध महत्वपूर्ण तत्वों की सांद्रता सामान्यतः कम है। कुछ स्थानीय क्षेत्रों, विशेषकर जलनिकासी नालों के आसपास, उच्च मान प्राप्त हुए, जिन्हें प्राथमिक खनिजीकरण के बजाय अपक्षय एवं परिवहन से उत्पन्न द्वितीयक समृद्धि माना गया है। बोरहोल डेटा से भी गहराई के साथ खनिज मूल्यों में कोई महत्वपूर्ण वृद्धि नहीं पाई गई, जिससे यह पुष्टि होती है कि क्षेत्र में सतत अधस्तलीय खनिजीकरण अनुपस्थित है।

खनिज संभाव्यता मूल्यांकन से यह निष्कर्ष निकलता है कि प्रमुख शैल प्रकार—मुख्यतः क्लास्टिक अवसादी चट्टानें—आर्थिक रूप से व्यवहार्य बॉक्साइट अथवा संबद्ध महत्वपूर्ण खनिजों के लिए अनुकूल होस्ट नहीं हैं। यद्यपि पूर्वी भाग में मातानोमाध संरचना के भीतर कुछ छोटे लैटराइटिक पैच पाए गए, किन्तु उनकी सीमित विस्तार और निरंतरता के अभाव के कारण महत्वपूर्ण खनिज संचयन की संभावना समाप्त हो जाती है।

भूवैज्ञानिक मानचित्रण, भू-रासायनिक डेटा तथा ड्रिलिंग परिणामों के समेकित विश्लेषण के आधार पर अध्ययन यह निष्कर्ष देता है कि लाखोंड क्षेत्र बॉक्साइट अथवा संबद्ध महत्वपूर्ण खनिजों की दृष्टि से संभावनाहीन है। प्राप्त खनिज मान निम्न, स्थानीयकृत तथा आर्थिक रूप से अव्यवहारिक हैं। अतः प्रतिवेदन में अनुशंसा की गई है कि इस क्षेत्र में आगे कोई अन्वेषण कार्य न किया जाए तथा वर्तमान अवस्था में इस ब्लॉक को भविष्य के खनिज अन्वेषण हेतु गैर-सम्भावनाशील माना जाए।

SUMMARY

The Geological Report presents the results of a **G4 stage reconnaissance survey** carried out in the Lakhond area of Kachchh district, Gujarat, under the NMEDT programme. The investigation was undertaken by Critical Mineral Trackers with the objective of assessing the potential for **bauxite and associated critical minerals such as gallium (Ga), vanadium (V), titanium (Ti), and rare earth elements (REE)**. The study was initiated based on preliminary indications from satellite imagery, previous geological studies, and limited sample analysis suggesting possible lateritic and bauxitic occurrences.

The study area covers about **6.12 sq. km** and lies near Bhuj with good regional connectivity, though internal access is limited. The terrain is characterized by pediplains, residual hillocks, and semi-arid climatic conditions. Land use is predominantly agricultural, with minor rocky outcrops and localized industrial activity such as china clay processing. The geomorphology and drainage pattern, particularly the presence of nala systems, play a role in sediment redistribution and localized geochemical anomalies.

Geologically, the area forms part of the **Kachchh basin**, comprising Mesozoic to Cenozoic sedimentary sequences overlain locally by Deccan Trap volcanics. The main formations exposed in the study area include the **Bhuj Formation (Cretaceous)** and **Sandhan Formation (Pliocene)**, with minor occurrences of **Gaj and Matanomadh formations** along the eastern margin. These formations are mainly composed of sandstones, siltstones, clays, and shales deposited in fluvial to marginal marine environments. Importantly, the lithological characteristics indicate the absence of well-developed lateritic profiles necessary for significant bauxite formation.

The exploration programme involved **large-scale geological mapping (1:12,500 scale), pitting, trenching, sampling, laboratory analysis, and limited scout drilling**. A total of 20 pits, 5 trenches, and 4 boreholes were executed to understand both surface and subsurface conditions. Geochemical analyses were conducted for major oxides and trace elements including REE, using standard laboratory techniques such as XRF and ICP-MS.

Summary of chemical analysis of Pits & Trenches

Bhuj Formation:

The Al2O3 values range from 0.10 to 39.34% and Mean 22.22%, Gallium (Ga) values ranges from 13.1 to 50.85(ppm) and mean 30.33ppm, Vanadium (V) values range from 53.40 to 502.08 (ppm) and mean 243.98ppm, Ti values range from 0.52 to 9.59 % and mean value 4.07%, Total Rare Earth Elements (TREE) values range from 217.29 to 1469.62 (ppm) and mean value 679.43ppm, and also Total Rare Earth Elements(TREE) including Scandium and Yttrium (TREE +Sc + Y) values range from 241.50 to 1555.25 (ppm) and mean value 733.18 (ppm).

Matanomadh Formation:

The value of Al2O3 is 28.59 % , Gallium (Ga) has value of 41.73 (ppm), Vanadium (V) has 199.78 (ppm), Ti has 1.48 %, Total Rare Earth Elements (TREE) has 504.64 (ppm), and also Total Rare Earth Elements including Scandium and Yttrium (TREE +Sc + Y) has a value of 554.22 (ppm).

Gaj Formation:

The value of Al2O3 is 16.31 %, Vanadium (V) has 93.7 (ppm), Ti has 1.69 %, in this formation and not analysed for Gallium & REE.

Sandhan Formation:

The Al2O3 values range from 0.24 to 46.01% and Mean 21.91%, Gallium (Ga) values range from 14.68 to 41.48(ppm) and mean 28.43 (ppm), Vanadium (V) values range from 32.5 to 444.00 (ppm) and mean 180.86 (ppm), Ti values range from 0.79 to 4.56 % and mean value 2.40 %, Total Rare Earth Elements (TREE) values range from 311.00 to 748.57 (ppm) and mean value 520.39 (ppm), and also Rare Earth Elements including Scandium and Yttrium (REE +Sc + Y) values range from 375.13 to 795.15 (ppm) and mean value 570.12 (ppm).

Summary of chemical analysis of Boreholes

LKD – BH – 01:

The Al2O3 values range from 16.39 to 36.82% and Mean 29.00 %, Gallium (Ga) values ranges from 29.00 to 43.1(ppm) and mean 35.00 (ppm), Vanadium (V) values range from 68.60 to 243.70 (ppm) and mean 161.03 (ppm), Ti values range from 1.48 to 5.23 % and mean value 3.53 %, Total Rare Earth Elements (TREE) values range from 278.7 to 623.6 (ppm) and mean value 448.5 (ppm), and also Total Rare Earth

Elements(TREE) including Scandium and Yttrium (TREE +Sc + Y) value range from 307.5 to 661.9 (ppm) and mean value 480.8 (ppm).

LKD – BH – 02:

The Al2O3 values range from 8.22 to 28.90% and Mean 16.53 %, Gallium (Ga) value ranges from 17.9 to 40.9(ppm) and mean 25.3 (ppm), Vanadium (V) value ranges from 126.3 to 506.70 (ppm) and mean 268.70 (ppm), Ti values range from 2.37 to 9.87 % and mean values 5.20 %, Total Rare Earth Elements (TREE) values range from 329.9 to 636.0 (ppm) and mean value 476.4 (ppm), and also Total Rare Earth Elements(TREE) including Scandium and Yttrium (TREE +Sc + Y) values range from 357.1 to 679.9 (ppm) and mean value 517.1 (ppm).

LKD – BH – 03:

The Al2O3 values range from 16.59 to 34.51% and Mean 26.97, Gallium (Ga) values range from 20.7 to 46.7(ppm) and mean 32.8 (ppm), Vanadium (V) values range from 34.50 to 898.60 (ppm) and mean 331.29 (ppm), Ti values range from 0.39 to 4.21 % and mean values 2.02 %, Total Rare Earth Elements (TREE) values range from 421.8 to 1187.5 (ppm) and mean value 695.5 (ppm), and also Total Rare Earth Elements(TREE) including Scandium and Yttrium (TREE +Sc + Y) values range from 445.6 to 1217.5 (ppm) and mean value 727.1(ppm).

LKD – BH – 04:

The Al2O3 values range from 17.44 to 27.48% and Mean 21.79 %, Gallium (Ga) values range from 14.9 to 31.3(ppm) and mean 20.8 (ppm), Vanadium (V) values range from 95.9 to 366.6 (ppm) and mean 178.5 (ppm), Ti values range from 0.55 to 1.45 % and mean values 1.10 %, Total Rare Earth Elements (TREE) values range from 226.7 to 504.3 (ppm) and mean value 399.3 (ppm), and also Total Rare Earth Elements(TREE) including Scandium and Yttrium (TREE +Sc + Y) values range from 243.8 to 528.4 (ppm) and mean value 421.6 (ppm).

Results from pit, trench and borehole samples indicate **generally low concentrations of Al_2O_3 and associated critical elements**, with only sporadic higher values observed in localized zones, particularly along drainage channels. These anomalies are interpreted as secondary enrichments due to weathering and transportation rather than primary mineralization. Similarly, borehole data reveal no significant increase in mineral values with depth, confirming the absence of persistent subsurface mineralization.

The mineral prospect evaluation suggests that the dominant lithologies—mainly clastic sedimentary rocks—are not favourable hosts for economically viable bauxite or associated critical minerals. Although minor lateritic patches occur within the Matanomadh Formation along the eastern margin, their limited extent and lack of continuity eliminate the possibility of significant mineral accumulation within the block.

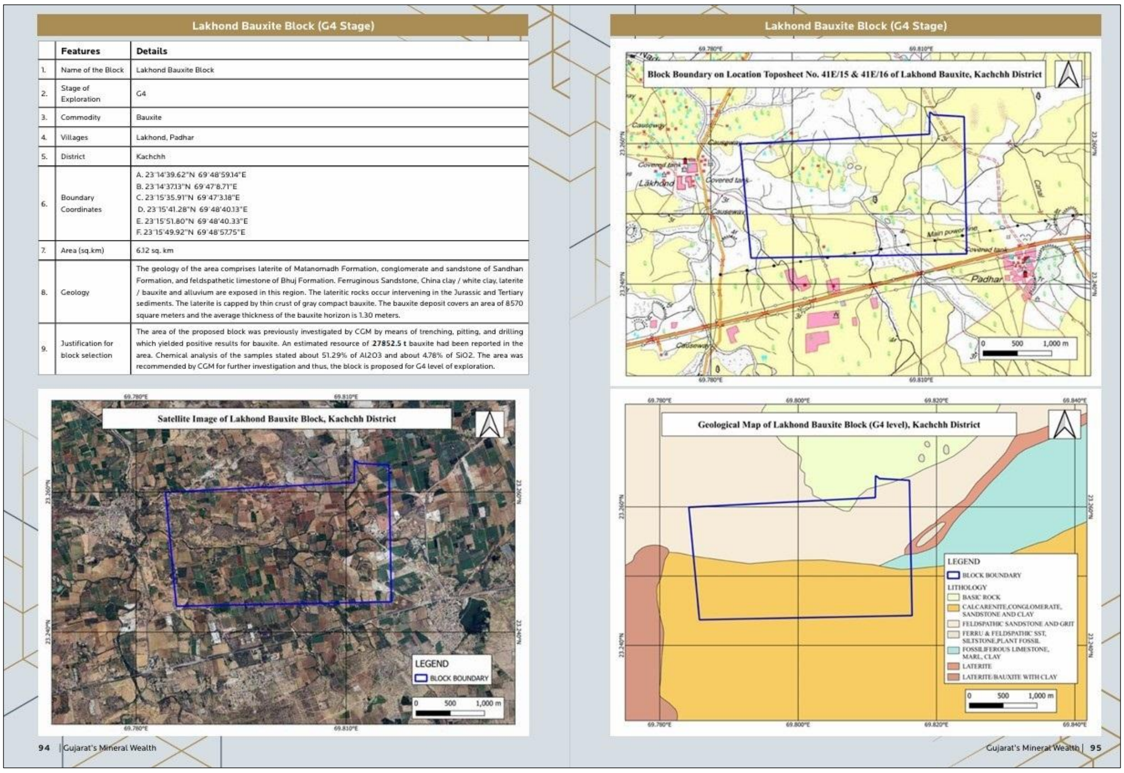
Based on the integrated interpretation of geological mapping, geochemical data, and drilling results, the study concludes that the **Lakhond area does not exhibit potential for bauxite or associated critical minerals**. The observed mineral values are low, localized, and not economically viable. Consequently, the report recommends that **no further exploration work be undertaken in this area**, and the block may be considered non-prospective for future mineral exploration at this stage.

CHAPTER – II

2.0 Introduction

The Commissioner of Geology & Mining, Gandhinagar, Gujarat organized one day workshop titled "Gujarat Mineral Wealth: A responsible exploration and development Paradigm on 17th August, 2024.Critical mineral trackers, 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 LAKHOND block, 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.


Lakhond Bauxite Block (G4 Stage)

	Features	Details
1.	Name of the Block	Lakhond Bauxite Block
2.	Stage of Exploration	G4
3.	Commodity	Bauxite
4.	Villages	Lakhond, Padhar
5.	District	Kachchh
6.	Boundary Coordinates	A. 23°14'39.62"N 69°48'59.14"E B. 23°14'37.13"N 69°47'8.71"E C. 23°15'35.91"N 69°47'3.18"E D. 23°15'41.28"N 69°48'40.13"E E. 23°15'51.80"N 69°48'40.33"E F. 23°15'49.92"N 69°48'57.75"E
7.	Area (sq.km)	6.12 sq. km
8.	Geology	The geology of the area comprises laterite of Matanomadh Formation, conglomerate and sandstone of Sandhan Formation, and feldspathetic limestone of Bhuj Formation. Ferruginous Sandstone, China clay / white clay, laterite / bauxite and alluvium are exposed in this region. The lateritic rocks occur intervening in the Jurassic and Tertiary sediments. The laterite is capped by thin crust of gray compact bauxite. The bauxite deposit covers an area of 8570 square meters and the average thickness of the bauxite horizon is 1.30 meters.
9.	Justification for block selection	The area of the proposed block was previously investigated by CGM by means of trenching, pitting, and drilling which yielded positive results for bauxite. An estimated resource of **27852.5 t** bauxite had been reported in the area. Chemical analysis of the samples stated about 51.29% of Al2O3 and about 4.78% of SiO2. The area was recommended by CGM for further investigation and thus, the block is proposed for G4 level of exploration.

Fig No: 1

CMT has undertaken a few field traverses in Lakhond block during 3rd week of November,2024 and collected representative samples and analysed at Lucid laboratory, Hyderabad (NABL accredited).

Subsequently CMT has prepared a proposal titled "Proposal for Bauxite exploration in Lakhond Block, Kachchh District, Gujarat State, Reconnaissance Survey (G4 Stage) under NMET falling under toposheets no: 41E/15 and 41E/16 incorporated the analytical results of selected samples and submitted to The Director, National Mineral Exploration Trust (NMET), Ministry of mines on 11th 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 Lakhond 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 22nd January, 2025 with an approved cost of Rs 60,01,701/- and communicated to M/s Critical mineral trackers Pvt Limited vide file no:23/569/2025-NMET/848 dated 10th February ,2025 and corrected version in the name of Critical mineral trackers was issued subsequently vide File no: 23/570/2025-NMET/900 dated 24th February, 2025.

The cost sheet has been revised on 12th Sept, 2025. vide OM no:23/569/2025-NMET/377 with an approved cost of Rs 68,75,922/- in 9th TCC-II (based on inhouse drilling programme). The final revision of cost sheet was done in 25th TCC-II held on 17th &18th march,2026 with an approved cost of Rs62,55,187/-

Accordingly, Critical mineral trackers-initiated field work on 14th Fenruary,2025 and completed large scale mapping in an area of 6.12 Sq.km, pitting, trenching and sampling works by 30th April,2025.

Objective of the Investigation: is to undertake **"*Reconnaissance Survey (G4) for Bauxite, Ga, V, Ti and REE in Lakhond area, Kachchh District, Gujarat".***

2.1 Investigating Agency:

Critical mineral trackers, an NPEA (Notified private exploration agency) based at the following 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.

E-mail of Prospector: criticalmineraltrackers@gmail.com
director.ops@criticalmineraltrackers.co.in
enquiry@criticalmineraltrackers.co.in

Critical Mineral Trackers is having 6 internal Technical Area Experts having decades of experience during service in GSI, MECL and other reputed earth science organisations. Similarly, more than 8 NABET accredited external Technical Area Experts and several other senior experts from different domains of earth sciences are on its panel of experts.

Besides, CMT Geo Solution Center, a wing of Critical Mineral Trackers is based at No E5, 3rd Floor, Technology Research Park, Indian Institute of Technology, Hyderabad, Kandi, Sanga Reddy – 502 284 is mostly concentrating on the application of RS/GIS and AI/ML technologies in mineral targeting using the baseline data viz., Geological, Geochemical and Geophysical data of GSI.

2.2 Basis for taking up the investigation:

Mineral potentiality was based on baseline data viz. geology, geophysics, ground geochemistry of the study area. As per the compilation by the Commissioner of Geology and Mines (CGM), Gujarat, on Mineral resources of the Gujarat, the proposed block comprises Deccan Traps, and the analysis of the satellite imagery of the proposed block seem to have indicated the presence of laterite/bauxite deposits. And the previous works of GSI between 1895 and 2022 also indicated the potential occurrence of lateritic bauxite and bauxite associated with litho-units of Matanomadh Formation and Anjar volcanics of Deccan Traps in the study area.

CGM has awarded this work to Critical Mineral Trackers (CMT). CMT has undertaken pre-field work during the 3rd week of November 2024 and analysed 3 samples for Bauxite &Titanium. The Al2O3 values varies from 43.78% to 48.78%, but the respective SiO_2(4.23-31.06%) and Fe_2O_3(1.69-17.04%) values are high and TiO_2 varies from 1.93 to 3.49%.CMT has prepared a proposal based on these results and submitted to NMET on 11th December 2024. During the review of the proposal, TCC-II has opined that this area may be potential for Gallium, Vanadium, Titanium & REE besides bauxite during 4th TCC-II meeting held on 26th & 27th December,2024, and hence included them in the project for investigation.

2.3 Objective of Investigation

Lakhond 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 formations (host rock) with the structural features to identify the surface manifestation and lateral disposition of the mineralized zones.

Table 2.1: 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	6.12	6.12
2	**Exploratory Mining**			
a	Excavation of pits (20 no's), size: 1*1*1	Cu.m	20	20
	Pit samples collected	Nos	20	20
b	Excavation of Trenches (5 no's), Size 10*1*1	Cu.m	50	50
	Trench samples (14*5=70) collected	Nos	70	70
3	**DGPS survey (6 block boundary points & 4 Borehole points)**	points	10	10
4	Scout drilling: 4 boreholes of 30m depth each (4*30=120m)	meters	120.00	101.00
a	Construction of borehole pillar	no's	4	4

b	Compensation for 4 Bhs	no's	4	-
c	Drill core preservation in GI boxes	meters	120	96
5	**Laboratory Studies**			
	Major oxides by XRF (Trench-70, pit-20, BH-40 =130 + 13 check samples)	Nos	143	(92+36) +(10+4) check =142
	REE 14 Elements by ICPMS 33+ 3 check	Nos	36	(15+15) +(2+2) check=34
	Combined determination of THA, MHA and Reactive silica	Nos	4	2
7	Preparation of polished thin sections	Nos	10	5
8	Complete petrographic//ore2qw34567 90- [21-microscopic / mineragraphic studies	`	10	5
9	XRD Mineral phase analysis	Nos	4	3
10	Report Preparation (5 Hard copies with a soft copy)	Nos.	1	1

2.4 Details of mode of operation of different work components

Table 2.2

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 & drilling	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

2.5 Personnel involved:

Table No: 2.3 Details of Personnel Associated with the exploration work are as under:

1	**Overall Planning, Co-ordination & Overall supervision**	:	S.Rama Murthy (Retd Dirctor, GSI), Technical area Expert (In house)
		:	S.Uma Maheswara rao (Retd Scientist, MECL), Technical Area Expert (In house)
3	**Project management & Field Operation**	:	S.Rama murthy, Technical area Expert (In house) S.Uma maheswara rao, Technical Area Expert (In house)
		:	B. Mahesh, Geologist (In house Team Member)
5	**Chemical Laboratory**	:	LUCID Laboratory Private Limited, Hyderabad, (NABL Accredited laboratory)
6	**Petrological studies**	:	Petrology Divn., Geological Survey of India, Southern Region, Hyderabad
8	**Data Processing & Documentation**	:	Shri S.Rama murthy, Technical area Expert (In house)
		:	S.Uma maheswara rao, Technical Area Expert (In house)
			Mr B. Mahesh, Geologist (In house Team Member)
9	**Reprography & Printing**	:	Mr. B. Mahesh Geologist (In house Team Member)
		:	Mr. V. Siva Kumar, Geologist (In house Team Member)

CHAPTER – III

3.0 Property Description

3.1 Location

Lakhond block admeasuring an area of 6.12 sq. km is bounded by latitudes 23.24364461°N to 23.26429575°Nand longitudes 69.78421958°E to 69.81640133°E lies under the administrative boundary of Bhuj Tehsil, Kachchh District of Gujarat. Bhuj is the nearest town and district head-quarters located 18 km towards west. Lakhond village lies at the western boundary and outside the study area. Four China clay processing plants are located within the block at the eastern boundary. The location map of the block is furnished as Text Fig No-1 as well as Plate No-I.

The Block is falling in parts of Survey of India Toposheet No 41E/15 and 41E/16. The coordinates of the cardinal points of the block boundary are given below in Table No. 3.1 and Annexure - I

Table No 3.1

Details of coordinates and elevation of 6 cardinal points

as determined by DGPS Survey

Cardinal Points	Geographic Coordinate System in Degree Decimal (WGS 1984)		UTM (WGS 1984, Zone 42N)			Area in Sq. Km
	Latitude (N)	Longitude (E)	Elevation (m)	Northing (m)	Easting (m)	
A	23.24428892	69.81640133	122.97	2570797.727	583516.695	6.12
B	23.24364461	69.78577922	116.156	2570709.109	580384.345	
C	23.25995236	69.78421958	121.514	2572513.684	580215.033	
D	23.26138486	69.81115114	119.173	2572687.425	582969.005	
E	23.26379086	69.81606814	120.549	2572956.616	583470.469	
F	23.26429575	69.81115711	122.990	2573009.696	582967.814	

3.2 Accessibility

Lakhond Block has good road and rail connectivity. The Bhuj–Bhachau State Highway (SH-42) passes just south of the block at a distance of about 0.6 km. A 2.5 km long link road connecting Lakhond village to SH-42 runs parallel to the western boundary of the block, but lies outside the block area. SH-42 further connects to National Highway-341 (Anjar–Bhuj Highway) near Kukma, located about 2.5km west of this junction.

The nearest railway station is Kukma, situated about 5 km southwest of the block on the Gandhidham–Bhuj line of Western Railway. Bhuj Railway Station and Bhuj Airport are also easily accessible and are located about 18 km west of the block.

However, within the block, access is limited to unmetalled roads that criss-cross the area.

3.3 Climate

The area of study and its surroundings experience 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)*

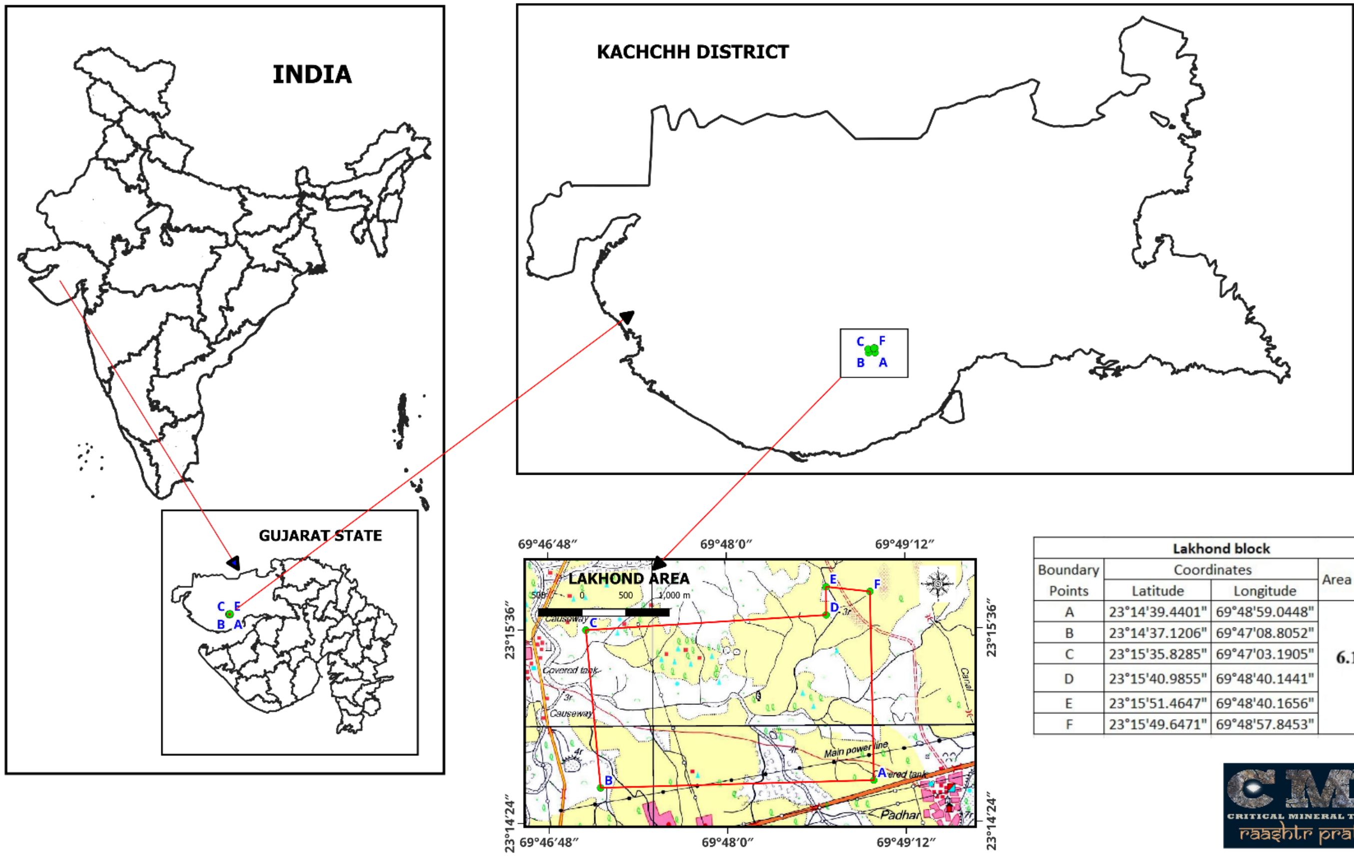
Average annual Rainfall: 483.00mm (1994-2024) **

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

3.4 Cadastral Details and Land Status

The block encompasses the Cadastral Survey Numbers falling within the revenue limits of Lakhond village (Toposheet No. 41 E/15 & 41 E/16). The land use pattern within the investigated area is predominantly characterized by Agricultural lands and a significant portion as Government Waste Land, Barren Rocky terrain towards Northwest. There are four small China clay processing plants present within the study area

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



Lakhond block			
Boundary Points	Coordinates		Area (sp.km)
	Latitude	Longitude	
A	23°14'39.4401"	69°48'59.0448"	6.12
B	23°14'37.1206"	69°47'08.8052"	
C	23°15'35.8285"	69°47'03.1905"	
D	23°15'40.9855"	69°48'40.1441"	
E	23°15'51.4647"	69°48'40.1656"	
F	23°15'49.6471"	69°48'57.8453"	

Fig No: 2

3.5 Land use & Land cover Pattern

The Land Use/Land Cover (LU/LC) map of the study area was prepared based on the tonal and textural characteristics of satellite imagery, supplemented by features interpreted from the toposheet and field observations collected during large-scale geological mapping. Individual land use/land cover units were delineated, digitised, classified, and appropriately labelled.

The majority of the study area (81%) is occupied by agricultural land, which includes both cultivated fields and fallow lands. Major crops grown in the area include castor, bajra, jowar, wheat, groundnut, mustard and vegetables. These agricultural lands are mainly developed over pediplain and pediment surfaces distributed along the southern, eastern, and northern parts of the study area.

A few isolated patches of plantations, mainly consisting of mango and pomegranate orchards, occur in the central part of the study area and categorised under plantation category (3.43%)

The residual hillocks/ridge present in the north-western part of the study area, along with a few scattered mounds in the central part, are characterised by rocky outcrops and sparse vegetation dominated by thorny babul trees. These areas are classified under the Rock Knobs category (8.82) %).

The main tributary of Pur nadi (locally called as Kurnai) which drain the Lakhond area, has been mapped under the water bodies category (2.45%).

Within the block, four China clay processing plants are located along the eastern margin and are classified under habitations/infrastructure (3.43%). The residue generated from the processing of China clay, after separation of the clay and silica-sand fractions, is disposed of on the surrounding barren lands. Such waste dumps are observed near the eastern part of the block. Barren land & Shrub land occupies 0.81% & 0.16% respectively in the south-western margin.

The Land Use/Land Cover map of the study area prepared by CMT is presented as Fig. No. 3.

3.6 Flora and Fauna

Lakhond and its surrounding areas lie 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.

3.7 Geomorphology

The study area is predominantly characterised by pediplains and pediment surfaces developed in the southern, eastern, and northern parts of the block. These areas are covered by red, brown, and yellow soils which support good agricultural activity. The elevation in these pediplain–pediment regions ranges between 115 m and 120 m above mean sea level (MSL). Major crops cultivated in the area include castor, bajra, jowar, wheat, groundnut, mustard and vegetables, largely supported by tube-well irrigation. In addition, mango and pomegranate orchards are observed in the central part of the study area.

Residual hillocks/ridge occurring in the north-western part of the study area are characterised by rocky outcrops and sparse vegetation dominated by Acacia trees and other thorny bushes, attaining the highest elevation of about 135 m above MSL.

The west-flowing tributary of Pur Nadi (locally called as Kurnai) drain the area and occupy the lowest topographic levels, with elevations around 105 m above MSL.

3.8 Local infrastructure

Lakhond village is located about 0.7 km west of the block boundary, while Bhuj, the nearest town and district headquarters, lies approximately 18 km to the west of the block. A Primary Health Centre (PHC) is available near Padhar village, situated on the south-eastern side of the block.

Within the study area, four China clay processing plants are present. These units procure China clay from external sources and the raw material is crushed & processed here to separate clay and silica-sand fractions. The residual waste material generated during processing is disposed of on adjacent barren land.

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

3.9 Population

Lakhond is a large size village located in Bhuj Taluka of Kachchh district, Gujarat with total 682 families residing. The Lakhond village has population of 3136 of which 1560are males while 1576 are females as per Population Census 2011.Out of total 682 families, 289 families belong to schedule caste and 11 families to schedule tribe

In Lakhond village population of children with age 0-6 is 473 which makes up 15.08 % of total population of village. Average Sex Ratio of Lakhond village is 1010 which is higher than Gujarat state average of 919.

Lakhond village has lower literacy rate compared to Gujarat. In 2011, literacy rate of lakhond village was 68.61 % compared to 78.03 % of Gujarat. In Lakhond Male literacy stands at 78.27 % while female literacy rate was 59.29 %. As per constitution of India and Panchyati Raaj Act, Lakhond village is administrated by Sarpanch (Head of Village) who is elected representative of village.

3.10 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.

3.11 Historical / Archaeological Site

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

3.12 Mineral(s) under investigation or granted under license or lease

The LAKHOND area was explored for the possible occurrences of Bauxite, Ga, V, Ti and REE. No existing licenses or lease for the above commodities.

LAND USE / LAND COVER MAP OF LAKHOND AREA, KACHCHH DISTRICT, GUJARAT

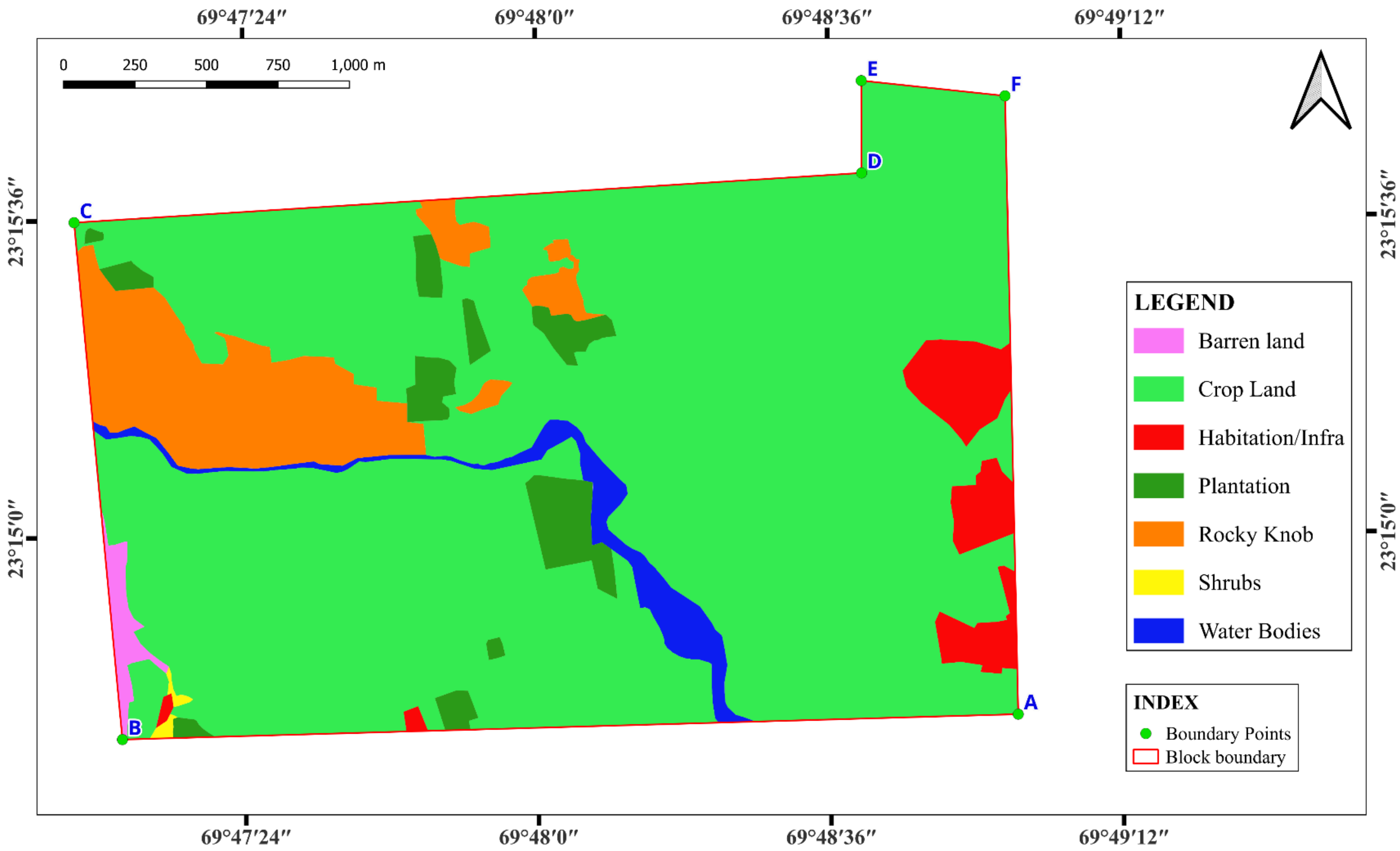


Fig No: 3

CHAPTER – IV

4.0 PREVIOUS WORK

The Kachchh region has attracted the attention of geo-scientists on account of its unique exposures of Mesozoic rocks and their rich fossil records. *Wynne* A.B. (1872) is a pioneer worker who has mapped Kachchh on 1”: 4-mile scale and given detailed

sediments into two major units i.e. marine and non-marine. *Waggen* (1875) studied the ammonite fauna correlating them with known European Zones to assign their age. *Waggen after Stoliczka*, (1875) gave first four-fold classification of the Mesozoic rocks into Patcham, Chari, Katrol and Umia in ascending order. Since then, this four- fold classification has been adopted widely with modifications from time to time. Subsequently *Gregory* (1893), *Kitchin* (1910), *Spath* (1933), *Cox* (1940) and others added information about the area, especially on invertebrate fossils. *Rajnath* (1932) modified the classification by distinguishing Bhuj stage and later on establishing it as separate as Bhuj Series. He subdivided Katrol Group into Lower, Middle and Upper Stages. Agrawal (1957) proposed Habo Series to replace the Chari Series from the fourfold classification of Waagen. He also suggested Mebha oolites for Dhosa oolite beds but these suggestions were not accepted by subsequent workers. *Mitra* & *Ghosh* (1964) carried out biostratigraphic work in Jhura dome area and gave more importance to brachiopods. He suggested that the brachiopod assemblage zone should be used for correlation and classification instead of ammonite zones. Biswas (1971, 74) proposed a comprehensive lithostratigraphic classification of Mesozoic and Tertiary rocks of Kachchh in accordance with the code of stratigraphic nomenclature of India. He subdivided the Mesozoic rocks in to Jhurio, Jhumara, Jhuran and Bhuj Formations in ascending order. *Biswas* (1987) has discussed the sequential development of the Kachchh basin and its regional tectonic framework. The Jhurio, Jhumara and Jhuran Formations in Biswas’ classification approximately correspond to Patcham, Chari and Katrol Formations of Waagen respectively. Lower part of Umia series of Waagen is included with Jhuran Formation of Biswas. He included the nonmarine sequence with Bhuj Formation and the boundary between Jhuran and Bhuj Formation is based on first appearance of Iron Formation or last appearance of calcareous sandstone. Ghevariya and Srikarni (1987), Ghevariya and others (1983-84, 1985-86, 1988-89) have extensively carried out mapping in the area and added valuable information about the stratigraphy and palaeontology of the area. Merh (1995) provided comprehensive account of the stratigraphy, tectonics, geomorphology and mineral resources of Gujarat in his book titled "Geology of Gujarat"

The proposed Lakhond area has not been previously explored for bauxite, gallium (Ga), vanadium (V), titanium (Ti), or rare-earth elements (REE). The area may fall within the coverage of the Kachchh Geochemical Mapping Programme (KGCMP).

A few China clay (kaolin) processing units are located along the eastern boundary of the block.

CHAPTER – V

5.0 Regional Geology of the area

5.1 Introduction

The proposed Lakhond 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. Mesozoic of Kachchh have attained significance on account of its rich fossil record of marine Jurassic in India and are overlain 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 (1971), and Ghevariya et al (1984a, 1984b) and Ghevariya and Srikarni (1991) from time to time. The general strike is East-West and with gentle to moderate dipping towards South, SE and SW.

Pachcham (Jhurio) Formation: Pachham Formation 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 and Upper members 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 intertrappean beds are recorded interstratified with deccan lava flows (Ghevariya &Srikarni,1988,1990) 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), 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).

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 argillaceous sandstones and clay of yellow, pink, brown and variegated colours.

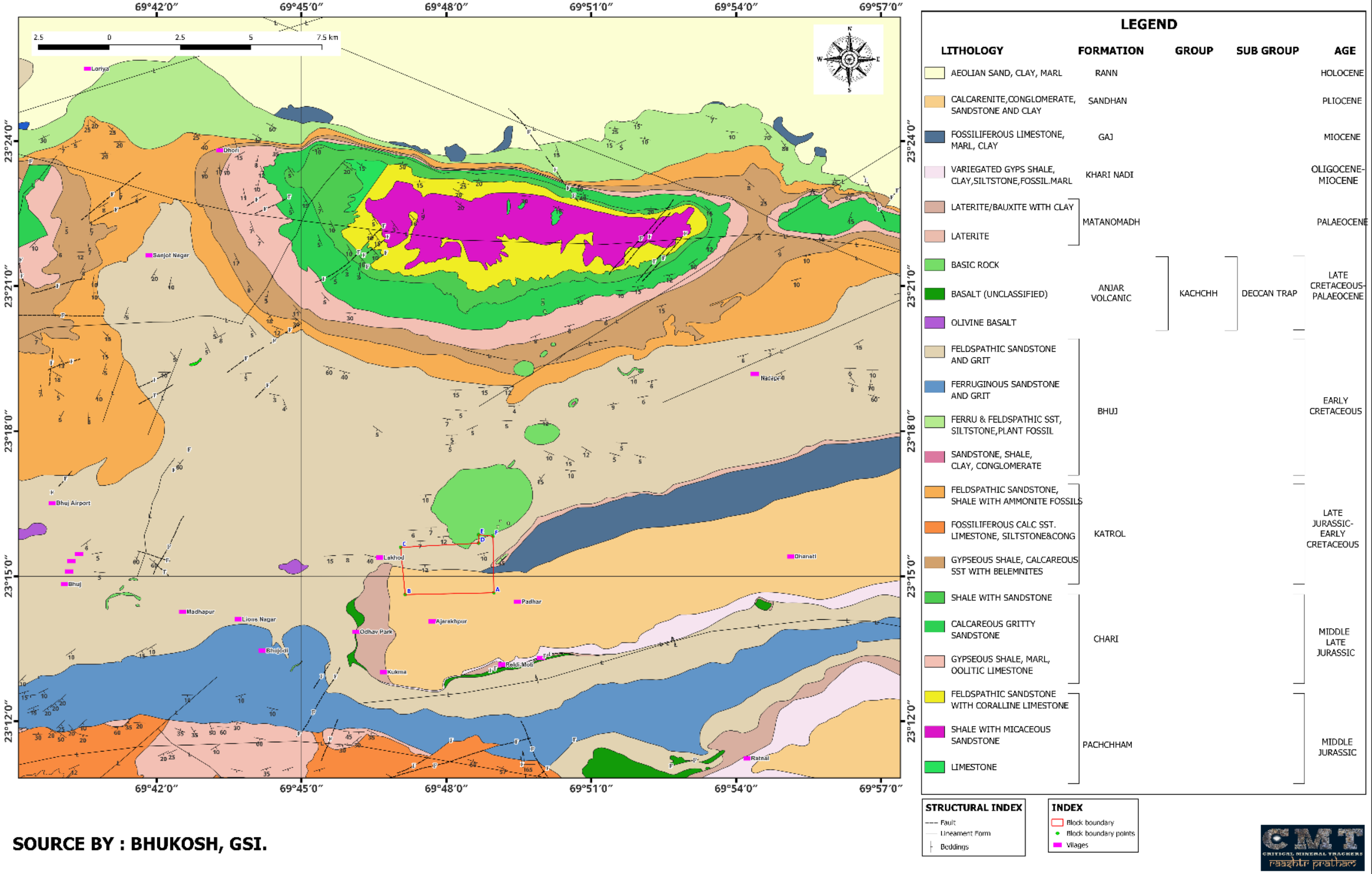
Holocene: Holocene deposits of Kachchh belongs to two categories namely 1. Sediments of the Rann in the north and 2. Coastal mud flats and sandy beaches in the south.

Table No: 5.1 Generalised stratigraphic succession of Kachchh mainland basin

(Source: 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 Gups 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, calc sandstone, limestone, siltstone
Middle to late Jurassic			Chari (Jhuran)	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 LAKHOND AREA, KACHCHH DISTRICT, GUJARAT



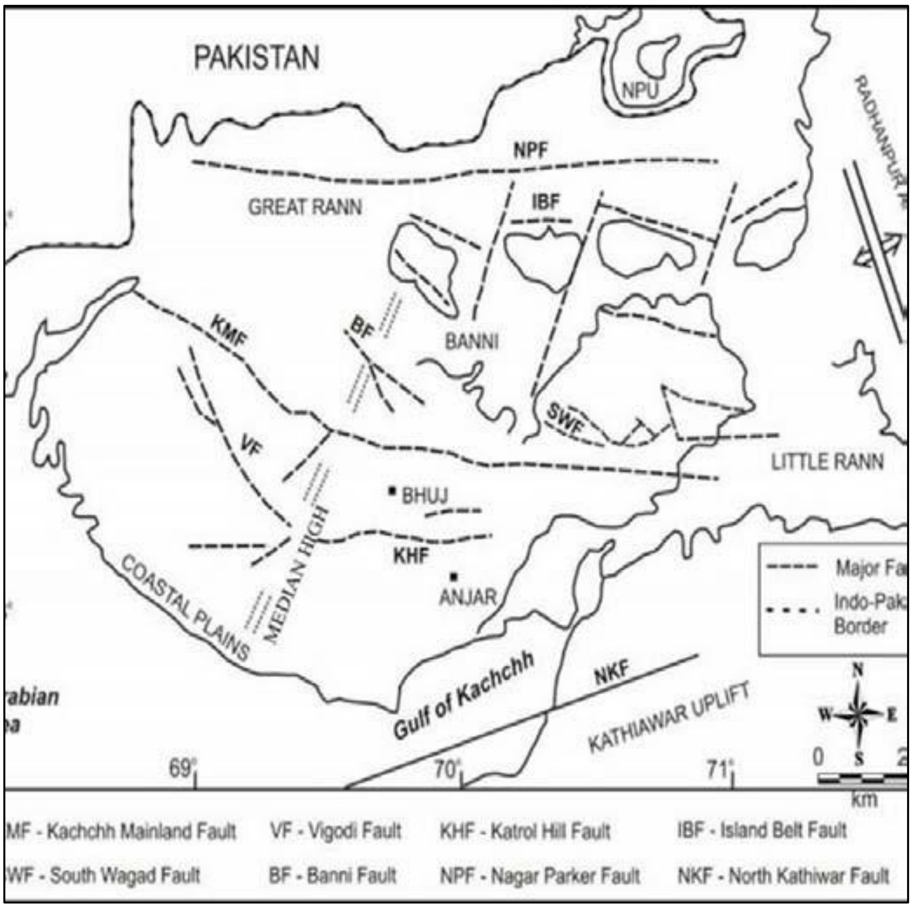
SOURCE BY : BHUKOSH, GSI.

Fig No: 4

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: 5 Tectonic maps of Kachchh (after Shukla, 2011)



5.3 Metamorphism

The area comprises Tertiary sedimentary rocks belonging to Bhuj and Sandhan formations of early Cretaceous and Pliocene respectively. No indications of metamorphis are found in the area

5.4 Host Rock for Mineralisation: No major minerals of economic importance are found in the area. However, most of the samples analysed both from Bhuj and Sandhan formations and plotted in the Ternary diagram (Bardoshshi,1981) are falling in field of Bauxitic clay (. One of the bed rock samples from Bhuj Formation near borehole No.3 analysed relatively higher TREE values 1187.5 but it is also noticed that these values are decreasing with the depth

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 6.12 Sq. Km in **Lakhond 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. Drilling

6.1 Large scale Geological Mapping (1:12500 scale)

Systematic large-scale geological mapping was carried out in the study area on a 1:12,500 scale during the period 14th February to 30th April, 2025. Traverses were conducted in a grid pattern, and at each observation point the lithological and structural characteristics of the exposed rocks were recorded.

Two major geological formations are exposed within the Lakhond block. The Bhuj Formation (Lower Cretaceous) occupies the northern part of the area, while the Sandhan Formation (Pliocene) is exposed towards the southern part. Minor occurrences of basic rocks belonging to the Anjar Volcanics (Late Cretaceous–Palaeocene) are observed near the northern boundary of the block. In addition, small patches of Gaj Formation (Miocene) and Matanomadh Formation (Oligocene–Miocene) are present along the eastern margin of the study area.

The tributary of Pur Nadi, flowing westwards through the central part of the study area, more or less forms faulted boundary separating the Bhuj Formation in the north from the Sandhan Formation in the south because of omission of strata that brings younger Sandhan formation (Pliocene) in juxtaposition to older Bhuj formation (early cretaceous)

The Bhuj Formation is predominantly composed of ferruginous gritty sandstone, which is very hard and compact in the upper part. This is followed by medium- to coarse-grained, friable, feldspathic sandstone of pinkish-white to greyish-white colour, often showing cross-bedding and graded bedding structures and interbedded with clay and siltstone layers. Minor shale intercalations are also present, though they are not laterally persistent. The sandstones are typically buff to reddish-brown in colour, suggesting deposition in a fluvial to marginal marine environment.

The Anjar Volcanics, represented by basic rocks, are considered to either overlie or occur intercalated with the Lower Cretaceous sedimentary sequence of the Bhuj Formation.

Younger Tertiary sediments, particularly the Gaj Formation of Miocene age, occur patchily in the area and consist of conglomerate, calcareous sandstone, and marl, representing shallow marine shelf deposition.

The Sandhan Formation (Pliocene), the youngest formation in the study area, occupies the southern part of the block and is composed of pink, yellow, and variegated argillaceous sandstones interbedded with white clay bands or lenses. These rocks are generally soft and highly friable in nature.

6.1.1 Description of lithology

Bhuj Formation

The Bhuj Formation, the oldest formation exposed in the study area, occurs predominantly in the northern part of the Lakhond block. In the study area, it is mainly represented by residual hills and pediments in the western part, which are covered by thorny shrubs and trees, whereas the pediplain areas in the southern, central and eastern parts are largely occupied by agricultural lands.

Lithologically, the Bhuj Formation is composed of hard ferruginous gritty sandstone forming the upper part, underlain by feldspathic, friable, medium- to coarse-grained sandstones of pinkish to greyish-white colour. These sandstones commonly exhibit cross-bedding and graded bedding structures. The feldspar grains are partly to completely kaolinized at places, resulting in the formation of kaolinitic clay associated with sand grains. The sandstones are frequently interbedded with clay layers (pink and white) and shale bands (pinkish-brown).

Field photographs and description of various lithological units noticed in Bhuj Formation are given below:

Photo No – 1: 1.01 km east of Lakhond in northwestern part of the block. Hard ferruginous Sandstone pebbles on the top followed by Pinkish-white, fine to medium grained, thinly laminated, friable feldspathic sandstone is exposed along the slope. Cross-bedding is observed within these rocks.

Photo No – 2: 2.22 km east side of the Lakhond. Reddish-brown laterite and gritty sandstone on the top underlain by pinkish white, greyish-white, friable feldspathic sandstone with white kaolinitic clay bands. Cross bedding and sand dyke's structures are noticed.

Phot No – 3: 1.95 km east of Lakhond. Ferruginous gritty sandstone shows well-developed sub horizontal bedding on the top followed by friable white feldspathic kaolinized sandstone/ clay beds at bottom.

Photo No – 4: 2.39 km east of Lakhond. The uppermost part is composed of hard, compact ferruginous sandstone, which is underlain by laterite and bauxitic clay at the bottom.

Photo No – 5: The area is situated approximately 1.47 km to the northeast of Lakhond, on the west side of the water tank, along the pediment area composed of reddish-brown, fine- to medium-grained, splintery ferruginous sandstone on the surface showing 2 sets of joints.

Photo No – 6: The exposure is located about 3.34 km east of Lakhond village and approximately 2.01 km from the SH–42 road. Laterite/bauxitic clay of pinkish to yellowish-white colour, with lenses of yellow clay, is exposed along the right bank of nala. The exposure extends for about 30 m in length and approximately 2 m in height, and contains occasional lenses of white clay and iron oxide patches.

Basalt

Although the northern part of the block area (0.09sq.km area) was mapped as basalt of the Anjar Volcanics by earlier workers, no in-situ rock exposures were observed during the present study. The area is predominantly covered by light grey soil and is largely under agricultural use. However, scattered small pebbles of basalt were observed on the surface, indicating the possible presence of basaltic bedrock beneath the soil cover.

Description of basic rocks area with field photograph

Photo No – 7: No outcrops of basalt are observed along the northern boundary of block, (2.95km NE of Lakhond village,) however, scattered pebbles of basic rock occur in the area.

Matanomadh Formation

The Matanomadh Formation (Oligocene–Miocene) is stratigraphically younger than the Bhuj Formation. A small patch(0.01Sq.km) of this formation occurs along the eastern margin of the study area and is represented by ferruginous conglomerate, reddish-brown laterite, and pinkish-white clays. Field observations indicate that this formation does not extend further westwards within the study area.

Description of Bhuj vs Matanomadh Formation with field photograph

Photo No – 8: Along the nala, about 4.0 km northeast of Lakhond village, hard ferruginous conglomerate exhibiting botryoidal structures is exposed along nala. This exposure may mark the contact between the Bhuj and Matanomadh formations, although the Matanomadh Formation itself is not clearly exposed.

Gaj Formation

A small patch (0.07Sq.km) of the Gaj Formation (Miocene), stratigraphically younger than the Matanomadh Formation, is exposed on the eastern side of the Lakhond area. The outcrops are scanty in nature and occur about 1.16 km from SH-42. Lithologically, the formation is represented by yellow/pink siltstone interbedded with clay. At present, the exposure is largely concealed by a China clay processing plant established over the area.

Sandhan Formation

The southern portion of the Lakhond area is largely covered by the Sandhan Formation (Pliocene), the youngest stratigraphic unit in the region. An east– west trending tributary of Pur Nadi divides the area, with the Bhuj Formation on the northern side and the Sandhan Formation on the southern side. Most of the area is represented by pediplains and is covered by red, yellow, brown soils. These soils support extensive agricultural activities in this area mostly by tube well cultivation. Along the tributary of Pur Nadi section exposed whitish-pink fine- to medium-grained feldspathic sandstone, yellow fine- to medium-grained argillaceous sandstone, white marl, calcarenite sandstone and clay bands/laminations.

Description of various lithological units encountered in Sandhan formation with field photographs

Photo No – 9: 1.49 km northeast of Lakhond. Laminated, arkosic, friable, pinkish-white sandstone with white clay bands is exposed. The feldspathic sandstone is kaolinized, with feldspars altered to clay. Cavernous structures have developed due to the weathering and removal of soft clay lenses.

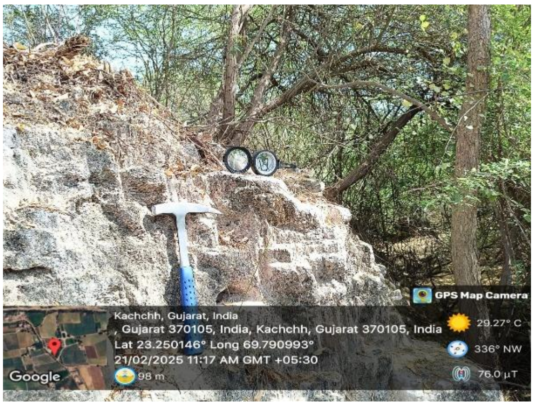


Photo No – 10: At approximately 1.56 km northeast of Lakhond village, near a small temple on the northwestern side of the block boundary. Pinkish-white laminated friable argillaceous sandstone is exposed.

Photo No – 11: At about 1.71 km northeast of Lakhond village, along south bank of tributary of Pur Nadi exposed ferruginous fine-grained reddish-brown sandstone at the top, underlain by pinkish-white fine to medium grained argillaceous sandstone containing clay lenses, and yellow sandstone at the base. Cavernous structures are observed within the pinkish-white sandstone.

Photo No – 12: Traverses along tributary of Pur Nadi where fine grained argillaceous pink/yellow friable sandstone of Sandhan formation was exposed along southern bank and hard, ferruginous gritty sandstone of Bhuj formation was exposed towards northern bank.

Photo No – 13: it is located about 1.60 km SE of Lakhond village, near boundary point B on the southwestern side of the block boundary, where pinkish-white clayey bauxite is exposed along a nala.

INTERPRETED LARGE SCALE GEOLOGICAL MAP OF LAKHOND AREA, KACHCHH DISTRICT, GUJARAT

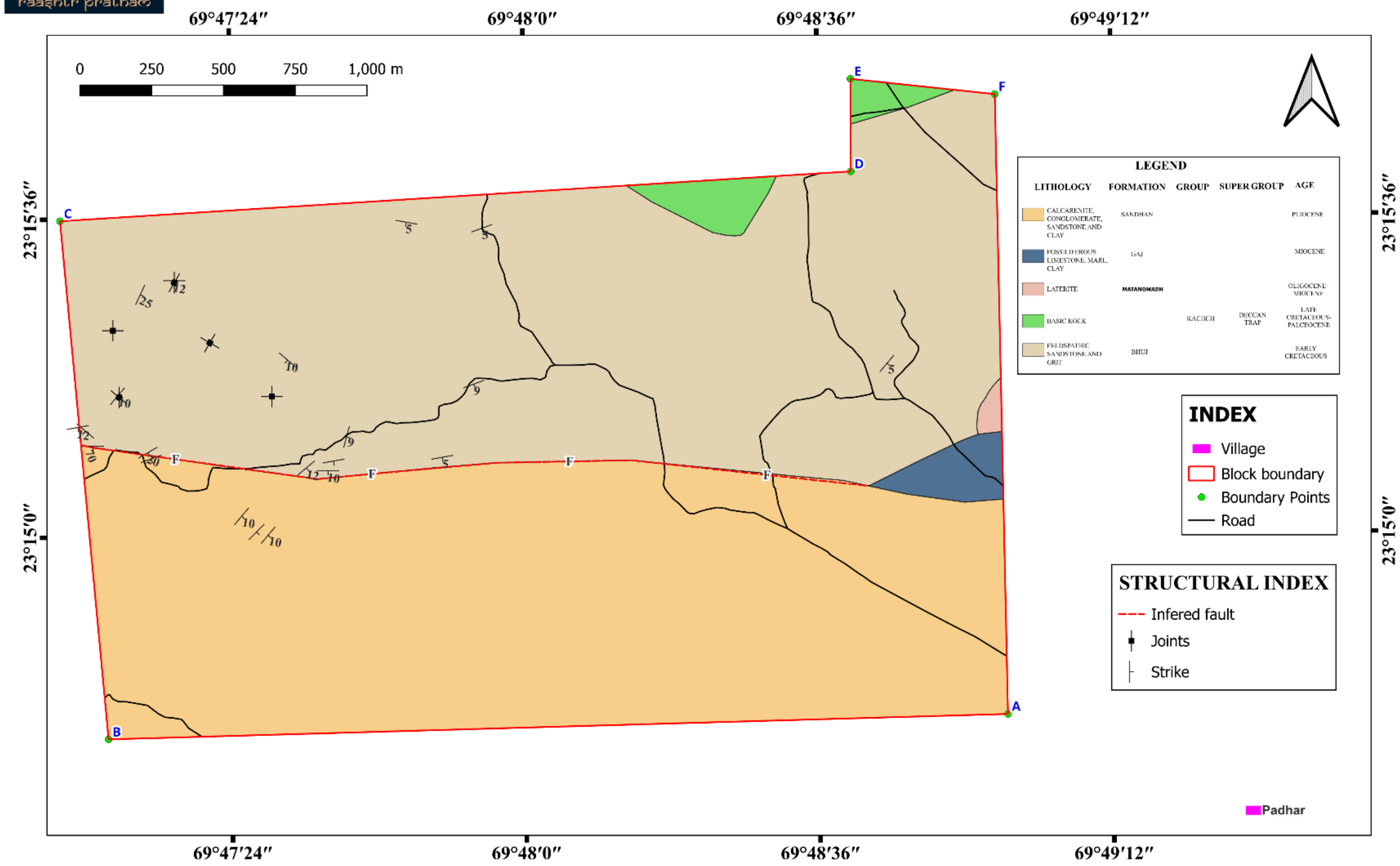
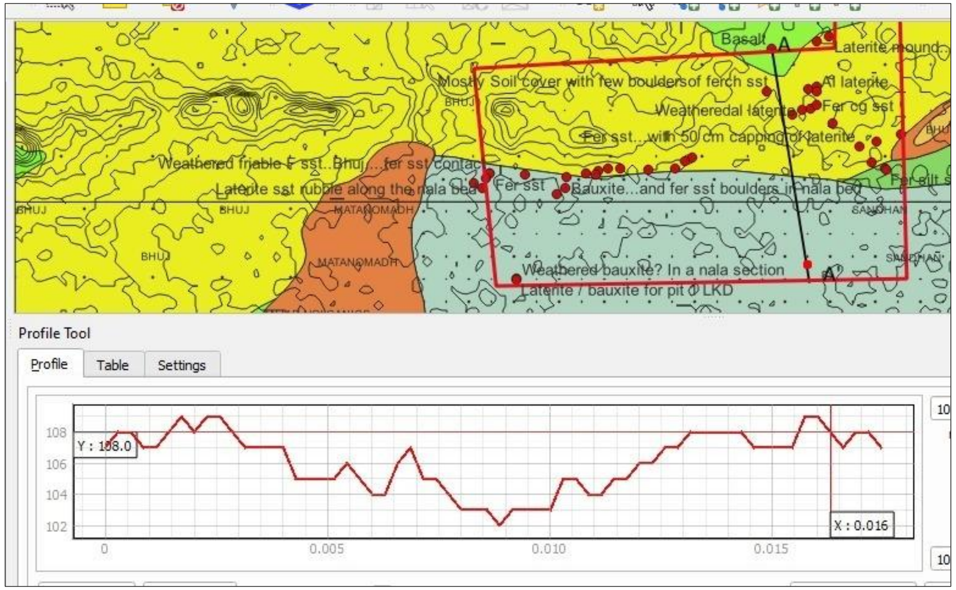


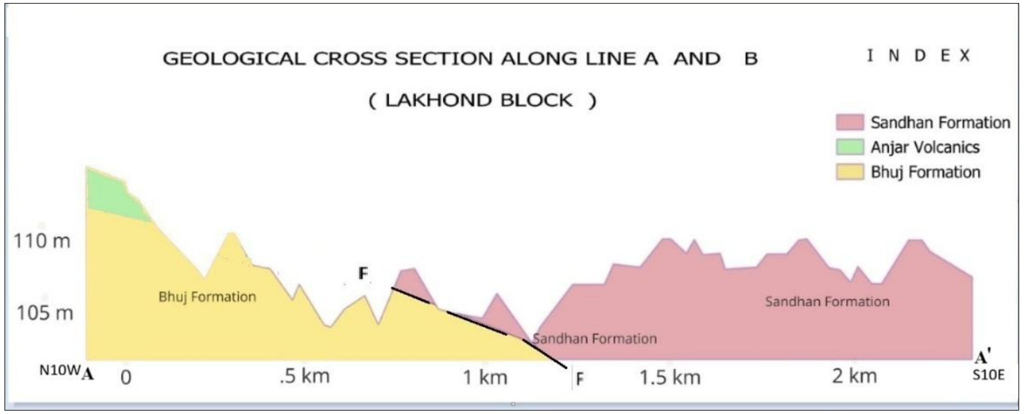
Fig No: 6

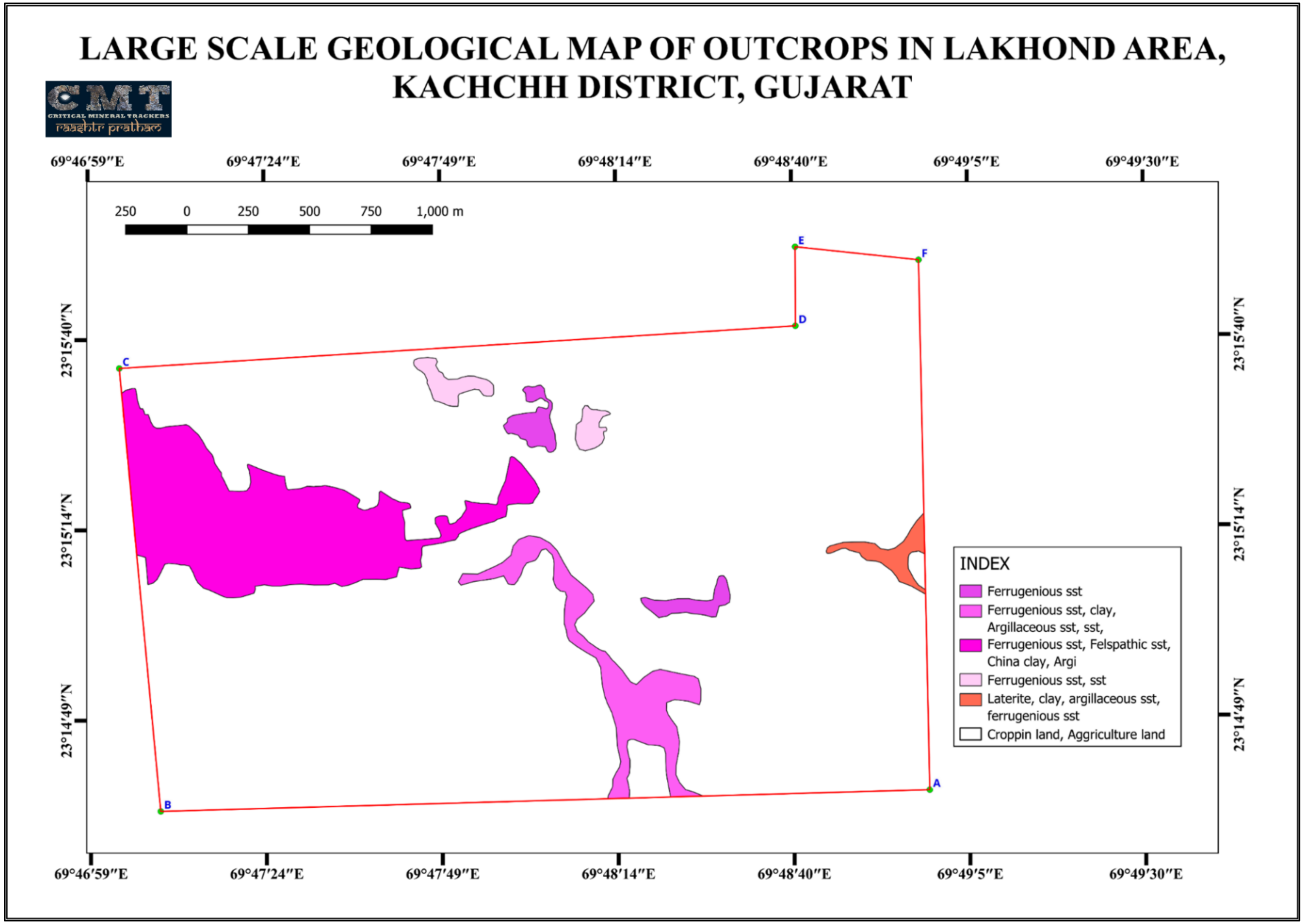
Geological cross section: Fig No: 7

Section Line and Profile:



Cross section:





No new laterite/bauxite occurrence recorded during LSM.

Fig No: 8

6.1.2 Description of rock types within the outcrop map

Ferruginous sandstone

In the Lakhond area, the north-western side of the block boundary the **Ferruginous gritty sandstone** is composed predominantly of angular to sub-rounded quartz grains cemented by iron oxides, primarily hematite and goethite. The presence of iron-rich cement imparts characteristic reddish-brown to yellowish-brown coloration to the rock. Ferruginous sandstone commonly exhibits fine- to medium grained texture and varies from moderately to well indurated depending on the degree of iron cementation.

6.1.3 Petrographic studies:

Ten rock specimens were submitted to the Petrology Division, Southern Region, GSI, Hyderabad for detailed petrographic studies. However, petrographic analysis was carried out on five specimens only, while the remaining five samples were rejected due to the soft and friable nature of the sandstones, which were unsuitable for preparation of thin sections. The detailed descriptions and results of the petrographic studies carried out on the analysed specimens are furnished below. as received from petrology laboratory, GSI, southern wing, Hyderabad.

1. **Specimen No: LB/TS/B5**

Specimen Photo No – 14: Sandy clay white (Bhuj formation)

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

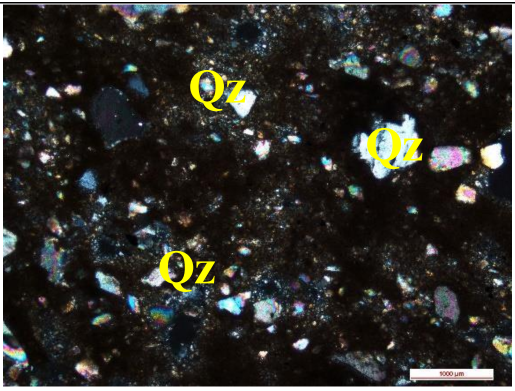


Fig. 1A. Photomicrograph showing presence of different grain size of quartz(Qz) in clay matrix under transmitted light XPL (5X).

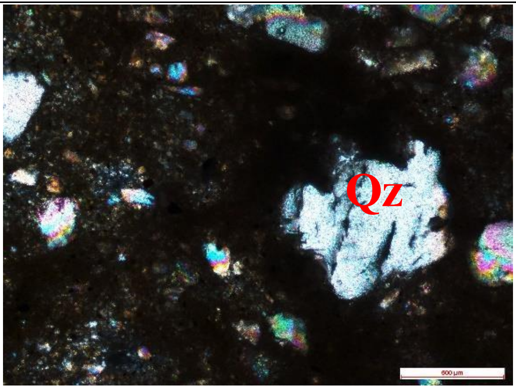


Fig. 1B. Photomicrograph showing presence of different grain size of quartz(Qz) in clay matrix under transmitted light XPL (10X).

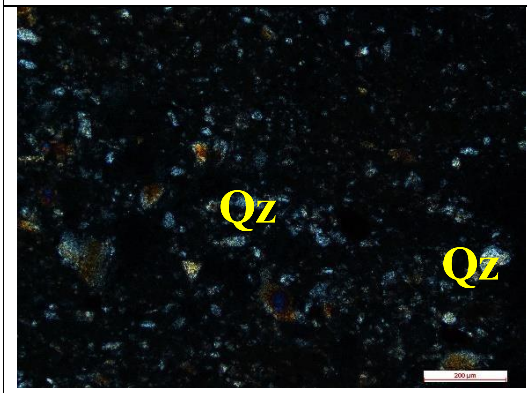


Fig. 1C. Photomicrograph showing presence of different grain size of quartz(Qz) in clay matrix under transmitted light XPL (2X).

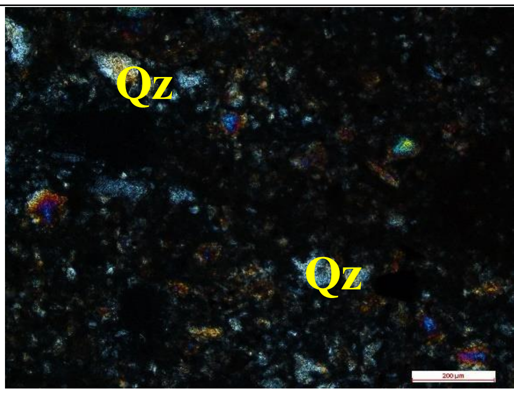


Fig. 1D. Photomicrograph showing presence of different grain size of quartz(Qz) in clay matrix under transmitted light XPL (2X).

Microscopic observations:

Microscopic study reveals that the rock displays a very fine-grained groundmass, typical of shale, with particle sizes mostly below 100 micrometers. The grains are closely packed in a matrix-supported texture, and little sorting is observed, consistent with rapid settling from suspension in a quiet water setting. The preferred orientation of fine grains creates a fissile fabric, giving the rock its characteristic ability to split into thin layers. Some larger quartz grains are embedded within this matrix, further demonstrating the heterogeneity at the microscale (Fig. 1A- 1D)

Quartz (Qz) grains are clearly identifiable across all images, scattered throughout the clay- rich matrix. Quartz occurs as both fine angular fragments and larger, subrounded grains, indicating a mix of detrital influx from distant and nearby sources. The prevalence of quartz highlights the siliciclastic nature of this shale and suggests significant mechanical weathering and transport before deposition.

No obvious secondary mineralization or cementation phases such as carbonates or silica overgrowths are visible, suggesting minimal post-depositional alteration. The fine clay matrix, likely dominated by illite, kaolinite, or smectite, binds the framework and contributes to the rock's compact nature. The lacking signs of recrystallization or strong compaction indicate a relatively low diagenetic maturity.

Overall, the shale is a fine-grained, quartz-rich sedimentary rock with a prominent clay matrix. The mineral assemblage and fissile texture point to deposition in a calm, low-energy environment. The dominance of quartz and lack of abundant authigenic minerals or cement suggest primary mud deposition without significant diagenetic alteration. These features are diagnostic for shales formed from suspended clay and silt settling in relatively undisturbed aquatic settings.

1. **Specimen No: LB/TS/BRS-1(Bhuj formation)**

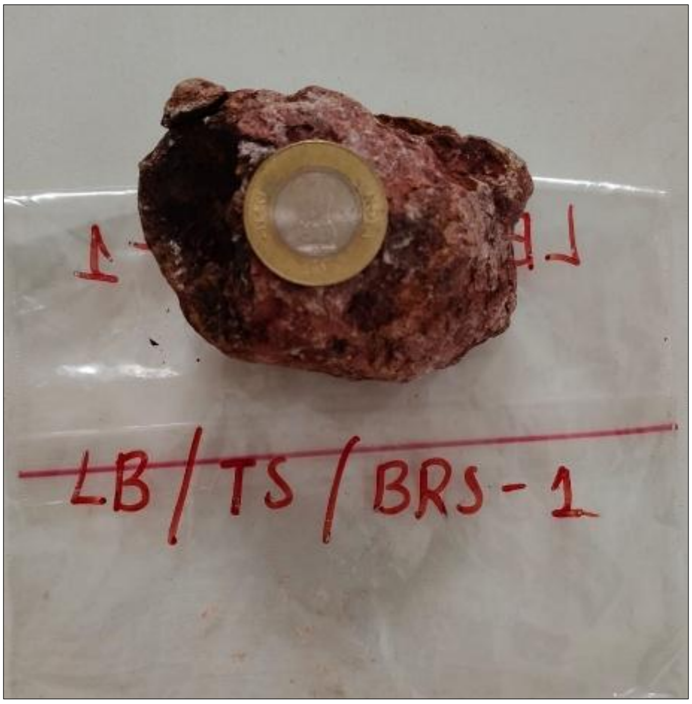


Photo No – 15 : Mixture of Laterite+ clay

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

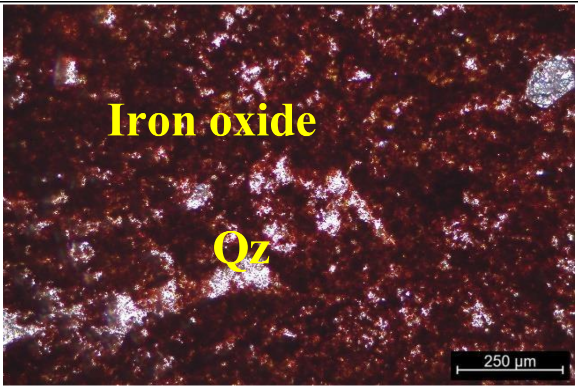


Fig. 2A. Photomicrograph showing presence of iron oxide and quartz (Qz) under transmitted light XPL (10X).

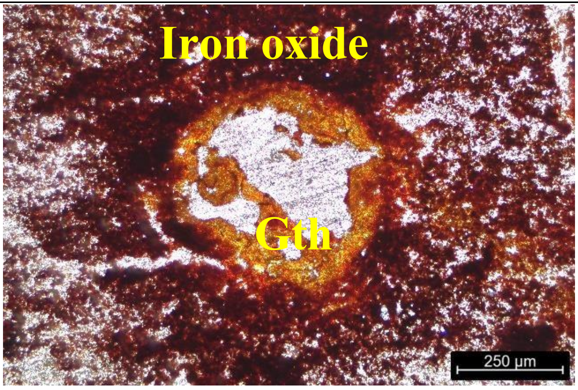


Fig. 2B. Photomicrograph showing presence of iron oxide and Goethite (Gth) under transmitted light XPL (10X).

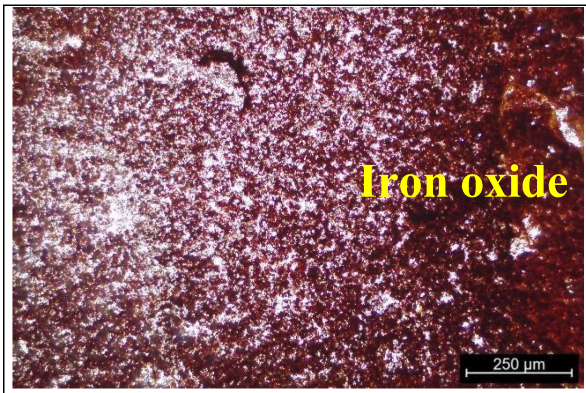


Fig. 2C. Photomicrograph showing presence of iron oxide under transmitted light XPL (10X).

Fig. 2D. Photomicrograph showing presence of iron oxide under transmitted light XPL (10X).

Microscopic observations:

Microscopic study reveals that the rock shows iron oxides are by far the most abundant and pervasive minerals, as evidenced by their consistent reddish-brown appearance and extensive distribution throughout the rock. The iron oxide phases, primarily goethite and hematite, dominate the groundmass with a fine-grained, almost cryptocrystalline texture. The presence of goethite (Gth) manifesting as concentric yellow-brown zones typical for its nodular habit in laterite (Fig. 2A-2D). Quartz (Qz) grains occur sporadically and are subordinate to the iron oxides, suggesting minor preservation of primary minerals from the parent rock.

The overall matrix is extremely fine-grained, poorly sorted, and appears primarily structureless except for occasional relict quartz or goethite nodules. Quartz grains are subangular and dispersed within the iron oxide matrix. Goethite nodules present as concentric growths, sometimes around remnant quartz or other detrital grains, indicating strong replacement and secondary precipitation processes during lateritization. The dominance of the iron oxide matrix over preserved silicate minerals illustrates the intense chemical weathering that characterizes laterite formation.

The dominance of iron oxides, with only minor quartz and the presence of goethite nodules, is indicative of advanced lateritization a process involving prolonged tropical or subtropical weathering, where leaching removes silica, alkalis, and other bases. The concentric goethite structures around relict grains highlight multiple generations of iron precipitation and secondary nodular growths, a symbol of mature laterites. Minimal cementation and open matrix texture have resulted in moderate porosity, which may facilitate further weathering and occasional secondary mineral infilling under changing soil chemistry conditions.

2. **Specimen No – LB/TS/P17(Bhuj formation)**

Reddish-brown claystone with sst. laminations Photo No – 16

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

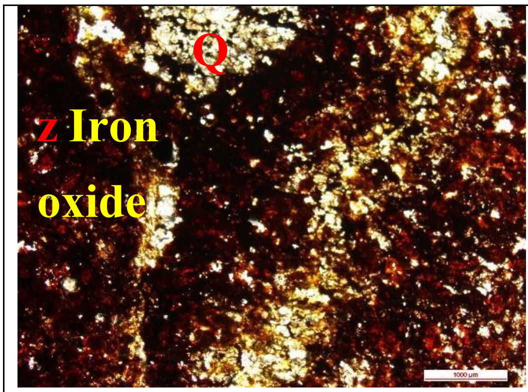


Fig. 3A. Photomicrograph showing presence of iron oxide and quartz (Qz) under transmitted light XPL (5X).

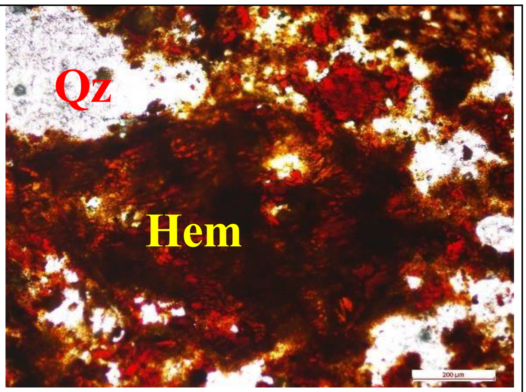


Fig. 3B. Photomicrograph showing presence of Hematite (Hem) and quartz (Qz) under transmitted light XPL (10X).

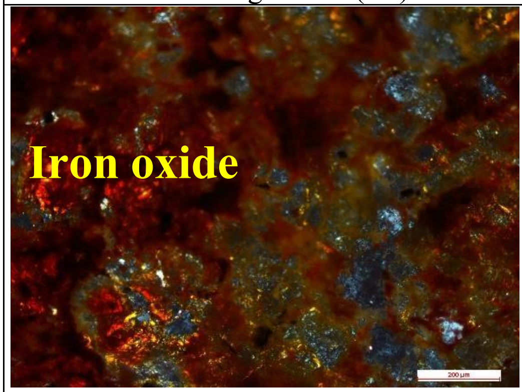


Fig. 3C. Photomicrograph showing presence of iron oxide under transmitted light XPL (10X).

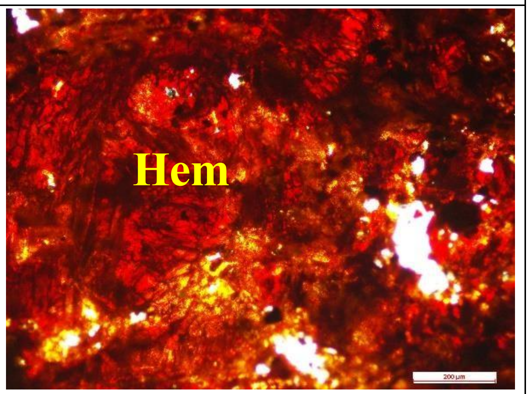


Fig. 3D. Photomicrograph showing presence of Hematite (Hem) under transmitted light XPL (10X).

Microscopic observations:

Microscopic study reveals that the rock displays iron oxides are the predominant mineral phases, distributed pervasively throughout rock. Specifically, quartz (Qz) is consistently present, but always as a subordinate phase. Hematite (Hem), identifiable by its deep red coloration and granular to earthy textures, appears in distinct masses and aggregates, typical of advanced ferrugination in mature laterites. Goethite is not specifically labelled in this image, but iron oxide distribution may include finely dispersed goethite in the matrix (Fig. 3A-3D).

Quartz grains, when present, are embedded within this iron-rich groundmass and display angular to subangular forms. Hematite occurs as large, locally massive, or variegated patches, suggesting precipitation from iron-rich solutions during or after intense weathering. The microtextures range from earthy, massive areas to discrete crystalline zones, indicating multi-stage iron accumulation and cementation.

The dominance of hematite points to oxidative conditions and mature weathering, while sporadic quartz grains mark relict remnants of parent silicates. No significant evidence of secondary carbonates or clay minerals is present,

Overall, Textural and mineral evidence support formation through prolonged leaching, iron enrichment, and secondary mineral growth in a well-drained, oxidizing environment. These petrographic features define advanced laterite, typical for soils overlying igneous or metamorphic rocks in tropical regions.

