GEOLOGICAL REPORT ON THE PRELIMINARY (G-3) EXPLORATION OF BAUXITE AND ASSOCIATED MINERALS IN

JULRAI BLOCK

(AREA: 8.12 sq km)

DISTRICT– KACHCHH, GUJARAT

(TEXT, ANNEXURES AND PLATES)

MINERAL EXPLORATION AND CONSULTANCY LIMITED

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GEOLOGICAL REPORT ON THE PRELIMINARY (G-3) EXPLORATION FOR BAUXITE AND ASSOCIATED MINERALS IN JULRAI BLOCK DISTRICT– KACHCHH, GUJARAT

SALIENT FEATURES

1.	Name of the block	Julrai Block Tehsil- Lakhpat District – Kachchh, State – Gujarat
2.	Mineral	Bauxite & Associated Minerals (Titanium, Vanadium, Gallium, REE)
3.	Total Area	4.86 sq.km.
4.	Area covered under present scheme	4.86 sq.km.
5.	Period of Exploration	May 2025 to March 2026.
6.	Meterage drilled by MECL	Total 77.0 m
7.	No. of Boreholes drilled by MECL	Total 05 Nos
8.	Thickness of Different Grade Bauxite	Average thickness of bauxite is 2.5m
9.	Cut-off grade	As per end use grade classification recommended by IBM. cutoff grade of 1. **Metallurgical Grade II Bauxite:** $Al_2O_3 \geq 40\%$ and $SiO_2 \leq 4\%$ 2. Low Grade Bauxite: $Al_2O_3 \geq 35\text{-}40\%$ and $SiO_2 \leq 10\%$ 3. **Aluminous Laterite:** $Al_2O_3 > 20$ 4. **TiO_2 demarcation**: $TiO_2 > 2\%$
10.	Resources	1. Metallurgical Grade Bauxite: 0.22 MT, Alumina 40.00% and SiO_2 3.85%, Fe_2O_3 31.51% TiO_2 5.42%, Sc 21.72 ppm, V 632.76 ppm and Ga 41.91 ppm 2. Low Grade Bauxite: 14.67 MT is estimated with an average grade of alumina 38.65% and SiO2 6.38%, Fe2O3 20.66% TiO2 6.41%, Sc 29.12 ppm, V 783.48 ppm and Ga 58.43 ppm. 3. Aluminous Laterite: 24.59 MT, Alumina 28.26% and SiO2 12.43%, Fe_2O_3 33.68% TiO_2 4.89%, Sc 25.24 ppm, Ga 44.01 ppm and V 730.74 ppm 4. TiO_2-bearing Horizon: 67.89 MT, Average grade of 4.76% TiO_2 5. Gallium: 16.92 MT is estimated with an average grade of Ga 61.27 ppm, Vanadium 845.76 ppm, Scandium 29.25 ppm, alumina 38.62% and silica 7.44%, TiO_2 6.58%. 6. Scandium: 9.56 MT is estimated with an average grade of Sc 56.56 ppm, alumina 28.14% and silica 18.71%, TiO_2 4.84% and V 768.96 ppm. 7. Vanadium: 58.11 MT is estimated with an average grade of V 748.38 ppm, Ga 41.54 ppm, Sc 33.21 ppm, alumina 31.68% and silica 15.75%, TiO_2 5.33%. *MT Million Tonnes
11.	Grade	Low Grade Bauxite / Ferruginous Bauxite
12.	UNFC Category	Inferred Category (333)
13.	Report Submission	May 2026

कार्यकारी सारांश

अध्याय-1A

कार्यकारी सारांश

1.1.0 पृष्ठभूमि

बॉक्साइट एल्युमिनियम का प्रमुख अयस्क है तथा एल्यूमिना (Al_2O_3) उत्पादन हेतु सर्वाधिक महत्वपूर्ण कच्चा पदार्थ है, जिसका उपयोग एल्युमिनियम धातु उत्पादन, रिफ्रैक्टरी उद्योग, अपघर्षक (Abrasives), रासायनिक उद्योग, सीमेंट उद्योग तथा विभिन्न सामरिक एवं औद्योगिक क्षेत्रों में व्यापक रूप से किया जाता है। आधारभूत संरचना, रक्षा, परिवहन, अक्षय ऊर्जा तथा उन्नत विनिर्माण क्षेत्रों में एल्युमिनियम एवं संबद्ध क्रिटिकल मिनरल्स की बढ़ती मांग के कारण भारत में लेटराइटिक बॉक्साइट निक्षेपों का व्यवस्थित अन्वेषण अत्यधिक महत्वपूर्ण हो गया है।

गुजरात का कच्छ क्षेत्र डेक्कन ट्रैप ज्वालामुखीय शैलों एवं सुप्रा-ट्रैपियन अवसादी अनुक्रमों पर विकसित लेटराइटिक बॉक्साइट, बेंटोनाइट, लिग्नाइट, चूना पत्थर तथा अन्य औद्योगिक खनिजों की उपस्थिति के लिए प्रसिद्ध है। पश्चिमी कच्छ क्षेत्र की खनिज संभावनाओं को दृष्टिगत रखते हुए राष्ट्रीय खनिज अन्वेषण न्यास (NMET) के अंतर्गत मिनरल एक्सप्लोरेशन एंड कंसल्टेंसी लिमिटेड (MECL) द्वारा जुलराई ब्लॉक में बॉक्साइट एवं सहवर्ती खनिजों हेतु प्रारंभिक अन्वेषण (G-3 स्तर) कार्य संपादित किया गया।

इस अन्वेषण कार्यक्रम का उद्देश्य जुलराई ब्लॉक में डेक्कन ट्रैप बेसाल्ट पर विकसित लेटराइटिक बॉक्साइट क्षितिजों की उपस्थिति, मोटाई, विस्तार, ग्रेड विशेषताओं तथा संबद्ध खनिज संभावनाओं का मूल्यांकन करना था। साथ ही लेटराइटिक प्रोफाइल में टाइटेनियम, वैनाडियम, गैलियम, स्कैंडियम एवं दुर्लभ मृदा तत्वों (REE) की उपस्थिति का भी अध्ययन किया गया।

1.2.0 स्थिति एवं पहुँच

जुलराई ब्लॉक गुजरात राज्य के कच्छ जिले की लखपत तहसील में स्थित है तथा पश्चिमी कच्छ मुख्य भू-भाग का हिस्सा है। यह ब्लॉक भारतीय सर्वेक्षण विभाग के टोपोशीट संख्या

41A/14 एवं 41A/15 में अवस्थित है तथा लगभग 8.12 वर्ग किमी क्षेत्रफल में विस्तृत है। भौगोलिक दृष्टि से यह क्षेत्र जुलराई, सायन, डेनमा एवं मातानोमाध ग्रामों के आसपास स्थित है।

यह क्षेत्र सड़क, रेल एवं वायु मार्ग से सुगम रूप से जुड़ा हुआ है। निकटतम रेलवे स्टेशन भुज रेलवे स्टेशन है, जो ब्लॉक से लगभग 105 किमी दूरी पर स्थित है, जबकि भुज हवाई अड्डा लगभग 103 किमी दूरी पर स्थित है। राष्ट्रीय राजमार्ग-41 एवं राष्ट्रीय राजमार्ग-754K क्षेत्रीय संपर्क प्रदान करते हैं। ब्लॉक के आंतरिक भाग सर्व-ऋतु मोटरेबल ग्रामीण सड़कों द्वारा जुड़े हुए हैं, जिससे अन्वेषण कार्य हेतु मानवबल, ड्रिलिंग उपकरण एवं सामग्री का सुचारु परिवहन संभव हुआ।

1.3.0 भू-आकृति एवं जलवायु

भू-आकृतिक दृष्टि से जुलराई ब्लॉक पश्चिमी कच्छ के अर्द्ध-शुष्क क्षेत्र का भाग है, जहाँ मृदुल उतार-चढ़ाव वाली समभूमियाँ, निम्न टीलानुमा पहाड़ियाँ, पेडिमेंट सतहें तथा समतल शीर्ष वाले लेटराइटिक उच्च भू-भाग विकसित हैं। क्षेत्र की ऊँचाई लगभग 86 मीटर से 108 मीटर औसत समुद्र तल (MSL) के मध्य है।

क्षेत्र की अपवाह प्रणाली मुख्यतः डेंड्राइटिक से उप-डेंड्राइटिक प्रकार की है तथा काकड़ी नदी एवं कोटावाड़ी नदी जैसी मौसमी धाराओं द्वारा निरूपित होती है। मानसून अवधि में सतही प्रवाह सक्रिय रहता है जबकि वर्ष के अधिकांश समय जलधाराएँ शुष्क रहती हैं।

यह क्षेत्र उष्ण अर्द्ध-शुष्क से शुष्क जलवायु वाला है, जहाँ उच्च तापमान, कम आर्द्रता, अधिक वाष्पीकरण तथा अल्प एवं अनियमित वर्षा पाई जाती है। औसत वार्षिक वर्षा लगभग 350 मिमी है, जो मुख्यतः दक्षिण-पश्चिम मानसून के दौरान प्राप्त होती है। क्षेत्र में विरल कांटेदार झाड़ियाँ एवं क्षेरोफाइटिक वनस्पतियाँ प्रमुख हैं।

1.4.0 क्षेत्रीय भूविज्ञान एवं संरचना

जुलराई ब्लॉक कच्छ बेसिन का हिस्सा है, जो पश्चिमी भारत का एक पेरि-क्रेटोनिक रिफ्ट बेसिन है तथा इसमें मध्यजीवी (Mesozoic) से वर्तमान काल तक की अवसादी एवं ज्वालामुखीय शैल अनुक्रम संरक्षित हैं। क्षेत्रीय रूप से यहाँ डेक्कन ट्रैप ज्वालामुखीय शैलें, सुप्रा-ट्रैपियन लेटराइटिक क्षितिज तथा तृतीयक (Tertiary) अवसादी संरचनाएँ, विशेषतः मातानोमाध एवं काकड़ी नदी संरचना, विकसित हैं।

डेक्कन ट्रैप बेसाल्ट आधारभूत शैल के रूप में विद्यमान है, जो सामान्यतः सूक्ष्म से मध्यम दानेदार, गहरे धूसर से काले रंग का तथा स्थानीय रूप से पोर्फाइरिटिक एवं अमिग्डालॉइडल प्रकृति का है। इसके ऊपर सुविकसित लेटराइटिक-बॉक्साइटिक प्रोफाइल विकसित है, जिसमें लेटराइट, बॉक्साइट, बॉक्साइटिक मृदा, लिथोमार्जिक क्ले, बेंटोनाइटिक क्ले तथा सैप्रोलाइटिक क्षितिज सम्मिलित हैं।

संरचनात्मक दृष्टि से क्षेत्र एक स्थिर ज्वालामुखीय पठार का प्रतिनिधित्व करता है, जहाँ शैल स्तर सामान्यतः क्षैतिज से उप-क्षैतिज प्रवृत्ति प्रदर्शित करते हैं। क्षेत्र में कोई प्रमुख भ्रंश या वलन संरचना नहीं पाई गई।

1.5.0 खनिजीकरण की प्रकृति

जुलराई ब्लॉक में बॉक्साइट खनिजीकरण अवशिष्ट लेटराइटिक (सुपरजीन) उत्पत्ति का है, जिसका विकास डेक्कन ट्रैप बेसाल्ट के दीर्घकालिक रासायनिक अपक्षय, डीसिलिकेशन, फेरुजिनाइजेशन तथा अवशिष्ट एल्यूमिना समृद्धि के फलस्वरूप हुआ है।

बॉक्साइट मुख्यतः पिसोलिटिक से ऊलिटिक तथा स्थानीय रूप से कंकड़युक्त (Conglomeratic) प्रकृति का है। लेटराइटिक प्रोफाइल में लेटराइट, बॉक्साइट, क्लेय बॉक्साइट, बॉक्साइटिक क्ले, लिथोमार्जिक क्ले एवं सैप्रोलाइटिक क्षितिज विकसित हैं। खनिजीकरण पार्श्व एवं ऊर्ध्वाधर दोनों दिशाओं में अनियमित एवं असतत प्रकृति का है।

लेटराइटिक प्रोफाइल में विशेष रूप से टाइटेनियम, वैनाडियम, गैलियम, स्कैंडियम एवं दुर्लभ मृदा तत्वों की समृद्धि भी पाई गई है।

1.6.0 पूर्व अन्वेषण

कच्छ क्षेत्र में पूर्व में भारतीय भूवैज्ञानिक सर्वेक्षण (GSI), गुजरात मिनरल डेवलपमेंट कॉर्पोरेशन (GMDC) एवं अन्य संस्थाओं द्वारा बॉक्साइट, लिग्नाइट, बेंटोनाइट एवं अन्य औद्योगिक खनिजों हेतु अन्वेषण कार्य किया गया है। आसपास के क्षेत्रों में बॉक्साइट एवं बेंटोनाइट के कई खनन पट्टे सक्रिय हैं।

वर्तमान अन्वेषण जुलराई ब्लॉक में लेटराइटिक बॉक्साइट क्षितिजों की मोटाई, विस्तार, ग्रेड एवं आर्थिक संभावनाओं के मूल्यांकन हेतु G-3 स्तर पर किया गया।

1.7.0 वर्तमान अन्वेषण

वर्तमान G-3 स्तर अन्वेषण कार्यक्रम में निम्न कार्य सम्मिलित थे:

- विस्तृत भूवैज्ञानिक मानचित्रण
- बेडरॉक सैम्पलिंग
- पिटिंग एवं ट्रेंचिंग
- अन्वेषणात्मक कोर ड्रिलिंग
- रासायनिक विश्लेषण
- पेट्रोग्राफिक अध्ययन
- मिनराग्राफिक अध्ययन
- XRD अध्ययन
- बल्क घनत्व निर्धारण
- संसाधन आकलन

क्षेत्र में व्यवस्थित भूवैज्ञानिक मानचित्रण एवं नमूना संग्रहण द्वारा विभिन्न शैल इकाइयों एवं खनिजीकृत क्षेत्रों की पहचान की गई। सतही संकेतों के आधार पर उपसतही निरंतरता एवं ग्रेड विशेषताओं के अध्ययन हेतु ड्रिलिंग कार्य संपादित किया गया।

वर्तमान अन्वेषण के अंतर्गत कुल 07 बोरहोल ड्रिल किए गए। सीमित एवं असतत बॉक्साइटिक लेटराइट अनावृत्तियों के कारण ड्रिलिंग 400 मीटर के समान अंतराल पर न होकर लगभग 600-800 मीटर अंतराल पर की गई। ड्रिलिंग का मुख्य उद्देश्य लेटराइटिक-बॉक्साइटिक प्रोफाइल की मोटाई, ऊर्ध्वाधर निरंतरता एवं ग्रेड विशेषताओं का निर्धारण करना था।

1.8.0 स्वीकृत बनाम संपादित कार्य की मात्रा

जुलराई ब्लॉक, जिला-कच्छ, गुजरात राज्य में एमईसीएल द्वारा स्वीकृत संशोधित कार्य मात्रा के विरुद्ध संपादित कार्य का विवरण

S. No	Item details	Unit	Proposed Quantum	Achieved Quantum	Remarks
1	Geological Mapping (1:4000 scale)	Sq. Km.	8.12	8.12	
2	Topographic Survey (Contour interval 2m) at 1:4000 scale	Sq. Km.	8.12		
3	Pitting	cu. m	150	50	
4	Trenching	cu. m	50	0	
5	Bore Hole Fixation and determination of co-ordinates & Reduced Level (RL) of	Nos.	30+5=19	12	

	the boreholes and demarcation of lease hold boundary points by DGPS				
6	Core drilling (400m x 400m grid).	m	900	96.25	7 Nos BH in phase I drilling
7	**Sampling & Chemical Analysis**				
A)	Primary samples to be analyzed for 7 radicals viz. Al_2O_3, SiO_2, Fe_2O_3, TiO_2, V, Ga, Sc & LOI				
i.	A. Bedrock samples for Bauxite	Nos.	50	50	
	B. Bedrock samples for limestone	Nos.	3	3	
ii.	Trench/ Pit samples	Nos.	20	19	
iii.	Borehole Core samples	Nos.	247	89	
iv.	For Each additional Trace Element viz.V,	Nos.	178	89	

	Ga, Sc. (from BH Core Sample)				
v.	Check samples (10% external)	Nos.	25	15	
8	**Physical Studies**				
a)	ICP-AES/ICPMS (sequential technique) for 34 elements i.e. 16 other elements viz. Li, Ga, In, Be, Ge, Mo, Ni, Cr, Ta, W, Ba, Co, Rb, Sr, Zr, Nb ;16 REE viz. La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Sc, Y; 02 Actinides viz. U, Th.	Nos.	20	20	
b)	X-RD studies for mineral identification	Nos.	5	5	
9	Petrographic Studies	Nos.	6	6	

10	Mineragraphic Studies	Nos.	4	4	
11	Preparation of Polished Section & Thin Section (05+05)	Nos.	10	10	
12	Bulk density	Nos.	5	3	
13	Combined determination of Trihydrate Alumina (THA-140°C), Monohydrate Alumina (MHA-240°C) & Reactive Silica	Nos.	8	5	
14	Proposal preparation	Nos.	1	1	
15	Geological Report Preparation {As per Mineral (Evidence of mineral contents) Rule-2015}	Nos.	1	1	

1.9.0 पेट्रोग्राफी एवं मिनराग्राफी

पेट्रोग्राफिक अध्ययनों से ज्ञात हुआ कि बॉक्साइट का निर्माण बेसाल्टिक मूल शैल के तीव्र लेटराइटीकरण एवं बॉक्साइटीकरण से हुआ है। नमूनों में पिसोलिटिक, फेरुजिनस, छिद्रयुक्त एवं क्लेय बनावट पाई गई। गिब्साइट फेरुजिनस एवं क्लेय मैट्रिक्स में प्रसारित कणों, पिसोलाइट्स एवं गुहिका भराव के रूप में पाया गया।

मिनराग्राफिक अध्ययनों में हेमेटाइट, गोएथाइट, लिमोनाइट, एनाटेस/रूटाइल एवं ल्यूकोक्सीन प्रमुख अयस्क खनिजों के रूप में पहचाने गए। टाइटेनियम युक्त खनिज मुख्यतः फेरुजिनस एवं पिसोलिटिक क्षेत्रों में पाए गए। खनिज संघटन एवं बनावटी संबंध दीर्घकालिक सुपरजीन अपक्षय, ऑक्सीकरण एवं अवशिष्ट समृद्धि प्रक्रियाओं को इंगित करते हैं।

1.10.0 भू-रासायनिक अध्ययन

भू-रासायनिक अध्ययनों से ज्ञात हुआ कि बॉक्साइट मुख्यतः फेरुजिनस से निम्न-ग्रेड प्रकृति का है। Al_2O_3-Fe_2O_3-SiO_2 त्रिघटक वर्गीकरण आरेख (Valeton, modified after Bardossy) लेटराइटीकरण एवं बॉक्साइटीकरण के दौरान प्रगतिशील डीसिलिकेशन एवं एल्यूमिना समृद्धि को दर्शाता है।

Al_2O_3 बनाम Fe_2O_3 तथा Al_2O_3 बनाम SiO_2 द्विघटक आरेख एल्यूमिना एवं सिलिका के मध्य विपरीत संबंध प्रदर्शित करते हैं, जो बॉक्साइटीकरण के दौरान सिलिका निष्कासन को इंगित करते हैं। TiO_2 बनाम Fe_2O_3 संबंध फेरुजिनस लेटराइटिक क्षेत्रों में टाइटेनियम की अवशिष्ट समृद्धि को प्रदर्शित करता है।

1.11.0 संसाधन आकलन

वर्तमान अन्वेषण के दौरान प्राप्त भूवैज्ञानिक, ड्रिलिंग, सैम्पलिंग, विश्लेषणात्मक एवं बल्क घनत्व आंकड़ों के आधार पर UNFC (333) श्रेणी के अंतर्गत पॉलीगोनल विधि द्वारा संसाधन आकलन किया गया।

संसाधनों का सारांश

खनिजीकरण	संसाधन	औसत ग्रेड
धातुकर्म श्रेणी बॉक्साइट	0.22 MT	Al_2O_3 40.00%, SiO_2 3.85%
निम्न-ग्रेड बॉक्साइट	14.67 MT	Al_2O_3 38.37%, SiO_2 6.02%
एल्यूमिनस लेटराइट	24.59 MT	Al_2O_3 28.26%, SiO_2 12.43%
TiO_2 युक्त क्षितिज	67.89 MT	TiO_2 4.76%

1.12.0 निष्कर्ष

वर्तमान G-3 स्तर अन्वेषण से जुलराई ब्लॉक में लेटराइटिक बॉक्साइट, एल्यूमिनस लेटराइट, एल्यूमिनस क्ले एवं टाइटेनियम युक्त फेरुजिनस क्षितिजों की उपस्थिति स्थापित हुई है। बॉक्साइट खनिजीकरण अत्यधिक अनियमित, असतत तथा मोटाई एवं ग्रेड में परिवर्तनीय प्रकृति का है।

ब्लॉक का दक्षिण-पश्चिमी भाग तुलनात्मक रूप से बेहतर लेटराइटिक बॉक्साइट विकास दर्शाता है, जबकि शेष भागों में मुख्यतः लेटराइट एवं एल्यूमिनस लेटराइट का प्रभुत्व है।

पेट्रोग्राफिक, मिनराग्राफिक एवं भू-रासायनिक अध्ययन यह दर्शाते हैं कि खनिजीकरण डेक्कन ट्रैप बेसाल्ट के दीर्घकालिक अपक्षय एवं डीसिलिकेशन से विकसित अवशिष्ट लेटराइटिक (सुपरजीन) उत्पत्ति का है।

1.13.0 अनुशंसा

बॉक्साइट क्षितिजों की सीमित निरंतरता, अनियमित वितरण एवं परिवर्तनीय ग्रेड विशेषताओं को दृष्टिगत रखते हुए जुलराई ब्लॉक में बॉक्साइट हेतु आगे विस्तृत ड्रिलिंग कार्य की अनुशंसा नहीं की जाती है।

हालाँकि, ब्लॉक के मध्य भाग में विद्यमान जीवाश्मयुक्त चूना पत्थर क्षितिज उत्साहवर्धक रासायनिक गुणधर्म प्रदर्शित करता है। अतः इस चूना पत्थर निक्षेप के संसाधन एवं आर्थिक

संभावनाओं के मूल्यांकन हेतु विस्तृत भूवैज्ञानिक मानचित्रण, ग्रिड-आधारित ड्रिलिंग एवं रासायनिक विश्लेषण सहित व्यवस्थित अन्वेषण की अनुशंसा की जाती है।

EXECUTIVE SUMMARY

GEOLOGICAL REPORT ON THE PRELIMINARY (G-3) EXPLORATION FOR BAUXITE AND ASSOCIATED MINERALS IN JULRAI BLOCK, DISTRICT - KACHCHH, STATE – GUJARAT

CHAPTER-1B

EXECUTIVE SUMMARY

1.1.0 Background

Bauxite constitutes the principal ore of aluminium and represents the most important raw material for the production of alumina (Al_2O_3), which is extensively utilized in aluminium smelting, refractory industries, abrasives, chemicals, cement, and several strategic industrial applications. Owing to the increasing demand for aluminium and associated critical minerals in infrastructure, defence, transportation, renewable energy, and advanced manufacturing sectors, systematic exploration of lateritic bauxite deposits has gained considerable significance in India.

The Kachchh region of Gujarat is well known for the occurrence of lateritic bauxite, bentonite, lignite, limestone, and associated industrial minerals developed over the Deccan Trap volcanic terrain and supra-trappean sedimentary horizons. In view of the mineral potential of the western Kachchh region, the present Preliminary Exploration (G-3) for Bauxite and Associated Minerals in the Julrai Block was undertaken by Mineral Exploration and Consultancy Limited (MECL) under the aegis of the National Mineral Exploration Trust (NMET).

The exploration programme was conceptualized to evaluate the occurrence, thickness, continuity, grade characteristics, and associated mineral potential of lateritic bauxite horizons developed over the Deccan Trap basaltic terrain within the Julrai Block. The study also aimed at assessing the occurrence of associated valuable elements such as titanium, vanadium, gallium, scandium, and REE within the lateritic profile.

1.2.0 Location and Accessibility

The Julrai Block is situated in Lakhpat Taluka of Kachchh District, Gujarat, and forms part of the western Kachchh mainland. The block falls within Survey of India Toposheet Nos. 41A/14 and 41A/15 and covers an area of approximately 8.12 sq. km.

Geographically, the block is located in and around Julrai, Sayan, Denma, and Matanomadh villages.

The area is well connected through road, rail, and air networks, facilitating smooth execution of exploration activities. The nearest railhead is Bhuj Railway Station, located about 105 km from the block, while Bhuj Airport, situated approximately 103 km away, provides air connectivity to major cities of Gujarat and other parts of India. Regional connectivity is mainly provided by National Highway–41 and National Highway–754K. The interior parts of the block are approachable through all-weather motorable village roads, enabling efficient transportation of manpower, drilling equipment, and exploration materials.

1.3.0 Physiography and Climate

Physiographically, the Julrai Block forms part of the semi-arid terrain of western Kachchh and is characterized by gently undulating plains interspersed with isolated low hillocks, mounds, pedimented surfaces, and flat-topped lateritic uplands developed over Deccan Trap basalt and associated sedimentary formations. The elevation within the block ranges approximately from 86 m to 108 m above Mean Sea Level (MSL), indicating moderate local relief.

The drainage pattern is predominantly dendritic to sub-dendritic and is represented by ephemeral streams and seasonal nalas such as Kakdi Nadi and Kotawadi Nadi. Surface runoff is mainly active during the monsoon period, while the channels remain dry during most part of the year due to low and erratic rainfall conditions.

The region experiences a hot arid to semi-arid climate characterized by high summer temperatures, low humidity, high evaporation rates, and scanty rainfall. The average annual rainfall is approximately 350 mm, most of which is received during the southwest monsoon season. Sparse thorny scrub vegetation and xerophytic plant species dominate the landscape, reflecting the arid environmental conditions prevailing in the region.

1.4.0 Regional Geology and Structure

The Julrai Block forms part of the Kachchh Basin, a peri-cratonic rift basin of western India preserving a thick succession of Mesozoic to Recent sedimentary and volcanic rocks. Regionally, the area is represented by Deccan Trap volcanics, supra-trappean lateritic horizons, and Tertiary sedimentary formations represented mainly by Matanomadh and Kakdi Nadi Formations.

The Deccan Trap basalt constitutes the basement lithology and is typically fine- to medium-grained, dark grey to black, locally porphyritic, and amygdaloidal in nature. Overlying the basalt is a well-developed lateritic–bauxitic profile comprising laterite, bauxite, bauxitic clay, lithomargic clay, bentonitic clay, saprolitic horizons, and associated ferruginous units.

Structurally, the area represents a tectonically stable volcanic plateau with generally horizontal to sub-horizontal attitudes. No major folding or faulting has been observed within the explored block area. Minor joints and fractures developed within basaltic and sedimentary units control local weathering, groundwater movement, and geomorphological features.

1.5.0 Nature of Mineralization

The bauxite mineralization within the Julrai Block is residual lateritic (supergene) in origin and has developed through prolonged chemical weathering, desilication, ferruginization, and residual alumina enrichment of the parent Deccan Trap basalt under tropical subaerial conditions.

The bauxite is predominantly pisolitic to oolitic and locally conglomeratic in nature. The lateritic profile comprises laterite, bauxite, clayey bauxite, bauxitic clay, lithomargic clay, and saprolitic horizons developed over weathered basalt. The mineralization is highly irregular and discontinuous both laterally and vertically.

Associated enrichment of titanium, vanadium, gallium, scandium, and rare earth elements has also been observed within the lateritic profile, particularly in ferruginous and aluminous horizons.

1.6.0 Previous Exploration

The Kachchh region has been investigated earlier by Geological Survey of India (GSI), Gujarat Mineral Development Corporation (GMDC), and other agencies for bauxite, lignite, bentonite, and associated industrial minerals. Several bauxite and bentonite mining leases are operational in adjoining parts of Kachchh District.

The present investigation was undertaken to evaluate the continuity, thickness, grade characteristics, and economic potential of lateritic bauxite horizons occurring within the Julrai Block under G-3 stage exploration.

1.7.0 Present Exploration

The present G-3 stage exploration programme comprised:

- Detailed Geological Mapping
- Bedrock Sampling
- Pitting and Trenching
- Exploratory Core Drilling
- Chemical Analysis
- Petrographic Studies
- Mineragraphic Studies
- XRD Studies
- Bulk Density Determination
- Resource Estimation

Systematic geological mapping and sampling were carried out to delineate lithological units and identify mineralized zones. Based on encouraging surface indications, exploratory drilling was undertaken to assess the subsurface continuity and grade characteristics of the bauxite horizons.

A total of 07 boreholes were drilled during the present investigation. The boreholes were not drilled at uniform 400 m spacing; instead, drilling spacing varied between approximately 600 m and 800 m owing to the limited and discontinuous surface exposure of bauxitic laterite. The drilling programme was primarily designed to establish the vertical continuity, thickness variation, and grade characteristics of the lateritic–bauxitic profile.

1.8.0 Quantum of Work: Approved vis-à-vis Achieved

Approved Revised Quantum of Work vs. Achievement by MECL in Julrai block, District: Kachchh, State: Gujarat

S. No	Item details	Unit	Proposed Quantum	Achieved Quantum	Remarks
1	Geological Mapping (1:4000 scale)	Sq. Km.	8.12	8.12	
2	Topographic Survey (Contour interval 2m) at 1:4000 scale	Sq. Km.	8.12	8.12	
3	Pitting	cu. m	150	50	
4	Trenching	cu. m	50	0	
5	Bore Hole Fixation and determination of co-ordinates & Reduced Level (RL) of the boreholes and demarcation of lease hold boundary points by DGPS	Nos.	30+5=19	12	
6	Core drilling (400m x 400m grid).	m	900	96.25	7 Nos BH in phase I drilling
7	**Sampling & Chemical Analysis**				
A)	Primary samples to be analyzed for 7 radicals viz. Al_2O_3, SiO_2, Fe_2O_3, TiO_2, V, Ga, Sc & LOI				
i.	A. Bedrock samples	Nos.	50	50	

	B. Bedrock samples for Limestone	Nos.	3	3	
ii.	Trench/ Pit samples	Nos.	20	19	
iii.	Borehole Core samples	Nos.	247	89	
iv.	For Each additional Trace Element viz.V, Ga, Sc. (from BH Core Sample)	Nos.	178	89	
v.	Check samples (10% external)	Nos.	25	15	
8	**Physical Studies**				
a)	ICP-AES/ICPMS (sequential technique) for 34 elements i.e. 16 other elements viz. Li, Ga, In, Be, Ge, Mo, Ni, Cr, Ta, W, Ba, Co, Rb, Sr, Zr, Nb ;16 REE viz. La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Sc, Y; 02 Actinides viz. U, Th.	Nos.	20	20	
b)	X-RD studies for mineral identification	Nos.	5	5	
9	Petrographic Studies	Nos.	6	6	
10	Mineragraphic Studies	Nos.	4	4	
11	Preparation of Polished Section & Thin Section (05+05)	Nos.	10	10	
12	Bulk density	Nos.	5	3	

13	Combined determination of Trihydrate Alumina (THA-140°C), Monohydrate Alumina (MHA-240°C) & Reactive Silica	Nos.	8	5	
14	Proposal preparation	Nos.	1	1	
15	Geological Report Preparation {As per Mineral (Evidence of mineral contents) Rule-2015}	Nos.	1	1	

1.9.0 Petrography and Mineragraphy

Petrographic studies indicate that the bauxite has been formed through intense lateritization and bauxitization of basaltic parent rock. The samples are characterized by pisolitic, ferruginous, porous, cavity-filling, and clayey textures. Gibbsite occurs as disseminations, pisolites, cavity fillings, and fine prismatic aggregates within the ferruginous and clay-rich matrix.

Mineragraphic investigations reveal the presence of hematite, goethite, limonite, anatase/rutile, and leucoxene as the principal ore minerals. Titanium-bearing phases occur mainly within ferruginous and pisolitic zones. The mineral assemblage and textural relationships indicate prolonged supergene alteration, oxidation, ferruginization, and residual concentration processes within the lateritic profile.

1.10.0 Geochemistry

Geochemical studies indicate that the bauxite is predominantly ferruginous to low-grade in nature. The Al_2O_3–Fe_2O_3–SiO_2 ternary classification diagram (after Valeton, modified from Bardossy) suggests progressive desilication and alumina enrichment during lateritization and bauxitization.

Binary plots of Al_2O_3 vs Fe_2O_3 and Al_2O_3 vs SiO_2 indicate an inverse relationship between alumina and silica, suggesting progressive removal of silica during bauxitization. The TiO_2 vs Fe_2O_3 relationship indicates enrichment of relatively immobile titanium within ferruginous lateritic zones.

The geochemical characteristics collectively indicate that the lateritic profile evolved through prolonged supergene weathering and residual enrichment processes.

1.11.0 Resource Estimation

Based on geological, drilling, sampling, analytical, and bulk density data generated during the present investigation, resources have been estimated under UNFC Inferred Category (333) using the Polygonal Method.

Summary of Estimated Resources

Mineralisation	Net Resource	Average Grade
Metallurgical Grade Bauxite	0.22 MT	Alumina 40.00% and SiO_2 3.85%, Fe_2O_3 31.51% TiO_2 5.42%, Sc 21.72 ppm, V 632.76 ppm and Ga 41.91 ppm
Low Grade Bauxite	14.67 MT	**Alumina 38.65% and SiO_2 6.38%, Fe_2O_3 20.66% TiO_2 6.41%, Sc 29.12 ppm, V 783.48** ppm and **Ga 58.43 ppm**
Aluminous Laterite	24.59 MT	Alumina 28.26% and SiO_2 12.43%, Fe_2O_3 33.68% TiO_2 4.89%, Sc 25.24 ppm, Ga 44.01 ppm and V 730.74 ppm
TiO_2-bearing Horizon	67.89 MT	Average grade of 4.76% TiO_2
Gallium	16.92 MT	Ga 61.27 ppm, Vanadium 845.76 ppm, Scandium 29.25 ppm, alumina 38.62% and silica 7.44%, TiO_2 6.58%.
Scandium	9.56 MT	Sc 56.56 ppm, alumina 28.14% and silica 18.71%, TiO_2 4.84% and V 768.96 ppm.
Vanadium	58.11 MT	V 748.38 ppm, Ga 41.54 ppm, Sc 33.21 ppm, alumina 31.68% and silica 15.75%, TiO_2 5.33%.

The bauxite occurring within the block is predominantly ferruginous low-grade bauxite with localized development of metallurgical grade horizons.

1.12.0 Conclusion

The present G-3 stage exploration has established the occurrence of lateritic bauxite, aluminous laterite, aluminous clay, and titanium-bearing ferruginous horizons within the Julrai Block. The bauxite mineralization is highly erratic, discontinuous, and variable in thickness and grade.

The south-western part of the block exhibits comparatively encouraging development of lateritic bauxite, whereas the remaining areas are largely represented by laterite, aluminous laterite, and ferruginous horizons with limited economically viable bauxite mineralization.

Petrographic, mineragraphic, and geochemical studies indicate that the mineralization is residual lateritic (supergene) in origin, developed through prolonged weathering and desilication of Deccan Trap basalt under tropical climatic conditions.

The occurrence of fossiliferous limestone in the central part of the block showing encouraging CaO values also indicates potential for future limestone exploration within the area.

1.13.0 Recommendation

Considering the irregular disposition, limited continuity, and variable grade characteristics of the bauxite horizons, further detailed drilling for bauxite mineralization within the Julrai Block is not recommended at the present stage.

However, the central part of the block is characterized by the occurrence of good-quality fossiliferous limestone exhibiting encouraging chemical and lithological characteristics. In view of its observed continuity and potential economic significance, the limestone horizon may be considered for systematic exploration involving detailed geological mapping, exploratory drilling, and geochemical studies to evaluate its resource potential. However, such exploration may be taken up subject to the restoration of conducive field conditions and resolution of the prevailing local issues in the area.

TEXT

CHAPTER-2

DETAILS OF THE QUALIFIED PERSON(S) / EXPLORATION AGENCY

2.1.1 EXPLORATION AGENCY

MINERAL EXPLORATION AND CONSULTANCY LIMITED

(Formerly Mineral Exploration Corporation Limited)

(A Govt. of India Enterprise; A Miniratna-I CPSE)

(Ministry of Mines, Govt. of India)

Dr. Babasaheb Ambedkar Bhawan, High Land Drive Road,

Seminary Hills, Nagpur-440006.

i. QUALIFIED PERSONS

Exploration agency: Mineral Exploration and Consultancy Limited

Experience: 52 Years, Since 1972

Email: cmd@mecl.gov.in; gm-exploration@mecl.gov.in

Table 2.1
List of qualified persons involved in exploration of the block

Sl.No.	Name of the Person	Designation
1	Shri Shrikant Sharma	HOD (Exploration)
2	Shri P. Ravindran	Retd. GM (Exploration)
3	Shri Swarup Dhara	Sr. Manager (Geology)
4	Shri Shubham Kumar	Geologist
5	Shri Hiresh Shrirame	Young Professional (Geology)
6	Shri Rohit Kumar Sharma	Manager (Chemical Lab)
7	Smt. Deepti Rahangdale	Manager (Chemical Lab)
8	Shri Pradeep Negi	OIC, Survey/ASMO
9	Shri Durgesh Devarshree	ASMO
10	Shri. Puneet Khandale	Sr. Technician

CHAPTER-3

TITLE AND OWNERSHIP

3.1.0 DETAILS OF OWNERSHIP

S No	Title	Details
1	Title of the report	GEOLOGICAL REPORT OF PRELIMINARY (G-3) EXPLORATION FOR BAUXITE AND ASSOCIATED MINERALS IN JULRAI BLOCK, DISTRICT - KACHCHH, STATE – GUJARAT.
2	Ownership	Government of Gujarat
3	Name of the Prospector	**MINERAL EXPLORATION AND CONSULTANCY LIMITED (Formerly Mineral Exploration Corporation Limited)** (A Govt. of India Enterprise; A Miniratna-I PSE) (Ministry of Mines, Govt. of India)
4	Address of Prospector	Dr. Babasaheb Ambedkar Bhavan High Land Drive Road, Seminary Hills, Nagpur, Maharashtra, Pin- 440006
5	E-Mail of the prospector	cmd@mecl.gov.in, gm-exploration@mecl.gov.in
6	Telephone numbers of prospectors	0712-2510289, 0712-2511829

3.2.0 DETAILS OF PERIOD OF PROSPECTING

3.2.1 The G-3 stage exploration in the Julrai Block commenced on 09.07.2025 with the initiation of systematic geological mapping, bedrock sampling and pitting over the study area to delineate lithological units and identify surface indications of mineralization.

Based on the analytical results obtained from the surface bedrock and pit samples, exploratory drilling was subsequently undertaken to assess the subsurface continuity and extent of mineralization. Drilling operations commenced with borehole MBJ-01 on 08.11.2025 and were completed with the closure of borehole MBJ-08 on 13.12.2025.