3. Specimen No: LB/TS/T5(Sandhan formation)

Brown laterite with clay patches Photo No – 17

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

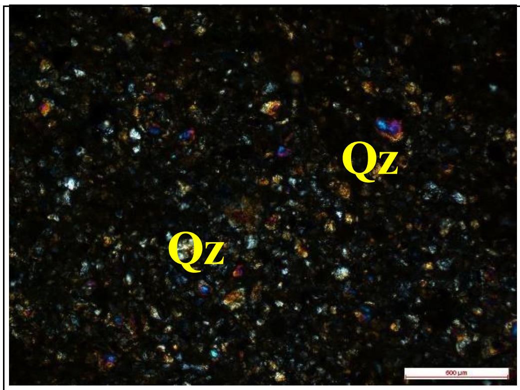


Fig. 4A. Photomicrograph showing presence of quartz (Qz) under transmitted light XPL (2X).

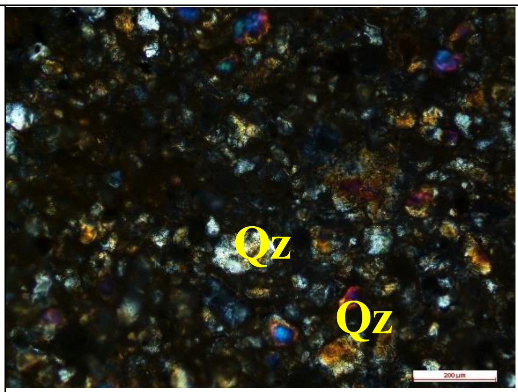


Fig. 4B. Photomicrograph showing presence of quartz (Qz) under transmitted light XPL (5X).

Fig. 4C. Photomicrograph showing presence of quartz (Qz) and Iron oxide under transmitted light XPL (5X).

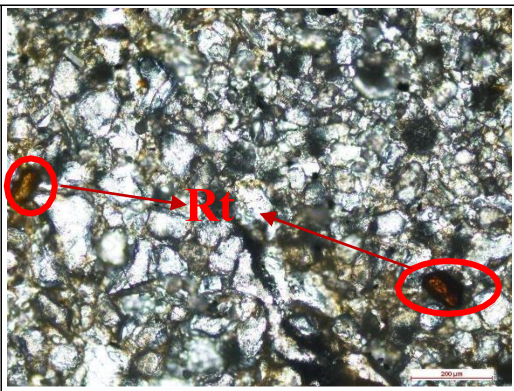


Fig. 4D. Photomicrograph showing presence of quartz (Qz) and Rutile under transmitted light PPL (10X).

Microscopic observations:

Microscopic study reveals that the rock demonstrates a matrix-supported texture, where quartz grains are enveloped by a fine-grained iron oxide matrix. The distribution appears heterogeneous, with clusters of iron oxide and sporadic quartz grains interspersed throughout. The rutile grains are discretely located among the matrix, further emphasizing the advanced state of chemical alteration. The very fine grain size and poor sorting reflect intense leaching and minimal preservation of primary rock fabric.

Quartz (Qz) is prominently identified, occurring as angular to subrounded grains typically embedded within a finer matrix. Iron oxide, present in large quantities, forms the dominant groundmass and imparts a brownish hue to the entire fabric. Its microcrystalline nature suggests pervasive chemical weathering and mobilization of iron from original host minerals. Notably, rutile (Rt) is observed, marked by its high relief and distinct shape—rutile's presence is significant as it is highly resistant to chemical breakdown, surviving prolonged weathering (Fig. 10A-10B).

The prevalence of iron oxide and rutile, coupled with the sparse occurrence of quartz, indicates an advanced lateritic profile—typical of prolonged tropical or subtropical weathering (Fig. 10C-10D). Leaching has removed most silicates and bases, leading to enrichment of insoluble iron oxides and accessory heavy minerals like rutile. There is no evidence of secondary carbonate or significant clay mineral presence, showing the dominance of ferruginous alteration.

Overall, the rock is characteristic of mature laterite, distinguished by iron oxide-rich groundmass, resistant quartz, and rutile grains. These microstructures and mineral assemblages typify extreme weathering, leaching, and residual enrichment, common in humid tropical climates over felsic or mafic parent rocks. The preservation of rutile and quartz amidst iron oxides further supports the identification of a highly evolved, mineralogically mature lateritic regolith.

4. **Specimen No: LB/TS/B8(Bhuj formation)**

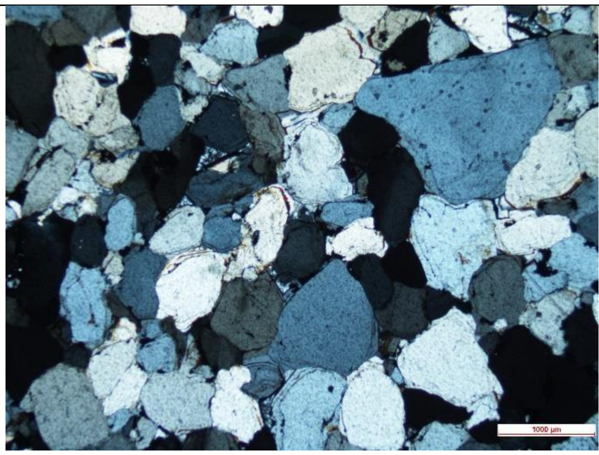
Hard Reddish-brown sandstone Photo No: 18

Mineral assemblage: Framework and matrix mineral: Quartz

Cement: Chert + Iron Oxide

Texture: It is a medium grained clastic sedimentary rock consisting only of quartz as frame working mineral. Cement is composed of chert and iron oxide binding the frame working quartz grains. Quartz grains are subangular to sub rounded with secondary authigenic quartz overgrowth. Chert and iron oxide occur as cement binding the frame working minerals. Authigenic growth of quartz over the earlier detrital grains are noted and a fine rim is discernible on every quartz grains. At places, the rock is cement supported with few clasts of quartz within it. Variable and wide range of grain size of frame working mineral and angularity of the grains indicate poor sorting and less transportation. Presence of quartz grains only as frame working mineral indicate second cycle of sedimentation and a sandstone rich provenance.

Name of the rock: Sandstone

	
Fig. 5.1 Sub-angular to sub-rounded quartz grains as framework minerals; note the quartz overgrowth and ferruginous cement.	Fig. 5.2 Same as Fig 20.1 under cross polarized light.

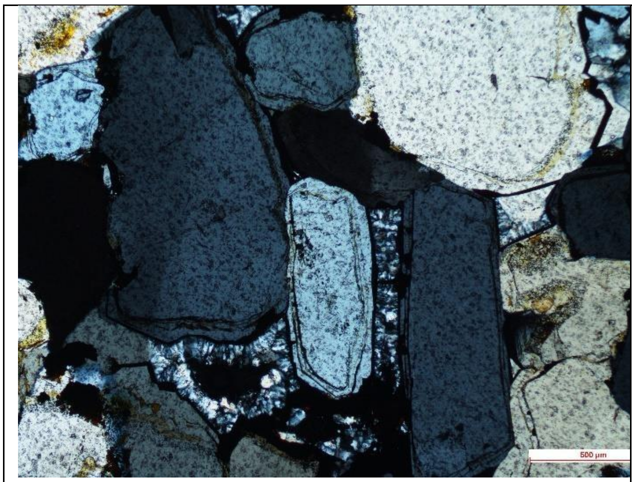
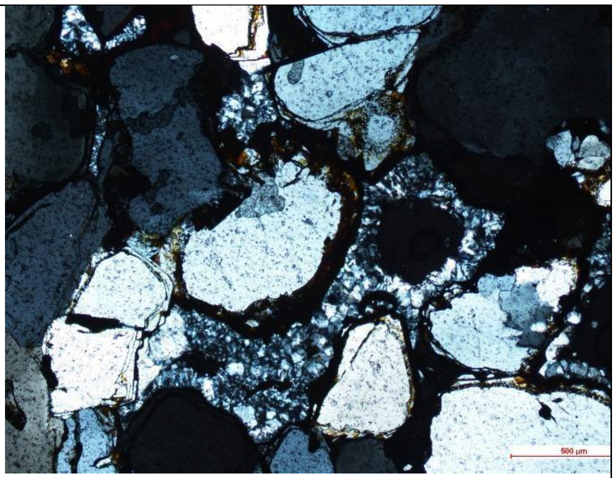
	

Fig. 5.3 Cherty cement along the grain boundaries; also note the quartz overgrowth	Fig. 5.4 Cherty and ferruginous cement in quartzite

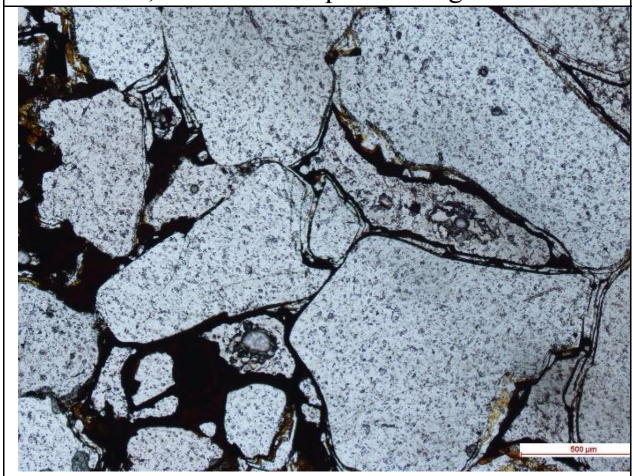
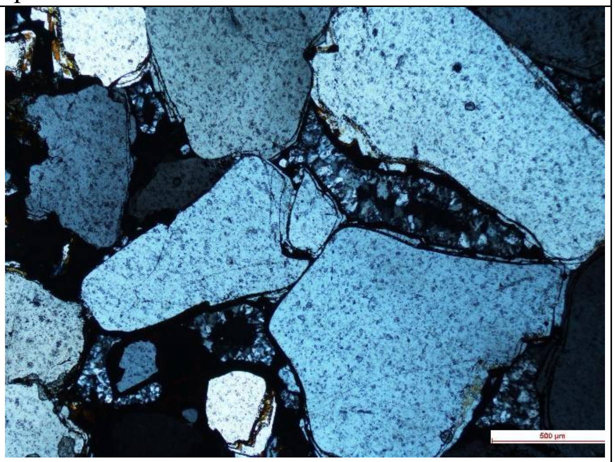

	

Fig. 5.5 Cherty and ferruginous cement in quartzite; at places ferruginous cement dominated	Fig. 5.6 Same as Fig. 20.5; under cross polarized light

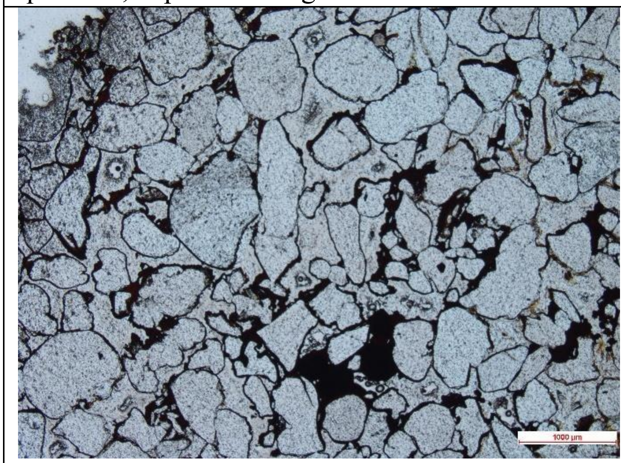
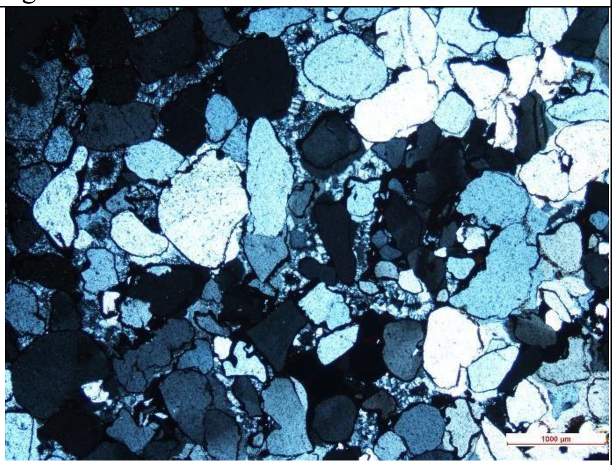

	

Fig. 5.7 Cherty cement dominated part with rounded and subrounded quartz grains; ferruginous cement also present	Fig. 5.8 Same as Fig. 20.7 under cross polarized light

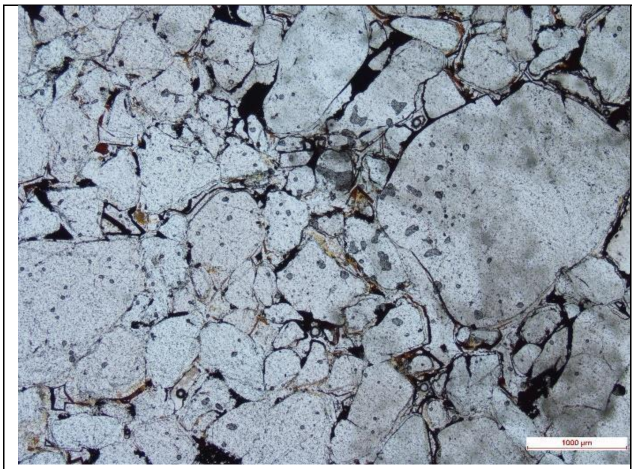


Fig. 5.9 Polymodal grain size distribution; texturally immatured

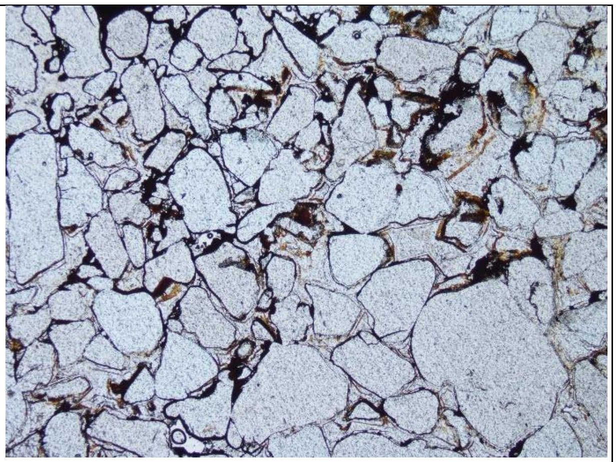


Fig. 5.10 With increasing cement content, frame working grains often have very little contact increasing the porosity.

6.1.4 Structures: The two major lithological units present in the study area, namely the Bhuj Formation and the Sandhan Formation, exhibit a regional structural trend of East–West, with minor local variations in NE–SW orientation. The strata generally dip 5° to 10° towards the south and southeast except near structurally disturbed areas.

The Bhuj Formation shows comparatively steeper dips ranging from 5° to 10°, whereas the younger Sandhan Formation exhibits gentler dips of about 5°, reflecting relatively lesser structural disturbance.

Two sets of sub-vertical joints are observed within the fine grained brown ferruginous sandstone units towards the western part of the study area near water tank. The general trend of these joints is E–W and N–S. Due to this jointing pattern, the fine-grained, hard ferruginous sandstone of the Bhuj Formation is broken into angular fragments and occurs as splintery blocks on the surface.

The contact between the Bhuj Formation and the Sandhan Formation, which runs roughly parallel to the tributary of Pur Nadi in the study area, appears to be faulted. Significant structural evidences observed along this tributary in the western and central parts which include steep dips ranging from 50° to 75°, silicification, fracturing, shearing, and minor open folding. An inferred fault F1-F1 is drawn.

The Bhuj Formation exhibits considerable lithological variability along with well-preserved primary sedimentary structures such as cross-bedding, graded bedding, lamination, and sand dyke assemblages, indicating deposition in a fluvial to deltaic environment.

The Sandhan Formation, composed of calcarenite, argillaceous sandstone/siltstone with clay bands or lenses, and conglomerate, also shows primary sedimentary structures such as cross-bedding, suggesting deposition under fluvio–deltaic conditions.

Structural evidences between Bhuj and Sandhan formation found along tributary of Pur Nadi in support of faulted contact

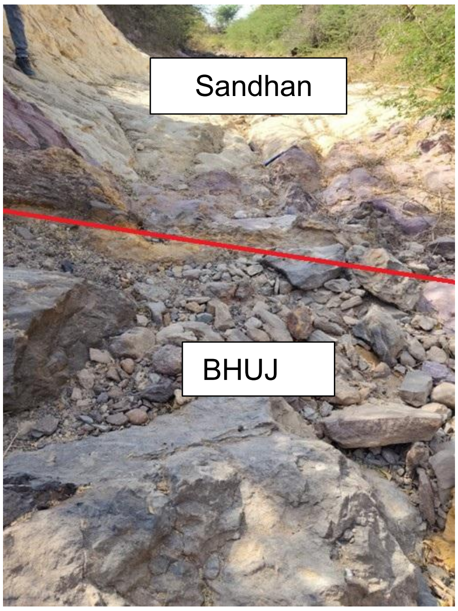


Photo No:19 0.70km east of Lakhond village along a tributary joining Pur Nadi. Faulted contact between Bhuj towards north (fractured, silicified Ferruginous sst and pink sst) and sandman towards south (fellow soft Argillaceous sandstone). strike E-W and dips 75-80° southerly and highly fractured, silicified Bhuj sandstone

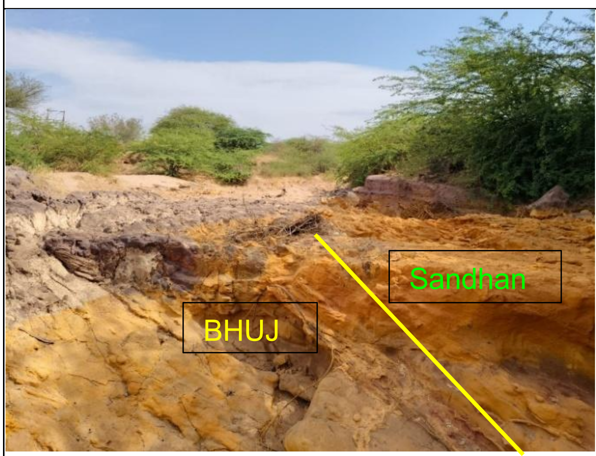


Photo No: 20 1.70km east of Lakhond village along a tributary joining Pur Nadi. Faulted contact between Bhuj formation towards north ((fractured, silicified Ferruginous gritty sst) and sandhan towards south (yellow friable Argillaceous sandstone). Fracture angle is 50°

Photo No: 21 1.70km east of Lakhond village along Pur nadi. Silicified ferruginous gritty sandstone of Bhuj formation showing shearing and open folding

Photo No: 22 1.80km east of Lakhond village along Pur Nadi. Silicified ferruginous fine-grained sandstone on the top followed by brown, yellow siltstones of Sandhan formation

Photo No: 23 Cross-bedding within Bhuj formation (Pinkish white coarse-grained laminated sandstone showing cross bedding and Greyish white coarse sandstone showing cross-bedding & sand dyke intrusion in the NW part of Lakhond area)

Photo No: 24 Cross bedding within Sandhan formation (Fine to medium grained pinkish white sandstone of Sandhan formation showing cross-bedding along south bank of Pur Nadi)

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 surface signatures of bauxite mineralisation were observed in the study area. This is mainly because the bauxite-bearing Matanomadh Formation is almost absent, except for a small exposure along the eastern boundary of the area, and it does not extend westward.

Lithologically, both the Bhuj Formation and Sandhan Formation are composed predominantly of feldspathic sandstones, argillaceous sandstones, siltstones interbedded with clay bands/lenses. Geochemical analysis indicates relatively high SiO_2 values, moderate Al_2O_3, and moderate TiO_2 contents, which classify these materials predominantly as bauxitic clay rather than true bauxite.

However, a limited occurrence of low-grade clayey bauxite (Bardoshshi,1981) was identified near Trench T3 along a nala in the southwestern corner of the study area. The sample is pinkish-white clayey bauxite and shows the following chemical composition:

SiO_2: 28.28%, Al_2O_3: 43.27%, Fe_2O_3: 3.36%, TiO_2: 3.45%

Reactive silica: 27.98% (it should be ≤ 5.0% for Bauxite) which is very high

Despite these fairly favourable values, no lateral or vertical continuity of this clayey bauxitic horizon was observed in the field and also in drill core sample values respectively.

Three samples were sent for XRD studies to find out major mineral phases. The laterite (T4/LB/2025/05 and P17/LB/2025) mainly comprises of kaolinite, hematite, goethite in major mineral phases and Titanium presents largely in fine or amorphous Ti oxide phases. while the bauxite mineral is mainly composed of gibbsite, kaolinite and Ilmenite (T3/LB/2025/03).

Further formation wise geochemical analysis of samples collected from pits and trenches indicates the following range & mean of major oxides, vanadium, gallium and Total REE and (TREE+Sc+Y)

Table No: 6.1 Bhuj Formation: major oxides, Vanadium, Gallium, TREE

Oxide/element	**Pits (17 samples)**			**Trenches (28 samples)**		
	Min	**Max**	**Mean**	**Min**	**Max**	**Mean**
SiO_2%	37.04	86.10	51.03	31.01	43.23	36.65
Al_2O_3%	0.10	39.34	21.99	14.95	30.80	22.31
Fe_2O_3%	1.21	24.19	9.45	3.07	32.78	16.60
TiO_2%	0.52	8.35	2.25	1.69	9.59	5.21
Vanadium(ppm)	53.40	502.00	197.62	80.40	502.08	274.51
	Pit & trench (10 samples)					
Gallium(ppm)	Min: 13.1		Max:50.85		Mean: 30.32	
Total REE ppm	Min: 217.29		Max:1469.62		Mean: 679.43	
(TREE+Sc+Y) ppm	Min: 241.5		Max:1555.25		Mean: 733.17	

Table No: 6.2 Sandhan Formation: major oxides, vanadium, Gallium, TREE

Oxide/element	Pits (3 samples)			Trenches (42 samples)		
	Min	Max	Mean	Min	Max	Mean
SiO2%	43.00	61.08	53.61	24.06	87.75	52.48
Al2O3%	15.16	35.15	22.38	0.24	46.01	21.87
Fe2O3%	0.99	8.85	5.70	1.02	120.61	8.00
TiO2%	1.73	3.85	2.74	0.79	4.56	2.37
Vanadium(ppm)	115.10	198.93	163.24	32.50	444.00	182.11
	Pit & trench (4 samples)					
Gallium(ppm)	Min: 14.68		Max:41.48		Mean: 28.43	
Total REE ppm	Min: 311.00		Max:748.57		Mean: 520.38	
(TREE+Sc+Y) ppm	Min: 375.13		Max:795.15		Mean: 570.12	

The relatively high silica content and comparatively lower alumina values indicate that the material corresponds to bauxitic clay rather than economic-grade bauxite. In addition, the presence of very high reactive silica values ranging from 27.98% to 30.25% further confirms that the material does not qualify as bauxite but represents bauxitic clay.

Furthermore, ternary diagram plotting of the major oxide compositions shows that the majority of the analysed samples fall within the bauxitic clay field, supporting the geochemical interpretation that the lithological units in the investigated area are predominantly siliceous and clay-rich rather than true bauxite-bearing horizons.

Both Bhuj and Sandhan formations show low to moderate geochemical anomalies of Total Rare Earth Elements (TREE); however, no depth persistence is observed in the drill core samples. REE is associated with reddish brown clays/Lateritic clays with iron oxide patches (Pit P17 and Trench T4).

In the Bhuj Formation, TREE values from pit and trench samples range from 217.29 ppm to 1469.62 ppm, with an average of 679.43 ppm. Gallium values range from 13.10

ppm to 50.85 ppm, averaging 30.32 ppm. Two relatively moderate TREE values were recorded in samples collected along the nala, likely due to weathering and secondary concentration enrichment.

Pit sample: P17/LB/2025 — 1214.66 ppm

Trench sample: T4/LB/2025/06 — 1469.62 ppm

In the Sandhan Formation, TREE values range from 311.00 ppm to 748.57 ppm, with an average of 520.38 ppm, while Gallium values range from 14.68 ppm to 41.68 ppm, averaging 28.43 ppm.

Overall, the geochemical characteristics indicate clay with minor REE enrichment but without significant economic potential due to lack of continuity and depth persistence.

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 20 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 work was undertaken, where the out crops are scanty, during the present exploration activity to obtain representative samples from a depth of 1 metre. A total of 20 pits were excavated, 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 from the 20 pits. The pits provided fresh exposures of subsurface lithology and allowed for systematic sampling for subsequent geochemical analysis. A total of 21 samples (two samples from pit no: P10 from two different lithologies encountered) from 20 pits and one more BRS-1 sample were collected and analysed for major oxides and REE, Gallium.

Detailed litho-logs of Pits and assay values of pits are given in plates no: VII and VIII, respectively, on a 1:100 scale.

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

Sr No	Pit No	Coordinate in Degree Decimal Datum WGS-1984		No of samples collected
		Longitude (E)	Latitude (N)	
1	P1/LB/2025	69.814738^0	23.252860^0	1
2	P2/LB/2025	69.813977^0	23.255813^0	1
3	P3/LB/2025	69.816050^0	23.253720^0	1
4	P4/LB/2025	69.790460^0	23.255342^0	1
5	P5/LB/2025	69.792138^0	23.253447^0	1
6	P6/LB/2025	69.788898^0	23.254332^0	1
7	P7/LB/2025	69.788103^0	23.255923^0	1
8	P8/LB/2025	69.787633^0	23.256877^0	1
9	P9/LB/2025	69.784910^0	23.258702^0	1
10/11	P10A/LB/2025 P10B/LB/2025	69.787800^0	23.255592^0	2
12	P11/LB/2025	69.786702^0	23.253205^0	1
13	P12/LB/2025	69.792063^0	23.248192^0	1
14	P13/LB/2025	69.785185^0	23.251845^0	1
15	P14/LB/2025	69.795188^0	23.253473^0	1
16	P15/LB/2025	69.785443^0	23.247943^0	1
17	P16/LB/2025	69.812915^0	23.254027^0	1
18	P17/LB/2025	69.809662^0	23.256977^0	1
19	P18/LB/2025	69.807545^0	23.255683^0	1
20	P19/LB/2025	69.802448^0	23.257502^0	1
21	P20/LB/2025	69.805964^0	23.258523^0	1
22	BRS-1	69.800300^0	23.255810^0	1

GEOLOGICAL MAP ON PIT, TRENCH & BOREHOLE POINTS IN LAKHOND AREA, KACHCHH DISTRICT, GUJARAT

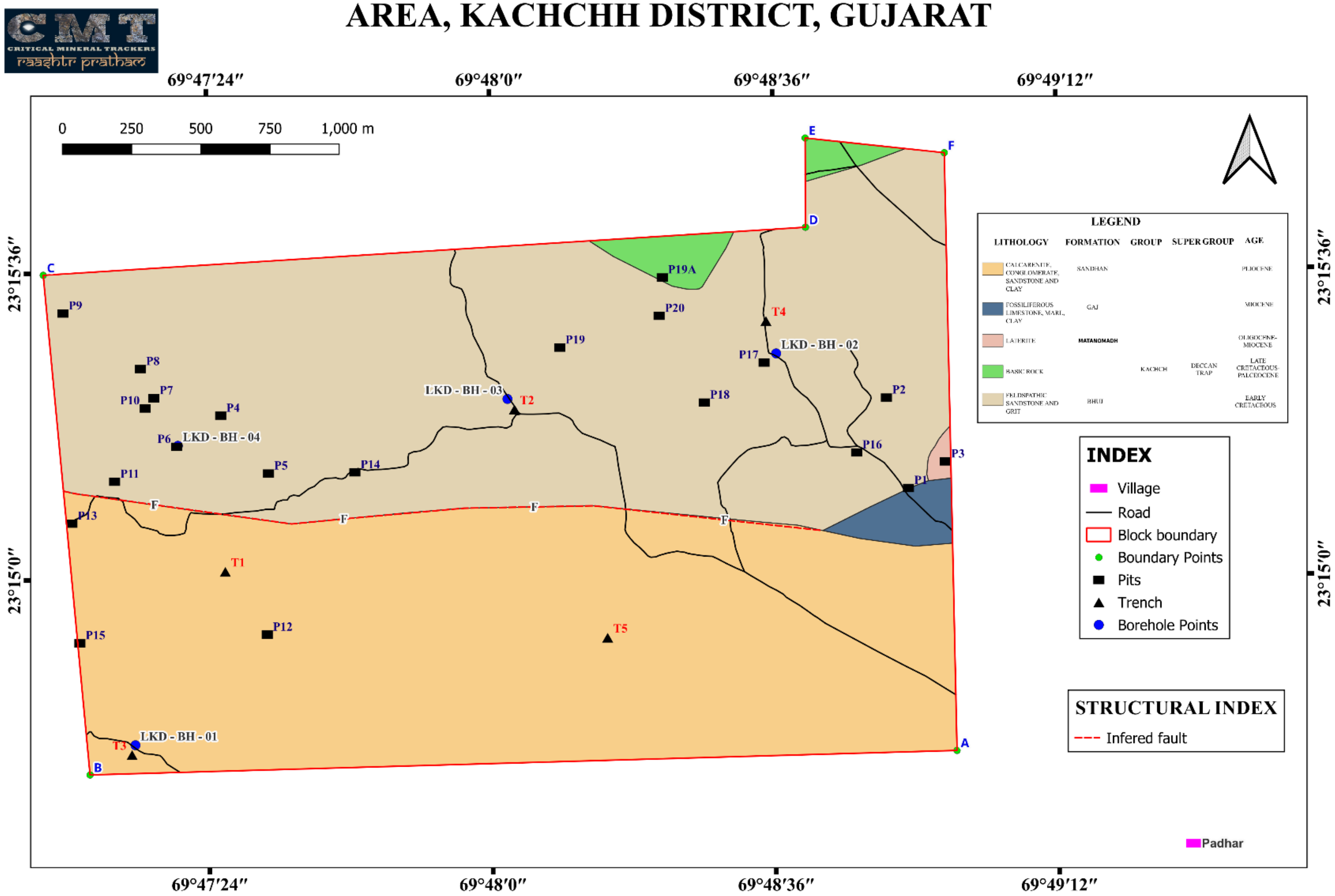
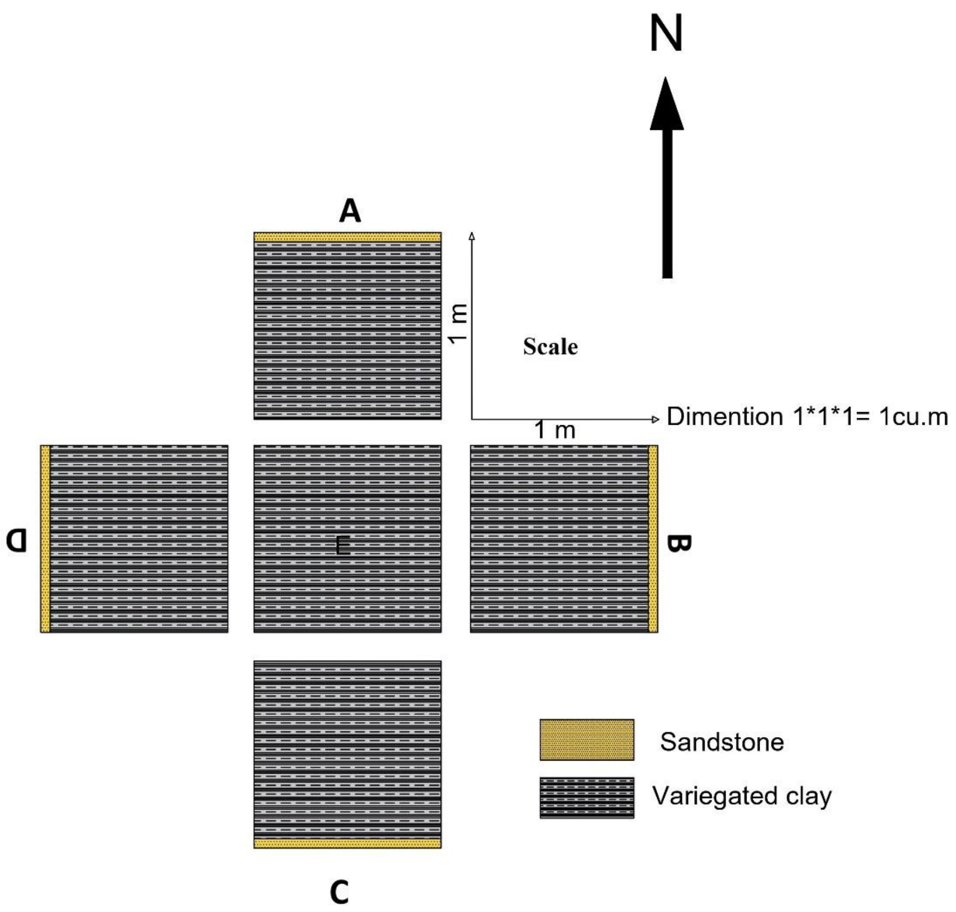


Fig No: 9

Photograph No: - 25: Image showing Pit in study area

(Size 1*1*1m)

Brief description of pit profiles is given below for 20 pits

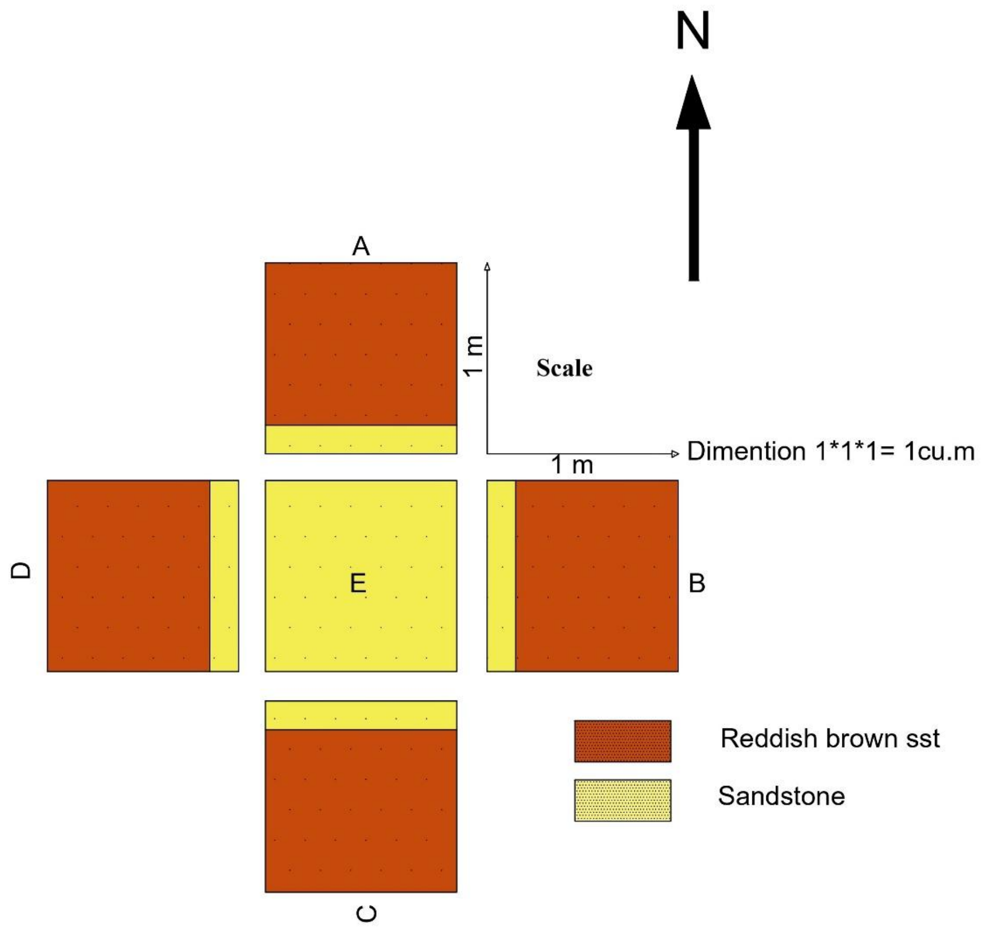


(Not to scale)

Detail of Log of Pit No: P1/LB/2025

Name of the investigation: Bauxite, Ga, V, Ti, REE	**Date of commencement:** 08/04/2025
Pit No: P1/LB/2025	**Date of completion:** 08/04/2025
Location: 23.252860 ^{0}, 69.814738^{0}	**Elevation:** 99 m
Pit top measurement: a. Length: 1m b. Breadth: 1m	**Pit bottom measurement:** a. Length: 1m b. Breadth: 1m c. Depth: 1m
Recorded by: B. Mahesh	
Lithology details: Variegated clay.	
Log of pit: A, B, C, D are side section and E plan view is bottom of the pit.	

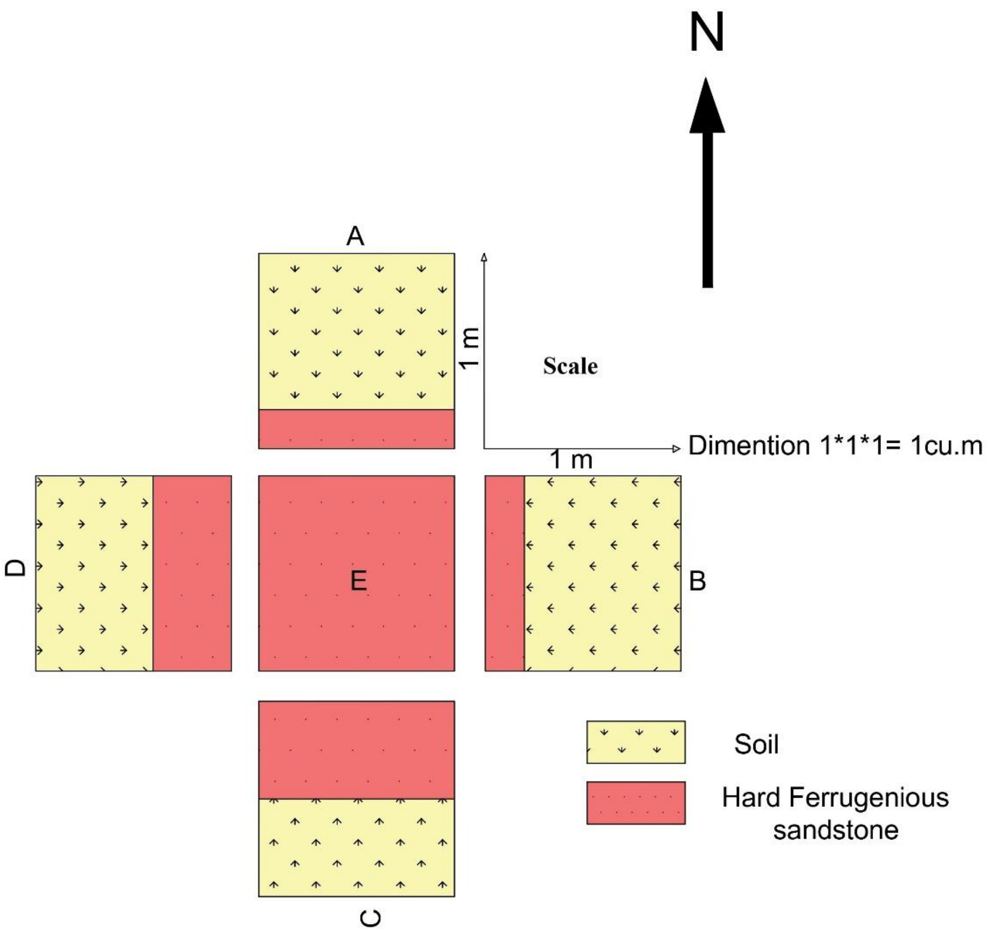
Sample: P1/LB/2025 sample was collected from bottom E of Variegated clay.



(Not to scale)

Detail of Log of Pit No: P2/LB/2025

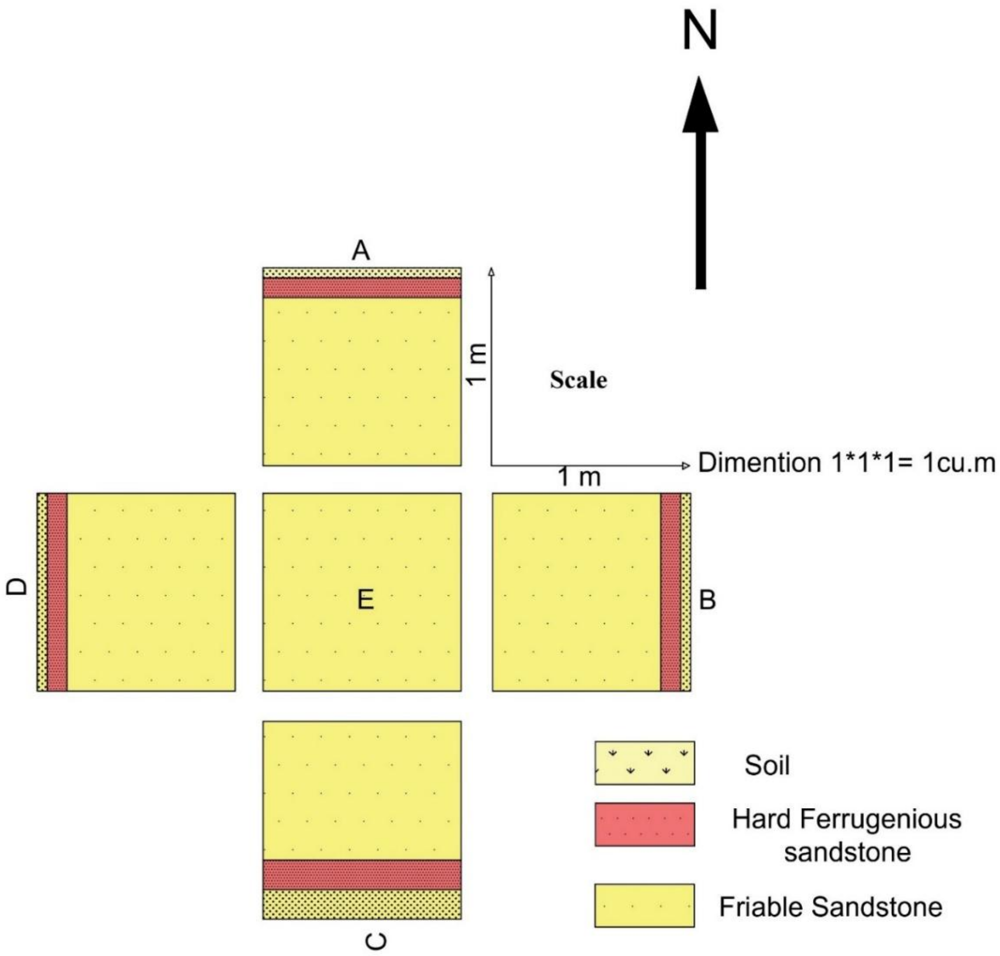
Name of the investigation: Bauxite, Ga, V, Ti, REE	**Date of commencement:** 08/04/2025
Pit No: P2/LB/2025	**Date of completion:** 08/04/2025
Location: 23.255813 ^{0}, 69.813977^{0}	**Elevation:** 102 m
Pit top measurement: a. Length: 1m b. Breadth: 1m	**Pit bottom measurement:** a. Length: 1m b. Breadth: 1m c. Depth: 1m
Recorded by: B. Mahesh	
Lithology details: Friable reddish-brown sandstone	
Log of pit: A, B, C, D are side section and E plan view is bottom of the pit.	
Sample: P2/LB/2025 sample was collected from bottom E of Friable reddish-brown sandstone.	



(Not to scale)

Detail of Log of Pit No: P3/LB/2025

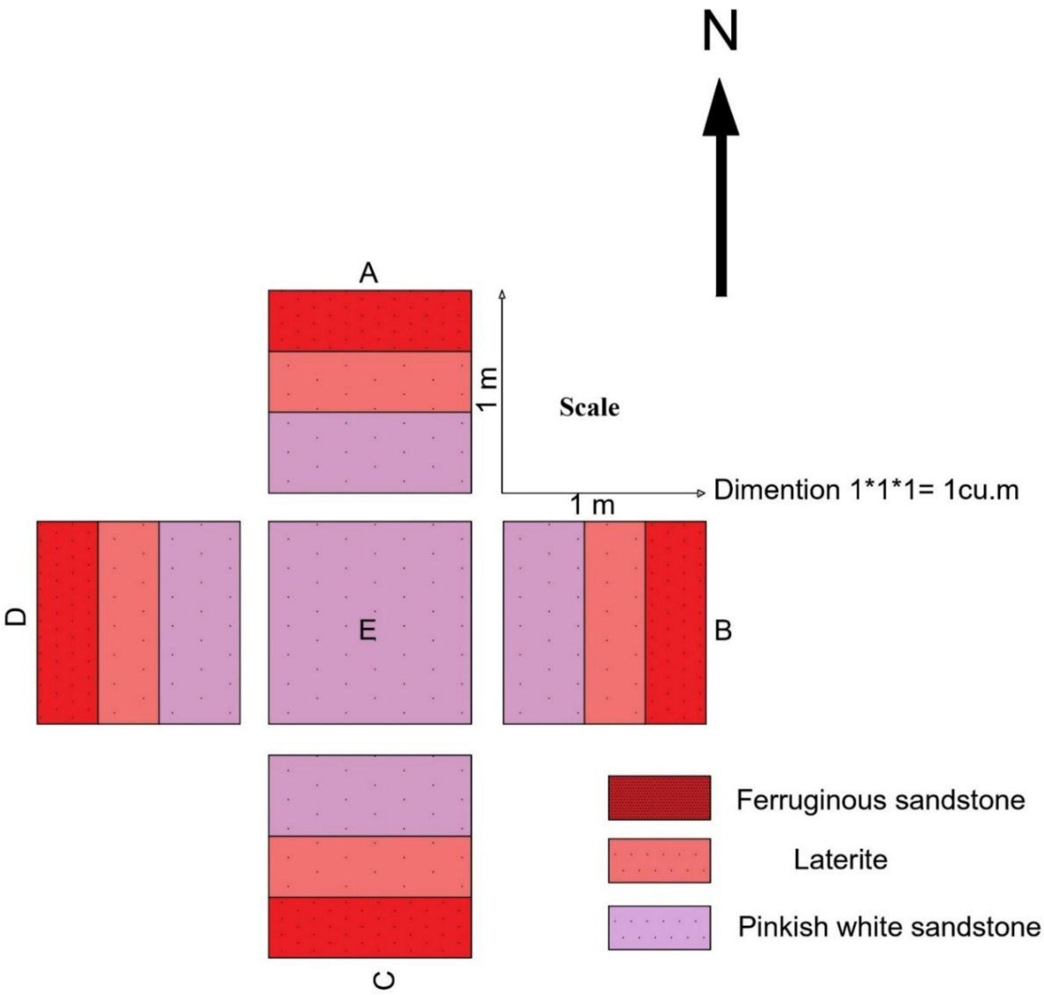
Name of the investigation: Bauxite, Ga, V, Ti, REE	**Date of commencement:** 08/04/2025
Pit No: P3/LB/2025	**Date of completion:** 08/04/2025
Location: 23.253720 ^{0}, 69.816050^0	**Elevation:** 112 m
Pit top measurement: a. Length: 1m b. Breadth: 1m	**Pit bottom measurement:** a. Length: 1m b. Breadth: 1m c. Depth: 1m
Recorded by: B. Mahesh	
Lithology details: Variegated clay and Hard ferruginous sandstone	
Log of pit: A, B, C, D are side section and E plan view is bottom of the pit.	
Sample: P3/LB/2025 sample was collected from bottom E of Ferruginous sandstone	



(Not to scale)

Detail of Log of Pit No: P4/LB/2025

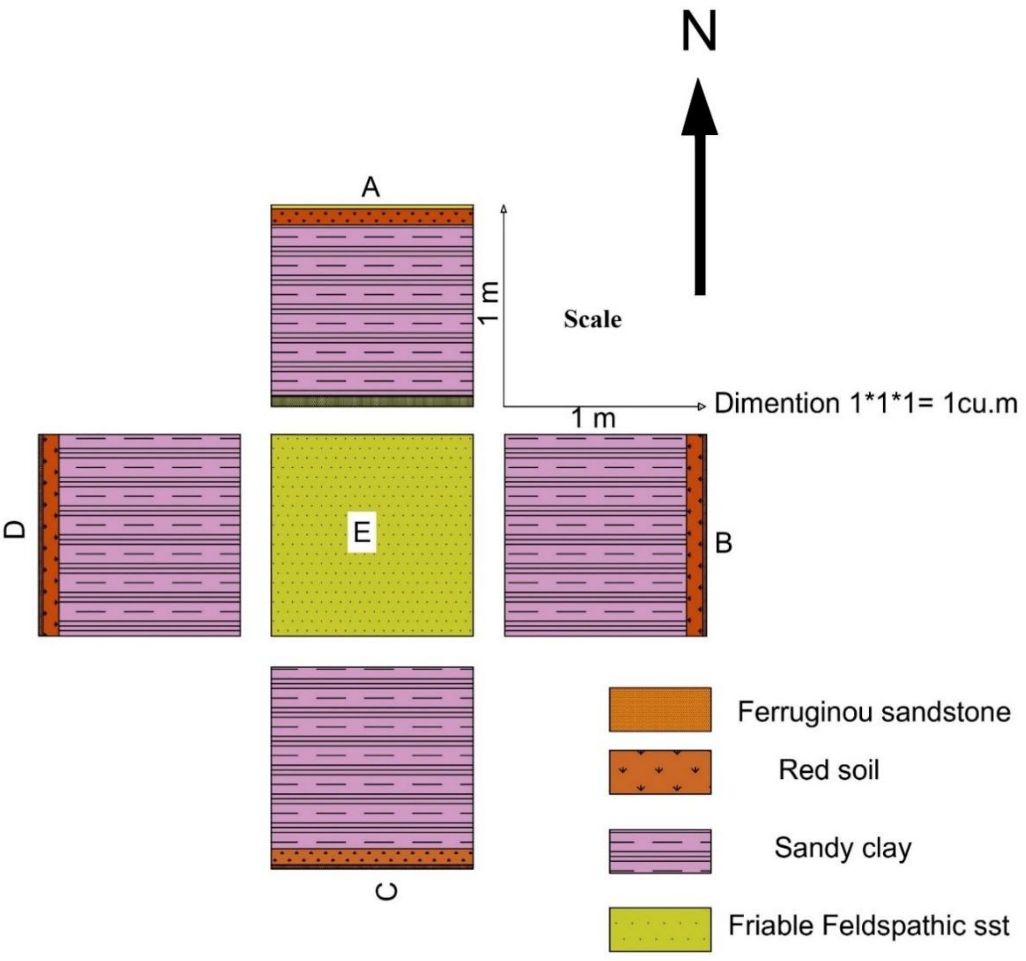
Name of the investigation: Bauxite, Ga, V, Ti, REE	**Date of commencement:** 09/04/2025
Pit No: P4/LB/2025	**Date of completion:** 09/04/2025
Location: 23.253720 ^{0}, 69.816050^{0}	**Elevation:** 105 m
Pit top measurement: a. Length: 1m b. Breadth: 1m	**Pit bottom measurement:** a. Length: 1m b. Breadth: 1m c. Depth: 1m
Recorded by: B. Mahesh	
Lithology details: Ferruginous sandstone and friable sandstone	
Log of pit: A, B, C, D are side section and E plan view is bottom of the pit.	
Sample: P4/LB/2025 sample was collected from bottom E Friable sandstone and gritty sandstone.	



(Not to scale)

Detail of Log of Pit No: P5/LB/2025

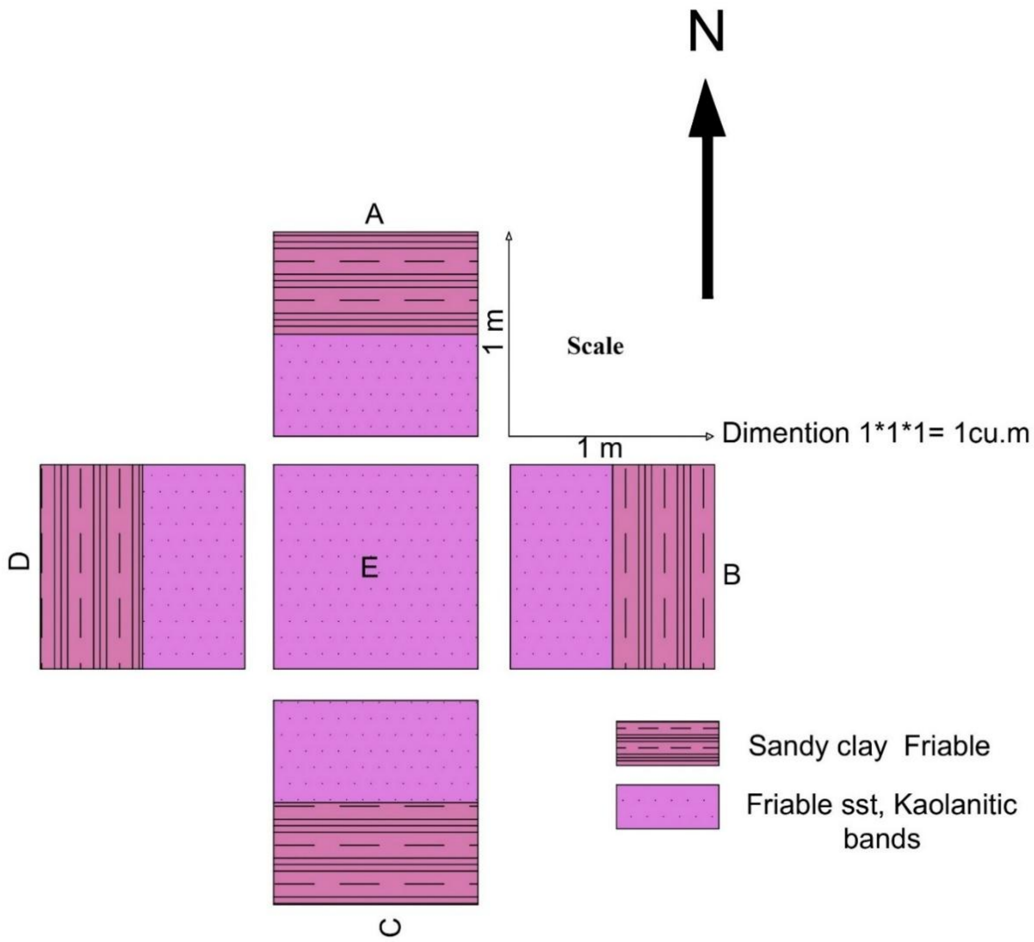
Name of the investigation: Bauxite, Ga, V, Ti, REE	**Date of commencement:** 09/04/2025
Pit No: P5/LB/2025	**Date of completion:** 09/04/2025
Location: 23.253447 ^{0}, 69.792138^{0}	**Elevation:** 104 m
Pit top measurement: a. Length: 1m b. Breadth: 1m	**Pit bottom measurement:** a. Length: 1m b. Breadth: 1m c. Depth: 1m
Recorded by: B. Mahesh	
Lithology details: Very hard ferruginous sandstone and laterite associated with yellowish-white to pinkish-white sandstone.	
Log of pit: A, B, C, D are side section and E plan view is bottom of the pit.	
Sample: P5/LB/2025 sample was collected from bottom E yellowish white, pinkish white sandstone argillaceous	



(Not to scale)

Detail of Log of Pit No: P6/LB/2025

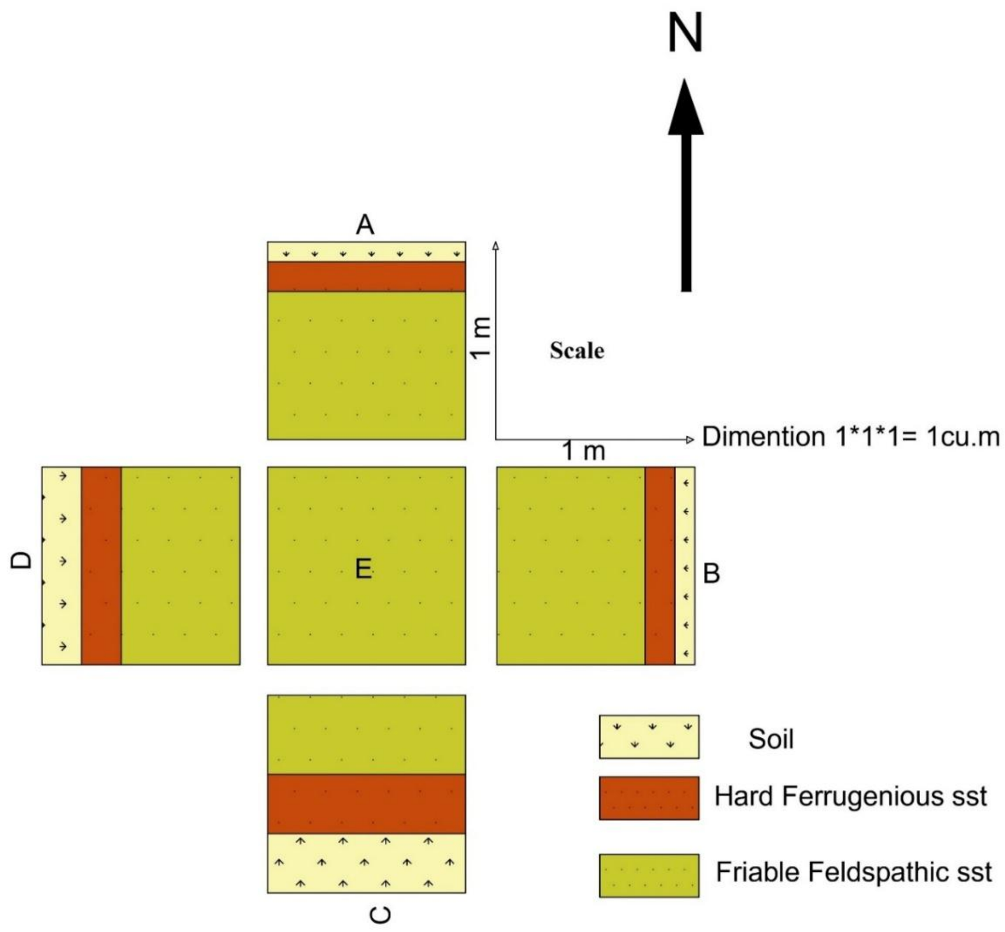
Name of the investigation: Bauxite, Ga, V, Ti, REE	**Date of commencement:** 09/04/2025
Pit No: P6/LB/2025	**Date of completion:** 09/04/2025
Location: 23.254332^0, 69.788893^0	**Elevation:** 103 m
Pit top measurement: a. Length: 1m b. Breadth: 1m	**Pit bottom measurement:** a. Length: 1m b. Breadth: 1m c. Depth: 1m
Recorded by: B. Mahesh	
Lithology details: Pebbles of ferruginous sandstone associated with red soil, pinkish-white to yellow sandy clay, and feldspathic sandstone.	
Log of pit: A, B, C, D are side section and E plan view is bottom of the pit.	
Sample: P6/LB/2025 sample was collected from bottom E very fine-grained feldspathic sandstone.	



(Not to scale)

Detail of Log of Pit No: P7/LB/2025

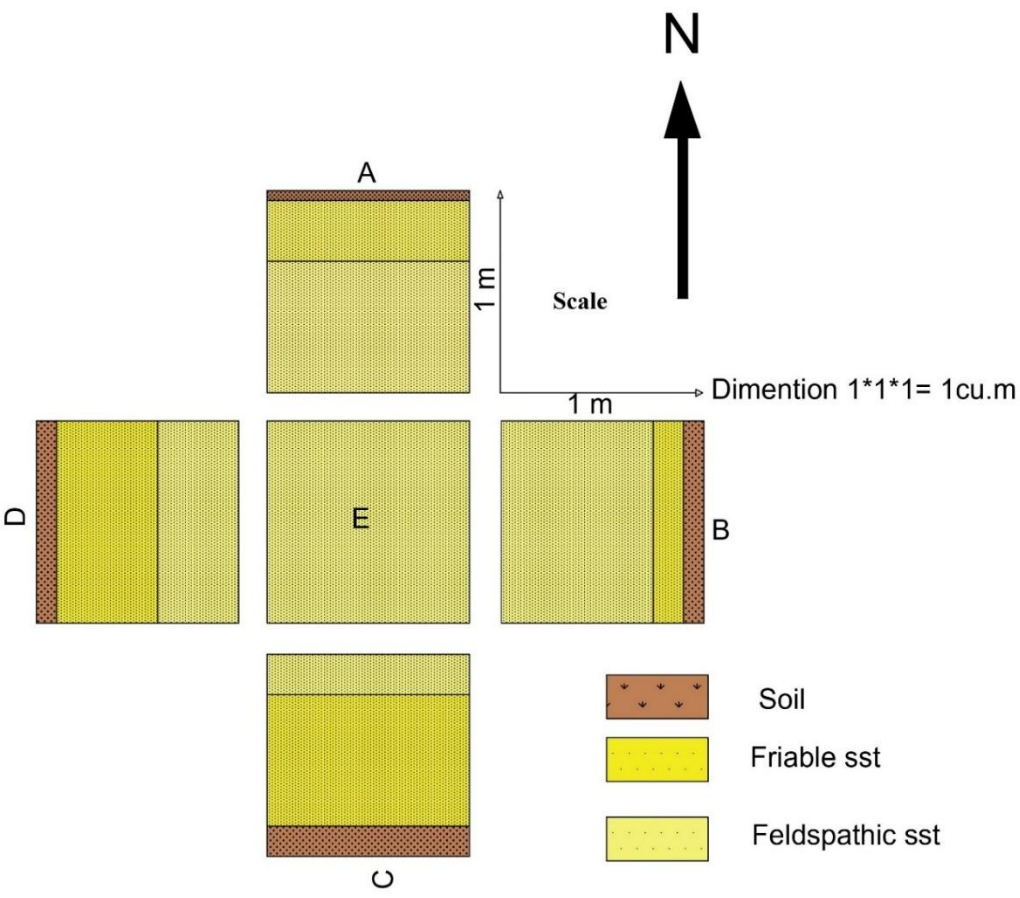
Name of the investigation: Bauxite, Ga, V, Ti, REE	**Date of commencement:** 09/04/2025
Pit No: P7/LB/2025	**Date of completion:** 09/04/2025
Location: 23.255923^{0}, 69.788103^{0}	**Elevation:** 115 m
Pit top measurement: a. Length: 1m b. Breadth: 1m	**Pit bottom measurement:** a. Length: 1m b. Breadth: 1m c. Depth: 1m
Recorded by: B. Mahesh	
Lithology details: Pink, highly friable sandy clay associated with pinkish-white friable sandstone containing kaolinized bands.	
Log of pit: A, B, C, D are side section and E plan view is bottom of the pit.	
Sample: P7/LB/2025 sample was collected from bottom E Pinkish white friable sandstone with kaolinized bands.	



(Not to scale)

Detail of Log of Pit No: P8/LB/2025

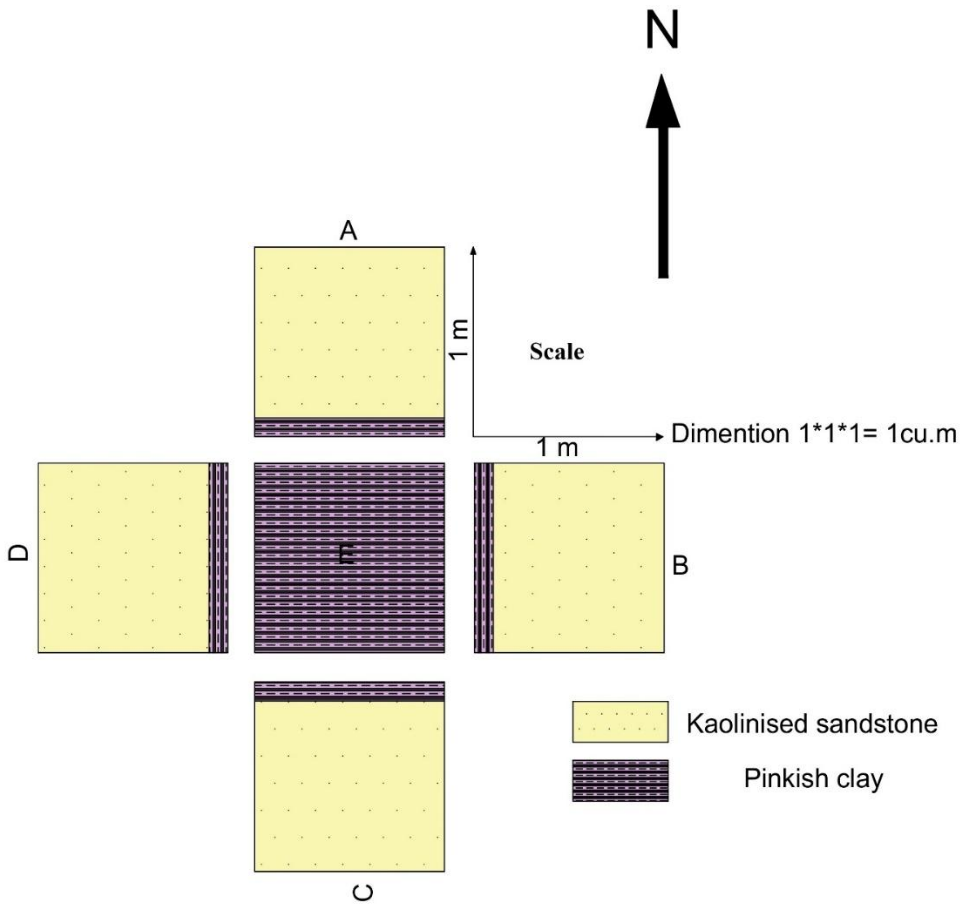
Name of the investigation: Bauxite, Ga, V, Ti, REE	**Date of commencement:** 09/04/2025
Pit No: P8/LB/2025	**Date of completion:** 09/04/2025
Location: 23.256877^{0}, 69.787633^{0}	**Elevation:** 112 m
Pit top measurement: a. Length: 1m b. Breadth: 1m	**Pit bottom measurement:** a. Length: 1m b. Breadth: 1m c. Depth: 1m
Recorded by: B. Mahesh	
Lithology details: Soil overlying by ferruginous sandstone and friable, thinly laminated feldspathic sandstone.	
Log of pit: A, B, C, D are side section and E plan view is bottom of the pit.	
Sample: P8/LB/2025 sample was collected from bottom E friable thinly laminated felspathic sst.	



(Not to scale)

Detail of Log of Pit No: P9/LB/2025

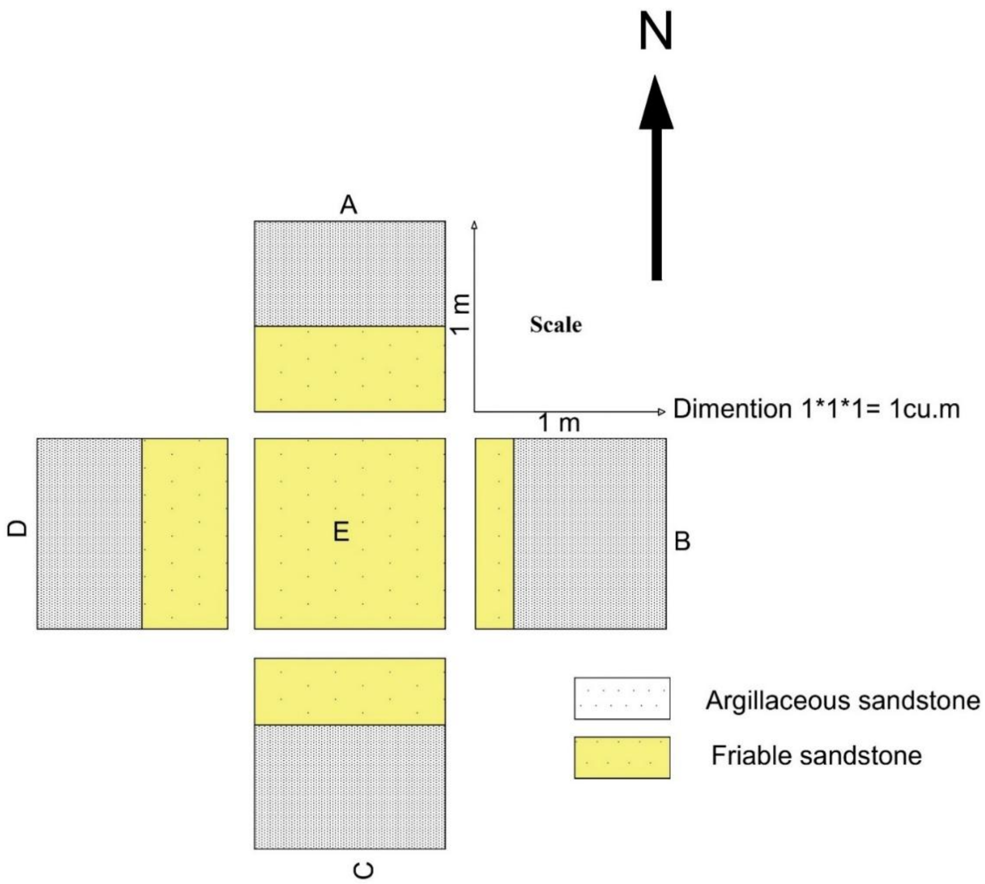
Name of the investigation: Bauxite, Ga, V, Ti, REE	**Date of commencement:** 09/04/2025
Pit No: P9/LB/2025	**Date of completion:** 09/04/2025
Location: 23.258702^0, 69.784910^0	**Elevation:** 102 m
Pit top measurement: a. Length: 1m b. Breadth: 1m	**Pit bottom measurement:** a. Length: 1m b. Breadth: 1m c. Depth: 1m
Recorded by: B. Mahesh	
Lithology details: Brown soil overlying yellowish friable sandstone and medium-grained feldspathic sandstone.	
Log of pit: A, B, C, D are side section and E plan view is bottom of the pit.	
Sample: P9/LB/2025 sample was collected from bottom E yellowish white sandstone and pink sandstone.	



(Not to scale)

Detail of Log of Pit No: P10/LB/2025

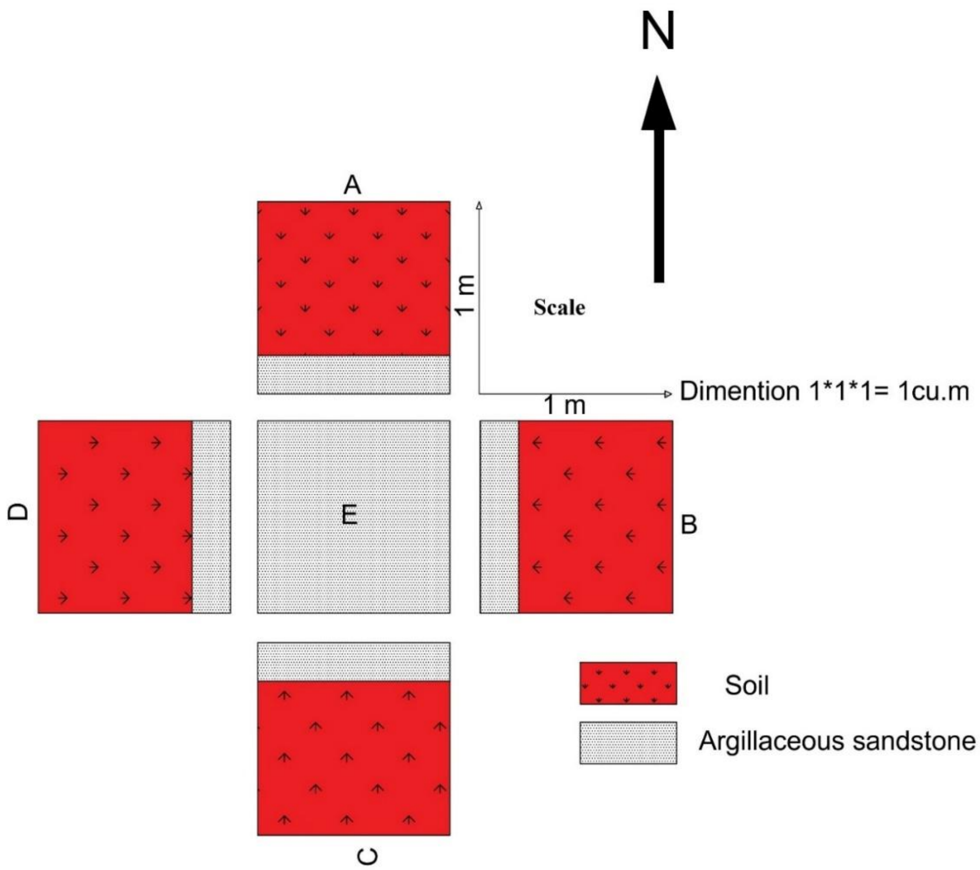
Name of the investigation: Bauxite, Ga, V, Ti, REE	**Date of commencement:** 10/04/2025
Pit No: P10/LB/2025	**Date of completion:** 10/04/2025
Location: 23.255592^0, 69.787800^0	**Elevation:** 119 m
Pit top measurement: a. Length: 1m b. Breadth: 1m	**Pit bottom measurement:** a. Length: 1m b. Breadth: 1m c. Depth: 1m
Recorded by: B. Mahesh	
Lithology details: Very fine-grained white kaolinized sandstone interbedded with claystone and pinkish clay.	
Log of pit: A, B, C, D are side section and E plan view is bottom of the pit.	
Sample: P10A/LB/2025, P10B/LB/2025samples were collected from top sandy clay white & bottom E pinkish clay.	



(Not to scale)

Detail of Log of Pit No: P11/LB/2025

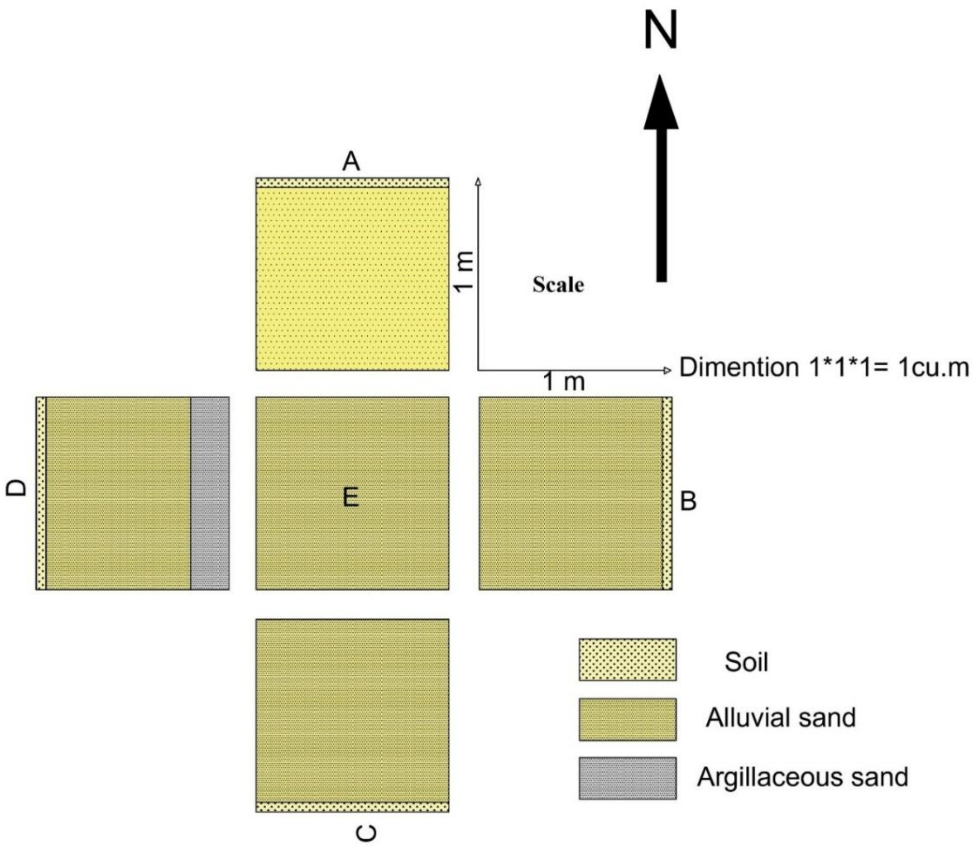
Name of the investigation: Bauxite, Ga, V, Ti, REE	**Date of commencement:** 10/04/2025
Pit No: P11/LB/2025	**Date of completion:** 10/04/2025
Location: 23.253205^0, 69.786702^0	**Elevation:** 101 m
Pit top measurement: a. Length: 1m b. Breadth: 1m	**Pit bottom measurement:** a. Length: 1m b. Breadth: 1m c. Depth: 1m
Recorded by: B. Mahesh	
Lithology details: Argillaceous sandstone overlies friable yellow sandstone.	
Log of pit: A, B, C, D are side section and E plan view is bottom of the pit.	
Sample: P11/LB/2025 sample was collected from bottom E Friable yellow sandstone.	



(Not to scale)

Detail of Log of Pit No: P12/LB/2025

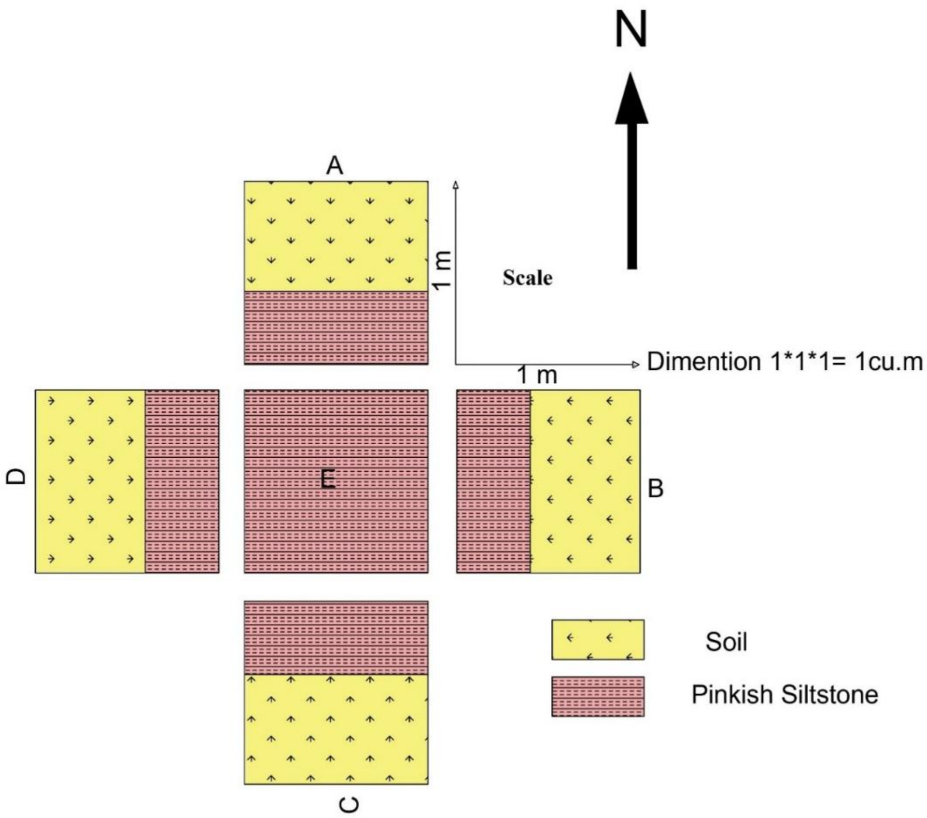
Name of the investigation: Bauxite, Ga, V, Ti, REE	**Date of commencement:** 10/04/2025
Pit No: P12/LB/2025	**Date of completion:** 10/04/2025
Location: 23.248192^0, 69.792063^0	**Elevation:** 100 m
Pit top measurement: a. Length: 1m b. Breadth: 1m	**Pit bottom measurement:** a. Length: 1m b. Breadth: 1m c. Depth: 1m
Recorded by: B. Mahesh	
Lithology details: Red soil with argillaceous sandstone	
Log of pit: A, B, C, D are side section and E plan view is bottom of the pit.	
Sample: P12/LB/2025 sample was collected from bottom E Greenish grey argillaceous sandstone.	



(Not to scale)

Detail of Log of Pit No: P13/LB/2025

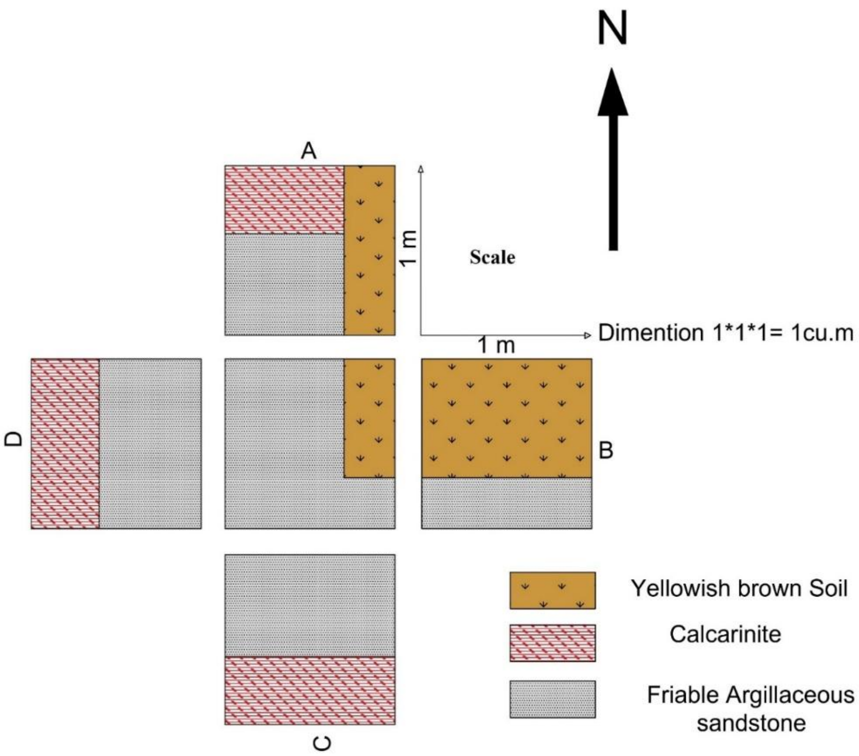
Name of the investigation: Bauxite, Ga, V, Ti, REE	**Date of commencement:** 10/04/2025
Pit No: P13/LB/2025	**Date of completion:** 10/04/2025
Location: 23.251845^0, 69.785185^0	**Elevation:** 101 m
Pit top measurement: a. Length: 1m b. Breadth: 1m	**Pit bottom measurement:** a. Length: 1m b. Breadth: 1m c. Depth: 1m
Recorded by: B. Mahesh	
Lithology details: Pebble sand and alluvial sand	
Log of pit: A, B, C, D are side section and E plan view is bottom of the pit.	
Sample: P13/LB/2025 sample was collected from bottom E alluvial sand.	