During the execution of the exploration programme, allied field activities including surveying, drilling, geological core logging and systematic sample collection were carried out concurrently. The collected samples were subjected to chemical analysis and laboratory investigations at the laboratories of MECL and Jawaharlal Nehru Aluminium Research Development and Design Centre (JNARDDC). The analytical results thus generated were utilized for interpretation of mineralization and preparation of the present Geological Report.

3.3.0 DETAILS OF EXPLORATION AGENCY, QUALIFICATION, AND EXPERIENCE OF ASSOCIATED TECHNICAL PERSONS ENGAGED IN EXPLORATION

3.3.1 Exploration Agency (EA):

Mineral Exploration and Consultancy Limited
(Formerly Mineral Exploration Corporation Limited)
(A Govt. of India Enterprise-A Mini Ratna-I CPSE)
(Ministry of Mines, Govt. of India)

3.3.2 Experience: Organization established in year 1972

Experience: Geologist have experience of more than 30 years
Qualification of Geologist: M.Sc./M.Sc. Tech (Geology/ Applied Geology)

Table no. 3.1 List of Personnel with Experience

Sl.No.	Name of the Person	Designation	Qualification	Experience
1	Shri Shrikant Sharma	HOD (Exploration)	M.Sc. (Geology)	23 Years
2	Shri P. Ravindran	Retd. GM (Exploration)	M.Sc. (Geology)	35 Years
3	Shri Swarup Dhara	Sr. Manager (Geology)	M.Sc. (Geology)	20 Years
4	Shri Shubham Kumar	Geologist	M.Sc. (Geology),	9 Years
5	Shri Hiresh Shrirame	Young Professional (Geology)	M.Sc. (Geology)	3 Years
6	Shri Rohit Kumar Sharma	Manager (Chemical Lab)	M.Sc., Chemistry	15 Years
7	Smt. Deepti Rahangdale	Manager (Chemical Lab)	M.Sc., Chemistry	15 Years
8	Shri Pradeep Negi	OIC, Survey/ASMO	Survey and Draftsman	35 Years
9	Shri Durgesh Devarshree	ASMO	Survey and Draftsman	13 Years
10	Shri. Puneet Khandale	Sr. Technician	Survey and Draftsman	5 Years

CHAPTER-4

DETAILS OF THE AREA

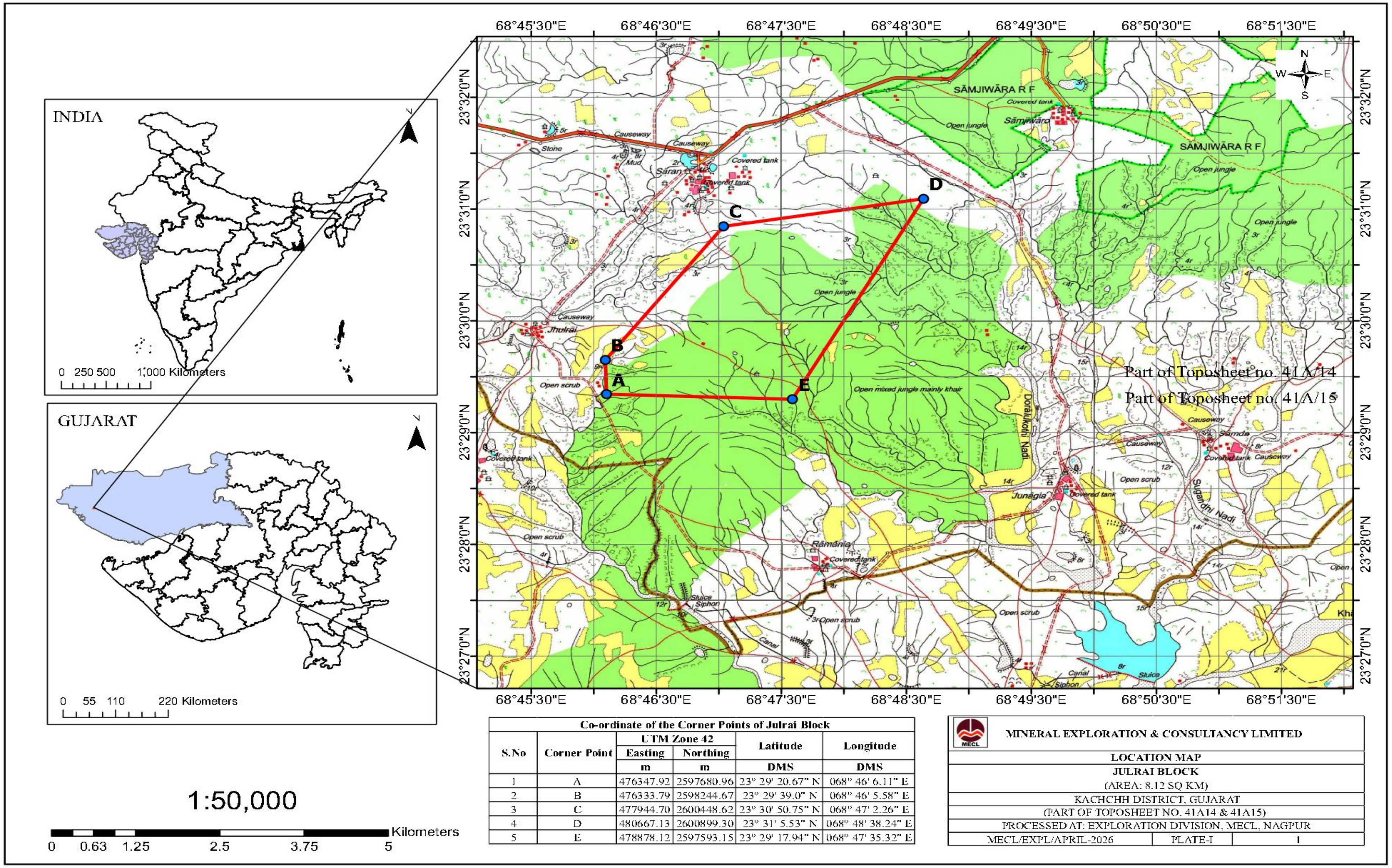
4.1.0 LOCATION AND ACCESSIBILITY OF THE BLOCK

4.1.1 The Julrai Block is located in the semi-arid tract of western Kachchh and is characterized by gently undulating terrain comprising low plateaus, pedimented surfaces, and gently sloping plains developed over Tertiary sedimentary formations underlain by the Deccan Traps basement. The block falls within Survey of India Toposheet 41A/14 & 41A/15 and encompasses an area of approximately 8.12 sq. km. Geographically, it lies in and around Sayan and Julrai villages of Lakhpat Taluka, within Kutch District, forming part of the western Kachchh mainland.

The area is well connected by road, rail, and air networks, facilitating logistical support for exploration activities. The nearest railhead is Bhuj Railway Station, located approximately 105 km from the block. Regional connectivity is primarily provided by National Highway 41, which connects Bhuj–Mandvi–Narayan Sarovar and passes about 15 km west of the block, while National Highway 754K lies approximately 18 km to the east, providing linkage towards Jodhpur and Bikaner. The block is further accessible through a network of all-weather motorable roads connecting nearby villages, enabling efficient movement of personnel, equipment, and exploration materials. The nearest air connectivity is available at Bhuj Airport, situated about 103 km from the area, which connects the region with major cities of Gujarat and other parts of the country.4.1.2 The block location is presented as **Plate-I** and **Text Figure-1**. Julrai block falls in part of Survey of India Toposheet No.41A/14 & 15 and is bounded by the following Co-ordinates presented in Annexure- I and Table- 4.1.

Co-ordinates of the corner points of the block boundary of Julrai Block, District: Kachchh, Gujarat

SR. NO.	CORNER POINT	DMS (WGS-84)		EASTING	NARTHING	RL (M)
		LATITUDE	LONGITUDE			
1	A	23°29'20.64162"N	68°46'06.10761"E	476347.849	2597680.089	72.147
2	B	23°29'39.00811"N	68°46'05.58853"E	476334.037	2598244.919	82.041
3	C	23°30'50.73608"N	68°47'02.24515"E	477944.280	2600448.197	110.572
4	D	23°31'05.53014"N	68°48'38.23698"E	480667.042	2600899.302	90.479
5	E	23°29'17.93434"N	68°47'35.33712"E	478878.603	2597592.974	81.188



Co-ordinate of the Corner Points of Julrai Block

S.No	Corner Point	UTM Zone 42		Latitude	Longitude
		Easting	Northing		
		m	m	DMS	DMS
1	A	476347.92	2597680.96	23° 29' 20.67" N	068° 46' 6.11" E
2	B	476333.79	2598244.67	23° 29' 39.0" N	068° 46' 5.58" E
3	C	477944.70	2600448.62	23° 30' 50.75" N	068° 47' 2.26" E
4	D	480667.13	2600899.30	23° 31' 5.53" N	068° 48' 38.24" E
5	E	478878.12	2597593.15	23° 29' 17.94" N	068° 47' 35.32" E

TEXT FIGURE-1: LOCATION MAP

4.2.0 DETAILS OF THE AREA WITH LAND USE

4.2.1 The Julrai Block is characterized by gently undulating to nearly flat terrain, with occasional low hillocks and minor topographic rises. The overall relief is moderate, and the landscape is predominantly represented by plains developed over the underlying geological formations.

The northern part of the block is occupied by relatively dense vegetation comprising scrub and thorny bushes, typical of the semi-arid conditions prevailing in the Kachchh region. Sparse to moderate vegetation cover is observed elsewhere across the block. Localized mining activities are evident in certain pockets, indicating the mineral potential of the area.

A considerable portion of the block is under agricultural use, where local inhabitants practice seasonal cultivation, largely dependent on rainfall and prevailing soil conditions. The land-use pattern thus reflects a combination of scrubland, agricultural fields, and minor mining zones.

Overall, the terrain conditions and existing land-use pattern are favourable for undertaking exploration activities, with minimal topographic hindrances and adequate accessibility across the block.

4.3.0 MINERAL(S) UNDER INVESTIGATION

4.3.1 The block has been explored for Bauxite and associated minerals at G-3 Stage exploration.

CHAPTER-5
PHYSIOGRAPHY AND ENVIRONMENT

5.1.0 RELIEF OF THE AREA WITH MINIMUM AND MAXIMUM ELEVATION, DRAINAGE PATTERN, NATURAL WATER COURSES, RESERVOIRS, ETC.

5.1.1 The Julrai Block exhibits a gently undulating topography marked by broad plains interspersed with mounds, low hillocks, and isolated flat-topped hills of low to moderate elevation (refer Text Figure No. 2). These geomorphic features represent erosional remnants developed over the basaltic flows of the Deccan Traps and associated sedimentary formations.

The elevation within the block ranges from a minimum of approximately 86 m to a maximum of about 108 m above Mean Sea Level (MSL), indicating moderate local relief. The northern part of the area forms a segment of the Matanomadh open scrub-jungle terrain, developed over basaltic exposures, imparting a comparatively rugged topographic expression relative to the adjoining plains.

The drainage pattern in the area is predominantly dendritic to sub-dendritic, controlled by local slope and lithological variations. The drainage is mainly seasonal in nature, comprising ephemeral nalas and minor natural water courses that remain active during the monsoon period and dry up subsequently. No major perennial rivers traverse the block; however, small depressions and natural channels facilitate surface runoff during periods of precipitation.

Surface water resources are limited, and no major reservoirs or permanent water bodies are observed within the block area, although minor seasonal water accumulation may occur in low-lying areas during the monsoon. Overall, the drainage and relief characteristics are conducive to exploration activities, with minimal geomorphological constraints.

Text Figure No. 2: Google-earth Imagery map with respect to Dhrang and Julrai block explored by MECL, District: Kachchh, Gujarat

5.2.0 ROADS, RAILWAY TRACK, ELECTRIC TRANSMISSION LINE, TELEPHONE LINE, ETC.

5.2.1 The Block is located to the west of Mata no Madh village in Lakhpat Taluka of Kuchchh District, Gujarat. The nearest towns to the block are Dayapar and Nakhatrana, while Bhuj serves as the district headquarters and the principal administrative centre. The block is well connected by metalled and all-weather roads, with the main access provided through the Mata no Madh road, facilitating convenient transportation of personnel, equipment, and materials to the exploration area.

5.2.2 The nearest railhead is Bhuj railway station, situated at a distance of approximately 110 km from the block. From the railway station, the area is accessible towards the southeast via metalled roads, primarily through the Mata no Madh–Bhuj road network, ensuring reliable connectivity for logistical support during exploration activities.

5.2.3 The nearest airport is Bhuj Airport, located about 105 km to the southeast of the block, providing air connectivity to major cities in Gujarat and other parts of India. The nearest seaport is Mundra Port, situated approximately 146 km to the south of the block, which serves as an important maritime gateway for the region.

5.2.4 The study area is traversed by a 33 kV electric transmission line, ensuring the availability of power infrastructure in the vicinity. In addition, wind energy installations (windmills) are present in and around the area, reflecting the region's suitability for renewable energy generation. Basic communication facilities, including telephone and mobile network connectivity, are available in nearby villages and towns, supporting field operations and coordination during exploration activities.

5.3.0 HOST POPULATION (LOCAL TRIBES), HUMAN SETTLEMENTS WITHIN AND NEARBY AREA

5.3.1 The population in and around the Julrai Block is predominantly rural, with the socio-economic framework largely dependent on agriculture and animal husbandry. The local inhabitants mainly comprise traditional agrarian and pastoral communities characteristic of the Kachchh region. Farming and livestock rearing constitute the primary sources of livelihood, with cattle, sheep, and goats forming an integral component of the rural economy. In addition to these activities, a section of the population is engaged in traditional handicrafts and small-scale cottage industries, which supplement household income.

5.3.2 The block lies in the vicinity of Julrai, Denma, and Matanomadh villages in Lakhpat Taluka of Kutch District (refer Text Figure No. 3). The area is characterized by dispersed rural settlements, typically comprising small clusters of dwelling units surrounded by agricultural fields and grazing lands. The settlement pattern reflects the typical rural landscape of the region, wherein habitation areas are interspersed with cultivated land and open scrub terrain.

5.3.3 Agriculture forms the backbone of the local economy, with crops such as cotton, millets, pulses, and seasonal vegetables cultivated depending on rainfall and soil conditions. Livestock rearing is widely practiced and contributes significantly to the subsistence and income of the local population. Overall, the settlement pattern and socio-economic characteristics of the area indicate a closely knit rural community with strong dependence on land-based resources.

5.3.4 Lakhpat Tehsil map is given below.

TEXT FIGURE-3

5.3.5 **Population:** As per the Census of India, 2011, Lakhpat Taluka of Kuchchh District, Gujarat recorded a total population of 62,552, which is entirely rural in character and distributed across 100 villages within the taluka. The total population comprises 32,274 males and 30,278 females, spread over a geographical area of approximately 2,190 km². The population in the age group of 0–6 years accounts for 10,966 individuals, indicating a significant young demographic. In terms of social composition, the Scheduled Castes population is 6,379, while the Scheduled Tribes population is 508 within the taluka. Matanomadh, one of the prominent villages located in Lakhpat Taluka and situated near the block area, comprises 411 households. As per the 2011 Census, the village has a total population of 2,259, including 1,151 males and 1,108 females. The child population (0–6 years) in the village is 342, constituting approximately 15.14% of the total population, reflecting the demographic structure typical of rural settlements in the region.

5.3.6 **Literacy:** The overall literacy rate of Lakhpat Taluka is 62.09%, reflecting the educational status of the predominantly rural population. The male literacy rate stands at 59.87%, while the female literacy rate is 41.96%, indicating a noticeable gender disparity in literacy levels within the taluka. In comparison, Matanomadh village records a relatively higher literacy rate of 65.94%, of which 76.30% pertains to male literacy and 55.50% to female literacy. These figures highlight a moderate level of educational attainment in the village, though a gap between male and female literacy continues to persist, reflecting broader socio-economic patterns prevalent in rural parts of the Kachchh region.

5.4.0 SOCIO DEMOGRAPHIC PROFILE OF THE AREA AND NEARBY

5.4.1 The Julrai Block is situated approximately 12 km west of Matanomadh village, which falls under Lakhpat Taluka of Kutch District, Gujarat. The region is predominantly rural in character, with the local population largely dependent on agriculture, livestock rearing, and other traditional occupations for their livelihood.

5.4.2 The overall literacy rate of Matanomadh village is recorded as 65.94%, indicating a moderate level of educational attainment among the inhabitants. Mining activities in the surrounding region have played a significant role in improving the socio-economic conditions of the area, particularly by generating employment opportunities for the local population. In addition, such activities have contributed to the development of basic infrastructure and social facilities, including educational institutions, healthcare services, and drinking water supply, thereby enhancing the overall quality of life of the local inhabitants.

5.4.3 Furthermore, the occurrence of lignite deposits in the Kachchh region has facilitated the establishment of several thermal power plants by the Government of Gujarat, which has strengthened the regional power infrastructure. As a result, electricity supply has been extended to most villages of Lakhpat Taluka, contributing to rural development and improved living standards in the area.

5.5.0 HISTORICAL SITES AND ARCHAEOLOGICAL MONUMENTS, PLACES OF WORSHIP, PUBLIC UTILITIES ETC.

The region surrounding the Julrai Block possesses several historical, cultural, and religious sites of significance, reflecting the rich heritage of the Kachchh region.

5.5.1 One of the most prominent religious centers near the study area is the Ashapura Mata Temple, Mata no Madh, a major shrine dedicated to Goddess Ashapura, who is regarded as the presiding deity of the Kachchh region. The temple holds great religious importance and attracts large numbers of devotees and pilgrims, particularly during major festivals such as Navratri, when the site becomes a significant center of pilgrimage activity.

5.5.2 Another important pilgrimage site in the vicinity is Narayan Sarovar, located in Lakhpat Taluka of Kutch District, Gujarat near the Kori Creek. Narayan Sarovar is considered one of the sacred pilgrimage destinations for Hindus. The ancient Koteshwar Temple, situated about 2 km to the northwest, is an important temple associated with the Vaishnavite tradition and is recognized among the 108 Abhimana Kshethrams.

5.5.3 The historic town of Lakhpat also holds archaeological and religious importance. The Lakhpat Fort represents a significant historical structure reflecting the region's maritime and trading past. Within the fort premises lies the Gurudwara Shri Nanak Darbar, Lakhpat, a revered Sikh shrine associated with the visit of Guru Nanak during his fourth missionary journey (Udasi) between 1519–1521 AD, while travelling to and returning from Mecca. The site has been preserved with historical reverence, and the heritage value of the monument has been recognized with an UNESCO Heritage Award.

5.5.3 In terms of civic infrastructure, essential public utilities such as banking services (both public and private sector banks), educational institutions, and medical facilities are available at Dayapar town, which is located approximately 15 km from the study area. These facilities provide necessary support for both the local population and field personnel engaged in exploration activities in the region.

5.6.0 FORESTS, SANCTUARIES, NATIONAL PARK AND WILD LIFE SANCTUARIES ETC.

The region surrounding the Julrai Block is characterized by semi-arid ecological conditions, supporting sparse vegetation, thorny scrub forests, and localized habitats of ecological significance.

5.6.1 One of the notable ecological sites in the vicinity is the Guneri Inland Mangrove Site, located near Guneri village. This site covers an area of approximately 32.78 hectares and is recognized for its unique inland mangrove ecosystem, where mangrove species grow on dry soil without direct contact with seawater, a rare ecological phenomenon. The area supports a variety of avian species, including migratory birds such as Greater Flamingo and Harrier, making it an important habitat for birdlife.

5.6.2 Another significant protected area in the region is the Narayan Sarovar Wildlife Sanctuary, situated in Lakhpat Taluka of Kutch District, Gujarat. The sanctuary is characterized by arid and semi-arid ecosystems, comprising thorn forests, scrublands, and grassland patches typical of the Kachchh landscape. It serves as an important habitat for several species of wildlife, notably the Chinkara (Indian Gazelle), along with other fauna adapted to the desert and semi-desert environment.

5.6.3 No reserved forests, national parks, or major wildlife sanctuaries fall directly within the Julrai Block area; however, the presence of ecologically significant habitats in the broader region highlights the environmental importance of the surrounding landscape.

5.7.0 FLORA AND FAUNA WITHIN AND NEARBY

5.7.1 The Matanomadh–Julrai region falls within the arid to semi-arid ecological zone of western Kachchh, where vegetation is predominantly composed of xerophytic thorny scrub and drought-resistant grasses adapted to conditions of low rainfall, saline soils, and high evapotranspiration. The natural vegetation is typically sparse and discontinuous, reflecting the harsh climatic conditions of the region. Common plant species occurring in the area include Acacia nilotica (Desi Babul) and Acacia senegal (Kumat), along with other hardy shrubs and grasses that are well adapted to the semi-arid environment.

5.7.2 The broader Kachchh region supports vegetation consisting mainly of thorny bushes, scrublands, and scattered grasslands, interspersed with drought-tolerant species such as cacti and wild grasses. Despite the arid climate, the region hosts a variety of wildlife adapted to desert and semi-desert ecosystems. Notable fauna found in the region include the Asiatic wild ass, Chinkara (Indian Gazelle), Desert fox, Indian pangolin, and Desert cat.

5.7.2 In addition to wild fauna, the local population maintains several domestic animals, which form an integral part of the rural economy. Common domesticated animals in the area include horses, camels, oxen, cows, buffaloes, sheep, goats, and donkeys, which are primarily reared for agricultural operations, transport, and livestock-based livelihoods.

5.8.0 WATER BODIES SUCH AS RIVER, NALA, STREAM, RESERVOIR, ETC.

5.8.1 The drainage system in and around the Julrai Block is predominantly represented by ephemeral streams and seasonal nalas, typical of the semi-arid climatic conditions of the Kachchh region. The Kakdi Nadi and Kotawadi Nadi constitute the principal drainage channels of the area. These seasonal streams act as the main surface runoff conduits, exhibiting a gentle gradient towards the north-west. They primarily carry water during the monsoon period, while remaining dry or showing negligible flow during the rest of the year, reflecting the low and erratic rainfall conditions of the region.

No major perennial rivers or significant reservoirs are present within the block area. Minor natural channels and shallow depressions facilitate localized drainage and temporary water accumulation during periods of precipitation.

5.8.2 Groundwater occurrence in the area is mainly confined to the weathered and fractured zones within the basaltic formations of the Deccan Traps and associated sedimentary units. The groundwater regime has, however, been considerably influenced by sustained extraction in the surrounding region. Continuous withdrawal of groundwater, initially by Gujarat Mineral Development Corporation and subsequently by Gujarat State Electricity Corporation Limited, has led to a progressive decline in groundwater levels. As a result, the present hydrogeological conditions are governed by both inherent geological controls and anthropogenic impacts related to industrial and mining activities.

5.9.0 CLIMATIC CONDITIONS

5.9.1 The Kachchh region experiences a hot and arid to semi-arid desert climate for most part of the year, characterized by high temperatures, low humidity, and scanty rainfall. The temperature in the region generally ranges between 10°C during winter months and up to about 45°C during peak summer, reflecting the extreme seasonal variation typical of desert environments. The summer season extends from March to June, during which temperatures rise significantly, often reaching 45°C, accompanied by hot and dry winds. The winter season generally prevails from November to February, when temperatures drop considerably and may fall to around 10°C, resulting in comparatively cooler and more pleasant climatic conditions.

5.9.2 Rainfall in the region is limited and erratic, with an average annual precipitation of approximately 350 mm. The area receives rainfall primarily during the Southwest Monsoon, which occurs between June and September and contributes nearly 90% of the total annual rainfall. A minor portion of rainfall may also occur during the Northeast Monsoon, though its contribution is relatively insignificant. Overall, the climatic conditions of the region are characterized by high evaporation rates and prolonged dry periods, which significantly influence the hydrology, vegetation, and land use patterns of the area.

5.10.0 OTHER PHYSIOGRAPHIC, SOCIAL AND ENVIRONMENTAL FACTOR

5.10.1 The Kachchh District, particularly Lakhpat Taluka, is characterized by an arid to semi-arid physiographic setting comprising gently undulating plains, low rocky uplands, and isolated lateritic remnants. The terrain gradually transitions northwards into marginal saline tracts adjoining the Great Rann of Kutch, while the Arabian Sea lies towards the south-west of the district. The geomorphology of the region is primarily governed by the underlying volcanic and sedimentary sequences, in conjunction with prolonged weathering and erosional processes under arid climatic conditions.

5.10.2 The drainage system is predominantly ephemeral, consisting of seasonal streams that remain active mainly during the monsoon period. For the major part of the year, these channels remain dry owing to low rainfall and high evaporation rates. Groundwater occurrence is generally at considerable depths and is often saline in nature, thereby limiting its suitability for potable and irrigation purposes. Consequently, the local population is largely dependent on rainfall and localized water-harvesting structures such as ponds, tanks, and check dams for meeting their water requirements.

5.10.3 The region is also endowed with significant mineral resources, particularly gibbsitic bauxite deposits occurring in areas such as Gadhsisa, Ratadia–Nagrecha, Mothala–Balachod, Nana Goniyasar, and Naredi-II within Kachchh district. Several mining leases for bauxite are operated by Gujarat Mineral Development Corporation in these sectors. In addition, bentonite deposits are widely distributed in the region, with multiple mining leases operated by Ashapura Group in the surrounding areas for the extraction of bentonitic clay. These mineral resources play a significant role in the industrial and economic development of the region and exert a notable influence on the local socio-economic framework.

CHAPTER-6

INFRASTRUCTURE

6.1.0 LOCAL INFRASTRUCTURE, HOST POPULATION, HISTORICAL SITES, FORESTS, SANCTUARIES, NATIONAL PARK AND ENVIRONMENTAL SETTING OF THE AREA.

6.1.1 The town of Lakhpat, located in Lakhpat Taluka of Kachchh District, serves as an important administrative centre in the region. Basic civic and infrastructural facilities are available in nearby settlements such as Dayapar, which functions as a local service hub for the surrounding villages. The area is supported by essential amenities including primary healthcare facilities, private dispensaries, educational institutions, banking services, postal facilities, public transport, and local markets, catering to both the resident population and personnel engaged in exploration and mining activities.

6.1.2 The region also hosts established mining operations, particularly related to lignite extraction, with activities being carried out in the vicinity by Gujarat Mineral Development Corporation. These operations contribute significantly to the regional economy and provide employment opportunities to the local population.

6.1.3 Details pertaining to host population, historical and cultural features, forest and ecological aspects, wildlife, and overall environmental conditions have been elaborated in Chapter 5.0.0 (Physiography and Environment) of this report, providing a comprehensive understanding of the socio-environmental framework within which exploration activities in the Julrai Block are undertaken.

6.1.4 Lakhpat Tehsil occupies the north-western part of Kachchh district and forms a part of the arid desertic terrain adjoining the Great Rann of Kutch and the coastal tract of the Arabian Sea. The terrain is characterized by sparse vegetation, saline flats, coastal plains, and low hillocks, forming a distinctive desert–coastal ecosystem. Climatically, the region falls under a hot arid zone, with high summer temperatures often exceeding 40°C and relatively mild winters. The average annual rainfall is low and erratic, generally ranging between 300–350 mm, predominantly received during the southwest monsoon. The drainage system is poorly developed, comprising mainly ephemeral streams that remain dry for most of the year and ultimately discharge into the Rann or adjacent creeks such as the Kori Creek.

6.1.5 Vegetation in the area is sparse and dominated by thorny scrub, desert grasses, and xerophytic shrubs adapted to arid and saline conditions, representing the desert thorn forest type. Common species include *Prosopis juliflora*, *Salvadora persica*, *Capparis decidua*, *Ziziphus nummularia*, and various *Euphorbia* species. Large tracts of land are covered by scrubland, saline wasteland, and grass patches, which provide suitable habitats for desert fauna.

6.1.6 An important protected area within the taluka is the Narayan Sarovar Wildlife Sanctuary, located in the western part of Lakhpat Tehsil. The sanctuary represents a typical desert ecosystem comprising thorn forests, grasslands, and seasonal wetlands, and supports diverse wildlife including chinkara (Indian gazelle), desert fox, Indian wolf, hyena, caracal, and nilgai. In the broader Kachchh region, the Kutch Bustard Sanctuary is another ecologically significant area, providing habitat for the endangered Great Indian Bustard and other migratory bird species.

6.1.7 The region is also of historical and cultural importance. The historic town of Lakhpat, situated near the Kori Creek, is enclosed by a fortification wall constructed during the nineteenth century and represents a prominent heritage site of western Kachchh. Notable cultural landmarks include the Gurudwara Guru Nanak Darbar, commemorating the visit of Guru Nanak, and the tomb of the Sufi saint Pir Ghaus Muhammad. The nearby area of Patgadh preserves archaeological remains of ancient settlements, indicating long-standing human occupation in the region.

6.1.8 Overall, the environmental setting of Lakhpat Tehsil is defined by an arid desert landscape with sparse vegetation, saline soils, and distinct desert wildlife habitats. The presence of ecologically sensitive zones such as the Narayan Sarovar Wildlife Sanctuary, coupled with the historical significance of Lakhpat town, imparts both ecological and cultural importance to the region.

MECL

CHAPTER-7

GEOLOGY

7.1.0 REGIONAL GEOLOGY

7.1.1 The Kutch Basin represents a well-developed east–west trending peri-cratonic rift basin preserving a near-continuous stratigraphic succession from the Middle Jurassic to Recent (Holocene). The basin records a complex geological history of marine and continental sedimentation, tectonism, volcanism, and erosion, and is of considerable significance in understanding the evolution of the western continental margin of India.

7.1.2 The Mesozoic and Cenozoic successions are separated by a major phase of non-deposition, deformation, erosion, and volcanism associated with the emplacement of the Deccan Traps towards the close of the Cretaceous. The Mesozoic succession comprises predominantly marine sediments of Bathonian to Tithonian age, followed by Cretaceous non-marine deposits, representing deposition in a sheltered gulf environment ranging from sub-littoral to deltaic settings. These sediments were laid down over a Precambrian granitic basement, exposed only in the Nagar Parkar region (Pakistan).

7.1.3 Subsequent tectonic activity resulted in uplift, folding, and intrusion of the Mesozoic strata, which were later overlain by Deccan Trap volcanics. The post-volcanic sequence includes Palaeocene terrestrial volcaniclastic deposits, followed by Early Eocene marine transgression and continued Tertiary sedimentation within basinal lows and peripheral depressions.

7.1.4 Structurally, the basin is asymmetrical and bounded by major tectonic features, with the Nagar Parkar Fault to the north and the North Kathiawar Fault to the south, while its eastern extent is limited by the Radhanpur–Barmer Arc and the western margin extend into the continental shelf of the Arabian Sea. The sedimentary fill is largely syn-rift in nature, reflecting active tectonism during Mesozoic deposition.

7.1.5 The regional lithostratigraphy comprises Mesozoic sequences ranging from Middle Jurassic to Late Cretaceous, overlain by Deccan Trap volcanics and younger Tertiary sediments. Based on fossil assemblages and petrographic characteristics, these sediments represent nearshore shallow marine environments with fluctuating neritic, lagoonal, and littoral conditions. The Tertiary succession is economically important and hosts mineral deposits such as limestone, clay, lignite, and bauxite.

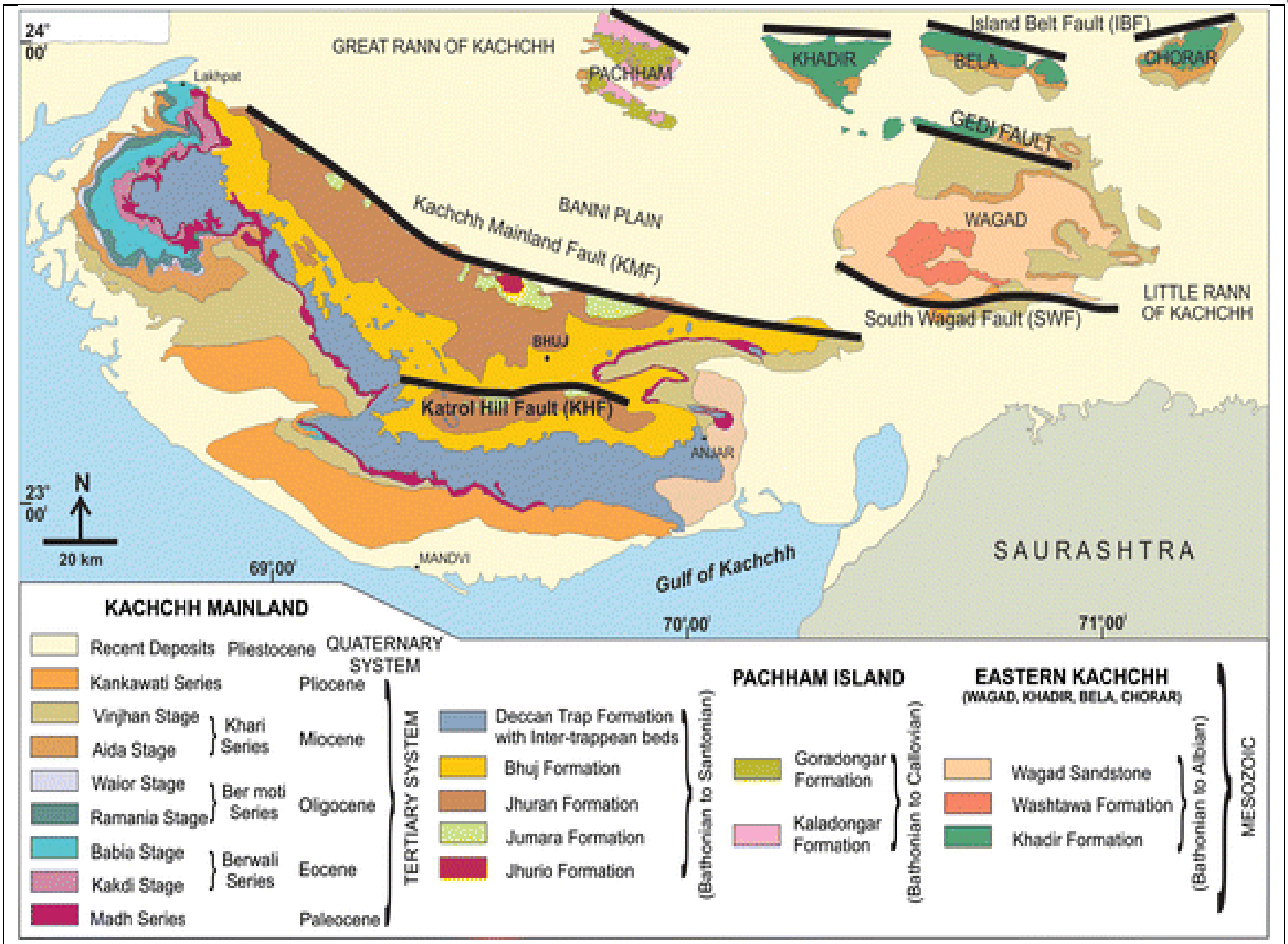
7.1.6. The Mesozoic stratigraphy of Kachchh was initially classified by Wilhelm Waagen (1875) into four major groups—Patcham, Chari, Katrol, and Umia—which were later revised by

S.K. Biswas (1971) into the Jhurio, Jhumara, Jhuran, and Bhuj formations, respectively. Subsequent studies have further refined the lithostratigraphic framework while largely retaining the earlier nomenclature. Detailed descriptions of the regional lithostratigraphic units are presented in the following sections.

7.1.7 Regional Geological Map is given as Text figure- 4and Regional Stratigraphy is given below. Regional Geological map of NGDR is presented in Plate-II.

Table-7.1
Geological Succession of the Kachchh Dist, Topo-sheet no 41A/14
(After GSI 2001)

Age	**Formation**	
Cretaceous	Bhuj	
	Umia	Ukra beds-Marine calcareous shales
		Umia beds: Barren sandstones and shales
		Trigonia beds; Barren Sandstones
		Umia ammonite bed
		Up. Katrol Shales
Upper Jurassic to Lower Cretaceous	Katrol	Gajansar Beds
		Upper Katrol (Barren sandstone)
		Middle Katrol (red sandstones)
		Lower Katrol (Sandstone, shale, marl)
		Kantkote Sandstone
Upper Jurassic to Middle Jurassic	Chari	Dhosa oolite
		Athleta beds (marls and gypseous shales)
		Anceps beds (limestone and shales)
		Rehmanni beds (yellow limestone)
Middle Jurassic	Patcham	Macrocephalus beds
		Patcham coral bed
		Patcham shell limestone



Text Figure-4

7.1.8 **Deccan volcanics**

The Deccan Trap Volcanics constitute a significant geological unit within the Kutch Basin, occurring predominantly in the southern part of the Kachchh mainland as a 10–20 km wide belt trending NW–SE. These volcanics unconformably overlie the Bhuj Formation of Mesozoic age and represent the terminal phase of Late Cretaceous–Early Palaeogene volcanic activity.

The lava flows are chiefly plateau-type basalts, dominantly tholeiitic in composition in the western sectors around Dayapar and Matanomadh, whereas alkaline basaltic variants are reported from Baladia, Anjar, and Bhachau areas. In addition to the flows, occurrences of highly alkaline intrusive rocks such as nephelinite, essexite, and olivine–analcite basalt have been recorded within the Mesozoic sedimentary sequence at select locations.

Geological studies indicate the presence of multiple lava flows in the southern Kachchh mainland, with an aggregate thickness of approximately 140–150 m. The basalts commonly exhibit pahoehoe-type flow structures, suggesting emplacement under low-viscosity conditions.

Numerous tholeiitic and alkaline intrusive bodies are also emplaced within both the Mesozoic sediments and the Deccan Trap sequence.

Prominent alkaline intrusive complexes are developed at Nirwandh and Kuran, comprising predominantly gabbroic rocks and pyroxenites, occasionally hosting disseminated sulphide mineralization. Peripheral zones of these intrusives are characterized by dykes and apophyses of hornblendite, ankaramite, granophyre, trachyte, andesite, and syenite. Mantle-derived peridotite nodules have also been reported from alkaline plugs at Bhuj, Vithonia, and Dhinodhar, indicating deep-seated magmatic processes.

Petrographically, the basalts are fine- to medium-grained and commonly exhibit vesicular, amygdaloidal, and fractured textures, with cavities filled by secondary minerals such as silica, zeolites, and calcite. Exfoliation and spheroidal weathering are characteristic features observed in many exposures, while chilled margins assist in delineating individual flow units.

Variations in flow characteristics and orientations indicate multiple phases of volcanic activity. Weathered basalt surfaces frequently display concentric bands of yellow, brown, and reddish hues due to limonitization and intense weathering. Porphyritic varieties are locally developed, further reflecting the compositional and textural heterogeneity of the Deccan volcanic suite in the Kachchh region.

7.1.9 Supra-trappean horizon

The Sub-/Supra-Trappean horizon represents the sedimentary and weathered stratigraphic interval developed immediately beneath the Deccan Trap Volcanics, marking the transitional phase between the pre-volcanic sedimentary succession and subsequent basaltic emplacement. This horizon forms the basal weathered surface over older sedimentary formations upon which the Deccan Trap flows were emplaced.

Lithologically, the sequence comprises lithomarge, grey to greenish bentonitic clays, ferruginous sandstones, aluminous (kaolinitic) clays, and laterite–bauxite horizons, along with yellowish to reddish laminated shales, locally associated with volcanic ash layers and gypseous partings. The laterite–bauxite horizons commonly exhibit intercalations of coarse, current-bedded ferruginous gritty sandstones, micaceous siltstones, and shales, indicating episodic sedimentary reworking during profile development.