(Not to scale)

Detail of Log of Pit No: P14/LB/2025

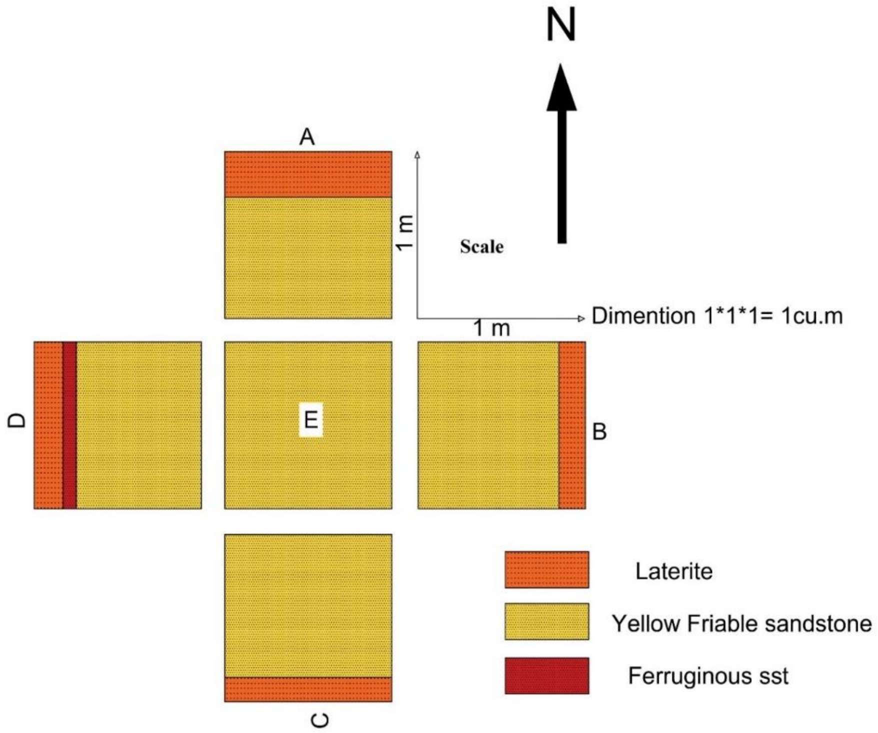
Name of the investigation: Bauxite, Ga, V, Ti, REE	**Date of commencement:** 11/04/2025
Pit No: P14/LB/2025	**Date of completion:** 11/04/2025
Location: 23.253473^0, 69.795188^0	**Elevation:** 89 m
Pit top measurement: a. Length: 1m b. Breadth: 1m	**Pit bottom measurement:** a. Length: 1m b. Breadth: 1m c. Depth: 1m
Recorded by: B. Mahesh	
Lithology details: alluvial soil and pinkish brown siltstone.	
Log of pit: A, B, C, D are side section and E plan view is bottom of the pit.	
Sample: P14/LB/2025 sample was collected from bottom E Pink pinkish brown siltstone friable.	



(Not to scale)

Detail of Log of Pit No: P15/LB/2025

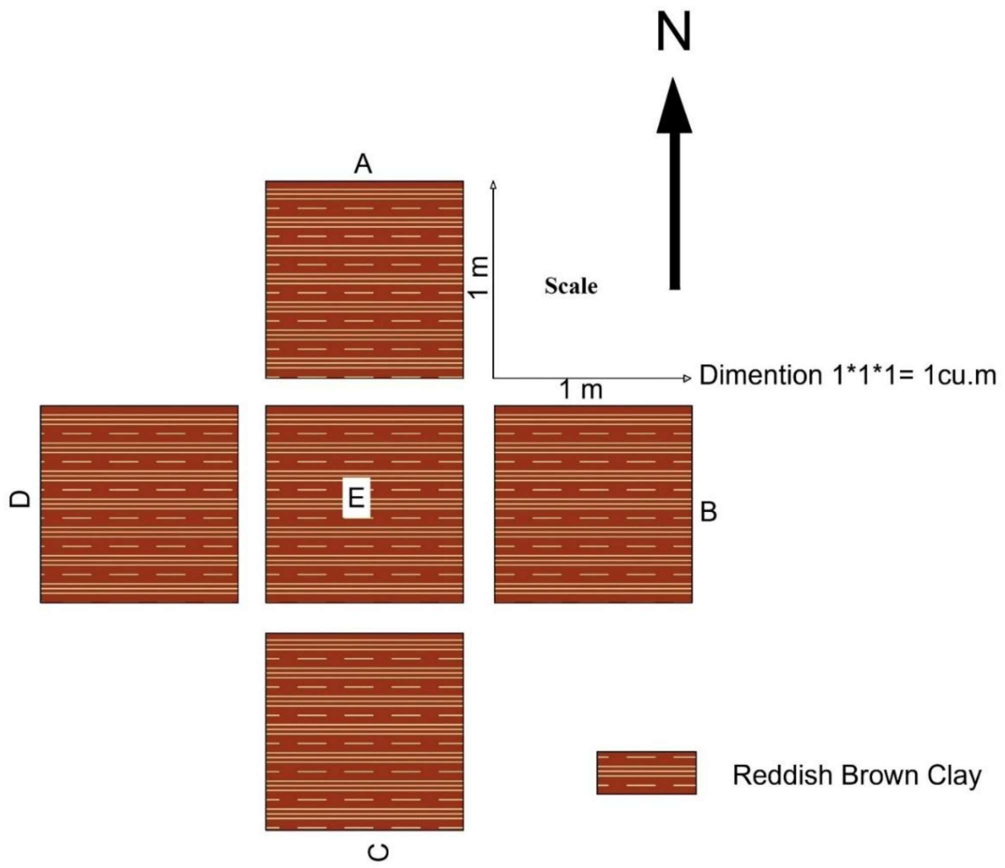
Name of the investigation: Bauxite, Ga, V, Ti, REE	**Date of commencement:** 12/04/2025
Pit No: P15/LB/2025	**Date of completion:** 12/04/2025
Location: 23.253473^{0}, 69.795188^{0}	**Elevation:** 102 m
Pit top measurement: a. Length: 1m b. Breadth: 1m	**Pit bottom measurement:** a. Length: 1m b. Breadth: 1m c. Depth: 1m
Recorded by: B. Mahesh	
Lithology details: Bright white calcarenite associated with dirty grey argillaceous sandstone and yellowish-brown soil.	
Log of pit: A, B, C, D are side section and E plan view is bottom of the pit.	
Sample: P15/LB/2025 sample was collected from bottom E calcarenite, argillaceous sandstone.	



(Not to scale)

Detail of Log of Pit No: P16/LB/2025

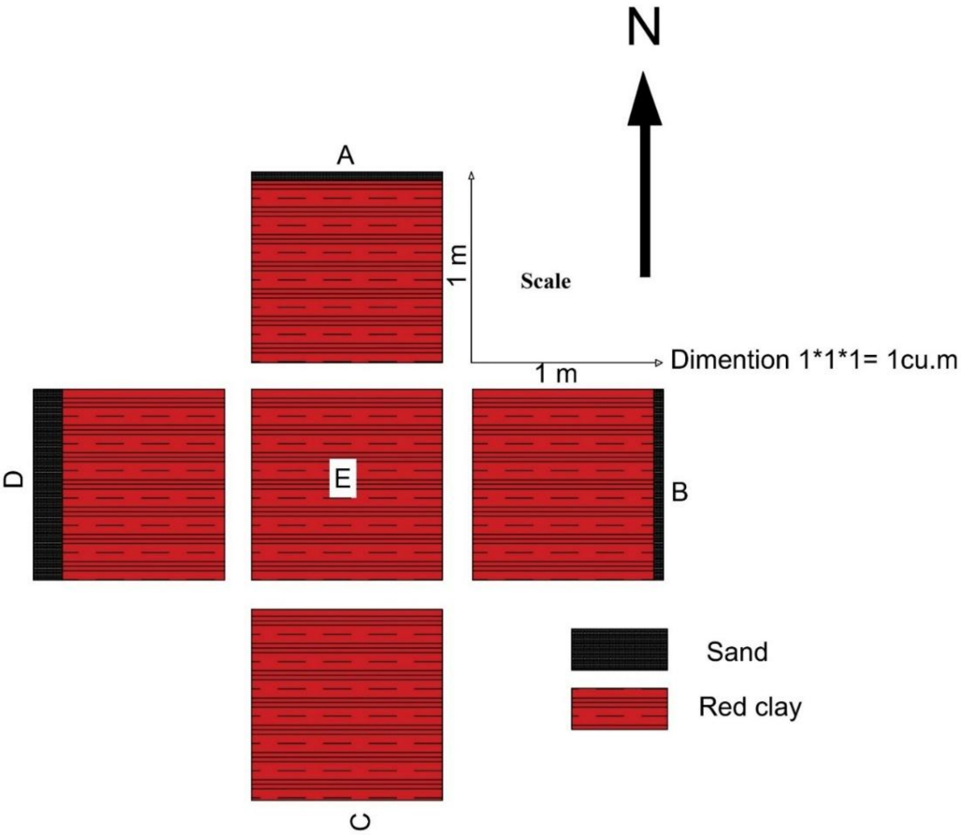
Name of the investigation: Bauxite, Ga, V, Ti, REE	**Date of commencement:** 13/04/2025
Pit No: P16/LB/2025	**Date of completion:** 13/04/2025
Location: 23.254027^0, 69.812915^0	**Elevation:** 103 m
Pit top measurement: a. Length: 1m b. Breadth: 1m	**Pit bottom measurement:** a. Length: 1m b. Breadth: 1m c. Depth: 1m
Recorded by: B. Mahesh	
Lithology details: Coarse-grained laterite containing iron concretions, associated with fine- to medium-grained yellow friable sandstone.	
Log of pit: A, B, C, D are side section and E plan view is bottom of the pit.	
Sample: P16/LB/2025 sample was collected from bottom E fine- to medium-grained yellow friable sandstone.	



(Not to scale)

Detail of Log of Pit No: P17/LB/2025

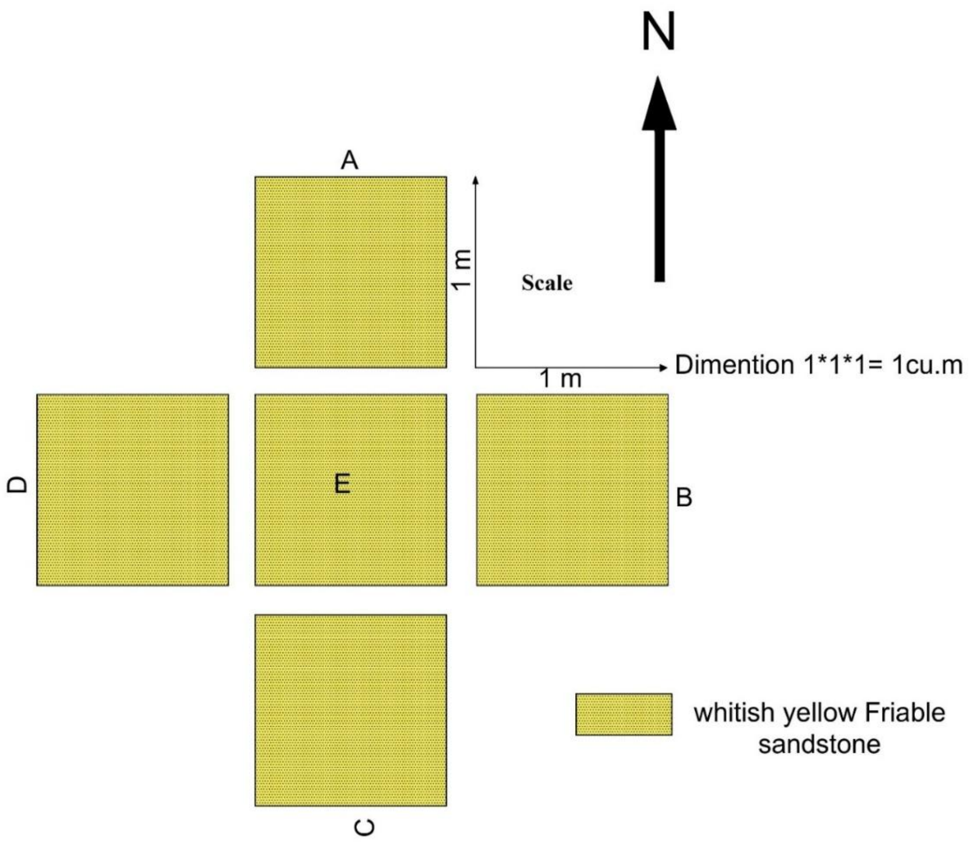
Name of the investigation: Bauxite, Ga, V, Ti, REE	**Date of commencement:** 13/04/2025
Pit No: P17/LB/2025	**Date of completion:** 13/04/2025
Location: 23.256977^0, 69.809662^0	**Elevation:** 101 m
Pit top measurement: a. Length: 1m b. Breadth: 1m	**Pit bottom measurement:** a. Length: 1m b. Breadth: 1m c. Depth: 1m
Recorded by: B. Mahesh	
Lithology details: Reddish-brown clay/claystone with interbeds of argillaceous sandstone.	
Log of pit: A, B, C, D are side section and E plan view is bottom of the pit.	
Sample: P17/LB/2025 sample was collected from bottom E Reddish-brown clay/claystone and argillaceous sandstone.	



(Not to scale)

Detail of Log of Pit No: P18/LB/2025

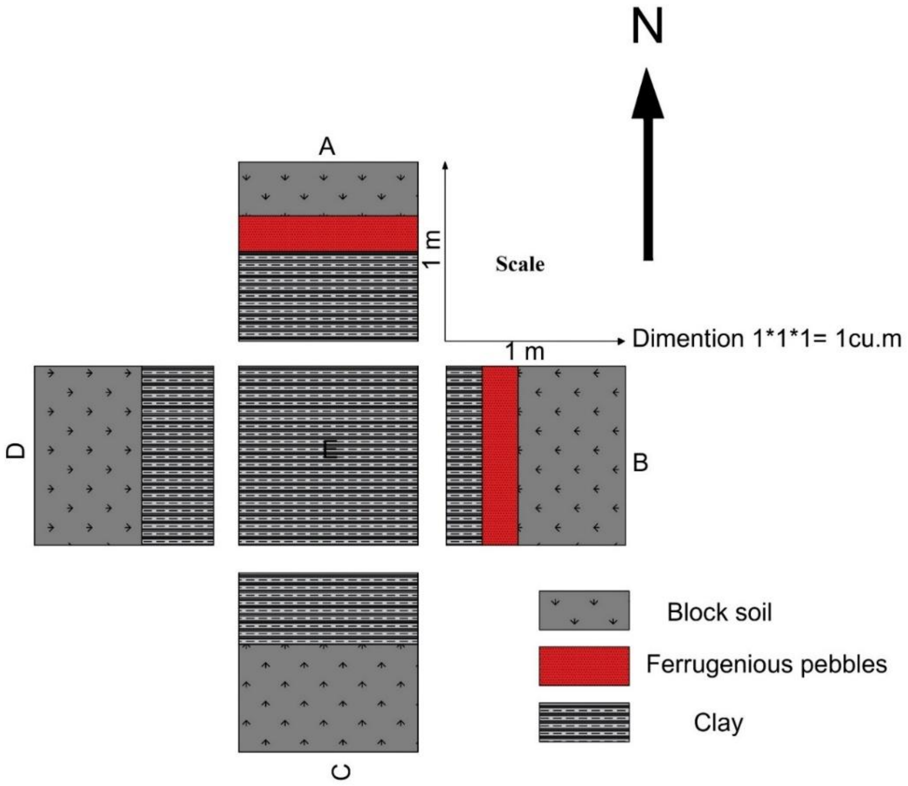
Name of the investigation: Bauxite, Ga, V, Ti, REE	**Date of commencement:** 13/04/2025
Pit No: P18/LB/2025	**Date of completion:** 13/04/2025
Location: 23.255683^0, 69.807545^0	**Elevation:** 107 m
Pit top measurement: a. Length: 1m b. Breadth: 1m	**Pit bottom measurement:** a. Length: 1m b. Breadth: 1m c. Depth: 1m
Recorded by: B. Mahesh	
Lithology details: alluvial sand with red clay.	
Log of pit: A, B, C, D are side section and E plan view is bottom of the pit.	
Sample: P18/LB/2025 sample was collected from bottom E red clay.	



(Not to scale)

Detail of Log of Pit No: P19/LB/2025

Name of the investigation: Bauxite, Ga, V, Ti, REE	**Date of commencement:** 13/04/2025
Pit No: P19/LB/2025	**Date of completion:** 13/04/2025
Location: 23.257502^0, 69.802448^0	**Elevation:** 112 m
Pit top measurement: a. Length: 1m b. Breadth: 1m	**Pit bottom measurement:** a. Length: 1m b. Breadth: 1m c. Depth: 1m
Recorded by: B. Mahesh	
Lithology details: whitish yellow medium to coarse grained friable sandstone.	
Log of pit: A, B, C, D are side section and E plan view is bottom of the pit.	
Sample: P19/LB/2025 sample was collected from bottom E Friable sandstone.	



(Not to scale)

Detail of Log of Pit No: P20/LB/2025

Name of the investigation: Bauxite, Ga, V, Ti, REE	**Date of commencement:** 14/04/2025
Pit No: P20/LB/2025	**Date of completion:** 14/04/2025
Location: 23.258523^0, 69.805964^0	**Elevation:** 115 m
Pit top measurement: a. Length: 1m b. Breadth: 1m	**Pit bottom measurement:** a. Length: 1m b. Breadth: 1m c. Depth: 1m
Recorded by: B. Mahesh	
Lithology details: Black soil containing ferruginous pebbles overlying fine- to medium-grained clay/claystone.	
Log of pit: A, B, C, D are side section and E plan view is bottom of the pit.	
Sample: P20/LB/2025 sample was collected from bottom E clay/ clay stone.	

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 m³. After excavation, the trench walls and floor were thoroughly cleaned to expose fresh, undisturbed lithology. From each trench, 10 representative channel samples (marked as T2/LB/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 T2/LB/2025/A, B, C, and D). This sampling approach ensured comprehensive coverage of both lateral and vertical lithological variations within the trench. Detailed litho-logs of trenches and assay values of trenches are given in plate no: IX, X respectively on 1:100 scale.

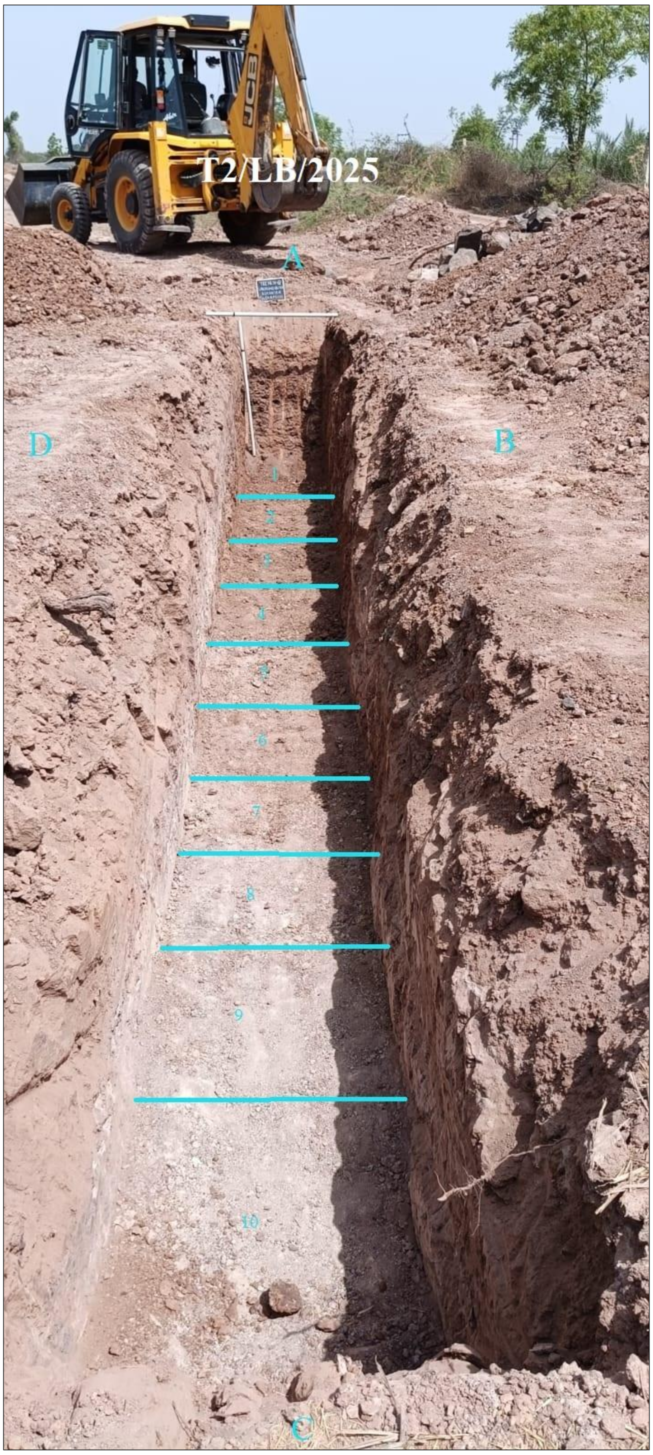
Table No: 6.4

The location of the trenches is mentioned below

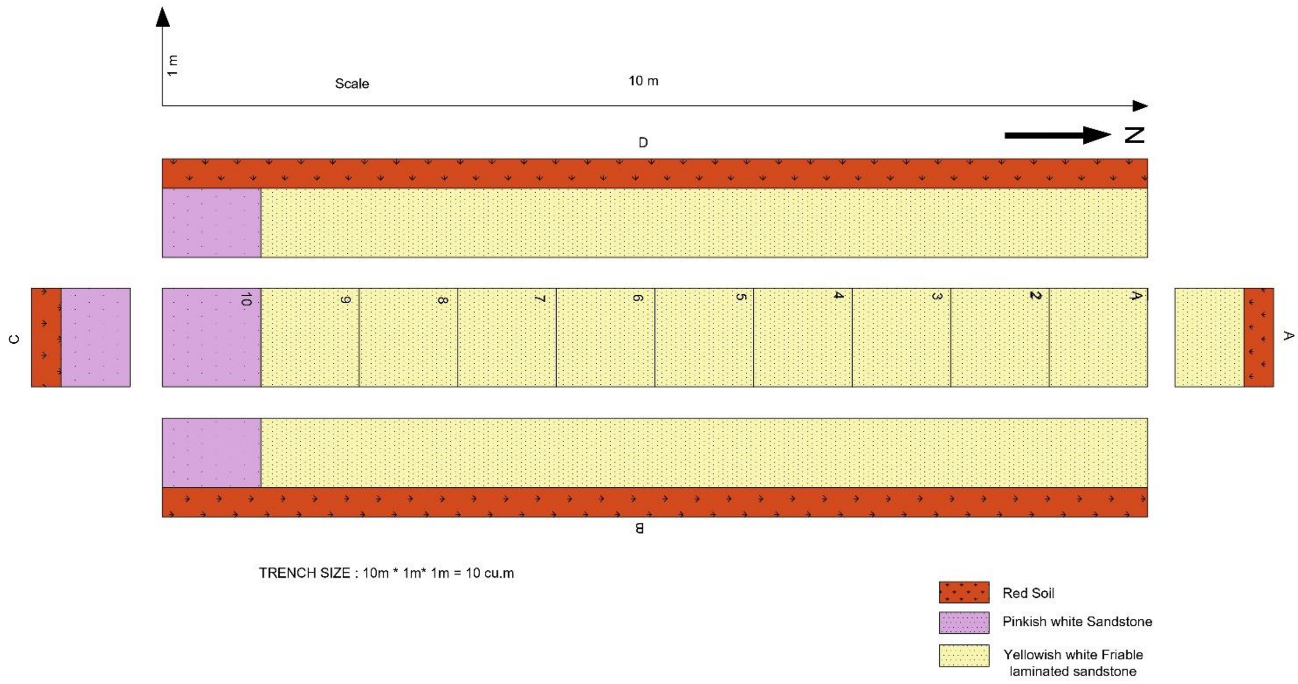
Sr No	Trench No	Coordinate in Degree Decimal Datum WGS-1984	
		Longitude (E)	Latitude(N)
1	T1/LB/2025	69.790595^0	23.250247^0
2	T2/LB/2025	69.800832^0	23.255485^0
3	T3/LB/2025	69.787268^0	23.244285^0
4	T4/LB/2025	69.809737^0	23.258332^0
5	T5/LB/2025	69.804085^0	23.248028^0

Photo No -: 26 Image showing trench in the study area

(Size 10*1*1 m)



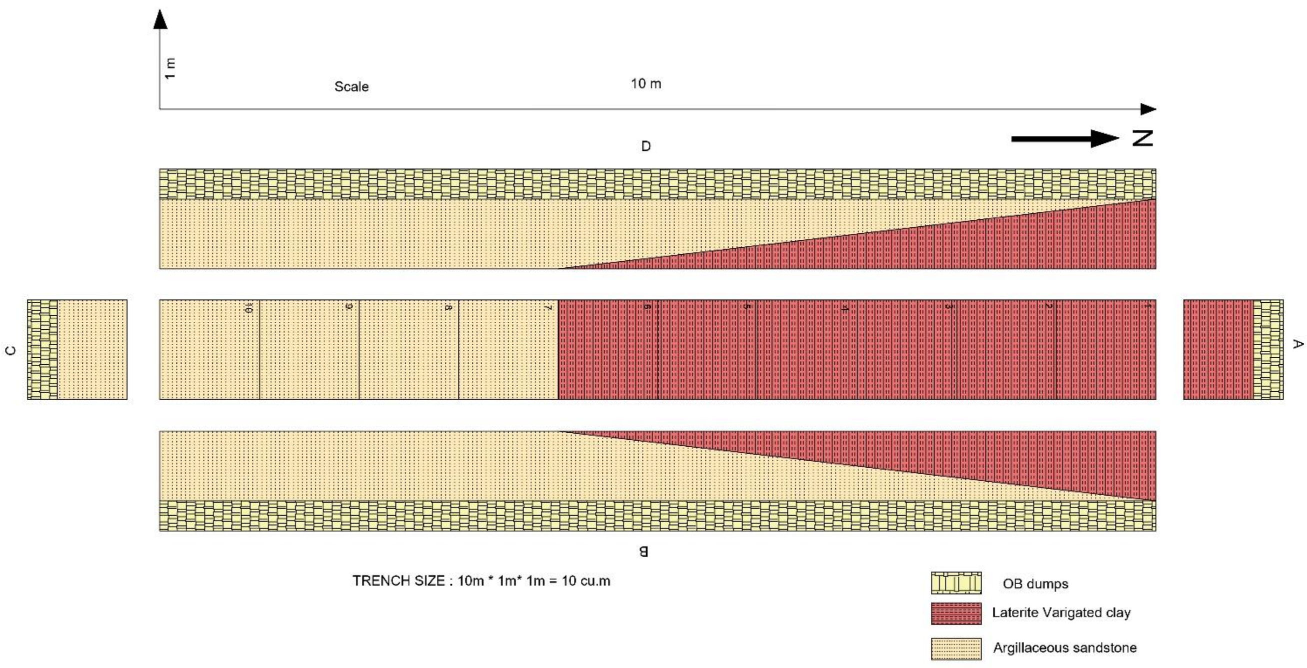
Brief description of trench profiles is given below for 5 trenches



(Not to scale)

Details of Log of Trench No: T1/LB/2025

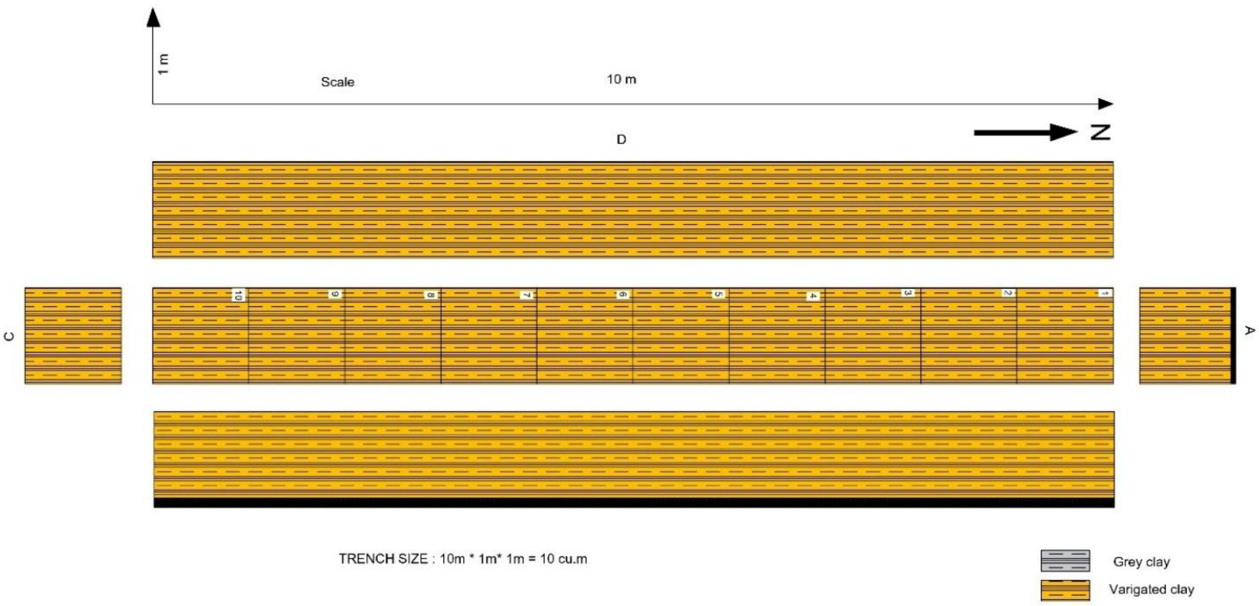
Name of the investigation: Bauxite, Ga, V, Ti, REE	**Date of commencement:** 10/04/2025
Trench No: T1/LB/2025	**Date of completion:** 10/04/2025
Location: 23.23.250247^{0}, 69.790593^{0}	**Elevation:** 101 m
a. Length: 10m b. Breadth: 1m c. Depth: 1m volume: (10 Cu.m)	
Recorded by: B. Mahesh	
Lithology details: Red soil underlain by yellowish-white, friable, laminated kaolinitic sandstone.	
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/LB/2025/01 to T1/LB/2025/10 and 4 samples from four side walls. (T1/LB/2025 - A, B, C, D respectively).Total 14 samples were collected from this trench.	



(Not to scale)

Details of Log of Trench No: T2/LB/2025

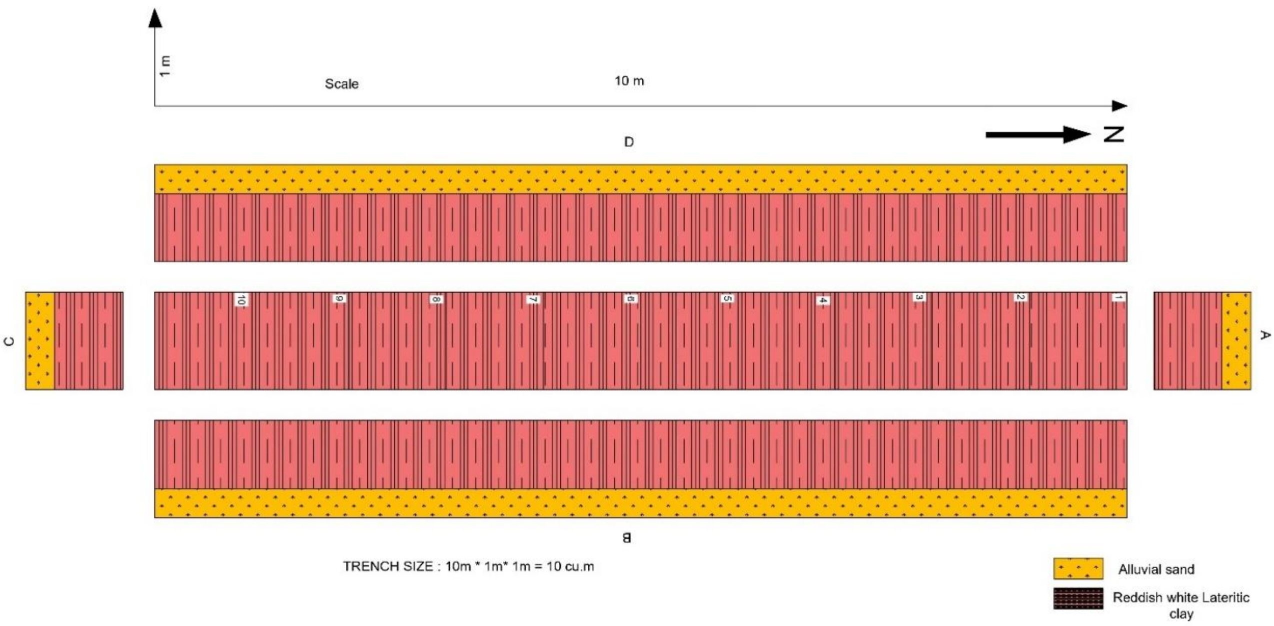
Name of the investigation: Bauxite, Ga, V, Ti, REE	**Date of commencement:** 11/04/2025
Trench No: T2/LB/2025	**Date of completion:** 11/04/2025
Location: 23.255485^0, 69.800832^0	**Elevation:** 117 m
a. Length: 10m b. Breadth: 1m c. Depth: 1m volume: (10 Cu.m)	
Recorded by: B. Mahesh	
Lithology details: Overburden (OB) dump comprising variegated lateritic clay with argillaceous sandstone.	
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/LB/2025/01 to T2/LB/2025/10 and 4 samples from four side walls. (T2/LB/2025 - A, B, C, D respectively).Total 14 samples were collected from this trench.	



(Not to scale)

Details of Log of Trench No: T3/LB/2025

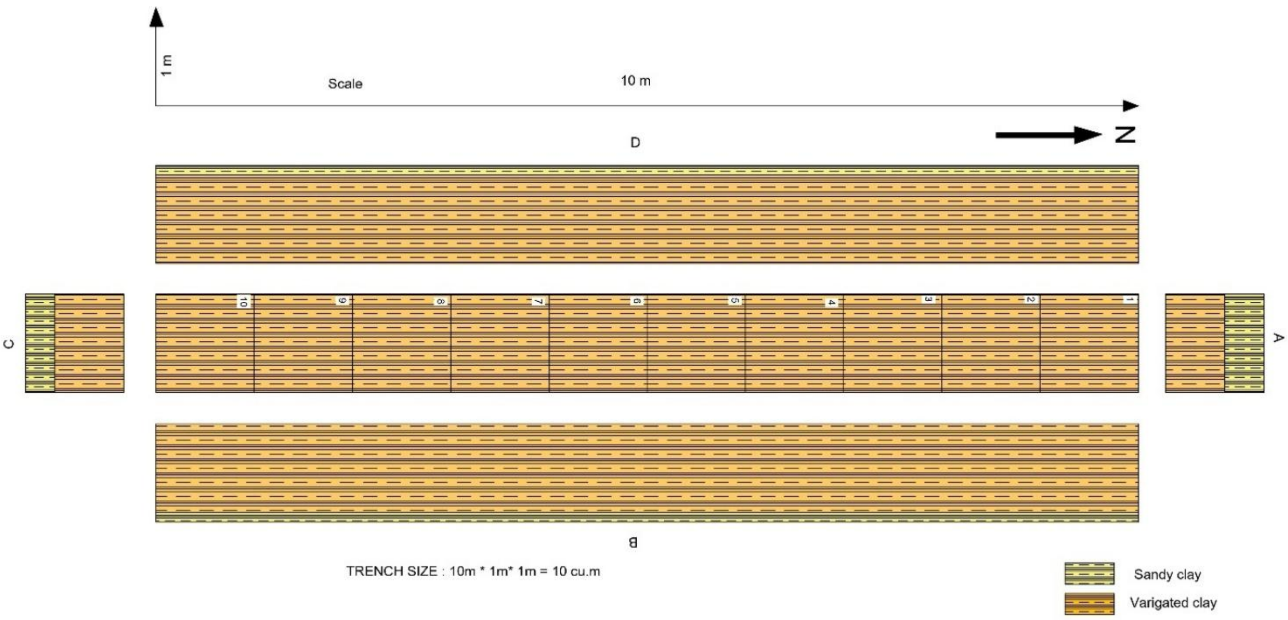
Name of the investigation: Bauxite, Ga, V, Ti, REE	**Date of commencement:** 12/04/2025
Trench No: T3/LB/2025	**Date of completion:** 12/04/2025
Location: 23.244285^0, 69.787268^0	**Elevation:** 103 m
a. Length: 10m b. Breadth: 1m c. Depth: 1m volume: (10 Cu.m)	
Recorded by: B. Mahesh	
Lithology details: The sequence comprises **clay, variegated clay, claystone, and bauxitic clay** occurring in association.	
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/LB/2025/01 to T3/LB/2025/10 and 4 samples from four side walls. (T3/LB/2025 - A, B, C, D respectively).Total 14 samples were collected from this trench.	



(Not to scale)

Details of Log of Trench No: T4/LB/2025

Name of the investigation: Bauxite, Ga, V, Ti, REE	**Date of commencement:** 13/04/2025
Trench No: T4/LB/2025	**Date of completion:** 13/04/2025
Location: 23.258332^0, 69.809737^0	**Elevation:** 100 m
a. Length: 10m b. Breadth: 1m c. Depth: 1m volume: (10 Cu.m)	
Recorded by: B. Mahesh	
Lithology details: Predominantly alluvial sand associated with reddish-white lateritic clay.	
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/LB/2025/01 to T4/LB/2025/10 and 4 samples from four side walls. (T4/LB/2025 - A, B, C, D respectively).Total 14 samples were collected from this trench.	



(Not to scale)

Details of Log of Trench No: T5/LB/2025

Name of the investigation: Bauxite, Ga, V, Ti, REE	**Date of commencement:** 14/04/2025
Trench No: T5/LB/2025	**Date of completion:** 14/04/2025
Location: 23.248028^0, 69.804085^0	**Elevation:** 102 m
a. Length: 10m b. Breadth: 1m c. Depth: 1m volume: (10 Cu.m)	
Recorded by: B. Mahesh	
Lithology details: The formation consists predominantly of **variegated clay** exhibiting reddish-brown, greenish-white, and yellow hues, with **localized patches of laterite** and **argillaceous sand of reddish-yellow color**.	
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/LB/2025/01 to T5/LB/2025/10 and 4 samples from four side walls. (T5/LB/2025 - A, B, C, D respectively). Total 14 samples were collected from this trench.	

6.1.8 Sampling

Sampling is a systematic process of collecting material from a geological medium to obtain the most representative information about its composition. In the present investigation of the Lakhond Area, sampling was carried out through the excavation of pits and trenches, enabling the collection of fresh, in-situ material for detailed geochemical analysis.

A total of 20 pit samples and 70 trench samples were collected through systematic pitting and trenching activities within the study area.

Sample collection

A representative sample (2–3 kg) was collected from the bottom of the pit 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 and structural details of all four walls and the pit bottom were systematically recorded.

Sample preparation

All samples were then transported to the nearest base camp for preparation of laboratory samples. The sample preparation followed a multi-stage crushing, grinding, and sieving protocol.

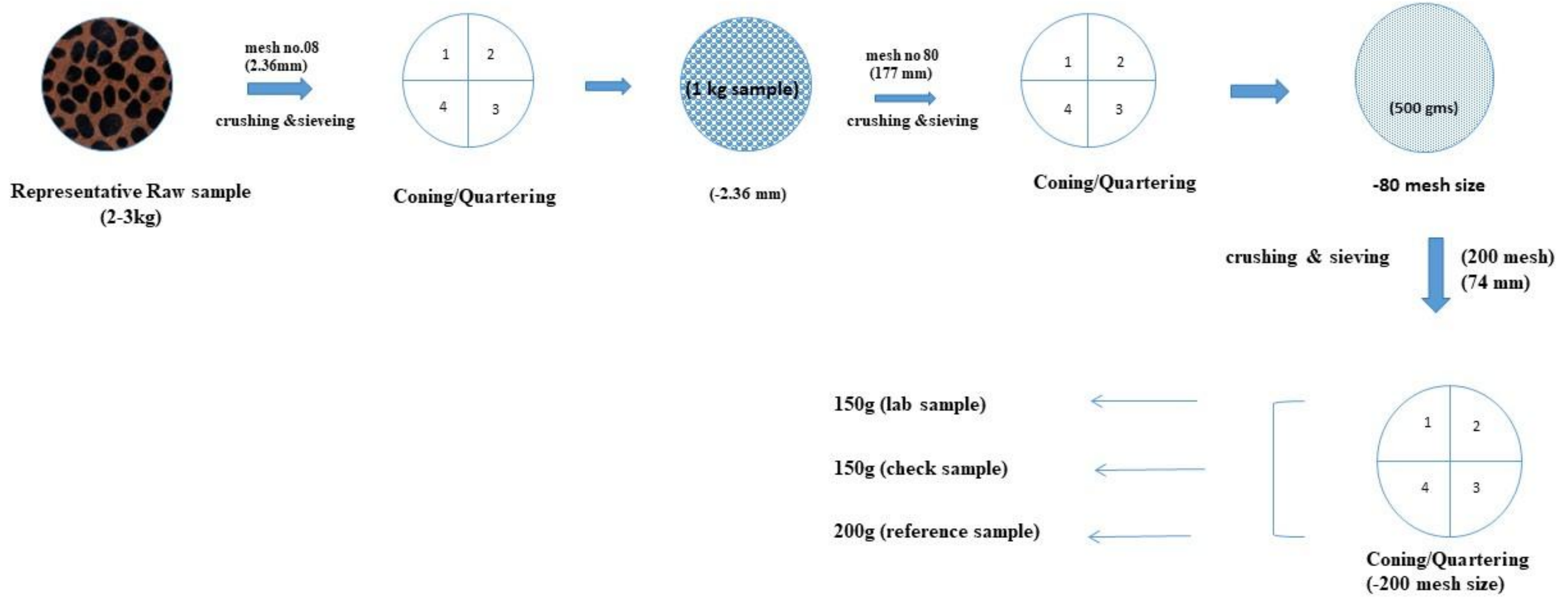
1. **Initial Crushing & Sieving**: Mesh No. 8 (2.36 mm) The entire bulk sample was crushed and sieved. The oversize was further crushed to pass through the mesh no:08 completely. The sieved material of (-8 mesh size) was reduced to 1 kg by Coning and Quartering, ensuring homogeneity.
2. **Second Stage**: 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 Sampling preparation Procedure



Note: In all the above stages of sample preparation, proper care is taken to maintain the homogeneity of the sample and preserve different fractions with proper packing and labelling. We use steel pistol & mortar for crushing and grinding purposes.

Fig No: 10

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

Photo 27: Sampling shed, CMT, Bhuj-Gujarat

Photo 28: Recording the details of the sample

Photo 29: Crushing and sieving of samples

Photo 30: Coning and Quartering

Sieves used:

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

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

Photo 33: Sieve no 200 mesh (~75 micron) and packing of the final sample

6.1.9 Discussion on Geochemistry of pit and trench samples

Geochemistry of pit and trench Samples:

A total of 92 pit and trench samples were analysed for major oxides, including TiO_2 and V, while 15 selected samples were analysed for Rare Earth Elements by ICPMS (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 to medium and fall below the threshold limits required for economic significance.

Lithologically, both the Bhuj Formation and Sandhan Formation are composed predominantly of feldspathic sandstones, argillaceous sandstones, siltstones interbedded with clay bands/lenses. Geochemical analysis indicates relatively high SiO_2 values, moderate Al_2O_3, and moderate TiO_2 contents, which classify these materials predominantly as bauxitic clay rather than true bauxite. This is mainly because the bauxite-bearing Matanomadh Formation is absent within the study area, except for a small exposure along the eastern boundary and it does not extend westward.

However, a limited occurrence of low-grade clayey bauxite was identified near Trench T3 along a nala in the southwestern corner of the study area. The sample is pinkish-white clayey bauxite and shows the following chemical composition: SiO_2: 28.28%, Al_2O_3: 43.27%, Fe_2O_3: 3.36%, TiO_2: 3.45% and Reactive silica: 27.98% (it should be ≤ 5.0% for Bauxite)

Despite these fairly favourable values of Al2O3, no lateral or vertical continuity of this clayey bauxitic horizon was observed in the field and in drill core sample values respectively.

Further geochemical analysis of samples collected from pits and trenches indicates the following average major oxide values:

Bhuj Formation:

Bhuj formation shows an average value of SiO_2: 42.08%, Al_2O_3: 22.22%, Fe_2O_3: 13.92%, TiO_2: 4.07% and Reactive Silica: 30.25% (in sample no: T4/LB/2025/06) and Vanadium: 243.98 ppm

Sandhan Formation:

Sandhan formation shows an average value of SiO_2: 52.55%, Al_2O_3: 21.91%, Fe_2O_3: 7.85%, TiO_2: 2.40% and Reactive silica: 27.98% (in sample no: T3/LB/2025/06) and Vanadium: 180.86 ppm

The relatively high silica content and comparatively lower alumina values indicate that the material corresponds to bauxitic clay/ clayey bauxite rather than economic-grade bauxite. In addition, the presence of very high reactive silica values ranging from 27.98% to 30.25% further confirms that the material does not qualify as bauxite but represents bauxitic clay.

Furthermore, ternary diagram plotting of the major oxide compositions of both Bhuj and sandhan formation shows that the majority of the analysed samples fall within the bauxitic clay field and few in clayey bauxite field, supporting the geochemical interpretation that the lithological units in the investigated area are predominantly siliceous and clay-rich rather than true bauxite-bearing horizons.

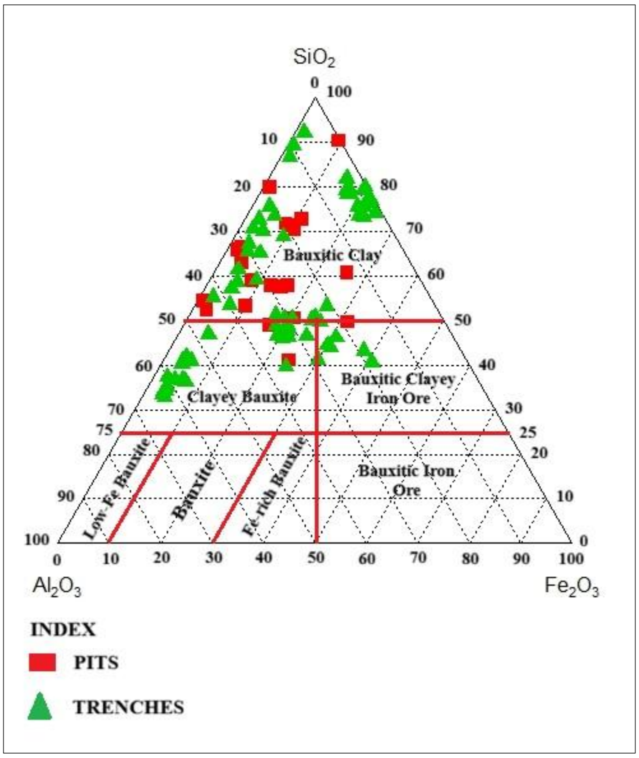


Fig no: 11 Ternary plots: Classification of Laterites (after Bardoshshi,1981)

Both Bhuj and Sandhan formations show low to moderate geochemical anomalies of Total Rare Earth Elements (TREE); however, no depth persistence is observed in the drill core samples. REE is associated with reddish brown clays/Lateritic clays with iron oxide patches (Pit P17 and Trench T4), white kaolinized sandstone (LKD-BH-03)

In the Bhuj Formation, TREE values from pit and trench samples range from 217.29 ppm to 1469.62 ppm, with an average of 625.37 ppm. Gallium values range from 13.10 ppm to 50.85 ppm, averaging 30.58 ppm. Two relatively moderate TREE values were recorded in samples collected along the nala (Pit P17 and Trench T4),, likely due to weathering and secondary concentration enrichment.

Pit sample: P17/LB/2025 — 1214.46 ppm

Trench sample: T4/LB/2025/06 — 1469.62 ppm

In the Sandhan Formation, TREE values range from 311.00 ppm to 748.57 ppm, with an average of 520.38 ppm, while Gallium values range from 14.68 ppm to 41.48 ppm, averaging 28.43 ppm.

Overall, the geochemical characteristics indicate bauxitic clay with minor REE enrichment but without significant economic potential due to lack of continuity and depth persistence.

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.

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

Geochemistry of Bhuj Formation:

A total of 17 pit samples (16 pit samples from 15 pits and one BRS-1 sample: P2, P4, P5, P6, P7, P8, P9, P10A, P10B, P11, P14, P16, P17, P18, P19 and P20) from pits and 28 samples from two Trenches T2 and T4. All 45 samples were analyzed for Major oxides including TiO2, Vanadium and 10 samples for REE and Gallium. The summary of the results are listed in the following tables. Analytical results of Major oxides and REE of Bhuj formation are given in Annexure – IV (A) & V (A) respectively

Table No 6.5: Summary of major oxide values (pit &trench samples) of Bhuj Formation

Oxides (%)/ Element (ppm)	Minimum value	Maximum values	Mean value
SiO2 (%)	31.01	86.10	42.08
Al2O3(%)	0.10	39.34	22.22
Fe2O3(%)	1.21	32.78	13.92
MnO (%)	0.01	0.16	0.02
MgO (%)	0.01	0.93	0.27
CaO (%)	0.13	15.68	3.47
Na2O (%)	0.04	0.39	0.14
K2O (%)	0.00	0.62	0.20
TiO2(%)	0.52	9.59	4.07
P2O5(%)	0.02	0.49	0.18
LOI (%)	1.63	17.70	13.23
V(ppm)	53.40	502.08	243.98

The Al_2O_3, SiO_2, Fe_2O_3, and TiO_2 values obtained from reddish-brown clays, clays with iron oxide patches, siltstones, and argillaceous sandstones of the Bhuj Formation align well with the characteristics of the "Bauxitic clay" category in laterite classification. In this classification, lateritic materials are categorized based on their chemical composition and mineralogy, commonly represented using a ternary diagram of Al_2O_3–SiO_2–Fe_2O_3 as the principal components.

The "Bauxitic clay" category is typically characterized by relatively low alumina (Al_2O_3) content and comparatively high silica (SiO_2) values. The analyzed samples show an average Al_2O_3 content of 22.22% (range 0.10–39.34%) and an average SiO_2 content of 42.08% (range 31.01–86.10%), which is consistent with this classification. The average TiO_2 value of 4.07% (range 0.52–9.59%) also falls within the expected range for such lateritic materials.

Therefore, the plotted geochemical data and ternary diagram results indicate that the sampled materials from the Bhuj Formation are best classified as "Bauxitic clay." This reflects intense weathering and partial concentration of aluminium oxides with significant silica content and characteristic TiO_2 values, which are typical of lateritic soils and clays rather than economically viable bauxite deposits.

The values of SiO_2, Al_2O_3, and Fe_2O_3 were plotted on a ternary diagram to classify the lateritic materials, and the results are presented in Fig. No 11

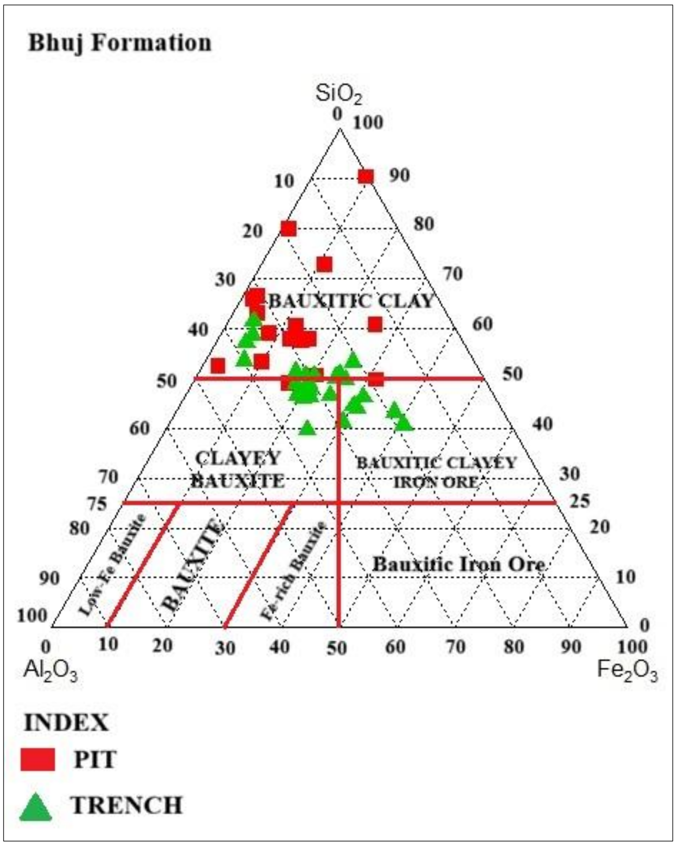


Fig No: 12 Ternary diagram to classify the laterite material in Bhuj Formation **(after Bardoshshi,1981)**

Further 10 samples were analyzed for REE, Ga from Bhuj formation and the analytical results are furnished in Table no: 6.7 below

Table 6.6: Summary of REE and Gallium values of (pit & trench samples) Bhuj Formation

Bhuj Formation			
Element (ppm)	**min**	**max**	**Average**
Lanthanum (La)	40.65	217.03	93.62
Cerium (Ce)	70.60	395.38	201.16
Praseodymium (Pr)	9.55	84.30	40.46
Neodymium (Nd)	60.50	565.65	252.03
Promethium (Pm)	-	-	-
Samarium (Sm)	5.83	64.88	23.03
Europium (Eu)	1.18	13.60	5.04
Gadolinium (Gd)	5.75	68.95	30.06
Terbium (Tb)	1.43	1.43	1.43
Dysprosium (Dy)	2.13	21.15	8.69
Holmium (Ho)	<1.0	<1.0	<1.0
Erbium (Er)	3.63	46.18	17.54
Thulium (Tm)	<1.0	<1.0	<1.0
Ytterbium (Yb)	1.73	12.98	5.27
Lutetium (Lu)	1.10	5.43	2.95
Total REE	**217.29**	**1469.62**	**679.43**
Scandium (Sc)	10.45	49.10	23.48
Yttrium(Y)	13.48	48.70	30.25
Total (REE +Sc+Y)	**241.50**	**1555.25**	**733.18**
Gallium (Ga)	13.10	50.85	30.32
Uranium (U)	32.80	260.18	80.44
Thorium (Th)	55.65	208.45	125.47

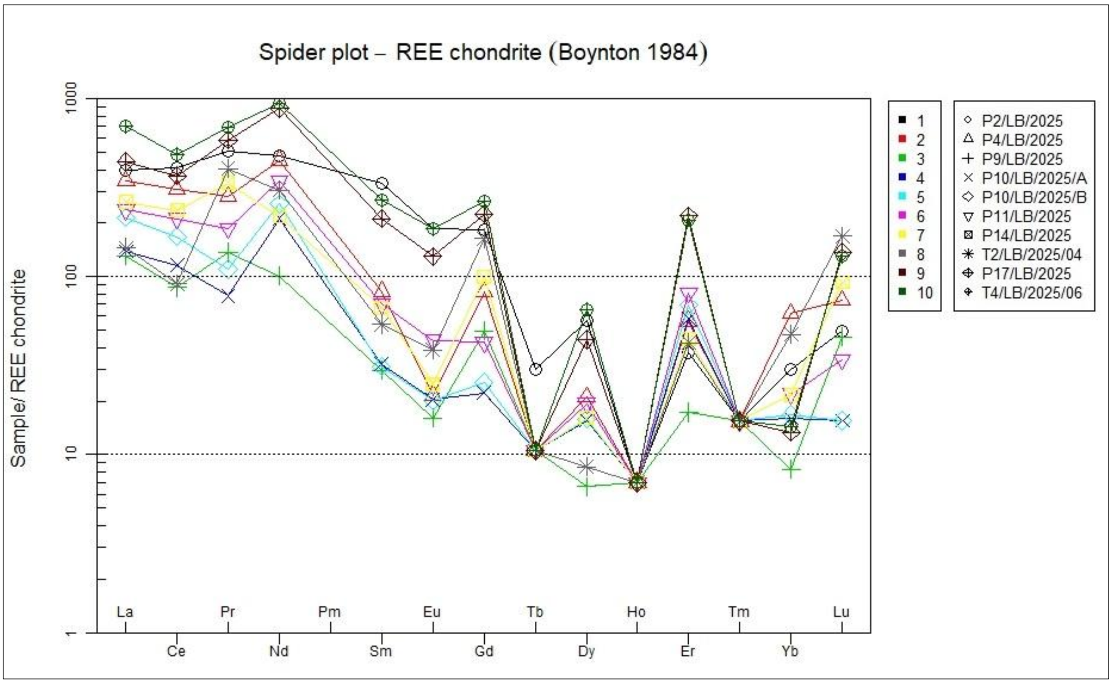


Fig No: 13 Spider plot of REE in Bhuj Formation

The total REE values in the Bhuj Formation are generally low to moderate. However, two samples, P17/LB/2025 (1214.46 ppm) and Trench T4/LB/2025/06 (1469.62 ppm), collected along the nala section, show comparatively higher concentrations. The enrichment of REE in these samples is likely attributed to weathering and secondary concentration along the drainage channel, which may have led to the accumulation of REE-bearing minerals.

In addition, these samples also show significant concentrations of Uranium and Thorium. Uranium values range from 32.8 ppm to 260.18 ppm, while the corresponding Thorium values vary from 43.00 ppm to 208.45 ppm. The elevated U and Th values may be related to the presence and concentration of heavy minerals during weathering and transportation processes.

Geochemistry of Sandhan Formation:

Three pit samples (P12, P13, and P15) and forty-two samples collected from three trenches (T1, T3, and T5) in the Sandhan Formation were analyzed for major oxides including Al_2O_3, SiO_2, Fe_2O_3, TiO_2, and Vanadium. In addition, four samples were analyzed for Rare Earth Elements (REE) and Gallium. The analytical results are presented in the following table.

The Al_2O_3, SiO_2, Fe_2O_3, and TiO_2 values obtained from pinkish white clays, clays with iron oxide patches, and siltstones of the Sandhan Formation correspond well with the characteristics of the “Bauxitic clay” category in laterite classification. In this classification, lateritic materials are categorized based on their chemical composition and mineralogy, commonly represented using a ternary diagram of Al_2O_3–SiO_2–Fe_2O_3. The “Bauxitic clay” category is typically characterized by relatively low alumina (Al_2O_3) content and comparatively high silica (SiO_2) values. The analyzed samples show an average Al_2O_3 value of 21.91% (range 0.24–46.01%) and an average SiO_2 value of 52.55% (range 24.06–87.75%), which is consistent with this classification. The average TiO_2 value of 2.40% (range 0.79–4.56%) also falls within the expected range for such lateritic materials.

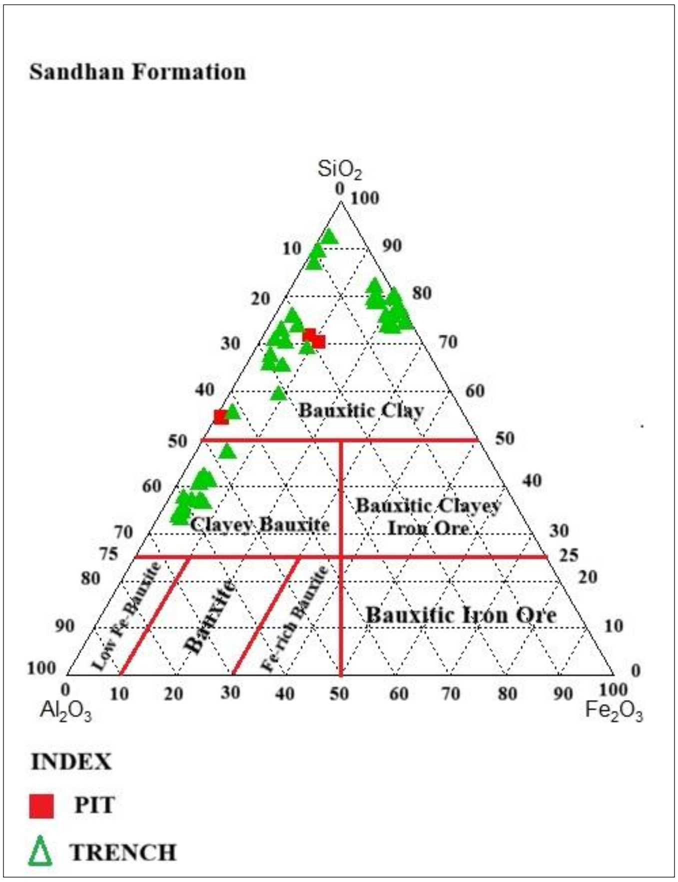
Table 6.7 Summary of major oxides (pit & trench samples) of Sandhan Formation

Oxides (%)/ Element (ppm)	Minimum value	Maximum values	Mean value
SiO2 (%)	24.06	87.75	52.55
Al2O3(%)	0.24	46.01	21.91
Fe2O3(%)	0.99	20.61	7.85
MnO (%)	0.01	0.18	0.06
MgO (%)	0.06	1.93	0.76
CaO (%)	0.13	3.92	0.96
Na2O (%)	0.08	1.50	0.49
K2O (%)	0.02	7.52	0.46
TiO2(%)	0.79	4.56	2.40
P2O5(%)	0.04	0.69	0.11
LOI (%)	3.21	22.29	12.29
V(ppm)	32.50	444.00	180.86

However, in Trench T3, a localized occurrence of clayey bauxite was encountered with geochemical values of SiO_2: 28.28%, Al_2O_3: 43.27%, Fe_2O_3: 3.36%, TiO_2: 3.45%, and reactive silica: 27.98%. The reactive silica value is significantly higher than the acceptable limit of ≤5% for metallurgical grade bauxite. Furthermore, geological mapping and drilling results indicate that this occurrence is patchy in nature and lacks both lateral and vertical continuity.

Therefore, the geochemical data and ternary diagram plots indicate that the sampled materials from the Sandhan Formation are best classified as "Bauxitic clay." This reflects intense weathering and partial enrichment of aluminium oxides with significant silica content and moderate TiO_2 values, which are typical characteristics of lateritic soils and clays rather than economically viable bauxite deposits.

Fig No: 14 Ternary plot of classification of laterites of Sandhan Formation (after Bardoshshi,1981)



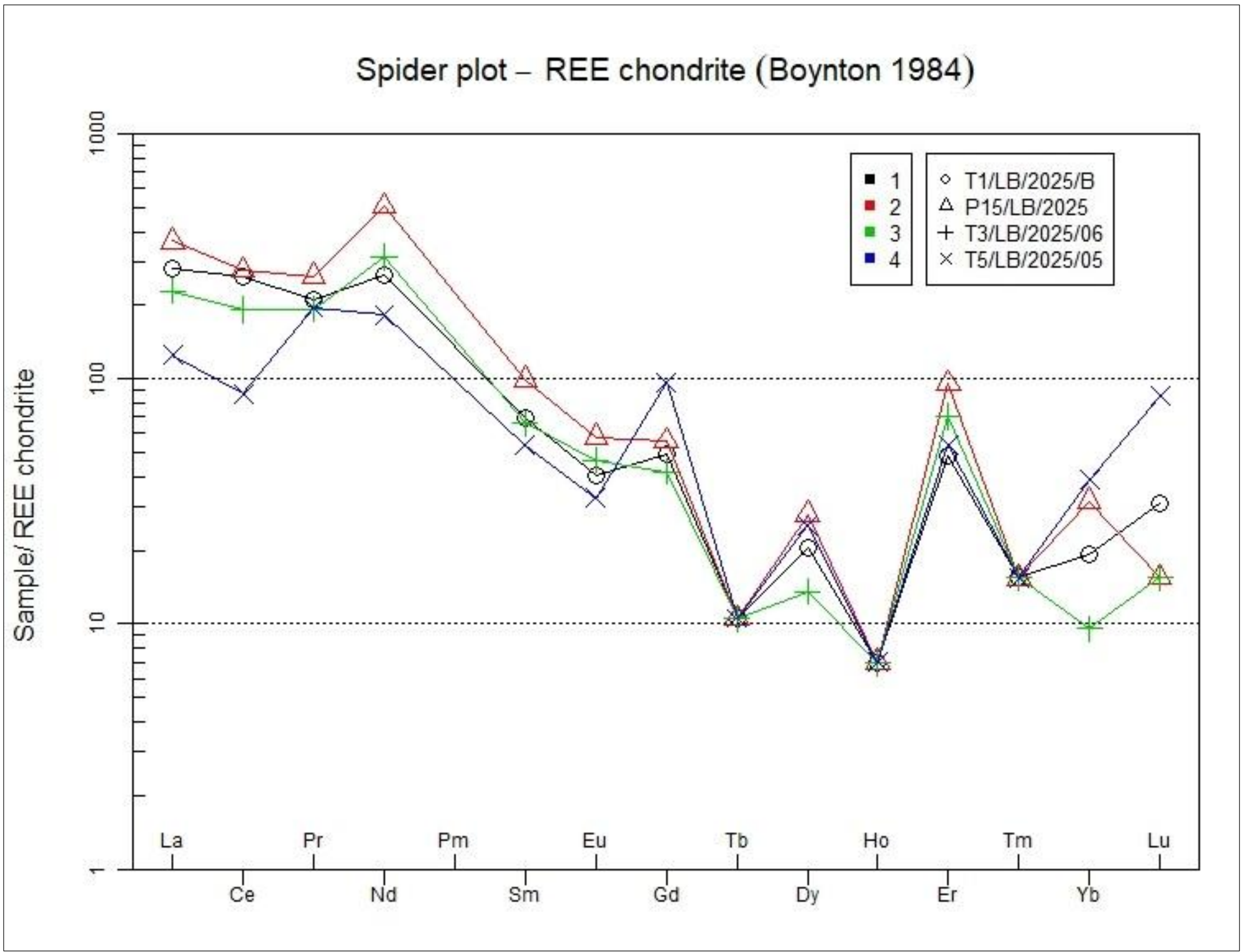
All the pit and trench samples are falling under Bauxitic clay except Trench T3 that falls under Clayey bauxite category due to high silica %.

Table no 6.8 Summarized table showing range of REE & Ga in Sandhan Formation

REE (ppm)	**Minimum value(ppm)**	**Maximum value (ppm)**	**Mean Value (ppm)**
Lanthanum (La)	38.80	113.15	77.71
Cerium (Ce)	70.43	224.35	165.42
Praseodymium (Pr)	23.53	32.15	26.30
Neodymium (Nd)	109.68	304.98	190.52
Promethium (Pm)	NA	NA	NA
Samarium (Sm)	10.43	19.45	14.08
Europium (Eu)	2.40	4.25	3.27
Gadolinium (Gd)	10.88	25.15	15.82
Terbium (Tb)	<1.0	<1.0	<1.0
Dysprosium (Dy)	4.38	9.03	7.04
Holmium (Ho)	<1.0	<1.0	<1.0
Erbium (Er)	10.18	20.13	14.11
Thulium (Tm)	<1.0	<1.0	<1.0
Ytterbium (Yb)	2.00	8.08	5.19
Lutetium (Lu)	1.00	2.75	1.88
Total REE	**311.00**	**748.57**	**520.39**
Scandium (Sc)	16.48	28.33	20.02
Yttrium(Y)	12.73	47.65	29.71
(Total REE+Sc+Y)	**375.13**	**795.15**	**570.12**
Gallium (Ga)	14.68	41.48	28.43
Uranium (U)	65.18	65.18	65.18
Thorium (Th)	43.00	148.53	83.97

The total REE values in the Sandhan Formation vary from low to moderate (311–748.57 ppm) and are not sufficiently high to indicate any potential for a prospective REE deposit.

Fig no: 15 Diagram showing Spider plot of REE is given below



Geochemistry of Matanomadh Formation: It occupies very small area in the eastern margin of the block and one pit was excavated from this formation (P3/LB/2025) and analysed for major oxides, Gallium, Vanadium & REE and the results are given below in Table No: 6.9

Table No: 6.9 Analysis of Major oxides in Matanomadh Formation

Oxides (%)/ Element (ppm)	Values
SiO2 (%)	33.99
Al2O3(%)	28.59
Fe2O3(%)	20.23
MnO (%)	0.05
MgO (%)	0.37
CaO (%)	1.01
Na2O (%)	0.38
K2O (%)	0.55
TiO2(%)	1.48
P2O5(%)	0.18
LOI (%)	12.96
V(ppm)	199.78
Total REE (ppm)	**504.64**
Scandium	21.75
Yitrium	27.83
Total REE + (Sc+Y)	**554.22**
Gallium(ppm)	41.73
Uranium (ppm)	140.63
Thorium (ppm)	133.60

lateritic bauxitic clay with low Al_2O_3 and relatively high SiO_2 values and also low TiO_2, Vanadium, Gallium and TREE values found in this sample.

Geochemistry of Gaj Formation: It occupies very small area in the eastern margin of the block and one pit was excavated from this formation (P1/LB/2025) and analysed for major oxides Vanadium and the results are given below in Table No: 6.10

Table No: 6.10 Analysis of Major Oxides in Gaj Formation

Oxides (%)/ Element (ppm)	Minimum value
SiO2 (%)	61.80
Al2O3(%)	16.31
Fe2O3(%)	8.63
MnO (%)	0.03
MgO (%)	0.78
CaO (%)	0.74
Na2O (%)	0.18
K2O (%)	0.76
TiO2(%)	1.69
P2O5(%)	0.09
LOI (%)	8.72
V(ppm)	93.7

The low Al_2O_3 content (16.31%) and relatively high SiO_2 content (61.80%) in the Gaj Formation make it unfavorable for bauxite mineralization.

Overall Geochemical Interpretation for Bauxite Prospect:

The geochemical analysis of samples collected from the Bhuj, Sandhan (major formations in the study area), Matanomadh and Gaj formations (occur as small patch near eastern margin) indicates that none of these formations show favorable characteristics for economically viable bauxite mineralization within the study area.

The Bhuj and Sandhan formations are predominantly represented by reddish-brown clays, silty clays, and argillaceous sandstones which, based on their Al_2O_3–SiO_2–Fe_2O_3 geochemical signatures and ternary diagram plots, fall within the "Bauxitic clay" category of laterite classification (Schellmann,W.(1986).Jadhav,G.N., Sharma, N. & Sen, P.(2012) and Singh,B.P. et al.(2019) .These materials are characterized by relatively low alumina and comparatively high silica contents, which are not suitable for metallurgical grade bauxite.

Although a localized occurrence of clayey bauxite was encountered in Trench T3 of the Sandhan Formation, it shows high reactive silica and lacks both lateral and vertical continuity, as confirmed through geological mapping and drilling. Similarly, the Gaj Formation exhibits low Al_2O_3 and high SiO_2 values, making it unfavorable for bauxite mineralization.

Therefore, based on geological mapping, geochemical analytical results, and laterite classification through ternary diagram plots, it is concluded that the formations exposed within the study area predominantly contain bauxitic clay and lateritic materials rather than economically viable bauxite deposits.

6.1.10 DGPS survey

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 Geographic coordinates and elevation of all pit and trench sites, as well as for outcrop mapping across the study area.

This DGPS survey was conducted to establish accurate ground control points and record precise coordinates for block boundary points and borehole locations in the study area.

Coordinates, in both, the Geographic Coordinate System (with WGS 1984 datum) and UTM coordinate system (Zone 42N, WGS 1984 datum), were recorded during the DGPS survey enabling accurate integration of field data with GIS-based mapping and interpretation. The Reduced level (RL) was to 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 LKD-TBM-1 and LKD-TBM-2. These temporary benchmarks may be used as reference points for subsequent mapping and geospatial integration. The details of RL, Co-ordinates of Block boundary points, borehole points and temporary bench marks are given in the following table no: 6.11.

Photo No: 34 Temparory bench mark (LKD-TBM-1)

Photo No: 35 Temparory bench mark (LKD-TBM-2)

Photo No: 36 LKD-BH-01 borehole pillars

Photo No: 37 LKD-BH-02 borehole pillars

Photo No: 38 LKD-BH-03 borehole pillars

Photo No:39 LKD-BH-04 borehole pillar

Table No 6.11: RL, Coordinates of Cardinal points, boreholes and Temporary bench marks in Lakhond Area, District: Kachchh, Gujarat (as Determined by DGPS Survey)

Cardinal Points	Geographic Coordinate System in Degree decimal (WGS-84)		UTM (WGS-84, Zone 42N)			Area
	Latitude (N)	Longitude (E)	Reduced level (m)	Northing (m)	Easting (m)	(Sq. Km)
A	23.24428892^0	69.81640133^0	122.97	2570797.727	583516.695	6.21
B	23.24364461^0	69.78577922^0	116.156	2570709.109	580384.345	
C	23.25995236^0	69.78421958^0	121.514	2572513.684	580215.033	
D	23.26138486^0	69.81115114^0	119.173	2572687.425	582969.005	
E	23.26379086^0	69.81606814^0	120.549	2572956.616	583470.469	
F	23.26429575^0	69.81115711^0	122.99	2573009.696	582967.814	
Borehole points						
LKD-BH-01	23.24460583^0	69.78738808^0	113.219	2570816.417	580548.359	
LKD-BH-02	23.25727389^0	69.81009092^0	116.957	2572231.69	582863.095	
LKD-BH-03	23.2558365^0	69.80059278^0	118.23	2572067.162	581892.377	
LKD-BH-04	23.25436653^0	69.78894228^0	118.228	2571897.891	580701.485	
Temporary bench marks						
LKD-TBM-1	23.25345558^0	69.79216758^0	117.079	2571798.84	581031.969	
LKD-TBM-2	23.25333181^0	69.79239911^0	115.973	2571785.264	581055.727	

6.2 Geophysical exploration

Not carried out in the study area (NOT APPLICABLE)

6.3 Geochemical exploration

Geochemistry of pit and trench Samples:

A total of 92 pit and trench samples were analysed for major oxides, including TiO_2 and V, while 15 selected samples were analysed for Rare Earth Elements by ICPMS (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 to medium and fall below the threshold limits required for economic significance.

Elemental Distribution maps of Al_2O_3, TiO_2, Gallium, Vanadium and Total REE are prepared based on analytical results. Since there is not much variation laterally in the analytical values of trench samples, an average of all 14 sample values in a trench was taken for plotting purposes.

Distribution maps of Al_2O_3%, SiO_2, TiO_2%, Vanadium(ppm), Gallium(ppm), and Total REE are given below in fig nos: 16 to 21, respectively.