In several localities, particularly along the western sector, basalt flows are observed resting directly over the laterite–bauxite horizons, suggesting that lateritization and bauxitization preceded the emplacement of Deccan Trap lavas. The development of this horizon reflects prolonged subaerial exposure, intense chemical weathering, and leaching, which facilitated the formation of lateritic profiles and gibbsitic bauxite mineralization in the region.

7.1.10 Matanomadh Formation

The Matanomadh Formation represents an important lithostratigraphic unit in and around the study area and is chiefly characterized by the occurrence of bauxite, laterite, and associated clay horizons developed over the basaltic terrain. The bauxite deposits are interpreted to have formed through intense chemical weathering and alteration of the underlying basalt, followed by processes of desilicification and secondary silicification under favourable climatic and geomorphological conditions.

Macroscopically, he bauxite is predominantly characterized by well-developed oolitic to pisolitic textures, which are diagnostic features of lateritic bauxite deposits. Field observations suggest that the processes of kaolinitization, lateritization, and bauxitization have operated in close association within the weathering profile, representing successive stages of chemical weathering, leaching, and residual enrichment. These processes have collectively contributed to the progressive concentration of alumina and the development of the lateritic–bauxitic horizon over the parent rock.

Petrographic and microscopic studies reveal the presence of alumina-rich minerals such as Gibbsite and Boehmite, along with titanium-bearing minerals including Ilmenite and Titanomagnetite. The assemblage also contains iron-bearing minerals such as Hematite, Magnetite, and Goethite, which contribute to the ferruginous character of the lateritic profile.

In hand specimen, the bauxite varies in colour from light brown and pale pink to greyish white, often displaying a clayey appearance, particularly in the lower portions of the bauxite zone. The bauxite horizon is commonly associated with small lateritic patches and cavities filled with ferruginous materials, imparting a patchy and variegated appearance to the deposit. Alternating bands and patches of cherry red, yellow, white, and brown colours are frequently observed due to the presence of laterite and ferruginous constituents.

The bauxite occurrences in the area are typically pocket-type deposits, occurring between laterite and clay horizons and forming small, discontinuous bodies. These deposits are generally scattered and localized, commonly occurring along the crests of flat-topped hills and ridges. In addition to the bauxite–laterite assemblage, the Matanomadh Formation also includes variegated bentonitic clays, which constitute an important lithological component of the formation and reflect post-volcanic weathering and sedimentary processes in the region.

7.1.11 **Kakdi Nadi Formation**

The Kakdi Nadi Formation is represented by a sequence of variegated to mottled siltstones, grey to olive-green shales, and micaceous siltstones, intercalated with fossiliferous marlite bands. These lithological assemblages indicate deposition under shallow marine to marginal marine conditions, reflecting fluctuating sedimentary environments during the early stages of the Palaeogene period.

Palaeontological evidence from this formation includes the occurrence of marine fossils such as Oysters, Turritella, and occasional Echinoids, which further support its marine depositional setting.

Within the proposed block area, the Kakdi Nadi Formation is primarily represented by variegated gypseous shale and clay horizons intercalated with limestone bands, which are assigned to the Palaeocene age. These lithological characteristics reflect periodic marine incursions and evaporitic conditions, resulting in the deposition of gypsiferous clay and shale associated with carbonate horizons.

7.1.12 **Laterite & Bauxite**

The laterite and bauxite horizons in the area occur as discontinuous pocket-type deposits, generally capping the lateritic profile of the Matanomadh Formation. These deposits are typically developed along the crests of flat-topped hills and elevated ridges, where favourable conditions for prolonged weathering and leaching prevailed.

The genesis of these deposits is attributed to the in-situ lateritization and bauxitization of the underlying Deccan Trap basalts and associated pyroclastic materials. Intense chemical weathering under suitable climatic conditions led to the progressive removal of silica (desilicification) and enrichment of alumina, resulting in the formation of laterite and subsequently bauxite within the weathering profile.

The bauxite formation process involved alteration of basaltic parent material, followed by desilicification and secondary silicification, which facilitated the concentration of aluminium-bearing minerals. In hand specimen, the bauxite commonly exhibits oolitic and pisolitic textures, which are characteristic features of lateritic bauxite deposits and indicate chemical precipitation and concretionary growth during weathering and diagenetic processes.

7.2.0 REGIONAL STRUCTURE

7.2.1 Structurally, the study area forms part of a relatively stable volcanic plateau within the Kutch Basin, exhibiting minimal deformation. The Deccan Trap Volcanics in the area are generally horizontal to gently dipping, indicating post-eruptive tectonic stability. No major structural features such as regional folding, large-scale faulting, or metamorphism have been recorded within the block.

The sedimentary formations display well-developed bedding, identifiable through variations in grain size, texture, and colour. These features are particularly prominent within the Bhuj Formation and Kakdi Nadi Formation, where feldspathic and ferruginous sandstones are distinctly recognized. Laminations are commonly observed in sandstones, siltstones, and shale units, suggesting deposition under low-energy sedimentary conditions. The strata generally exhibit horizontal to sub-horizontal attitudes across the area.

Primary sedimentary structures are well preserved, including cross-bedding in the Bhuj sandstones, indicative of fluvial to shallow marine depositional environments. Ripple marks are also recorded, reflecting wave and current action during sedimentation. Biogenic structures such as vertical burrows and trails are locally present, representing trace fossils formed by organisms during deposition.

Secondary structural features developed post-lithification include joints, fractures, minor faults, and slickensides. These are particularly well developed within both the Bhuj Formation and the basaltic flows of the Deccan Traps. Such features play a significant role in controlling weathering patterns, groundwater movement, and the local geomorphological evolution of the area.

7.3.0 GEOLOGY OF THE BLOCK

7.3.1 The Julrai Block, covering an area of 8.12 sq. km, is located in the Matanomadh region of Kachchh District, Gujarat. The block forms part of the Deccan Trap volcanic province, overlain and modified by intense tropical weathering, leading to the development of bauxite, laterite, bauxitic clay, lithomarge clay, and bentonite.

7.3.2 It slopes gradually towards south. Steep gradients with cliff faces are characteristics of the north and north western part of the hillocks. Southern part is generally flat to low elevated.

7.3.3 The highest point of Block is at 108m above M.S.L and lowest point towards the eastern portion in is about 86m above M.S.L The geology of the block is heterogeneous in nature, largely controlled by topography, geomorphological position, and the varying degree of weathering of the basaltic parent rock. The geological framework of the block has been interpreted based on detailed geological mapping at 1:4000 scale, supported by systematic field traverses, bedrock sampling, nala section observations, examination of old workings, pitting, core drilling, and integration of subsurface data through geological cross-sections.

7.3.4 Detailed geological mapping indicates that the southern part of the block, characterized by moderate elevation, hosts well-developed bauxite of pisolitic to conglomeratic nature along the crests of hillocks, while the slopes are occupied by laterite grading into clay. The central part, comprising relatively low to moderately elevated terrain, shows moderate development of bauxite. The eastern sector is marked by the presence of lateritic bauxite, whereas the north-eastern part exhibits only minor exposures of aluminous laterite and bauxite; however, drilling in this sector indicates the absence of subsurface bauxite horizons. Old mine workings are also observed in the north-eastern part, some of which are partially backfilled. The western part of the block shows limited occurrences of pisolitic bauxite in small, discontinuous exposures. Gypseous shale–siltstone exposures are noted in the south-eastern part of the block.

7.3.5 Apart from bauxitic occurrences, basalt of medium- to fine-grained, locally porphyritic to massive nature is well developed, particularly in the north-eastern sector. Fossiliferous to massive limestone exposures are also present in the central and southern parts of the block. The overall lithological succession established through mapping comprises bauxite, laterite, bauxitic clay, lithomargic clay, bentonitic clay, and saprolitic zones.

7.3.6 The area is predominantly underlain by Tertiary formations represented by the Matanomadh and Kakdi Nadi Formations, along with basaltic flows of the Deccan Trap Volcanics and recent alluvial deposits. The supra-trappean sequence is represented by oolitic to pisolitic, locally conglomeratic (reworked) bauxite and laterite of varied colours, associated with lithomarge and aluminous clays.

7.3.7 The Deccan Trap basalt forms the basement lithology and is typically fine- to medium-grained, dark grey to black in colour, and locally porphyritic with feldspar phenocrysts. Amygdaloidal structures filled with secondary minerals are common, particularly in the north-eastern sector. The basalt exhibits variable degrees of weathering, ranging from fresh massive rock to highly altered clayey material.

7.3.8 Overlying the basalt is a well-developed lateritic–bauxitic profile belonging to the Mata-no-Madh Formation. The uppermost laterite is mainly developed in the southern and south-eastern parts of the block and is commonly limonitized, clay-filled, and locally in direct contact with the parent basalt. The bauxite horizon is predominantly pisolitic to oolitic, greyish-pink to off-white in colour, and moderately to well indurated. Pisolites occur as concentric, circular to elliptical bodies and are locally enriched by iron-bearing fluids, particularly along hill crests. Conglomeratic bauxite boulders are observed along slopes, indicating reworking and downslope transport.

7.3.8 Associated lithologies include clayey bauxite and bauxitic clay, occurring in alternation with lithomargic clay, particularly in low-lying basaltic terrain in the central and north-eastern parts. Lithomargic clay represents the basal unit of the lateritic profile and is exposed in pits and old workings, indicating advanced kaolinization and leaching of the parent basalt. Supra-trappean bentonitic clay occurs as light-yellow, soft to moderately compact material with secondary vesicles, suggesting alteration of volcanic ash or tuffaceous material.

7.3.9 Sedimentary units of the Kakdi Nadi Formation are represented by gypseous shale, siltstone, and limestone with clay infilling, exposed in localized patches in the south-eastern part of the block, indicating deposition under shallow marine to lagoonal conditions.

The succession of Tertiary rocks as exposed in Julrai Block, Kachchh is given in **Table No. 7.2**. The Geological map of the block is presented as **Plate No.-III** and **Text Figure-5.**

Table No. 7.2: The Local Stratigraphic Succession in and around Julrai block (after GSI, 2001).

Age	Formation	Lithology
Recent		Alluvium
Lower to Middle Miocene	Gaj Formation	Olive green shale and siltstone with gypsum
Oligocene to Lower Miocene	Kharinadi Formation	Mottled siltstone and variegated clay
Lower Eocene	Kakdi Nadi Formation	Greyish to variegated clay, carbonaceous and lignite-bearing shale with fossiliferous marlite and limestone
Palaeocene	Matanomadh Formation	Lithomargic clay, laterite and lateritic Bauxite
Cretaceous to Eocene	Deccan Trap Volcanics	Basalt

7.4.0 DESCRIPTION OF DIFFERENT LITHO UNITS IS GIVEN BELOW

The lithological succession within the block comprises soil, laterite, bauxite, variegated clay, and lithomargic clay, developed as a result of intense weathering and alteration of the underlying basaltic parent rock. These litho-units have been encountered in boreholes at varying depths and thicknesses, reflecting the heterogeneous nature of the weathering profile and local geomorphological controls.

1. **Soil:** The soil profile is well developed in most part of the block. The Soil is brownish to Reddish in colour. The thickness of soil cover is around 0.0 to 0.8m.

Photo 1: Soil Cover is observed at near bentonite quarry at block.

2. **Gypseous Shale-Siltstone-Limestone with clay** – The south-eastern part of the study area is characterized by the presence of **gypseous shale–siltstone**, associated with basalt. **Iron-filled pisolites** are observed at the contact with **clayey pisolitic bauxite**, particularly along **nala cutting sections**. The exposures in this zone are limited in width and restricted mainly to nala sections.

Photo 7.2: Gypseous Shale-Siltstone is observed near bentonite old working at block.

3. **Laterite/Aluminous laterite:** The laterite/aluminous horizon constitutes the uppermost unit of the lateritic–bauxitic profile within the study area and is predominantly developed in the southern, south-eastern, and central parts of the block. In these sectors, laterite commonly occurs with clay infilling and exhibits pronounced limonitization, often

preserving relict textures and structural features of the parent basalt (Photograph 7.3). At several locations, the laterite is observed in direct contact with the underlying Deccan Trap Basalt, indicating in-situ weathering and alteration.

Within the block, laterite occurs as irregular, discontinuous bodies associated with lateritic clay, with thickness varying from about 1.40 m to 4.50 m. Stratigraphically, it generally overlies the bauxite horizon and is, in places, capped by lateritic soil. Megascopically, the laterite is reddish in colour, hard, compact, and massive, exhibiting characteristic vesicular, scoriaceous, and ferruginous textures. Locally, aluminous vesicles are observed, suggesting partial aluminium enrichment during lateritization. A distinct segregation of bauxite is commonly developed immediately beneath the pisolitic laterite, marking the transition from laterite to bauxite within the profile.

In several exposures, the laterite contains clay-filled cavities and fractures, with colour variations ranging from cherry red to off-white. The material is generally hard and compact in the north-western part of the block, whereas in the central and slope regions of hillocks it becomes relatively friable due to enhanced weathering and clay alteration. These variations reflect the influence of topographic position, intensity of weathering, and local geomorphological conditions across the area.

i) Laterite in direct contact with basalt   ii) Laterite exposure at central portion of the block

Photo 7.3: Laterite profile as observed and mapped along dry nala in NE part of the block (on bank of river) and exposure in Central portion of the block

4. **Bauxite**: Bauxite within the study area occurs as part of a lateritic profile developed over the Deccan Trap basalts and is mainly associated with the Mata-no-Madh Formation.

Structurally, the lateritic–bauxitic band shows a general NW–SE trend in the Soutern and central parts of the block, which gradually swings to NNW–ENE in the eastern part. Stratigraphically, the Mata-no-Madh Formation overlies the Deccan Trap basalts in the north eastern part of the block and is overlain by the Kakdi Nadi Formation in the southern part, indicating a well-developed lateritic weathering horizon separating the volcanic basement from the younger sedimentary succession. Lithologically, the Mata-no-Madh Formation in the block is dominantly composed of laterite with localized occurrences of pisolitic bauxite, clayey bauxite, and bauxitic clay. These bauxitic horizons are generally preserved along the crest and upper slopes of hillocks where the lateritic profile is well developed. Based on field characteristics, particularly the degree of pisolitic development and the proportion of clay in the rock unit, the lateritic sequence has been classified into bauxite (bauxite-bearing laterite), clayey bauxite, bauxitic clay, and lithomargic clay.

The bauxite is generally greyish-pink to off-white in colour, moderately to well indurated, and exhibits well-developed pisolitic to oolitic textures. Pisolites are typically circular to elliptical and display distinct concentric internal structures. The pisolitic bauxite occurs prominently along the crest of hillocks, whereas along the slopes conglomeratic bauxite boulders are locally observed, suggesting reworking and downslope transport of bauxitic material. Megascopically, some pisolitic bodies (Photograph –7.4and 7.5) exhibit ferruginous impregnation by iron-bearing fluids, while others remain relatively free from iron enrichment.

The formation of laterite and bauxite in the area is attributed to prolonged tropical weathering under conditions of intense rainfall and strong chemical leaching. During lateritization, relatively mobile elements such as calcium, sodium, potassium, and magnesium are progressively removed from the parent rock, whereas relatively immobile elements including aluminium, iron, titanium, and zirconium become concentrated in the residual material. Continued weathering over extended geological periods results in the development of lateritic profiles, which may evolve into iron-rich laterite or aluminium-rich bauxite depending on the degree of leaching and geochemical conditions.

Photograph no 7.4: Exposure of pisolitic–oolitic lateritic bauxite along the crest of hillock.

Photograph no 7.5: Conglomeratic and pisolitic Type of Pisolitic Bauxit

In the lateritic sequence, aluminous laterite occurs in association with the bauxite horizon and typically appears light pink to grey in colour, containing rounded to ellipsoidal aluminous fillings dispersed within the matrix. The bauxite encountered in the block is identified as gibbsitic-type bauxite, occurring as hard and compact masses with well-developed pisolitic structures composed predominantly of gibbsite.

Petrographic examination of the lateritic–bauxitic samples indicates that the bauxite has been formed through intense lateritization and bauxitization of the parent basaltic rock. In thin section, the rock exhibits reddish brown to whitish grey coloration and commonly shows pisolitic, porous and cavernous textures. The specimens display varying degrees of weathering and alteration, characterized by the development of pores, cavities, concentric pisolites, ferruginous patches, and secondary mineral fillings.

Microscopically, the bauxite is predominantly composed of very fine- to fine-grained aggregates of gibbsite occurring as disseminations, segregated patches, pisolites, and cavity fillings. The gibbsite commonly forms very fine to medium prismatic aggregates and locally replaces earlier pisolitic constituents. In several sections, gibbsite occurs as cavity and fracture fillings associated with ferruginous material and clay minerals, indicating progressive alumina enrichment during lateritization.

Clay minerals constitute an important component of the matrix and occur as very fine to fine pisolitic aggregates, segregated patches, and dirty semi-opaque clayey masses. The clay-rich portions are commonly stained by ferruginous matter and locally form the dominant matrix in bauxitic clay and clayey bauxite varieties. In some samples, quartz occurs as fine- to medium-grained anhedral grains embedded within the clayey matrix.

Ferruginous matter is present as reddish brown amorphous aggregates, patches, stains, pisolitic forms, and fracture fillings. It commonly occurs in association with clay minerals and locally forms ferruginous rims around pisolites. The ferruginous material is interpreted to comprise hydrated iron oxides developed during intense weathering and oxidation processes.

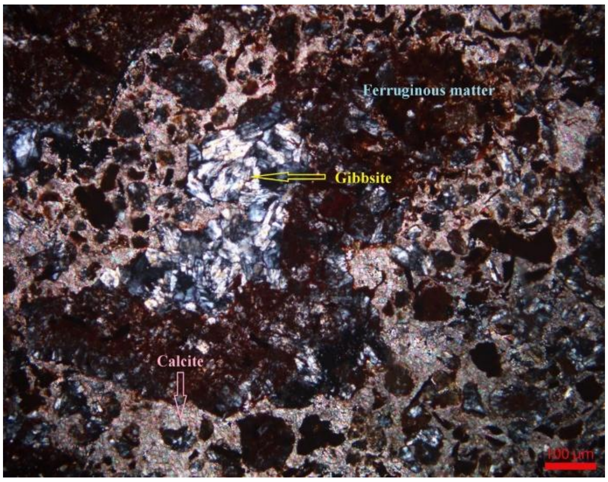
Cliachite is observed as fine- to moderately coarse pisolites and patchy relicts within the bauxitic matrix. The pisolites frequently exhibit well-developed concentric structures and contraction cracks, which are commonly filled by secondary gibbsite and/or boehmite. In several sections, cliachitic pisolites are partially replaced by fine granular gibbsite, indicating progressive alteration and alumina enrichment.

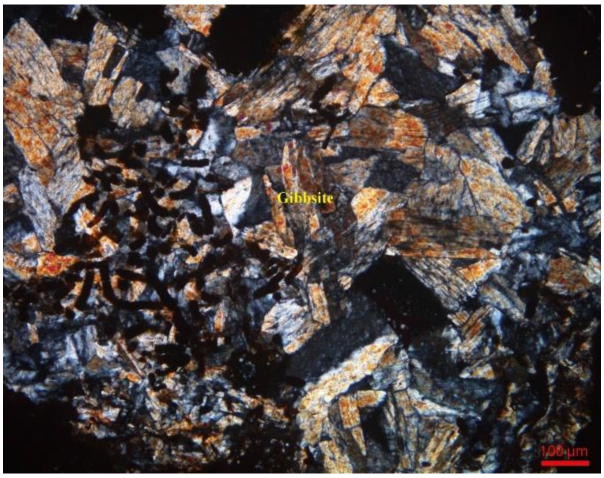
Opaque minerals occur as very fine disseminated grains, blades, anhedral patches, and patchy relicts within ferruginous zones. Calcite is locally present as thin veinlets, cavity fillings, and patchy intrusions traversing the specimen, and certain samples exhibit immediate effervescence with cold dilute HCl, confirming the presence of secondary carbonate material.

The petrographic characteristics collectively indicate that the lateritic–bauxitic profile has evolved through prolonged supergene weathering, leaching, ferruginization, and residual alumina enrichment of the basaltic parent rock. The development of pisolitic textures, gibbsite-rich matrix, ferruginous patches, and clay alteration suggests multiple stages of lateritization and bauxitization under subaerial tropical weathering conditions.

The bauxite horizon exhibits several pisolitic facies reflecting variable intensities of weathering and mineralogical alteration. Elongated aluminous pisolites showing localized infillings of goethite and hematite indicate secondary iron enrichment. Ferruginous pisolitic bauxite is characterized by fine pisolites coated with iron-oxide films, whereas massive pisolitic bauxite consists of well-sorted spheroidal concretions embedded within a lateritic matrix. In some sections, brecciated pisolitic bauxite is observed, indicating syn- and post-weathering deformation and episodic re-cementation during lateritization. These features collectively indicate cyclic iron mobilization, progressive silica depletion, and fluctuating redox conditions during the evolution of the lateritic bauxite profile.

Overall, the lithological and petrographic characteristics indicate that the bauxite of the study area represents a well-developed lateritic bauxite profile formed through prolonged chemical weathering and lateritization of basaltic parent rock, resulting in enrichment of alumina predominantly in the form of gibbsite and boehmite with associated ferruginous and accessory mineral phases.





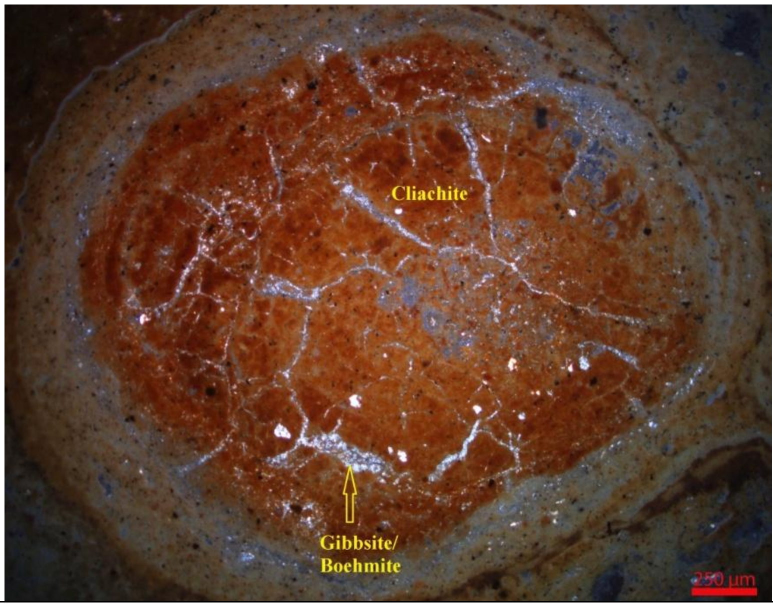
Pmg – 1: **Pmg – 2:**

Pmg – 1: Photomicrograph showing gibbsite aggregates, ferruginous patches and calcite fillings as seen under crossed nicols.

Specimen No.: MBJ/P/01 **Magnification: 100X**

Pmg – 2: Photomicrograph showing fine prismatic aggregates of gibbsite as seen under crossed nicols.

Specimen No. : MBJ/P/02 **Magnification : 100X**



Pmg – 3: Photomicrograph depicts cliachite pisolite showing concentric rings and contraction cracks filled by gibbsite/ boehmite fillings as seen under crossed nicols.

Specimen No. : MBJ/P/05 **Magnification : 40X**

The bauxite horizon displays multiple pisolitic facies, indicating varying degrees of lateritic weathering and mineralogical alteration. Elongated aluminous pisolites are commonly observed, showing localized infillings of goethite and hematite, suggesting secondary iron enrichment during weathering. Ferruginous pisolitic bauxite occurs with fine pisolites coated by lustrous iron-oxide films, reflecting intense ferruginization within the lateritic profile. In some sections, the bauxite appears massive and homogeneous, characterized by well-sorted spheroidal pisolitic concretions embedded within a fine lateritic matrix. Heterogeneous to brecciated pisolitic bauxite is also present, indicating syn- and post-depositional deformation along with episodic re-cementation during lateritization. The associated aluminous laterite shows pronounced limonitization, brecciation, and brittle fracture fabrics, suggesting advanced stages of chemical weathering. These features collectively reflect cyclic iron mobilization, progressive silica depletion, and fluctuating redox conditions during the development of the lateritic bauxite profile.

Biopedological observations reveal the presence of Commiphora genus shrubs (Photograph – 7.6) over the lateritic and bauxitic terrain in the vicinity of the Mata-no-Madh region. These xerophytic plants show strong ecological adaptation to highly weathered, ferruginous, and aluminium-rich soils typical of lateritic terrains. Such soils are generally porous, well drained, nutrient deficient, and subjected to seasonal moisture fluctuations, favouring drought-tolerant thorn-scrub vegetation. The occurrence of Commiphora therefore indicates prolonged geomorphic stability and sustained lateritic weathering within the upland terrain.

Photograph No. 7.6: Commiphora genus shrubs over the lateritic and bauxitic terrain.

In general, the bauxite horizon occurs immediately beneath the soil cover in the Southern,Central and South eastern of the block. The bauxite is typically hard, dense, and compact, forming a well-developed lateritic horizon. The thickness of the bauxite layer shows considerable variation across the block, ranging from 1.0 m to about 6.50 m(In only one Borehole MBJ-01), reflecting differential lateritic development and localized geomorphological control.

(i) Exploratory drilling carried out by MECL has established the occurrence of Metallurgical Grade–II bauxite within the block. The average thickness of the metallurgical grade bauxite intercepted in only two boreholes is 3.50 m. The minimum thickness of 0.50 m has been recorded in borehole MBJ-06, whereas the maximum thickness of 6.50 m has been encountered in borehole MBJ-01. The depth of intersection of the bauxite horizon from surface exposure (0.00 m) in borehole MBJ-01 and MBJ-02 to a depth of 1.00 m indicating that the bauxite horizon generally occurs near the surface beneath a thin soil cover.

(ii) Chemical analysis of the demarcated bauxite zones indicates that Al_2O_3 content varies from 38.24% (MBJ-01) to 43.84% (MBJ-01), while SiO_2 content ranges from 3.93% (MBJ-01) to 5.85% (MBJ-01). The relatively high alumina content coupled with low silica values confirms the metallurgical grade quality of the bauxite, making it suitable for alumina extraction and other metallurgical applications.

These results collectively indicate that the bauxite horizon in the block exhibits moderate thickness with favourable chemical characteristics of the deposit.

(a) **Clayey Bauxite:** Clayey bauxite within the block occurs interbedded with lithomargic clay, forming an alternating sequence within the bauxitic weathering profile. This unit is characterized by the presence of pisolitic structures embedded within a clay-rich matrix, indicating partial lateritic alteration and incomplete alumina concentration compared to well-developed pisolitic bauxite.

Megascopically, the clayey bauxite exhibits off-white to pinkish-white coloration (Photograph -7.7). The pinkish tint is primarily attributed to the presence of pisolitic constituents and ferruginous staining, whereas the whitish colour reflects the dominance of clayey material within the rock matrix. The material is relatively soft and friable in nature and commonly soils the hand upon handling, reflecting its high clay content and comparatively low degree of induration.

Field observations indicate that clayey bauxite is frequently encountered in measured stratigraphic sections where it occurs in alternating bands with lithomargic clay, representing transitional horizons within the lateritic profile. This lithological association suggests progressive alteration and gradation from clay-rich horizons to more aluminous bauxite zones.

Clayey bauxite is widely observed in several sections across the block, particularly in the South eastern and eastern part of the study area, where it often exhibits relict textures.

Exploratory drilling has revealed that the thickness of the clayey bauxite horizon varies locally, with a thickness of approximately 6.00 m recorded in borehole MBJ-01 and 3.00 m in borehole MBJ-03 (Photograph-7). The occurrence of this horizon within the lateritic sequence indicates transitional stages of weathering and alumina enrichment within the bauxite-bearing profile of the block.

Photograph No.7.7: Core Photograph of MBJ-01 showing Clayey Bauxite intercepted between 07.50 to 13.50m

(b) **Bauxitic clay:** Bauxitic clay occurs as small discontinuous patches within the clayey bauxite horizon and is distinguished by its relatively higher proportion of clay content compared to the surrounding clayey bauxite. This unit represents a transitional lithology within the lateritic profile, reflecting advanced weathering and partial alumina enrichment.

Megascopically, the bauxitic clay appears reddish white in colour under dry conditions and reddish when moist, indicating variations in moisture content and clay mineral composition. The rock mass commonly contains minor relict pisolitic structures, suggesting derivation from earlier pisolitic bauxite horizons that have undergone further alteration and clay enrichment. At several locations, ferruginous material are observed, indicating secondary iron mobilization and precipitation during lateritic weathering processes.

Spatially, the bauxitic clay horizon is mainly developed in the central and southern parts of the mapped area, where it occurs both as surface exposures and within borehole sections. The unit is also exposed as isolated patches within the basaltic terrain at relatively lower elevations, reflecting localized weathering and accumulation within depressional zones of the landscape. In addition, bauxitic clay has been identified in pit sections within the study area, presence within the lateritic stratigraphic sequence.

(c) **Lithomargic Clay:** Lithomargic clay constitutes the lowermost unit of the lateritic–bauxite sequence within the study area. This unit is well exposed in pit sections and in the old workings of in the northeastern part of the mapped area, where the complete lateritic weathering profile is preserved.

Megascopically, lithomargic clay is fine grained, soft, and typically grey to white in colour (Photograph- 7.9). The material exhibits a characteristic soapy feel and readily soils the hand, reflecting its high clay mineral content and advanced stage of chemical weathering. In several exposures, lithomargic clay is observed to occur in repeated sequences with clayey bauxite, indicating transitional stages within the lateritic alteration profile and progressive modification of the parent basaltic rock.

The whitish colour of the lithomargic clay is interpreted to be primarily due to the dominance of kaolinite and associated clay minerals, which form through intense chemical weathering and leaching processes under lateritic conditions. The development of this horizon therefore represents the initial stage of lateritic alteration of the basaltic parent rock, preceding the formation of overlying clayey bauxite and pisolitic bauxite horizons within the lateritic profile.

Photograph No.7.8: Core Photograph of MBJ-07 showing Lithomergic Clay intercepted between 8.80 to 11.00m

(d) **Bentonitic Clay:** Bentonite within the study area occurs as light yellow coloured, soft to moderately compact material, typically displaying a fine-grained and plastic nature. The unit locally exhibits secondary vesicular structures, indicating post-depositional alteration and diagenetic processes within the clay-rich horizon.

This bentonitic horizon has been observed in the southern part and majorly in the northern part, particularly within the old working within the block area (Photograph– 7.9). Field observations indicate that the bentonite occurs at a depth of approximately 20 m to 25 m below the surface, suggesting its occurrence as part of the sedimentary sequence underlying the lateritic and bauxitic horizons.

The occurrence of bentonite in the area is interpreted by GSI to be related to the alteration of volcanic ash or tuffaceous material, resulting in the formation of smectite-rich clay minerals. Its presence within the subsurface stratigraphy further indicates favourable geological conditions for the development of bentonitic clay deposits within the basin sequence of the region.


Photographs No. 7.9: Bentonite Old working and old stock in northeastern part of the block.

5. **Basalt:** Basalt forms the basement lithology of the study area and represents the volcanic flows of the Deccan Trap sequence. Field observations indicate the presence of both phenocrystic and non-phenocrystic varieties of basalt, reflecting variations in cooling history and textural development within the lava flows.

The phenocrystic basalt is characterized by the presence of distinct plagioclase phenocrysts embedded within a fine-grained groundmass, imparting a typical porphyritic texture (Photograph – 7.10). In several exposures, this basalt displays well-developed columnar jointing (Photograph- 7.11), which is indicative of contractional cooling structures formed during the solidification of basaltic lava. At certain locations, the basalt also exhibits spheroidal weathering, resulting from progressive chemical weathering along joints and fractures leading to concentric exfoliation of the rock.

In addition to the phenocrystic variety, fine-grained massive basalt is also observed across the study area. Megascopically, the basalt is generally dark grey to black in colour and fine to medium grained in nature. Feldspar phenocrysts are commonly visible in hand specimens. Amygdaloidal structures, formed by the infilling of vesicles by secondary mineral phases, are particularly well developed in the northern part of the block. The basalt shows varying degrees of weathering, ranging from fresh and compact exposures to partially altered varieties. Representative field photographs illustrating these features are provided below. In some places calcite are found as fracture filling within basalt.

Basalt in the exhibits a porphyritic texture and represents a very fine-grained mafic rock composed mainly of plagioclase, augite, opaque minerals, and occasionally biotite/chlorite. Plagioclase occurs as medium to fine subhedral prismatic phenocrysts and also as very fine laths within the groundmass.

Another textural variety observed is vesicular basalt, which is a very fine-grained melanocratic massive rock characterized by the presence of pores, vesicles, and amygdaloids. Mineralogically, it is composed of plagioclase, augite, volcanic glass.

The basaltic units occurring within the study area display similar mineralogical composition and textural characteristics, suggesting that they likely belong to a single basaltic lava flow.

Photographs No. 7.10: Porphyritic Basalt and Amygdaloidal Basalt

Photographs No. 7.11: Columnar Joint in Basalt

6. **Limestone:** Limestone occurrences within the Julrai Block, Kachchh, are represented by marine fossiliferous varieties comprising grey (Photograph: 7.12, 7.12 and 7.14), carbonate rocks rich in faunal assemblages such as ammonites, bivalves, and foraminifera. These lithounits are indicative of deposition under shallow to moderately deep marine conditions associated with repeated phases of marine transgression within the Kutch Basin during the Jurassic to Tertiary periods.

   The limestone is generally medium- to fine-grained, compact to massive, and occurs as stratified horizons within the sedimentary sequence. Fossil content is often well preserved, providing important stratigraphic and paleoenvironmental indicators. In certain locations, relict patches of limestone are observed over lateritic terrain, suggesting remnants of earlier sedimentary cover preserved amidst subsequent lateritization and erosional processes.

   These occurrences reflect the complex interplay of marine sedimentation, uplift, and prolonged subaerial weathering that has shaped the present geomorphological and stratigraphic framework of the area.

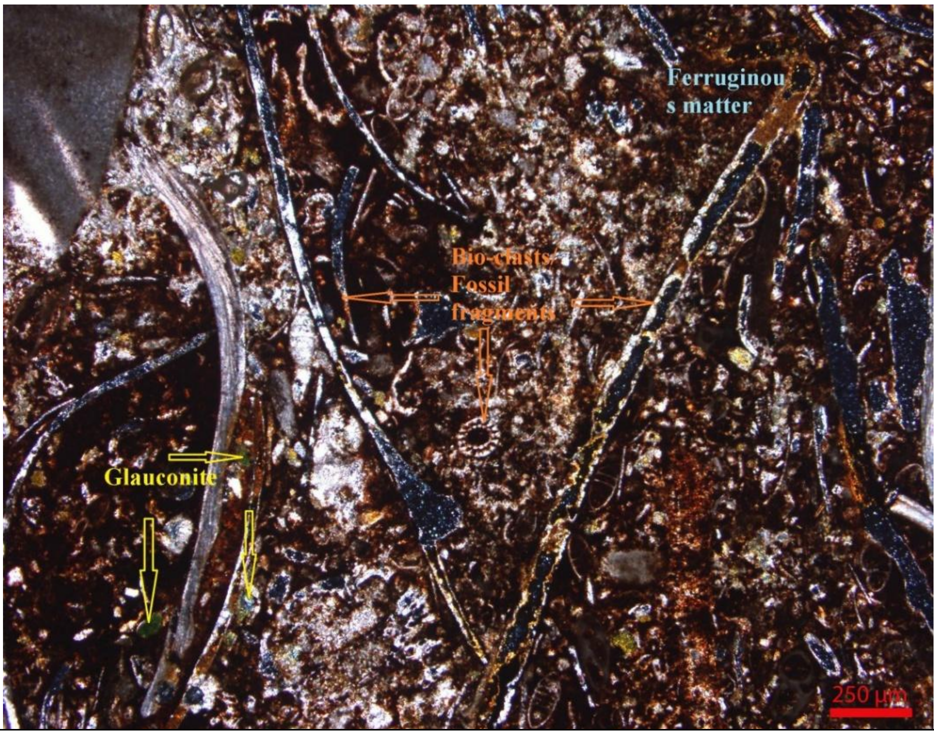
Photograph No. 7.12: Outcrop of Fossiliferous Limestone at Central part of the block.

Photograph No. 7.13: Outcrop of Fossiliferous Limestone and relict of limestone along central part of the block.

Photograph No. 7.14: Outcrop of Fossiliferous Limestone and relict of limestone along central part of the block.

Petrographic examination reveals that the limestone is a dark grey, massive carbonate rock exhibiting visible fine- to medium-grained bioclasts, along with pores and cavities. The specimen shows immediate effervescence with cold dilute HCl, confirming its calcareous nature.

Microscopically, the limestone comprises abundant fine- to medium-grained bioclasts/fossil fragments embedded in a micritic matrix. Intergranular spaces are predominantly filled with sparry calcite cement, imparting a biosparitic texture. Ferruginous matter occurs as patches and stains, while glauconite is present as fine sub-rounded pellets. Accessory quartz occurs as very fine silt-sized detrital grains. Based on its mineralogical composition and textural characteristics, the limestone is classified as a glauconite-bearing ferruginous biosparite.



Pmg – 4: Photomicrograph showing bio-clasts set in sparry matrix, which is stained by reddish ferruginous matter and associating glauconite pellets as seen under crossed nicols.