DISTRIBUTION MAP OF Al2O3 (%) FROM PIT & TRENCH SAMPLES IN LAKHOND AREA, KACHCHH DISTRICT, GUJARAT

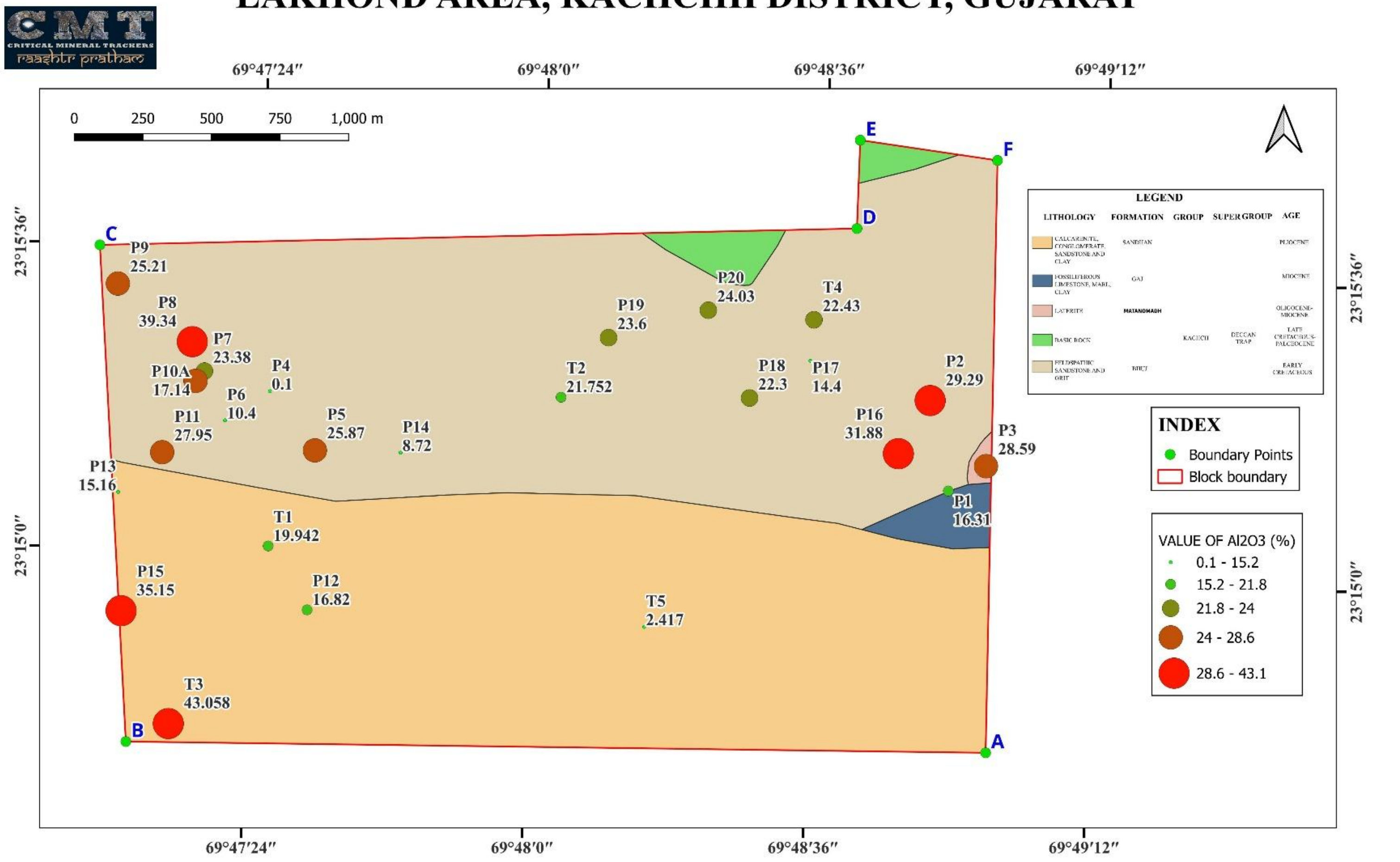


Fig No: 16

DISTRIBUTION MAP OF SiO2(%) FROM PIT & TRENCH SAMPLES IN LAKHOND AREA, KACHCHH DISTRICT, GUJARAT

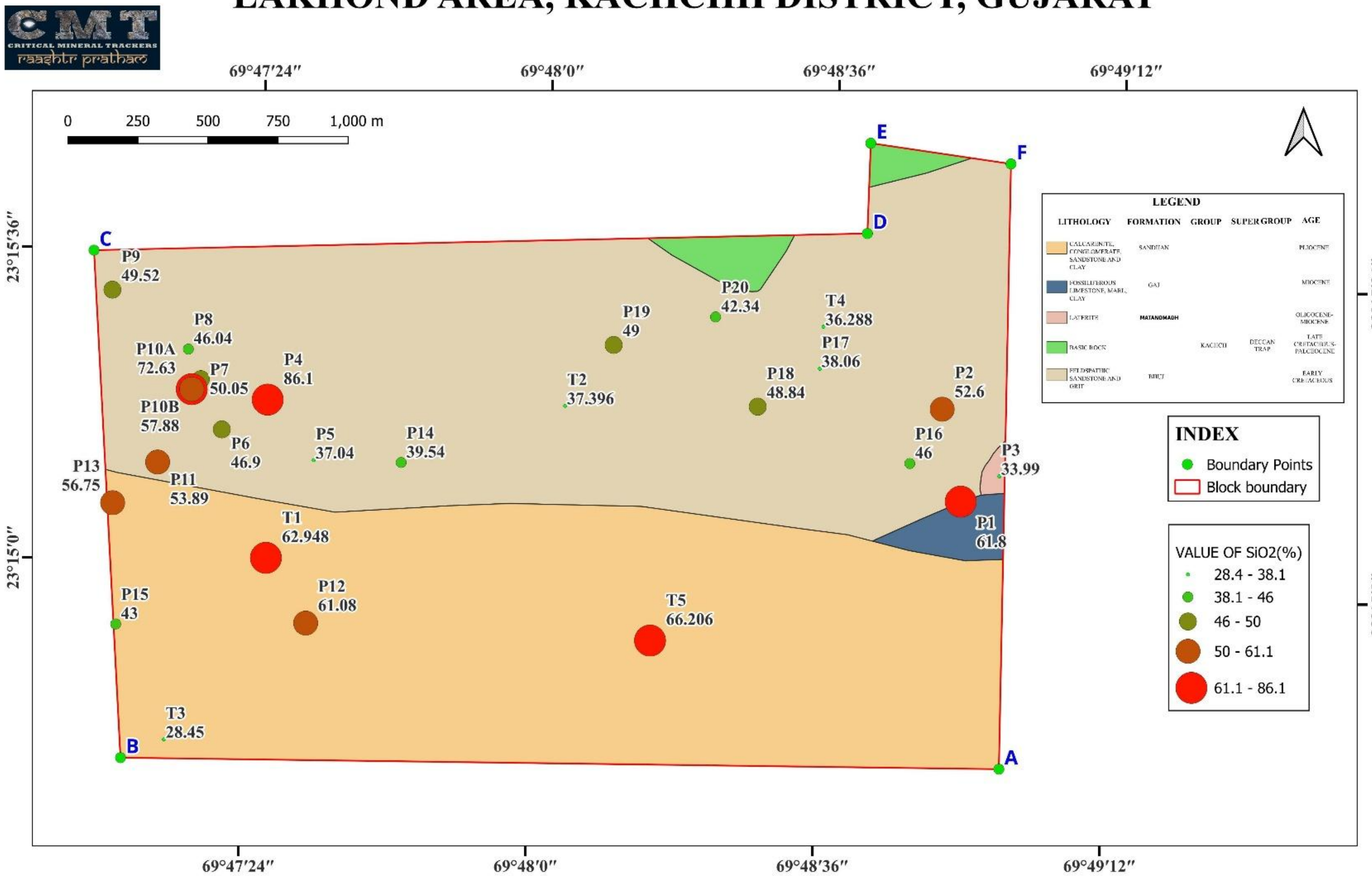


Fig No: 17

DISTRIBUTION MAP OF TiO2(%) FROM PIT & TRENCH SAMPLES IN LAKHOND AREA, KACHCHH DISTRICT, GUJARAT

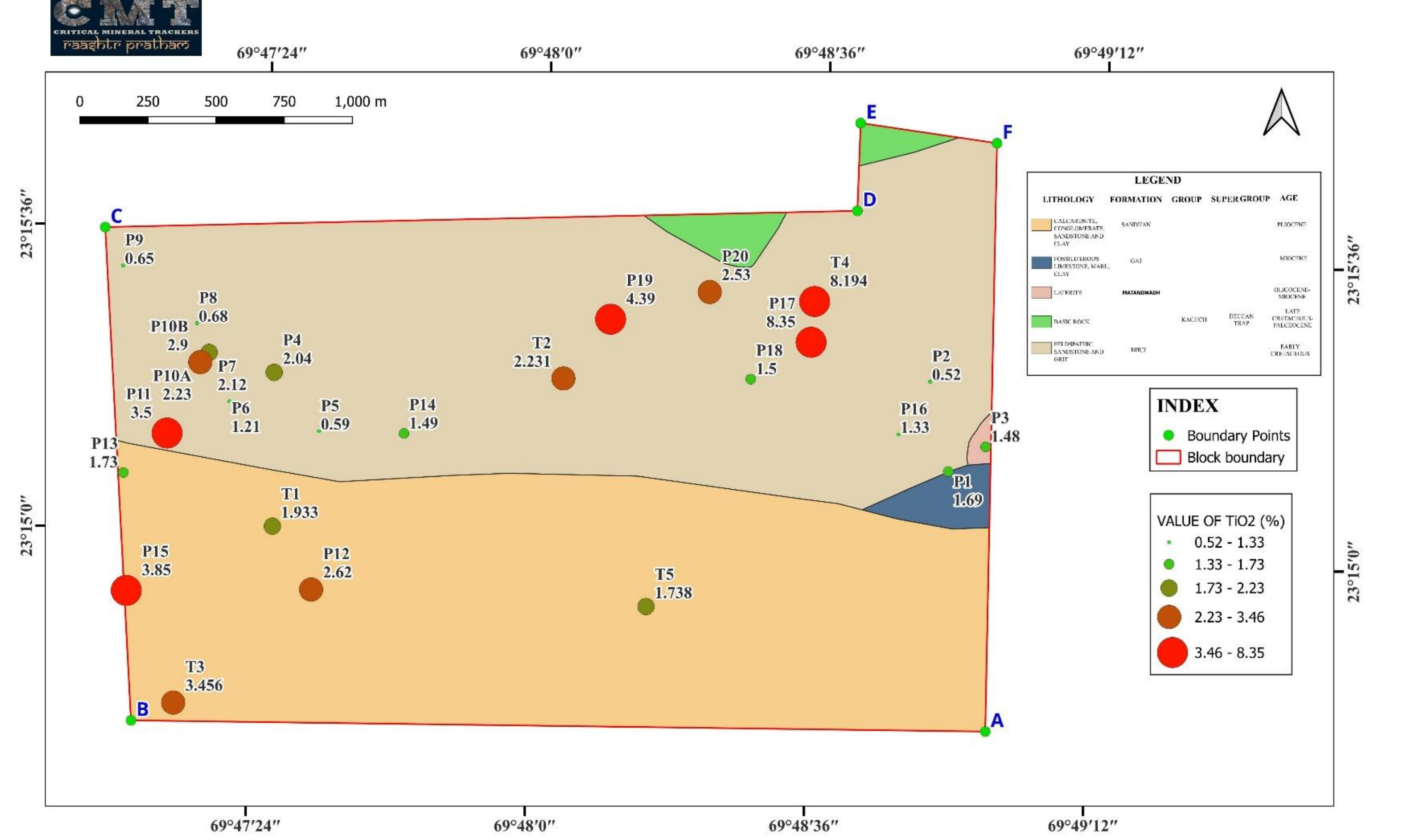


Fig No: 18

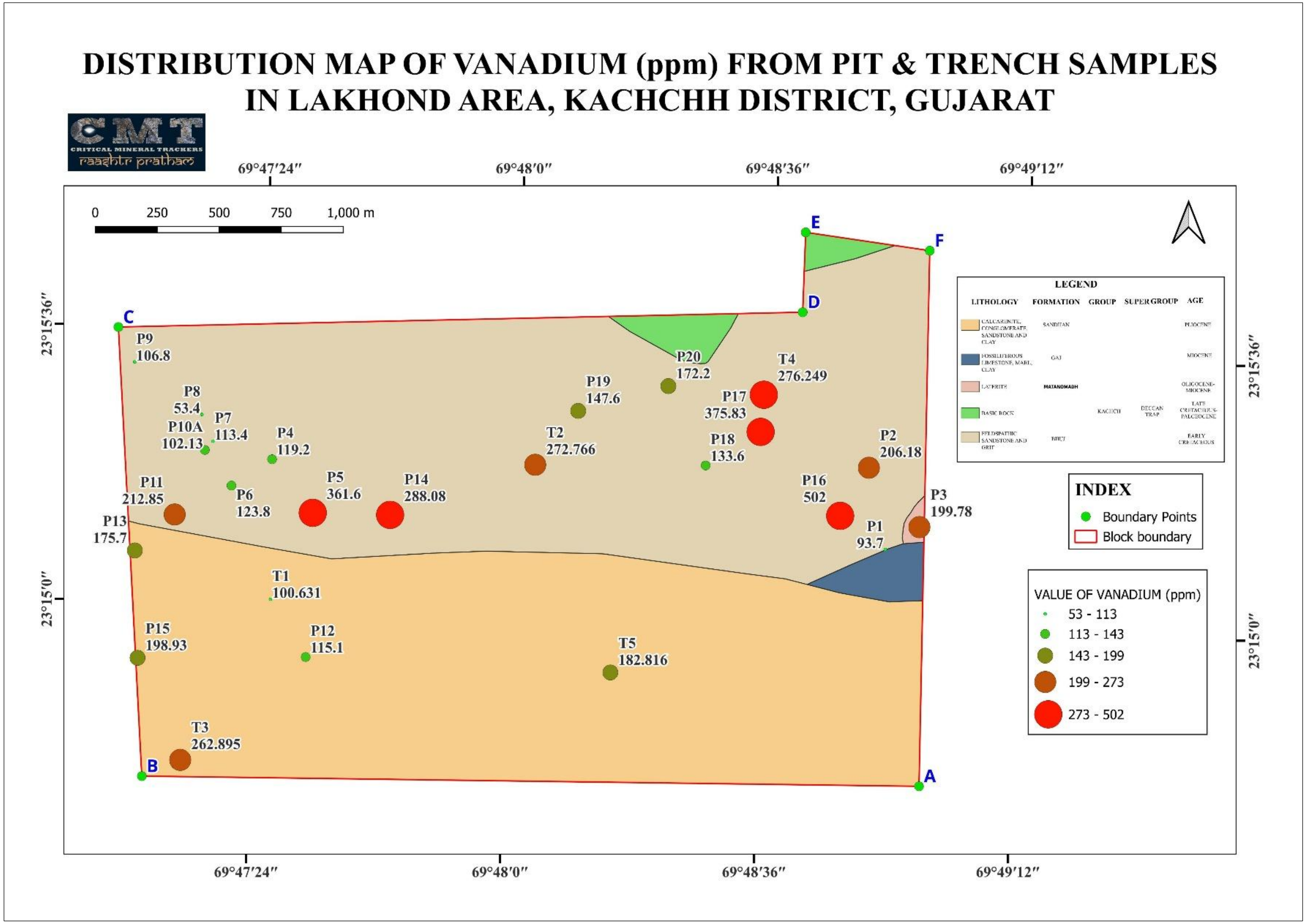

DISTRIBUTION MAP OF VANADIUM (ppm) FROM PIT & TRENCH SAMPLES
IN LAKHOND AREA, KACHCHH DISTRICT, GUJARAT
CMT
CRITICAL MINERAL TRACKERS
raashtr pratham
69°47′24″
69°48′0″
69°48′36″
69°49′12″
23°15′36″
23°15′0″
0 250 500 750 1,000 m
E
F
C
D
B
A
P9
106.8
P8
53.4
P7
113.4
P10A
102.13
P4
119.2
P11
212.85
P6
123.8
P5
361.6
P14
288.08
P13
175.7
T1
100.631
P15
198.93
P12
115.1
T3
262.895
T5
182.816
P19
147.6
P20
172.2
T4
276.249
P17
375.83
T2
272.766
P18
133.6
P2
206.18
P16
502
P3
199.78
P1
93.7
LEGEND
LITHOLOGY
FORMATION
GROUP
SUPERGROUP
AGE
CALCARENITE, CONGLOMERATE, SANDSTONE AND CLAY
SANDHAN
PLIOCENE
FOSSILIFEROUS LIMESTONE, MARL, CLAY
GAJ
MIOCENE
LATERITE
MATANOMADH
OLIGOCENE-MIOCENE
BASIC ROCK
KACHCH
DECCAN TRAP
LATE CRETACEOUS-PALEOCENE
FELDSPATHIC SANDSTONE AND GRIT
BHUJ
EARLY CRETACEOUS
INDEX
Boundary Points
Block boundary
VALUE OF VANADIUM (ppm)
53 - 113
113 - 143
143 - 199
199 - 273
273 - 502

Fig No: 19

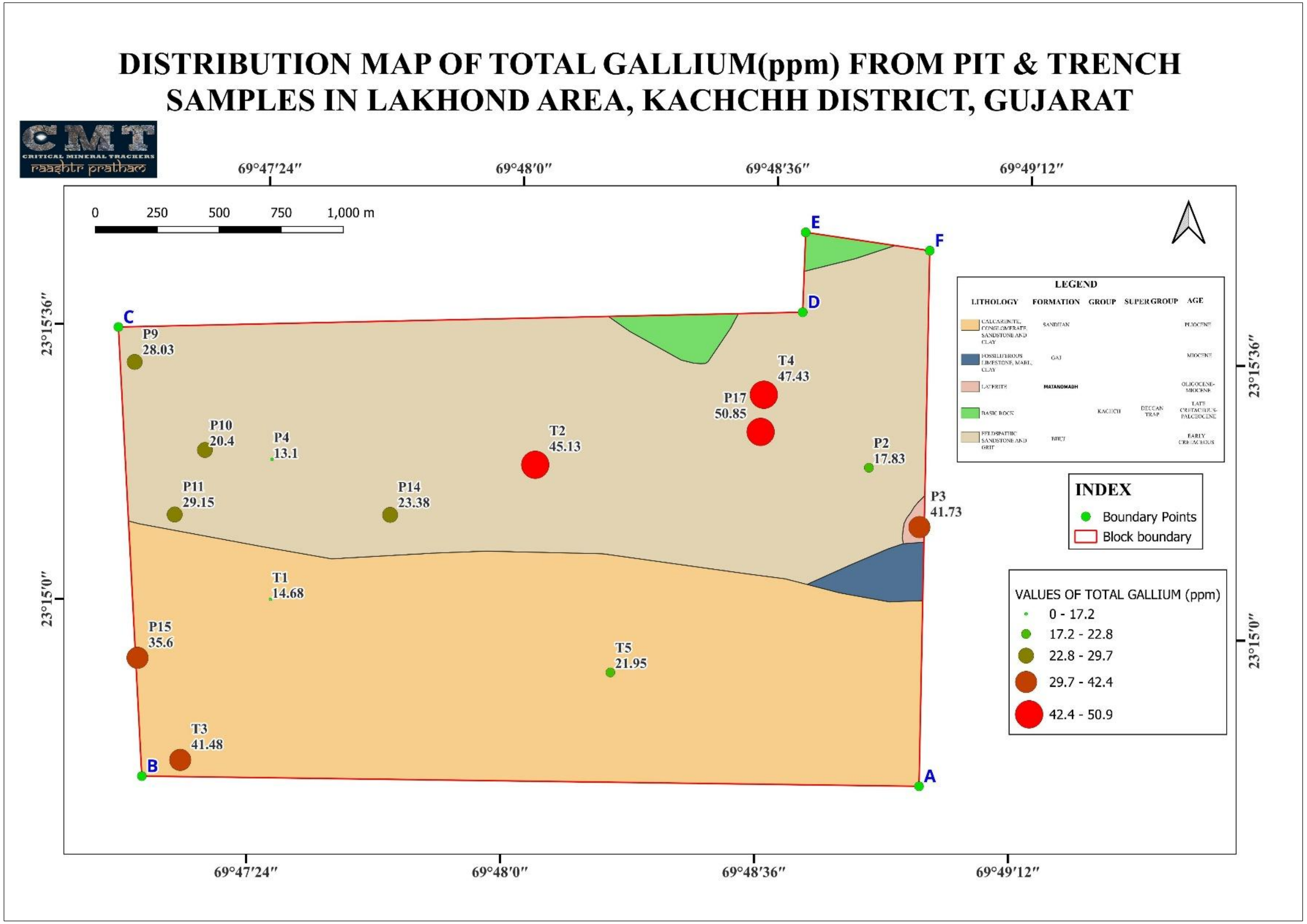

DISTRIBUTION MAP OF TOTAL GALLIUM(ppm) FROM PIT & TRENCH SAMPLES IN LAKHOND AREA, KACHCHH DISTRICT, GUJARAT
69°47′24″
69°48′0″
69°48′36″
69°49′12″
23°15′36″
23°15′0″
0 250 500 750 1,000 m
E
F
D
C
B
A
P9 28.03
P10 20.4
P4 13.1
P11 29.15
P14 23.38
T2 45.13
T4 47.43
P17 50.85
P2 17.83
P3 41.73
T1 14.68
P15 35.6
T5 21.95
T3 41.48
LEGEND
LITHOLOGY FORMATION GROUP SUPER GROUP AGE
CALCARENITE, CONGLOMERATE, SANDSTONE AND CLAY SANDHAN PLIOCENE
FOSSILIFEROUS LIMESTONE, MARL, CLAY GAJ MIOCENE
LATERITE MATANOMADH OLIGOCENE-MIOCENE
BASIC ROCK KACHCH DECCAN TRAP LATE CRETACEOUS-PALEOCENE
FELDSPATHIC SANDSTONE AND GRIT BHUJ EARLY CRETACEOUS
INDEX
Boundary Points
Block boundary
VALUES OF TOTAL GALLIUM (ppm)
0 - 17.2
17.2 - 22.8
22.8 - 29.7
29.7 - 42.4
42.4 - 50.9

Fig No: 20

DISTRIBUTION MAP OF TOTAL REE(ppm) FROM PIT & TRENCH SAMPLES IN LAKHOND AREA, KACHCHH DISTRICT, GUJARAT

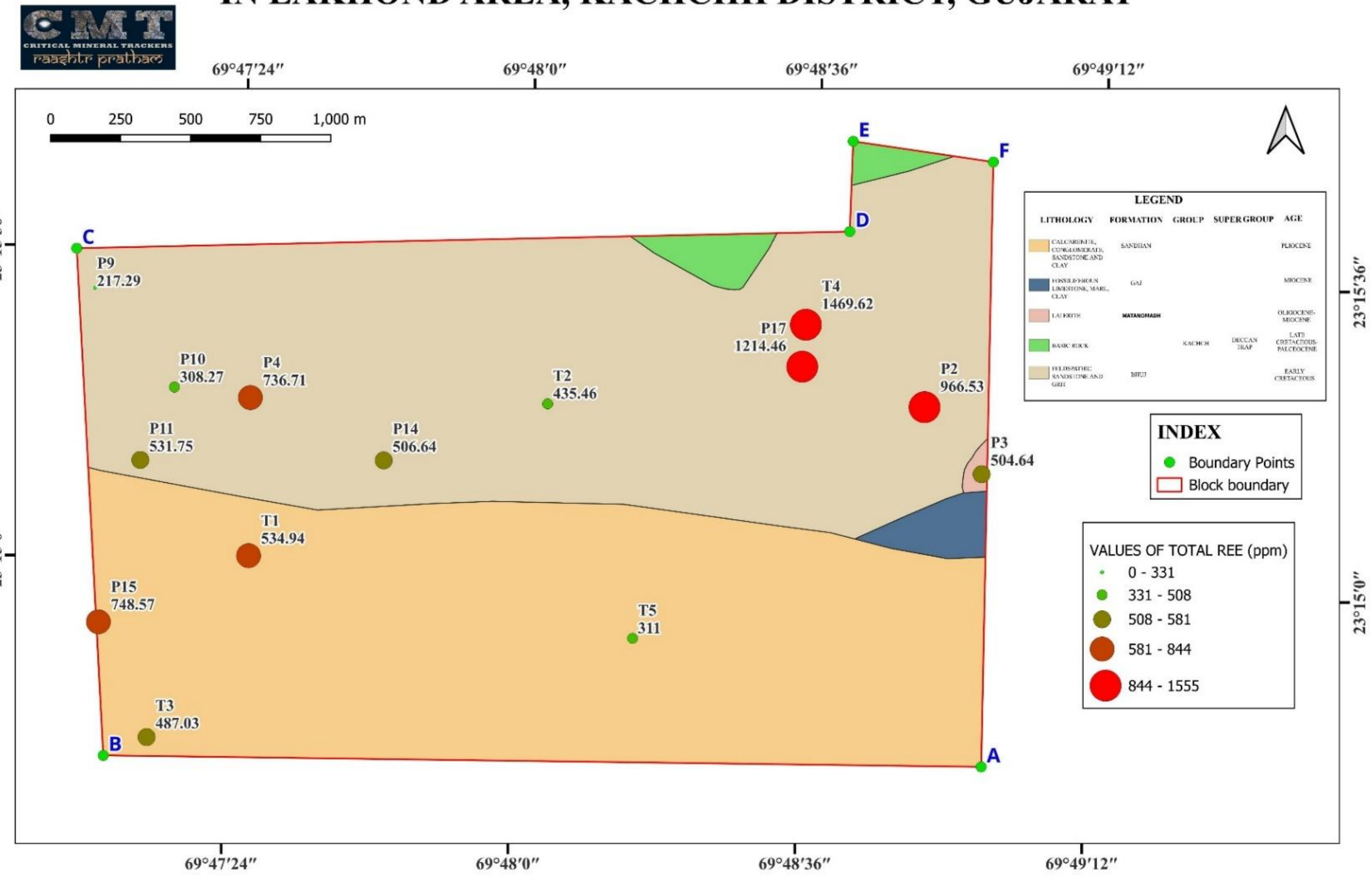


Fig No: 21

6.4 XRD Analysis

XRD analysis of three samples were carried out at Shiva Laboratory, Bengaluru to understand the mineral composition of the samples. The XRD study reveals that the Lithomargic clay is enriched in Kaolinite. Hematite is present as the main phase of iron oxides. TiO2 is present in the form of Ilmenite in the samples. The ratio of the minor minerals varies from sample to sample. The analytical results of the 3 samples are given in Table 6.

Table No 6.12: XRD analytical results of samples

Sl. No	Sample No.	Mineral Phases	Approximate %
1	P27/LB/2025 (Original no: P17/LB/2025)	Kaolinite	40.06
		Hematite	1.85
		Goethite	24.10
		M-silicate	0.98
2	T13/LB/2025/03 (Original no: T3/LB/2025/03)	Kaolinite	35.37
		Gibbsite	39.85
		Ilmenite	2.16
3	T14/RB/2025/05 (Original no: T4/LB/2025/05)	Kaolinite	31.05
		Goethite	21.69
		Hematite	5.91
		Calcite	5.53
		Quratz	2.95
		Cristobalite	2.94

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 Al_2O_3, G, V, TiO_2 and REE etc have been prepared and discussed in the Chapter 6.

Prepared interpreted Geological map and outcrop map of the study area on 1:12500 scale Creation of geological (lithological & structural), geochemical and outcrop maps on 1:12,500 scale, Shape files in GIS format for the themes LULC, lithology, Oriented structures, Outcrop map, sample locations, pit locations and various elemental distribution maps viz Al_2O_3, Ti, Ga, V, and total REE etc have been prepared and discussed in the Chapter 6.

No geophysical component is in the scope of the present investigation.

No aero geophysical data is available in the public domain for the block area

CHAPTER - VIII

8.0 Mineral prospect: The study area is represented by two major stratigraphic units, namely the Bhuj Formation (Early Cretaceous) and the Sandhan Formation (Pliocene), with minor occurrences of the Gaj and Matanomadh formations in the eastern part and basic intrusive rocks in the northern part of the area. Both the Bhuj and Sandhan formations predominantly comprise sandstones, siltstones, shales, and clay beds. Lithologically, these formations represent clastic sedimentary sequences deposited in fluvial to deltaic environments. Such litho-units generally lack the lateritic profiles, aluminous enrichment zones, and favourable weathering conditions required for the formation and preservation of economically viable bauxite deposits.

In contrast, the neighbouring regions where bauxite mineralisation has been reported are associated with the Matanomadh Formation, which is known to host lateritic bauxite horizons. Although this formation is exposed over a small area along the eastern boundary of the study area, where laterite is present, it does not extend westward into the main part of the block. This limited occurrence eliminates the primary stratigraphic control necessary for the development of significant bauxite mineralisation within the study area.

The total REE values recorded in the Bhuj and Sandhan formations are generally low to moderate. However, relatively higher values of 1214.46 ppm and 1469.62 ppm were observed in Pit P17 and Trench T4, respectively, along a nala section. These localized anomalies are likely the result of weathering and secondary concentration along the drainage channel. Drilling results indicate no depth persistence of these anomalies, confirming their secondary and localized nature.

Furthermore, the analytical results of pit and trench samples indicate the absence of significant Al_2O_3 enrichment and associated critical mineral concentrations. Therefore, based on geological mapping, stratigraphic disposition, geochemical analytical results, and drilling data, the study area does not show favourable conditions for economically viable bauxite or associated critical mineral mineralisation.

CHAPTER – 1X

9.0 Exploration by scout drilling:

After reviewing the geochemical analytical results of pit and trench samples, the 9th TCC-II approved the drilling of four scout boreholes, each with a proposed depth of 30.00 m, with a total planned meterage of 120.00 m. Accordingly, Critical Mineral Trackers planned the boreholes and mobilized a Calyx type drilling machine equipped with a double tube core barrel, having a drilling capacity of up to 50 m depth.

Exploratory core drilling was carried out in the Lakhond Area during the period 19.07.2025 to 21.09.2025. A total of four boreholes, namely LKD-BH-01, LKD-BH-02, LKD-BH-03 and LKD-BH-04, were drilled, achieving a total meterage of 101.00 m.

Photo No: 40 Calyx rotary drilling machine used for drilling in Lakhond Area, Kachchh District, Gujarat

9.1 Stage of exploration: G4 stage of exploration. Guidelines followed as per **MEMC Rule, 2015** are in compliance with.

9.2 Methodology of drilling:

Drilling is a critical component of mineral exploration as it helps to understand the subsurface geological conditions and structure of potential mineral deposits. It provides essential information for evaluating the mineralization potential of a target area and plays a decisive role in assessing its viability as a mineable prospect. Different drilling methods are adopted depending on the nature of litho-units and the objectives of exploration.

In the Lakhond block, drilling was carried out using a Calyx type drill machine equipped with a double tube core barrel and diamond bit. In this method, a diamond-tipped drill bit penetrates the litho-units and retrieves cylindrical core samples. The double tube core barrel system helps in preserving the core and improving recovery by minimizing disturbance to the core during drilling.

The boreholes were drilled vertically in NX size (54.7 mm core diameter) using the double tube core barrel technique to enhance core recovery. The diameter of the borehole was 74.7 mm, while the core diameter obtained was 54.7 mm. Short drilling runs were maintained to ensure optimum core recovery and better preservation of the core samples.

9.3 Borehole planning

Boreholes were strategically planned to intersect the bauxite/laterite horizon with the objective of determining its thickness and areal extension. Following detailed geological mapping, pitting, and trenching in the Lakhond Area, a total of four vertical boreholes were planned across the block based on the geochemical results obtained from pit and trench samples.

Drilling was carried out using a Calyx rotary drilling machine equipped with a double tube core barrel and diamond bit to ensure good core recovery. The coordinates and Reduced Levels (RLs) of the boreholes were determined through a DGPS survey. After completion of drilling, standard size borehole pillars were erected at each location for proper identification and future reference.

9.4 Borehole Summary

Table no.-9.1 showing Coordinates, RL, Total depth, core recovery date of commencement and completion

Bore Hole No.	Geographic Coordinate System in Degree Minutes Seconds (WGS 1984)		Geographic Coordinate System in Degree Decimal (WGS 1984)		RL Collar (m)	Core recovery (%)	Date of Commencement	Date of Completion	Total depth(m)
	Latitude (DMS)	Longitude (DMS)	Latitude (DD)	Longitude (DD)					
LKD BH - 1	23°14'40.5810"	69°47'14.5971"	23.2446058°	69.7873881°	113.219	63.00%	19.07.2025	24.07.2025	30.00
LKD BH - 2	23°15'26.1860"	69°48'36.3273"	23.2572739°	69.8100909°	116.957	85.00%	25.07.2025	02.08.2025	30.00
LKD BH - 3	23°15'21.0114"	69°48'02.1340"	23.2558365°	69.8005928°	118.23	90%	17.09.2025	19.09.2025	30.00
LKD BH - 4	23^{0}15'15.7195"	69°47'20.1922"	23.2543665°	69.7889423°	118.228	93.00%	20.09.2025	21.09.2025	11.00

GEOLOGICAL MAP ON BOREHOLE POINTS IN LAKHOND AREA, KACHCHH DISTRICT, GUJARAT

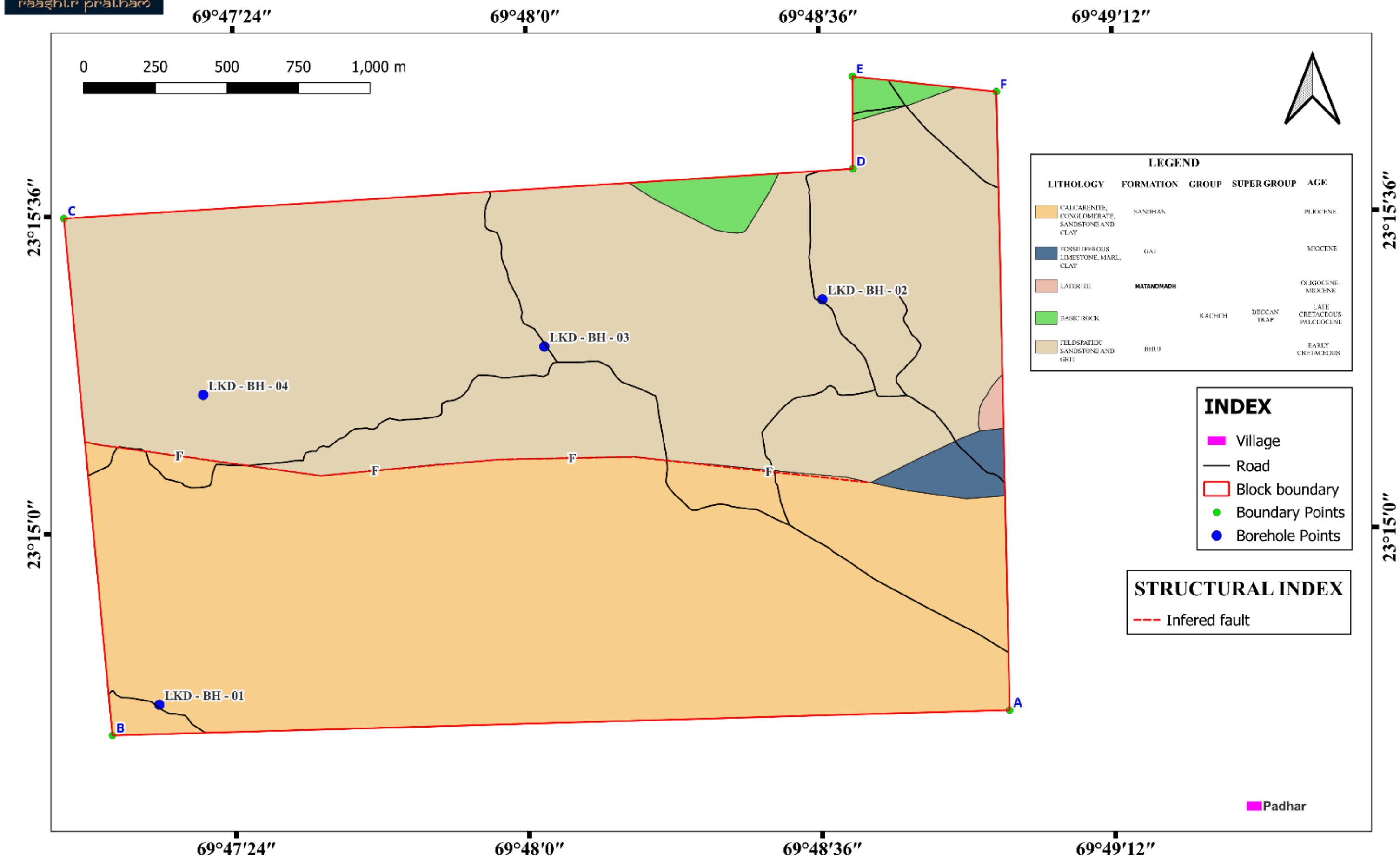


Fig No: 22

9.5 Core Recovery: All efforts were made to achieve desired core recovery by using a double tube core barrel, diamond bit, slow rotation, and short drilling runs. The overall core recovery is good (about 90%) in boreholes LKD-BH-02, LKD-BH-03, and LKD-BH-04, which were drilled in the older Bhuj Formation (Early Cretaceous), except in a few zones comprising friable siltstones Argillaceous sandstones, feldspathic friable sandstones interbedded with clays.

However, borehole LKD-BH-01 was drilled in the younger Sandhan Formation of Pliocene age, which is composed predominantly of soft clays and highly friable siltstones/sandstones. Due to the unconsolidated and friable nature of these litho-units, the overall core recovery in this borehole was about 63%.

9.6 Borehole Logging: The drill cores were systematically preserved in GI core boxes in a book pattern from left to right, with proper orientation arrows and depth markings indicated on steel plates. Detailed core logging was carried out to study the lithological variations, colour, grain size, nature of the rock, and structural features encountered in the boreholes.

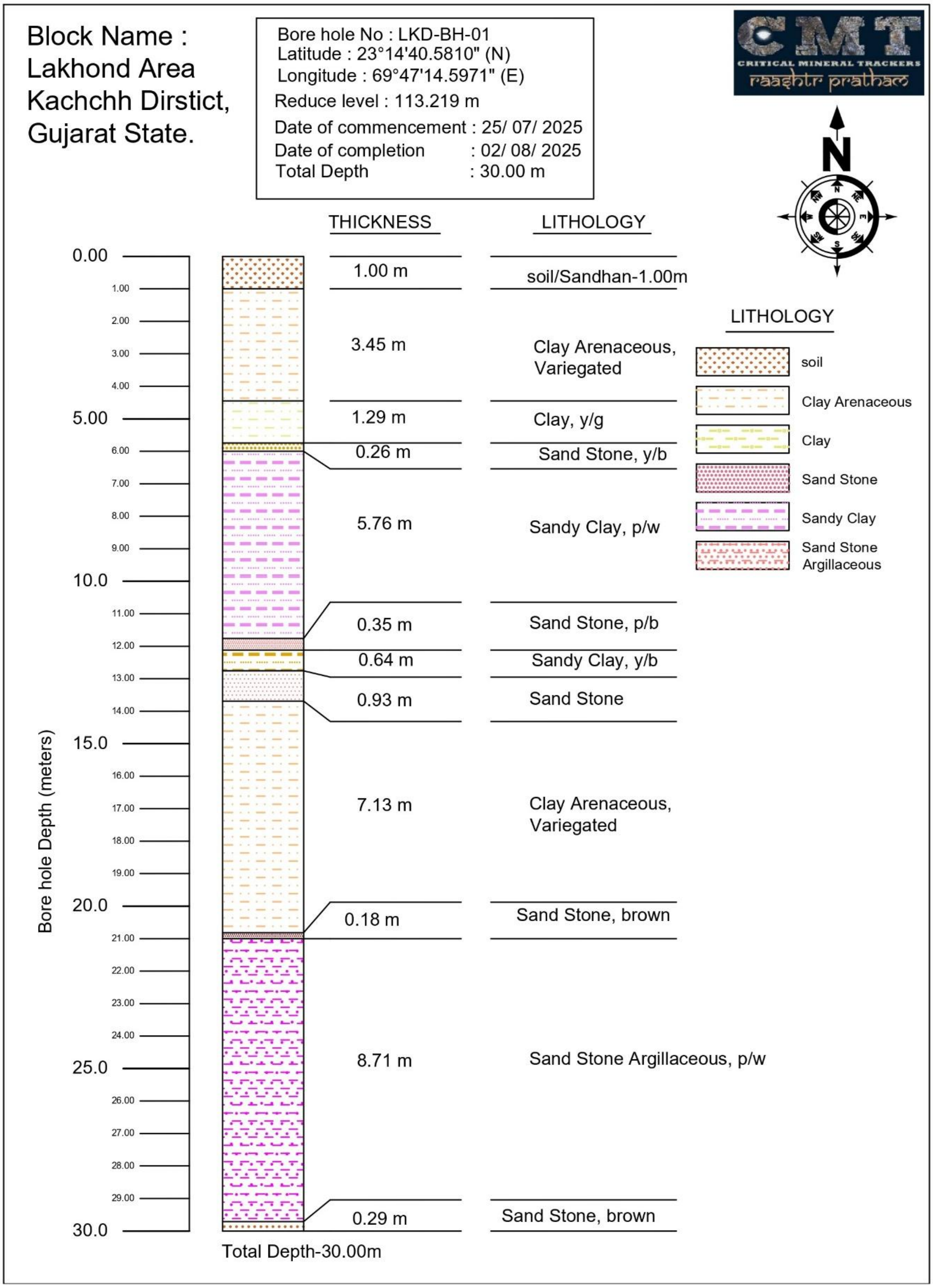
The lithologs of the boreholes are presented in summarized form in table no:6.11 & Annexure-VII while the graphical lithologs are provided in Plate-XI. A brief description of all four boreholes is given below. Geophysical logging is not recommended for these boreholes. As the boreholes were short and vertical, Borehole deviation test is not required.

9.7 Description of Boreholes: Out of total 4 four boreholes, three were drilled in Bhuj Formation (LKD-BH-02,03 & 04 and one borehole in Sandhan formation (LKD BH-01).

LKD-BH-01

Based on the analytical results of Trench T3 located along a nala, where pinkish-white clayey bauxite was encountered up to 1.00 m depth with average values of SiO_2: 28.28%, Al_2O_3: 43.27%, Fe_2O_3: 3.36%, TiO_2: 3.45%, and reactive silica: 27.98%, borehole LKD-BH-01 was drilled 120.00 m north of Trench T3 to examine the depth persistence of the clayey bauxitic horizon.

Fig No: 23 Graphic litholog of borehole LKD-BH-01 is given below



The borehole intersected soil and clayey material up to 1.00 m, followed by arenaceous clay, clay, and sandy clay up to 5.74 m depth. From 1.00 m to 5.74 m depth, four samples were collected and analyzed. In this interval, the average Al_2O_3 value decreases to 22.57% (range 16.39–27.93%), while the SiO_2 value increases to 57.05% (range 43.36–67.34%), Fe_2O_3 value. 4.63 % (range 2.51-6.89%) average TiO_2 value decreases to 2.09% (range 1.48–3.55%). Based on the analytical results, this horizon is interpreted as *bauxitic clay* occurring between 1.00 m and 5.74 m depth, and the clayey bauxite horizon intersected in Trench T3 up to 1.00 m depth is completely absent in this borehole. The detailed lithology of the borehole is given in Annexure-VII and graphic litholog & graphic log with assay valuers are presented in Plate No: XI & XII. The assay values of major oxides and REE are given in Annexure No: VIII, IX .

Table No: 9.2 Major oxides and Total REE in BH - 1

LKD - BH - 01			
Oxides/element	**Minimum**	**Maximum**	**Mean**
SiO2 %	34.26	67.34	47.14
Al2O3 %	16.39	36.82	29.00
Fe2O3%	2.20	14.69	6.85
TiO2%	1.48	5.23	3.53
P205%	0.05	0.38	0.15
Vanadium(ppm)	68.60	243.70	161.03
Gallium (ppm)	29.0	43.1	35.0
Total REE (ppm)	**278.7**	**623.6**	**448.5**
TREE+Sc+Y(ppm)	**307.5**	**661.9**	**480.8**

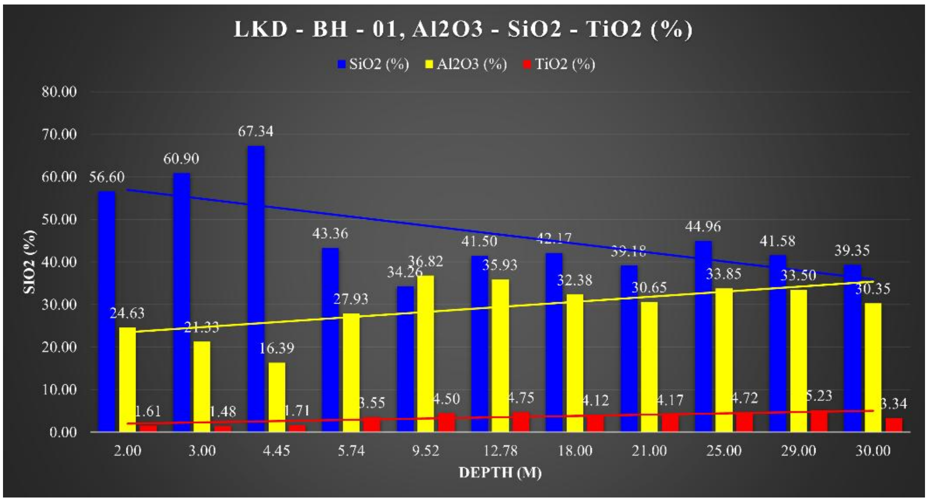


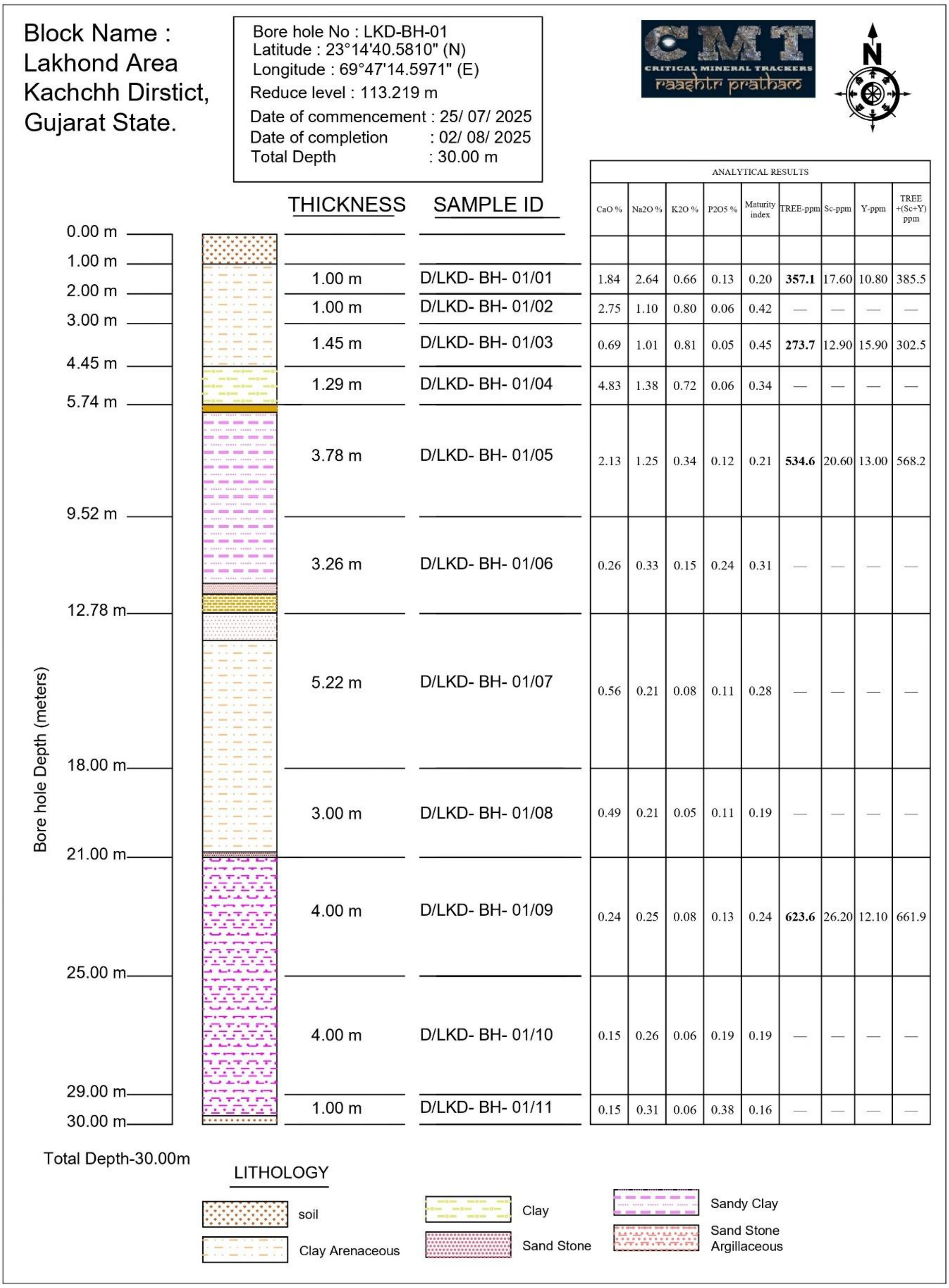
Fig No:24 Bar chart comparison of Al2O3-SiO2-TiO2 (%) in BH - 01

Below 5.74 m depth up to 30.00 m, the major lithologies encountered include sandy clay, arenaceous clay with occasional sandstone bands, and argillaceous sandstone with brown ferruginous sandstone bands. The geochemical analysis of this interval shows average values of Al_2O_3: 33.35%, SiO_2: 40.43%, Fe_2O_3: 7.66%, and TiO_2: 4.40%, which may be attributed to the increase in sandy facies and ferruginous nature of the lithology.

From 0.00 to 30.00m depth, Al203% increases and Sio2 values decreases but the overall SiO2 is always higher than Al2O3% in all cases, but TiO2 values increase with depth (as shown in Fig no: 24.)

Overall, 7 out of 10 samples plot within the bauxitic clay field in the ternary diagram (as show in Fig No: 26). Based on these results, it is inferred that the clayey bauxite encountered in Trench T3 lacks both lateral and vertical continuity and represents an isolated patch with a thickness of approximately 1.00 m. Borehole was closed at 30.00m depth

Fig No: 25 Graphic litholog and Assay values of borehole LKD-BH-01 are given below



ANALYTICAL RESULTS

THICKNESS	SAMPLE ID	CaO %	Na2O %	K2O %	P2O5 %	Maturity index	TREE-ppm	Sc-ppm	Y-ppm	TREE +(Sc+Y) ppm
1.00 m	D/LKD- BH- 01/01	1.84	2.64	0.66	0.13	0.20	**357.1**	17.60	10.80	385.5
1.00 m	D/LKD- BH- 01/02	2.75	1.10	0.80	0.06	0.42	—	—	—	—
1.45 m	D/LKD- BH- 01/03	0.69	1.01	0.81	0.05	0.45	**273.7**	12.90	15.90	302.5
1.29 m	D/LKD- BH- 01/04	4.83	1.38	0.72	0.06	0.34	—	—	—	—
3.78 m	D/LKD- BH- 01/05	2.13	1.25	0.34	0.12	0.21	**534.6**	20.60	13.00	568.2
3.26 m	D/LKD- BH- 01/06	0.26	0.33	0.15	0.24	0.31	—	—	—	—
5.22 m	D/LKD- BH- 01/07	0.56	0.21	0.08	0.11	0.28	—	—	—	—
3.00 m	D/LKD- BH- 01/08	0.49	0.21	0.05	0.11	0.19	—	—	—	—
4.00 m	D/LKD- BH- 01/09	0.24	0.25	0.08	0.13	0.24	**623.6**	26.20	12.10	661.9
4.00 m	D/LKD- BH- 01/10	0.15	0.26	0.06	0.19	0.19	—	—	—	—
1.00 m	D/LKD- BH- 01/11	0.15	0.31	0.06	0.38	0.16	—	—	—	—

Fig No: 26 Ternary Diagram of LKD – BH – 01**(after Bardoshshi,1981)**

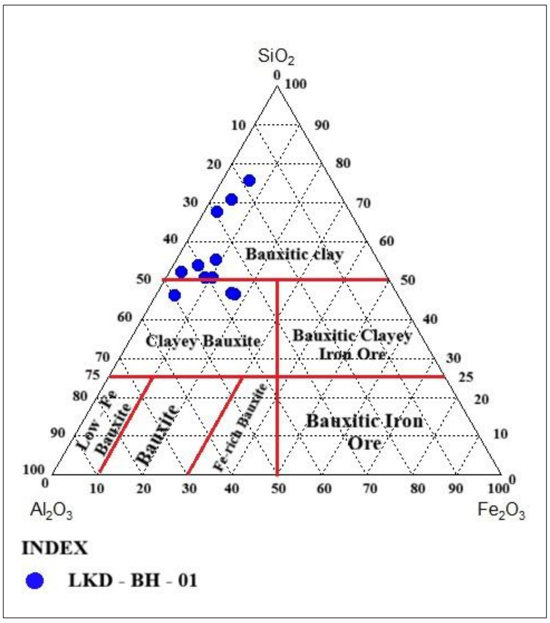
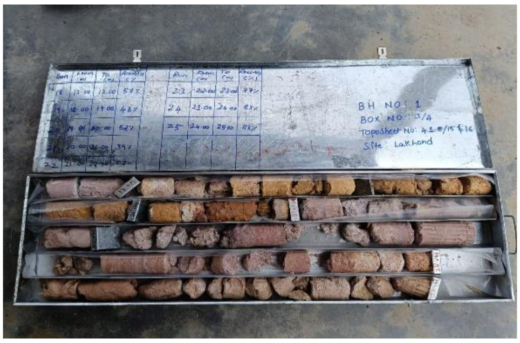


Photo No: 41 Core Boxes of borehole no: LKD-BH-01

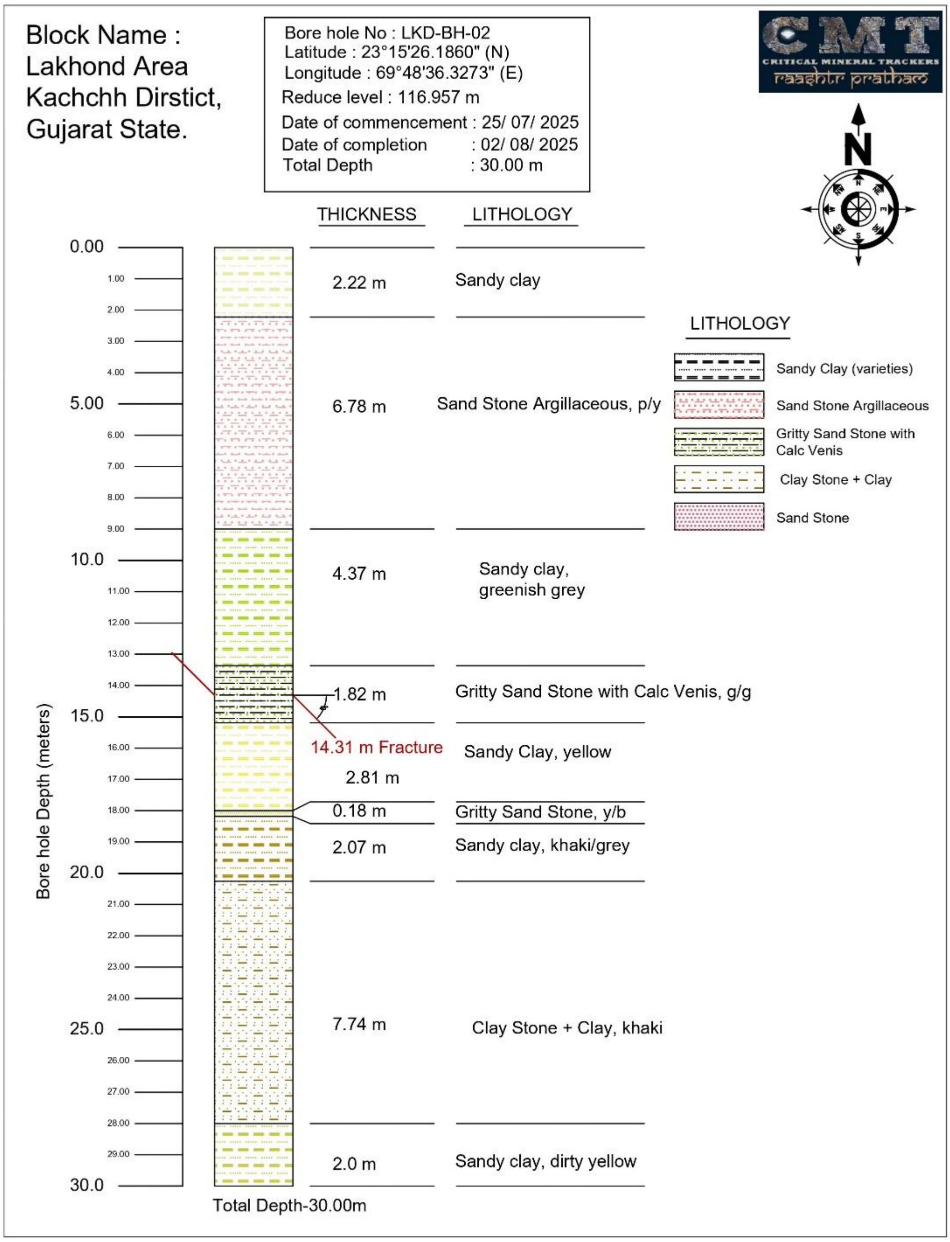
:

 Box No: 1	 Box No: 2
 Box No:3	 Box No: 4

LKD–BH–02

Based on the analytical results of Pit P17 and Trench T4 located along a nala, where moderate Total REE values ranging from 1214.46 to 1469.62 ppm and TiO_2 values ranging from 8.19% to 8.35% were recorded, borehole LKD-BH-02 was drilled between these two locations on the left bank of the nala to examine the depth persistence of Total REE (TREE) and TiO_2 values.

Fig No: 27 Graphic litholog of borehole LKD-BH-02 is given below



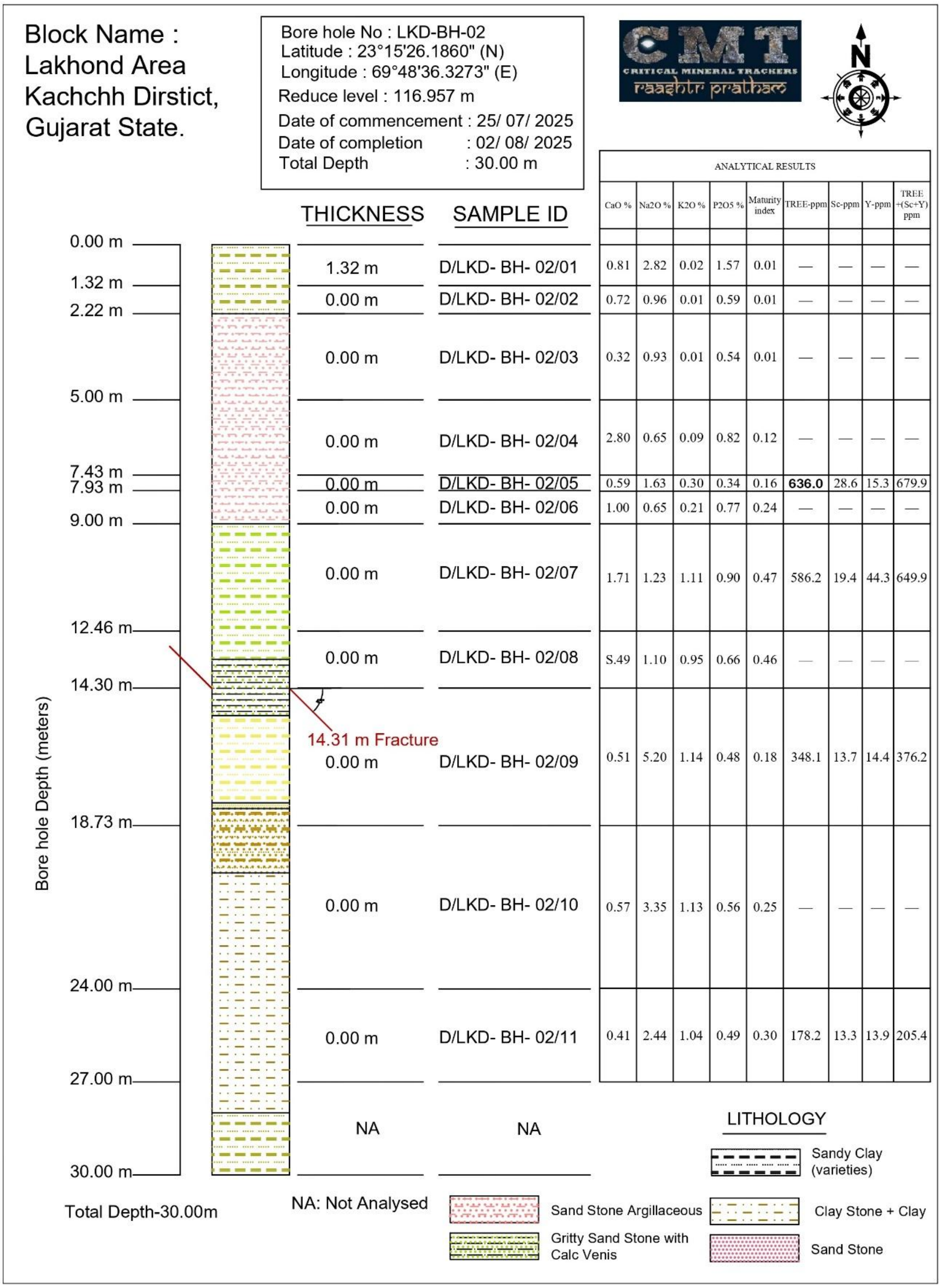
The borehole intersected pinkish-yellow argillaceous sandstone and greenish-grey sandy clay from 0.00 to 12.46 m depth. This interval is relatively enriched in TiO_2, with values decreasing from 9.87% near the surface to 3.56% with depth, while Total REE values decrease from 636 ppm to 591.5ppm.

The geochemical data of Pit-P17 and Trench-T4/06 indicating higher TiO_2 (8.35%,7.72%) values and moderate Total REE (1214.4,1469.6 ppm) values are not persistent with depth in this borehole, and the values decrease significantly (636 to 329.9ppm in the subsurface. The comparatively higher concentrations near the surface are likely due to weathering and secondary concentration along the nala.

From 12.46 m to 30.00 m depth, the borehole intersected gritty sandstone with calcite veins and dirty yellow to khaki-grey sandy clay. These lithologies contain relatively low TiO_2 and low Total REE values (348.1-329.9 ppm) compared to the upper horizon. Borehole was terminated at 30.00m depth.

The detailed lithology of the borehole is given in Annexure-VII and graphic litholog & graphic log with assay valuers are presented in Plate No: XI & XII. The assay values of major oxides and REE are given in Annexure No: VIII, IX .

Fig No: 28 Graphic litholog and Assay values of borehole LKD-BH-02 are given below



THICKNESS	SAMPLE ID	CaO %	Na2O %	K2O %	P2O5 %	Maturity index	TREE-ppm	Sc-ppm	Y-ppm	TREE +(Sc+Y) ppm
1.32 m	D/LKD- BH- 02/01	0.81	2.82	0.02	1.57	0.01	—	—	—	—
0.00 m	D/LKD- BH- 02/02	0.72	0.96	0.01	0.59	0.01	—	—	—	—
0.00 m	D/LKD- BH- 02/03	0.32	0.93	0.01	0.54	0.01	—	—	—	—
0.00 m	D/LKD- BH- 02/04	2.80	0.65	0.09	0.82	0.12	—	—	—	—
0.00 m	D/LKD- BH- 02/05	0.59	1.63	0.30	0.34	0.16	**636.0**	28.6	15.3	679.9
0.00 m	D/LKD- BH- 02/06	1.00	0.65	0.21	0.77	0.24	—	—	—	—
0.00 m	D/LKD- BH- 02/07	1.71	1.23	1.11	0.90	0.47	586.2	19.4	44.3	649.9
0.00 m	D/LKD- BH- 02/08	S.49	1.10	0.95	0.66	0.46	—	—	—	—
0.00 m	D/LKD- BH- 02/09	0.51	5.20	1.14	0.48	0.18	348.1	13.7	14.4	376.2
0.00 m	D/LKD- BH- 02/10	0.57	3.35	1.13	0.56	0.25	—	—	—	—
0.00 m	D/LKD- BH- 02/11	0.41	2.44	1.04	0.49	0.30	178.2	13.3	13.9	205.4
NA	NA									

Table No: 9.3 Major Oxides & Total REE in BH – 02

LKD - BH - 02			
Oxides/element	**Minimum**	**Maximum**	**Mean**
SiO2 %	18.59	48.32	36.26
Al2O3 %	8.22	28.90	16.53
Fe2O3%	10.43	36.93	18.73
TiO2%	2.37	9.87	5.20
P205%	0.34	1.57	0.70
Vanadium(ppm)	126.30	506.70	268.70
Gallium (ppm)	17.9	40.9	25.3
Total REE (ppm)	**329.9**	**636.0**	**476.4**
TREE+Sc+Y(ppm)	**357.1**	**679.9**	**517.1**

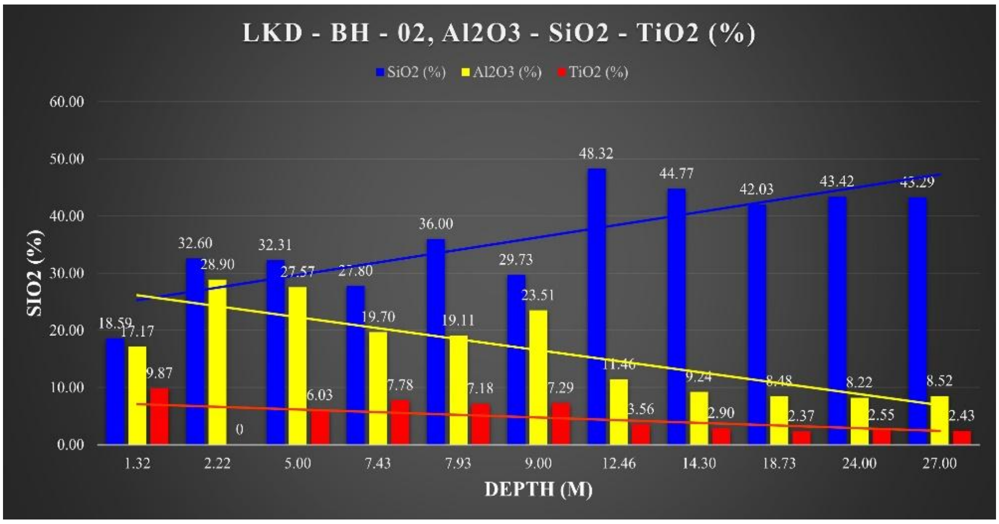


Fig No:29 Bar chart comparison of Al2O3-SiO2-TiO2 (%) in BH - 02

Overall, from 0.00 to 30.00m depth, SiO2% values increase, Al2O3% and TiO2% values decrease with depth. (as shown in Fig no:). TREE (ppm)values also decrease from 636.0-329.9 with depth

Fig No: 30 Ternary Diagram of LKD – BH – 02**(after Bardoshshi,1981)**

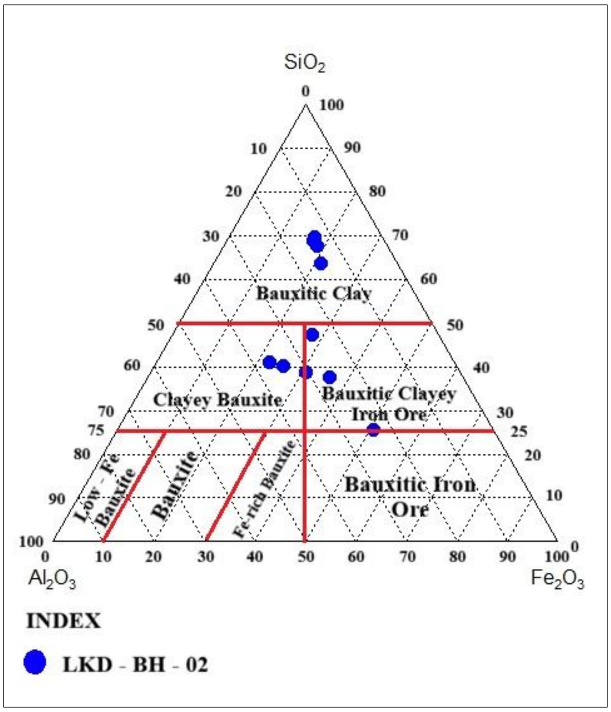
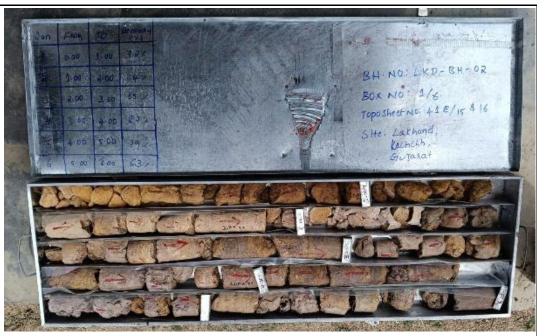
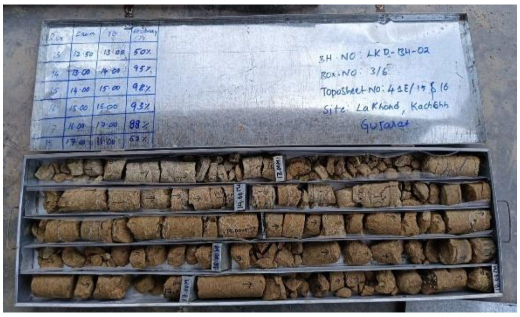


Photo No: 42 Core Boxes of borehole no: LKD-BH-02

 **Box No: 1**	 **Box No: 2**
 **Box No:3**	 **Box No: 4**

Box No:5

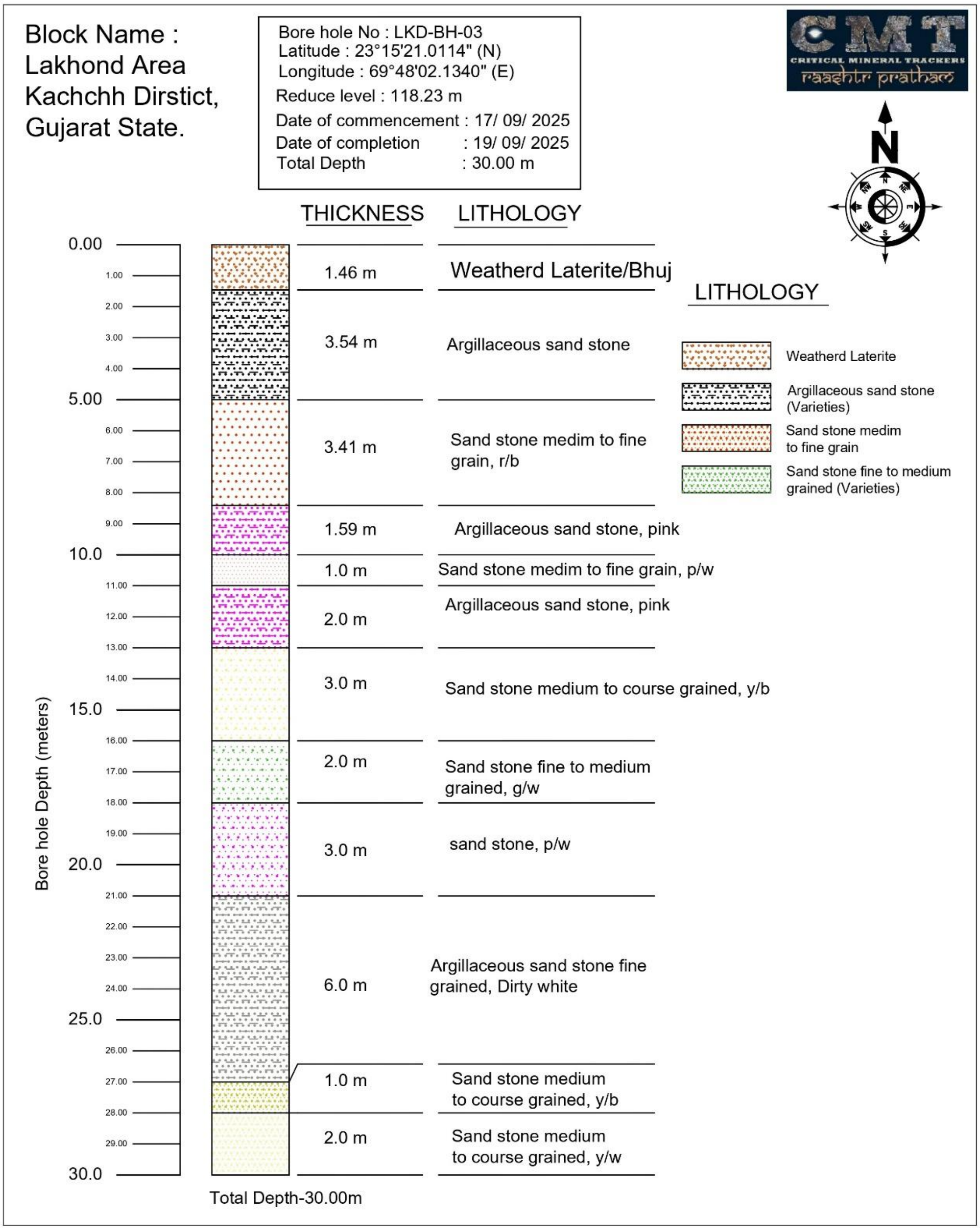
Box No:6

LKD–BH–03

Based on the analytical results of Trench T2 and BRS-01 samples, where Al_2O_3 values range from 14.97–30.80%, SiO_2 from 32.06–43.24%, TiO_2 from 1.70–2.94%, and Total REE (TREE) value of 435.46 ppm, borehole LKD-BH-03 was drilled near Trench T2 to examine the depth persistence of TiO_2 and TREE values.

From 0.00 to 13.00 m depth, the borehole intersected a zone comprising weathered laterite at the top, followed by friable white kaolinized sandstone, ferruginous friable sandstone, and argillaceous sandstone. This interval shows Total REE values ranging from 421.8 to 1187.5 ppm, TiO_2 values ranging from 0.39% to 4.21%, and P_2O_5 values between 0.11% and 0.42%.

Fig No: 31 Graphic litholog of borehole LKD-BH-03 are given below

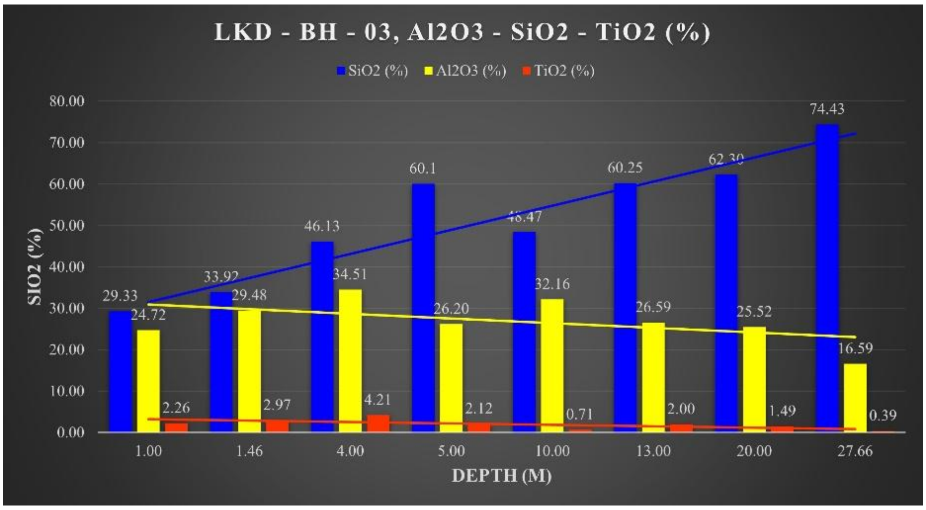


From 13.00 m to 30.00 m depth, the borehole intersected medium- to coarse-grained friable sandstone and fine-grained argillaceous sandstone.

Table No: 9.4 Major Oxides & Total REE in BH - 03

LKD - BH - 03			
Oxides/element	**Minimum**	**Maximum**	**Mean**
SiO2 %	29.33	74.43	51.87
Al2O3 %	16.59	34.51	26.97
Fe2O3%	1.26	25.52	7.63
TiO2%	0.39	4.21	2.02
P205%	0.06	0.42	0.18
Vanadium(ppm)	34.50	898.60	331.29
Gallium (ppm)	20.7	46.7	32.8
Total REE (ppm)	**421.8**	**1187.5**	**695.5**
TREE+Sc+Y(ppm)	**445.6**	**1217.5**	**727.1**

Fig No: 32 Bar chart comparison of Al2O3-SiO2-TiO2 (%) in BH - 03



Considering the entire borehole interval, the average geochemical values are SiO_2: increases, corresponding Al2O3 values and TiO2 values decreases with depth. (As shown in Fig No: 31) Based on the Al_2O_3–SiO_2–Fe_2O_3 ternary plot, the lithology falls within the bauxitic clay field (Fig No: 9.4). TREE values are not showing a regular pattern with depth and the average value is 695.5ppm (range 421.8-1187.5ppm) The borehole was terminated at a depth of 30.00 m.

The detailed lithology of the borehole is given in Annexure-VII and graphic litholog & graphic log with assay valuers are presented in Plate No: XI & XII. The assay values of major oxides and REE are given in Annexure No: VIII, IX .

Fig No: 33 Graphic litholog and Assay values of borehole LKD-BH-03 are given below

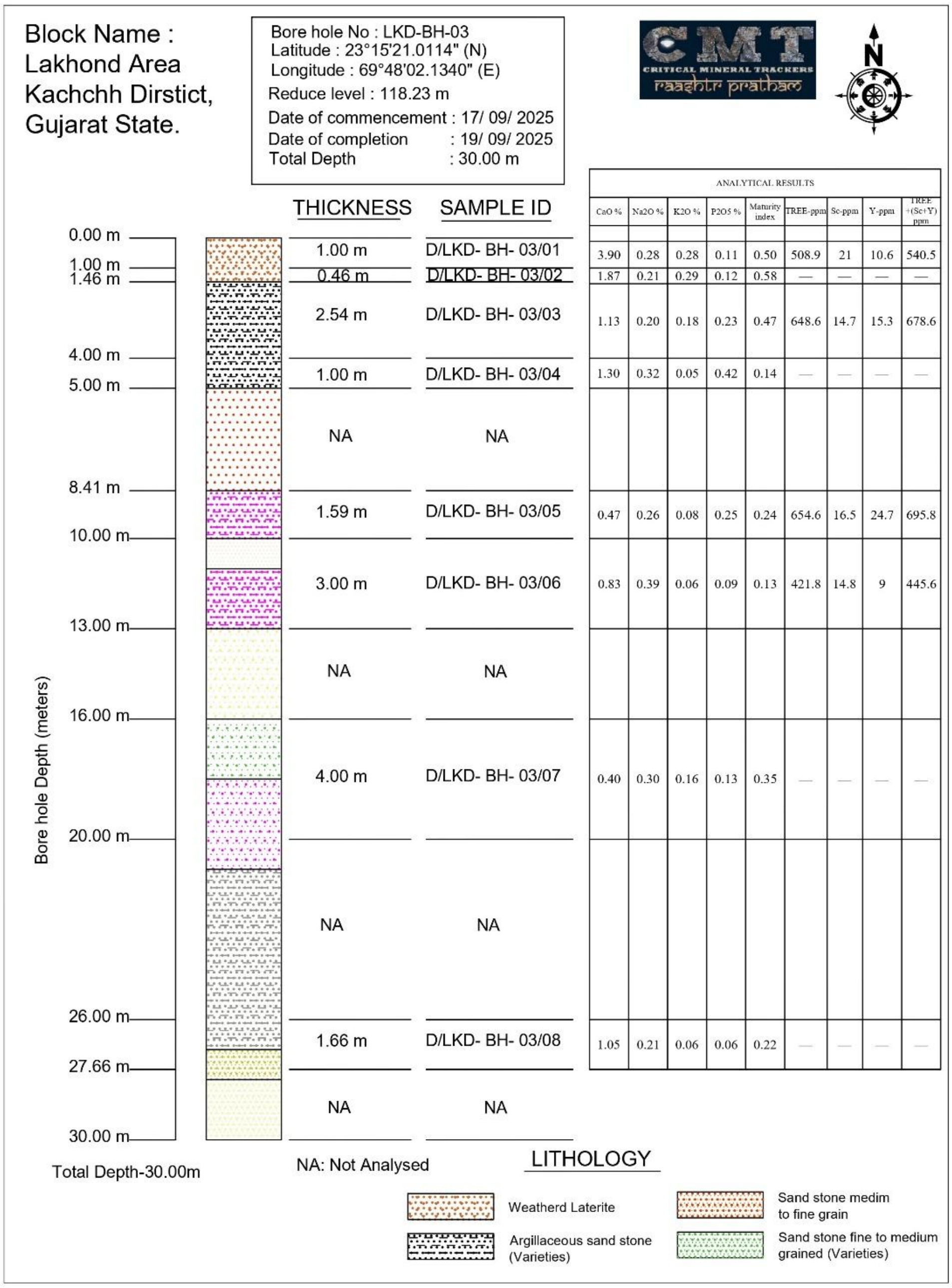


Fig No:34 Ternary plot of LKD – BH - 03**(after Bardoshshi,1981)**

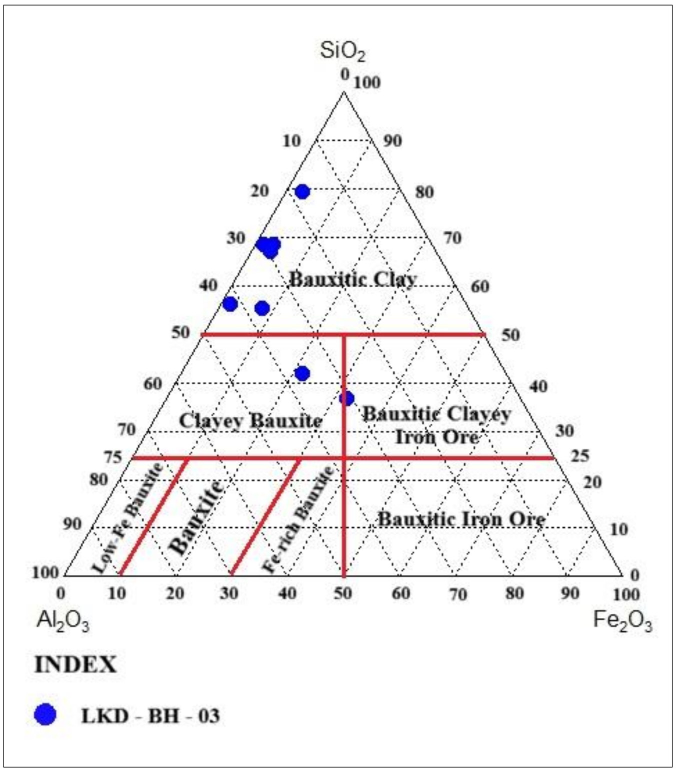


Photo No: 43 Core Boxes of borehole no: LKD-BH-03

Box No: 1

Box No: 2

Box No:3

Box No: 4

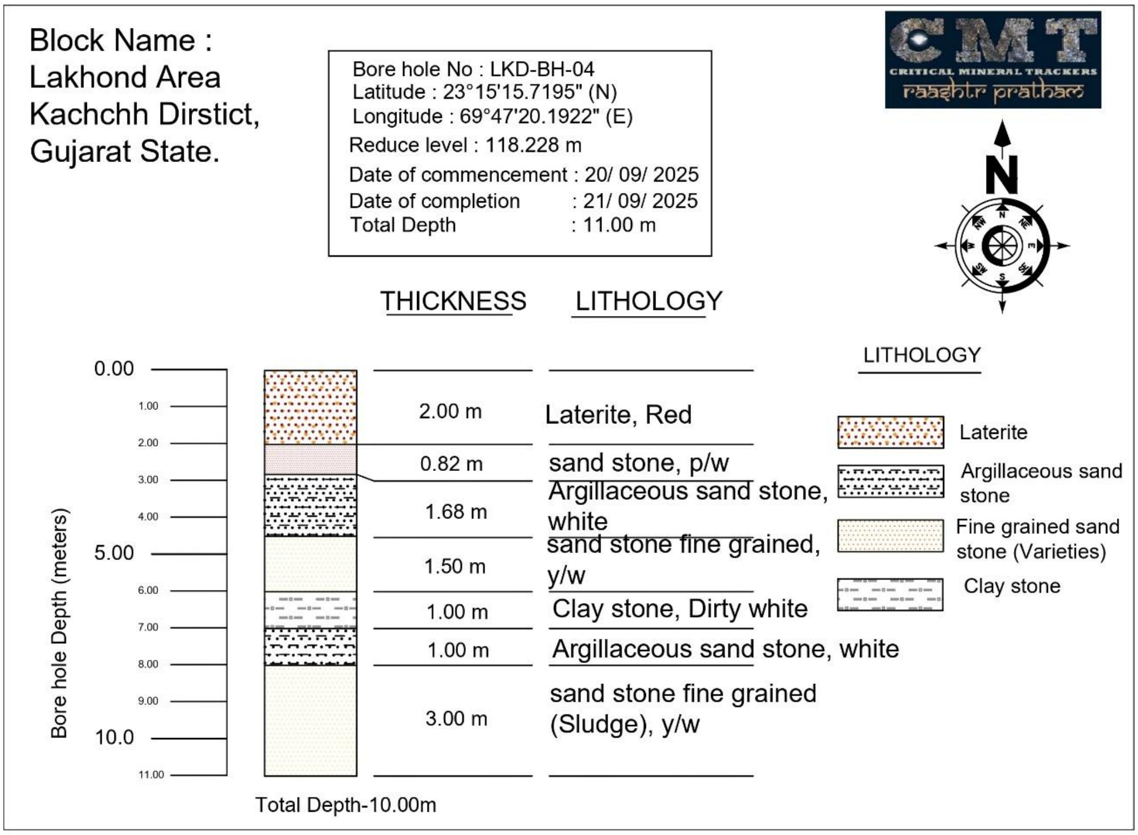
 **Box No:5**	 **Box No:6**

LKD–BH–04

Borehole LKD-BH-04 was drilled based on the analytical results of Pit P6, where low values of TiO_2 (1.20%) and Al_2O_3 (10.40%) were recorded, and also considering the Total REE (TREE) values of 736.71 ppm and 531.75 ppm obtained from nearby Pit P4 and Pit P11, respectively. The borehole was planned to examine the depth persistence of TREE values in this part of the study area

.

Fig No: 35 Graphic litholog of borehole LKD-BH-04 is given below



However, the borehole LKD-BH-04 was terminated at a depth of 11.00 m due to complete water loss during drilling.

Lithologically, brown lateritic soil at the top is followed by fine-grained sandstone and argillaceous sandstone from 0.00 to 11.00 m depth. Geochemical analysis of this interval shows average values of Al_2O_3: 21.79%, SiO_2: 51.33%, Fe_2O_3: 7.08%, TiO_2: 1.10%, and Total REE (TREE): 399.3 ppm.

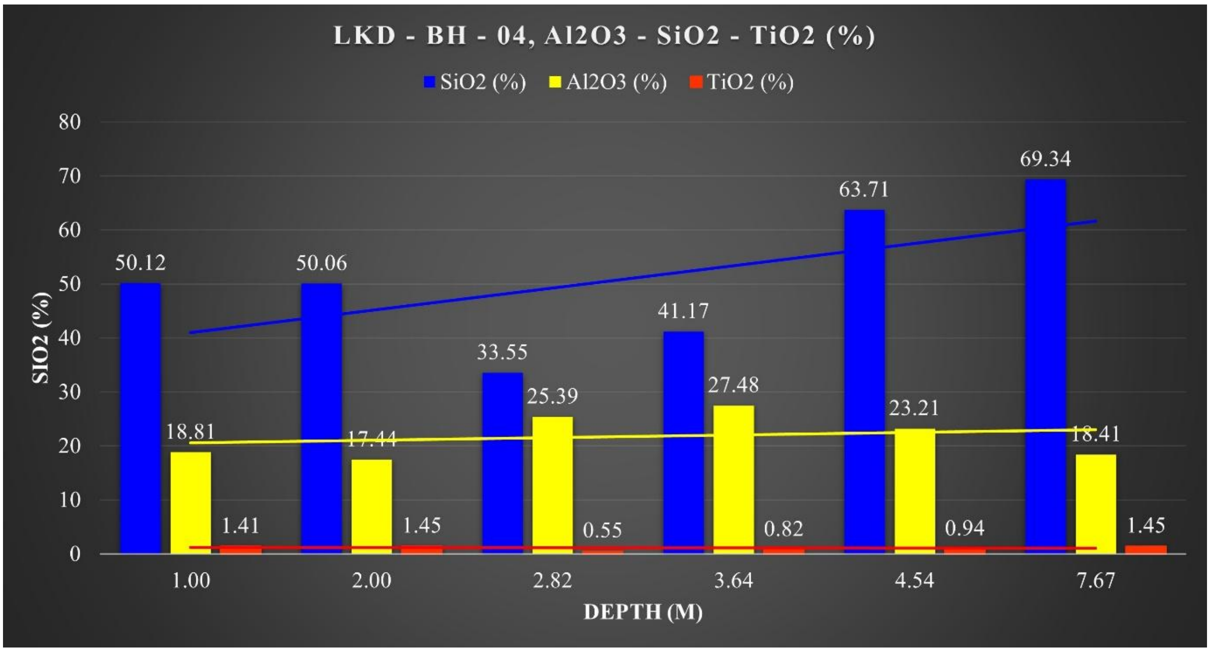
The analytical results indicate that the moderate TREE values observed near the surface in the nearby pits are not persistent with depth, suggesting that the REE enrichment is confined to the near-surface zone and does not continue in the subsurface.

The detailed lithology of the borehole is given in Annexure-VII and graphic litholog & graphic log with assay valuers are presented in Plate No: XI & XII. The assay values of major oxides and REE are given in Annexure No: VIII, IX .

Table No: 9.5 Major Oxides & Total REE in BH - 04

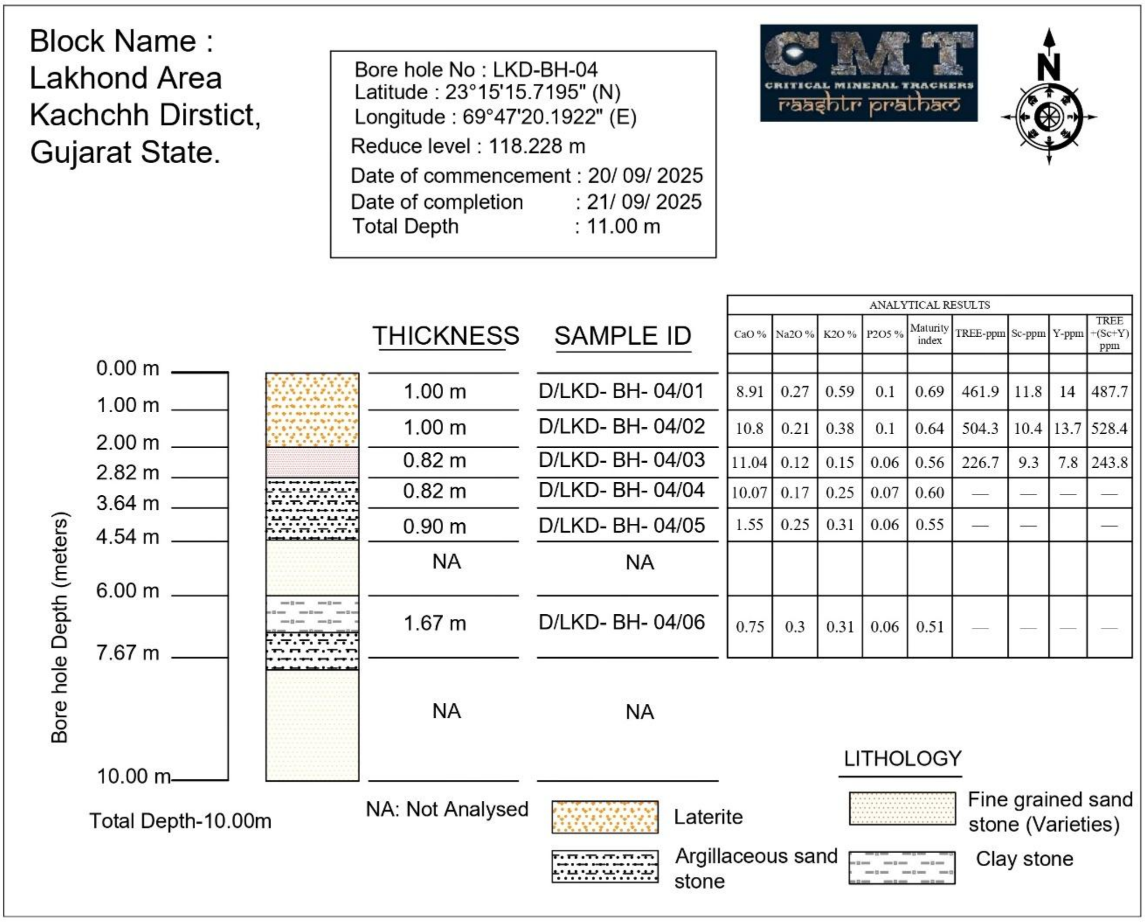
LKD - BH - 04			
Oxides/element	**Minimum**	**Maximum**	**Mean**
SiO2 %	33.55	69.34	51.33
Al2O3 %	17.44	27.48	21.79
Fe2O3%	3.93	10.53	7.08
TiO2%	0.55	1.45	1.10
P205%	0.06	0.1	0.08
Vanadium(ppm)	95.9	366.6	178.5
Gallium (ppm)	14.9	31.3	20.8
Total REE (ppm)	**226.7**	**504.3**	**399.3**
TREE+Sc+Y(ppm)	**243.8**	**528.4**	**421.6**

Fig No: 36 Bar chart comparison of Al2O3-SiO2-TiO2 (%) in BH - 04



Overall, from 0.00 to 11.00m depth, SiO2 Vales increase, but Al2O3 and TiO2 values show more or less flat pattern with depth (as shown in Fig No: 35). TREE values also decrease with depth (492.7-243.8ppm)

Fig No: 37 Graphic litholog and Assay values of borehole LKD-BH-04 are given below



THICKNESS	SAMPLE ID	CaO %	Na2O %	K2O %	P2O5 %	Maturity index	TREE-ppm	Sc-ppm	Y-ppm	TREE +(Sc+Y) ppm
1.00 m	D/LKD- BH- 04/01	8.91	0.27	0.59	0.1	0.69	461.9	11.8	14	487.7
1.00 m	D/LKD- BH- 04/02	10.8	0.21	0.38	0.1	0.64	504.3	10.4	13.7	528.4
0.82 m	D/LKD- BH- 04/03	11.04	0.12	0.15	0.06	0.56	226.7	9.3	7.8	243.8
0.82 m	D/LKD- BH- 04/04	10.07	0.17	0.25	0.07	0.60	—	—	—	—
0.90 m	D/LKD- BH- 04/05	1.55	0.25	0.31	0.06	0.55	—	—		—
NA	NA									
1.67 m	D/LKD- BH- 04/06	0.75	0.3	0.31	0.06	0.51	—	—	—	—
NA	NA									

Fig No: 38 Ternary plot of LKD – BH - 04**(after Bardoshshi,1981)**

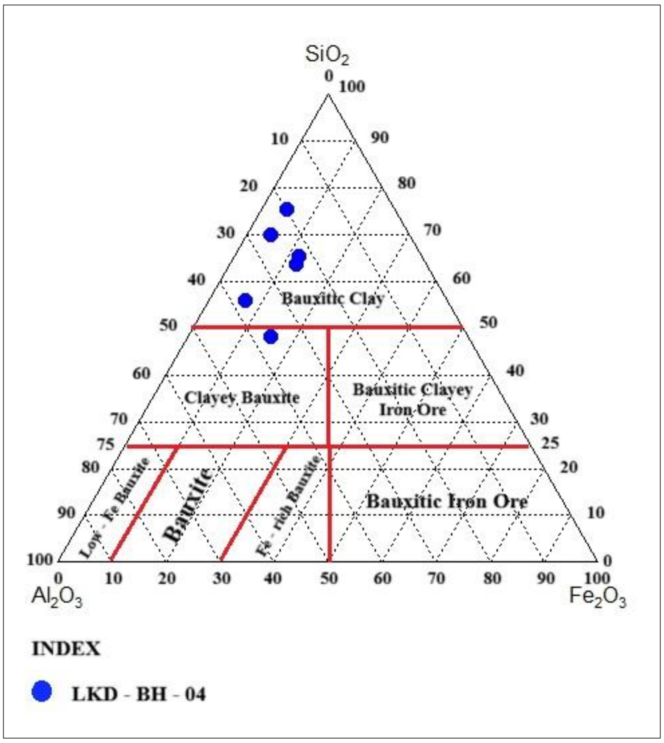


Photo No: 44 Core Boxes of borehole no: LKD-BH-04

Box No: 1

Box No: 2

Box No:3

9.8 Mineralogy of Ore Zone:

No ore zone of economic significance is found in the area

9.9 Petrographic studies: As the most of the core samples from the boreholes drilled in the area are soft and highly friable, hence petrographic studies of the drill core samples could not be done

9.10 Methodology of ore zone sampling & sample preparation

No significant ore zone was delineated within the study area. However closely spaced drill core sampling was carried out within the Bhuj Formation and Sandhan Formation and samples got analysed for major oxides, REE and associated elements.

The sampling depths were carefully demarcated in the core boxes, and the corresponding cores were longitudinally split using a core splitter. One-half of the core was used for sample preparation and geochemical analysis, while the remaining half was systematically preserved in GI core boxes for record and future reference.

All collected samples were analysed for major oxides, while selected representative samples were analysed for REE and Gallium, in accordance with the provisions of the NQT.

9.11 Chemical analysis and laboratory procedures

9.11.1 Discussion on chemical analysis

A total of 36 borehole core samples were selected for chemical analysis of major oxides,15 samples for REE, including samples of laterite/lateritic bauxite, clay, siltstone, saprolite, and Ferruginous sandstone.

In the borehole LKD – BH - 01**,** the value of Al_2O_3 ranges from 16.39 to 36.82% with an average 29.00%, the SiO_2 and Fe_2O_3 value ranges from 34.26 to 67.34% and 2.20 to 14.69% with an average 47.14% and 6.85%, respectively. The TiO_2 value ranges from 1.48 to 5.23% with an average 3.53%. The Gallium and Vanadium value ranging from 29.00 to 43.1 ppm and from 68.60 to 243.70 ppm, with an average of 35.00 ppm and 161.03 ppm, respectively. The total REE (including Sc+Y) values range from 307.5 to 661.9 ppm with average of 480.8ppm.

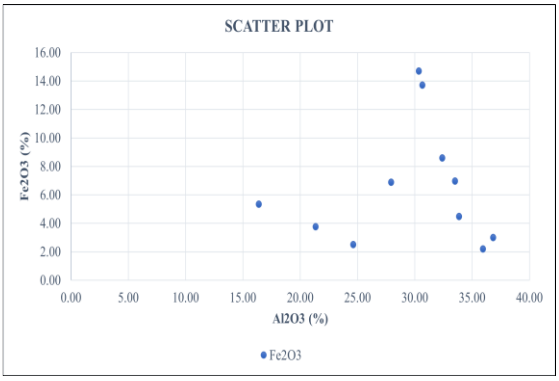


Fig No: 39 Scatter plot showing negative correlation between Al2O3 and Fe2O3

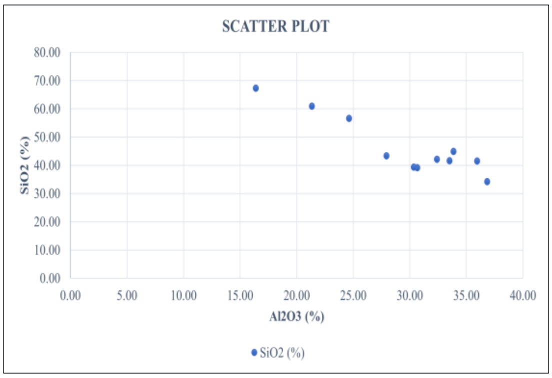


Fig No:40 Scatter plot showing negative correlation between Al2O3 and SiO2

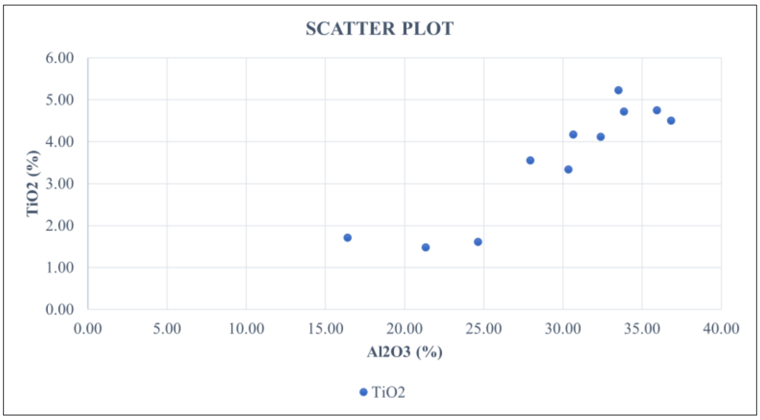


Fig No:41 Scatter plot showing negative correlation between Al2O3 and TiO2

Fig No: 42 Graphical representations of LKD – BH - 01 borehole core samples showing the gradual depletion of Al2O3 with depth.

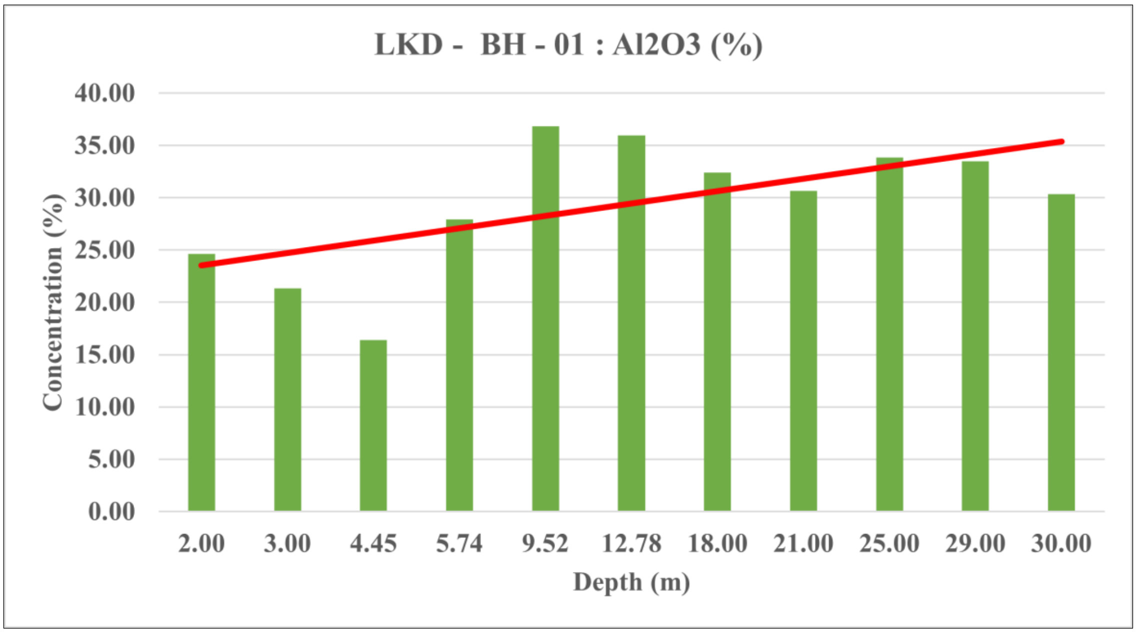
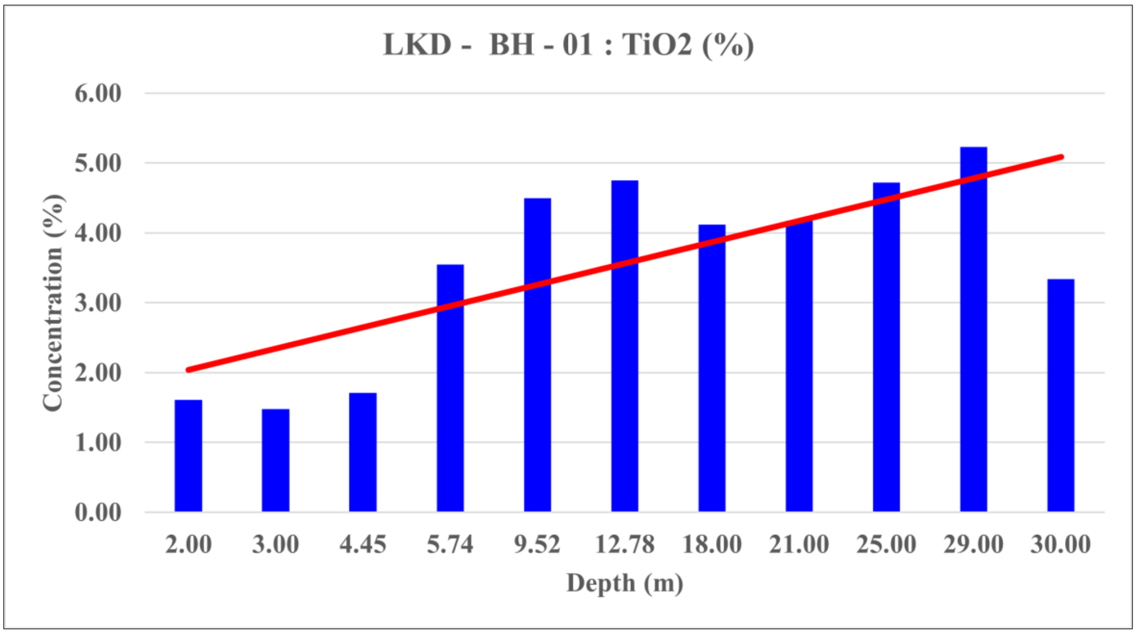


Fig No: 43 Graphical representations of LKD – BH - 01 borehole core samples showing the trend of TiO2 with depth.



In the borehole **LKD – BH - 02,** the value of Al_2O_3 ranges from 8.22 to 28.90% with an average of 16.53%. The SiO_2 and Fe_2O_3 values range from 18.59 to 48.32% and from 10.43 to 36.93 %, with an average 36.26% and 18.73%, respectively. The TiO2 value ranges from 2.37 to 9.87 % with an average of 5.20%. For the Gallium and Vanadium values ranging from 17.9 to 40.9 ppm and from 126.30 to 506.70 ppm, with an average of 25.3 ppm and 268.70 ppm, respectively. The Total REE (including Sc+Y) values range from 357.1 to 679.9 ppm with an average of 517.1 ppm.

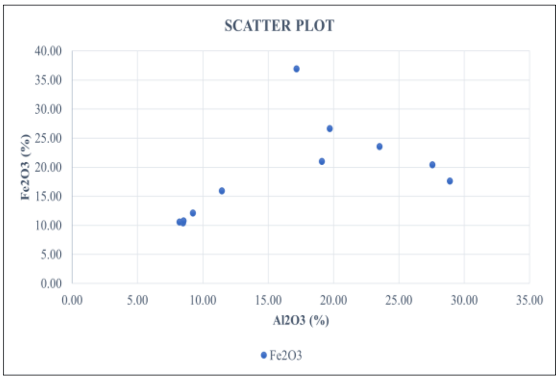


Fig No:44 Scatter plot showing negative correlation between Al2O3 and Fe2O3

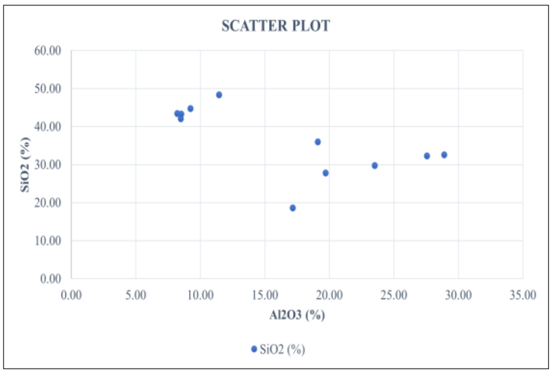


Fig No:45 Scatter plot showing negative correlation between Al2O3 and SiO2

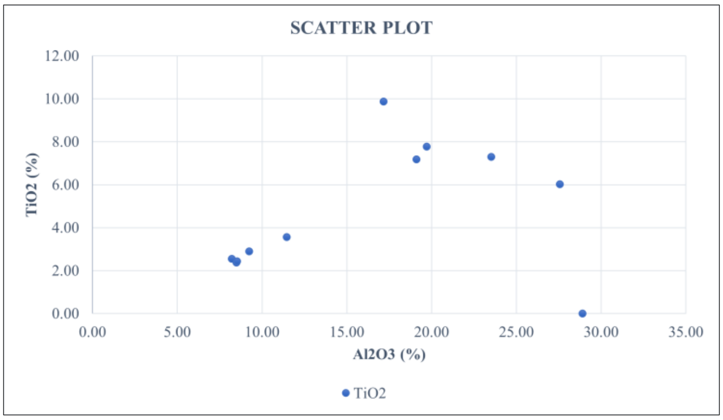


Fig No:46 Scatter plot showing negative correlation between Al2O3 and TiO2

Fig No: 47 Graphical representations of LKD – BH - 02 borehole core samples showing the gradual depletion of Al2O3 with depth

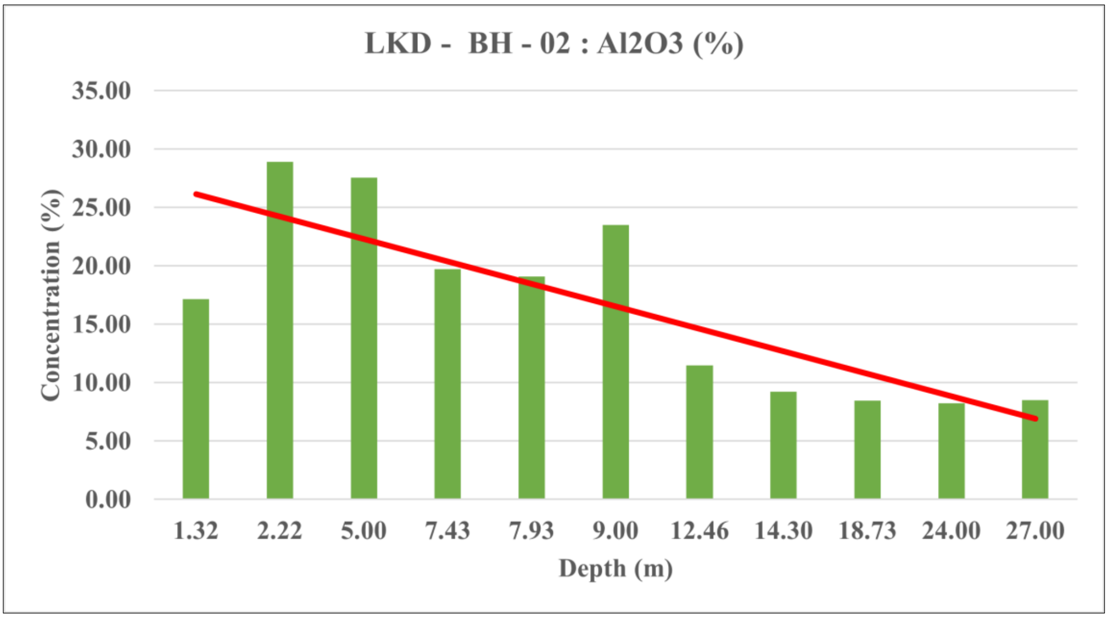
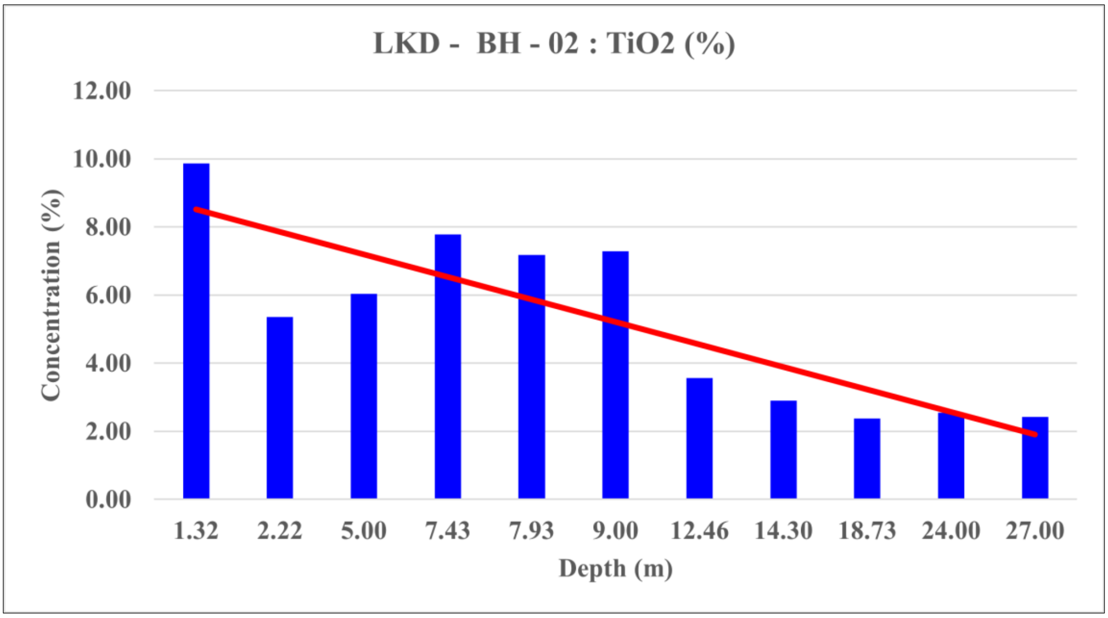


Fig No: 48 Graphical representations of LKD – BH - 02 borehole core samples showing the trend of TiO2 with depth.



In bore hole LKD – BH - 03, the values of Al_2O_3 ranges from 16.59 to 34.51% with an average of 26.97%. The SiO_2 and Fe_2O_3 values range from 29.33 to 74.43% and from 1.26 to 25.52%, with averages of 51.87% and 7.63%, respectively. The TiO_2 value ranges from 0.39 to 4.21% with an average of 2.02%. The Gallium and Vanadium values range from 20.7 to 46.7 ppm and from 34.50 to 898.60 ppm, with averages of 32.8 ppm and 331.29 ppm, respectively. The Total REE value (including Sc+Y) ranges from 445.6 to 1217.5 ppm with an average 727.1 ppm

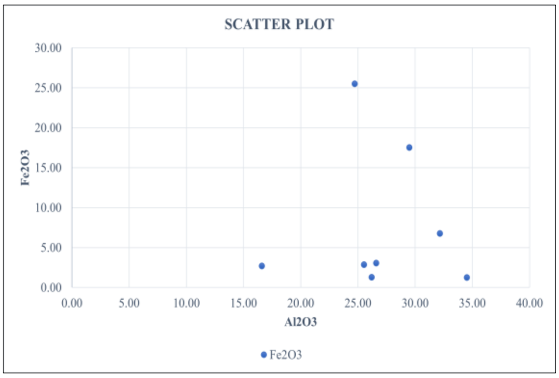


Fig No:49 Scatter plot showing negative correlation between Al2O3 and Fe2O3

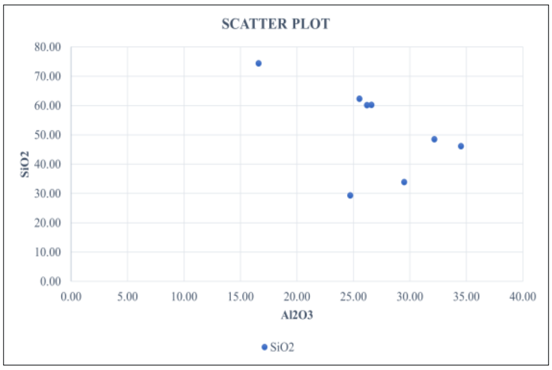


Fig No:50 Scatter plot showing negative correlation between Al2O3 and SiO2

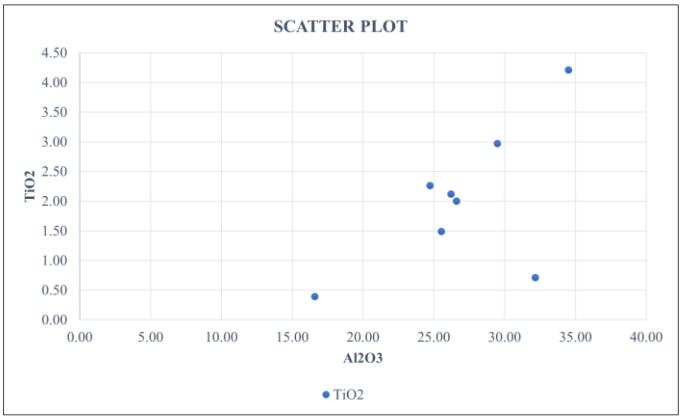


Fig No:51 Scatter plot showing negative correlation between Al2O3 and TiO2

Fig No: 52 Graphical representations of LKD – BH - 03 borehole core samples showing the gradual depletion of Al_2O_3 with depth.

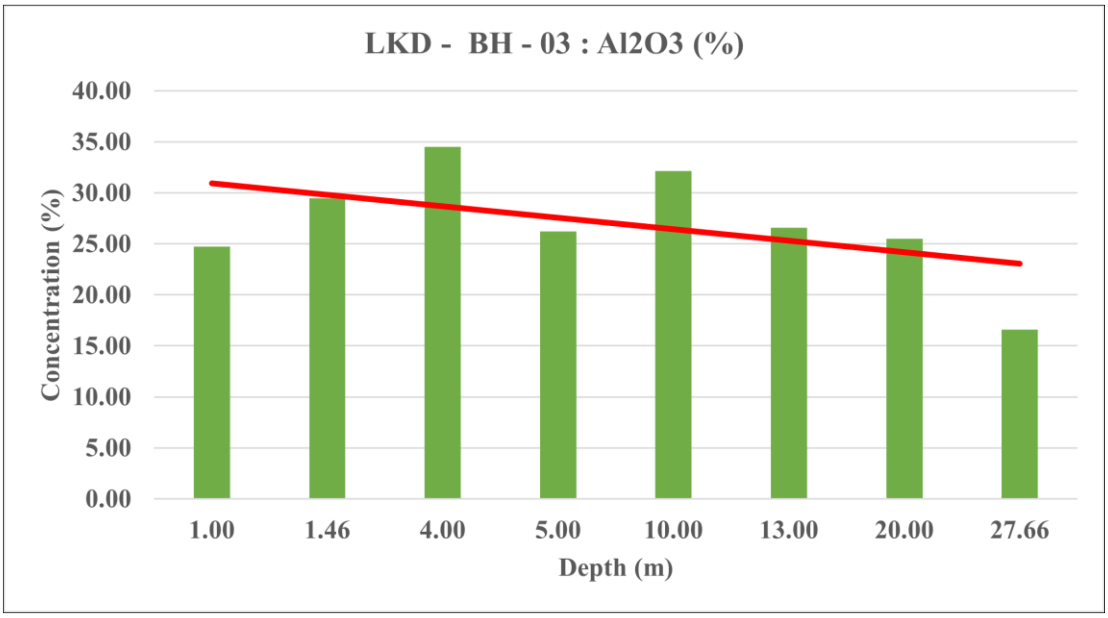
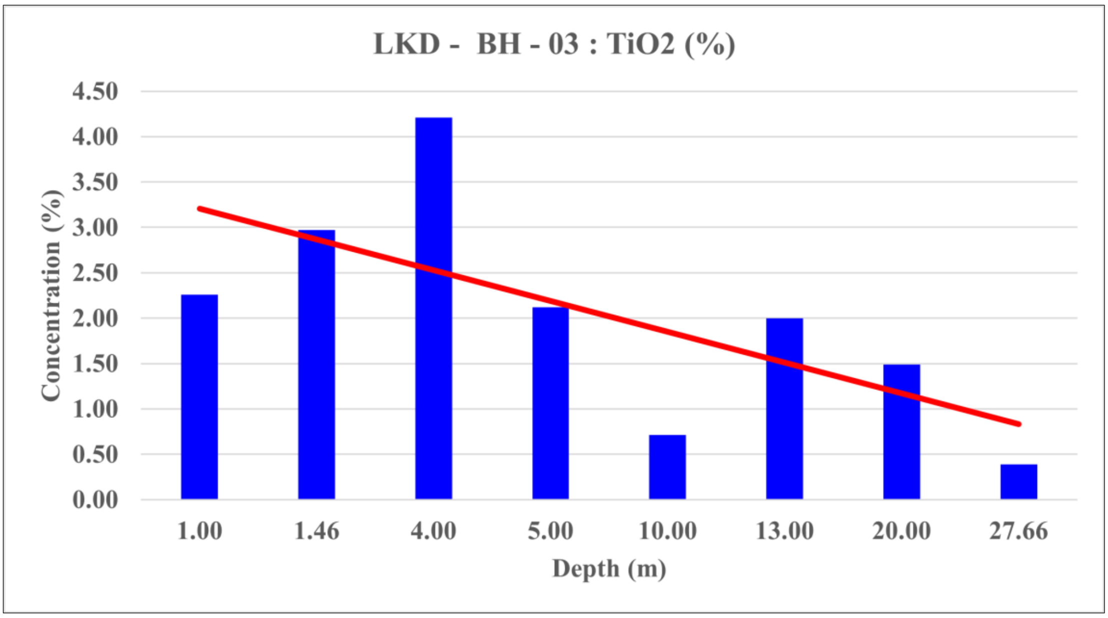


Fig No: 53 Graphical representations of LKD – BH - 03 borehole core samples showing the gradual depletion of TiO_2 with depth.



In borehole no. LKD – BH - 04 The values of Al_2O_3 range from 17.44 to 27.48% with an average of 21.79%. The SiO_2 and Fe_2O_3 values range from 33.55 to 69.34% and from 3.93 to 10.53%, with an average of 51.33% and 7.08%, respectively. The TiO_2 value ranges from 0.55 to 1.45% with an average of 1.1%. The Gallium and Vanadium value ranges from 14.9 to 31.3ppm and from 95.9 to 366.6ppm with an average of 20.8 ppm and 178.53 ppm, respectively. The Total REE value (including Sc+Y) ranges from 243.8 to 528.4 ppm with an average of 421.6 ppm.

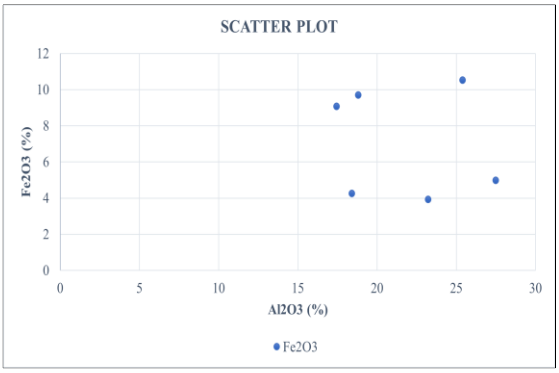


Fig No:54 Scatter plot showing negative correlation between Al2O3 and Fe2O3

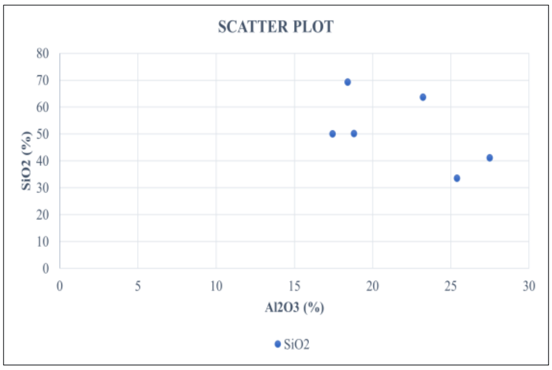


Fig No:55 Scatter plot showing negative correlation between Al2O3 and SiO2

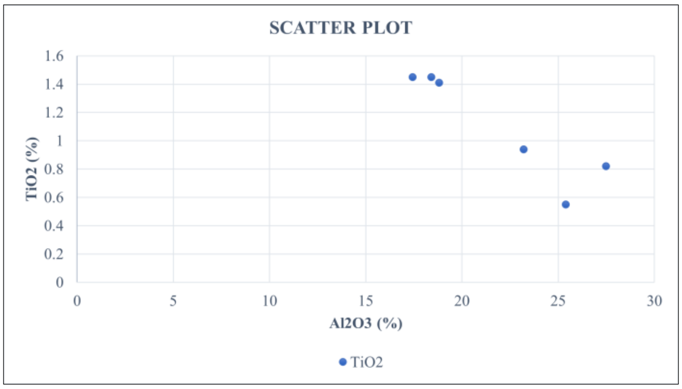


Fig No:56 Scatter plot showing negative correlation between Al2O3 and TiO2

Fig No:57 Graphical representations of LKD – BH - 04 borehole core samples showing the gradual depletion of Al_2O_3 with depth.

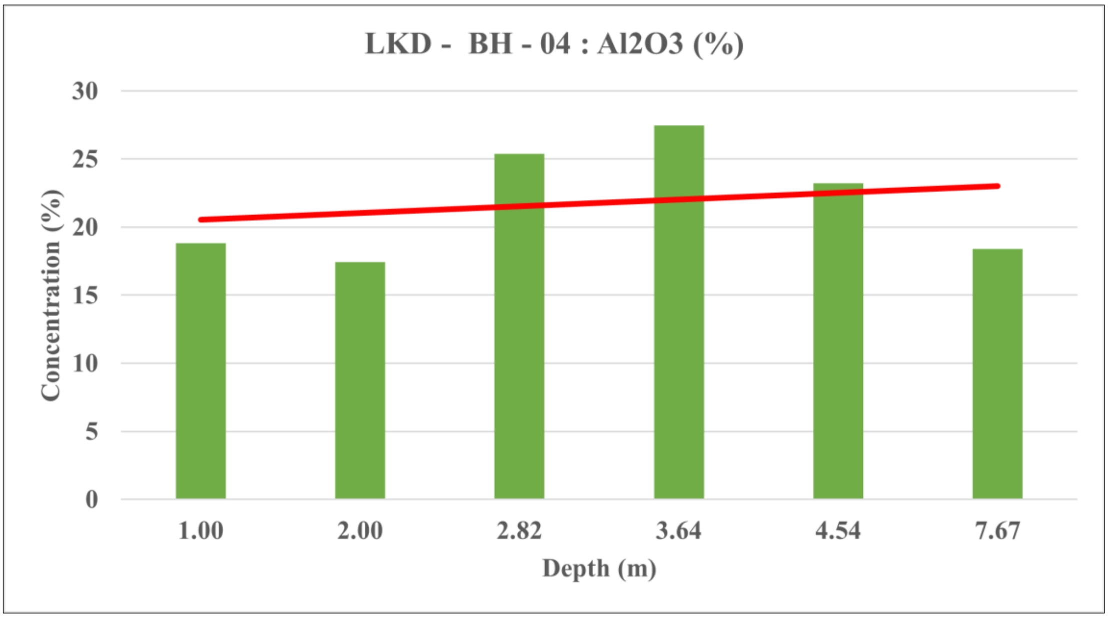
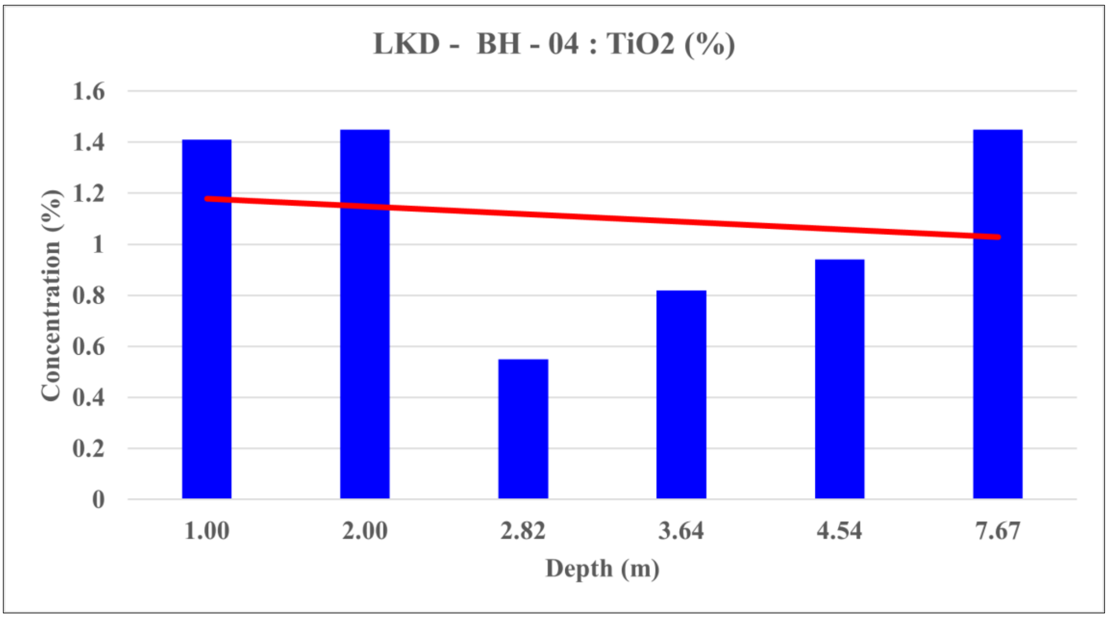


Fig No:58 Graphical representations of LKD – BH - 04 borehole core samples showing the consistency in the TiO_2 with depth.



9.11.2 REE values of the boreholes

The Total REE (TREE) values of Sandhan Formation (LKD-BH-01) are low to moderate values range from 278.7-534.6 ppm (4 samples), Whereas the other three boreholes (LKD-BH-02, LKD-BH-03and LKD-BH-04), which were drilled in the Bhuj Formation has given low to moderate values of TREE range from 226.7-1187.5ppm (11 samples0

Characterisation of TREE (Lanthanum to Lutetium) of drill core samples analysed in Bhuj Formation:

Table No 9.6: Summary statistics of the analytical data relevant to TREE Characterisation of Bhuj Formation

Parameters	Min	Max	Average
Total LREE	186.1	1143.7	508.1
Total HREE	20.5	91.6	49
Total REE	228.2	1189.5	557
Total REE + SC, Y	245.3	1219.5	590
LREE/HREE	4.5	25	11.8
LREE (%)	81.8	96.1	90.2
HREE (%)	3.9	18.2	9.8
%Nd in TREE	39.3	57.7	46.8
La/Yb	6	45.7	15.5

The Bhuj Formation sediments exhibit moderate to high REE concentrations (avg. ~557 ppm), with strong LREE enrichment (~90%) and variable HREE content (~10%). The wide range of LREE/HREE (4.5–25) and La/Yb ratios (6–45.7) indicates heterogeneous provenance, likely derived from predominantly felsic upper continental crust sources with minor mafic contributions. Elevated Nd content (~47% of TREE) suggests significant economic potential, particularly for LREE-bearing minerals such as monazite. Compared to the Sandhan Formation, the Bhuj sediments show higher REE enrichment, greater variability, and slightly enhanced HREE contribution, indicating a more dynamic depositional and provenance system. Borehole LKD-BH-02 and LKD-BH-03 have maturity index < 0.5 indicating immature sediments (sodic rich) where as LKD-NH-04 shows mature sediments (potash rich) with index > 0.5. Immature sediments have an affinity to hold more REE by adsorption.

analysed in Sandhan Formation:

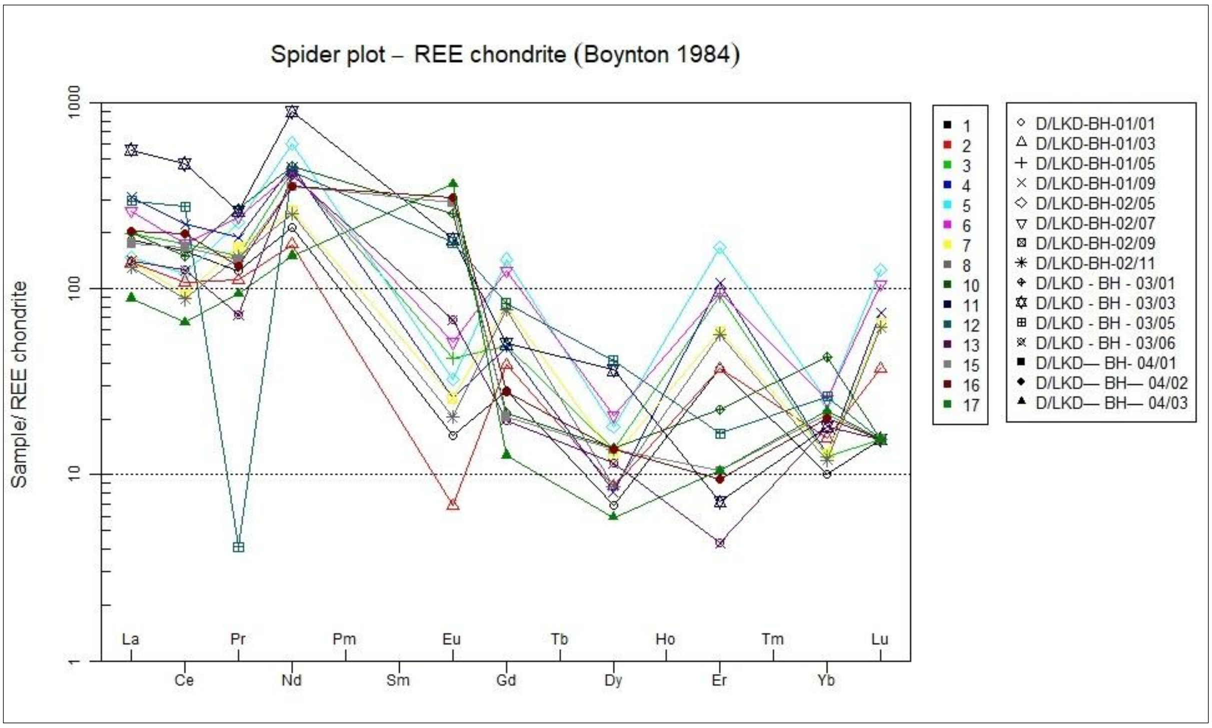
Characterisation of TREE (Lanthanum to Lutetium) of drill core samples

Table No 9.7: Summary statistics of the analytical data relevant to TREE Characterisation of Sandhan formation

Parameters	Sandhan Formation		
	Min	Max	Average
Total LREE	253.5	578.9	415.325
Total HREE	22.7	46.2	35.1
Total REE	280.7	625.1	450.4
Total REE + SC, Y	309.5	663.4	482.7
LREE/HREE	9.3	14.8	12
LREE (%)	90.3	93.7	92.1
HREE (%)	6.3	9.7	7.9
%Nd in TREE	35.6	48.2	41.1
La/Yb	13	35.8	24.9

The Sandhan Formation sediments exhibit moderate to high total REE concentrations (avg. ~450 ppm) with pronounced LREE enrichment (~92%) and relatively low HREE content (~8%). The elevated LREE/HREE ratios (avg. ~12) and high La/Yb values (~25) indicate derivation from felsic upper continental crust sources under stable tectonic conditions. The consistent REE patterns suggest sediment recycling and moderate maturity. The significant proportion of Nd (~41% of TREE) highlights favorable economic potential, particularly for LREE mineralization, likely hosted in monazite-bearing phases.

Fig No: 59 Spider plot of Borehole data



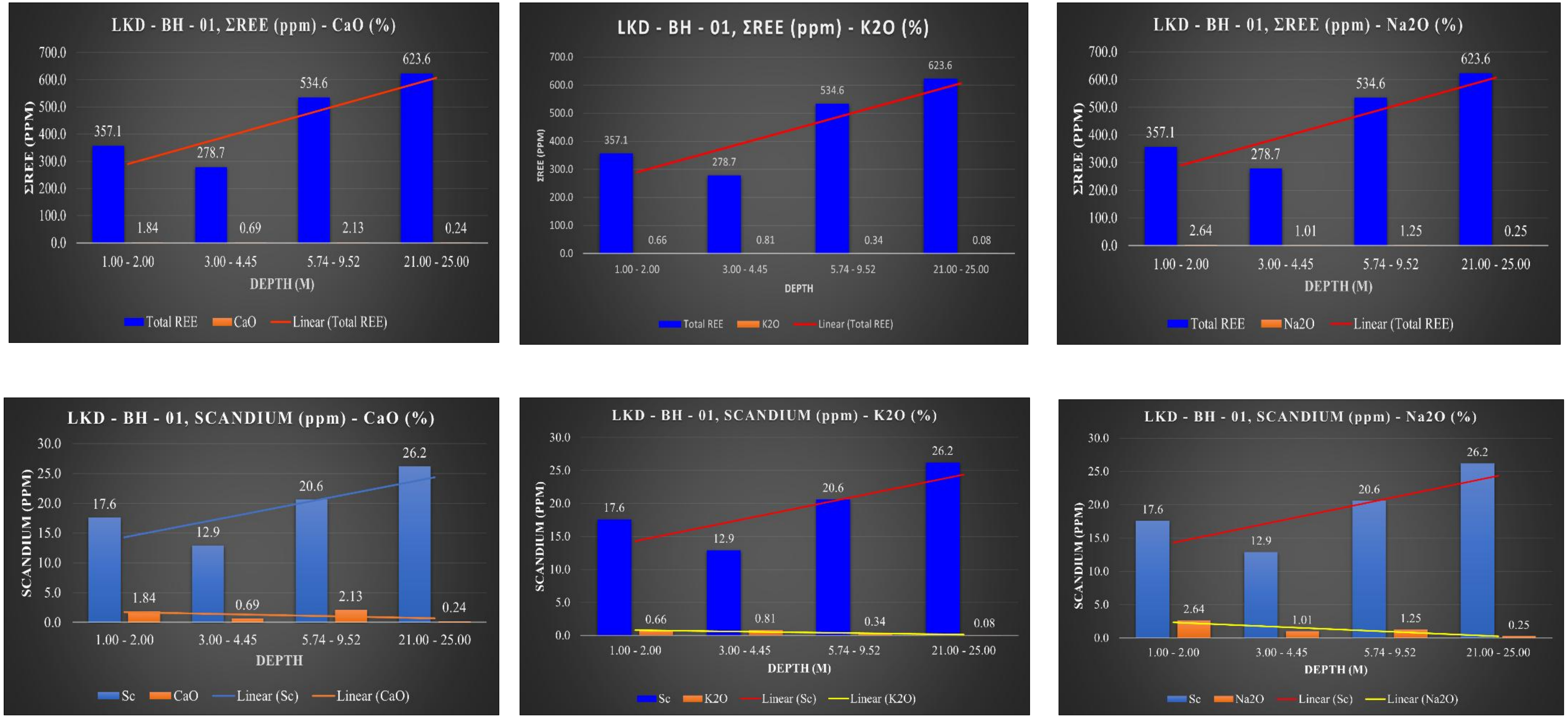
The chondrite-normalized REE patterns (after Boynton) for the Bhuj and Sandhan formations samples from the Kutchchh region display a consistent enrichment of light rare earth elements (LREE: La–Nd) relative to heavy rare earth elements (HREE: Dy–Lu), producing a pronounced right-sloping pattern. This overall signature is characteristic of sediments derived predominantly from felsic upper continental crust. The marked LREE enrichment, coupled with comparatively lower and flatter HREE concentrations, indicates a strong contribution from granitic and high-grade metamorphic source rocks, with little influence from juvenile mantle-derived material.

A well-developed negative europium (Eu) anomaly is evident in most samples, suggesting plagioclase fractionation in the source region, which is typical of evolved felsic lithologies such as granites and gneisses. This further supports derivation from Precambrian continental basement terrains and possibly recycled sedimentary sequences. The middle REE segment (Sm–Dy) shows slight variability, likely reflecting the effects of weathering, sedimentary sorting, and mixing of multiple source lithologies. The relatively subdued HREE fractionation indicates limited control of garnet-bearing sources and suggests that deep crustal contributions were not dominant.

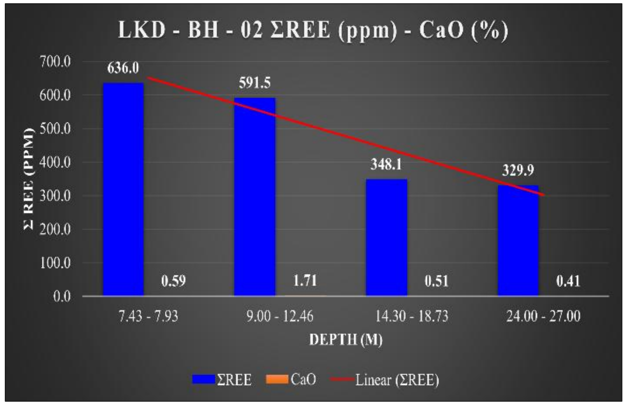
Variations among individual sample patterns point to heterogeneity in provenance, implying contributions from multiple felsic sources and differing degrees of weathering and transport prior to deposition. Overall, the REE geochemistry of the Bhuj and Sandhan formations' sediments indicates derivation from a predominantly felsic, upper continental crustal provenance, with evidence of sediment recycling, consistent with deposition in a rift-related basin setting such as the Kutch Basin.

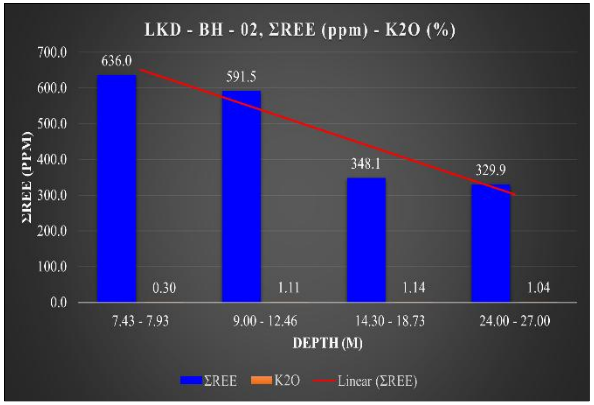
Fig No: 60 BAR CHART INDICATING THE ENRICHMENT/DEPLETION OF TREE & Sc IN RELATION TO CaO, Na2O and K2O

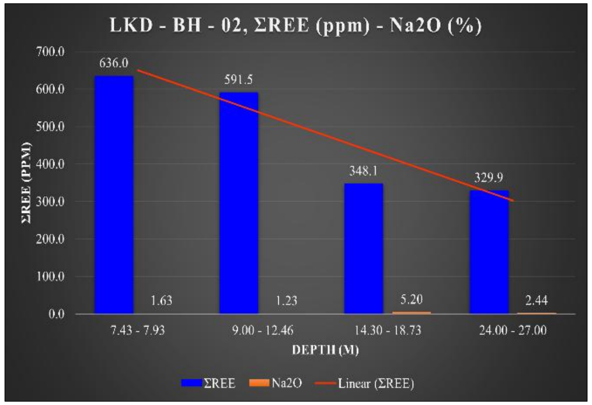
LKD – BH - 01

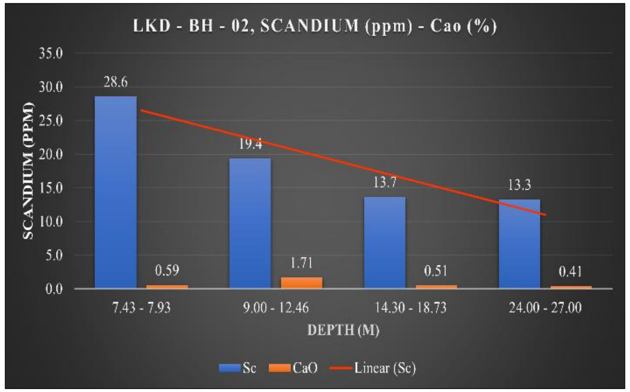


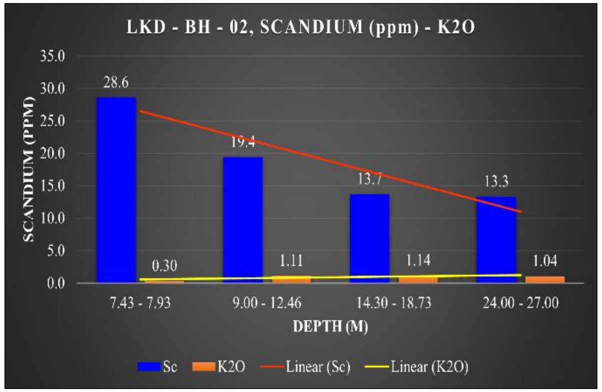
LKD – BH - 02

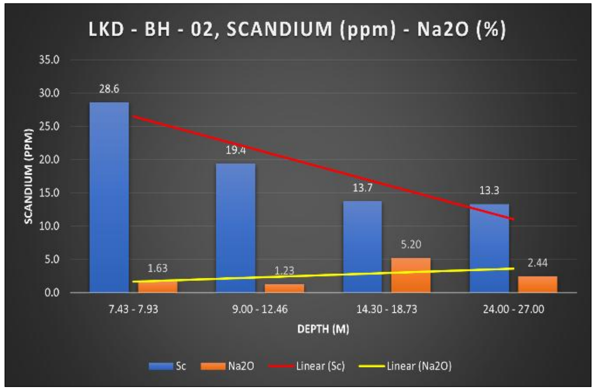

LKD - BH - 02 ΣREE (ppm) - CaO (%)
Σ REE (PPM)
636.0
591.5
348.1
329.9
0.59
1.71
0.51
0.41
7.43 - 7.93
9.00 - 12.46
14.30 - 18.73
24.00 - 27.00
DEPTH (M)
ΣREE
CaO
Linear (ΣREE)


LKD - BH - 02, ΣREE (ppm) - K2O (%)
ΣREE (PPM)
636.0
591.5
348.1
329.9
0.30
1.11
1.14
1.04
7.43 - 7.93
9.00 - 12.46
14.30 - 18.73
24.00 - 27.00
DEPTH (M)
ΣREE
K2O
Linear (ΣREE)

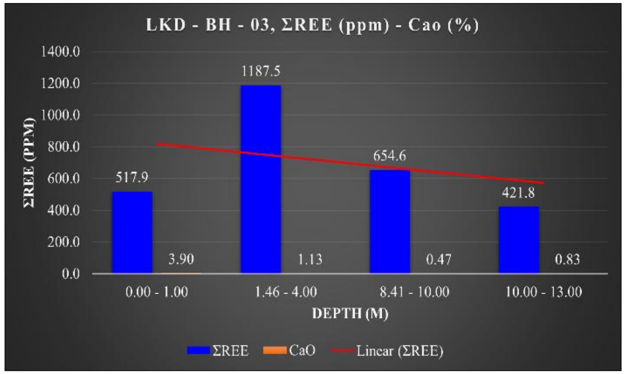

LKD - BH - 02, ΣREE (ppm) - Na2O (%)
ΣREE (PPM)
636.0
591.5
348.1
329.9
1.63
1.23
5.20
2.44
7.43 - 7.93
9.00 - 12.46
14.30 - 18.73
24.00 - 27.00
DEPTH (M)
ΣREE
Na2O
Linear (ΣREE)

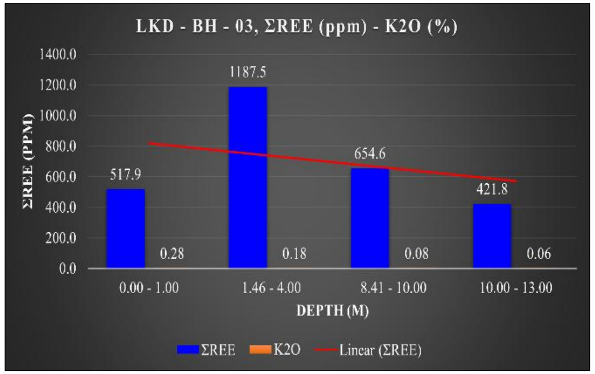

LKD - BH - 02, SCANDIUM (ppm) - Cao (%)
SCANDIUM (PPM)
28.6
19.4
13.7
13.3
0.59
1.71
0.51
0.41
7.43 - 7.93
9.00 - 12.46
14.30 - 18.73
24.00 - 27.00
DEPTH (M)
Sc
CaO
Linear (Sc)

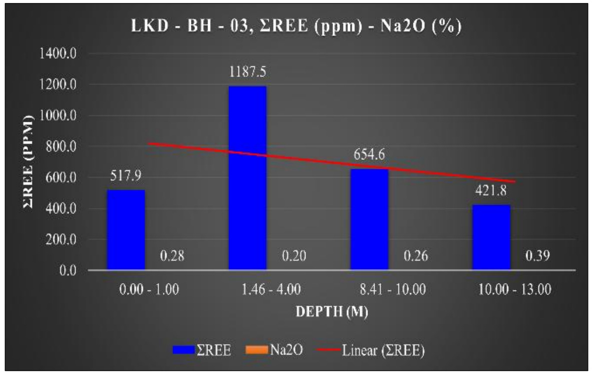

LKD - BH - 02, SCANDIUM (ppm) - K2O
SCANDIUM (PPM)
28.6
19.4
13.7
13.3
0.30
1.11
1.14
1.04
7.43 - 7.93
9.00 - 12.46
14.30 - 18.73
24.00 - 27.00
DEPTH (M)
Sc
K2O
Linear (Sc)
Linear (K2O)

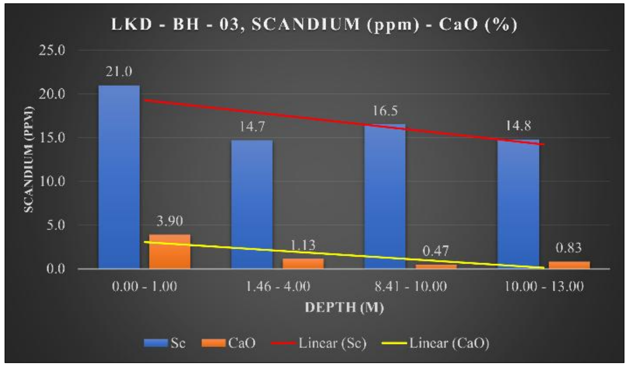

LKD - BH - 02, SCANDIUM (ppm) - Na2O (%)
SCANDIUM (PPM)
28.6
19.4
13.7
13.3
1.63
1.23
5.20
2.44
7.43 - 7.93
9.00 - 12.46
14.30 - 18.73
24.00 - 27.00
DEPTH (M)
Sc
Na2O
Linear (Sc)
Linear (Na2O)

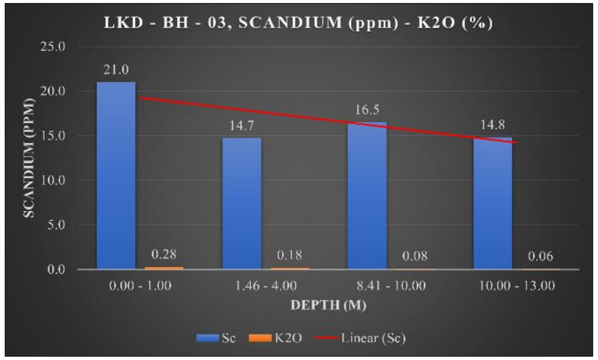
LKD – BH - 03

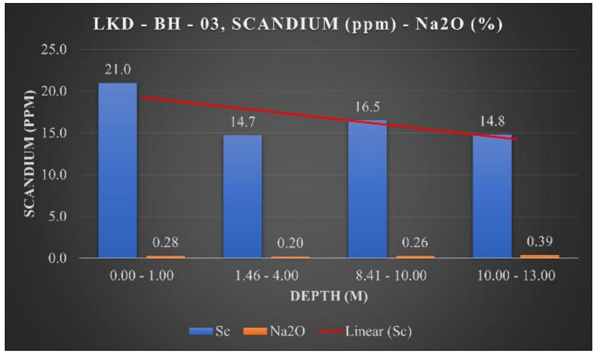

LKD - BH - 03, ΣREE (ppm) - Cao (%)
ΣREE (PPM)
DEPTH (M)
0.00 - 1.00
1.46 - 4.00
8.41 - 10.00
10.00 - 13.00
517.9
1187.5
654.6
421.8
3.90
1.13
0.47
0.83
ΣREE
CaO
Linear (ΣREE)


LKD - BH - 03, ΣREE (ppm) - K2O (%)
ΣREE (PPM)
DEPTH (M)
517.9
1187.5
654.6
421.8
0.28
0.18
0.08
0.06
ΣREE
K2O
Linear (ΣREE)

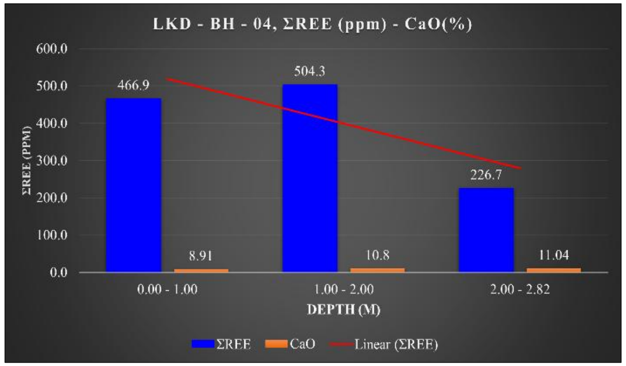

LKD - BH - 03, ΣREE (ppm) - Na2O (%)
ΣREE (PPM)
DEPTH (M)
517.9
1187.5
654.6
421.8
0.28
0.20
0.26
0.39
ΣREE
Na2O
Linear (ΣREE)

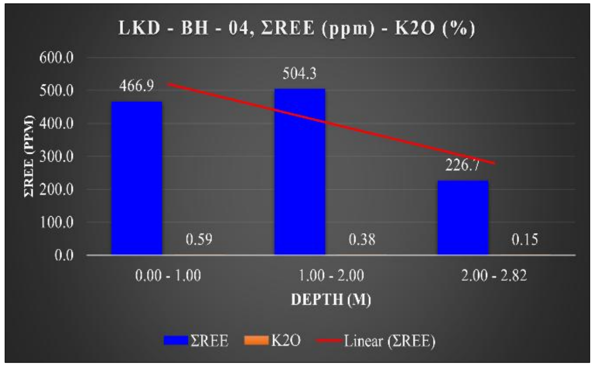

LKD - BH - 03, SCANDIUM (ppm) - CaO (%)
SCANDIUM (PPM)
DEPTH (M)
21.0
14.7
16.5
14.8
3.90
1.13
0.47
0.83
Sc
CaO
Linear (Sc)
Linear (CaO)

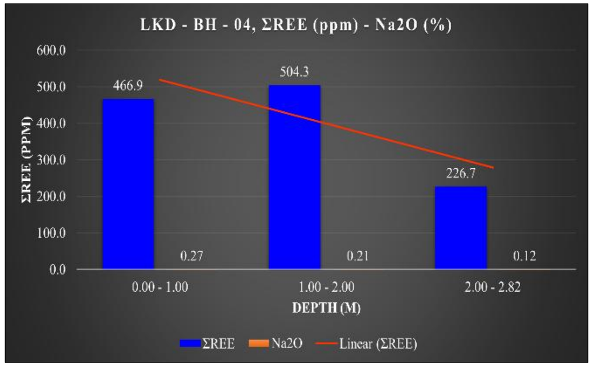

LKD - BH - 03, SCANDIUM (ppm) - K2O (%)
SCANDIUM (PPM)
DEPTH (M)
21.0
14.7
16.5
14.8
0.28
0.18
0.08
0.06
Sc
K2O
Linear (Sc)

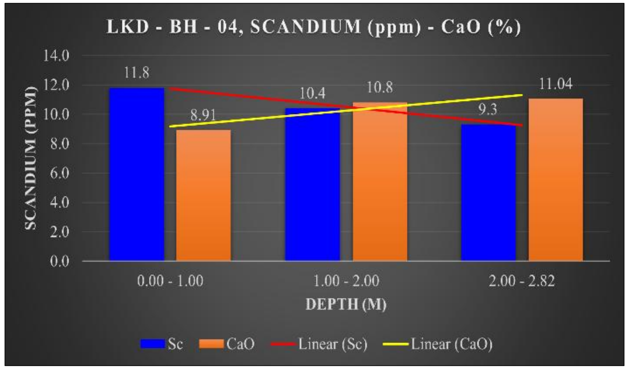

LKD - BH - 03, SCANDIUM (ppm) - Na2O (%)
SCANDIUM (PPM)
DEPTH (M)
21.0
14.7
16.5
14.8
0.28
0.20
0.26
0.39
Sc
Na2O
Linear (Sc)

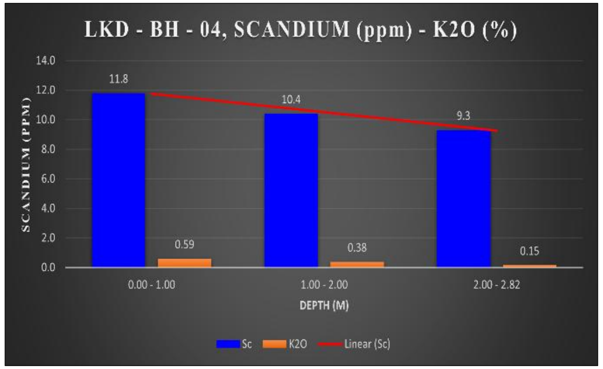
LKD – BH - 04

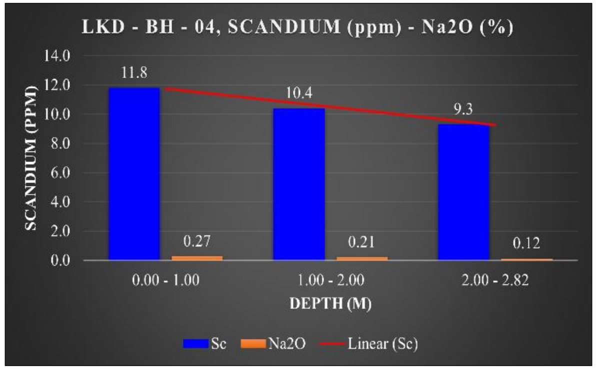

LKD - BH - 04, ΣREE (ppm) - CaO(%)
ΣREE (PPM)
600.0
500.0
400.0
300.0
200.0
100.0
0.0
466.9
504.3
226.7
8.91
10.8
11.04
0.00 - 1.00
1.00 - 2.00
2.00 - 2.82
DEPTH (M)
ΣREE
CaO
Linear (ΣREE)


LKD - BH - 04, ΣREE (ppm) - K2O (%)
ΣREE (PPM)
600.0
500.0
400.0
300.0
200.0
100.0
0.0
466.9
504.3
226.7
0.59
0.38
0.15
0.00 - 1.00
1.00 - 2.00
2.00 - 2.82
DEPTH (M)
ΣREE
K2O
Linear (ΣREE)


LKD - BH - 04, ΣREE (ppm) - Na2O (%)
ΣREE (PPM)
600.0
500.0
400.0
300.0
200.0
100.0
0.0
466.9
504.3
226.7
0.27
0.21
0.12
0.00 - 1.00
1.00 - 2.00
2.00 - 2.82
DEPTH (M)
ΣREE
Na2O
Linear (ΣREE)


LKD - BH - 04, SCANDIUM (ppm) - CaO (%)
SCANDIUM (PPM)
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
11.8
8.91
10.4
10.8
9.3
11.04
0.00 - 1.00
1.00 - 2.00
2.00 - 2.82
DEPTH (M)
Sc
CaO
Linear (Sc)
Linear (CaO)


LKD - BH - 04, SCANDIUM (ppm) - K2O (%)
SCANDIUM (PPM)
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
11.8
10.4
9.3
0.59
0.38
0.15
0.00 - 1.00
1.00 - 2.00
2.00 - 2.82
DEPTH (M)
Sc
K2O
Linear (Sc)


LKD - BH - 04, SCANDIUM (ppm) - Na2O (%)
SCANDIUM (PPM)
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
11.8
10.4
9.3
0.27
0.21
0.12
0.00 - 1.00
1.00 - 2.00
2.00 - 2.82
DEPTH (M)
Sc
Na2O
Linear (Sc)

9.11.3 Laboratory procedures

Laboratory Details

The chemical analysis of the geological samples was carried out at Lucid Laboratories Pvt. Ltd., located in Balanagar, Hyderabad. The laboratory is accredited by the National Accreditation Board for Testing and Calibration Laboratories (NABL) in accordance with ISO/IEC 17025:2017 standards (Certificate No. TC-5918) for the chemical testing of ores and minerals.

Analysis of Major Oxides by X-Ray Fluorescence (XRF)

The major oxides (SiO_2, Al2O3, Fe2O3, TiO2, CaO, MgO, Na2O, K2O, MnO, P2O5) were determined using Wavelength Dispersive X-Ray Fluorescence (WD-XRF) spectrometry.

Loss on Ignition (LOI)

Prior to XRF analysis, a known weight of the sample (approx. 1 g) was heated in a muffle furnace at 1000°C for 1 hour. The weight loss was recorded to determine the Loss on Ignition (LOI), representing volatile components such as moisture, organic matter, and carbonate content.

Fused Bead Preparation

To eliminate particle size effects and mineralogical heterogeneity, the samples were prepared as fused glass beads:

Weighing: The calcined sample was weighed and mixed with a borate flux (Lithium Tetraborate/Lithium Metaborate ratio 66:34) in a platinum crucible.

Fusion: The mixture was fused at a temperature of 1100°C – 1200°C in an automated fusion machine.

Casting: The molten material was cast into a homogeneous glass disc (bead) with a flat surface suitable for X-ray irradiation.

Instrumental Analysis

The fused beads were analysed using a WD-XRF spectrometer. The instrument measured the intensity of secondary X-rays emitted by the sample, which were converted to concentration values (Weight %) using calibration curves derived from Certified Reference Materials (CRMs).

Analysis of Rare Earth Elements (REE) by ICP-MS

The determination of Rare Earth Elements (La to Lu) plus Yttrium (Y) and Scandium (Sc) was carried out using Inductively Coupled Plasma Mass Spectrometry (ICP-MS) to ensure low detection limits (ppb levels).

Sample Decomposition (Digestion)

To ensure the complete release of REEs from resistant mineral phases (such as zircon or monazite, often found in laterites/bauxite), a rigorous digestion method was employed:

Method: Open Acid Digestion (Four-Acid Method) or Fusion.

Procedure: A 0.1 g to 0.2 g sub-sample was treated with a combination of Hydrofluoric (HF), Nitric (HNO3), Perchloric (HClO4), and Hydrochloric (HCl) acids in Teflon beakers. The mixture was heated on a hot plate to fume off the acids and break down the silicate lattice.

Final Solution: The residue was dissolved in dilute Nitric Acid (HNO3) to make up the final volume for aspiration into the instrument.

Instrumental Analysis

The sample solution was nebulized into the ICP-MS plasma torch (Argon plasma). The ions were extracted into the mass spectrometer, separated by their mass-to-charge ratio (m/z), and detected.

Internal Standards: Elements such as Rhodium (Rh) or Indium (In) were used as internal standards to correct for instrumental drift and matrix suppression.

External Check Analysis

To evaluate the accuracy and bias of the primary analytical results, a program of external check analysis was implemented. This process involves the re-analysis of a selected 10% of samples at an independent, NABL-accredited third-party laboratory.

Sample Selection

In accordance with standard geological exploration norms, 10% of the total samples from the Lakhond block were selected for check analysis.

Selection Method: Samples were selected randomly from the mineralized zones to cover the full range of grade variation high-grade bauxite/laterite.

Sample Type: Duplicate samples (homogenized -200 mesh powder) were used to eliminate variance caused by sample preparation, focusing purely on analytical precision.

Third-Party Laboratory Details

The duplicate samples were dispatched to Shiva Analyticals Pvt. ltd, which holds a valid NABL accreditation (ISO/IEC 17025:2017). This laboratory is entirely independent of the primary laboratory (Lucid Laboratories Pvt. ltd) and the exploration agency.

Analytical Methodology for Check Samples

The check samples were analysed using the identical methodology employed by the primary laboratory to ensure direct comparability:

Major Oxides: Analysed by X-Ray Fluorescence (XRF) using the Fused Bead method.

REE: Analysed by ICP-MS following acid digestion/fusion

9.12 Statistical Analysis of Check Samples

The results received from the primary laboratory and the check laboratory were subjected to statistical comparison to quantify precision and identify any systematic bias.

Table No 9.8: Statement showing drill core analysis of External check samples for major oxides and their comparison with primary samples of Lakhond area, Kachchh district, Gujarat

S.no	Primary check sample	Sample name	SiO2	Al2O3	Fe2O3	MnO	MgO	CaO	Na2O	K2O	TiO2	P2O5	LOI	Remarks
			(%)											
1	Primary	D/LKD- BH- 01/05	34.26	36.82	3.01	0.01	0.29	2.13	1.25	0.34	4.50	0.12	16.79	Lucid Laboratory
1	Check	D/LKD-BH-01/61	36.23	31.35	3.26	0.00	0.26	2.60	0.48	0.33	3.49	0.10	19.38	Shiva Analyticals
2	Primary	D/LKD- BH- 02/02	32.60	28.90	17.64	0.05	0.40	0.72	0.96	0.01	5.35	0.59	12.29	Lucid Laboratory
2	Check	D/LKD-BH-02/62	30.55	23.66	21.91	<0.05	0.52	0.92	0.21	<0.05	6.12	0.83	14.76	Shiva Analyticals
3	Primary	D/LKD - BH - 03/03	46.13	34.51	1.26	0.01	0.17	1.13	0.2	0.18	4.21	0.23	11.49	Lucid Laboratory
3	Check	D/LKD-BH-03/63	57.73	23.97	1.29	<0.05	0.16	1.32	<0.08	0.13	3.89	0.17	10.87	Shiva Analyticals
4	Primary	D/LKD - BH - 04/01	50.12	18.81	9.71	0.03	0.67	8.91	0.27	0.59	1.41	0.1	9.05	Lucid Laboratory
4	Check	D/LKD-BH-04/64	72.24	6.84	7.31	<0.05	0.25	4.05	<0.08	0.29	1.18	0.06	7.44	Shiva Analyticals

For the reliability of analytical data, 10% of duplicate samples from various borehole samples were sent to NABL-accredited laboratories for cross-checking and correlation of assay values. The samples analysed by Shiva Analyticals (India) Private Limited and Lucid Laboratories Private Limited were interchanged with each other. The analytical report indicates that the variation of values of both original and check samples for Al_2O_3 concentrations are in the range of 16 to 50%.

Table No: 9.9 Summarized the table showing statistical analysis of Primary Vs External Check sample assay of SiO_2, Al_2O_3, Fe_2O_3, MnO, MgO and CaO, Na_2O, K_2O, TiO_2 and P_2O_5

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	4	4	4	4	4	4	4	4	4	4
2	Arithmetic mean	40.778	49.186	29.760	21.454	7.905	8.442	0.025	0.019	0.383	0.299
3	Standard Deviation	8.666	19.319	8.022	10.372	7.442	9.321	0.019	0.013	0.213	0.151
4	Standard error of mean	4.333	9.659	4.011	5.186	3.721	4.661	0.010	0.006	0.107	0.076
5	Variance	75.094	373.206	64.349	107.586	55.382	86.887	0.000	0.000	0.046	0.023
6	Mean of deviation	-8.408		8.306		-0.537		0.006		0.084	
7	Standard Deviation (Error)	10.786		3.458		2.763		0.017		0.230	
8	Correlation Co-efficient	0.991		0.961		0.970		0.522		0.238	
9	Mean absolute error	9.434		8.306		1.738		0.014		0.142	

Sr. No	Comparison Parameter	CaO (%)		Na2O (%)		K2O (%)		TiO2(%)		P2O5(%)	
		PRIMARY	CHECK	PRIMARY	CHECK	PRIMARY	CHECK	PRIMARY	CHECK	PRIMARY	CHECK
1	No. of sample pairs	4	4	4	4	4	4	4	4	4	4
2	Arithmetic mean	3.223	2.221	0.670	0.193	0.280	0.194	3.868	3.668	0.260	0.290
3	Standard Deviation	3.838	1.414	0.517	0.209	0.247	0.142	1.708	2.024	0.227	0.365
4	Standard error of mean	1.919	0.707	0.258	0.104	0.123	0.071	0.854	1.012	0.114	0.183
5	Variance	14.727	1.998	0.267	0.044	0.061	0.020	2.918	4.097	0.052	0.133
6	Mean of deviation	1.002		0.477		0.086		0.200		-0.030	
7	Standard Deviation (Error)	2.576		0.327		0.144		0.733		0.144	
8	Correlation Co-efficient	0.930		0.945		0.861		0.937		0.990	
9	Mean absolute error	1.429		0.477		0.094		0.583		0.092	

CHAPTER – X

10.0 Resource Estimation:

Based on the integrated evaluation of geological setting, stratigraphic framework, subsurface investigations, and geochemical data, the Lakhond 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 stage exploration carried out over an area of 6.12 sq. km in the Lakhond area, Kachchh District, was aimed at assessing the potential for bauxite and associated critical minerals such as Ga, V, Ti, and Rare Earth Elements (REE).

Detailed geological mapping on a 1:12,500 scale established the presence of two major litho-units belonging to the Bhuj Formation and Sandhan Formation, while small exposures of Gaj and Matanomadh formations occur near the eastern margin, along with basalts of Anjar Volcanics in the northern part of the study area. None of these formations are known to host lateritic or bauxitic enrichment in the region.

Subsurface exploration was carried out through 20 pits and 5 trenches, which provided representative samples for geochemical analysis. The analytical results of 90 samples indicate generally low concentrations of the targeted elements.

Further subsurface investigation through four boreholes, namely LKD-BH-01, LKD-BH-02, LKD-BH-03, and LKD-BH-04, drilled up to depths of 30.00 m, 30.00 m, 30.00 m, and 11.00 m, respectively, was undertaken to examine the depth persistence of clayey bauxite, TiO_2, and Total REE (TREE) within the study area.

The analytical results of the borehole samples indicate that Al_2O_3, TiO_2, and Total REE values do not show any significant increase with depth, and no economically significant concentrations of bauxite or associated critical minerals were encountered in the subsurface. The comparatively higher values observed in some pits and trenches appear to be localized and restricted to near-surface zones, likely due to weathering and residual concentration.

Based on the results of geological mapping, subsurface exploration, and geochemical analysis, it is concluded that the study area does not exhibit promising subsurface potential for bauxite or associated critical mineralization. Therefore, no further exploration is recommended in this area at the present stage, and the area is considered non-prospective for further exploration.