Specimen No.: MBJ/P/03 **Magnification : 40X**

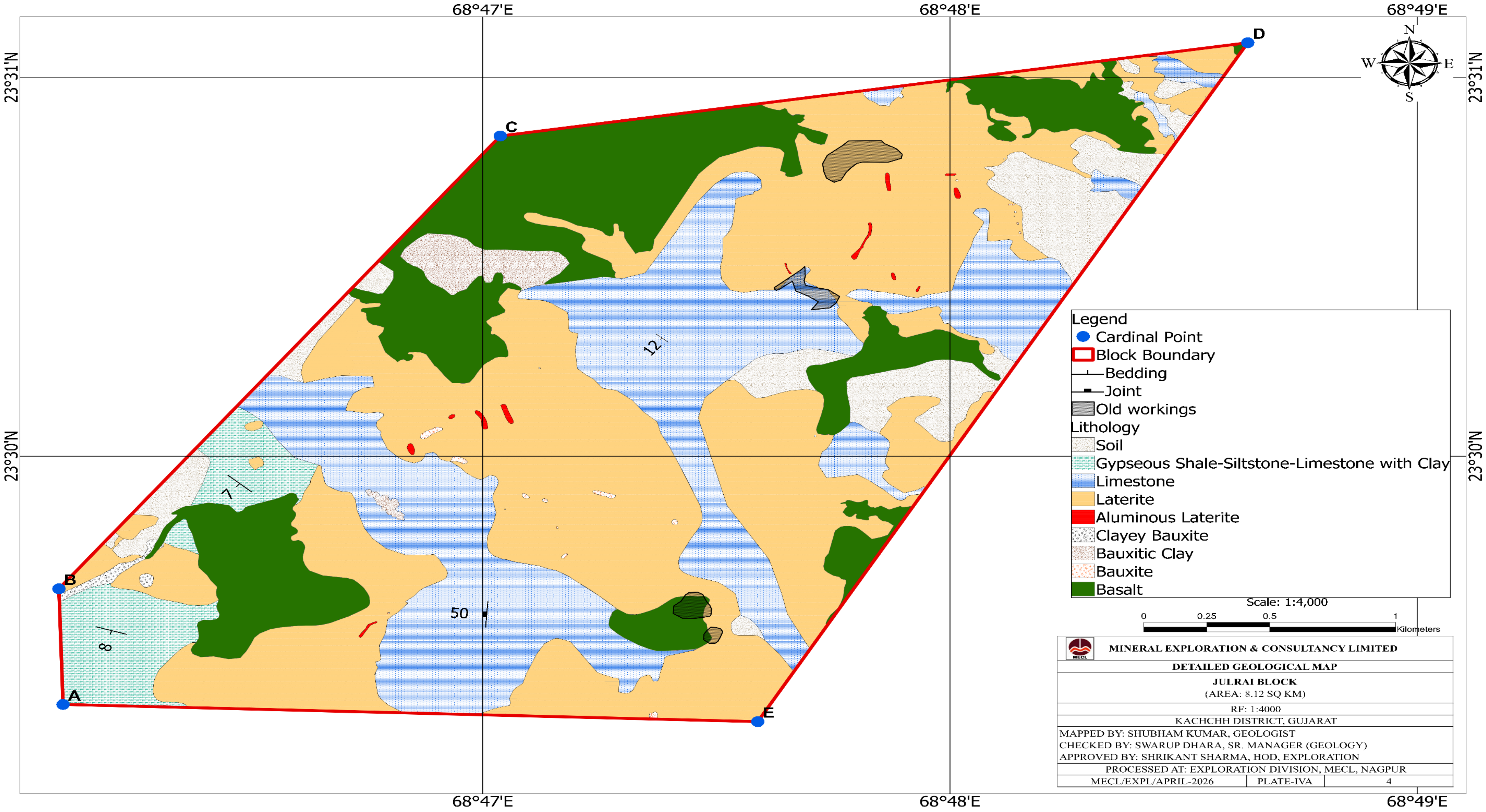
7.5.0 VERTICAL LATERITIC WEATHERING PROFILE

7.5.1 The lateritic profile developed within the Julrai Block represents a typical residual weathering sequence formed over basaltic parent rocks. The vertical succession generally consists of soil cover at the top followed by laterite, pisolitic bauxite, clayey bauxite, lithomargic clay and unaltered basalt at depth.

The uppermost layer comprises reddish to brown soil containing ferruginous nodules derived from weathering of lateritic material. This is followed by a compact laterite horizon characterized by ferruginous matrix and vesicular texture. The laterite horizon commonly overlies the bauxite zone and acts as a protective cap over the mineralised layer.

The bauxite horizon is generally pisolitic in nature and consists of rounded nodules embedded within a ferruginous or aluminous matrix. The pisolites display concentric structures indicating chemical precipitation during lateritization. Below the pisolitic bauxite zone occurs clayey bauxite and lithomargic clay which represent transitional weathering products formed due to partial alteration of basaltic parent rocks.

The development of this vertical profile indicates prolonged chemical weathering under stable geomorphological conditions which favoured the formation and preservation of bauxite deposits in the study area.



TEXT FIGURE- 5 (Geological Map)

7.6.0 STRUCTURE OF THE BLOCK

The structural features observed during geological mapping of the study area have been broadly categorized into primary (non-diastrophic) structures and secondary (diastrophic) structures. Primary structures are those formed during the deposition or emplacement of the rock units, whereas secondary structures developed subsequently due to tectonic stresses, cooling, weathering, or post-emplacement processes.

7.6.1 **Primary Structures**

Primary structures in the study area are represented mainly by pisolitic structures within the bauxite and lateritic horizons, as well as igneous structures within the basaltic rocks. The bauxite and lateritic bauxite commonly exhibit well-developed pisolitic textures, where the pisolites range in diameter from approximately 0.10 mm to 0.40 mm. These pisolites occur in variable shapes and sizes and are occasionally observed to contain grey-coloured clay infillings, reflecting localized alteration and clay enrichment within the lateritic profile.

Within the basaltic rocks, the primary igneous structures are characterized by columnar jointing, particularly well developed in the phenocrystic basalt exposures. These columnar structures are formed due to contractional stresses during the cooling and solidification of basaltic lava flows and represent typical primary igneous features associated with Deccan Trap volcanism.

In addition to these features, traces of bedding with gentle dip, burrows and trails are locally observed within certain sedimentary horizons, indicating minor biogenic activity during or shortly after deposition. The bedding of the limestone bands showing WNW-ESE strike with gentle dip towards SW.

7.6.2 **Secondary Structures**

Secondary structures in the area are primarily represented by vesicular and amygdaloidal features as well as joints and fractures. The basaltic rocks display well-developed vesiculation resulting from the escape of volatile gases during the later stages of lava solidification. In several exposures, these vesicles are subsequently filled with secondary minerals forming amygdaloidal structures.

In many sections, the basalt exhibits a massive, compact, and fine-grained character, representing the dense interior portion of the lava flow where gas escape was minimal during solidification. Laterally and vertically, this massive basalt gradually transitions into vesicular and amygdaloidal basalt, characterized by numerous cavities formed due to volatile exsolution during the late stages of cooling. These cavities are commonly filled by secondary mineral phases. The transition from massive basalt to amygdaloidal facies within the same flow unit reflects the degassing behaviour, cooling dynamics, and subsequent mineral infilling processes associated with basaltic lava emplacement.

Apart from vesicular features, sparse joints and fractures are also observed within the basaltic rocks of the Deccan Trap sequence, although they are relatively sparse in occurrence within the study area. The joints generally exhibit a dominant NE–SW trend, which may reflect regional tectonic stress patterns and cooling-induced fracturing within the basaltic flow units.

Overall, the structural features observed in the area provide important insights into the volcanic emplacement processes, lateritic weathering, and subsequent tectonic and weathering modifications affecting the rock units of the study area.

7.7.0 MINERALISATION

7.7.1 The lateritic profile of the study area is developed directly over the Deccan Trap Volcanics and associated pyroclastic rocks, with the laterite–bauxite sequence resting unconformably over the volcanic basement. In certain sectors, the lateritic horizon is also observed in proximity to the Bhuj Formation, indicating a complex stratigraphic association within the basin framework. Field studies indicate that the laterite–bauxite deposits have formed through intense lateritization and bauxitization of basaltic and pyroclastic lithologies under prolonged subaerial weathering conditions.

7.7.2 The laterite horizon is generally massive and compact; however, in several exposures it preserves relict textures of the parent basalt, including plagioclase phenocrysts embedded within a fine-grained groundmass and flow alignment of laths, reflecting the original volcanic fabric. These features confirm the in-situ alteration of basalt and the residual nature of the bauxitic profile.

7.7.3 Topographically, the Julrai Block exhibits subdued relief, with elevations ranging from approximately 104 m to 130 m above Mean Sea Level (MSL). Within this geomorphic setting, laterite and bauxite horizons are developed over basaltic country rocks, forming a characteristic lateritic weathering profile.

7.7.4 The bauxites of the Mata-no-Madh Formation are interpreted to have originated through alteration of pyroclastic facies of the Deccan basaltic flows under prolonged tropical weathering. The stratigraphic succession comprises ferruginous laterite overlying basalt, which is in turn overlain by Eocene gypseous shale, indicating that lateritization preceded the deposition of younger sedimentary units. The formation of these deposits is attributed to long-term chemical weathering, leaching of mobile constituents, and enrichment of relatively immobile elements such as aluminium, iron, and titanium.

7.7.5 Mineralization within the block occurs predominantly as bauxite-rich lateritic cappings, forming pocket- to blanket-type deposits. These are mainly developed in the north-western part of the block, where favourable geomorphological and lithological conditions have facilitated accumulation of aluminous laterite and pisolitic bauxite.

7.7.6 The bauxite horizon is characterized by fine- to medium-grained pisolites composed of aggregates of gibbsite and boehmite, typically arranged in concentric structures. In several instances, pisolites are rimmed or partially infilled by carbonate minerals, indicating secondary mineral deposition. Petrographic studies reveal partial replacement of cliachitic pisolites by fine granular aggregates of gibbsite–boehmite, reflecting progressive lateritization and alumina enrichment. These minerals also occur as cavity fillings within the pisolitic matrix, confirming the chemical origin of the deposits.

7.7.7 Associated mineral phases include iron oxides, titanium-bearing minerals, and minor sulphides. Limonite occurs as fine amorphous aggregates and stains, while goethite and hematite are present as dendritic, patchy, and relic forms within the ferruginous matrix, indicating progressive oxidation. Titanium minerals such as anatase and rutile occur as fine disseminations, along with ilmenite, which often shows alteration to goethite. Minor sulphide phases, including pyrite, pyrrhotite, pentlandite, and chalcopyrite, are present in trace amounts as disseminations within the matrix.

Overall, the mineral assemblage and petrographic characteristics indicate that the bauxite mineralization is of chemical origin, formed through prolonged tropical weathering and lateritic alteration of Deccan Trap basalts and associated pyroclastics. The resulting profile is marked by significant enrichment of alumina in the form of gibbsite and boehmite, accompanied by ferruginous and titanium-bearing phases, forming economically viable bauxite deposits within the Mata-no-Madh Formation.

7.8.0 GENETIC MODEL OF BAUXITE FORMATION

7.8.1 The bauxite mineralisation in the Julrai Block represents a typical lateritic type deposit formed through prolonged chemical weathering of basaltic parent rocks. The formation of bauxite is primarily controlled by intense tropical weathering processes that resulted in progressive leaching of silica and enrichment of aluminium and iron oxides.

7.8.2 During the lateritization process, basaltic rocks undergo intense alteration under conditions of high temperature and seasonal rainfall, leading to breakdown of primary silicate minerals such as feldspar and pyroxene. The leaching of silica and mobile elements results in residual concentration of aluminium hydroxides mainly in the form of gibbsite along with iron oxides and hydroxides. Over time, this process leads to the development of a characteristic vertical weathering profile consisting of soil, laterite, pisolitic bauxite, clayey bauxite and lithomargic clay horizons.

7.8.3 The pisolitic texture observed within the bauxite horizon indicates repeated cycles of weathering, re-precipitation and concretionary growth of aluminium-rich nodules. The development of bauxite horizons is strongly influenced by geomorphological stability, gentle slopes and efficient drainage conditions which favour removal of silica and enrichment of aluminium.

Thus, the bauxite deposits of the Julrai Block can be interpreted as residual lateritic bauxite formed over basaltic parent rocks under prolonged tropical weathering conditions during post-Deccan geological evolution of the Kachchh region.

7.9.0 MODE OF OCCURRENCE

7.9.1 In the study area, lateritic bauxite occurs as three distinct bands forming cappings over flat-topped hillocks, representing residual products of intense lateritization and bauxitization of the Deccan Trap Basalt. These horizons are typically preserved over elevated geomorphic surfaces, where prolonged weathering and leaching have resulted in the development of a well-defined lateritic profile.

The lateritic–bauxitic sequence exhibits a characteristic vertical zonation comprising five lithological units, reflecting progressive stages of chemical weathering, alumina enrichment, and clay formation. The uppermost unit is ferruginous laterite, forming a hard, compact, and massive cap that protects the underlying horizons and imparts resistance to erosion.

Underlying the laterite is the pisolitic bauxite horizon, which constitutes the principal aluminous zone. It is characterized by well-developed pisolites with concentric structures composed predominantly of gibbsite and other aluminium-bearing minerals, along with iron oxides and minor clay constituents. This horizon indicates advanced lateritic alteration and significant alumina concentration.

Below this, the clayey bauxite horizon occurs, representing an intermediate stage of alteration wherein pisolites are embedded within a clay-rich matrix, reflecting partial development of bauxite. This is followed by the bauxitic clay zone, which contains a higher proportion of clay minerals and locally preserves relict pisolitic or oolitic textures. Megascopically, it appears white in dry conditions and grey when moist.

The lowermost unit of the profile is lithomargic clay, which is fine-grained, grey to white in colour, and exhibits a characteristic soapy feel. It commonly occurs in alternation with clayey bauxite, indicating fluctuating environmental conditions during lateritic profile development, possibly reflecting variations in moisture regime and climatic conditions.

The lateritic profile rests over the unaltered basement, comprising either Deccan Trap basalt or, locally, sandstone of the Bhuj Formation. In several sections, the underlying bedrock shows extensive alteration, indicating progressive transformation into laterite and bauxite through prolonged chemical weathering .

Based on field characteristics such as pisolitic development, colour, and clay content, the sequence is classified into laterite, pisolitic bauxite, clayey bauxite, bauxitic clay, and lithomargic clay. The bauxite-bearing bands generally exhibit a NW–SE trend in the central and southern parts of the block, attaining an approximate strike length of 1 km, with widths ranging from 40 m to 80 m. The thickness of the lateritic–bauxitic profile varies between 10 m and 20 m.

Within the mapped area, the Mata-no-Madh Formation is predominantly composed of laterite, with localized occurrences of pisolitic bauxite, clayey bauxite, and bauxitic clay. In the south-eastern part, gypseous shale–siltstone of the Kakdi Nadi Formation forms the topmost lithological unit. The lateritic profile generally rests directly over the Deccan Trap basalt, although in some localities it is associated with sediments of the Bhuj Formation.

In several exposures, the laterite exhibits pronounced limonitization, imparting characteristic reddish to yellowish coloration due to the formation of hydrated iron oxides during weathering. During bauxitization, primary minerals such as plagioclase feldspar and other silicates undergo progressive alteration to aluminium hydroxide minerals, chiefly gibbsite, which constitutes the dominant ore mineral. Accessory minerals include iron oxides (Fe_2O_3), rutile (TiO_2), and kaolinite, with the lower horizons (bauxitic clay and lithomargic clay) showing enrichment in kaolinite due to intense leaching.

The development of bauxite in the region is closely linked to prolonged tropical to sub-tropical weathering conditions, involving intense chemical alteration, leaching of mobile constituents, and residual enrichment of relatively immobile elements such as aluminium, iron, and titanium. The Mata-no-Madh Formation thus represents a typical lateritic bauxite horizon formed through in-situ weathering of Deccan Trap basalt, occurring stratigraphically between the Bhuj Formation and the overlying Kakdi Nadi Formation. The alternating sequence of clayey and lithomargic units further reflects periodic climatic and hydrological variations during the evolution of the lateritic system.

7.9.2 Factors Controlling Bauxitization

The process of bauxitization involves the neoformation of hydroxides, hydrated oxides, and oxides of aluminium, iron, and titanium, while silicate minerals and quartz may persist as residual phases. The liberation and redistribution of these minerals from the parent rock are influenced by several factors, including the bond strength within mineral crystal lattices, solubility of secondary mineral phases, redox potential (Eh) and pH of the circulating solutions, oxidation state of elements, temperature and concentration of the weathering fluids, and the presence of other dissolved ions within the weathering environment.

i) Genesis

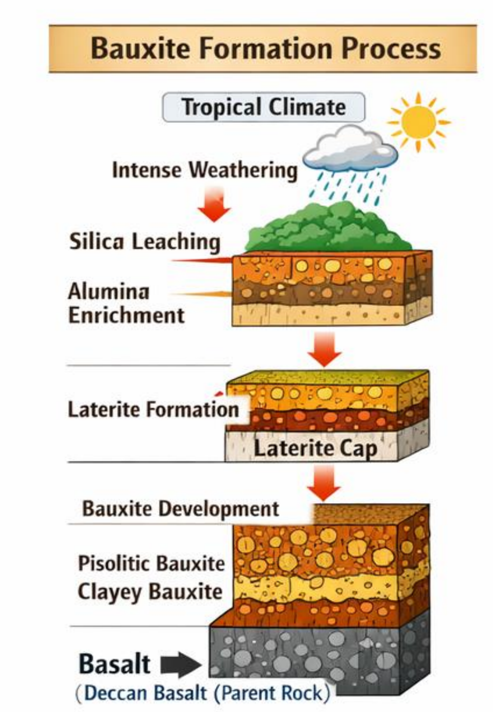
The genesis of bauxite and laterite is strongly controlled by the geochemical behaviour of aluminium, iron, silica, and titanium in aqueous solutions, together with the prevailing Eh–pH conditions of the weathering environment. Dissolution and removal of silica represent a critical step in the development of bauxite deposits. Iron is also gradually mobilized and redistributed during lateritization, although it commonly accumulates in upper parts of the profile forming ferruginous caps.

Titanium is typically enriched within bauxitic profiles and occurs mainly as anatase, rutile, or ilmenite. Although titanium may partially substitute for silica within certain mineral structures, its incorporation is limited due to differences in ionic radius. The bauxite and laterite profile significanly enriched with Vanadium and Galium also.

During weathering, hydrolysis reactions generate colloidal systems containing negatively charged silica (SiO_2) and ferric hydroxide [$Fe(OH)_3$] as well as positively charged aluminium hydroxide [$Al(OH)_3$], although aluminium hydroxide may also acquire negative charges in alkaline conditions. Titanium ions may play a role in modifying charge balance within these systems. The formation of clay minerals results from reactions between silica and amorphous aluminium hydroxides, and the resulting mineral assemblage is strongly influenced by drainage conditions that regulate silica availability.

The pH of the weathering environment is typically alkaline in the case of mafic source rocks such as basalt, which, when combined with effective drainage, favours the precipitation of aluminium hydroxides. Iron, once mobilized in solution, tends to precipitate under oxidizing surface conditions, resulting in the formation of ferruginous caps. In deeper parts of the profile where reducing conditions prevail and drainage becomes sluggish; iron may be removed while clay minerals accumulate.

Collectively, these chemical, climatic, and geomorphological processes lead to the development of the distinct vertical zonation observed in the lateritic bauxite profile of the study area, ultimately resulting in the formation of economically significant bauxite deposits within the Mata-no-Madh Formation.



Text Figure 6: Bauxite formation conceptual model of Julrai Block.

7.10.0 MINERAGRAPHIC AND PETROGRAPHIC STUDIES OF MINERALISED CORE SAMPLES

7.10.1 A total of 5nos. of XRD samples were collected from different bauxite/laterite zones and sent for mineralogical studies in Chemical lab of MECL, Nagpur. X-ray Diffraction (XRD) studies were carried out on selected representative samples of bauxite and aluminous laterite from the Julrai Block to determine the mineralogical composition and nature of alumina-bearing, ferruginous, and associated gangue phases within the lateritic profile. The detailed XRD analytical results are presented in Annexure–VI.

The XRD investigations reveal that the bauxitic horizons are predominantly composed of gibbsite, which occurs as the principal alumina-bearing mineral in almost all the analysed samples. Associated aluminous phases such as boehmite and diaspore are also recorded in subordinate proportions, indicating varying degrees of bauxitization and alumina enrichment within the profile.

Ferruginous constituents are represented mainly by hematite and goethite, while anatase occurs consistently as the dominant titanium-bearing phase. Minor amounts of magnetite and ilmenite are also identified in some samples. Clay minerals such as kaolinite and dickite are present particularly within clay-rich and transitional horizons, indicating advanced weathering and alteration of the parent basaltic material. Accessory mica minerals including **muscovite**, **biotite**, and **phlogopite** are recorded in trace to minor proportions. In certain samples, the presence of **calcite** suggests secondary carbonate enrichment along fractures and cavities.

The mineral assemblage identified through XRD studies corroborates the petrographic and mineragraphic observations and confirms that the lateritic–bauxitic profile has evolved through prolonged supergene weathering, desilication, ferruginization, and residual alumina enrichment of the parent Deccan Trap basalt. The dominance of gibbsite along with associated boehmite and diaspore indicates moderate to advanced stages of lateritization and bauxitization under tropical weathering conditions. The details is placed as Annexure-VI.