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CHAPTER – XII

12.0 EXPENDITURE

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

The total expenditure incurred for execution of the project "Reconnaissance survey (G4) for Bauxite, Ga, V, Ti & REE in Lakhond Area, Kachchh district, Gujarat" is Rs. 62.55 lakhs (Sixty-two lakhs fifty-five thousand only), including GST. This has been approved by the 25th TCC-II held on 17nd & 18th March 2026 and also in the 7th PSC held 27th March of NMEDT (Vide No: 117/1/2025-NMET/SO-16 dated: 08-04-2026)

Agenda 25.3.6 Reconnaissance Survey (G4) for Bauxite, Ga, V, Ti & REE in Lakhond area, Kachchh District, Gujarat.
[Implementing Agency: M/s Critical Mineral Trackers]

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 approved cost of ₹ 60.01/- Lakh (including GST). The project was reviewed in 9th meeting of TCC-II held on 29th & 30th May 2025. In that meeting the committee recommended the revised cost of ₹68.76 Lakh (including GST) due to the change from outsourced drilling to in-house drilling in the project. The proposed revised cost was approved in 43rd meeting of EC held on 14th August 2025. During the project review in 23rd TCC-II meeting held on 16th and 17th February 2026 the committee recommended timeline extension up to 31st March 2026 for GR submission.

b) M/s Critical Mineral Trackers informed that the approved drilling target has not been fully achieved as the 4th Borehole was closed at 11m (against approved 30m) due to complete water loss. Attempt for redrilling after lowering the casing was also not successful.

c) The TCC-II advised that, characterization of TREE and the enrichment/depletion of Sc in relation to Na, K, and Ca in drill core sample chemistry should be undertaken. Thin-section studies of REE mineral phases in enriched zones are also required. The geological report should include a detailed discussion on the variation of TREE and other critical mineral contents, their controlling factors with respect to the chemical environment, and insights into potential new prospective areas.

d) The revised cost sheet of the project has been evaluated and recommended by the committee for approval of PSC, as the approved drilling target has not been fully achieved.

Recommendation TCC

- ***The Committee recommended the proposal for approval of PSC for "revised cost ₹62.55 Lakh (including GST) against the approved cost of ₹68.76 Lakh (including GST) as per Annexures 6, due to incomplete drilling (11m drilled against approved 30m) in 4th borehole caused by complete water loss & timeline extension of 03 months up to 31st March 2026 for GR submission".***
- ***The committee advised characterization of TREE and the enrichment/depletion of Sc in relation to Na, K, and Ca in drill core sample chemistry; thin-section studies of REE mineral phases in enriched zones and detailed discussion on the variation of TREE and other critical mineral contents, their controlling factors with respect to the chemical environment, and insights into potential new prospective areas in final geological report.***

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Annexure-6

Estimated cost of Reconnaissance Survey (G4) for Bauxite, Ga, V, Ti, & REE in Lakhond Block, Kachchh, District, Gujarat
Total Area -6.12sq.km ; No of Boreholes- 4 ; Completion Time -10 months, Review: 4 months
Exploration Agency – Critical Mineral Trackers, Hyderabad

S.No	Item of Work	Unit	Rates as per NMEDT SoC		Estimated Cost of the Proposal		Rates as per NMEDT SoC		Revised Cost of the Proposal		Revised cost sheet/ actual expenses			Remarks
			SoC-Item-SI No.	Rates as per SOC	Qtm	Total Amount (Rs)	SoC-Item-SI No.	Rates as per SOC	Qtm	Total Amount (Rs)	Rate	Qtm	Total Amount (Rs)	
A	**Geological Work**													
1	Geological Mapping (1:25,000) & sampling – Geologist field-days	6.12	1.2	11000	150	16,50,000	1.2	11000	150	16,50,000	11,000	150	16,50,000	man days
2	Geologists (HQ)days, pre & post field interpretation 15 +20 days	One Geologist Per Day	1.2	9000	35	3,15,000	1.2	9000	35	3,15,000	9,000	35	3,15,000	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	2.1.2	3800	20	76,000	3,800	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	2.1.1	3300	50	1,66,500	3,300	50	1,65,000	50 cu. m
5	sampler	45 days	1.5.2	5100	23	1,17,300	1.5.2	5100	23	1,17,300	5,100	23	1,17,300	man days

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6	Labour (2 labour) attached tosampler	90 labour days	1.5.2	526	92	48,392	1.5.2	526	92	48,392	526	92	48,392	labour days
7	Labour (100Field days) per team:2 workers: 100*4 for two geologist team	Per Team of 2 Geologists (2*2=4) Labour/ Field workers	5.7	526	300	1,57,800	5.7	526	300	1,57,800	526	300	1,57,800	labour days
	Sub-Total -A					**25,29,492**				**25,30,992**			**25,29,492**	
B	**Survey Work:**												0	
1	Surveyor: Fixation & connection of boundary points (6 nos.),4 BH by Total station/DGPS	One surveyor	1.6.2	19,200	8	1,53,600	1.6.2	19,200	10	1,92,000	19,200	10	1,92,000	
	Sub-total-B					**1,53,600**				**1,92,000**			**1,92,000**	
C	**Core Drilling**												0	
1	Scout drilling(coring) :4 Points (each 30m deep) 4*30	Per meter	2.2.1.1b	7,168	120	8,60,160	2.2.1.1b	7,168	120	8,60,160	7,168	101	7,23,968	3bhs-30m each LKD -BH-1,2 ,3), 4th BH closed at 11.00m due complete water loss. Redrilled by

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														lowering casing but not successful
2	Construction of BH pillar (12"*12"*30")	Per pillar	2.2.7a	2000	0	0	2.2.7a	2000	4	8,000	2,000	4	8,000	4 pillars
3	**Mobilisation & demobilisation of drilling machine & inter BH shifting	12km away from Reldi Moti block	2.2.8	24	0	0	2.2.8	24	36	864	24	36	864	Lakhaod is 12km away from Reldi Moti block
4	Monthly accommodation charges for drilling camp	Rs50,000/ month		50,000	0	0		50,000	1	50,000	50,000	1	50,000	one month
5	Drilling camp setting cost	lumpsum	2.2.9a	2,50,000	0	0	2.2.9a	2,50,000	1	2,50,000	2,50,000	1	2,50,000	fixed cost
6	Drilling camp winding cost	lumpsum	2.2.9b	2,50,000	0	0	2.2.9b	2,50,000	1	2,50,000	2,50,000	1	2,50,000	fixed cost
7	Approach road making		2.2.10a	22020	0	0	2.2.10a	22020	5	1,10,100	22,020	0.0	0	no road making
8	Compensation for 4 Bhs		5.6	20,000	0	0	5.6	20,000	4	80,000	20,000	0	0	No compensation paid

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9	Drill core preservation in GI boxes	Per meter	5.3	1590	120	1,90,800	5.3	1590	120	1,90,800	1,590	95	1,51,050	19 core boxes
	Subtotal-C					**10,50,960**				**17,99,924**			**14,33,882**	
D	**Laboratory Studies**													
1	Trench Samples (5*5=25nos):by AAS method	First five radicals +2,Ga, v,Ti,Sc ,REE	4.1.7a &7b	0	90	0	4.1.7a &7b	0	90	0				90 samples
2	Pitting Sample: (20*1=20nos) -AAS method	First five radicals+ 2, Ga, v,Ti,Sc ,REE	4.1.7a &7b		60	0	4.1.7a &7b		60	0				60 samples
3	Core drilling Samples- 4*30=120 Total depth 30m each, samples will be collected at every 5m interval. AAS method	First five Radicals +2,Ga, v,Ti,Sc, REE	4.1.7a &7b		24		4.1.7a &7b		24					24samples
	XRF-Major oxides		4.1.15a	4200	143	6,00,600	4.1.15a	4200	143	6,00,600	4,200	128	5,37,600	Trench:50 horizontal. 20 vertical, pits:20, BHs

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														:40(130+13 Check samples)
4	Analysis for REE (14 elements/radicals) by ICP-MS	14 elements/ radicals	4.1.13	5380	36	1,93,680	4.1.13	5380	36	1,93,680	5,380	30	1,61,400	pit-20, Trench-5, BHs:8 (33+3 check samples)
5	Combined determination of THA, MHA and Reactive silica		4.1.17a	6700	4	26,800	4.1.17a	6700	4	26,800	6,700	2	13,400	4 samples
6	Preparation of polished thin section	Per sample	4.3.2	1549	10	15,490	4.3.2	1549	10	15,490	3,080	5	15,400	5 thin section preparation & complete petrographic studies by GSI, Hyderabad
7	Complete petrographic /ore-microscopic/ mineragraphic studies	per sample	4.3.4	4232	10	42,320	4.3.4	4232	10	42,320				
8	XRD analysis for identification of minerals(random) a t shiva labs	Per sample	4.5.1	4000	4	16,000	4.5.1	4000	4	16,000	4,000	3	12,000	4 samples
	Check samples by Shiva lab													
	Check samples XRF						4.1.15a	4200			1,500	14	21,000	(10 P&T)+ 4 drill core

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	Check samples-ICPMS						4.1.13	5380			2,500	4	10,000	2 P&T+2-drill core)
	Sub-total-D					**8,94,890**				**8,94,890**			**7,70,800**	
E	**Surface Geophysical Survey**		**Not recommended**				**Not recommended**							
	Sub-total-E					**0**				**0**				
	TOTAL (A+B+C+D)					**46,28,942**				**54,17,806**			**49,26,174**	
F	**Preparation of Exploration Proposal** (5 Hard copies with a soft copy)		5.1	2% of the project cost subject to a maximum of 5 lakhs	1	92,579	5.1	2% of the project cost subject to a maximum of 5 lakhs		1,08,326			98523	2% of the Project cost.
G	**Geological Report** (5 Hard copies with a soft copy)		5.2	5% of the Project cost		2,31,447	5.2	5% of the Project cost		2,70,815			2,46,309	5% of the Project Cost.
	Tender Process Cost					17203.2				0				
	Operational Charges					86016				0				
	peer review		30,000			30,000	30,000			30,000			30,000	
	Additional Copy			1000	0	0		1000	0	0				
	Project Cost without GST					**50,86,187**				**58,27,052**			**53,01,006**	
	18% GST					**9,15,514**				1048869			954181	
	Total Project Cost					**68,75,922**				**68,75,922**			**62,55,187**	
Note:														
1	Strict adherence to the ministry of finance's and GFR guidelines is mandatory. Every transaction must adhere to GFR rule-21													

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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 NMEDT SoC and item no:6 of NMEDT 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

13.0 REFERENCES

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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 Lakhond and Padhar village during field investigations are also sincerely appreciated.

CHAPTER – XIV

14.0 LOCALITY INDEX

Location of villages/ factories/Railway stations/Airport around Lakhond block

Table no:14.1

Locality	Latitude(N) (Degree decimal)	Longitude (E) (Degree decimal)
Ajrakpur	23.2335	69.7972
Bhuj Airport	23.275506	69.663865
Bhuj city	23.242572	69.664388
Bhuj Railway station	23.265908	69.678027
Kukma	23.216733	69.777743
Lakhond	23.2556	69.7762
Padhar	23.240591	69.824396

LIST OF ANNEXURES

Annexure-I: RL, Coordinates of Cardinal points, boreholes and Temporary bench marks in Lakhond Area, Kachchh District, Gujarat (Determined by DGPS Survey)

Cardinal Points	Geographic Coordinate System in Degree decimal (WGS-84)		UTM (WGS-84, Zone 42N)			Area
	Latitude (N)	Longitude (E)	Reduced level (m)	Northing (m)	Easting (m)	(Sq. Km)
A	23.24428892^{0}	69.81640133^{0}	122.97	2570797.727	583516.695	6.21
B	23.24364461^{0}	69.78577922^{0}	116.156	2570709.109	580384.345	
C	23.25995236^{0}	69.78421958^{0}	121.514	2572513.684	580215.033	
D	23.26138486^{0}	69.81115114^{0}	119.173	2572687.425	582969.005	
E	23.26379086^{0}	69.81606814^{0}	120.549	2572956.616	583470.469	
F	23.26429575^{0}	69.81115711^{0}	122.99	2573009.696	582967.814	
Borehole points						
LKD-BH-01	23.24460583^{0}	69.78738808^{0}	113.219	2570816.417	580548.359	
LKD-BH-02	23.25727389^{0}	69.81009092^{0}	116.957	2572231.69	582863.095	
LKD-BH-03	23.2558365^{0}	69.80059278^{0}	118.23	2572067.162	581892.377	
LKD-BH-04	23.25436653^{0}	69.78894228^{0}	118.228	2571897.891	580701.485	
Temporary bench marks						
LKD-TBM-1	23.25345558^{0}	69.79216758^{0}	117.079	2571798.84	581031.969	
LKD-TBM-2	23.25333181^{0}	69.79239911^{0}	115.973	2571785.264	581055.727	

Annexure-II: Elevation, co-ordinates of Pits and Trenches excavated in Lakhond Area, Kachchh District, Gujarat

Sr No	Sample No	Formation	Coordinate in Degree Decimal Datum WGS-1984		Elevation (m)	Size	Excavation (Cu.m)	No of samples collected
			Longitude (in DD)	Latitude (in DD)				
1	P1/LB/2025	Gaj	69.814738	23.25286	99	1m*1m*1m	1 Cu.m	1
2	P2/LB/2025	Bhuj	69.813977	23.255813	102	1m*1m*1m	1 Cu.m	1
3	P3/LB/2025	Matanomadh	69.81605	23.25372	112	1m*1m*1m	1 Cu.m	1
4	P4/LB/2025	Bhuj	69.79046	23.255342	105	1m*1m*1m	1 Cu.m	1
5	P5/LB/2025	Bhuj	69.792138	23.253447	104	1m*1m*1m	1 Cu.m	1
6	P6/LB/2025	Bhuj	69.788898	23.254332	103	1m*1m*1m	1 Cu.m	1
7	P7/LB/2025	Bhuj	69.788103	23.255923	115	1m*1m*1m	1 Cu.m	1
8	P8/LB/2025	Bhuj	69.787633	23.256877	112	1m*1m*1m	1 Cu.m	1
9	P9/LB/2025	Bhuj	69.78491	23.258702	102	1m*1m*1m	1 Cu.m	1
10	P10A/LB/2025	Bhuj	69.7878	23.255592	119	1m*1m*1m	1 Cu.m	2
	P10B/LB/2025	Bhuj			119	1m*1m*1m	1 Cu.m	
12	P11/LB/2025	Bhuj	69.786702	23.253205	101	1m*1m*1m	1 Cu.m	1
13	P12/LB/2025	Sandhan	69.792063	23.248192	100	1m*1m*1m	1 Cu.m	1
14	P13/LB/2025	Sandhan	69.785185	23.251845	101	1m*1m*1m	1 Cu.m	1
15	P14/LB/2025	Bhuj	69.795188	23.253473	89	1m*1m*1m	1 Cu.m	1
16	P15/LB/2025	Sandhan	69.785443	23.247943	102	1m*1m*1m	1 Cu.m	1
17	P16/LB/2025	Bhuj	69.812915	23.254027	103	1m*1m*1m	1 Cu.m	1
18	P17/LB/2025	Bhuj	69.809662	23.256977	101	1m*1m*1m	1 Cu.m	1
19	P18/LB/2025	Bhuj	69.807545	23.255683	107	1m*1m*1m	1 Cu.m	1
20	P19/LB/2025	Bhuj	69.802448	23.257502	112	1m*1m*1m	1 Cu.m	1
21	P20/LB/2025	Bhuj	69.805964	23.258523	115	1m*1m*1m	1 Cu.m	1
22	BRS-1	Bhuj	69.80030	23.25581	120			1

23	**Trenches**							
24	T1/LB/2025	Sandhan	69.790595	23.250247	101	10m*1m*1m	10 Cu.m	14
25	T2/LB/2025	Bhuj	69.800832	23.255485	117	10m*1m*1m	10 Cu.m	14
26	T3/LB/2025	Sandhan	69.787268	23.244285	103	10m*1m*1m	10 Cu.m	14
27	T4/LB/2025	Bhuj	69.809737	23.258332	100	10m*1m*1m	10 Cu.m	14
28	T5/LB/2025	Sandhan	69.804085	23.248028	102	10m*1m*1m	10 Cu.m	14
	Total samples						***70 Cu.m***	***92***
	Note: Elevation and coordinates were determined by DPS(Garmin)							

Annexure-III Statement showing analytical details of major oxides (by XRF) of 20 pit samples in Lakhond Area, Kachchh District, Gujarat

S.no	Reg No	Sample name	Lithology	Formation	SiO2	Al2O3	Fe2O3	MnO	MgO	CaO	Na2O	K2O	TiO2	P2O5	LOI	Total	V(ppm)
					(%)												
1	1203/1	P1/LB/2025	Sticky varigated clay	Gaj	61.80	16.31	8.63	0.03	0.78	0.74	0.18	0.76	1.69	0.09	8.72	99.79	93.70
2	1203/2	P2/LB/2025	Sandstone, Argillaceous sandstone	Bhuj	52.60	29.29	7.35	0.09	0.23	0.32	0.04	0.00	0.52	0.35	8.99	99.91	206.18
3	1203/3	P3/LB/2025	Varigated clay, Hard ferrugenous sandstone	Matanomadh, Laterite	33.99	28.59	20.23	0.05	0.37	1.01	0.38	0.55	1.48	0.18	12.96	99.81	199.78
4	1203/4	P4/LB/2025	Ferrugenous sandstone, Friable sandstone, Gritty sandstone	Bhuj	86.10	0.10	9.10	0.01	0.24	0.17	0.09	0.21	2.04	0.05	1.63	99.76	119.20
5	1203/5	P5/LB/2025	Ferrugenous sandstone, Argillaceous sandstone	Bhuj	37.04	25.87	12.70	0.03	0.71	5.17	0.07	0.46	0.59	0.25	16.95	99.89	361.60
6	1203/6	P6/LB/2025	Ferrugenous sandstone, sandy clay, Feldspathic sandstone	Bhuj	46.90	10.40	7.15	0.01	0.67	15.68	0.08	0.34	1.21	0.08	17.38	99.93	123.80

7	1203/7	P7/LB/2025	Pinkish sandy clay, Friable sandstone	Bhuj	50.05	23.38	2.03	0.01	0.43	7.00	0.22	0.15	2.12	0.04	14.31	99.79	113.40
8	1203/8	P8/LB/2025	Ferrugenous sandstone, Feldspathic sandstone	Bhuj	46.04	39.34	2.43	0.01	0.13	0.36	0.06	0.10	0.68	0.02	10.68	99.87	53.40
9	1203/9	P9/LB/2025	Friable sandstone, Feldspathic sandstone, sandstone	Bhuj	49.52	25.21	10.75	0.03	0.81	1.43	0.10	0.39	0.65	0.04	10.77	99.75	106.80
10	1203/10	P10/LB/2025/A	Kaolinized sandstone	Bhuj	72.63	17.14	1.21	0.01	0.18	0.13	0.26	0.16	2.23	0.02	5.88	99.85	102.13
11	1203/11	P10/LB/2025/B	Pinkish clay	Bhuj	57.88	28.28	1.80	0.01	0.17	0.13	0.25	0.19	2.90	0.04	8.29	99.94	143.23
12	1203/12	P11/LB/2025	Argillaceous sandstone	Bhuj	53.89	27.95	3.80	0.03	0.26	0.66	0.14	0.27	3.50	0.09	9.31	99.89	212.85
13	1203/13	P12/LB/2025	Argillaceous sandstone	Sandhan	61.08	16.82	7.25	0.02	0.60	1.10	1.38	0.43	2.62	0.04	8.51	99.86	115.10
14	1203/14	P13/LB/2025	Pebble sand, alluvial sand	Sandhan	56.75	15.16	8.85	0.06	1.07	1.42	0.30	7.52	1.73	0.69	6.25	99.81	175.70
29	1203/29	P14/LB/2025	Siltstone, Friable sandstone	Bhuj	39.54	8.72	16.91	0.02	0.93	14.95	0.10	0.46	1.49	0.15	16.56	99.87	288.08
44	1203/44	P15/LB/2025	Friable sandstone	Sandhan	43.00	35.15	0.99	0.01	0.20	0.93	0.37	0.02	3.85	0.09	15.29	99.93	198.93
59	1203/59	P16/LB/2025	Laterite, Friable sandstone	Bhuj	46.00	31.88	8.64	0.16	0.23	0.18	0.08	0.15	1.33	0.15	11.06	99.91	502.00
60	1203/60	P17/LB/2025	clay, Argillaceous sandstone	Bhuj	38.06	14.40	24.19	0.02	0.01	0.74	0.39	0.01	8.35	0.43	13.17	99.80	375.83

61	1203/61	P18/LB/2025	Alluvial sand, clay	Bhuj	48.84	22.30	13.29	0.03	0.72	0.64	0.17	0.62	1.50	0.05	11.53	99.73	133.60
76	1203/76	P19/LB/2025	Friable sandstone	Bhuj	49.00	23.60	12.42	0.01	0.14	0.60	0.26	0.07	4.39	0.14	9.19	99.86	147.60
77	1203/77	P20/LB/2101	clay/clay stone	Bhuj	42.34	24.03	17.42	0.01	0.29	1.07	0.12	0.33	2.53	0.04	11.60	99.82	172.20
				Min	**33.99**	**0.10**	**0.99**	**0.01**	**0.01**	**0.13**	**0.04**	**0.00**	**0.52**	**0.02**	**1.63**	**99.73**	**53.40**
				Max	**86.10**	**39.34**	**24.19**	**0.16**	**1.07**	**15.68**	**1.38**	**7.52**	**8.35**	**0.69**	**17.38**	**99.94**	**502.00**
				Average	**51.10**	**22.09**	**9.39**	**0.03**	**0.44**	**2.59**	**0.24**	**0.63**	**2.26**	**0.14**	**10.91**	**99.84**	**187.86**

Annexure-IV: Statement showing analytical details of major oxides (by XRF) of 70 trench samples in Lakhond Area, Kachchh District, Gujarat

S.no	Reg No	Sample name	Lithology	Formation	SiO2	Al2O3	Fe2O3	MnO	MgO	CaO	Na2O	K2O	TiO2	P2O5	LOI	Total	V(ppm)
					(%)												
TRENCH - 1																	
1	1203/15	T1/LB/2025/01	friable laminated sandstone	Sandhan	66.38	18.46	3.02	0.01	0.38	1.56	0.11	0.14	1.70	0.09	7.87	99.74	84.10
2	1203/16	T1/LB/2025/02	friable laminated sandstone	Sandhan	62.68	21.08	2.37	0.02	0.68	1.89	0.16	0.24	1.76	0.10	8.78	99.79	90.30
3	1203/17	T1/LB/2025/03	friable laminated sandstone	Sandhan	57.46	20.60	3.98	0.02	0.45	3.07	0.08	0.22	1.45	0.10	12.45	99.92	99.00
4	1203/18	T1/LB/2025/04	friable laminated sandstone	Sandhan	63.21	18.23	4.66	0.03	0.66	2.03	0.11	0.35	1.77	0.12	8.68	99.89	104.40
5	1203/19	T1/LB/2025/05	friable laminated sandstone	Sandhan	54.98	23.74	5.74	0.03	0.79	2.05	0.13	0.43	2.07	0.13	9.76	99.90	123.30
6	1203/20	T1/LB/2025/06	friable laminated sandstone	Sandhan	80.10	10.68	1.58	0.01	0.31	0.60	0.10	0.12	1.12	0.07	5.01	99.75	54.20
7	1203/21	T1/LB/2025/07	friable laminated sandstone	Sandhan	87.75	5.69	1.76	0.01	0.18	0.33	0.09	0.06	0.79	0.06	3.21	99.96	32.50
8	1203/22	T1/LB/2025/08	friable laminated sandstone	Sandhan	84.14	9.01	1.02	0.01	0.12	0.23	0.12	0.07	1.02	0.06	3.97	99.80	35.10
9	1203/23	T1/LB/2025/09	friable laminated sandstone	Sandhan	62.21	23.53	2.37	0.01	0.43	0.83	0.19	0.17	2.34	0.09	7.63	99.86	84.50
10	1203/24	T1/LB/2025/10	sandstone	Sandhan	43.34	33.18	2.04	0.02	0.24	1.49	0.15	0.19	4.56	0.09	14.56	99.89	130.70
11	1203/25	T1/LB/2025/A	friable laminated kailinised sandstone	Sandhan	57.03	17.98	7.88	0.01	0.41	3.92	0.11	0.19	1.78	0.21	10.16	99.72	138.20
12	1203/26	T1/LB/2025/B	friable laminated kailinised sandstone	Sandhan	57.58	25.00	3.00	0.01	0.46	2.45	0.19	0.22	1.66	0.11	9.12	99.84	137.63

13	1203/27	T1/LB/2025/C	friable laminated kailinised sandstone	Sandhan	48.75	26.24	7.59	0.02	0.63	1.67	0.30	0.27	2.92	0.13	11.25	99.81	197.70
14	1203/28	T1/LB/2025/D	friable laminated kailinised sandstone	Sandhan	55.62	25.71	3.56	0.01	0.46	2.17	0.21	0.20	2.06	0.10	9.82	99.96	97.20
				Min	**43.34**	**5.69**	**1.02**	**0.01**	**0.12**	**0.23**	**0.08**	**0.06**	**0.79**	**0.06**	**3.21**	**99.72**	**32.50**
				Max	**87.75**	**33.18**	**7.88**	**0.03**	**0.79**	**3.92**	**0.30**	**0.43**	**4.56**	**0.21**	**14.56**	**99.96**	**197.70**
				Average	**62.95**	**19.94**	**3.61**	**0.02**	**0.44**	**1.74**	**0.15**	**0.21**	**1.93**	**0.10**	**8.73**	**99.84**	**100.63**
S.no	**Reg No**	**Sample name**	**Lithology**	**Formation**	**SiO2**	**Al2O3**	**Fe2O3**	**MnO**	**MgO**	**CaO**	**Na2O**	**K2O**	**TiO2**	**P2O5**	**LOI**	**Total**	**V(ppm)**
					(%)												
TRENCH - 2																	
15	1203/30	T2/LB/2025/01	laterite	Bhuj	32.06	22.50	23.31	0.02	0.34	4.39	0.09	0.40	2.40	0.09	14.09	99.74	383.20
16	1203/31	T2/LB/2025/02	laterite with variegated clay	Bhuj	34.54	19.68	23.50	0.02	0.29	4.65	0.09	0.31	2.02	0.06	14.60	99.81	340.40
17	1203/32	T2/LB/2025/03	laterite with variegated clay	Bhuj	32.70	14.97	32.78	0.02	0.26	3.39	0.08	0.27	1.84	0.06	13.47	99.90	423.40
18	1203/33	T2/LB/2025/04	laterite with variegated clay	Bhuj	34.29	14.95	30.04	0.02	0.27	4.18	0.08	0.28	1.69	0.06	13.90	99.81	498.83
19	1203/34	T2/LB/2025/05	laterite with variegated clay	Bhuj	35.90	17.67	24.11	0.02	0.33	5.06	0.10	0.32	1.84	0.06	14.30	99.76	315.10
20	1203/35	T2/LB/2025/06	sandy clay	Bhuj	36.59	24.87	15.47	0.01	0.26	4.78	0.10	0.29	2.36	0.06	15.09	99.93	326.20
21	1203/36	T2/LB/2025/07	argillaceous sandstone	Bhuj	37.89	23.82	15.52	0.02	0.30	5.15	0.11	0.29	2.20	0.06	14.48	99.89	330.70
22	1203/37	T2/LB/2025/08	argillaceous sandstone	Bhuj	41.42	30.80	5.22	0.01	0.26	3.87	0.12	0.30	2.94	0.06	14.85	99.89	156.10
23	1203/38	T2/LB/2025/09	argillaceous sandstone	Bhuj	43.23	26.38	4.11	0.01	0.31	6.23	0.14	0.29	2.62	0.06	16.37	99.79	101.20
24	1203/39	T2/LB/2025/10	argillaceous sandstone	Bhuj	42.63	28.08	3.92	0.01	0.28	5.93	0.14	0.28	2.75	0.06	15.80	99.93	107.10
25	1203/40	T2/LB/2025/A	Laterite	Bhuj	33.80	19.22	23.97	0.02	0.32	5.45	0.08	0.32	1.97	0.06	14.65	99.90	270.00
26	1203/41	T2/LB/2025/B	argillaceous sandstone	Bhuj	37.22	19.01	18.03	0.01	0.36	7.21	0.10	0.32	2.03	0.07	15.29	99.70	244.10

27	1203/42	T2/LB/2025/C	laterite clay/Ferrugenous sandstone	Bhuj	43.01	23.96	3.07	0.01	0.31	8.95	0.13	0.26	2.44	0.06	17.70	99.96	80.40
28	1203/43	T2/LB/2025/D	laterite clay	Bhuj	38.21	18.57	18.54	0.02	0.33	6.69	0.10	0.29	2.06	0.06	14.90	99.80	242.00
				Min	**32.06**	**14.95**	**3.07**	**0.01**	**0.26**	**3.39**	**0.08**	**0.26**	**1.69**	**0.06**	**13.47**	**99.70**	**80.40**
				Max	**43.23**	**30.80**	**32.78**	**0.02**	**0.36**	**8.95**	**0.14**	**0.40**	**2.94**	**0.09**	**17.70**	**99.96**	**498.83**
				Average	**37.39**	**21.75**	**17.26**	**0.02**	**0.30**	**5.43**	**0.11**	**0.30**	**2.23**	**0.06**	**14.96**	**99.84**	**272.77**
S.no	**Reg No**	**Sample name**	**Lithology**	**Formation**	**SiO2**	**Al2O3**	**Fe2O3**	**MnO**	**MgO**	**CaO**	**Na2O**	**K2O**	**TiO2**	**P2O5**	**LOI**	**Total**	**V(ppm)**
					(%)												
TRENCH - 3																	
29	1203/45	T3/LB/2025/01	Varigated clay /clay stone	Sandhan	24.06	46.01	3.18	0.01	0.08	0.58	0.18	0.12	3.97	0.08	21.63	99.93	241.00
30	1203/46	T3/LB/2025/02	Varigated clay /clay stone	Sandhan	25.05	45.42	2.60	0.01	0.08	0.71	0.21	0.12	3.67	0.09	21.91	99.90	214.30
31	1203/47	T3/LB/2025/03	Varigated clay /clay stone	Sandhan	24.30	46.01	2.73	0.02	0.06	0.23	0.22	0.13	4.28	0.08	21.65	99.74	234.30
32	1203/48	T3/LB/2025/04	Varigated clay /clay stone	Sandhan	25.00	45.22	2.90	0.01	0.07	0.30	0.27	0.20	3.52	0.12	22.29	99.95	266.00
33	1203/49	T3/LB/2025/05	Varigated clay /clay stone	Sandhan	26.00	45.49	2.73	0.02	0.09	0.43	0.22	0.17	3.94	0.10	20.75	99.98	238.50
34	1203/50	T3/LB/2025/06	Varigated clay /clay stone	Sandhan	28.01	45.05	2.03	0.02	0.16	1.12	0.24	0.20	2.74	0.09	20.07	99.87	261.33
35	1203/51	T3/LB/2025/07	Varigated clay /clay stone	Sandhan	27.31	43.64	3.35	0.02	0.12	0.39	0.21	0.16	3.91	0.09	20.65	99.90	239.50
36	1203/52	T3/LB/2025/08	Varigated clay /clay stone	Sandhan	30.42	42.10	3.05	0.02	0.15	0.19	0.20	0.17	3.72	0.09	19.73	99.88	214.00
37	1203/53	T3/LB/2025/09	Varigated clay /clay stone	Sandhan	31.87	41.07	3.19	0.02	0.27	0.21	0.25	0.28	3.01	0.12	19.64	99.92	237.20
38	1203/54	T3/LB/2025/10	Varigated clay /clay stone	Sandhan	31.17	42.07	2.93	0.02	0.19	0.16	0.21	0.22	2.95	0.09	19.82	99.87	206.50
39	1203/55	T3/LB/2025/A	clay / clay stone	Sandhan	37.29	37.49	4.66	0.01	0.15	0.83	0.30	0.29	2.56	0.07	16.20	99.90	293.20
40	1203/56	T3/LB/2025/B	clay / clay stone	Sandhan	31.08	40.64	4.19	0.02	0.13	0.39	0.27	0.22	3.52	0.08	19.19	99.77	288.00

41	1203/57	T3/LB/2025/C	clay / clay stone	Sandhan	26.99	42.48	5.02	0.02	0.17	0.13	0.28	0.27	3.15	0.12	21.09	99.76	444.00
42	1203/58	T3/LB/2025/D	clay / clay stone	Sandhan	27.32	43.06	4.40	0.02	0.09	0.53	0.26	0.19	3.39	0.09	20.58	99.97	302.70
				Min	**24.06**	**37.49**	**2.03**	**0.01**	**0.06**	**0.13**	**0.18**	**0.12**	**2.56**	**0.07**	**16.20**	**99.74**	**206.50**
				Max	**37.29**	**46.01**	**5.02**	**0.02**	**0.27**	**1.12**	**0.30**	**0.29**	**4.28**	**0.12**	**22.29**	**99.98**	**444.00**
				Average	**28.28**	**43.27**	**3.36**	**0.02**	**0.13**	**0.44**	**0.24**	**0.20**	**3.45**	**0.09**	**20.37**	**99.88**	**262.90**
S.no	**Reg No**	**Sample name**	**Lithology**	**Formation**	**SiO2**	**Al2O3**	**Fe2O3**	**MnO**	**MgO**	**CaO**	**Na2O**	**K2O**	**TiO2**	**P2O5**	**LOI**	**Total**	**V(ppm)**
					(%)												
TRENCH - 4																	
43	1203/62	T4/LB/2025/01	Reddish white lateritic clay at the bottom.	Bhuj	38.39	15.18	18.54	0.01	0.05	3.12	0.13	0.03	8.89	0.44	15.06	99.88	270.80
44	1203/63	T4/LB/2025/02	Reddish white lateritic clay at the bottom.	Bhuj	34.68	16.87	18.40	0.01	0.06	4.73	0.14	0.03	8.69	0.49	15.74	99.89	316.90
45	1203/64	T4/LB/2025/03	Reddish white lateritic clay at the bottom.	Bhuj	35.06	23.09	15.21	0.01	0.09	2.70	0.14	0.01	8.05	0.36	14.96	99.73	230.10
46	1203/65	T4/LB/2025/04	Reddish white lateritic clay at the bottom.	Bhuj	33.88	23.34	15.90	0.01	0.12	3.45	0.14	0.01	7.25	0.37	15.43	99.95	205.20
47	1203/66	T4/LB/2025/05	Reddish white lateritic clay at the bottom.	Bhuj	35.86	23.04	15.26	0.01	0.03	1.54	0.14	0.01	9.59	0.41	13.94	99.87	267.20
48	1203/67	T4/LB/2025/06	it is reddish brown ferrugenous sandstone/laterite with having a white clay	Bhuj	31.01	28.08	19.18	0.01	0.03	1.04	0.10	0.01	7.72	0.40	12.17	99.75	502.08
49	1203/68	T4/LB/2025/07	Reddish white lateritic clay at the bottom.	Bhuj	37.15	25.25	13.61	0.01	0.09	1.99	0.16	0.01	7.81	0.24	13.51	99.89	253.20

50	1203/69	T4/LB/2025/08	Reddish white lateritic clay at the bottom.	Bhuj	34.55	21.05	18.74	0.01	0.04	1.69	0.16	0.03	9.40	0.42	13.62	99.77	309.10
51	1203/70	T4/LB/2025/09	Reddish white lateritic clay at the bottom.	Bhuj	36.35	23.25	15.50	0.01	0.07	1.38	0.16	0.02	8.90	0.40	13.63	99.71	266.50
52	1203/71	T4/LB/2025/10	Reddish white lateritic clay at the bottom.	Bhuj	35.71	26.05	16.06	0.01	0.14	0.90	0.17	0.02	7.08	0.34	13.37	99.90	268.50
53	1203/72	T4/LB/2025/A	laterite clay	Bhuj	38.10	23.82	12.49	0.01	0.06	1.62	0.16	0.01	8.81	0.45	14.35	99.94	201.90
54	1203/73	T4/LB/2025/B	laterite clay	Bhuj	37.61	22.92	14.01	0.01	0.09	2.07	0.16	0.03	8.22	0.33	14.23	99.72	231.00
55	1203/74	T4/LB/2025/C	laterite clay/Ferrugenous sandstone	Bhuj	36.10	26.31	15.00	0.01	0.14	1.43	0.16	0.01	6.89	0.23	13.59	99.90	276.40
56	1203/75	T4/LB/2025/D	laterite clay	Bhuj	38.14	22.00	15.38	0.01	0.11	2.16	0.15	0.01	7.36	0.34	14.08	99.79	268.60
				Min	**31.01**	**15.18**	**12.49**	**0.01**	**0.03**	**0.90**	**0.10**	**0.01**	**6.89**	**0.23**	**12.17**	**99.71**	**201.90**
				Max	**38.39**	**28.08**	**19.18**	**0.01**	**0.14**	**4.73**	**0.17**	**0.03**	**9.59**	**0.49**	**15.74**	**99.95**	**502.08**
				Average	**35.90**	**22.88**	**15.95**	**0.01**	**0.08**	**2.13**	**0.15**	**0.02**	**8.19**	**0.37**	**14.12**	**99.83**	**276.25**
S.no	**Reg No**	**Sample name**	**Lithology**	**Formation**	**SiO2**	**Al2O3**	**Fe2O3**	**MnO**	**MgO**	**CaO**	**Na2O**	**K2O**	**TiO2**	**P2O5**	**LOI**	**Total**	**V(ppm)**
					(%)												
TRENCH - 5																	
57	1203/78	T5/LB/2025/01	Laterite /argillaceous sand	Sandhan	67.74	3.07	14.28	0.14	1.93	0.67	1.50	0.53	2.01	0.07	7.73	99.72	197.90
58	1203/79	T5/LB/2025/02	Laterite /argillaceous sand	Sandhan	66.91	0.50	19.67	0.09	1.67	0.50	1.27	0.49	1.87	0.10	6.76	99.88	189.90
59	1203/80	T5/LB/2025/03	Laterite /argillaceous sand	Sandhan	70.98	2.51	13.20	0.14	1.69	0.47	1.23	0.52	2.07	0.07	6.87	99.81	159.90
60	1203/81	T5/LB/2025/04	Laterite /argillaceous sand	Sandhan	66.47	1.66	18.94	0.18	1.66	0.41	1.04	0.48	1.61	0.09	7.21	99.79	197.40
61	1203/82	T5/LB/2025/05	Laterite /argillaceous sand	Sandhan	68.68	3.71	14.34	0.13	1.78	0.46	0.86	0.51	1.62	0.08	7.69	99.88	193.43

62	1203/83	T5/LB/2025/06	Laterite /argillaceous sand	Sandhan	67.07	3.56	15.00	0.11	1.89	0.61	0.83	0.49	1.68	0.07	8.43	99.79	153.10
63	1203/84	T5/LB/2025/07	Laterite /argillaceous sand	Sandhan	64.83	3.42	17.61	0.17	1.74	0.52	0.64	0.50	1.84	0.07	8.35	99.73	175.90
64	1203/85	T5/LB/2025/08	Laterite /argillaceous sand	Sandhan	63.06	3.97	18.63	0.14	1.81	0.67	0.87	0.51	1.83	0.08	8.24	99.86	206.50
65	1203/86	T5/LB/2025/09	Laterite /argillaceous sand	Sandhan	67.60	3.86	14.64	0.15	1.69	0.63	0.75	0.53	1.77	0.07	8.01	99.74	175.20
66	1203/87	T5/LB/2025/10	Laterite /argillaceous sand	Sandhan	63.03	3.25	19.65	0.17	1.63	0.47	0.69	0.50	1.85	0.10	8.48	99.85	216.10
67	1203/88	T5/LB/2025/A	Varigated Laterite /argillaceous sand	Sandhan	67.31	0.77	16.81	0.17	1.60	0.83	1.27	0.44	1.67	0.09	8.70	99.71	154.40
68	1203/89	T5/LB/2025/B	Varigated Laterite /argillaceous sand	Sandhan	68.59	0.24	16.95	0.15	1.66	0.85	1.24	0.44	1.45	0.08	8.09	99.77	169.20
69	1203/90	T5/LB/2025/C	Varigated Laterite /argillaceous sand	Sandhan	63.06	2.33	18.08	0.15	1.62	0.91	1.14	0.45	1.55	0.12	10.36	99.81	185.50
70	1203/91	T5/LB/2025/D	Varigated Laterite /argillaceous sand	Sandhan	61.51	0.92	20.61	0.18	1.72	1.08	1.07	0.46	1.45	0.10	10.59	99.73	185.00
				Min	**61.51**	**0.24**	**13.20**	**0.09**	**1.60**	**0.41**	**0.64**	**0.44**	**1.45**	**0.07**	**6.76**	**99.71**	**153.10**
				Max	**70.98**	**3.97**	**20.61**	**0.18**	**1.93**	**1.08**	**1.50**	**0.53**	**2.07**	**0.12**	**10.59**	**99.88**	**216.10**
				Average	**66.20**	**2.41**	**17.03**	**0.15**	**1.72**	**0.65**	**1.03**	**0.49**	**1.73**	**0.09**	**8.25**	**99.79**	**182.82**

Annexure-IV-A: Analytical results of Major oxides in Bhuj formation (Pit & Trench samples)

S.no	Reg No	Sample name	Lithology	Formation	SiO2	Al2O3	Fe2O3	MnO	MgO	CaO	Na2O	K2O	TiO2	P2O5	LOI	Total	V(ppm)
					(%)												
1	1203/2	P2/LB/2025	Sandstone, Argillaceous sandstone	Bhuj	52.60	29.29	7.35	0.09	0.23	0.32	0.04	0.00	0.52	0.35	8.99	99.91	206.18
2	1203/4	P4/LB/2025	Ferrugenous sandstone, Friable sandstone, Gritty sandstone	Bhuj	86.10	0.10	9.10	0.01	0.24	0.17	0.09	0.21	2.04	0.05	1.63	99.76	119.20
3	1203/5	P5/LB/2025	Ferrugenous sandstone, Argillaceous sandstone	Bhuj	37.04	25.87	12.70	0.03	0.71	5.17	0.07	0.46	0.59	0.25	16.95	99.89	361.60
4	1203/6	P6/LB/2025	Ferrugenous sandstone, sandy clay, Feldspathic sandstone	Bhuj	46.90	10.40	7.15	0.01	0.67	15.68	0.08	0.34	1.21	0.08	17.38	99.93	123.80
5	1203/7	P7/LB/2025	Pinkish sandy clay, Friable sandstone	Bhuj	50.05	23.38	2.03	0.01	0.43	7.00	0.22	0.15	2.12	0.04	14.31	99.79	113.40
6	1203/8	P8/LB/2025	Ferrugenous sandstone, Feldspathic sandstone	Bhuj	46.04	39.34	2.43	0.01	0.13	0.36	0.06	0.10	0.68	0.02	10.68	99.87	53.40
7	1203/9	P9/LB/2025	Friable sandstone, Feldspathic sandstone, sandstone	Bhuj	49.52	25.21	10.75	0.03	0.81	1.43	0.10	0.39	0.65	0.04	10.77	99.75	106.80
8	1203/10	P10/LB/2025/A	Kaolinized sandstone	Bhuj	72.63	17.14	1.21	0.01	0.18	0.13	0.26	0.16	2.23	0.02	5.88	99.85	102.13
9	1203/11	P10/LB/2025/B	Pinkish clay	Bhuj	57.88	28.28	1.80	0.01	0.17	0.13	0.25	0.19	2.90	0.04	8.29	99.94	143.23
10	1203/12	P11/LB/2025	Argillaceous sandstone	Bhuj	53.89	27.95	3.80	0.03	0.26	0.66	0.14	0.27	3.50	0.09	9.31	99.89	212.85

11	1203/29	P14/LB/2025	Siltstone, Friable sandstone	Bhuj	39.54	8.72	16.91	0.02	0.93	14.95	0.10	0.46	1.49	0.15	16.56	99.87	288.08
12	1203/59	P16/LB/2025	Laterite, Friable sandstone	Bhuj	46.00	31.88	8.64	0.16	0.23	0.18	0.08	0.15	1.33	0.15	11.06	99.91	502.00
13	1203/60	P17/LB/2025	clay, Argillaceous sandstone	Bhuj	38.06	14.40	24.19	0.02	0.01	0.74	0.39	0.01	8.35	0.43	13.17	99.80	375.83
14	1203/61	P18/LB/2025	Alluvial sand, clay	Bhuj	48.84	22.30	13.29	0.03	0.72	0.64	0.17	0.62	1.50	0.05	11.53	99.73	133.60
15	1203/76	P19/LB/2025	Friable sandstone	Bhuj	49.00	23.60	12.42	0.01	0.14	0.60	0.26	0.07	4.39	0.14	9.19	99.86	147.60
16	1203/77	P20/LB/2101	clay/clay stone	Bhuj	42.34	24.03	17.42	0.01	0.29	1.07	0.12	0.33	2.53	0.04	11.60	99.82	172.20
17		BRS - 1			51.24	23.23	10.41	0.01	0.48	1.11	0.31	0.68	1.49	0.03	10.85		130.80
18	1203/30	T2/LB/2025/01	laterite	Bhuj	32.06	22.50	23.31	0.02	0.34	4.39	0.09	0.40	2.40	0.09	14.09	99.74	383.20
19	1203/31	T2/LB/2025/02	laterite with variegated clay	Bhuj	34.54	19.68	23.50	0.02	0.29	4.65	0.09	0.31	2.02	0.06	14.60	99.81	340.40
20	1203/32	T2/LB/2025/03	laterite with variegated clay	Bhuj	32.70	14.97	32.78	0.02	0.26	3.39	0.08	0.27	1.84	0.06	13.47	99.90	423.40
21	1203/33	T2/LB/2025/04	laterite with variegated clay	Bhuj	34.29	14.95	30.04	0.02	0.27	4.18	0.08	0.28	1.69	0.06	13.90	99.81	498.83
22	1203/34	T2/LB/2025/05	laterite with variegated clay	Bhuj	35.90	17.67	24.11	0.02	0.33	5.06	0.10	0.32	1.84	0.06	14.30	99.76	315.10
23	1203/35	T2/LB/2025/06	sandy clay	Bhuj	36.59	24.87	15.47	0.01	0.26	4.78	0.10	0.29	2.36	0.06	15.09	99.93	326.20
24	1203/36	T2/LB/2025/07	argillaceous sandstone	Bhuj	37.89	23.82	15.52	0.02	0.30	5.15	0.11	0.29	2.20	0.06	14.48	99.89	330.70
25	1203/37	T2/LB/2025/08	argillaceous sandstone	Bhuj	41.42	30.80	5.22	0.01	0.26	3.87	0.12	0.30	2.94	0.06	14.85	99.89	156.10
26	1203/38	T2/LB/2025/09	argillaceous sandstone	Bhuj	43.23	26.38	4.11	0.01	0.31	6.23	0.14	0.29	2.62	0.06	16.37	99.79	101.20
27	1203/39	T2/LB/2025/10	argillaceous sandstone	Bhuj	42.63	28.08	3.92	0.01	0.28	5.93	0.14	0.28	2.75	0.06	15.80	99.93	107.10
28	1203/40	T2/LB/2025/A	Laterite	Bhuj	33.80	19.22	23.97	0.02	0.32	5.45	0.08	0.32	1.97	0.06	14.65	99.90	270.00
29	1203/41	T2/LB/2025/B	argillaceoous sandstone	Bhuj	37.22	19.01	18.03	0.01	0.36	7.21	0.10	0.32	2.03	0.07	15.29	99.70	244.10
30	1203/42	T2/LB/2025/C	laterite clay/Ferrugenous sandstone	Bhuj	43.01	23.96	3.07	0.01	0.31	8.95	0.13	0.26	2.44	0.06	17.70	99.96	80.40
31	1203/43	T2/LB/2025/D	laterite clay	Bhuj	38.21	18.57	18.54	0.02	0.33	6.69	0.10	0.29	2.06	0.06	14.90	99.80	242.00

32	1203/62	T4/LB/2025/01	Reddish white lateritic clay at the bottom.	Bhuj	38.39	15.18	18.54	0.01	0.05	3.12	0.13	0.03	8.89	0.44	15.06	99.88	270.80
33	1203/63	T4/LB/2025/02	Reddish white lateritic clay at the bottom.	Bhuj	34.68	16.87	18.40	0.01	0.06	4.73	0.14	0.03	8.69	0.49	15.74	99.89	316.90
34	1203/64	T4/LB/2025/03	Reddish white lateritic clay at the bottom.	Bhuj	35.06	23.09	15.21	0.01	0.09	2.70	0.14	0.01	8.05	0.36	14.96	99.73	230.10
35	1203/65	T4/LB/2025/04	Reddish white lateritic clay at the bottom.	Bhuj	33.88	23.34	15.90	0.01	0.12	3.45	0.14	0.01	7.25	0.37	15.43	99.95	205.20
36	1203/66	T4/LB/2025/05	Reddish white lateritic clay at the bottom.	Bhuj	35.86	23.04	15.26	0.01	0.03	1.54	0.14	0.01	9.59	0.41	13.94	99.87	267.20
37	1203/67	T4/LB/2025/06	it is reddish brown ferrugenous sandstone/laterite with having a white clay	Bhuj	31.01	28.08	19.18	0.01	0.03	1.04	0.10	0.01	7.72	0.40	12.17	99.75	502.08
38	1203/68	T4/LB/2025/07	Reddish white lateritic clay at the bottom.	Bhuj	37.15	25.25	13.61	0.01	0.09	1.99	0.16	0.01	7.81	0.24	13.51	99.89	253.20
39	1203/69	T4/LB/2025/08	Reddish white lateritic clay at the bottom.	Bhuj	34.55	21.05	18.74	0.01	0.04	1.69	0.16	0.03	9.40	0.42	13.62	99.77	309.10
40	1203/70	T4/LB/2025/09	Reddish white lateritic clay at the bottom.	Bhuj	36.35	23.25	15.50	0.01	0.07	1.38	0.16	0.02	8.90	0.40	13.63	99.71	266.50
41	1203/71	T4/LB/2025/10	Reddish white lateritic clay at the bottom.	Bhuj	35.71	26.05	16.06	0.01	0.14	0.90	0.17	0.02	7.08	0.34	13.37	99.90	268.50
42	1203/72	T4/LB/2025/A	laterite clay	Bhuj	38.10	23.82	12.49	0.01	0.06	1.62	0.16	0.01	8.81	0.45	14.35	99.94	201.90
43	1203/73	T4/LB/2025/B	laterite clay	Bhuj	37.61	22.92	14.01	0.01	0.09	2.07	0.16	0.03	8.22	0.33	14.23	99.72	231.00
44	1203/74	T4/LB/2025/C	laterite clay/Ferrugenous sandstone	Bhuj	36.10	26.31	15.00	0.01	0.14	1.43	0.16	0.01	6.89	0.23	13.59	99.90	276.40
45	1203/75	T4/LB/2025/D	laterite clay	Bhuj	38.14	22.00	15.38	0.01	0.11	2.16	0.15	0.01	7.36	0.34	14.08	99.79	268.60

				Min	**31.01**	**0.10**	**1.21**	**0.01**	**0.01**	**0.13**	**0.04**	**0.00**	**0.52**	**0.02**	**1.63**	**99.70**	**53.40**
				Max	**86.10**	**39.34**	**32.78**	**0.16**	**0.93**	**15.68**	**0.39**	**0.68**	**9.59**	**0.49**	**17.70**	**99.96**	**502.08**
				Average	**42.08**	**22.22**	**13.92**	**0.02**	**0.27**	**3.47**	**0.14**	**0.20**	**4.07**	**0.18**	**13.23**	**99.84**	**243.98**

Annexure-IV-B: Analytical results of Major oxides in Sandhan formation (Pit & Trench samples)

S.no	Reg No	Sample name	Lithology	Formation	SiO2	Al2O3	Fe2O3	MnO	MgO	CaO	Na2O	K2O	TiO2	P2O5	LOI	Total	V(ppm)
					(%)												
13	1203/13	P12/LB/2025	Argillaceous sandstone	Sandhan	61.08	16.82	7.25	0.02	0.60	1.10	1.38	0.43	2.62	0.04	8.51	99.86	115.10
14	1203/14	P13/LB/2025	Pebble sand, alluvial sand	Sandhan	56.75	15.16	8.85	0.06	1.07	1.42	0.30	7.52	1.73	0.69	6.25	99.81	175.70
44	1203/44	P15/LB/2025	Friable sandstone	Sandhan	43.00	35.15	0.99	0.01	0.20	0.93	0.37	0.02	3.85	0.09	15.29	99.93	198.93
1	1203/15	T1/LB/2025/01	friable laminated sandstone	Sandhan	66.38	18.46	3.02	0.01	0.38	1.56	0.11	0.14	1.70	0.09	7.87	99.74	84.10
2	1203/16	T1/LB/2025/02	friable laminated sandstone	Sandhan	62.68	21.08	2.37	0.02	0.68	1.89	0.16	0.24	1.76	0.10	8.78	99.79	90.30
3	1203/17	T1/LB/2025/03	friable laminated sandstone	Sandhan	57.46	20.60	3.98	0.02	0.45	3.07	0.08	0.22	1.45	0.10	12.45	99.92	99.00
4	1203/18	T1/LB/2025/04	friable laminated sandstone	Sandhan	63.21	18.23	4.66	0.03	0.66	2.03	0.11	0.35	1.77	0.12	8.68	99.89	104.40
5	1203/19	T1/LB/2025/05	friable laminated sandstone	Sandhan	54.98	23.74	5.74	0.03	0.79	2.05	0.13	0.43	2.07	0.13	9.76	99.90	123.30
6	1203/20	T1/LB/2025/06	friable laminated sandstone	Sandhan	80.10	10.68	1.58	0.01	0.31	0.60	0.10	0.12	1.12	0.07	5.01	99.75	54.20
7	1203/21	T1/LB/2025/07	friable laminated sandstone	Sandhan	87.75	5.69	1.76	0.01	0.18	0.33	0.09	0.06	0.79	0.06	3.21	99.96	32.50
8	1203/22	T1/LB/2025/08	friable laminated sandstone	Sandhan	84.14	9.01	1.02	0.01	0.12	0.23	0.12	0.07	1.02	0.06	3.97	99.80	35.10
9	1203/23	T1/LB/2025/09	friable laminated sandstone	Sandhan	62.21	23.53	2.37	0.01	0.43	0.83	0.19	0.17	2.34	0.09	7.63	99.86	84.50
10	1203/24	T1/LB/2025/10	sandstone	Sandhan	43.34	33.18	2.04	0.02	0.24	1.49	0.15	0.19	4.56	0.09	14.56	99.89	130.70

11	1203/25	T1/LB/2025/A	friable laminated kailinised sandstone	Sandhan	57.03	17.98	7.88	0.01	0.41	3.92	0.11	0.19	1.78	0.21	10.16	99.72	138.20
12	1203/26	T1/LB/2025/B	friable laminated kailinised sandstone	Sandhan	57.58	25.00	3.00	0.01	0.46	2.45	0.19	0.22	1.66	0.11	9.12	99.84	137.63
13	1203/27	T1/LB/2025/C	friable laminated kailinised sandstone	Sandhan	48.75	26.24	7.59	0.02	0.63	1.67	0.30	0.27	2.92	0.13	11.25	99.81	197.70
14	1203/28	T1/LB/2025/D	friable laminated kailinised sandstone	Sandhan	55.62	25.71	3.56	0.01	0.46	2.17	0.21	0.20	2.06	0.10	9.82	99.96	97.20
29	1203/45	T3/LB/2025/01	Varigated clay /clay stone	Sandhan	24.06	46.01	3.18	0.01	0.08	0.58	0.18	0.12	3.97	0.08	21.63	99.93	241.00
30	1203/46	T3/LB/2025/02	Varigated clay /clay stone	Sandhan	25.05	45.42	2.60	0.01	0.08	0.71	0.21	0.12	3.67	0.09	21.91	99.90	214.30
31	1203/47	T3/LB/2025/03	Varigated clay /clay stone	Sandhan	24.30	46.01	2.73	0.02	0.06	0.23	0.22	0.13	4.28	0.08	21.65	99.74	234.30
32	1203/48	T3/LB/2025/04	Varigated clay /clay stone	Sandhan	25.00	45.22	2.90	0.01	0.07	0.30	0.27	0.20	3.52	0.12	22.29	99.95	266.00
33	1203/49	T3/LB/2025/05	Varigated clay /clay stone	Sandhan	26.00	45.49	2.73	0.02	0.09	0.43	0.22	0.17	3.94	0.10	20.75	99.98	238.50
34	1203/50	T3/LB/2025/06	Varigated clay /clay stone	Sandhan	28.01	45.05	2.03	0.02	0.16	1.12	0.24	0.20	2.74	0.09	20.07	99.87	261.33
35	1203/51	T3/LB/2025/07	Varigated clay /clay stone	Sandhan	27.31	43.64	3.35	0.02	0.12	0.39	0.21	0.16	3.91	0.09	20.65	99.90	239.50
36	1203/52	T3/LB/2025/08	Varigated clay /clay stone	Sandhan	30.42	42.10	3.05	0.02	0.15	0.19	0.20	0.17	3.72	0.09	19.73	99.88	214.00
37	1203/53	T3/LB/2025/09	Varigated clay /clay stone	Sandhan	31.87	41.07	3.19	0.02	0.27	0.21	0.25	0.28	3.01	0.12	19.64	99.92	237.20
38	1203/54	T3/LB/2025/10	Varigated clay /clay stone	Sandhan	31.17	42.07	2.93	0.02	0.19	0.16	0.21	0.22	2.95	0.09	19.82	99.87	206.50
39	1203/55	T3/LB/2025/A	clay / clay stone	Sandhan	37.29	37.49	4.66	0.01	0.15	0.83	0.30	0.29	2.56	0.07	16.20	99.90	293.20

40	1203/56	T3/LB/2025/B	clay / clay stone	Sandhan	31.08	40.64	4.19	0.02	0.13	0.39	0.27	0.22	3.52	0.08	19.19	99.77	288.00
41	1203/57	T3/LB/2025/C	clay / clay stone	Sandhan	26.99	42.48	5.02	0.02	0.17	0.13	0.28	0.27	3.15	0.12	21.09	99.76	444.00
42	1203/58	T3/LB/2025/D	clay / clay stone	Sandhan	27.32	43.06	4.40	0.02	0.09	0.53	0.26	0.19	3.39	0.09	20.58	99.97	302.70
57	1203/78	T5/LB/2025/01	Laterite /argillaceous sand	Sandhan	67.74	3.07	14.28	0.14	1.93	0.67	1.50	0.53	2.01	0.07	7.73	99.72	197.90
58	1203/79	T5/LB/2025/02	Laterite /argillaceous sand	Sandhan	66.91	0.50	19.67	0.09	1.67	0.50	1.27	0.49	1.87	0.10	6.76	99.88	189.90
59	1203/80	T5/LB/2025/03	Laterite /argillaceous sand	Sandhan	70.98	2.51	13.20	0.14	1.69	0.47	1.23	0.52	2.07	0.07	6.87	99.81	159.90
60	1203/81	T5/LB/2025/04	Laterite /argillaceous sand	Sandhan	66.47	1.66	18.94	0.18	1.66	0.41	1.04	0.48	1.61	0.09	7.21	99.79	197.40
61	1203/82	T5/LB/2025/05	Laterite /argillaceous sand	Sandhan	68.68	3.71	14.34	0.13	1.78	0.46	0.86	0.51	1.62	0.08	7.69	99.88	193.43
62	1203/83	T5/LB/2025/06	Laterite /argillaceous sand	Sandhan	67.07	3.56	15.00	0.11	1.89	0.61	0.83	0.49	1.68	0.07	8.43	99.79	153.10
63	1203/84	T5/LB/2025/07	Laterite /argillaceous sand	Sandhan	64.83	3.42	17.61	0.17	1.74	0.52	0.64	0.50	1.84	0.07	8.35	99.73	175.90
64	1203/85	T5/LB/2025/08	Laterite /argillaceous sand	Sandhan	63.06	3.97	18.63	0.14	1.81	0.67	0.87	0.51	1.83	0.08	8.24	99.86	206.50
65	1203/86	T5/LB/2025/09	Laterite /argillaceous sand	Sandhan	67.60	3.86	14.64	0.15	1.69	0.63	0.75	0.53	1.77	0.07	8.01	99.74	175.20
66	1203/87	T5/LB/2025/10	Laterite /argillaceous sand	Sandhan	63.03	3.25	19.65	0.17	1.63	0.47	0.69	0.50	1.85	0.10	8.48	99.85	216.10
67	1203/88	T5/LB/2025/A	Varigated Laterite /argillaceous sand	Sandhan	67.31	0.77	16.81	0.17	1.60	0.83	1.27	0.44	1.67	0.09	8.70	99.71	154.40
68	1203/89	T5/LB/2025/B	Varigated Laterite /argillaceous sand	Sandhan	68.59	0.24	16.95	0.15	1.66	0.85	1.24	0.44	1.45	0.08	8.09	99.77	169.20
69	1203/90	T5/LB/2025/C	Varigated Laterite /argillaceous sand	Sandhan	63.06	2.33	18.08	0.15	1.62	0.91	1.14	0.45	1.55	0.12	10.36	99.81	185.50
70	1203/91	T5/LB/2025/D	Varigated Laterite /argillaceous sand	Sandhan	61.51	0.92	20.61	0.18	1.72	1.08	1.07	0.46	1.45	0.10	10.59	99.73	185.00
				Min	**24.06**	**0.24**	**0.99**	**0.01**	**0.06**	**0.13**	**0.08**	**0.02**	**0.79**	**0.04**	**3.21**	**99.71**	**32.50**
				Max	**87.75**	**46.01**	**20.61**	**0.18**	**1.93**	**3.92**	**1.50**	**7.52**	**4.56**	**0.69**	**22.29**	**99.98**	**444.00**

				Average	**52.55**	**21.91**	**7.85**	**0.06**	**0.76**	**0.96**	**0.49**	**0.46**	**2.40**	**0.11**	**12.29**	**99.84**	**180.86**

Annexure-IV-C: Analytical results of Major oxides in Gaj formation (Pit)

S.no	Reg No	Sample name	Sample No	Lithology	Formation	SiO2	Al2O3	Fe2O3	MnO	MgO	CaO	Na2O	K2O	TiO2	P2O5	LOI	Total	V(ppm)
						(%)												
1	1203/1	P1/LB/2025	P1	Sticky varigated clay	Gaj	61.80	16.31	8.63	0.03	0.78	0.74	0.18	0.76	1.69	0.09	8.72	99.79	93.70

Annexure-IV-D: Analytical results of Major oxides in Matanomadh formation (Pit)

S.no	Reg No	Sample name	Sample No	Lithology	Formation	SiO2	Al2O3	Fe2O3	MnO	MgO	CaO	Na2O	K2O	TiO2	P2O5	LOI	Total	V(ppm)
						(%)												
3	1203/3	P3/LB/2025	P3	Varigated clay, Hard ferrugenous sandstone	Matanomadh, Laterite	33.99	28.59	20.23	0.05	0.37	1.01	0.38	0.55	1.48	0.18	12.96	99.81	199.78

ANNEXURE - V : STATEMENT SHOWING ANALYTICAL VALUES OF REE, Ga, V, Ti FROM PIT & TRENCH SAMPLES IN LAKHOND AREA, KACHCHH DISTRICT, GUJARAT

S.No	Reg No	Sample No	Lithology	Formation	La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	ΣREE	Sc	Y	ΣREE + (Sc +Y)	Th	U	Ga	V	Ti as TiO2% by mass
1	1203/02	P2/LB/2025	Argill.SST	Bhuj	123.88	331.05	61.60	288.60	—	64.88	13.60	47.38	1.43	18.30	<1.0	7.88	<1.0	6.33	1.60	**966.53**	21.98	48.70	**1037.21**	55.65	33.03	17.83	206.18	0.52
2	1203/03	P3/LB/2025	vari.clay,Ferr.sst	Matanomadh	70.68	158.25	46.75	150.48	—	18.65	3.45	34.10	<1.0	5.13	<1.0	9.30	<1.0	4.15	3.70	**504.64**	21.75	27.83	**554.22**	133.60	140.63	41.73	199.78	1.48
3	1203/04	P4/LB/2025	Ferr.gritty SST	Bhuj	107.10	250.50	34.48	271.73	—	16.15	1.58	21.25	<1.0	6.78	<1.0	11.78	<1.0	12.98	2.38	**736.71**	10.45	33.48	**780.64**	184.78	32.80	13.10	119.23	2.04
4	1203/09	P9/LB/2025	Feld.SST. Friable	Bhuj	40.65	70.60	16.68	60.50	—	5.83	1.18	12.88	<1.0	2.13	<1.0	3.63	<1.0	1.73	1.48	**217.29**	10.73	13.48	**241.50**	57.48	56.55	28.03	106.80	0.65
5	1203/10	P10/LB/2025/A	kaolinised sst	Bhuj	43.15	93.98	9.55	127.53	—	6.28	1.50	5.75	<1.0	5.03	<1.0	12.15	<1.0	3.35	<1.0	**308.27**	21.80	23.35	**353.42**	70.68	<1.0	20.40	102.13	2.23
6	1203/11	P10/LB/2025/B	clay-pinkishwhite	Bhuj	66.85	136.13	13.43	153.90	—	6.10	1.48	6.63	<1.0	5.10	<1.0	14.53	<1.0	3.50	<1.0	**407.65**	17.53	27.00	**452.18**	87.70	<1.0	27.98	143.23	2.9
7	1203/12	P11/LB/2025	Argill.SST	Bhuj	73.58	171.55	22.78	206.90	—	13.70	3.23	11.10	<1.0	6.25	<1.0	16.98	<1.0	4.58	1.10	**531.75**	18.78	30.28	**580.81**	102.53	<1.0	29.15	212.85	3.5
8	1203/26	T1/LB/2025/B	laminated kaolnised SST	sandhan	88.00	211.53	25.73	158.50	—	13.58	2.98	12.78	<1.0	6.63	<1.0	10.18	<1.0	4.03	1.00	**534.94**	18.60	28.55	**582.09**	148.53	<1.0	14.68	137.63	1.66
9	1203/29	P14/LB/2025	Siltstone friable	Bhuj	81.33	190.35	40.98	131.13	—	13.05	1.83	25.83	<1.0	5.18	<1.0	9.43	<1.0	4.53	3.00	**506.64**	15.43	29.78	**551.85**	208.45	96.28	23.38	288.08	1.49
10	1203/33	T2/LB/2025/04	Laterite with clay	Bhuj	45.15	73.50	49.40	184.40	—	10.55	2.85	42.60	<1.0	2.75	<1.0	8.95	<1.0	9.88	5.43	**435.46**	23.25	18.28	**476.99**	146.73	260.18	45.13	498.83	1.69
11	1203/44	P15/LB/2025	Friable SST	sandhan	113.15	224.35	32.15	304.98	—	19.45	4.25	14.45	<1.0	9.03	<1.0	20.13	<1.0	6.63	<1.0	**748.57**	16.68	29.90	**795.15**	69.03	<1.0	35.60	198.93	3.85
12	1203/50	T3/LB/2025/06	vari.clay/clay stone	sandhan	70.90	155.35	23.53	188.93	—	12.85	3.43	10.88	<1.0	4.38	<1.0	14.78	<1.0	2.00	<1.0	**487.03**	28.33	12.73	**528.09**	43.00	<1.0	41.48	261.33	2.74
13	1203/60	P17/LB/2025	clay,Argill.SST	Bhuj	137.50	298.58	71.48	530.03	—	41.33	9.58	58.25	<1.0	14.30	<1.0	46.18	<1.0	2.80	4.43	**1214.46**	49.10	38.35	**1301.91**	182.48	48.23	50.85	375.83	8.35
14	1203/67	T4/LB/2025/06	Laterite-white clay	Bhuj	217.03	395.38	84.30	565.65	—	52.45	13.60	68.95	<1.0	21.15	<1.0	43.93	<1.0	3.00	4.18	**1469.62**	45.80	39.83	**1555.25**	158.25	36.03	47.43	502.08	7.72
15	1203/82	T5/LB/2025/05	Laterite/Argil.SST	Sandhan	38.80	70.43	23.80	109.68	—	10.43	2.40	25.15	<1.0	8.13	<1.0	11.35	<1.0	8.08	2.75	**311.00**	16.48	47.65	**375.13**	75.33	65.18	21.95	193.43	1.62
				Min	**38.80**	**70.43**	**9.55**	**60.50**	—	**5.83**	**1.18**	**5.75**	**1.43**	**2.13**	**0.00**	**3.63**	**0.00**	**1.73**	**1.00**	217.29	**10.45**	**12.73**	241.50	**43.00**	**32.80**	**13.10**	**102.13**	**0.52**
				Max	**217.03**	**395.38**	**84.30**	**565.65**	—	**64.88**	**13.60**	**68.95**	**1.43**	**21.15**	**0.00**	**46.18**	**0.00**	**12.98**	**5.43**	1469.62	**49.10**	**48.70**	1555.25	**208.45**	**260.18**	**50.85**	**502.08**	**8.35**
				Average	**87.85**	**188.77**	**37.11**	**228.86**	—	**20.35**	**4.46**	**26.53**	**1.43**	**8.02**	**0.00**	**16.08**	**0.00**	**5.17**	**2.82**	625.37	**22.45**	**29.95**	677.76	**114.95**	**85.43**	**30.58**	**236.42**	**2.83**

ANNEXURE - V (A) : ANALYTICAL VALUES OF REE, Ga, V, Ti FROM PIT & TRENCH SAMPLES OF BHUJ FORMATION IN LAKHOND AREA, KACHCHH

S.No	Reg No	Sample No	Lithology	Formation	La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	ΣREE	Sc	Y	ΣREE + (Sc +Y)	Th	U	Ga	V	Ti as TiO2% by mass
1	1203/02	P2/LB/2025	Argill.SST	Bhuj	123.88	331.05	61.60	288.60	—	64.88	13.60	47.38	1.43	18.30	<1.0	7.88	<1.0	6.33	1.60	**966.53**	21.98	48.70	**1037.21**	55.65	33.03	17.83	206.18	0.52
2	1203/04	P4/LB/2025	Ferr.gritty SST	Bhuj	107.10	250.50	34.48	271.73	—	16.15	1.58	21.25	<1.0	6.78	<1.0	11.78	<1.0	12.98	2.38	**736.71**	10.45	33.48	**780.64**	184.78	32.80	13.10	119.23	2.04
3	1203/09	P9/LB/2025	Feld.SST. Friable	Bhuj	40.65	70.60	16.68	60.50	—	5.83	1.18	12.88	<1.0	2.13	<1.0	3.63	<1.0	1.73	1.48	**217.29**	10.73	13.48	**241.50**	57.48	56.55	28.03	106.80	0.65
4	1203/10	P10/LB/2025/A	kaolinised sst	Bhuj	43.15	93.98	9.55	127.53	—	6.28	1.50	5.75	<1.0	5.03	<1.0	12.15	<1.0	3.35	<1.0	**308.27**	21.80	23.35	**353.42**	70.68	<1.0	20.40	102.13	2.23
5	1203/11	P10/LB/2025/B	clay-pinkishwhite	Bhuj	66.85	136.13	13.43	153.90	—	6.10	1.48	6.63	<1.0	5.10	<1.0	14.53	<1.0	3.50	<1.0	**407.65**	17.53	27.00	**452.18**	87.70	<1.0	27.98	143.23	2.9
6	1203/12	P11/LB/2025	Argill.SST	Bhuj	73.58	171.55	22.78	206.90	—	13.70	3.23	11.10	<1.0	6.25	<1.0	16.98	<1.0	4.58	1.10	**531.75**	18.78	30.28	**580.81**	102.53	<1.0	29.15	212.85	3.5
7	1203/29	P14/LB/2025	Siltstone friable	Bhuj	81.33	190.35	40.98	131.13	—	13.05	1.83	25.83	<1.0	5.18	<1.0	9.43	<1.0	4.53	3.00	**506.64**	15.43	29.78	**551.85**	208.45	96.28	23.38	288.08	1.49
8	1203/33	T2/LB/2025/04	Laterite with clay	Bhuj	45.15	73.50	49.40	184.40	—	10.55	2.85	42.60	<1.0	2.75	<1.0	8.95	<1.0	9.88	5.43	**435.46**	23.25	18.28	**476.99**	146.73	260.18	45.13	498.83	1.69
9	1203/60	P17/LB/2025	clay,Argill.SST	Bhuj	137.50	298.58	71.48	530.03	—	41.33	9.58	58.25	<1.0	14.30	<1.0	46.18	<1.0	2.80	4.43	**1214.46**	49.10	38.35	**1301.91**	182.48	48.23	50.85	375.83	8.35
10	1203/67	T4/LB/2025/06	Laterite-white clay	Bhuj	217.03	395.38	84.30	565.65	—	52.45	13.60	68.95	<1.0	21.15	<1.0	43.93	<1.0	3.00	4.18	**1469.62**	45.80	39.83	**1555.25**	158.25	36.03	47.43	502.08	7.72
				MIN	**40.65**	**70.60**	**9.55**	**60.50**	—	**5.83**	**1.18**	**5.75**	**1.43**	**2.13**	**0.00**	**3.63**	**0.00**	**1.73**	**1.10**	**217.29**	**10.45**	**13.48**	**241.50**	**55.65**	**32.80**	**13.10**	**102.13**	**0.52**
				MAX	**217.03**	**395.38**	**84.30**	**565.65**	—	**64.88**	**13.60**	**68.95**	**1.43**	**21.15**	**0.00**	**46.18**	**0.00**	**12.98**	**5.43**	**1469.62**	**49.10**	**48.70**	**1555.25**	**208.45**	**260.18**	**50.85**	**502.08**	**8.35**
				AVERAGE	**93.62**	**201.16**	**40.47**	**252.04**	—	**23.03**	**5.04**	**30.06**	**1.43**	**8.70**	**0.00**	**17.54**	**0.00**	**5.27**	**2.95**	**679.44**	**23.49**	**30.25**	**733.18**	**125.47**	**80.44**	**30.33**	**255.52**	**3.11**

ANNEXURE - V (B) : ANALYTICAL VALUES OF REE, Ga, V, Ti FROM PIT & TRENCH SAMPLES OF SANDHAN FORMATION IN LAKHOND AREA, KACHCHH DISTRICT, GUJARAT

S.No	Reg No	Sample No	Lithology	Formation	La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	ΣREE	Sc	Y	ΣREE + (Sc +Y)	Th	U	Ga	V	Ti as TiO2% by mass
8	1203/26	T1/LB/2025/B	laminated kaolnised SST	sandhan	88.00	211.53	25.73	158.50	—	13.58	2.98	12.78	<1.0	6.63	<1.0	10.18	<1.0	4.03	1.00	**534.94**	18.60	28.55	**582.09**	148.53	<1.0	14.68	137.63	1.66
11	1203/44	P15/LB/2025	Friable SST	sandhan	113.15	224.35	32.15	304.98	—	19.45	4.25	14.45	<1.0	9.03	<1.0	20.13	<1.0	6.63	<1.0	**748.57**	16.68	29.90	**795.15**	69.03	<1.0	35.60	198.93	3.85
12	1203/50	T3/LB/2025/06	vari.clay/clay stone	sandhan	70.90	155.35	23.53	188.93	—	12.85	3.43	10.88	<1.0	4.38	<1.0	14.78	<1.0	2.00	<1.0	**487.03**	28.33	12.73	**528.09**	43.00	<1.0	41.48	261.33	2.74
15	1203/82	T5/LB/2025/05	Laterite/Argil.SST	Sandhan	38.80	70.43	23.80	109.68	—	10.43	2.40	25.15	<1.0	8.13	<1.0	11.35	<1.0	8.08	2.75	**311.00**	16.48	47.65	**375.13**	75.33	65.18	21.95	193.43	1.62
				MIN	**38.80**	**70.43**	**23.53**	**109.68**	—	**10.43**	**2.40**	**10.88**	**0.00**	**4.38**	**0.00**	**10.18**	**0.00**	**2.00**	**1.00**	**311.00**	**16.48**	**12.73**	**375.13**	**43.00**	**65.18**	**14.68**	**137.63**	**1.62**
				MAX	**113.15**	**224.35**	**32.15**	**304.98**	—	**19.45**	**4.25**	**25.15**	**0.00**	**9.03**	**0.00**	**20.13**	**0.00**	**8.08**	**2.75**	**748.57**	**28.33**	**47.65**	**795.15**	**148.53**	**65.18**	**41.48**	**261.33**	**3.85**
				AVERAGE	**77.71**	**165.42**	**26.30**	**190.52**	—	**14.08**	**3.27**	**15.82**	**0.00**	**7.04**	**0.00**	**14.11**	**0.00**	**5.19**	**1.88**	**520.39**	**20.02**	**29.71**	**570.12**	**83.97**	**65.18**	**28.43**	**197.83**	**2.47**

ANNEXURE - V (C) : ANALYTICAL VALUES OF REE, Ga, V, Ti FROM PIT & TRENCH SAMPLES OF MATANOMADH FORMATION IN LAKHOND AREA, KACHCHH DISTRICT, GUJARAT

S.No	Reg No	Sample No	Lithology	Formation	La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	ΣREE	Sc	Y	ΣREE + (Sc +Y)	Th	U	Ga	V	Ti as TiO2% by mass
2	1203/03	P3/LB/2025	vari.clay,Fer r.sst	Matanomad h	70.68	158.25	46.75	150.48	—	18.65	3.45	34.10	<1.0	5.13	<1.0	9.30	<1.0	4.15	3.70	**504.64**	21.75	27.83	**554.22**	133.60	140.63	41.73	199.78	1.48

Annexure-VI: Reduced level, co-ordinates, Total depth, Recovery%, Date of commencement & closure of Boreholes drilled in Lakhond Area, Kachchh District, Gujarat

Bore Hole No.	Geographic Coordinate System in Degree Minutes Seconds (WGS 1984)		Geographic Coordinate System in Degree Decimal (WGS 1984)		RL Collar (m)	Core recovery (%)	Date of Commencement	Date of Completion	Total depth
	Latitude (DMS)	Longitude (DMS)	Latitude (DD)	Longitude (DD)					
LKD BH - 1	23°14'40.5810"	69°47'14.5971"	23.2446058°	69.7873881°	113.219	63.00%	19.07.2025	24.07.2025	30.00
LKD BH - 2	23°15'26.1860"	69°48'36.3273"	23.2572739°	69.8100909°	116.957	85.00%	25.07.2025	02.08.2025	30.00
LKD BH - 3	23°15'21.0114"	69°48'02.1340"	23.2558365°	69.8005928°	118.23	90%	17.09.2025	19.09.2025	30.00
LKD BH - 4	23^{0}15'15.7195"	69°47'20.1922"	23.2543665°	69.7889423°	118.228	93.00%	20.09.2025	21.09.2025	11.00

Annexure VII - Borehole lithologs drilled in Lakhond area, Kachchh district, Gujarat

Title of the Project	**Reconnaissance Survey G4 for Bauxite, Ga, V, Ti & REE in Lakhond Area, Kachchh dist, Gujarat.**
Field Season:	2025
Borehole No	LKD - BH - 01
Location	Lakhond, Gujarat
Latitude	23°14'40.5810"
Longitude	69°47'14.5971"
Angle	Vertical
Collar Rl	113.22
Date of Commencement	19-07-2025
Date of Closing	24-07-2025
Total Depth	30.00

Corebox No	From	To	Thinckness	Rec Thinckness	Rec (%)	Core loss(%)	Unit Length	Ext. Length	Floor Depths	Description (Lithology color, Texture)	Remarks
CB - 1	0.00	1.00	1.00	0.28	28	73	0.28	1.00	1.00	soft yellowish-grey weathered Sandy clays	soil/sandhan 1.00m
CB - 1	1.00	2.00	1.00	0.74	74	26	0.74	1.00	2.00	yellowish-white soft verigated arenaceous clay	
CB - 1	2.00	3.00	1.00	0.83	83	17	0.83	1.00	3.00	Greenish brown soft varigated clay with lenses of laterite	
CB - 1	3.00	4.00	1.00	0.63	63	37	0.12	0.19	3.19	-Do-	loose

						100	0.51	0.81	4.00	-Do-	loose
CB - 1	4.00	5.00	1.00	0.85	85	15	0.38	0.45	4.45	Verigated clay arenaceous	friable
								0.55	5.00	clay yellowish-grey Calcareous soft	
CB - 1	5.00	6.00	1.00	0.43	43	57	0.32	0.74	5.74	yellowish-grey soft sandy clay soft	friable
							0.11	0.26	6.00	yellowish-brown coarse grained/sst with clay matrix	
CB - 1	6.00	7.00	1.00	0.46	46	54	0.29	0.63	6.63	yelllowish-grey Sandy clay soft	friable
							0.17	0.37	7.00	Clay soft pinkish white calcareous	friable
CB - 1	7.00	8.00	1.00	0.57	57	43	0.57	1.00	8.00	Pinkish grey soft clay	friable
CB - 1	8.00	9.00	1.00	0.40	40	60	0.40	1.00	9.00	Pinkish white soft sandy clay	friable
CB - 1,2	9.00	10.00	1.00	0.69	69	31	0.36	0.52	9.52	Varigated clay soft	friable
							0.33	0.48	10.00	white soft clay Arenaceous	friable
CB - 2	10.00	11.00	1.00	0.40	40	60	0.40	1.00	11.00	-Do-	friable
CB - 2	11.00	12.00	1.00	0.69	69	31	0.53	0.77	11.77	-Do-	friable
CB - 2							0.16	0.23	12.00	Ferrugenious sandstone with feldspathic grains friable	hard
CB - 2	12.00	13.00	1.00	0.68	68	32	0.08	0.12	12.12	-Do-	
							0.45	0.66	12.78	White friable sandy clay	fiable

							0.15	0.22	13.00	Yellowish - brown friable ferrugenious Sandy clay	friable
CB - 2	13.00	14.00	1.00	0.55	55	45	0.38	0.69	13.69	-Do-	friable
							0.17	0.31	14.00	Yellow clay arenaceous brown friable	friable
CB - 2	14.00	15.00	1.00	0.42	42	58	0.42	1.00	15.00	-Do-	friable
CB - 2	15.00	16.00	1.00	0.60	60	40	0.60	1.00	16.00	-Do-	friable
CB - 2	16.00	17.00	1.00	0.44	44	56	0.44	1.00	17.00	-Do-	friable
CB - 2,3	17.00	18.00	1.00	0.57	57	43	0.38	0.67	17.67	Clay aranaceous yellowish brown	friable
							0.19	0.33	18.00	Clay aranaceous pinkish white	friable
CB - 3	18.00	19.00	1.00	0.48	48	52	0.17	0.35	18.35	-Do-	friable
						100	0.31	0.65	19.00	Clay aranaceous calcarious yellow soft	friable
CB - 3	19.00	20.00	1.00	0.52	52	48	0.52	0.52	20.00	Clay aranaceous calcarious	friable
CB - 3	20.00	21.00	1.00	0.39	39	61	0.32	0.82	20.82	Yellowish white clay aranaceous	friable
							0.07	0.18	21.00	Brown ferrugenious sandstone	friable
CB - 3	21.00	22.00	1.00	0.57	57	43	0.57	1.00	22.00	Whitish pink clay aranaceous argillaceous sandstone friable	friable
CB - 3	22.00	23.00	1.00	0.70	70	30	0.70	1.00	23.00	Whitish pink friable argillaceous	friable
CB - 3	23.00	24.00	1.00	0.74	74	26	0.54	0.73	23.73	-Do-	friable

							0.20	0.27	24.00	whitish yellow friable argillaceous sandstone	friable
CB - 3	24.00	25.00	1.00	0.83	83	17	0.83	1.00	25.00	-Do-	friable
CB - 3	25.00	26.00	1.00	0.82	82	18	0.82	1.00	26.00	yellowish pink Soft argillaceous sandstone fine grained to medium grained	friable
CB - 4	26.00	27.00	1.00	0.80	80	20	0.80	1.00	27.00	-Do-	friable
CB - 4	27.00	28.00	1.00	0.73	73	27	0.73	1.00	28.00	-Do-	friable
CB - 4	28.00	29.00	1.00	0.84	84	16	0.84	1.00	29.00	-Do-	friable
CB - 4	29.00	30.00	1.00	0.92	92	8	0.65	0.71	29.71	pinkish Argillaceous sandstone	
							0.27	0.29	30.00	Brown ferrugenious sandstone hard	hard

Borehole closed at 30.00 m on 24-07-2025
Number of core boxes: 4
Recovery lenth: 18.29 %
Run lenth 2.00 to 30.00 (29.00 m)
Recovery pencentage : 63.06 %

Title of the Project	**Reconnaissance Survey G4 stage for Bauxite, Ga, V, Ti & REE in Lakhond Area, Kachchh dist, Gujarat.**
Field Season:	2025
Borehole No	LKD - BH - 02
Location	Lakhond, Gujarat
Latitude	23°15'26.1860"
Longitude	69°48'36.3273"
Angle	Vertical
Collar Rl	116.96
Date of Commencement	25-07-2025
Date of Closing	02-08-2025
Total Depth	30.00

Core Box No	From	To	Thinckness	Rec Thinckness	Rec (%)	Core loss(%)	Unit Length	Ext. Length	Floor Depths	Description (Lithology color, Texture)	Remarks
CB - 1	0.00	1.00	1.00	0.72	72	28	0.72	1.00	1.00	yellow soft sandy clay	
CB - 1	1.00	2.00	1.00	0.80	80	20	0.26	0.32	1.32	-Do-	
							0.54	0.68	2.00	Yellowish pink soft sandy clay	
CB - 1	2.00	3.00	1.00	0.92	92	8	0.20	0.22	2.22	-Do-	
							0.72	0.78	3.00	pinkish yellow fgd - mgd argillaceous sandstone	

CB - 1	3.00	4.00	1.00	0.94	94	6	0.94	1.00	4.00	pinkish yellow fgd - mgd argillaceous sandstone, Friable	
CB - 1	4.00	5.00	1.00	0.80	80	20	0.80	1.00	5.00	pinkish yellow fgd - mgd argillaceous sandstone,Friable	
CB - 1	5.00	6.00	1.00	0.68	68	32	0.60	1.00	6.00	pinkish yellow fgd - mgd argillaceous sandstone,Friable	
CB - 1	6.00	7.00	1.00	0.75	75	25	0.75	1.00	7.00	yellowish pink mgd - cgd friable sandstone	
CB - 2	7.00	8.00	1.00	0.70	70	30	0.30	0.43	7.43	yellowish pink mgd argillaceous sst	
							0.35	0.50	7.93	brick red sandy clay with fine grained with sst laminae(yellow)	
							0.05	0.07	8.00	yellow argillaceous sandstone	
CB - 2	8.00	9.00	1.00	0.68	68	32	0.68	1.00	9.00	pinkish yellow fgd argillaceous sandstone	

CB - 2	9.00	10.00	1.00	0.81	81	19	0.81	1.00	10.00	Sandy clay greenish grey (Gluconite?)	
CB - 2	10.00	11.00	1.00	0.69	69	31	0.69	1.00	11.00	-Do-	
CB - 2	11.00	12.00	1.00	0.80	80	20	0.80	1.00	12.00	-Do-	
CB - 2	12.00	13.00	1.00	0.99	99	1	0.46	0.46	12.46	sandy clay greenish grey	
							0.53	0.54	13.00	-Do-	
CB - 2,3	13.00	14.00	1.00	0.95	95	5	0.35	0.37	13.37	-Do-	
							0.60	0.63	14.00	Gritty to conglomerate with clay matrixs greenish grey and white calcarious veins	
CB - 3	14.00	15.00	1.00	0.98	98	2	0.30	0.31	14.31	Do + Sandstone greenish grey gluconitic fault zone	may be fault zone
							0.68	0.69	15.00	Do + Yellowish brown calcarious veins	may be fault zone
CB - 3	15.00	16.00	1.00	0.93	93	7	0.18	0.19	15.19	-Do-	may be fault zone
							0.75	0.81	16.00	Sandy clay dirty yellow	
CB - 3	16.00	17.00	1.00	0.88	88	12	0.88	1.00	17.00	Sandy clay dirty yellow hard	

CB - 3	17.00	18.00	1.00	0.67	67	33	0.67	1.00	18.00	Sandy clay dirty yellow with clac veins	
CB - 3	18.00	19.00	1.00	0.74	74	26	0.54	0.73	18.73	Gritty calcarious dirty yellow broken	
							0.20	0.27	19.00	Sandy clay khaky grey	
CB - 4	19.00	20.00	1.00	0.80	80	20	0.31	0.39	19.39	Conglomerate lenses green (2 - 3 cm long sub-rounded pebbles)	
							0.49	0.61	20.00	Sandy clay khaky	
CB - 4	20.00	21.00	1.00	0.89	89	11	0.23	0.26	20.26	-Do-	
CB - 4							0.24	0.27	20.53	Hard claystone khaky vfg calcarious veins	
							0.42	0.47	21.00	Clay khaky soft	
CB - 4	21.00	22.00	1.00	0.92	92	8	0.68	0.74	21.74	Clay stone khaky calcarious veins	
							0.24	0.26	22.00	Clay khaky soft	
CB - 4	22.00	23.00	1.00	0.89	89	11	0.30	0.34	22.34	Clay stone sandy hard with plant fossils	
							0.59	0.66	23.00	Clay khaky grey soft	

CB - 4,5	23.00	24.00	1.00	0.94	94	6	0.10	0.11	23.11	Clay stone hard khaky grey	
							0.84	0.89	24.00	Clay khaky grey soft	
CB - 5	24.00	25.00	1.00	0.89	89	11	0.39	0.44	24.44	Clay soft khaky	
							0.50	0.56	25.00	Clay stone and calcarious veins plant fossils ,dirty white matrixs is calcarious white	vertical fracture
CB - 5	25.00	26.00	1.00	0.89	89	11	0.29	0.33	25.33	-Do-	
							0.60	0.67	26.00	Clay khaky grey soft	
CB - 5	26.00	27.00	1.00	0.92	92	8	0.28	0.30	26.30	Sandstone mgd argillaceous khaky grey	
							0.29	0.32	26.62	sandy clay khaky	
							0.35	0.38	27.00	claystone with sandstone mgd cal matrixs	
CB - 5	27.00	28.00	1.00	0.92	92	8	0.92	1.00	28.00	clay stone aranaceous hard compact dark grey vfg	
CB - 5,6	28.00	29.00	1.00	0.98	98	2	0.98	1.00	29.00	Sandy clay soft dirty yellow	
CB - 6	29.00	30.00	1.00	0.90	90	10	0.90	1.00	30.00	Do + Sand grains angular	

Borehole closed at 30.00 m on 02-08-2025
Number of core boxes: 6
Recovery lenth: 25.37 %
Run lenth: 1.00 to 30.00 (30.00 m)
Recovery pencentage: 84.56

Title of the Project	**Reconnaissance Survey G4 stage for Bauxite, Ga, V, Ti & REE in Lakhond Area, Kachchh dist, Gujarat.**
Field Season:	2025
Borehole No	LKD - BH - 03
Location	Lakhond, Gujarat
Latitude	23°15'21.0114"
Longitude	69°48'02.1340"
Angle	Vertical
Collar Rl	118.23
Date of Commencement	17-09-2025
Date of Closing	19-09-2025
Total Depth	30.00

CoreBox No	From	To	Thincknes	Rec Thincknes	Core Recovery (%)	Core loss (%)	Unit Length	Ext. Length	Floor Depths	Description (Lithology color, Texture)	Remarks

CB - 1	0.00	1.00	1.00	0.65	65	35	0.65	1.00	1.00	yellowish white weathered laterite iron concretions	
CB - 1	1.00	2.00	1.00	0.76	76	24	0.35	0.46	1.46	weathered laterite	
							0.41	0.54	2.00	white argillaceous sandstone friable fgd mgd feldspathic	
CB - 1	2.00	3.00	1.00	0.60	60	40	0.60	1.00	3.00	-Do-	
CB - 1	3.00	4.00	1.00	0.97	97	3	0.97	1.00	4.00	-Do-	
CB - 1	4.00	5.00	1.00	0.81	81	19	0.31	0.38	4.38	-Do-	
							0.50	0.62	5.00	whitish pink soft friable fgd mgd argillaceous sandstone	
CB - 1	5.00	6.00	1.00	0.93	93	7	0.93	1.00	6.00	friable sandstone fine to medium grained	
CB - 1	6.00	7.00	1.00	0.99	99	1	0.85	0.86	6.86	friable sandstone whitish grey color fine to medium grained	
							0.14	0.14	7.00	reddish brown fgd - mgd ferrugenious sandstone	
CB - 2	7.00	8.00	1.00	0.90	90	10	0.83	0.92	7.92	reddish brown fgd - mgd friable sandstone	

							0.07	0.08	8.00	reddish brown fgd - mgd ferrugenious sandstone	
CB - 2	8.00	9.00	1.00	0.99	99	1	0.41	0.41	8.41	-Do-	
							0.31	0.31	8.72	reddish argillaceous sandstone lateritic	
							0.27	0.27	9.00	pinkish white friable argillaceous sandstone	
CB - 2	9.00	10.00	1.00	0.98	98	2	0.98	1.00	10.00	pinkish argillaceous sandstone	
CB - 2	10.00	11.00	1.00	0.98	98	2	0.98	1.00	11.00	mgd - cgd friable sandstone	
CB - 2	11.00	12.00	1.00	0.90	90	10	0.90	1.00	12.00	pinkish white argillaceous sandstone friable fgd to mgd	
CB - 3	12.00	13.00	1.00	0.99	99	1	0.78	0.79	12.79	dirty white fgd mgd argillaceous friable sandstone	
							0.21	0.21	13.00	friable pink argillaceous sandstone	

CB - 3	13.00	14.00	1.00	0.99	99	1	0.99	1.00	14.00	yellowish brown medium to coarse grained loose friable sandstone	
CB - 3	14.00	15.00	1.00	0.98	98	2	0.65	0.66	14.66	-Do-	
							0.33	0.34	15.00	white friable mgd cgd sandstone	
CB - 3	15.00	16.00	1.00	0.98	98	2	0.52	0.53	15.53	mgd -cgd sandstone light red color	
							0.46	0.47	16.00	dirty white friable sandstone with in middle of red argillaceous sandstone	
CB - 3	16.00	17.00	1.00	0.95	95	5	0.95	1.00	17.00	fgd - mgd pinkish white friable Argillaceous sandstone	
CB - 4	17.00	18.00	1.00	0.99	99	1	0.75	0.76	17.76	pinkish brown sandstone	
							0.24	0.24	18.00	-Do-	
CB - 4	18.00	19.00	1.00	0.98	98	2	0.98	1.00	19.00	pinkish white mgd - cgd friable sandstone	
CB - 4	19.00	20.00	1.00	0.98	98	2	0.98	1.00	20.00	-Do-	
CB - 4	20.00	21.00	1.00	0.90	90	10	0.90	1.00	21.00	-Do-	

CB - 4	21.00	22.00	1.00	0.80	80	20	0.80	1.00	22.00	fgd argillaceous sandstone, dirty white. Friable	
CB - 5	22.00	23.00	1.00	0.97	97	3	0.97	1.00	23.00	-Do-	
CB - 5	23.00	24.00	1.00	0.90	90	10	0.30	0.33	23.33	-Do-	
							0.60	0.67	24.00	-Do-	
CB - 5	24.00	25.00	1.00	0.89	89	11	0.29	0.33	24.33	-Do-	
							0.60	0.67	25.00	-Do-	
CB - 5	25.00	26.00	1.00	0.98	98	2	0.38	0.39	25.39	-Do-	
CB - 5							0.60	0.61	26.00	-Do-	
CB - 5	26.00	27.00	1.00	0.98	98	2	0.98	1.00	27.00	cgd yellowish brown argillaceous sandstone Friable	
CB - 6	27.00	28.00	1.00	0.61	61	39	0.40	0.66	27.66	mgd cgd yellowish brown sandstone	friable
							0.21	0.31	28.00	-Do-	
CB - 6	28.00	29.00	1.00	0.58	58	42	0.58	1.00	29.00	fgd mgd yellowish brown friable argillaceous sandstone	friable
CB - 6	29.00	30.00	1.00	0.72	72	28	0.72	1.00	30.00	yellowish white friable sandstone	friable
Borehole closed at 30.00 m on 19-09-2025											
Number of core boxes: 6											
Recovery lenth: 25.98 m											
Run lenth: 1.00 to 30.00 (30 m)											
Recovery pencentage: 89.58 %											

Title of the Project	**Reconnaissance Survey G4 stage for Bauxite, Ga, V, Ti & REE in Lakhond Area, Kachchh dist, Gujarat.**
Field Season:	2025
Borehole No	LKD - BH - 04
Location	Lakhond, Gujarat
Latitude	23°15'15.7195"
Longitude	69°47'20.1922"
Angle	Vertical
Collar Rl	118.23
Date of Commencement	20-09-2025
Date of Closing	21-09-2025
Total Depth	11.00

Corebox No	**From**	**To**	**Thincknes**	**Rec Thincknes**	**Rec (%)**	**Core loss (%)**	**Unit Length**	**Ext. Length**	**Floor Depths**	**Description (Lithology color, Texture)**	**Remarks**
CB - 1	0.00	1.00	1.00	0.95	95	5	0.95	1.00	1.00	Laterite brown	
CB - 1	1.00	2.00	1.00	0.98	98	2	0.98	1.00	2.00	-Do-	
CB - 1	2.00	3.00	1.00	0.97	97	3	0.80	0.82	2.82	fine grained pinkish white sandstone with clay bands	
							0.17	0.18	3.00	pinkish white fgd mgd argillaceous sandstone	
CB - 1	3.00	4.00	1.00	0.92	92	8	0.59	0.64	3.64	yellowish brown argillaceous sandstone	
							0.33	0.36	4.00	y/w Gritty sandstone	

CB - 1	4.00	5.00	1.00	0.93	93	7	0.49	0.53	4.53	white mgd argillaceous sandstone	
							0.44	0.47	5.00	y/w Gritty sandstone	
CB - 1	5.00	6.00	1.00	0.92	92	8	0.92	1.00	6.00	yellowish white friable sandstone	
CB - 2	6.00	7.00	1.00	0.97	97	3	0.97	1.00	7.00	clay stone with iron concretions	
CB - 2	7.00	8.00	1.00	0.79	79	21	0.53	0.67	7.67	argillaceous sandstone	
							0.26	0.33	8.00	Clay	
CB - 2	8.00	9.00	1.00	0.85	85	15	0.85	1.00	9.00	loose friable sandstone	sludge
CB - 2	9.00	10.00	1.00	0.93	93	7	0.93	1.00	10.00	-Do-	sludge
CB - 3	10.00	11.00	1.00	0.98	98	2	0.98	1.00	11.00	loose friable sandstone	sludge

Borehole closed at 11.00 m on 21-09-2025

Number of core boxes: 3

Recovery lenth: 7.43 m

Run lenth: 0.00 to 8.00 m

Recovery pencentage: 92.87 %

The borehole is closed at 11.0m depth due to no core recovery from 8.00m to 11.00m friable/ loose sand. There is a tendency of jamming the rods & water loss. Hence stopped drilling.
However the desired lateritic portion on the top is recovered

Annexure: VIII: Statement showing analytical details of major oxides (by XRF) of 36 drill core samples in Lakhond Area, Dist: Kachchh, Gujarat

S. N0	From	To	Core Length	Sample No	Lithology	Formation	SiO2	Al2O3	Fe2O3	MnO	MgO	CaO	Na2O	K2O	TiO2	P2O5	LOI	V(ppm)
							(%)											
1	1.00	2.00	1.00	D/LKD- BH-01/01	Clay Arenaceous varigated	Sandhan	56.60	24.63	2.51	0.01	0.58	1.84	2.64	0.66	1.61	0.13	8.07	68.6
2	2.00	3.00	1.00	D/LKD- BH-01/02	Clay Arenaceous	Sandhan	60.90	21.33	3.76	0.02	0.46	2.75	1.10	0.80	1.48	0.06	6.64	83.3
3	3.00	4.45	1.45	D/LKD- BH-01/03	Clay Arenaceous	Sandhan	67.34	16.39	5.34	0.02	0.30	0.69	1.01	0.81	1.71	0.05	5.86	89.1
4	4.45	5.74	1.29	D/LKD- BH-01/04	Clay	Sandhan	43.36	27.93	6.89	0.09	0.48	4.83	1.38	0.72	3.55	0.06	10.21	140.3
5	5.74	9.52	3.78	D/LKD- BH-01/05	Sandy Clay	Sandhan	34.26	36.82	3.01	0.01	0.29	2.13	1.25	0.34	4.50	0.12	16.79	199.1
6	9.52	12.78	3.26	D/LKD- BH-01/06	Sandy clay pinkish white	Sandhan	41.50	35.93	2.20	0.01	0.14	0.26	0.33	0.15	4.75	0.24	14.00	194.9
7	12.78	18.00	5.22	D/LKD- BH-01/07	Clay Arenaceous Varigated	Sandhan	42.17	32.38	8.59	0.01	0.16	0.56	0.21	0.08	4.12	0.11	11.11	251.S
0	18.00	21.00	3.00	D/LKD- BH-01/08	Clay Arenaceous Varigated	Sandhan	39.18	30.65	13.71	0.01	0.16	0.49	0.21	0.05	4.17	0.11	10.65	227.7
9	21.00	25.00	4.00	D/LKD- BH-01/09	Sandy Clay	Sandhan	44.96	33.85	4.49	0.01	0.19	0.24	0.25	0.08	4.72	0.13	10.54	204.9
10	25.00	29.00	4.00	D/LKD- BH-01/10	Argillaceous sandstone	Sandhan	41.58	33.50	6.96	0.02	0.20	0.15	0.26	0.06	5.23	0.19	11.47	243.7
11	29.00	30.00	1.00	D/LKD- BH-01/11	Argillaceous sandstone	Sandhan	39.35	30.35	14.69	0.01	0.15	0.15	0.31	0.06	3.34	0.38	10.71	168.5
						Min	**34.26**	**16.39**	**2.20**	**0.01**	**0.14**	**0.15**	**0.21**	**0.05**	**1.48**	**0.05**	**5.86**	**68.60**
						Max	**67.34**	**36.82**	**14.69**	**0.09**	**0.58**	**4.83**	**2.64**	**0.81**	**5.23**	**0.38**	**16.79**	**243.70**
						Average	**47.14**	**29.00**	**6.85**	**0.02**	**0.29**	**1.47**	**0.91**	**0.36**	**3.53**	**0.15**	**10.67**	**161.03**

S.N0	From	To	Core Length	Sample No	Lithology	Formation	SiO2	Al2O3	Fe2O3	MnO	MgO	CaO	Na2O	K2O	TiO2	P2O5	LOI	V(ppm)
							(%)											
12	0.00	1.32	1.32	D/LKD- BH-02/01	Sandy clay	Bhuj	18.59	17.17	36.93	0.03	0.48	0.81	2.82	0.02	9.87	1.57	11.2S	483.6
13	1.32	2.22	0.90	D/LKD- BH-02/02	Sandy clay	Bhuj	32.60	28.90	17.64	0.05	0.40	0.72	0.96	0.01	5.3S	0.59	12.29	247.5
14	2.22	5.00	2.78	D/LKD- BH-02/03	Argillaceous sandstone Pinkish yellow	Bhuj	32.31	27.57	20.43	0.10	0.42	0.32	0.93	0.01	6.03	0.54	10.79	335.4
15	5.00	7.43	2.43	D/LKD- BH-02/04	Argillaceous sandstone Pinkish yellow	Bhuj	27.80	19.70	26.66	0.08	1.36	2.80	0.65	0.09	7.78	0.82	11.49	474.5
16	7.43	7.93	0.50	D/LKD- BH-02/05	Sandstone Argillaceous	Bhuj	36.00	19.11	20.99	0.04	0.80	0.59	1.63	0.30	7.18	0.34	12.78	210.7
17	7.93	9.00	1.07	D/LKD- BH-02/06	Sandstone Argillaceous	Bhuj	29.73	23.51	23.57	0.06	1.03	1.00	0.65	0.21	7.29	0.77	11.39	506.7
18	9.00	12.46	3.46	D/LKD- BH-02/07	Gritty sandstone and Calc Veins	Bhuj	48.32	11.46	15.91	0.07	4.79	1.71	1.23	1.11	3.56	0.90	10.16	167.8
19	12.46	14.30	1.84	D/LKD- BH-02/08	Sandy clay, Gritty sandstone greenish grey	Bhuj	44.77	9.24	12.13	0.29	7.86	S.49	1.10	0.95	2.90	0.66	14.03	126.3
20	14.30	18.73	4.43	D/LKD- BH-02/09	Gritty sandstone, Calc veins	Bhuj	42.03	8.48	10.43	0.14	15.10	0.51	5.20	1.14	2.37	0.48	13.74	126.7
21	18.73	24.00	5.27	D/LKD- BH-02/10	Gritty yellowish brown, clay stone	Bhuj	43.42	8.22	10.59	0.06	16.69	0.57	3.35	1.13	2.55	0.56	12.44	142.4
22	24.00	27.00	3.00	D/LKD- BH-02/11	Clay stone, Clay	Bhuj	43.29	8.52	10.76	0.05	17.12	0.41	2.44	1.04	2.43	0.49	12.98	134.1
						Min	**18.59**	**8.22**	**10.43**	**0.03**	**0.40**	**0.32**	**0.65**	**0.01**	**2.37**	**0.34**	**10.16**	**126.30**

						Max	**48.32**	**28.90**	**36.93**	**0.29**	**17.12**	**2.80**	**5.20**	**1.14**	**9.87**	**1.57**	**14.03**	**506.70**
						Average	**36.26**	**16.53**	**18.73**	**0.09**	**6.00**	**0.94**	**1.91**	**0.55**	**5.20**	**0.70**	**12.21**	**268.70**
S.N0	**From**	**To**	**Core Length**	**Sample No**	**Lithology**	**Formation**	**SiO2**	**Al2O3**	**Fe2O3**	**MnO**	**MgO**	**CaO**	**Na2O**	**K2O**	**TiO2**	**P2O5**	**LOI**	**V(ppm)**
							(%)											
23	0.00	1.00	1.00	D/LKD - BH - 03/01	Weathered laterite	Bhuj	29.33	24.72	25.52	0.02	0.35	3.90	0.28	0.28	2.26	0.11	12.74	872.3
24	1.00	1.46	0.46	D/LKD - BH - 03/02	Sandstone argillaceous	Bhuj	33.92	29.48	17.55	0.01	0.23	1.87	0.21	0.29	2.97	0.12	12.83	898.6
25	1.46	4.00	2.54	D/LKD - BH - 03/03	Argillaceous sandstone	Bhuj	46.13	34.51	1.26	0.01	0.17	1.13	0.20	0.18	4.21	0.23	11.49	153.7
26	4.00	5.00	1.00	D/LKD - BH - 03/04	Argillaceous sandstone	Bhuj	60.1	26.20	1.28	0.01	0.11	1.30	0.32	0.05	2.12	0.42	6.78	78.1
27	8.41	10.00	1.59	D/LKD - BH - 03/05	Pinkish yellow Argillaceous sandstone	Bhuj	48.47	32.16	6.77	0.01	0.19	0.47	0.26	0.08	0.71	0.25	10.10	351.4
28	10.00	13.00	3.00	D/LKD - BH - 03/06	Pinkish white Argillaceous sandstone	Bhuj	60.25	26.59	3.08	0.01	0.15	0.83	0.39	0.06	2.00	0.09	6.12	166.4
29	16.00	20.00	4.00	D/LKD - BH - 03/08	Fine to medium grained sandstone	Bhuj	62.30	25.52	2.88	0.01	0.13	0.40	0.30	0.16	1.49	0.13	6.23	95.3
30	26.00	27.66	1.66	D/LKD - BH - 03/11	Sandstone argillaceous fine grained Dirty white	Bhuj	74.43	16.59	2.72	0.01	0.09	1.05	0.21	0.06	0.39	0.06	4.17	34.5
						Min	**29.33**	**16.59**	**1.26**	**0.01**	**0.09**	**0.40**	**0.20**	**0.05**	**0.39**	**0.06**	**4.17**	**34.50**
						Max	**74.43**	**34.51**	**25.52**	**0.02**	**0.35**	**3.90**	**0.39**	**0.29**	**4.21**	**0.42**	**12.83**	**898.60**
						Average	**51.87**	**26.97**	**7.63**	**0.01**	**0.18**	**1.37**	**0.27**	**0.15**	**2.02**	**0.18**	**8.81**	**331.29**
S.N0	**From**	**To**	**Core Length**	**Sample No**	**Lithology**	**Formation**	**SiO2**	**Al2O3**	**Fe2O3**	**MnO**	**MgO**	**CaO**	**Na2O**	**K2O**	**TiO2**	**P2O5**	**LOI**	**V(ppm)**
							(%)											

31	0.00	1.00	1.00	D/LKD - BH - 04/01	Laterite red	Bhuj	50.12	18.81	9.71	0.03	0.67	8.91	0.27	0.59	1.41	0.1	9.05	133.9
32	1.00	2.00	1.00	D/LKD - BH - 04/02	Laterite Red	Bhuj	50.06	17.44	9.07	0.02	0.49	10.8	0.21	0.38	1.45	0.1	9.61	129.8
33	2.00	2.82	0.82	D/LKD-BH - 04/03	Sandstone pinkish white	Bhuj	33.55	25.39	10.53	0.01	0.31	11.04	0.12	0.15	0.55	0.06	17.97	366.6
34	2.82	3.64	0.82	D/LKD-BH - 04/04	wihite Argillaceous sandstone	Bhuj	41.17	27.48	4.99	0.01	0.36	10.07	0.17	0.25	0.82	0.07	14.26	195.3
35	3.64	4.54	0.90	D/LKD-BH - 04/05	yellowish white sandstone	Bhuj	63.71	23.21	3.93	0.01	0.26	1.55	0.25	0.31	0.94	0.06	5.52	149.7
36	6.00	7.67	1.67	D/LKD-BH - 04/06	Clay stone dirty white	Bhuj	69.34	18.41	4.26	0.01	0.24	0.75	0.3	0.31	1.45	0.06	4.43	95.9
						Min	**33.55**	**17.44**	**3.93**	**0.01**	**0.24**	**0.75**	**0.12**	**0.15**	**0.55**	**0.06**	**4.43**	**95.9**
						Max	**69.34**	**27.48**	**10.53**	**0.03**	**0.67**	**11.04**	**0.3**	**0.59**	**1.45**	**0.1**	**17.97**	**366.6**
						Average	**51.325**	**21.79**	**7.08**	**0.02**	**0.39**	**7.19**	**0.22**	**0.33**	**1.10**	**0.08**	**10.14**	**178.53**

ANNEXURE - IX : STATEMENT SHOWING VALUES OF REE, GALLIUM, THORIUM, URANIUM (BY ICPMS) IN DRILL CORE SAMPLES OF LAKHOND AREA, KACHCHH DISTRICT, GUJARAT

S.No	Reg no	Sample ID	From	To	Core Length	Lithology	Formation	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Total REE	Sc	Y	Total REE + SC, Y	Th	U	Ga
								(ppm)																				
		LKD - BH - 01																										
1	6538/01	D/LKD-BH-01/01	1.00	2.00	1.00	Clay Arenaceous	Sandhan	57.1	129.6	15.3	127.9	6.5	1.2	7.3	<1.0	2.2	<1.0	7.9	<1.0	2.1	<1.0	**357.1**	17.6	10.8	**385.5**	33.0	<1.0	32.0
2	6538/03	D/LKD-BH-01/03	3.00	4.45	1.45	Clay Arenaceous	Sandhan	43.0	87.7	13.6	104.2	5.0	<1.0	10.1	<1.0	2.8	<1.0	7.8	<1.0	3.3	1.2	**278.7**	12.9	15.9	**307.5**	58.9	7.5	29.0
3	6538/05	D/LKD-BH-01/05	5.74	9.52	3.78	Sandy Clay	Sandhan	61.8	141.7	18.3	258.4	12.3	3.1	12.8	<1.0	4.4	<1.0	19.2	<1.0	2.6	<1.0	**534.6**	20.6	13.0	**568.2**	39.8	<1.0	43.1
4	6538/09	D/LKD-BH-01/09	21.00	25.00	4.00	Sandy Clay	Sandhan	96.6	180.5	23.0	272.0	6.8	1.9	12.6	<1.0	2.6	<1.0	22.5	<1.0	2.7	2.4	**623.6**	26.2	12.1	**661.9**	69.2	<1.0	35.7
							Min	43.0	87.7	13.6	104.2	5.0	1.2	7.3	0.0	2.2	0.0	7.8	0.0	2.1	1.2	**278.7**	12.9	10.8	**307.5**	33.0	7.5	29.0
						Sandhan Formation	**Max**	96.6	180.5	23.0	272.0	12.3	3.1	12.8	0.0	4.4	0.0	22.5	0.0	3.3	2.4	**623.6**	26.2	15.9	**661.9**	69.2	7.5	43.1
							Average	64.6	134.9	17.6	190.6	7.7	2.1	10.7	#DIV/0!	3.0	#DIV/0!	14.4	#DIV/0!	2.7	1.8	**448.5**	19.3	13.0	**480.8**	50.2	7.5	35.0
		LKD - BH - 02																										
5	6538/16	D/LKD-BH-02/05	7.43	7.93	**0.50**	Sandstone Argillaceous	Bhuj	46.1	97.2	28.0	364.1	10.5	2.4	37.4	<1.0	5.8	<1.0	35.2	<1.0	5.2	4.1	**636.0**	28.6	15.3	**679.9**	184.5	50.3	17.9
6	6538/18	D/LKD-BH-02/07	9.00	12.46	**3.46**	Gritty sandstone and Calc Veins	Bhuj	81.8	141.9	29.8	252.5	13.8	3.8	32.4	<1.0	6.7	<1.0	20.1	<1.0	5	3.4	**591.5**	19.4	44.3	**655.2**	129.4	48.3	40.9
7	6538/20	D/LKD-BH-02/09	14.30	18.73	**4.43**	Gritty sandstone, Calc veins	Bhuj	43.2	76.2	20.5	156.9	7.2	1.9	21.0	<1.0	4.0	<1.0	12.4	<1.0	2.7	2.1	**348.1**	13.7	14.4	**376.2**	90.5	54.4	19.3
8	6538/22	D/LKD-BH-02/11	24.00	27.00	**3.00**	Clay stone, Clay	Bhuj	40.4	71.3	18.1	151.7	7.5	1.5	20.1	<1.0	2.8	<1.0	12.0	<1.0	2.5	2.0	**329.9**	13.3	13.9	**357.1**	87.7	38.3	23.1
							Min	40.4	71.3	18.1	151.7	7.2	1.5	20.1	0.0	2.8	0.0	12.0	0.0	2.5	2.0	**329.9**	13.3	13.9	**357.1**	87.7	38.3	17.9
							Max	81.8	141.9	29.8	364.1	13.8	3.8	37.4	0.0	6.7	0.0	35.2	0.0	5.3	4.1	**636.0**	28.6	44.3	**679.9**	184.5	54.4	40.9
							Average	52.9	96.7	24.1	231.3	9.8	2.4	27.7	#DIV/0!	4.8	#DIV/0!	19.9	#DIV/0!	3.9	2.9	**476.4**	18.8	22.0	**517.1**	123.0	47.8	25.3

		LKD - BH - 03																										
9	7472/01	D/LKD - BH - 03/01	0.00	1.00	**1.00**	Weathered laterite	Bhuj	62.3	120.9	32.9	275.1	2.9	18.7	5.6	<1.0	4.5	<1.0	4.7	<1.0	9.0	<1.0	**517.9**	21.0	10.6	**549.5**	243	394.3	47
10	7472/03	D/LKD - BH - 03/03	1.46	4.00	**2.54**	Argillaceous sandstone	Bhuj	173.6	380.6	32.0	538.9	18.6	13.6	13.1	<1.0	11.8	<1.0	1.5	<1.0	3.8	<1.0	**1187.5**	14.7	15.3	**1217.5**	50.5	<1.0	34.8
11	7472/05	D/LKD - BH - 03/05	8.41	10.00	**1.59**	Pinkish yellow Argillaceous sandstone	Bhuj	92.3	224.2	<1.0	257.7	23.5	13.1	21.6	<1.0	13.2	<1.0	3.5	<1.0	5.5	<1.0	**654.6**	16.5	24.7	**695.8**	73.7	70.4	28.8
12	7472/06	D/LKD - BH - 03/06	10.00	13.00	**3.00**	Pinkish white Argillaceous sandstone	Bhuj	43.8	101.9	8.8	244.4	4.4	5.0	5.1	<1.0	3.7	<1.0	0.9	<1.0	3.8	<1.0	**421.8**	14.8	9.0	**445.6**	52.3	<1.0	20.7
							Min	43.8	101.9	8.8	244.4	2.9	5.0	5.1	0.0	3.7	0.0	0.9	0.0	3.8	0.0	**421.8**	14.7	9.0	**445.6**	50.5	70.4	20.7
							Max	173.6	380.6	32.9	538.9	23.5	13.6	21.6	0.0	13.2	0.0	4.7	0.0	9.0	0.0	**1187.5**	21.0	24.7	**1217.5**	243.2	394.3	46.7
							Average	93.0	206.9	24.6	329.0	12.4	10.6	11.4	#DIV/0!	8.3	#DIV/0!	2.7	#DIV/0!	5.5	#DIV/0!	**695.5**	16.8	14.9	**727.1**	104.9	232.4	32.8
		LKD - BH - 04																										
13	7473/01	D/LKD - BH- 04/01	0.00	1.00	**1.00**	Laterite red	Bhuj	54.3	135.2	17.5	213.6	5	21.4	5.3	<1.0	4.4	<1.0	2.2	3.6	4.4	<1.0	**466.9**	11.8	14.0	**492.7**	99.8	87.9	16.3
14	7473/02	D/LKD - BH - 04/02	1.00	2.00	**1.00**	Laterite Red	Bhuj	63.0	160.3	16.1	215.5	4.5	22.9	7.2	<1.0	4.4	<1.0	2.0	4.2	4.2	<1.0	**504.3**	10.4	13.7	**528.4**	100.4	98.9	14.9
15	7473/03	D/LKD - BH - 04/03	2.00	2.82	**0.82**	Sandstone pinkish white	Bhuj	27.6	53.4	11.5	90.2	3.9	26.9	3.3	<1.0	1.9	<1.0	2.2	1.2	4.6	<1.0	**226.7**	9.3	7.8	**243.8**	104.4	163.7	31.3
						Bhuj Formation	**Min**	27.6	53.4	11.5	90.2	3.9	21.4	3.3	0.0	1.9	0.0	2.0	1.2	4.2	0.0	**226.7**	9.3	7.8	**243.8**	99.8	87.9	14.9
							Max	63.0	160.3	17.5	215.5	5.0	26.9	7.2	0.0	4.4	0.0	2.2	4.2	4.6	0.0	**504.3**	11.8	14.0	**528.4**	104.4	163.7	31.3
							Average	48.3	116.3	15.0	173.1	4.5	23.7	5.3	#DIV/0!	3.6	#DIV/0!	2.1	3.0	4.4	#DIV/0!	**399.3**	10.5	11.8	**421.6**	101.5	116.8	20.8

Annexure - X: Analytical results of THA, MHA and Reactive silica in Lakhond area, Kachchh Dist, Gujarat

S.no	Lab code	Sample no	%THA	%MHA	% Reactive SiO2
1	1202/50	T3/LB/2025/06	34.68	7.21	27.98
2	1202/67	T4/LB/2025/06	18.39	2.26	30.25

Annexure-XI: Analytical results of Primary & check samples of Pit & Trench (Oxides) in Lakhond area, Kachchh District, Gujarat

S.no	Reg No	Sample name	SiO2	Al2O3	Fe2O3	MnO	MgO	CaO	Na2O	K2O	TiO2	P2O5	LOI	Remarks
			(%)											
1	1203/13	P12/LB/2025	61.083	16.818	7.252	0.021	0.604	1.095	1.380	0.432	2.623	0.043	8.510	Lucid lab
1	G2296-10	P25/LB/2025	55.10	26.92	0.57	<0.05	0.30	2.12	0.26	<0.05	3.92	0.13	10.13	Shiva lab
2	1203/24	T1/LB/2025/10	43.347	33.181	2.041	0.021	0.243	1.491	0.154	0.192	4.563	0.095	14.560	Lucid lab
2	G2296-13	T11/LB/2025/10	57.17	20.69	2.07	<0.05	0.29	3.91	<0.08	0.20	3.58	0.09	11.46	Shiva lab
3	1203/42	T2/LB/2025/C	43.014	23.968	3.079	0.010	0.315	8.958	0.139	0.268	2.446	0.067	17.700	Lucid lab
3	G2296-14	T12/LB/2025/C	53.57	15.20	3.01	<0.05	0.27	10.77	<0.08	0.26	2.12	0.06	14.42	Shiva lab
4	1203/44	P15/LB/2025	43.005	35.150	0.992	0.010	0.206	0.933	0.370	0.028	3.850	0.099	15.290	Lucid lab
4	G2296-11	P26/LB/2025	58.38	10.96	6.76	0.08	3.23	4.39	0.78	0.76	1.26	<0.05	12.82	Shiva lab
5	1203/47	T3/LB/2025/03	24.300	46.010	2.736	0.020	0.069	0.234	0.221	0.136	4.282	0.083	21.650	Lucid lab
5	G2296-15	T13/LB/2025/03	25.33	44.29	2.31	<0.05	0.21	0.39	0.13	0.21	3.98	0.11	21.87	Shiva lab
6	1203/60	P17/LB/2025	38.069	14.402	24.190	0.026	0.011	0.745	0.391	0.017	8.350	0.431	13.170	Lucid lab

6	G2296-12	P27/LB/2025	23.14	20.15	30.04	<0.05	0.69	0.90	0.28	<0.05	9.11	0.88	14.00	Shiva lab
7	1203/66	T4/LB/2025/05	35.867	23.045	15.266	0.010	0.038	1.543	0.148	0.012	9.592	0.412	13.940	Lucid lab
7	G2296-16	T14/LB/2025/05	29.96	19.59	22.37	<0.05	0.34	4.37	<0.08	<0.05	7.63	0.87	14.19	Shiva lab
8	1203/69	T4/LB/2025/08	34.550	21.057	18.743	0.016	0.046	1.698	0.169	0.035	9.406	0.427	13.620	Lucid lab
8	G2296-17	T15/LB/2025/08	26.96	18.87	28.40	<0.05	0.45	2.21	0.09	<0.05	7.54	0.91	13.92	Shiva lab
9	1203/80	T5/LB/2025/03	70.989	2.517	13.202	0.149	1.692	0.479	1.238	0.523	2.071	0.079	6.870	Lucid lab
9	G2296-18	T16/LB/2025/03	68.75	7.97	10.88	0.20	0.93	0.52	0.67	0.66	1.64	0.09	7.21	Shiva lab
10	1203/67	T4/LB/2025/06	36.390	21.781	19.789	0.014	0.037	1.245	0.179	0.012	7.720	0.408	12.170	Lucid lab
10	G2296-28	T41/LB/2025/6	26.75	20.42	27.94	<0.05	0.34	2.05	0.09	<0.05	7.85	0.91	13.08	Shiva lab

Annexure: XII Analytical results of Primary and check samples in pit & Trench (REE, Gallium) in Lakhond area, Kachchh District, Gujarat

S.No	Reg No	Sample No	La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Sc	Y	Th	U	Ga	Remarks
			(ppm)																				
1	1203/60	P17/LB/2025	137.50	298.58	71.48	530.03	—	41.33	9.58	58.25	<1.0	14.30	<1.0	46.18	<1.0	2.80	4.43	49.10	38.35	182.48	48.23	50.85	Lucid lab
1	G2296-12	P27/LB/2025	195.00	512.00	47.00	203.00	—	42.70	13.30	48.05	4.56	19.08	2.44	5.73	0.57	3.14	<0.5	60.05	49.00	18.06	5.54	28.05	Shiva lab
2	1203/67	T4/LB/2025/06	217.03	395.38	84.30	565.65	—	52.45	13.60	68.95	<1.0	21.15	<1.0	43.93	<1.0	3.00	4.18	45.80	39.83	158.25	36.03	47.43	Lucid lab
2	G2296-28	T41/LB/2025/06	299.00	498.00	44.05	185.00	—	39.04	13.00	48.09	4.80	21.06	2.65	5.91	0.59	3.75	<0.5	58.08	42.08	17.06	4.99	28.06	Shiva lab

Annexure-XIII: Analytical results of Primary & check samples of drill cores (Oxides) in Lakhond area, Kachchh District, Gujarat

S.no	Reg No	Sample name	SiO2	Al2O3	Fe2O3	MnO	MgO	CaO	Na2O	K2O	TiO2	P2O5	LOI	Remarks
			(%)											
1	LL/25-26/006538-01	D/LKD- BH-01/05	34.26	36.82	3.01	0.01	0.29	2.13	1.25	0.34	4.50	0.12	16.79	Lucid lab
1	G3256-11	D/LKD-BH-01/61	36.23	31.35	3.26	0.00	0.26	2.60	0.48	0.33	3.49	0.10	19.38	Shiva lab
2	LL/25-26/006558-13	D/LKD- BH-02/02	32.60	28.90	17.64	0.05	0.40	0.72	0.96	0.01	5.35	0.59	12.29	Lucid lab
2	G3256-12	D/LKD-BH-02/62	30.55	23.66	21.91	<0.05	0.52	0.92	0.21	<0.05	6.12	0.83	14.76	Shiva lab
3	LL/25-26/007472-03	D/LKD - BH - 03/03	46.13	34.51	1.26	0.01	0.17	1.13	0.2	0.18	4.21	0.23	11.49	Lucid lab
3	G3256-13	D/LKD-BH-03/63	57.73	23.97	1.29	<0.05	0.16	1.32	<0.08	0.13	3.89	0.17	10.87	Shiva lab
4	LL/25-26/007473-01	D/LKD - BH - 04/01	50.12	18.81	9.71	0.03	0.67	8.91	0.27	0.59	1.41	0.1	9.05	Lucid lab
4	G3256-14	D/LKD-BH-04/64	72.24	6.84	7.31	<0.05	0.25	4.05	<0.08	0.29	1.18	0.06	7.44	Shiva lab

Annexure-XIV: Analytical results of Primary & check samples of drill cores REE, Ga, V Values of borehole samples, Lakhond area

S.No	Sample ID	Reg no	La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Sc	Y	U	Ga	Remarks
			(ppm)																			
1	D/LKD-BH-01/05	6538/05	61.8	141.7	18.3	258.4	—	12.3	3.1	12.8	<1.0	4.4	<1.0	19.2	<1.0	2.6	<1.0	20.6	13.0	<1.0	43.1	Lucid lab
1	D/LKD-BH-01/61	G3256-11	65.09	144.46	17.53	71.68	—	13.81	2.82	9.67	1.06	4.89	0.68	1.91	<0.5	1.38	<0.5	25.36	14.04	2.10	33.97	Shiva lab
2	D/LKD-BH-04/01	7473/01	54.3	135.2	17.5	214	—	5	21	5.3	<1.0	4.4	<1.0	2.2	3.6	4.4	<1.0	11.8	14	88	16.3	Lucid lab
2	D/LKD-BH-04/64	G3256-14	62.57	119.97	13.34	49.22	—	8.24	0.73	7.26	0.63	3.46	0.54	1.62	<0.5	1.52	<0.5	8.88	15.18	1.74	11.24	Shiva lab

ANNEXURE – XV

Statement showing details of Pit & Trench sample analysis of Major oxides & REE in Lakhond 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/25-26/001203 (1-92)
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 : Lakhond,
Sample Qty : 500g x 92 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/25-26/001203/01	P1/LB/2025	61.80	16.31	8.63	0.03	0.78	0.74	0.18	0.76	1.69	0.09	93.70	8.72
02	LL/25-26/001203/02	P2/LB/2025	52.60	29.29	7.35	0.09	0.23	0.32	0.04	0.0	0.52	0.35	206.18	8.99
03	LL/25-26/001203/03	P3/LB/2025	33.99	28.59	20.23	0.05	0.37	1.01	0.38	0.55	1.48	0.18	199.78	12.96
04	LL/25-26/001203/04	P4/LB/2025	86.10	0.10	9.10	0.01	0.24	0.17	0.09	0.21	2.04	0.05	119.20	1.63
05	LL/25-26/001203/05	P5/LB/2025	37.04	25.87	12.70	0.03	0.71	5.17	0.07	0.46	0.59	0.25	361.60	16.95
06	LL/25-26/001203/06	P6/LB/2025	46.90	10.40	7.15	0.01	0.67	15.68	0.08	0.34	1.21	0.08	123.80	17.38
07	LL/25-26/001203/07	P7/LB/2025	50.05	23.38	2.03	0.01	0.43	7.00	0.22	0.15	2.12	0.04	113.40	14.31
08	LL/25-26/001203/08	P8/LB/2025	46.04	39.34	2.43	0.01	0.13	0.36	0.06	0.10	0.68	0.02	53.40	10.68
09	LL/25-26/001203/09	P9/LB/2025	49.52	25.21	10.75	0.03	0.81	1.43	0.10	0.39	0.65	0.04	106.80	10.77
10	LL/25-26/001203/10	P10/LB/2025/A	72.63	17.13	1.20	0.01	0.18	0.12	0.26	0.16	2.23	0.02	102.13	5.88
11	LL/25-26/001203/11	P10/LB/2025/B	57.88	28.27	1.80	0.01	0.17	0.12	0.25	0.1	2.90	0.04	143.23	8.29
12	LL/25-26/001203/12	P11/LB/2025	53.89	27.94	3.79	0.02	0.26	0.65	0.14	0.27	3.50	0.09	212.85	9.31
13	LL/25-26/001203/13	P12/LB/2025	61.08	16.81	7.25	0.02	0.60	1.09	1.38	0.43	2.62	0.04	115.10	8.51
14	LL/25-26/001203/14	P13/LB/2025	56.75	15.16	8.85	0.05	1.07	1.42	0.30	7.52	1.73	0.69	175.70	6.25
15	LL/25-26/001203/15	T1/LB/2025/01	66.38	18.46	3.02	0.01	0.38	1.56	0.11	0.14	1.70	0.09	84.10	7.87
16	LL/25-26/001203/16	T1/LB/2025/02	62.68	21.08	2.37	0.02	0.68	1.89	0.16	0.24	1.76	0.10	90.30	8.78
17	LL/25-26/001203/17	T1/LB/2025/03	57.46	20.60	3.98	0.02	0.45	3.07	0.08	0.22	1.45	0.10	99.00	12.45
18	LL/25-26/001203/18	T1/LB/2025/04	63.21	18.23	4.66	0.03	0.66	2.03	0.11	0.35	1.77	0.12	104.40	8.68
19	LL/25-26/001203/19	T1/LB/2025/05	54.98	23.74	5.74	0.03	0.79	2.05	0.13	0.43	2.07	0.13	123.30	9.76
20	LL/25-26/001203/20	T1/LB/2025/06	80.10	10.68	1.58	0.01	0.31	0.60	0.10	0.12	1.12	0.07	54.20	5.01
21	LL/25-26/001203/21	T1/LB/2025/07	87.75	5.69	1.76	0.01	0.18	0.33	0.09	0.06	0.79	0.06	32.50	3.21
22	LL/25-26/001203/22	T1/LB/2025/08	84.14	9.017	1.02	0.01	0.12	0.23	0.12	0.07	1.02	0.06	35.10	3.97
23	LL/25-26/001203/23	T1/LB/2025/09	62.21	23.53	2.37	0.01	0.43	0.83	0.19	0.17	2.34	0.09	84.50	7.63

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

Page No. 1/4

Reviewed by

Dr.R.Krishna Moorthy
AUTHORISED SIGNATORY

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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/25-26/001203 (1-92)
Report Issue Date : 29.05.2025
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Date of Starting of Analysis : 05.05.2025
Date of Completing of Analysis : 29.05.2025

Sample Particulars: Bauxite Samples.
Customer Ref Letter: CMT/Lucid/01/2025 Dated: 30.04.2025
Block Name : Lakhond,
Sample Qty : 500g x 92 N
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	Aluminium as Al_2O_3	Iron as Fe_2O_3	Manganese as MnO	Magnesium as MgO	Calcium as CaO	Sodium as Na_2O	Potassium as K_2O	Titanium as TiO_2	Phosphorus as P_2O_5	Vanadium as V	Loss on Ignition (LOI)
			(% by mass)	(% by mass)	(% by mass)	(% by mass)	(% by mass)	(% by mass)	(% by mass)	(% by mass)	(% by mass)	(% by mass)	(ppm)	(% by mass)
24	LL/25-26/001203/24	T1/LB/2025/10	43.34	33.18	2.04	0.02	0.24	1.49	0.15	0.19	4.56	0.09	130.70	14.56
25	LL/25-26/001203/25	T1/LB/2025/A	57.03	17.98	7.88	0.01	0.41	3.92	0.11	0.19	1.78	0.21	138.20	10.16
26	LL/25-26/001203/26	T1/LB/2025/B	57.58	25.00	3.00	0.01	0.46	2.45	0.19	0.22	1.66	0.11	137.63	9.12
27	LL/25-26/001203/27	T1/LB/2025/C	48.75	26.24	7.59	0.02	0.63	1.67	0.30	0.27	2.92	0.13	197.70	11.25
28	LL/25-26/001203/28	T1/LB/2025/D	55.62	25.71	3.56	0.01	0.46	2.17	0.21	0.20	2.06	0.10	97.20	9.82
29	LL/25-26/001203/29	P14/LB/2025	39.54	8.72	16.91	0.02	0.93	14.95	0.10	0.46	1.49	0.15	288.08	16.56
30	LL/25-26/001203/30	T2/LB/2025/01	32.06	22.50	23.31	0.02	0.34	4.39	0.09	0.40	2.40	0.09	383.20	14.09
31	LL/25-26/001203/31	T2/LB/2025/02	34.54	19.68	23.50	0.02	0.29	4.65	0.09	0.31	2.02	0.06	340.40	14.60
32	LL/25-26/001203/32	T2/LB/2025/03	32.70	14.97	32.78	0.02	0.26	3.39	0.08	0.27	1.84	0.06	423.40	13.47
33	LL/25-26/001203/33	T2/LB/2025/04	34.29	14.95	30.04	0.02	0.27	4.18	0.08	0.28	1.69	0.06	498.83	13.90
34	LL/25-26/001203/34	T2/LB/2025/05	35.90	17.67	24.11	0.02	0.33	5.06	0.10	0.32	1.84	0.06	315.10	14.30
35	LL/25-26/001203/35	T2/LB/2025/06	36.59	24.87	15.47	0.01	0.25	4.78	0.10	0.29	2.36	0.06	326.20	15.09
36	LL/25-26/001203/36	T2/LB/2025/07	37.89	23.82	15.52	0.02	0.30	5.15	0.11	0.29	2.20	0.06	330.70	14.48
37	LL/25-26/001203/37	T2/LB/2025/08	41.42	30.80	5.22	0.01	0.26	3.87	0.12	0.30	2.94	0.06	156.10	14.85
38	LL/25-26/001203/38	T2/LB/2025/09	43.23	26.38	4.11	0.01	0.31	6.23	0.14	0.29	2.62	0.06	101.20	16.37
39	LL/25-26/001203/39	T2/LB/2025/10	42.63	28.08	3.92	0.01	0.28	5.93	0.14	0.28	2.75	0.06	107.10	15.80
40	LL/25-26/001203/40	T2/LB/2025/A	33.80	19.21	23.97	0.02	0.32	5.45	0.08	0.32	1.97	0.06	270.00	14.65
41	LL/25-26/001203/41	T2/LB/2025/B	37.22	19.01	18.03	0.01	0.36	7.21	0.10	0.32	2.03	0.07	244.10	15.29
42	LL/25-26/001203/42	T2/LB/2025/C	43.01	23.96	3.07	0.01	0.31	8.95	0.13	0.26	2.44	0.06	80.40	17.70
43	LL/25-26/001203/43	T2/LB/2025/D	38.21	18.57	18.54	0.02	0.33	6.69	0.10	0.29	2.06	0.06	242.00	14.90
44	LL/25-26/001203/44	P15/LB/2025	43.00	35.15	0.99	0.01	0.20	0.93	0.37	0.02	3.85	0.09	198.93	15.29
45	LL/25-26/001203/45	T3/LB/2025/01	24.06	46.01	3.18	0.01	0.08	0.58	0.18	0.12	3.97	0.08	241.00	21.63
46	LL/25-26/001203/46	T3/LB/2025/02	25.05	45.42	2.60	0.01	0.08	0.71	0.21	0.12	3.67	0.09	214.30	21.91

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

Reviewed by

Dr.R.Krishna Moorthy
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Page No. 2/4

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

TEST RESULTS OF BAUXITE SAMPLES

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Sample Particulars: Bauxite Samples.
Block Name : Lakhond,
Sample Qty : 500g x 92 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	Aluminium as Al_2O_3	Iron as Fe_2O_3	Manganese as MnO	Magnesium as MgO	Calcium as CaO	Sodium as Na_2O	Potassium as K_2O	Titanium as TiO_2	Phosphorus as P_2O_5	Vanadium as V	Loss on Ignition (LOI)
			(% by mass)	(% by mass)	(% by mass)	(% by mass)	(% by mass)	(% by mass)	(% by mass)	(% by mass)	(% by mass)	(% by mass)	(ppm)	(% by mass)
47	LL/25-26/001203/47	T3/LB/2025/03	24.30	46.01	2.73	0.02	0.06	0.23	0.22	0.13	4.28	0.08	234.30	21.65
48	LL/25-26/001203/48	T3/LB/2025/04	25.00	45.22	2.90	0.01	0.07	0.30	0.27	0.20	3.52	0.12	266.00	22.29
49	LL/25-26/001203/49	T3/LB/2025/05	26.00	45.49	2.73	0.02	0.09	0.43	0.22	0.17	3.94	0.10	238.50	20.75
50	LL/25-26/001203/50	T3/LB/2025/06	28.01	45.05	2.03	0.02	0.16	1.12	0.24	0.20	2.74	0.09	261.33	20.07
51	LL/25-26/001203/51	T3/LB/2025/07	27.31	43.64	3.35	0.02	0.12	0.39	0.21	0.16	3.91	0.09	239.50	20.65
52	LL/25-26/001203/52	T3/LB/2025/08	30.42	42.10	3.05	0.02	0.15	0.19	0.20	0.17	3.72	0.09	214.00	19.73
53	LL/25-26/001203/53	T3/LB/2025/09	31.87	41.07	3.19	0.02	0.22	0.21	0.25	0.28	3.01	0.12	237.20	19.64
54	LL/25-26/001203/54	T3/LB/2025/10	31.17	42.07	2.93	0.02	0.19	0.16	0.21	0.22	2.95	0.09	206.50	19.82
55	LL/25-26/001203/55	T3/LB/2025/A	37.29	37.49	4.66	0.01	0.15	0.83	0.30	0.29	2.56	0.07	293.20	16.20
56	LL/25-26/001203/56	T3/LB/2025/B	31.08	40.64	4.19	0.02	0.13	0.39	0.27	0.22	3.52	0.08	288.00	19.19
57	LL/25-26/001203/57	T3/LB/2025/C	26.99	42.48	5.02	0.02	0.17	0.13	0.28	0.27	3.15	0.12	444.00	21.09
58	LL/25-26/001203/58	T3/LB/2025/D	27.32	43.06	4.40	0.02	0.09	0.53	0.26	0.19	3.39	0.09	302.70	20.58
59	LL/25-26/001203/59	P16/LB/2025	46.00	31.88	8.64	0.16	0.23	0.18	0.08	0.15	1.33	0.15	502.00	11.06
60	LL/25-26/001203/60	P17/LB/2025	38.06	14.40	24.19	0.02	0.01	0.74	0.39	0.01	8.35	0.43	375.83	13.17
61	LL/25-26/001203/61	P18/LB/2025	48.84	22.30	13.29	0.03	0.72	0.64	0.17	0.62	1.50	0.05	133.60	11.53
62	LL/25-26/001203/62	T4/LB/2025/01	38.39	15.18	18.54	0.01	0.05	3.12	0.13	0.03	8.89	0.44	270.80	15.06
63	LL/25-26/001203/63	T4/LB/2025/02	34.68	16.87	18.40	0.01	0.06	4.73	0.14	0.03	8.69	0.49	316.90	15.74
64	LL/25-26/001203/64	T4/LB/2025/03	35.06	23.09	15.21	0.01	0.09	2.70	0.14	0.01	8.05	0.36	230.10	14.96
65	LL/25-26/001203/65	T4/LB/2025/04	33.88	23.34	15.90	0.01	0.12	3.45	0.14	0.01	7.25	0.37	205.20	15.43
66	LL/25-26/001203/66	T4/LB/2025/05	35.86	23.04	15.26	0.01	0.03	1.54	0.14	0.01	9.59	0.41	267.20	13.94
67	LL/25-26/001203/67	T4/LB/2025/06	31.01	28.08	19.18	0.01	0.03	1.04	0.10	0.01	7.72	0.40	502.08	12.17
68	LL/25-26/001203/68	T4/LB/2025/07	37.15	25.25	13.61	0.01	0.09	1.99	0.16	0.01	7.81	0.24	253.20	13.51
69	LL/25-26/001203/69	T4/LB/2025/08	34.55	21.05	18.74	0.01	0.04	1.69	0.16	0.03	9.40	0.42	309.10	13.62

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. 3/4

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

CMT
CRITICAL MINERAL TRACKERS
raashtr pratham

TEST RESULTS OF BAUXITE SAMPLES

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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	Aluminium as Al_2O_3	Iron as Fe_2O_3	Manganese as MnO	Magnesium as MgO	Calcium as CaO	Sodium as Na_2O	Potassium as K_2O	Titanium as TiO_2	Phosphorus as P_2O_5	Vanadium as V	Loss on Ignition (LOI)
			(% by mass)	(% by mass)	(% by mass)	(% by mass)	(% by mass)	(% by mass)	(% by mass)	(% by mass)	(% by mass)	(% by mass)	(ppm)	(% by mass)
70	LL/25-26/001203/70	T4/LB/2025/09	36.35	23.25	15.50	0.01	0.07	1.38	0.16	0.02	8.90	0.40	266.50	13.63
71	LL/25-26/001203/71	T4/LB/2025/10	35.71	26.05	16.06	0.01	0.14	0.90	0.17	0.02	7.08	0.34	268.50	13.37
72	LL/25-26/001203/72	T4/LB/2025/A	38.10	23.82	12.49	0.01	0.06	1.62	0.16	0.01	8.81	0.45	201.90	14.35
73	LL/25-26/001203/73	T4/LB/2025/B	37.61	22.92	14.01	0.01	0.09	2.07	0.16	0.03	8.22	0.33	231.00	14.23
74	LL/25-26/001203/74	T4/LB/2025/C	36.10	26.31	15.00	0.01	0.14	1.43	0.16	0.01	6.89	0.23	276.40	13.59
75	LL/25-26/001203/75	T4/LB/2025/D	38.14	22.00	15.38	0.01	0.11	2.16	0.15	0.01	7.36	0.34	268.60	14.08
76	LL/25-26/001203/76	P19/LB/2025	49.00	23.60	12.42	0.01	0.14	0.60	0.26	0.07	4.39	0.14	147.60	9.19
77	LL/25-26/001203/77	P20/LB/2101	42.34	24.03	17.42	0.01	0.29	1.07	0.12	0.33	2.53	0.04	172.20	11.60
78	LL/25-26/001203/78	T5/LB/2025/01	67.74	3.07	14.28	0.14	1.93	0.67	1.50	0.53	2.01	0.07	197.90	7.73
79	LL/25-26/001203/79	T5/LB/2025/02	66.91	0.50	19.67	0.09	1.67	0.50	1.27	0.49	1.87	0.10	189.90	6.76
80	LL/25-26/001203/80	T5/LB/2025/03	70.98	2.51	13.20	0.14	1.69	0.47	1.23	0.52	2.07	0.07	159.90	6.87
81	LL/25-26/001203/81	T5/LB/2025/04	66.47	1.66	18.94	0.18	1.66	0.41	1.04	0.48	1.61	0.09	197.40	7.21
82	LL/25-26/001203/82	T5/LB/2025/05	68.68	3.71	14.34	0.13	1.78	0.46	0.86	0.51	1.62	0.08	193.43	7.69
83	LL/25-26/001203/83	T5/LB/2025/06	67.07	3.56	15.00	0.11	1.89	0.61	0.83	0.49	1.68	0.07	153.10	8.43
84	LL/25-26/001203/84	T5/LB/2025/07	64.82	3.42	17.61	0.17	1.74	0.52	0.64	0.50	1.84	0.07	175.90	8.35
85	LL/25-26/001203/85	T5/LB/2025/08	63.06	3.97	18.63	0.14	1.81	0.67	0.87	0.51	1.83	0.08	206.50	8.24
86	LL/25-26/001203/86	T5/LB/2025/09	67.60	3.86	14.64	0.15	1.69	0.63	0.75	0.53	1.77	0.07	175.20	8.01
87	LL/25-26/001203/87	T5/LB/2025/10	63.03	3.25	19.65	0.17	1.63	0.47	0.69	0.50	1.85	0.10	216.10	8.48
88	LL/25-26/001203/88	T5/LB/2025/A	67.31	0.77	16.81	0.17	1.60	0.83	1.27	0.44	1.67	0.09	154.40	8.70
89	LL/25-26/001203/89	T5/LB/2025/B	68.59	0.24	16.95	0.15	1.66	0.85	1.24	0.44	1.45	0.08	169.20	8.09
90	LL/25-26/001203/90	T5/LB/2025/C	63.06	2.33	18.08	0.15	1.62	0.91	1.14	0.45	1.55	0.12	185.50	10.36
91	LL/25-26/001203/91	T5/LB/2025/D	61.51	0.92	20.61	0.18	1.72	1.08	1.07	0.46	1.45	0.10	185.00	10.59
92	LL/25-26/001203/92	BRS - 1	51.24	23.23	10.41	0.01	0.48	1.11	0.31	0.68	1.49	0.03	130.80	10.85

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**

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/25-26/001203 (1-15)
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

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

Sample Particulars: Bauxite Samples.
Block Name : Reldi Moti,
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)	Praseodymium 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/25-26/001203/02**	P2/LB/2025	331.05	18.30	7.88	13.60	47.38	<1.0	123.88	1.60	288.60	61.60	64.88	21.98	1.43	55.65	<1.0	6.33	48.70	33.03	17.83
2	**LL/25-26/001203/03**	P3/LB/2025	158.25	5.13	9.30	3.45	34.10	<1.0	70.68	3.70	150.48	46.75	18.65	21.75	<1.0	133.60	<1.0	4.15	27.83	140.63	41.73
3	**LL/25-26/001203/04**	P4/LB/2025	250.50	6.78	11.78	1.58	21.25	<1.0	107.10	2.38	271.73	34.48	16.15	10.45	<1.0	184.78	<1.0	12.98	33.48	32.80	13.10
4	**LL/25-26/001203/09**	P9/LB/2025	70.60	2.13	3.63	1.18	12.88	<1.0	40.65	1.48	60.50	16.68	5.83	10.73	<1.0	57.48	<1.0	1.73	13.48	56.55	28.03
5	**LL/25-26/001203/10**	P10/LB/2025/A	93.98	5.03	12.15	1.50	5.75	<1.0	43.15	<1.0	127.53	9.55	6.28	21.80	<1.0	70.68	<1.0	3.35	23.35	<1.0	20.40
6	**LL/25-26/001203/11**	P10/LB/2025/B	136.13	5.10	14.53	1.48	6.63	<1.0	66.85	<1.0	153.90	13.43	6.10	17.53	<1.0	87.70	<1.0	3.50	27.00	<1.0	27.98
7	**LL/25-26/001203/12**	P11/LB/2025	171.55	6.25	16.98	3.23	11.10	<1.0	73.58	1.10	206.90	22.78	13.70	18.78	<1.0	102.53	<1.0	4.58	30.28	<1.0	29.15
8	**LL/25-26/001203/26**	T1/LB/2025/B	211.53	6.63	10.18	2.98	12.78	<1.0	88.00	1.00	158.50	25.73	13.58	18.60	<1.0	148.53	<1.0	4.03	28.55	<1.0	14.68
9	**LL/25-26/001203/29**	P14/LB/2025	190.35	5.18	9.43	1.83	25.83	<1.0	81.33	3.00	131.13	40.98	13.05	15.43	<1.0	208.45	<1.0	4.53	29.78	96.28	23.38
10	**LL/25-26/001203/33**	T2/LB/2025/04	73.50	2.75	8.95	2.85	42.60	<1.0	45.15	5.43	184.40	49.40	10.55	23.25	<1.0	146.73	<1.0	9.88	18.28	260.18	45.13
11	**LL/25-26/001203/44**	P15/LB/2025	224.35	9.03	20.13	4.25	14.45	<1.0	113.15	<1.0	304.98	32.15	19.45	16.68	<1.0	69.03	<1.0	6.63	29.90	<1.0	35.60
12	**LL/25-26/001203/50**	T3/LB/2025/06	155.35	4.38	14.78	3.43	10.88	<1.0	70.90	<1.0	188.93	23.53	12.85	28.33	<1.0	43.00	<1.0	2.00	12.73	<1.0	41.48
13	**LL/25-26/001203/60**	P17/LB/2025	298.58	14.30	46.18	9.58	58.25	<1.0	137.50	4.43	530.03	71.48	41.33	49.10	<1.0	182.48	<1.0	2.80	38.35	48.23	50.85
14	**LL/25-26/001203/67**	T4/LB/2025/06	395.38	21.15	43.93	13.60	68.95	<1.0	217.03	4.18	565.65	84.30	52.45	45.80	<1.0	158.25	<1.0	3.00	39.83	36.03	47.43
15	**LL/25-26/001203/82**	T5/LB/2025/05	70.43	8.13	11.35	2.40	25.15	<1.0	38.80	2.75	109.68	23.80	10.43	16.48	<1.0	75.33	<1.0	8.08	47.65	65.18	21.95

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 – XVI

Analytical results of MHA / THA and Reactive silica in Lakhond 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/25-26/001203 (2)
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 : Lakhond
Sample Qty : 500g x 2 N
Test Parameters: THA+ MHA, Reactive SiO2

SI.No	Lab. No.	Sample No	THA	MHA	Reactive SiO2
			%	%	%
1	LL/25-26/001203/50	T3/LB/2025/06	34.68	7.21	27.98
2	LL/25-26/001203/67	T4/LB/2025/06	18.39	2.26	30.25

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 – XVII

Statement showing Check sample analysis of Major oxides & REE (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/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	0.10
			Units	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
			Lab ID	Al2O3	BaO	CaO	Cr2O3	Fe2O3	K2O	MgO	MnO	Na2O	P2O5	SiO2	SO3	SrO	TiO2	V2O5	LOI
1.	P25/LB/2025	Powder	G2296-10	26.92	<0.05	2.12	0.08	0.57	<0.05	0.30	<0.05	0.26	0.13	55.10	0.23	<0.05	3.92	<0.05	10.13
2.	P25/LB/2025	Powder	G2296-10	26.96	<0.05	2.13	0.08	0.57	<0.05	0.30	<0.05	0.24	0.13	55.18	0.23	<0.05	3.94	<0.05	10.10
3.	P26/LB/2025	Powder	G2296-11	10.96	<0.05	4.39	<0.05	6.76	0.76	3.23	0.08	0.78	<0.05	58.38	0.35	<0.05	1.26	<0.05	12.82
4.	P27/LB/2025	Powder	G2296-12	20.15	0.23	0.90	0.11	30.04	<0.05	0.69	<0.05	0.28	0.88	23.14	0.18	0.12	9.11	<0.05	14.00
5.	T11/LB/2025/10	Powder	G2296-13	20.69	<0.05	3.91	<0.05	2.07	0.20	0.29	<0.05	<0.08	0.09	57.17	0.07	<0.05	3.58	<0.05	11.46
6.	T12/LB/2025/C	Powder	G2296-14	15.20	<0.05	10.77	<0.05	3.01	0.26	0.27	<0.05	<0.08	0.06	53.57	<0.05	<0.05	2.12	<0.05	14.42
7.	T13/LB/2025/03	Powder	G2296-15	44.29	<0.05	0.39	0.08	2.31	0.21	0.21	<0.05	0.13	0.11	25.33	0.94	<0.05	3.98	<0.05	21.87
8.	T14/LB/2025/05	Powder	G2296-16	19.59	0.12	4.37	0.16	22.37	<0.05	0.34	<0.05	<0.08	0.87	29.96	0.06	0.09	7.63	<0.05	14.19
9.	T15/LB/2025/08	Powder	G2296-17	18.87	0.09	2.21	0.17	28.40	<0.05	0.45	<0.05	0.09	0.91	26.96	0.09	0.08	7.54	<0.05	13.92
10.	T16/LB/2025/03	Powder	G2296-18	7.97	<0.05	0.52	0.17	10.88	0.66	0.93	0.20	0.67	0.09	68.75	0.17	<0.05	1.64	<0.05	7.21
11.	T41/LB/2025/6	Powder	G2296-28	20.42	0.12	2.05	0.09	27.94	<0.05	0.34	<0.05	0.09	0.91	26.75	0.06	0.10	7.85	0.05	13.08

Abbreviations:
LOQ-- Limit of Quantification
SOP/OM/105: Lithium Borate Fusion Bead followed by WDXRF Finish
SOP/OM/103: Loss On Ignition followed by Gravimetry Finish

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

** END OF THE REPORT **

Prepared by: Naveen
Verified by: Satyanarayana

Page No.1 of 1

TEST REPORT

Shiva Assay(REE)_G2296

SHIVA

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, Concource 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	5

Sl. No.	Customer Code	Sample Description	Method		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	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
			Units		ppm(mg/kg)	ppm(mg/kg)	ppm(mg/kg)	ppm(mg/kg)	ppm(mg/kg)	ppm(mg/kg)	ppm(mg/kg)	ppm(mg/kg)	ppm(mg/kg)	ppm(mg/kg)	ppm(mg/kg)	ppm(mg/kg)	ppm(mg/kg)	ppm(mg/kg)	ppm(mg/kg)	ppm(mg/kg)	ppm(mg/kg)	ppm(mg/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**	**Y**	**La**	**Ce**	**Pr**	**Nd**	**Sm**	**Eu**	**Gd**	**Tb**	**Dy**	**Ho**	**Er**	**Tm**	**Yb**	**Lu**	**Th**	**U**
1	P27/LB/2025	Powder	G2296-12		28.5	60.5	49.0	195	512	47.0	203	42.7	13.3	48.5	4.56	19.8	2.44	5.73	0.57	3.14	<0.5	18.6	5.54
2	T41/LB/2025/6	Powder	G2296-28		28.6	58.8	42.8	299	498	44.5	185	39.4	13.0	48.9	4.80	21.6	2.65	5.91	0.59	3.75	<0.5	17.6	4.99

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

Mr. SATYANARAYANA Head ORES & MINERALS 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 inany advertising media without prior written permission.5. 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: Naveen
Verified by: Satyanarayana

Page No.1 of 1

ANNEXURE – XVIII

Detailed Report on complete Petrographic study carried out on three bedrock samples, Lakhond 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 भूवैज्ञानिक सर्वेक्षण / Geological Survey of India
दक्षिण 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 & Corordination,
Critical mineralTrackers,
Hyderabad

Madam,

Please find the attached petrographic report on submitted samples (22 nos.) for your perusal.

Thanking you,

Yours sincere

K. Basak

(Dr. KRISHNAPRIYA BASAK)

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

Page 1 of 12

1. Sample code: LB/TS/B5

Microscopic observations:

Microscopic study reveals that the rock displays a very fine-grained groundmass, typical of shale, with particle sizes mostly below 100 micrometers. The grains are closely packed in a matrix-supported texture, and little sorting is observed, consistent with rapid settling from suspension in a quiet water setting. The preferred orientation of fine grains creates a fissile fabric, giving the rock its characteristic ability to split into thin layers. Some larger quartz grains are embedded within this matrix, further demonstrating the heterogeneity at the microscale (Fig. 7A-7D).

Quartz (Qz) grains are clearly identifiable across all images, scattered throughout the clay-rich matrix. Quartz occurs as both fine angular fragments and larger, subrounded grains, indicating a mix of detrital influx from distant and nearby sources. The prevalence of quartz highlights the siliciclastic nature of this shale and suggests significant mechanical weathering and transport before deposition.

No obvious secondary mineralization or cementation phases such as carbonates or silica overgrowths are visible, suggesting minimal post-depositional alteration. The fine clay matrix, likely dominated by illite, kaolinite, or smectite, binds the framework and contributes to the rock's compact nature. The lacking signs of recrystallization or strong compaction indicate a relatively low diagenetic maturity.

Overall, the shale is a fine-grained, quartz-rich sedimentary rock with a prominent clay matrix. The mineral assemblage and fissile texture point to deposition in a calm, low-energy environment. The dominance of quartz and lack of abundant authigenic minerals or cement suggest primary mud deposition without significant diagenetic alteration. These features are diagnostic for shales formed from suspended clay and silt settling in relatively undisturbed aquatic settings.

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

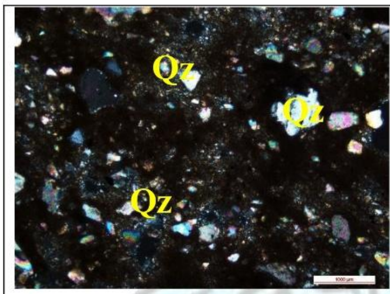

Fig. 1A. Photomicrograph showing presence of different grain size of quartz(Qz) in clay matrix under transmitted light XPL (5X).

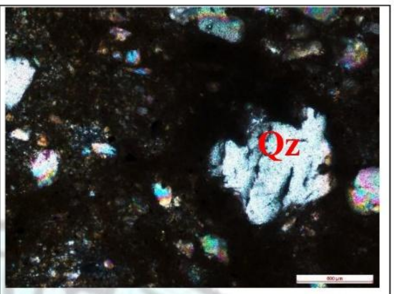

Fig. 1B. Photomicrograph showing presence of different grain size of quartz(Qz) in clay matrix under transmitted light XPL (10X).

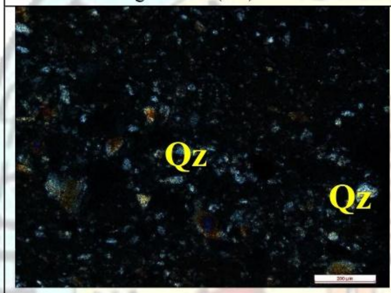

Fig. 1C. Photomicrograph showing presence of different grain size of quartz(Qz) in clay matrix under transmitted light XPL (2X).

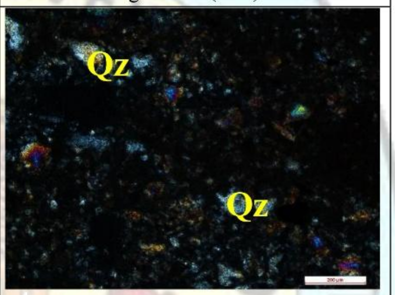

Fig. 1D. Photomicrograph showing presence of different grain size of quartz(Qz) in clay matrix under transmitted light XPL (2X).

2. Sample code: LB/TS/BRS-1

Microscopic observations:

Microscopic study reveals that the rock shows iron oxides are by far the most abundant and pervasive minerals, as evidenced by their consistent reddish-brown appearance and extensive distribution throughout the rock. The iron oxide phases, primarily goethite and hematite, dominate the groundmass with a fine-grained, almost cryptocrystalline texture. The presence of goethite (Gth) manifesting as concentric yellow-brown zones—typical for its nodular habit in laterite (Fig. 8A-8D). Quartz (Qz) grains occur sporadically and are subordinate to the iron oxides, suggesting minor preservation of primary minerals from the parent rock.

The overall matrix is extremely fine-grained, poorly sorted, and appears primarily structureless except for occasional relict quartz or goethite nodules. Quartz grains are subangular and dispersed within the iron oxide matrix. Goethite nodules present as concentric growths, sometimes around remnant quartz or other detrital grains, indicating strong replacement and secondary precipitation processes during lateritization. The dominance of the iron oxide matrix over preserved silicate minerals illustrates the intense chemical weathering that characterizes laterite formation.

The dominance of iron oxides, with only minor quartz and the presence of goethite nodules, is indicative of advanced lateritization—a process involving prolonged tropical or subtropical weathering, where leaching removes silica, alkalis, and other bases. The concentric goethite structures around relict grains highlight multiple generations of iron precipitation and secondary nodular growths, a symbol of mature laterites. Minimal cementation and open matrix texture have resulted in moderate porosity, which may facilitate further weathering and occasional secondary mineral infilling under changing soil chemistry conditions.

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

Fig. 2A. Photomicrograph showing presence of iron oxide and quartz (Qz) under transmitted light XPL (10X).

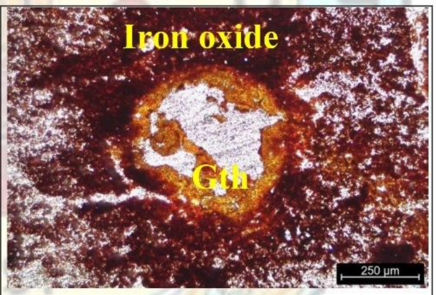

Fig. 2B. Photomicrograph showing presence of iron oxide and Goethite (Gth) under transmitted light XPL (10X).

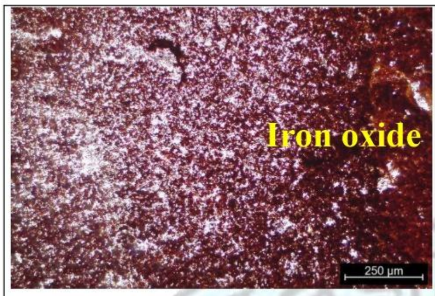

Fig. 2C. Photomicrograph showing presence of iron oxide under transmitted light XPL (10X).

Fig. 2D. Photomicrograph showing presence of iron oxide under transmitted light XPL (10X).

3. Sample code: LB/TS/P17

Microscopic observations:

Microscopic study reveals that the rock displays iron oxides are the predominant mineral phases, distributed pervasively throughout rock. Specifically, quartz (Qz) is consistently present, but always as a subordinate phase. Hematite (Hem), identifiable by its deep red coloration and granular to earthy textures, appears in distinct masses and aggregates, typical of advanced ferrugination in mature laterites. Goethite is not specifically labeled in this image, but iron oxide distribution may include finely dispersed goethite in the matrix (Fig. 9A-9D).

Quartz grains, when present, are embedded within this iron-rich groundmass and display angular to subangular forms. Hematite occurs as large, locally massive, or variegated patches, suggesting precipitation from iron-rich solutions during or after intense weathering. The microtextures range from earthy, massive areas to discrete crystalline zones, indicating multi-stage iron accumulation and cementation.

The dominance of hematite points to oxidative conditions and mature weathering, while sporadic quartz grains mark relict remnants of parent silicates. No significant evidence of secondary carbonates or clay minerals is present,

Overall, Textural and mineral evidence support formation through prolonged leaching, iron enrichment, and secondary mineral growth in a well-drained, oxidizing environment. These petrographic features define advanced laterite, typical for soils overlying igneous or metamorphic rocks in tropical regions.

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

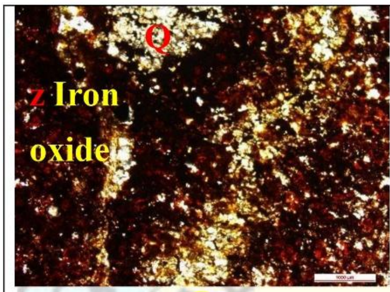

Fig. 3A. Photomicrograph showing presence of iron oxide and quartz (Qz) under transmitted light XPL (5X).

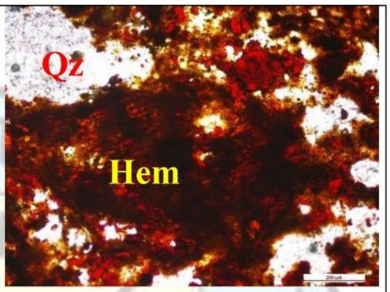

Fig. 3B. Photomicrograph showing presence of Hematite (Hem) and quartz (Qz) under transmitted light XPL (10X).

Fig. 3C. Photomicrograph showing presence of iron oxide under transmitted light XPL (10X).

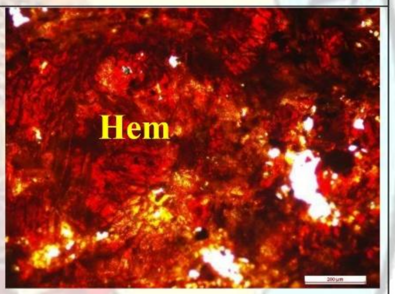

Fig. 3D. Photomicrograph showing presence of Hematite (Hem) under transmitted light XPL (10X).

4. **Sample code: LB/TS/T5**

Microscopic observations:

Microscopic study reveals that the rock demonstrate a matrix-supported texture, where quartz grains are enveloped by a fine-grained iron oxide matrix. The distribution appears heterogeneous, with clusters of iron oxide and sporadic quartz grains interspersed throughout. The rutile grains are discretely located among the matrix, further emphasizing the advanced state of chemical alteration. The very fine grain size and poor sorting reflect intense leaching and minimal preservation of primary rock fabric.

Quartz (Qz) is prominently identified, occurring as angular to subrounded grains typically embedded within a finer matrix. Iron oxide, present in large quantities, forms the dominant groundmass and imparts a brownish hue to the entire fabric. Its microcrystalline nature suggests pervasive chemical weathering and mobilization of iron from original host minerals. Notably, rutile (Rt) is observed, marked by its high relief and distinct shape—rutile's presence is significant as it is highly resistant to chemical breakdown, surviving prolonged weathering (Fig. 10A-10B).

The prevalence of iron oxide and rutile, coupled with the sparse occurrence of quartz, indicates an advanced lateritic profile—typical of prolonged tropical or subtropical weathering (Fig. 10C-10D). Leaching has removed most silicates and bases, leading to enrichment of insoluble iron oxides and accessory heavy minerals like rutile. There is no evidence of secondary carbonate or significant clay mineral presence, showing the dominance of ferruginous alteration.

Overall, the rock is characteristic of mature laterite, distinguished by iron oxide-rich groundmass, resistant quartz, and rutile grains. These microstructures and mineral assemblages typify extreme weathering, leaching, and residual enrichment, common in humid tropical climates over felsic or mafic parent rocks. The preservation of rutile and quartz amidst iron oxides further supports the identification of a highly evolved, mineralogically mature lateritic regolith.

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

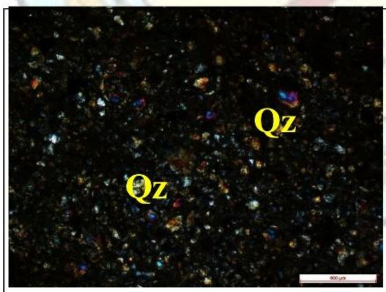

Fig. 4A. Photomicrograph showing presence of quartz (Qz) under transmitted light XPL (2X).

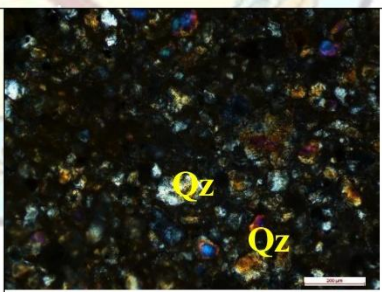

Fig. 4B. Photomicrograph showing presence of quartz (Qz) under transmitted light XPL (5X).

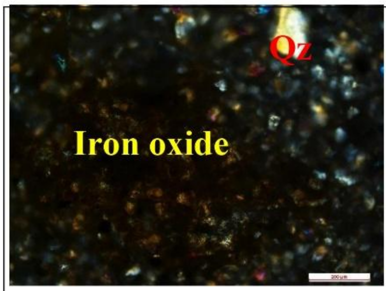

Fig. 4C. Photomicrograph showing presence of quartz (Qz) and Iron oxide under transmitted light XPL (5X).

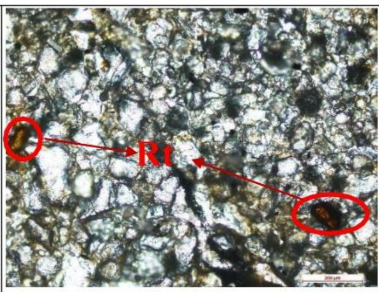

Fig. 4D. Photomicrograph showing presence of quartz (Qz) and Rutile under transmitted light PPL (10X).

5. Sample no.LB/TS/B-8

Mineral assemblage: Framework and matrix mineral: Quartz

Cement: Chert + Iron Oxide

Texture: It is a medium grained clastic sedimentary rock consisting only of quartz as frameworking mineral. Cement is composed of chert and iron oxide binding the frameworking quartz grains. Quartz grains are subangular to sub rounded with secondary authigenic quartz overgrowth. Chert and iron oxide occur as cement binding the frameworking minerals. Authigenic growth of quartz over the earlier detrital grains are noted and a fine rim is discernible on every quartz grains. At places , the rock is cement supported with few clasts of quartz within it. Variable and wide range of grain size of frameworking mineral and angularity of the grains indicate poor sorting and less transportation. Presence of quartz grains only as frameworking mineral indicate second cycle of sedimentation and a sandstone rich provenance.

Name of the rock: Sandstone

Fig. 5.1 Sub-angular to sub-rounded quartz grains as framework minerals; note the quartz overgrowth and ferruginous cement.

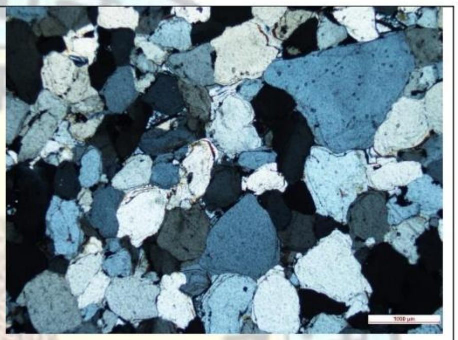

Fig. 5.2 Same as Fig 20.1 under cross polarized light.

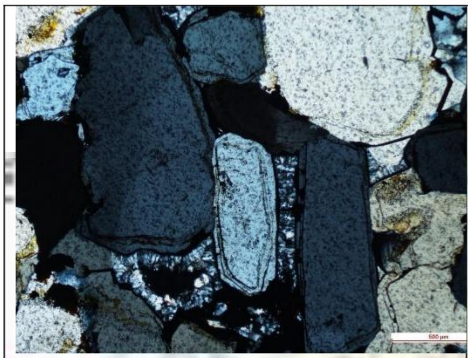

Fig. 5.3 Cherty cement along the grain boundaries; also note the quartz overgrowth

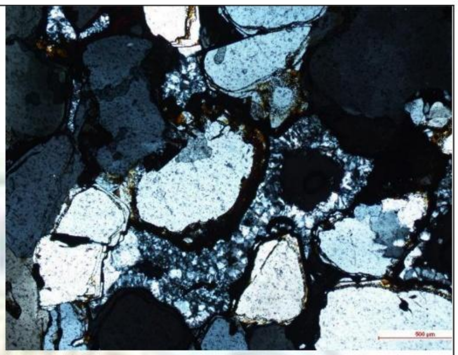

Fig. 5.4 Cherty and ferruginous cement in quartzite

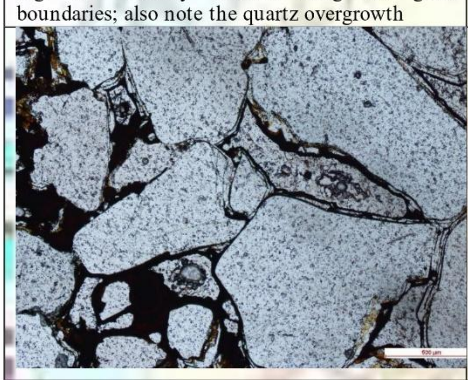

Fig. 5.5 Cherty and ferruginous cement in quartzite; at places ferruginous cement dominated

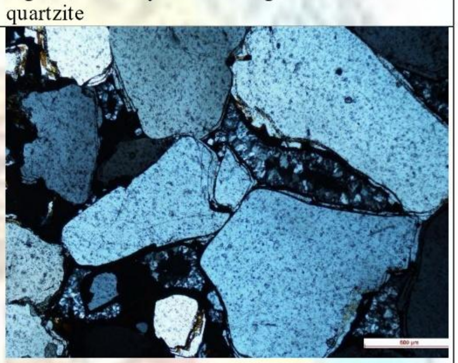

Fig. 5.6 Same as Fig. 20.5; under cross polarized light

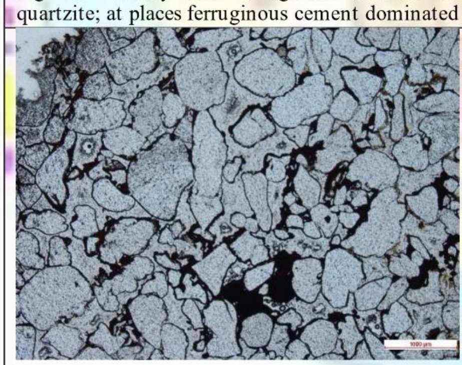

Fig. 5.7 Cherty cement dominated part with rounded and subrounded quartz grains; ferruginous cement also present

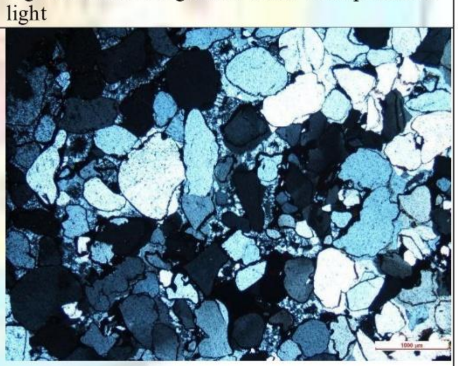

Fig. 5.8 Same as Fig. 20.7 under cross polarized light

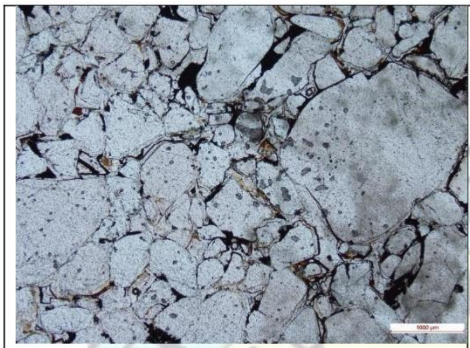

Fig. 5.9 Polymodal grain size distribution; texturally immatured

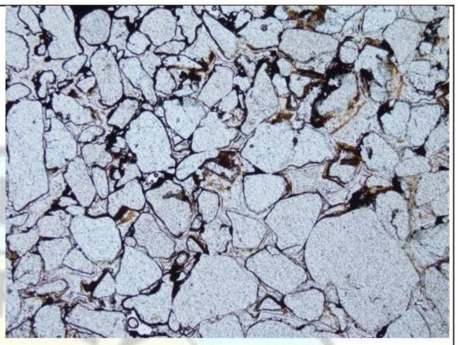

Fig. 5.10 With increasing cement content, frameworking grains often have very little contact increasing the porosity.

ANNEXURE – XIX

Statement showing XRD analysis (as received form Shiva Analyticals India Pvt. Ltd, Bangalore)

1. **Sample No :** P27/LB/2025 (original no : P17/LB/2025)

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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 : P27/LB/2025
Lab ID : G2296-12

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 G2296-12 (P27/LB/2025)

Summary

Sample G2296-12: WDXRF (Bruker S8) bulk oxides and XRD (Bruker D8) major phases reconciled.
Reported XRD major phases: Kaolinite 40.06 wt%, Hematite 1.85 wt%, Goethite 24.1 wt%, M?silicate ~0.98 wt% (approx.).
Reported crystallinity = 67.0% → inferred amorphous fraction = 33.00% (note: user-stated amorphous 35% conflicts with crystallinity; we used 100–crystallinity).

WDXRF data

Oxide	Wt %
Al2O3	20.15
SiO2	23.14
Fe2O3	30.04
TiO2	9.11
CaO	0.90
MgO	0.69
P2O5	0.88
SO3	0.18
LOI	14.00

XRD major phases (preliminary)

Mineral phase	Wt % (sample)	Representative formula
Kaolinite	40.06	Al2Si2O5(OH)4
Hematite	1.85	Fe2O3
Goethite	24.10	FeO(OH)
M-silicate(MSiO3)	0.98	(Ca0.016Fe0.666Mg0.318)SiO3 (approx. MSiO3)

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: 39.50 ; SiO2: 46.55 ; H2O (LOI): 13.96	Typical clay; contributes Al2O3 & SiO2 and structural water.
Hematite	Fe2O3	159.687	Fe2O3: 100.00	Primary Fe-oxide;

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				contributes Fe2O3.
Goethite	FeO(OH)	72.852	Fe2O3 (equiv): 109.60 ; H2O (LOI): -9.60	Hydroxy-iron oxide; will contribute Fe2O3 equivalent and LOI.
M-silicate (approx.)	(Ca0.016Fe0.666Mg0.318)SiO3	121.646	SiO2: 49.39 ; Fe2O3 equiv: 87.43 ; CaO: 0.74 ; MgO: 10.54	Minor indexed silicate — treated as MSiO3 for oxide accounting.

Predicted oxide contributions from crystalline phases

Oxide	Measured (WDXRF)	From Kaolinite	From Hematite	From Goethite	From M�silicate
Al2O3	20.15	15.82	0.00	0.00	0.00
SiO2	23.14	18.64	0.00	0.00	0.48
Fe2O3	30.04	0.00	1.85	26.41	0.86
TiO2	9.11	0.00	0.00	0.00	0.00
CaO	0.90	0.00	0.00	0.00	0.01
MgO	0.69	0.00	0.00	0.00	0.10
LOI	14.00	0.00	0.00	-2.31	0.00

Predicted totals, residuals and inferred amorphous composition

Oxide	Measured (wt%)	Predicted from crystalline (wt%)	Residual = Meas – Pred (wt%)
Al2O3	20.15	15.82	4.32
SiO2	23.14	19.13	4.01
Fe2O3	30.04	29.12	0.92
TiO2	9.11	0.00	9.11
CaO	0.90	0.01	0.89
MgO	0.69	0.10	0.59
LOI	14.00	3.28	10.72

Inferred amorphous fraction = 33.00 % of sample. Residual positive oxides are attributed primarily to this amorphous fraction. Below are residuals normalized to the amorphous mass (i.e., % of the 33.00% amorphous).

Oxide	Residual (wt% of sample)	Inferred % of amorphous (residual/33.0×100)
LOI	10.72	32.49
TiO2	9.11	27.60
Al2O3	4.33	13.12
SiO2	4.01	12.15
Fe2O3	0.92	2.79

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CaO	0.89	2.71
P2O5	0.88	2.67
MgO	0.59	1.78
Na2O	0.28	0.85
BaO	0.23	0.70
SO3	0.18	0.55
SrO	0.12	0.36
Cr2O3	0.11	0.33
ZrO2	0.09	0.27
PbO	0.04	0.12
V2O5	0.02	0.06
NiO	0.02	0.06
K2O	0.01	0.03
MnO	0.01	0.03
ZnO	0.01	0.03

Interpretation, origin assessment & commercial implications

Interpretation:

- The sample is Al- and Fe-rich (Al2O3 20.15%, Fe2O3 30.04%) with substantial TiO2 (9.11%) and SiO2 (23.14%), and LOI 14%. The dominant minerals by XRD are kaolinite and Fe-oxides (goethite + hematite), summing ≈66.99% (=67%).
- The mineralogy and high Fe and Ti content strongly suggest a ferruginous lateritic / weathering profile or an iron-rich sediment with significant Ti-bearing heavy minerals (rutile/ilmenite or altered Ti-oxides). Kaolinite indicates advanced chemical weathering; goethite/hematite indicate Fe-oxide enrichment. The small M?silicate suggests minor detrital silicate relics.

Origin assessment:

- Most consistent with intense tropical/subtropical weathering (laterite/bauxite-lateritic profile) or an iron?rich residual/regolith derived from mafic/ultramafic or volcanic parent rocks.

Commercial implications:

- Iron: Fe2O3 ~30% — material could be of interest as an industrial iron-bearing product for pigments or specialized iron products, but grade and form (oxides) are not directly suitable for blast?furnace iron without concentration.
- TiO2 ~9% is significant — if Ti is present as discrete ilmenite/rutile with liberable grains, beneficiation could yield Ti feedstock for pigment or Ti metal production.
- Kaolinite: 40% kaolinite indicates potential use for ceramics, paper filler, and other industrial mineral applications, subject to Ti/Fe impurity levels which may limit high?brightness uses.
- Overall: the sample looks more suited to industrial mineral applications (ceramics, pigments, fillers) or as a target for heavy?mineral (Ti) concentration, rather than immediate metallurgical Fe ore.

Minor / secondary phases likely present (not listed as majors)

- Rutile/ilmenite or leucoxene (source of TiO2)
- Amorphous silica/opaline silica or microcrystalline quartz (contributing residual SiO2)

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- Allophane/smectite (poorly crystalline aluminosilicates in amorphous fraction)
- Apatite/fluorapatite (minor P_2O_5 = 0.88%)
- Sulfates or gypsum (trace SO_3 = 0.18%)
- Accessory zircon, chromite traces (ZrO_2, Cr_2O_3 present)

Concise final results

• XRD major phases (wt%): Kaolinite 40.06, Goethite 24.10, Hematite 1.85, M-silicate ~0.98 (sum ≈ 67.0%). Amorphous ≈ 33.00%.
• Bulk WDXRF (wt%): Al_2O_3 20.15, Fe_2O_3 30.04, TiO_2 9.11, SiO_2 23.14, LOI 14.00.
• Interpretation: Ferruginous, highly weathered material (lateritic / iron-rich regolith) with potential for Ti concentration and industrial mineral uses; not meteoritic.

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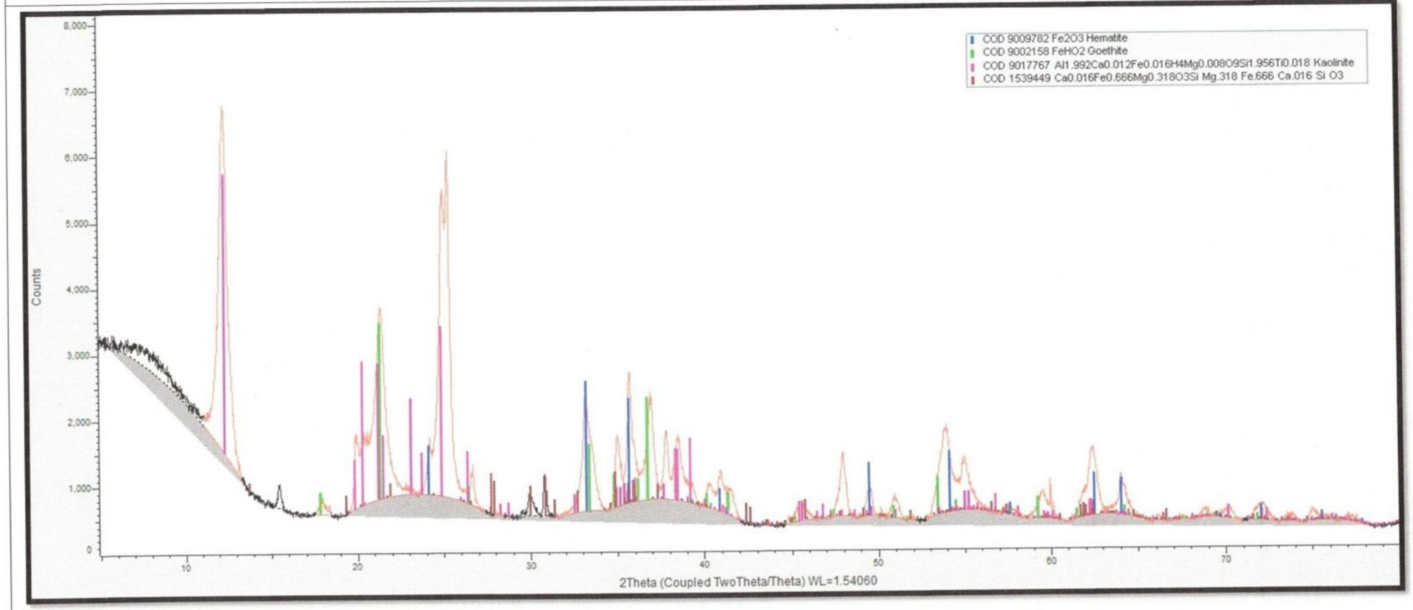
BRUKER D8 ADVANE XRD TEST DATA

G2296-12 | T23/RB/2025/01 | XRD Scan Report_1 of 2



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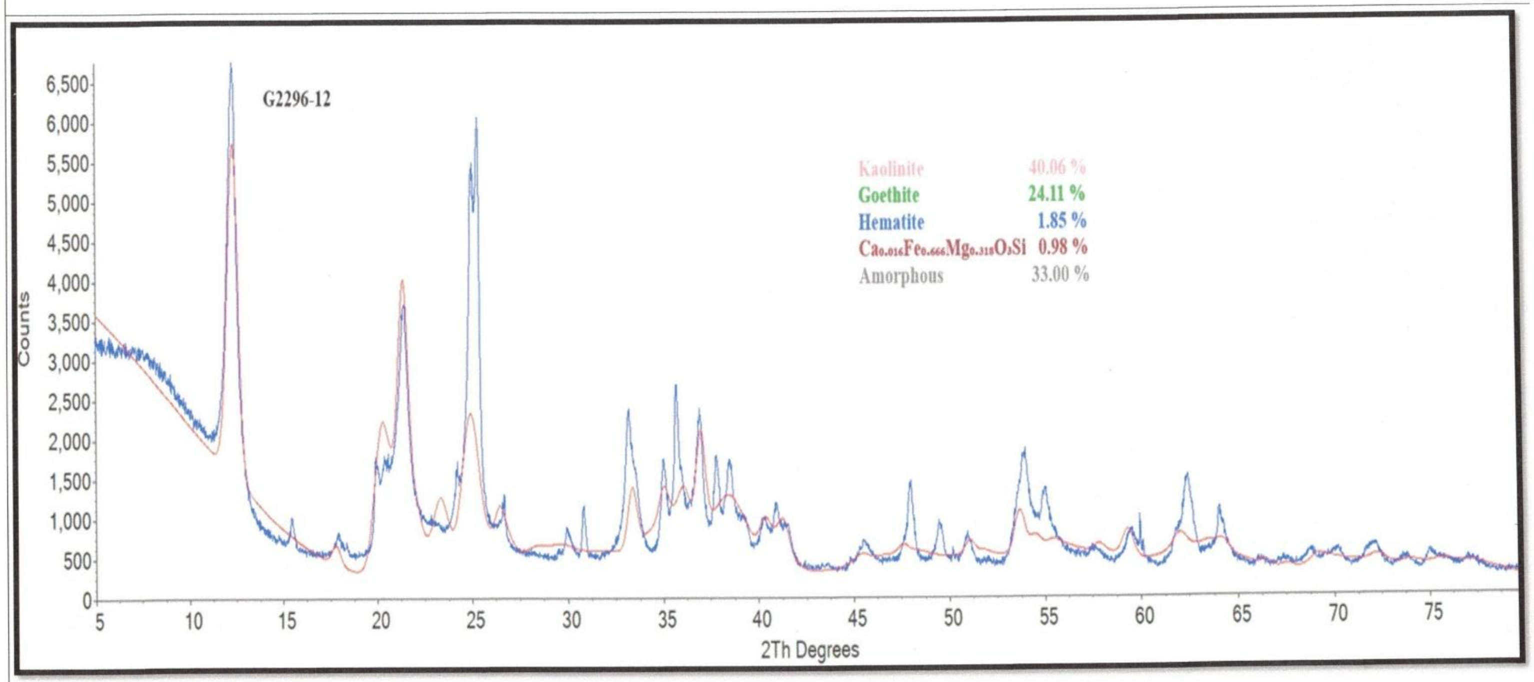
BRUKER D8 ADVANE XRD TEST DATA

G2296-12 | P27/LB/2025 | XRD Scan Report_2 of 2



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2. Sample No : T13/LB/2025/03 (original no : T3/LB/2025/03)

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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 : T13/LB/2025/03
Lab ID : G2296-15

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 G2296-15 (T13/LB/2025/03)

Summary

Sample G2296-15: WDXRF bulk oxides (Bruker S8 Tiger 4 kW) and XRD (Bruker D8 Advance) major phases reconciled. XRD phases (crystalline fraction): Gibbsite 51.49 %, Kaolinite 45.71 %, Ilmenite 2.8 % with crystallinity = 77.4% and amorphous fraction = 22.6% of the whole sample.
Below we show stoichiometric conversions, predicted oxide contributions from the crystalline phases (expressed as wt% of the whole sample), residuals (measured – predicted) and an inferred composition of the amorphous fraction.

WDXRF data

Oxide	Wt % (measured)
Al2O3	44.29
SiO2	25.33
Fe2O3	2.31
TiO2	3.98
CaO	0.39
MgO	0.21
P2O5	0.11
SO3	0.94
LOI	21.87

XRD phases

The absolute phase weight percent in the whole sample = (phase% of crystalline) × (crystallinity/100).

Mineral (reported % of crystalline)	Absolute wt% of sample (calculated)	Representative formula
Kaolinite (45.71% of crystalline)	35.37	Al2Si2O5(OH)4
Gibbsite (51.49% of crystalline)	39.85	Al(OH)3
Ilmenite (2.80% of crystalline)	2.16	FeTiO3 (Ilmenite)

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Stoichiometric conversions (mineral → oxide equivalents)

Mineral	Formula	Mol. mass (g/mol)	Major oxide wt% (per 100 g mineral)	Notes
Kaolinite	Al2Si2O5(OH)4	258.15	Al2O3: 39.495 ; SiO2: 46.548 ; H2O (LOI): 13.957	Expressed as Al2O3 + 2SiO2 + 2H2O.
Gibbsite	Al(OH)3	78.00	Al2O3: 65.357 ; H2O (LOI): 34.643	2 Al(OH)3 = Al2O3 + 3 H2O (used for oxide accounting).
Ilmenite	FeTiO3	151.70	FeO (as Fe): 47.356 (converted to Fe2O3 equiv); TiO2: 52.644	Fe present as Fe2+ in ilmenite -> converted to Fe2O3 equivalent for comparison with XRF.

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

Oxide	Measured (WDXRF, wt%)	From Kaolinite (wt%)	From Gibbsite (wt%)	From Ilmenite (wt%)	Total predicted (wt%)
Al2O3	44.29	13.97	26.05	0.00	40.02
SiO2	25.33	16.47	0.00	0.00	16.47
Fe2O3	2.31	0.00	0.00	2.28	2.28
TiO2	3.98	0.00	0.00	1.14	1.14
LOI	21.87	0.00	0.00	0.00	0.00
CaO	0.39	0.00	0.00	0.00	0.00
MgO	0.21	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	44.29	40.02	4.27
SiO2	25.33	16.47	8.86
Fe2O3	2.31	2.28	0.03
TiO2	3.98	1.14	2.84
LOI	21.87	18.74	3.13
CaO	0.39	0.00	0.39

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MgO	0.21	0.00	0.21

Inferred amorphous fraction = 22.60 % of sample. Positive residuals are allocated to the amorphous fraction. Residuals normalized to the amorphous mass (i.e., percent of the 22.60% amorphous) are shown below.

Oxide	Residual (wt% of sample)	Inferred % of amorphous (residual/22.6×100)
SiO2	8.86	39.21
Al2O3	4.27	18.89
LOI	3.13	13.83
TiO2	2.84	12.56
SO3	0.94	4.16
CaO	0.39	1.73
K2O	0.21	0.93
MgO	0.21	0.93
Na2O	0.13	0.58
P2O5	0.11	0.49
Cr2O3	0.08	0.35
ZrO2	0.05	0.22
SrO	0.04	0.18
PbO	0.03	0.13
Fe2O3	0.03	0.13
MnO	0.01	0.04
V2O5	0.01	0.04
CuO	0.01	0.04
NiO	0.01	0.04

Interpretation, origin assessment & commercial implications

Interpretation:

• The sample is strongly Al enriched (Al2O3 = 44.29 wt%), with significant structural water (LOI = 21.87 wt%) and moderate SiO2 (25.33 wt%). XRD indicates the crystalline Al bearing minerals are kaolinite and gibbsite, which together account for most of the crystalline mass (absolute: Kaolinite 35.38 wt%, Gibbsite 39.85 wt%). Ilmenite is a minor heavy mineral (≈ 2.17 wt%).

Origin assessment:

• This assemblage (high Al2O3, large gibbsite fraction, large LOI) strongly supports intense chemical weathering and residual concentration — typical of bauxitic/lateritic profiles developed in tropical/subtropical climates. Gibbsite dominance (high Al(OH)3) commonly forms under sustained leaching and low silica activity (bauxitic conditions). Presence of minor ilmenite suggests a mafic/igneous detrital source for Ti.

Commercial implications:

• Al2O3 ~44.3% and high gibbsite content suggest potential as a bauxite precursor for alumina production (Bayer process). However, the silica (SiO2 ~25.3%) and LOI need assessment for Bayer suitability — high reactive silica is detrimental. • Kaolinite/gibbsite-rich materials are also used in ceramics, refractories, filler applications, and as feedstock for metakaolin (after calcination).

• Ilmenite (~2.2 wt% absolute) and TiO2 ~3.98% indicate low Ti potential unless heavy mineral concentrations

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increase with simple gravity concentration.

Minor / secondary phases likely present

- Amorphous/allophanic aluminosilicates (allophane, imogolite) in the amorphous fraction
- Poorly crystalline silica (opal/opal-CT) or microcrystalline quartz (contributes residual SiO_2)
- Iron oxides present in low abundance (hematite/goethite) as coatings — consistent with low Fe_2O_3 (2.31 wt%)
- Anatase/rutile or altered ilmenite as Ti-bearing fine phases
- Trace apatite (P_2O_5 = 0.11%) or adsorbed phosphates

Final concise results

• XRD major phases (absolute wt% of sample): Kaolinite 35.38 wt%, Gibbsite 39.85 wt%, Ilmenite 2.17 wt%. Crystallinity = 77.4%, Amorphous = 22.6%.
• Bulk WDXRF (wt%): Al_2O_3 44.29, SiO_2 25.33, TiO_2 3.98, Fe_2O_3 2.31, LOI 21.87.
• Interpretation: Strongly lateritic/bauxitic material with high gibbsite content — promising for alumina after appropriate beneficiation and silica control; low Ti and Fe metallurgical potential unless concentrated.

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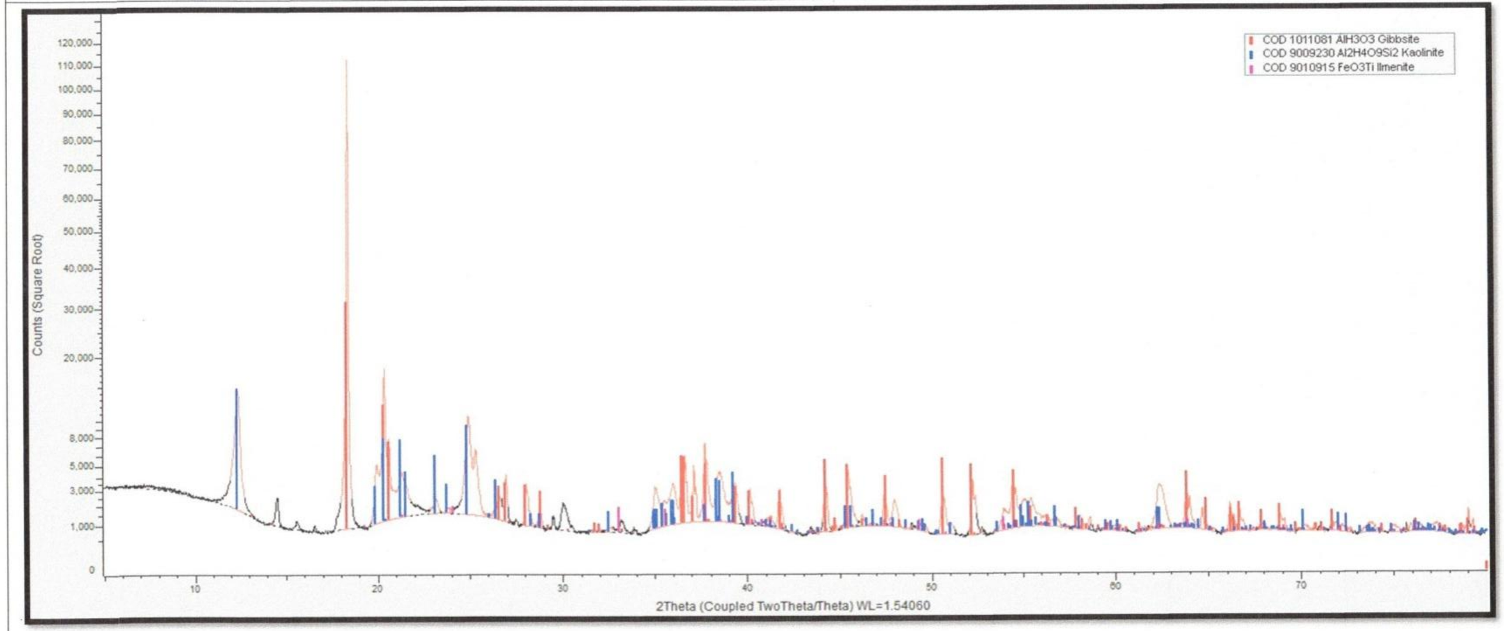
BRUKER D8 ADVANE XRD TEST DATA

G2296-15 | T13/LB/2025/03 | XRD Scan Report_1 of 2



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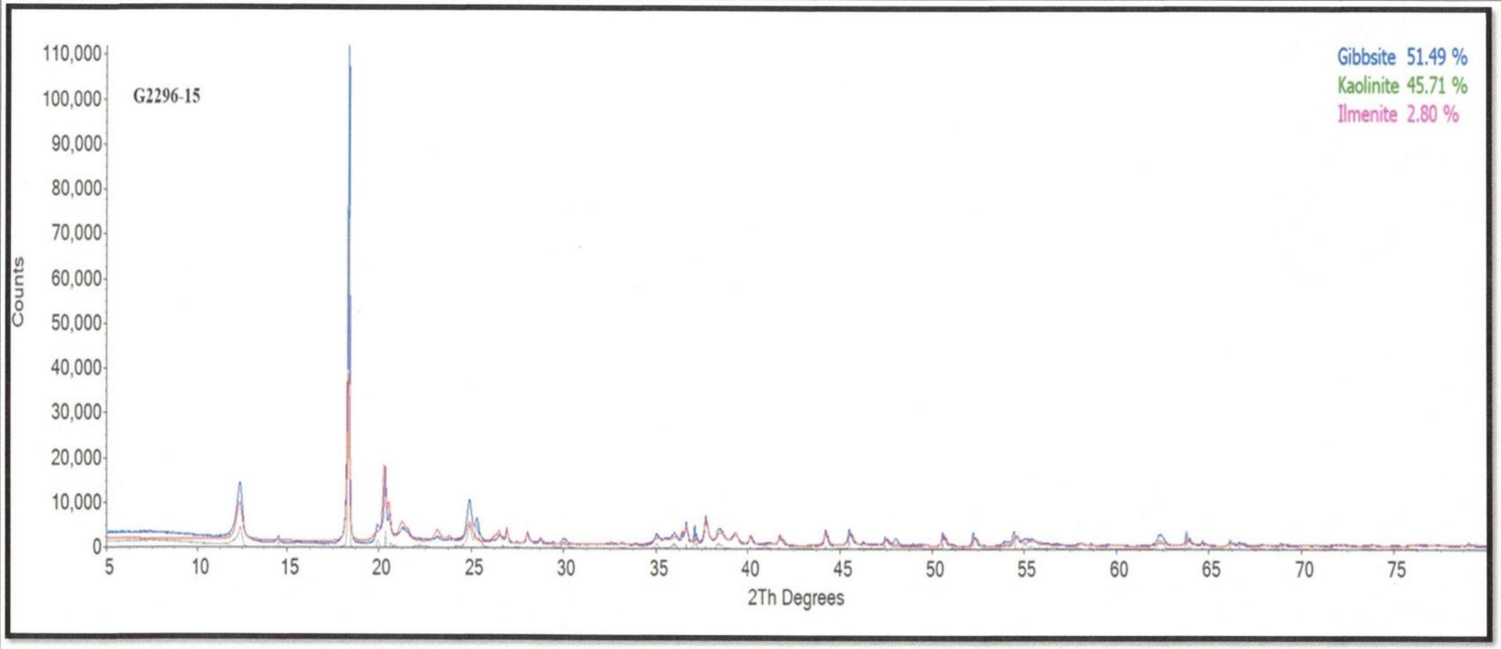
BRUKER D8 ADVANE XRD TEST DATA

G2296-15 T13/LB/2025/03 XRD Scan Report_2 of 2



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3. **Sample No :** T14/LB/2025/05 (original no : T4/LB/2025/05)

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Customer Ref : T14/LB/2025/05
Lab ID : G2296-16

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 G2296-16 (T14/LB/2025/05)

Sample G2296-16

Summary

Sample G2296-16: WDXRF bulk oxides (Bruker S8 Tiger 4 kW) and XRD (Bruker D8 Advance) major phases reconciled with crystallinity = 70.10 % and amorphous = 29.90 %.

WDXRF Data

Oxide	Wt % (measured)
Al2O3	19.59
SiO2	29.96
Fe2O3	22.37
TiO2	7.63
CaO	4.37
MgO	0.34
P2O5	0.87
SO3	0.06
LOI	14.19

XRD major phases (scaled to crystallinity)

Mineral phase	Wt % (sample, scaled)	Representative formula
Kaolinite	31.05	$Al_2Si_2O5(OH)_4$
Goethite	21.69	FeO(OH)
Hematite	5.91	Fe_2O_3
Calcite	5.53	$CaCO_3$
Quartz	2.95	SiO_2 (quartz)
Cristobalite	2.94	SiO_2 (cristobalite)

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 (LOI): 10.138	Hydroxy-iron oxide; contributes Fe2O3 equivalent and LOI.
Hematite	Fe2O3	159.687	Fe2O3: 100.00	Primary iron oxide.

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Calcite	$CaCO_3$	100.086	CaO: 56.029 ; CO_2 (LOI): 43.971	Contributes CaO and CO_2 (as LOI).
Quartz / Cristobalite	SiO_2	60.084	SiO_2: 100.00	Silica polymorphs; contribute SiO_2.

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

Oxide	Measured (WDXRF)	From Kaolinite	From Fe-oxides (Goethite+Hematite)	From Carbonate (Calcite)	From Quartz/Cristobalite
Al_2O_3	19.59	12.27	0.00	0.00	0.00
SiO_2	29.96	14.46	0.00	0.00	20.36
Fe_2O_3	22.37	0.00	25.41	0.00	0.00
CaO	4.37	0.00	0.00	3.10	0.00
LOI	14.19	0.00	2.20	2.43	0.00
TiO_2	7.63	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%)
Al_2O_3	19.59	12.27	7.32
SiO_2	29.96	20.36	9.60
Fe_2O_3	22.37	25.41	-3.04
CaO	4.37	3.10	1.27
LOI	14.19	8.97	5.22
TiO_2	7.63	0.00	7.63

Inferred amorphous fraction = 29.90 % of sample. Residual positive oxides are primarily attributed to this amorphous fraction. Residuals normalized to the amorphous mass (i.e., % of the 29.90% amorphous) are shown below.

Oxide	Residual (wt% of sample)	Inferred % of amorphous (residual/29.9×100)
SiO_2	9.60	32.10
TiO_2	7.63	25.52
Al_2O_3	7.32	24.49
LOI	5.22	17.47
CaO	1.27	4.25
P_2O_5	0.87	2.91
MgO	0.34	1.14
Cr_2O_3	0.16	0.54
BaO	0.12	0.40
SrO	0.09	0.30
ZrO_2	0.08	0.27
Na_2O	0.07	0.23
SO_3	0.06	0.20
PbO	0.04	0.13

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Oxide	Residual (wt% of sample)	Inferred % of amorphous (residual/29.9×100)
V2O5	0.03	0.10
K2O	0.02	0.07
MnO	0.01	0.03
NiO	0.01	0.03
ZnO	0.01	0.03
Fe2O3	-3.03	-3.03

Interpretation & expert justification

• The identified crystalline phases account for most measured Al2O3, Fe2O3 and part of SiO2 and CaO. Measured LOI (14.19 wt%) exceeds predicted crystalline LOI, indicating additional structural water or carbonates/organic matter in the amorphous fraction.

• Residual TiO2 (~7.63 wt%) suggests Ti is present largely in fine or amorphous Ti�oxide phases (anatase/rutile/leucoxene) not resolved by XRD at detection limits.

• The assemblage indicates intense weathering (lateritic/ferruginous profile) potentially derived from mafic/volcanic parent materials, with some carbonate influence (calcite). Meteoritic origin is unlikely.

Minor / secondary phases likely present

- Anatase/rutile/ilmenite (source of TiO2)
- Amorphous silica (opal/opal-CT) or microcrystalline quartz
- Poorly crystalline allophane/imogolite-type aluminosilicates
- Ferrihydrite and coated iron oxyhydroxides
- Smectite or mixed-layer clays as minor components
- Apatite/other phosphate phases (P2O5 = 0.87%)

Commercial significance & recommendations

• Commercial uses: kaolinite for ceramics/fillers, Fe-oxides for pigments/specialty uses, Ti-oxide concentration for pigment/metal feedstock if economically recoverable. Calcite as minor filler/soil amendment.
• Recommendations: Rietveld with internal standard, TGA/DSC, SEM-EDS/QEMSCAN, heavy/mineral separation and magnetic separation tests to evaluate Ti/Fe recoverability, and reactive silica tests if Al recovery is of interest.

Final concise results

• Scaled XRD major phases (wt% of sample): Kaolinite 31.06%, Goethite 21.69%, Hematite 5.92%, Calcite 5.53%, Quartz 2.96%, Cristobalite 2.95% (sum = 70.10%). Crystallinity = 70.10%, Amorphous = 29.90%.
• Bulk WDXRF (wt%): Al2O3 19.59, SiO2 29.96, Fe2O3 22.37, TiO2 7.63, LOI 14.19.
• Interpretation: Lateritic/ferruginous regolith; industrial mineral potential and candidate for Ti enrichment with further testing.

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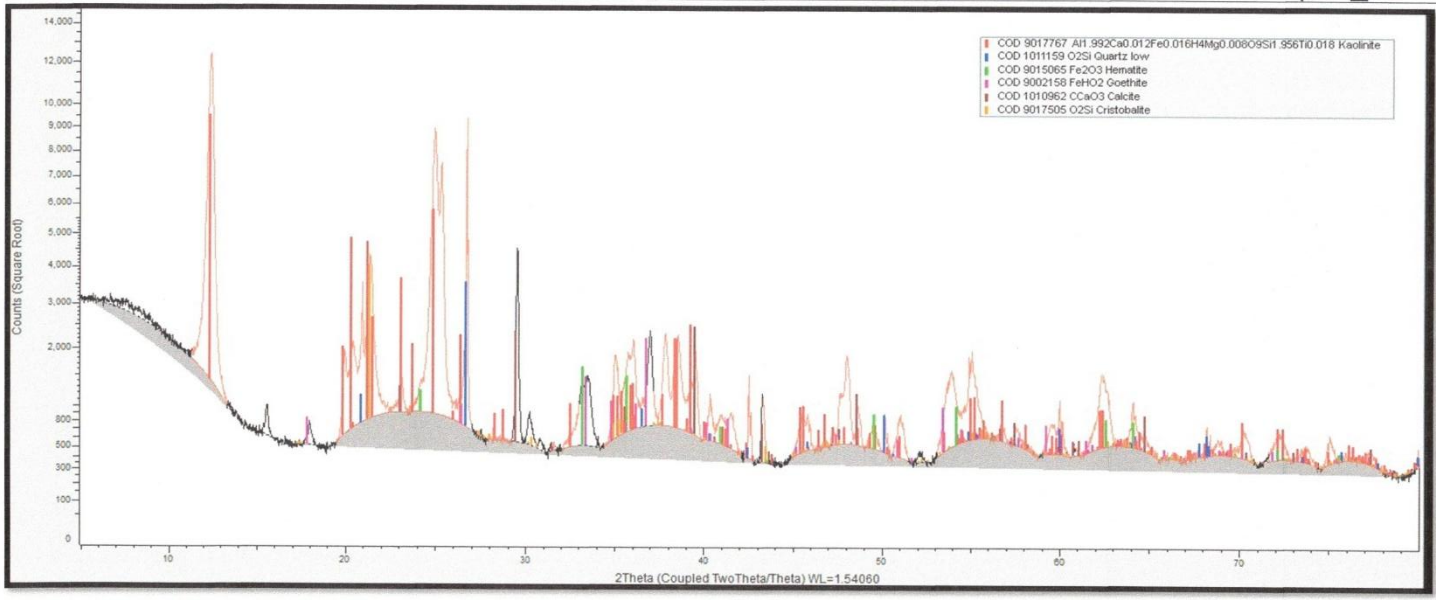
SHIVA ANALYTICALS INDIA PRIVATE LIMITED | BRUKER D8 ADVANE XRD TEST DATA

G2296-16 | T14/LB/2025/05 | XRD Scan Report_1 of 2



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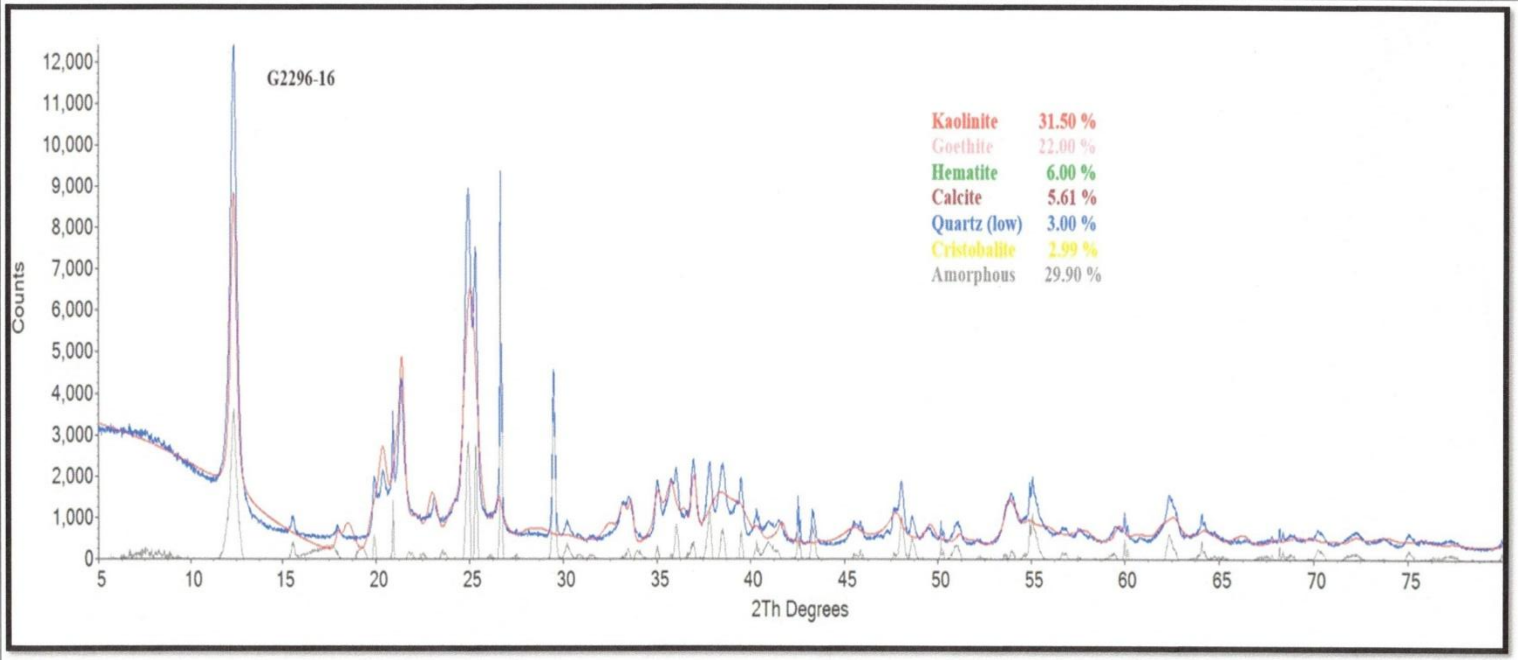
BRUKER D8 ADVANE XRD TEST DATA

G2296-16 T14/LB/2025/05 XRD Scan Report_2 of 2



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CMT CRITICAL MINERAL TRACKERS raashtr pratham

ANNEXURE – XX

Statement showing details of drill core samples analysis of Major oxides, REE, and Ga in the Lakhond 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/25-26/006538 (1-22)
Report Issue Date : 29.09.2025
Date of Receipt of Sample : 13.09.2025
Date of Starting of Analysis : 15.09.2025
Date of Completing of Analysis : 29.09.2025

Sample Particulars: Bauxite Samples.
Sample Qty: 500g x 22 N
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	Aluminium as Al_2O_3	Iron as Fe_2O_3	Manganese as MnO	Magnesium as MgO	Calcium as CaO	Sodium as Na_2O	Potassium as K_2O	Titanium as TiO_2	Phosphorus as P_2O_5	Loss on Ignition (LOI)	Vanadium as V
			(% by mass)	(% by mass)	(% by mass)	(% by mass)	(% by mass)	(% by mass)	(% by mass)	(% by mass)	(% by mass)	(% by mass)	(% by mass)	(ppm)
01	LL/25-26/006538-01	D/LKD- BH- 01/01	56.60	24.63	2.51	0.01	0.58	1.84	2.64	0.66	1.61	0.13	8.07	68.6
02	LL/25-26/006538-02	D/LKD- BH- 01/02	60.90	21.33	3.76	0.02	0.46	2.75	1.10	0.80	1.48	0.06	6.64	83.3
03	LL/25-26/006538-03	D/LKD- BH- 01/03	67.34	16.39	5.34	0.02	0.30	0.69	1.01	0.81	1.71	0.05	5.86	89.1
04	LL/25-26/006538-04	D/LKD- BH- 01/04	43.36	27.93	6.89	0.09	0.48	4.83	1.38	0.72	3.55	0.06	10.21	140.3
05	LL/25-26/006538-05	D/LKD- BH- 01/05	34.26	36.82	3.01	0.01	0.29	2.13	1.25	0.34	4.50	0.12	16.79	199.1
06	LL/25-26/006538-06	D/LKD- BH- 01/06	41.50	35.93	2.20	0.01	0.14	0.26	0.33	0.15	4.75	0.24	14.00	194.9
07	LL/25-26/006538-07	D/LKD- BH- 01/07	42.17	32.38	8.59	0.01	0.16	0.56	0.21	0.08	4.12	0.11	11.11	251.5
08	LL/25-26/006538-08	D/LKD- BH- 01/08	39.18	30.65	13.71	0.01	0.16	0.49	0.21	0.05	4.17	0.11	10.65	227.7
09	LL/25-26/006538-09	D/LKD- BH- 01/09	44.96	33.85	4.49	0.01	0.19	0.24	0.25	0.08	4.72	0.13	10.54	204.9
10	LL/25-26/006538-10	D/LKD- BH- 01/10	41.58	33.50	6.96	0.02	0.20	0.15	0.26	0.06	5.23	0.19	11.47	243.7
11	LL/25-26/006538-11	D/LKD- BH- 01/11	39.35	30.35	14.69	0.01	0.15	0.15	0.31	0.06	3.34	0.38	10.71	168.5
12	LL/25-26/006538-12	D/LKD- BH- 02/01	18.59	17.17	36.93	0.03	0.48	0.81	2.82	0.02	9.87	1.57	11.25	483.6
13	LL/25-26/006538-13	D/LKD- BH- 02/02	32.60	28.90	17.64	0.05	0.40	0.72	0.96	0.01	5.35	0.59	12.29	247.5
14	LL/25-26/006538-14	D/LKD- BH- 02/03	32.31	27.57	20.43	0.10	0.42	0.32	0.93	0.01	6.03	0.54	10.79	335.4
15	LL/25-26/006538-15	D/LKD- BH- 02/04	27.80	19.70	26.66	0.08	1.36	2.80	0.65	0.09	7.78	0.82	11.49	474.5
16	LL/25-26/006538-16	D/LKD- BH- 02/05	36.00	19.11	20.99	0.04	0.80	0.59	1.63	0.30	7.18	0.34	12.78	210.7
17	LL/25-26/006538-17	D/LKD- BH- 02/06	29.73	23.51	23.57	0.06	1.03	1.00	0.65	0.21	7.29	0.77	11.39	506.7
18	LL/25-26/006538-18	D/LKD- BH- 02/07	48.32	11.46	15.91	0.07	4.79	1.71	1.23	1.11	3.56	0.90	10.16	167.8
19	LL/25-26/006538-19	D/LKD- BH- 02/08	44.77	9.24	12.13	0.29	7.86	5.49	1.10	0.95	2.90	0.66	14.03	126.3
20	LL/25-26/006538-20	D/LKD- BH- 02/09	42.03	8.48	10.43	0.14	15.10	0.51	5.20	1.14	2.37	0.48	13.74	126.7
21	LL/25-26/006538-21	D/LKD- BH- 02/10	43.42	8.22	10.59	0.06	16.69	0.57	3.35	1.13	2.55	0.56	12.44	142.4
22	LL/25-26/006538-22	D/LKD- BH- 02/11	43.29	8.52	10.76	0.05	17.12	0.41	2.44	1.04	2.43	0.49	12.98	134.1

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

Page No. 1/1

Reviewed by

X.L.Kanta Rao
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**

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/25-26/007472 (1-08)
Report Issue Date : 24.10.2025
Date of Receipt of Sample : 08.10.2025
Date of Starting of Analysis : 10.10.2025
Date of Completing of Analysis : 24.10.2025

Sample Particulars: Bauxite Samples.
Sample Qty : 500g x 08 N

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	Aluminium as Al_2O_3	Iron as Fe_2O_3	Manganese as MnO	Magnesium as MgO	Calcium as CaO	Sodium as Na_2O	Potassium as K_2O	Titanium as TiO_2	Phosphorus as P_2O_5	Loss on Ignition (LOI)	Vanadium as V
			(% by mass)	(% by mass)	(% by mass)	(% by mass)	(% by mass)	(% by mass)	(% by mass)	(% by mass)	(% by mass)	(% by mass)	(% by mass)	(ppm)
01	LL/25-26/007472-01	D/LKD - BH - 03/01	29.33	24.72	25.52	0.02	0.35	3.90	0.28	0.28	2.26	0.11	12.74	872.3
02	LL/25-26/007472-02	D/LKD - BH - 03/02	33.92	29.48	17.55	0.01	0.23	1.87	0.21	0.29	2.97	0.12	12.83	898.6
03	LL/25-26/007472-03	D/LKD - BH - 03/03	46.13	34.51	1.26	0.01	0.17	1.13	0.20	0.18	4.21	0.23	11.49	153.7
04	LL/25-26/007472-04	D/LKD - BH - 03/04	60.81	26.20	1.28	0.01	0.11	1.30	0.32	0.05	2.12	0.42	6.78	78.1
05	LL/25-26/007472-05	D/LKD - BH - 03/05	48.47	32.16	6.77	0.01	0.19	0.47	0.26	0.08	0.71	0.25	10.10	351.4
06	LL/25-26/007472-06	D/LKD - BH - 03/06	60.25	26.59	3.08	0.01	0.15	0.83	0.39	0.06	2.00	0.09	6.12	166.4
07	LL/25-26/007472-07	D/LKD - BH - 03/08	62.30	25.52	2.88	0.01	0.13	0.40	0.30	0.16	1.49	0.13	6.23	95.3
08	LL/25-26/007472-08	D/LKD - BH - 03/11	74.43	16.59	2.72	0.01	0.09	1.05	0.21	0.06	0.39	0.06	4.17	34.5

Test method: SOP-OM-11,**Instrument Used :** WD-XRF
Note: The above results are expressed on dry basis.

Page No. 1/1

P.V.V. Satyakumari
Reviewed by

A. Kanta Rao
A.L.Kanta Rao
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**

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.

Sample Particulars: Bauxite Samples.
Sample Qty : 500g x 06 N

Report No : LL/25-26/007473 (1-06)
Report Issue Date : 24.10.2025
Date of Receipt of Sample : 08.10.2025
Date of Starting of Analysis : 10.10.2025
Date of Completing of Analysis : 24.10.2025

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	Aluminium as Al_2O_3	Iron as Fe_2O_3	Manganese as MnO	Magnesium as MgO	Calcium as CaO	Sodium as Na_2O	Potassium as K_2O	Titanium as TiO_2	Phosphorus as P_2O_5	Loss on Ignition (LOI)	Vanadium as V
			(% by mass)	(% by mass)	(% by mass)	(% by mass)	(% by mass)	(% by mass)	(% by mass)	(% by mass)	(% by mass)	(% by mass)	(% by mass)	(ppm)
01	LL/25-26/007473-01	D/LKD - BH - 04/01	50.12	18.81	9.71	0.03	0.67	8.91	0.27	0.59	1.41	0.10	9.05	133.9
02	LL/25-26/007473-02	D/LKD - BH - 04/02	50.06	17.44	9.07	0.02	0.49	10.80	0.21	0.38	1.45	0.10	9.61	129.8
03	LL/25-26/007473-03	D/LKD - BH - 04/03	33.55	25.39	10.53	0.01	0.31	11.04	0.12	0.15	0.55	0.06	17.97	366.6
04	LL/25-26/007473-04	D/LKD - BH - 04/04	41.17	27.48	4.99	0.01	0.36	10.07	0.17	0.25	0.82	0.07	14.26	195.3
05	LL/25-26/007473-05	D/LKD - BH - 04/05	63.71	23.21	3.93	0.01	0.26	1.55	0.25	0.31	0.94	0.06	5.52	149.7
06	LL/25-26/007473-06	D/LKD - BH - 04/06	69.34	18.41	4.26	0.01	0.24	0.75	0.30	0.31	1.45	0.06	4.43	95.9

Test method: SOP-OM-11,**Instrument Used :** WD-XRF
Note: The above results are expressed on dry basis.

Page No. 1/1

P.V.V. Satyakumari
Reviewed by

A.L.Kanta Rao
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**

TC-5918

TEST RESULTS

LUCID Laboratories Pvt. Ltd.
Testing to the Core

Issued to:
Critical Mineral Trackers,
N.No 7-1-58/CC/406, 'Concourse ', Opp.Lal Bungalow
Greenlands, Ameerpet,
Hyderabad-500 016
Kind Attn.:Mr.K.Nageshwar Rao, 7893847742

ULR : TC591825000003172F
LAB REGISTRATION NO: LL/25-26/006538(1 to 08)
Date. Of Receipt of Sample : 13.09.2025
Date. Of Starting of Analysi : 15.09.2025
Date. Of Completing of Analysis : 27.09.2025

Sample Particulars: Bauxite Samples.
Sample Qty : 500g x 08Nos

S.No	Sample ID	Reg no	Cerium as Ce (ppm)	Dysprosium as Dy (ppm)	Erbium as Er (ppm)	Europium as Eu (ppm)	Gadolinium as Gd (ppm)	Holmium as Ho (ppm)	Lanthanum as La (ppm)	Lutetium as Lu (ppm)	Neodymium as Nd (ppm)	Praseodymium as Pr (ppm)	Samerium as Sm (ppm)	Scandium as Sc (ppm)	Terbium as Tb (ppm)	Thorium as Th (ppm)	Thullium as Tm (ppm)	Ytterbium as Yb (ppm)	Yettrium as Y (ppm)	Uranium as U (ppm)	Gallium as Ga (ppm)	Vanadium as V (ppm)	Titanium as TiO2 (% by mass)
1	D/LKD-BH-01/01	6538/01	129.6	2.2	7.9	1.2	7.3	<1.0	57.1	<1.0	127.9	15.3	6.5	17.6	<1.0	33.0	<1.0	2.1	10.8	<1.0	32.0	69.0	1.87
2	D/LKD-BH-01/03	6538/03	87.7	2.8	7.8	<1.0	10.1	<1.0	43.0	1.2	104.2	13.6	5.0	12.9	<1.0	58.9	<1.0	3.3	15.9	7.5	29.0	89.0	1.39
3	D/LKD-BH-01/05	6538/05	141.7	4.4	19.2	3.1	12.8	<1.0	61.8	<1.0	258.4	18.3	12.3	20.6	<1.0	39.8	<1.0	2.6	13.0	<1.0	43.1	199.0	3.97
4	D/LKD-BH-01/09	6538/09	180.5	2.6	22.5	1.9	12.6	<1.0	96.6	2.4	272.0	23.0	6.8	26.2	<1.0	69.2	<1.0	2.7	12.1	<1.0	35.7	205.0	6.11
5	D/LKD-BH-02/05	6538/16	97.2	5.8	35.2	2.4	37.4	<1.0	46.1	4.1	364.1	28.0	10.5	28.6	<1.0	184.5	<1.0	5.2	15.3	50.3	17.9	211.0	5.56
6	D/LKD-BH-02/07	6538/18	141.9	6.7	20.1	3.8	32.4	<1.0	81.8	3.4	252.5	29.8	13.8	19.4	<1.0	129.4	<1.0	5.3	44.3	48.3	40.9	168.0	4.04
7	D/LKD-BH-02/09	6538/20	76.2	4.0	12.4	1.9	21.0	<1.0	43.2	2.1	156.9	20.5	7.2	13.7	<1.0	90.5	<1.0	2.7	14.4	54.4	19.3	127.0	2.84
8	D/LKD-BH-02/11	6538/22	71.3	2.8	12.0	1.5	20.1	<1.0	40.4	2.0	151.7	18.1	7.5	13.3	<1.0	87.7	<1.0	2.5	13.9	38.3	23.1	134.0	2.96

Test Method: SOP OM-8 and SOP-OM-1, Instrument Used: ICP-OES
Note 1: The above results are expressed on dry basis.

Page 1 of 1

Reviewed

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AUTHORISED SIGNATORY

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

TC-5918

LUCID Laboratories Pvt. Ltd.
Testing to the Core

TEST RESULTS

Issued to:
Critical Mineral Trackers,
N.No 7-1-58/CC/406, 'Concourse ', Opp.Lal Bungalow
Greenlands, Ameerpet,
Hyderabad-500 016
Kind Attn.:Mr.K.Nageshwar Rao, 7893847742

ULR : TC591825000003212F
LAB REGISTRATION NO: LL/25-26/007472(1 to 04)
Date. Of Receipt of Sample : 08.10.2025
Date. Of Starting of Analysi : 10.10.2025
Date. Of Completing of Analysis : 24.10.2025

Sample Particulars: Bauxite Samples.
Sample Qty : 500g x 04Nos

S. No	Sample ID	Reg no	Cerium as Ce	Dysprosium as Dy	Erbium as Er	Europium as Eu	Gadolinium as Gd	Holmium as Ho	Lanthanum as La	Lutetium as Lu	Neodymium as Nd	Praseodymium as Pr	Samerium as Sm	Scandium as Sc	Terbium as Tb	Thorium as Th	Thullium as Tm	Ytterbium as Yb	Yettrium as Y	Uranium as U	Gallium as Ga	Vanadium as V	Titanium as TiO2
			(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(% by mass)
1	D/LKD - BH - 03/01	7472/01	120.9	4.5	4.7	18.7	5.6	<1.0	62.3	<1.0	275.1	32.9	2.9	21.0	<1.0	243.2	<1.0	9.0	10.6	394.3	46.7	872.3	2.26
2	D/LKD - BH - 03/03	7472/03	380.6	11.8	1.5	13.6	13.1	<1.0	173.6	<1.0	538.9	32.0	18.6	14.7	<1.0	50.5	<1.0	3.8	15.3	<1.0	34.8	153.7	4.21
3	D/LKD - BH - 03/05	7472/05	224.2	13.2	3.5	13.1	21.6	<1.0	92.3	<1.0	257.7	<1.0	23.5	16.5	<1.0	73.7	<1.0	5.5	24.7	70.4	28.8	351.4	0..71
4	D/LKD - BH - 03/06	7472/06	101.9	3.7	0.9	5.0	5.1	<1.0	43.8	<1.0	244.4	8.8	4.4	14.8	<1.0	52.3	<1.0	3.8	9.0	<1.0	20.7	166.4	2.00

Test Method: SOP OM-08 and SOP-OM-12, Instrument Used: ICP-OES
Note 1: The above results are expressed on dry basis.

Page 1 of 1

P.V.V. Satya kumari
Reviewed

A.L.Kanta Rao
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Lucid Laboratories Pvt. Ltd.
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TC-5918

TEST RESULTS

LUCID Laboratories Pvt. Ltd.
Testing to the Core

Issued to:
Critical Mineral Trackers,
N.No 7-1-58/CC/406, 'Concourse', Opp.Lal Bungalow
Greenlands, Ameerpet,
Hyderabad-500 016
Kind Attn.:Mr.K.Nageshwar Rao, 7893847742

ULR : TC591825000003213F
LAB REGISTRATION NO: LL/25-26/007473(1 to 03)
Date. Of Receipt of Sample : 08.10.2025
Date. Of Starting of Analysi : 10.10.2025
Date. Of Completing of Analysis : 24.10.2025

Sample Particulars: Bauxite Samples.
Sample Qty : 500g x 03Nos

S.No	Sample ID	Reg no	Cerium as Ce	Dysprosium as Dy	Erbium as Er	Europium as Eu	Gadolinium as Gd	Holmium as Ho	Lanthanum as La	Lutetium as Lu	Neodymium as Nd	Praseodymium as Pr	Samerium as Sm	Scandium as Sc	Terbium as Tb	Thorium as Th	Thullium as Tm	Ytterbium as Yb	Yettrium as Y	Uranium as U	Gallium as Ga	Vanadium as V	Titanium as TiO2
			(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(% by mass)
1	D/LKD- BH- 04/01	7473/01	135.2	4.4	2.2	21.4	5.3	<1.0	54.3	<1.0	213.6	17.5	5.0	11.8	<1.0	99.8	3.6	4.4	14.0	87.9	16.3	133.9	1.41
2	D/LKD- BH- 04/02	7473/02	160.3	4.4	2.0	22.9	7.2	<1.0	63.0	<1.0	215.5	16.1	4.5	10.4	<1.0	100.4	4.2	4.2	13.7	98.9	14.9	129.8	1.45
3	D/LKD- BH- 04/03	7473/03	53.4	1.9	2.2	26.9	3.3	<1.0	27.6	<1.0	90.2	11.5	3.9	9.3	<1.0	104.4	1.2	4.6	7.8	163.7	31.3	366.6	0.55

Test Method: SOP OM-08 and SOP-OM-12, Instrument Used: ICP-OES
Note 1: The above results are expressed on dry basis.

Page 1 of 1

P.V.V. Satya Kumari
Reviewed

A.L.Kanta Rao
AUTHORISED SIGNATORY

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

ANNEXURE – XXI

Statement showing Check sample analysis of Major oxides, REE and Ga (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)_G3256

Customer Name	Critical Mineral Trackers an NPEA , Ministry of Mines, GOI, Concource 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 Powder
Lab ID	G3256
Sample Receipt Date	27-Nov-26
Analysis Completion Da	05-Dec-26
Date of Reporting	05-Dec-26
Sample Count	14

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/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	0.10
			Units	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
			Lab ID	Al_2O_3	BaO	CaO	Cr_2O_3	Fe_2O_3	K_2O	MgO	MnO	Na_2O	P_2O_5	SiO_2	SO_3	TiO_2	V_2O_5	LOI
1	D/LKD-BH-01/61	Powder	G3256-11	31.35	<0.05	2.60	0.07	3.26	0.33	0.26	<0.05	0.48	0.10	36.23	2.27	3.49	<0.05	19.38
2	D/LKD-BH-02/62	Powder	G3256-12	23.66	0.15	0.92	<0.05	21.91	<0.05	0.52	<0.05	0.21	0.83	30.55	0.11	6.12	<0.05	14.76
3	D/LKD-BH-03/63	Powder	G3256-13	23.97	<0.05	1.32	<0.05	1.29	0.13	0.16	<0.05	<0.08	0.17	57.73	0.06	3.89	<0.05	10.87
4	D/LKD-BH-04/64	Powder	G3256-14	6.84	<0.05	4.05	<0.05	7.31	0.29	0.25	<0.05	<0.08	0.06	72.24	0.06	1.18	<0.05	7.44

Abbreviations:

LOQ-- Limit of Quantification
SOP/OM/105: Borate Fusion Bead followed by WDXRF Finish
SOP/OM/103: Loss On Ignition @1000°C

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

** END OF THE REPORT **

Prepared by: Naveen
Verified by: Satyanarayana

Page No.1 of 1

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(REE)_G3256

Customer Name	Critical Mineral Trackers an NPEA , Ministry of Mines, GOI, Concource 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 Powder
Lab ID	G3256
Sample Receipt Date	27-Nov-25
Analysis Completion Date	05-Dec-25
Date of Reporting	05-Dec-25
Sample Count	4

Sl. No.	Customer Code	Sample Description	Lab ID	Ga	Sc	Y	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Th	U
			Method	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	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
			Units	ppm(mg/kg)	ppm(mg/kg)	ppm(mg/kg)	ppm(mg/kg)	ppm(mg/kg)	ppm(mg/kg)	ppm(mg/kg)	ppm(mg/kg)	ppm(mg/kg)	ppm(mg/kg)	ppm(mg/kg)	ppm(mg/kg)	ppm(mg/kg)	ppm(mg/kg)	ppm(mg/kg)	ppm(mg/kg)	ppm(mg/kg)	ppm(mg/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
3	D/LKD-BH-01/61	Powder	G3256-11	33.97	25.36	14.04	65.09	144.46	17.53	71.68	13.81	2.82	9.67	1.06	4.89	0.68	1.91	<0.5	1.38	<0.5	11.36	2.10
4	D/LKD-BH-04/64	Powder	G3256-14	11.24	8.88	15.18	62.57	119.97	13.34	49.22	8.24	0.73	7.26	0.63	3.46	0.54	1.62	<0.5	1.52	<0.5	21.06	1.74

Abbreviations

LOQ-Limit of Quantification
SOP/OM/051-- 4 Acid digestion followed by ICPOES Finish

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

** END OF THE REPORT **

Prepared by: Naveen
Verified by: Satyanarayana

ANNEXURE – XXII

Analytica results of Standard Reference Materials (SRMs) in respect of Ga, Sc, V & REE (as received from Lucid Laboratory, Hyderabad

Standards	Sc (ppm)	V(ppm)	Ga(ppm)	La(ppm)	Ce(ppm)	Pr(ppm)	Nd(ppm)	Sm(ppm)	Eu(ppm)	Gd(ppm)	Tb(ppm)	Dy(ppm)	Ho(ppm)	Er(ppm)	Tm(ppm)	Yb(ppm)	Lu(ppm)	Th(ppm)	U(ppm)
OREAS 45f (Practical Value)	34.84	258.37	24.99	16.25	29.55	3.44	12.74	2.41	0.64	2.36	0.35	2.20	0.44	1.32	0.18	1.29	0.17	10.03	2.68
OREAS 45f (Certified Value)	**36.30**	**253.00**	**26.70**	**15.70**	**28.80**	**3.43**	**12.30**	**2.49**	**0.63**	**2.31**	**0.37**	**2.23**	**0.45**	**1.33**	**0.20**	**1.25**	**0.19**	**9.99**	**2.09**
OREAS 130(Practical Value)	8.34	76.58	12.67	28.38	65.91	7.48	27.80	5.01	0.84	4.61	0.62	3.52	0.68	2.04	0.28	1.88	0.27	11.42	10.35
OREAS 130(Certified Value)	**8.64**	**80.00**	**14.00**	**26.90**	**58.00**	**7.18**	**27.60**	**5.09**	**0.89**	**4.44**	**0.63**	**3.63**	**0.74**	**2.14**	**0.30**	**2.04**	**0.31**	**10.10**	**9.98**

The samples submitted by CMT (Critical Mineral Trackers), Hyderabad, for the analysis of Trace Elements and Rare Earth Elements (REE), by Lucid Laboratories Private Limited, Hyderabad, invariably as a standard practice incorporate or check the analysis with analyzed check samples and with standard reference samples for a batch of 10 samples with the following standards reference samples and their analytical date for Ga,V, REE including Sc.

Regards,

R. K.

Dr. R Krishnamoorthy
Director (Research & Development)

LUCID LABORATORIES PVT. LTD.
Hyderabad

LUCID Laboratories Pvt. Ltd.
Testing to the Core

The samples submitted by CMT (Critical Mineral Trackers), Hyderabad, for the analysis of Trace Elements and Rare Earth Elements (REE), by Lucid Laboratories Private Limited, Hyderabad, invariably as a standard practice incorporate or check the analysis with analyzed check samples and with standard reference samples for a batch of 10 samples with the following standards reference samples and their analytical data for Ga,V, REE including Sc.

Regards,

R. K. M.

Dr. R Krishnamoorthy
Director (Research & Development)

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CIN No. : U24239TG2004PTC042390

The methodology being followed by Shiva Labs, Bangalore to who analysed the check samples

The purpose of this document is to describe the procedure for the estimation of majors, minors, trace and rare earth elements in powder samples by making a fusion bead followed by WDXRF analysis for oxides, - Al_2O_3, BaO, CaO, Cr_2O_3, Fe_2O_3, K_2O, MgO, MnO, Na_2O, P_2O_5, SiO_2, TiO_2, SO_3, V_2O_5, NiO, CuO, ZnO, SrO, ZrO_2, and PbO.

Fusion Bead preparation:

Flux composition--9.45 gm +/- 0.010g of Lithium tetra borate + Lithium Metaborate with 0.5g of Lithium bromide as wetting agent) in a glass bottle with lid, then the sample 0.550 gm +/- 0.005g of sample is weighed in a glass container containing already weighed flux, mixed thoroughly and transferred into a cleaned Pt- crucible and kept in a Fusion bead machine XRF Fuse 6. The fusion bead machine will make a fusion bead according to the program and pours into a mold, which is used for WDXRF analysis. Generally XRF Fuse 6 machine will preheat the sample at 650°C and sample is automatically melted, mixed by movements and melted completely at 1050°C. The molten sample is poured into a Pt mold which is cooled by forced air and finally a fused glass bead of sample is prepared for WDXRF analysis.

Instrumentation

The WDXRF procedure is based on X-ray fluorescence spectroscopy and is used for the sequential element determination of elements in a variety of sample matrices. The instrument has a vacuum chamber for sample, goniometer for changing the angle of detectors (both Scintillation and gas detector). Also Crystals for focusing the secondary x-rays from the samples towards the detector. The XRF instrument is connected with a PC which controls the operations, analysis and results. The X-ray tube is protected by a circulating water from a chiller unit which helps to keep the tube at 25°C.

LIST OF PLATES (ENCLOSED SEPARATLY)

Plate No	Title	Scale
I	Location Map of Reconnaissance Survey G4 for Bauxite, Ga, V, Ti & REE in Lakhond Area, Dist : Kachchh, Gujarat	Not To Scale
II	Regional Geological Map of Kachchh basin (part) with location of Lakhond Area, Kachchh district, Gujarat	Not To Scale
III	Interpreted Large Scale Geological Map of Lakhond Area, Dist: Kachchh, Gujarat	1:12500
IV	Large Scale Geological Map of outcrops in Lakhond area, Dist: Kachchh, Gujarat	1:12500
V	Location of Pits & Trench on Large Scale Geological Map of Lakhond Area, Dist: Kachchh, Gujarat	1:12500
VI	Land use / Land cover map of Lakhond area, Kachchh district, Gujarat	1:12500
VII	Lithological map of pits in Lakhond area, Kachchh district, Gujarat	1:100
VIII	Assay Map of pits Lakhond area, Kachchh district, Gujarat	1:100
IX	Lithological map of Trenches in Lakhond area, Kachchh district, Gujarat	1:100
X	Assay Map of Trenches Lakhond area, Kachchh district, Gujarat	1:100
XI	Graphic Lithologs of Boreholes (drilled in) Lakhond Area, Kachchh district, Gujarat	1:200
XII	Assay values of Boreholes (drilled in) Lakhond Area, Kachchh district, Gujarat.	1:200

CHAPTER – XV

15. PEER REVIWER COMMENTS

Peer Reviewer, Dr P.R. Golani, DDG (Retd), GSI, comments on the technical and scientific content of the Geological Report

Dated 3rd May, 2026

From:

Dr. P. R. Golani
Dy. Director General, GSI (Retd.)
Flat No. 1054, Prestige Dolce Vita,
ECC Road, Whitefield, Bengaluru- 560 066

To:

The Director (Operations),
Critical Mineral Trackers,
Concourse Road, Ameerpet,
Hyderabad-500016

Sub: Peer Review of report titled 'Reconnaissance Survey (G-4) for bauxite, Ga, V, Ti, & REE in Lakhond area, Kutchch district, Gujarat' by Critical Mineral Trackers, Hyderabad.

Ref: 1. Your letter dated 18th April, 2026 along with the report for review.
2. NMEDT, F. No. 44/1/2017-NMET/909, dated 16.03.2026

Sir,

With reference to the above, please find enclosed the report titled 'Reconnaissance Survey (G-4) for Bauxite, Ga, V, Ti, & REE in Lakhond area, Kutchch district, Gujarat' reviewed by the undersigned. It is requested to go through the observations and modifications suggested in the report and attend to the comments and queries mentioned in the text part as well as at the margins of Tables and Plates. In addition, the following comments on the technical and scientific content of the said report are given below:

1. Summary Section: The summary section must include the analytical average and range of analytical values in respect of Al_2O_3, Ga, V, Ti and REE which constitute the main objective of the present reconnaissance survey report.

2. Introduction (Chapter-II, see the Table and geological map given in the mosaic Fig.1):

   i) The basic information stated to be provided by the Commissionerate of Geology and Mining (CGM), Gujarat indicates that bauxite occupies an area of 8570 sq m and a mean thickness 1.30 m with an average Al_2O_3 content of 51.29 %. Assuming specific gravity of 2.5, the **estimated tonnage comes to be 27852.5 tonnes** (or **0.02785 Mt.), whereas it is given in the present report as 27.85 Mt**. The former estimated tonnage values appear to be in consonance with the parameters of the bauxite-expanse given in the table that accompanies the Fig.1. The low 0.2785 Mt tonnage of bauxite does not require any investigation even if it contains deposit-grade values of Ga, V, Ti and REE.

   ii) The coordinates of the area of present investigation as shown in the geological map indicates that the earlier marked bauxite is kept outside the purview of the investigation (see Fig. 1 Geological map).

   iii) Basis of taking up the present investigation (see Page 6, top three lines): Analytical values of preliminary sampling in respect of Ga, V, Ti and REE that were presented before the Technical Evaluation Committee, which eventually led to approval of this project. The chemical values especially high SiO_2 and low Al_2O_3 do not indicate presence of bauxite.

3. Laterite/bauxite was shown in the far eastern part of the earlier map provided by CGM. This rock of interest remains non-existent in the Large-Scale Map (PLATE-IV) prepared during the

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present exploration work. It is therefore, imperative to mark location of a few samples on the LSM that were collected and analysed and their chemical results formed basis of taking up this project.

4. Bauxitic clays (see page nos. 54, 55, 91 and also at several other places): Believing that the pits and trenches are excavated at geologically appropriate places, the occurrence of sandstones in most of such exploratory work indicates absence of bauxite, lithomargic clays and/or saprolites. Since there is no bauxite *per se*, it is therefore, suggested not to use the term bauxitic clays/clayey bauxite.

5. Ga, V, Sc and REE contents (see Tables 6.1 and 6.2 at pages 53 and 54): Looking at the immobile nature of Ga, there is not much enrichment of its content in the so called 'bauxitic clays'. Analytical values of Gallium (Ga) average around 30 ppm. Enrichment of Vanadium and REE-Scandium-Yttrium is below the significant values are much below the prospect-level contents. Analytical values of Al_2O_3 averages 22.18% for pits and 44.56% for trenches while mean silica (SiO_2) is 52.32% for pits and 44.56% for trenches. These chemical attributes dispel the belief that the area is prospective for bauxite investigation.

6. Boreholes (Section 9.0, P. 119): Pitting and trenching carried out during the present exploration revealed that the Lakhond area is underlain largely by sandstones. Chemical analyses also show that there is no bauxite or 'bauxitic clays' (see the comment no. 5). No bauxite *per se* has been intersected in boreholes. It is largely sandstone and some clays that dominate the lithologs. The scientific reasoning for drilling four scout boreholes in the aftermath of discouraging results from pitting and trenching appear unjustified.

7. Variations in Primary vs Check samples (see Table 9.8 at P. 164): The analytical table shows consistent lower reporting of the values in the check samples especially in respect of Al_2O_3 which is the defining chemical component of bauxites. The variations from the mean value of primary and check samples vary from 16% to over 50%, which is far too more than the commonly accepted variation of ± 5% for major elements like Al_2O_3. Quality of analyses is beyond the permissible limit of acceptability.

8. Analytical results of the Standard Reference Material (SRMs) in respect of Ga, Sc, V and REE should be provided as it increases authenticity of analytical values.

9. References:
   - Ternary diagram (see P. 92 and also at other places): Pl. cite the author who has devised the Ternary diagram for laterites, and give its complete reference.
   - Citations should appear in the list of References. For example, reference of Patel cited at page 22 is missing in the list of references. At several places there is no match of years of work cited in the text with its citation in the reference list.

10. There appears to be a goof up at headers on top left side of pages from 161 to 167 which reads 'RECONNAISSANCE SURVEY (G4) FOR BAUXITE, Ga, V, Ti & REE IN RELDI MOTI AREA, KACHCHH DISTRICT, GUJARAT'.

The geological map provided by Commissionerate of Geology and Mining (CGM) does not show presence of any bauxite in the allotted area of 6.12 sq km to the exploration agency. Based on a few surface samples that analysed high silica and moderate alumina, the evaluators and decision makers appeared to be convinced that the Lakhond area was prospective for search of bauxite along with critical

Prakash.

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minerals like Ga, V and REE-Sc-Y. The present exploration work clearly indicates that the Lakhond Block in Kutchchh district, Gujarat may be considered as non-prospective from the point of view of bauxite and associated critical minerals.

Pl. note: The reviewed report (Hard copy) along with Plates is being sent to the Critical Mineral Trackers, Hyderabad by post.

Yours Sincerely

(Dr. P. R. Golani)

Dy. Director General, GSI (Retd.),

Email: prggsi@gmail.com , Mb: 8448834701

Copy for information to:

1. The Director, NMEDT Secretariat, Ministry of Mines, Govt. of India, New Delhi-110 001.

Prakash.

(Dr. P. R. Golani)

Dy. Director General, GSI (Retd.)

Note: All the comments and suggestions made by Dr P.R. Golani, DDG, GSI (Retd), the Peer Reviewer, were attended to