Mineragraphic studies were carried out on eight representative samples collected from the lateritic–bauxitic horizons of the Julrai Block to ascertain the nature, association, and distribution of ore minerals within the profile. The polished section studies indicate that the ore minerals are predominantly represented by iron oxides/hydroxides and titanium-bearing phases occurring within the ferruginous and clay-rich matrix. The detailed mineragraphic results are furnished in Annexure– VIIB and summarized below.

The mineragraphic examination reveals that hematite, goethite, limonite, anatase/rutile, and leucoxene constitute the principal ore mineral assemblage within the lateritic–bauxitic profile. Hematite and goethite commonly occur as intermixed disseminations, patches, cavity fillings, and colloform aggregates, indicating intense ferruginization under oxidizing supergene conditions. In several specimens, hematite shows partial replacement by goethite, suggesting progressive hydration and alteration during lateritization. Limonite is widely developed as reddish brown amorphous aggregates, stains, patches, and fillings throughout the specimens, reflecting advanced weathering and oxidation processes.

Titanium-bearing minerals are represented mainly by anatase, rutile, and leucoxene. Anatase/rutile commonly occur as very fine bladed, amorphous, microcrystalline, or granular aggregates, frequently concentrated within clayey patches and pisolitic zones. Leucoxene occurs as fine pseudomorphic patches and segregations associated with ferruginous constituents, indicating alteration of primary Ti-bearing phases during weathering. The concentration of anatase and rutile within pisolitic and clay-rich portions suggests residual enrichment of relatively immobile titanium during bauxitization.

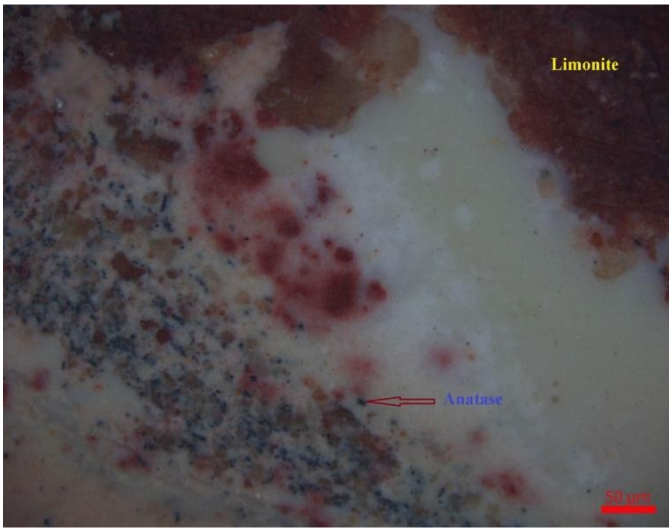
Opaque minerals occur mainly as very fine disseminated grains, blades, hairline fillings, and patchy segregations associated with ferruginous aggregates. Minor sulphide phases such as chalcopyrite and pyrite are recorded in trace amounts as very fine specks within a few samples, indicating relic primary sulphide mineralization preserved within the lateritic profile.

In some polished sections, hematite–goethite aggregates exhibit compositional zoning and colloform textures, reflecting multiple stages of precipitation and reworking under fluctuating oxidation conditions. The widespread occurrence of ferruginous patches, limonitic stains, and titanium-rich segregations indicates prolonged supergene alteration and residual concentration processes within the profile.

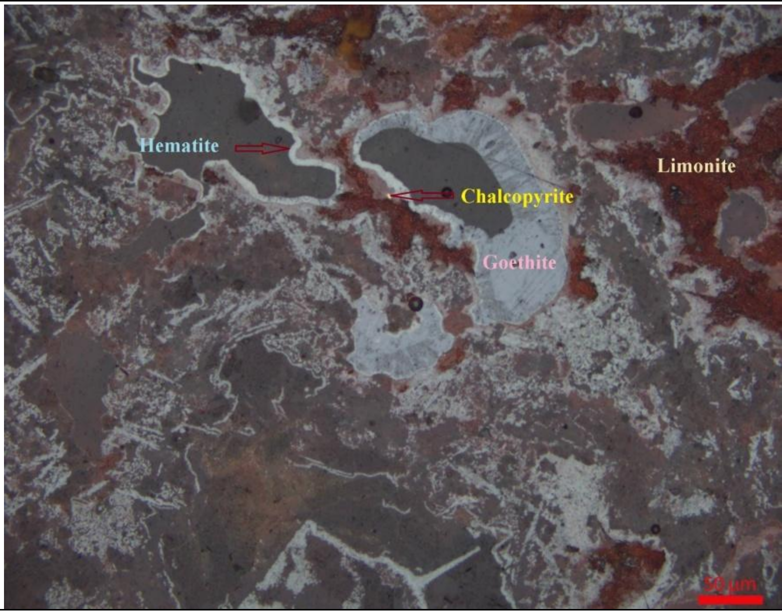
Overall, the mineragraphic studies indicate that the lateritic–bauxitic profile of the Julrai Block is characterized by intense ferruginization, oxidation, and residual enrichment of titanium-bearing minerals under prolonged tropical weathering conditions. The mineral assemblage and textural relationships support the interpretation that the bauxite mineralization is of residual lateritic origin developed through supergene weathering and alteration of the parent basaltic rocks.

A total of eight samples each were initially subjected to petrographic and mineragraphic investigations, which confirmed the lithology as bauxite/aluminous laterite. The studies were carried out in accordance with the original approved exploration programme. However, during the course of review and subsequent revised approval, the scope of laboratory investigations was rationalized, and the number of samples was revised to six for petrographic studies and four for mineragraphic studies. The sample wise details of the petrographic studies and Mineragraphic studies are presented as Annexure-VIIA & VIIB.

Pmg – 5: Photomicrograph showing hematite blades, lecoxene patches and reddish amorphous aggregates of limonite as seen under reflected light.
Specimen No. : MBJ/M/02 Magnification : 200X



Pmg – 6: Photomicrograph showing very fine segregation of anatase and reddish limonite patches as seen under reflected light.
Specimen No. : MBJ/M/04 Magnification: 200X



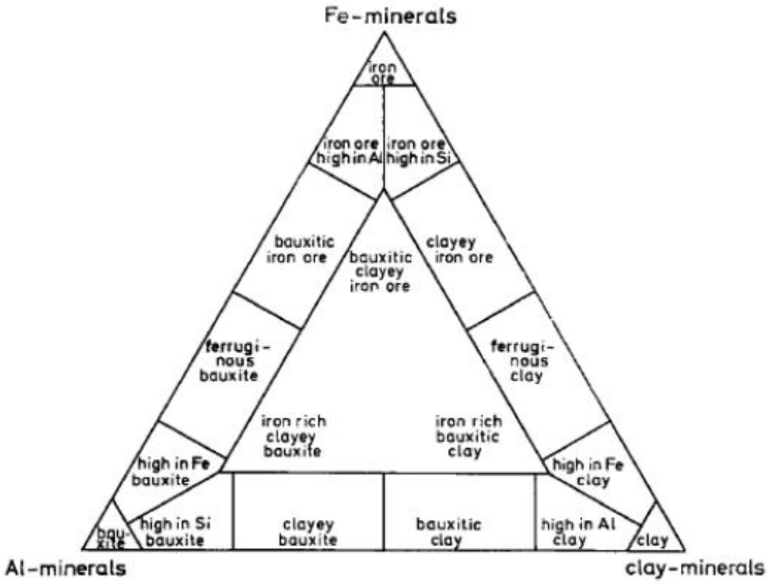
Pmg – 7: Photomicrograph goethite and hematite patches and fillings and reddish limonitic patches as seen under reflected light.
Specimen No. : MBJ/M/06 Magnification : 200X

7.10.2 Available Alumina and Reactive Silica: Analysis received and placed in Annexure VA and VB.

7.11.0 GEOCHEMISTRY OF BAUXITE

7.11.1 The classification proposed by Valeton (1972), modified from Bardossy (1963), is based primarily on genesis (mode of formation) and parent rock type, reflecting the geological and geochemical processes involved in bauxite formation.

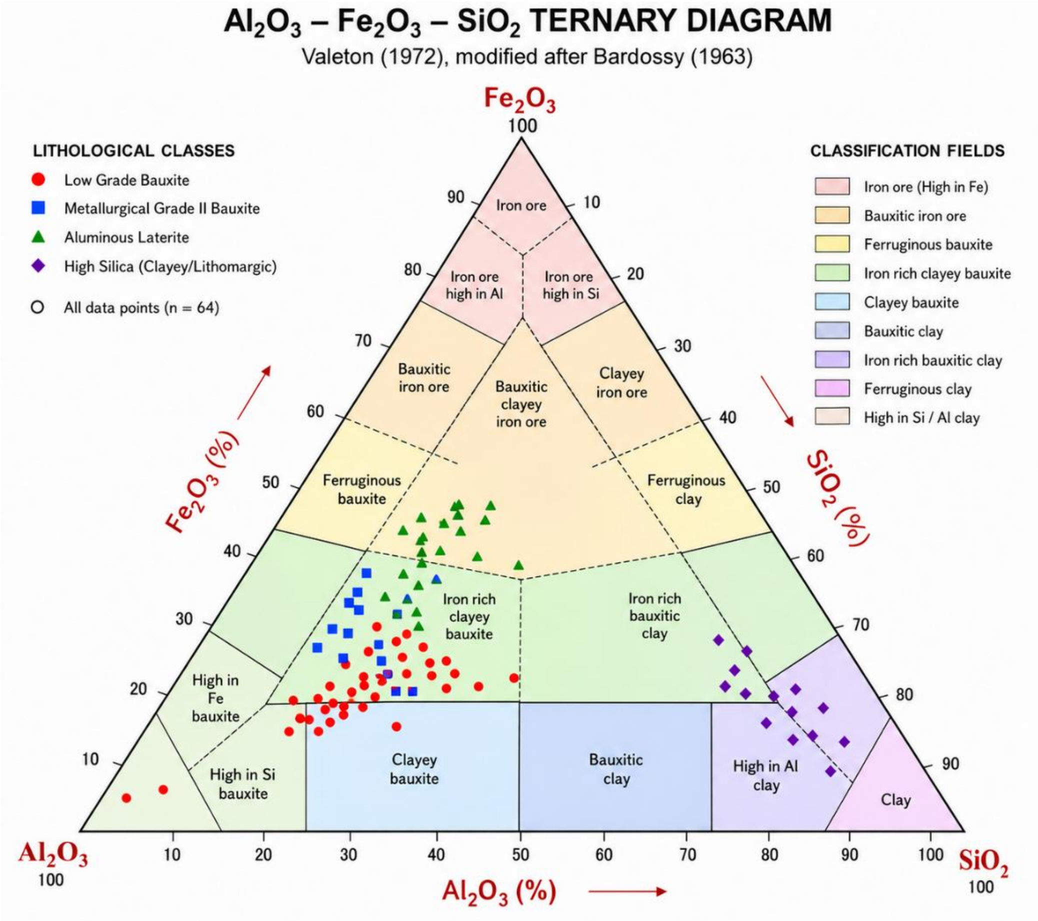
Classification scheme proposed by Valeton, modified from BARDOSSY(1963) is shown below,



TEXT FIGURE- 7

7.9.2 All the sample data of bauxite, low grade bauxite and Aluminous laterite are plotted on Ternary diagram and based on the Al_2O_3–Fe_2O_3–SiO_2 ternary diagram, bauxites along with its transition varieties from Bauxitic clayey iron ore to Iron rich clayey Bauxiteto Clayey bauxite (Fig. 7).

TEXT FIGURE- 8 – Al_2O_3–Fe_2O_3–SiO_2 ternary diagram **of Samples analyzed in Julrai block.**



7.9.3 The Al_2O_3–Fe_2O_3–SiO_2 ternary plot, prepared following the classification scheme of Valeton (1972), modified after Bárdossy (1963), indicates that the analysed samples are distributed mainly within the bauxite, ferruginous bauxite, iron-rich clayey bauxite, bauxitic clay and clay-rich fields. The distribution pattern reflects variable degrees of lateritization, bauxitization, ferruginization and clay alteration within the lateritic profile.

7.9.10 Most of the high Al_2O_3 and low SiO_2 samples plot towards the bauxite to ferruginous bauxite fields, indicating effective leaching of silica and residual enrichment of alumina during lateritic weathering. These samples represent relatively better-developed bauxitic horizons, where alumina enrichment is associated with gibbsite/boehmite-bearing pisolitic to oolitic bauxite.

7.9.11 A significant number of samples show a shift towards the Fe_2O_3 apex and fall within ferruginous bauxite to iron-rich clayey bauxite fields. This indicates higher iron enrichment, mainly due to the concentration of iron oxides/hydroxides such as hematite, goethite and limonite during weathering. Such samples represent ferruginous parts of the lateritic profile and may correspond to laterite, ferruginous bauxite or transitional zones between laterite and bauxite.

7.9.12 Samples plotting towards the SiO_2 side fall within bauxitic clay, clayey bauxite and clay-rich fields, suggesting relatively higher silica content due to incomplete desilication and greater abundance of clay minerals, particularly kaolinite/lithomargic clay. These samples are interpreted to represent lower or transitional parts of the lateritic profile, where bauxitization is comparatively weak and clay alteration is more prominent.

7.9.13 Overall, the ternary distribution supports the field observation that the Julrai Block contains a vertically zoned lateritic–bauxitic profile comprising laterite, pisolitic bauxite, clayey bauxite, bauxitic clay and lithomargic clay. The progressive variation from Al-rich bauxite to Fe-rich laterite and Si-rich clay indicates differential intensity of chemical weathering, leaching, drainage conditions and parent-rock alteration. The plot confirms that the bauxite mineralization is mainly of residual/supergene origin, developed through prolonged lateritization and bauxitization of Deccan Trap basalt and associated volcanic material.

CHAPTER-8

PREVIOUS WORK

8.1.0 DETAILS OF PREVIOUS EXPLORATION CARRIED OUT BY OTHER AGENCIES/PARTIES

8.1.1. The geology and mineral potential of the Kachchh region have been investigated by several workers of the Geological Survey of India (GSI), Oil and Natural Gas Commission (ONGC), and other institutions over the past several decades. These studies encompass geological mapping, stratigraphic classification, palaeontological investigations, geophysical surveys, and exploration of economically important minerals such as lignite, bentonite, glauconite, potash and lateritic bauxite.

8.1.2 The earliest documented investigation of the mineral resources of the region was carried out by Roy (1948), who studied the mineral resources of the Lakhpat–Nakhatrana area of Kachchh district, Gujarat, and documented his findings in an unpublished progress report of the Geological Survey of India. Subsequently, Poddar and Venkatappayya (1953) investigated the occurrence of coal and lignite deposits in Kachchh district, providing one of the first systematic descriptions of the lignite-bearing stratigraphic units of the basin.

8.1.3 A major contribution to the stratigraphic framework of the basin was made by Biswas (1971) of ONGC, who proposed a revised litho-chronostratigraphic classification of the Tertiary rocks of the Kachchh Basin. In his work, the Tertiary sequence was subdivided into eight distinct lithostratigraphic units, a classification that continues to be widely followed in geological studies of the basin.

8.1.4 Occurrences of glauconite in the Mesozoic and Tertiary sedimentary sequences of Kachchh were reported by several researchers including Kulkarni and Agarwal (1963–64), Kulkarni and Desikan (1965–66), Ghevariya (1980–81), Vijaya Sarathi and Sable (1984–85), and Ghevariya and Srikarni (1990–91). These studies highlighted the presence of glauconitic horizons within the sedimentary sequences and emphasized their stratigraphic and economic significance.

8.1.5 Bhattacharya (1978–79) investigated the lignite deposits of the north-western part of Kachchh district, identifying six major deposits namely Panandhro, Metanomadh-Lefri, Umarsar, Ghuneri, Akri and Jhulrai-Waghpadhar.

8.1.6 Subsequently, Ghevariya (1979–82) carried out investigations for bentonite deposits in parts of Toposheet Nos. 41A/10, 41A/11, 41A/13, 41A/14 and 41A/15. The investigation involved regional traverse mapping on 1:50,000 scale followed by detailed mapping on 1:2,000 scale for delineation of bentonite deposits. During the course of the study, reworked bentonite and associated white clay horizons within the Tertiary sedimentary sequence were also identified. In particular, white clay deposits with thickness ranging from 1.5 m to 2 m were reported from the Guneri area, associated with Mesozoic formations.

8.1.7 Vijaya Sarathi (1981–82) carried out geological mapping over approximately 400 sq km on 1:50,000 scale in parts of Toposheet Nos. 41A/9, 41A/10, 41A/13, 41A/14 and 41A/15 with the objective of delineating the Tertiary stratigraphy of the region. Based on palaeontological evidence and lithological characteristics, four lithostratigraphic units were delineated, representing marine depositional environments ranging in age from Paleocene to Oligocene.

8.1.8 Geophysical investigations were subsequently carried out by Baranwal, Chattopadhyay and Ray (1989–90) in the Umarasar–Pranpur area using magnetic, electrical resistivity and seismic refraction techniques to delineate the configuration of basement trap rocks and thickness of the overlying sedimentary formations.

8.1.9 Gandhi (1990–91) carried out regional exploration for lignite in the Umarsar area of Kachchh district covering an area of about 19 sq km. A total of 2618.20 m of drilling was completed in 18 boreholes (GLK-81 to GLK-98) with an inter-borehole spacing of approximately 750 m. The investigation established that lignite seams occur within the Lakhpat and Fulra Dam Formations of Paleocene to Lower Eocene age, which overlie the Deccan Trap or Bhuj Formation.

8.1.10 In a palaeontological investigation, Prasad (1992–93) carried out systematic collection of invertebrate fossils from Middle Jurassic to Lower Cretaceous sediments exposed in the Ghuneri, Maudhan and Lakhapar areas, contributing to the establishment of biostratigraphic zones and regional correlations within the Kachchh mainland.

8.1.11 Jain (1994–95) investigated the potash potential of glauconite-bearing shale and sandstone formations over an area of 100 sq km at 1:25,000 scale in Kachchh district. Based on the occurrence of a glauconite-bearing band with cumulative thickness of about 1.5 m and strike continuity of 3–4 km, approximately 0.02 million tonnes of glauconite reserves containing about 5.33% K_2O were estimated.

8.1.12 Later, Saxena and Fulzele (2002–03) carried out seismotectonic studies along the Kachchh Mainland Fault (KMF) involving geological mapping over about 250 sq km at 1:25,000 scale, trenching and trench face mapping. Their investigations revealed significant neotectonic activity and palaeoseismic features, including soft-sediment deformation structures and east–west trending faults within Holocene fluvial sediments.

8.1.13 Sarkar and Banerjee (2011) suggested an authigenic origin of glauconite within the Naredi Formation, contributing to the understanding of glauconite genesis in the basin. Subsequently, Basheer and Kumar (2014–15) carried out detailed investigation for potash in glauconite-bearing formations around Guneri village, during which two samples of lateritic bauxite analysed yielded 20–22 wt.% Al_2O_3.

8.1.14 More recently, Sahu et al. (F.S. 2016–18) carried out laterite-bauxite investigations in Toposheet No. 41A/13. The lateritic profile was classified into bauxite, clayey bauxite, bauxitic clay and lithomargic clay based on physical characteristics and pisolitic texture. The profile typically consists of laterite at the top, bauxite in the middle and lithomargic clay at the base. The laterite thickness ranges from 1–2 m, while bauxite varies from 0.5 m to 7 m and lithomargic clay from 0.3 m to 5 m. The laterite-bauxite belt exhibits a strike continuity of about 6 km with width ranging from 1 m to 350 m. Based on reconnaissance investigations during F.S. 2016–17, 744,313.18 tonnes of bauxite resources with an average grade of 42.84% Al_2O_3 and 36,549 tonnes of lithomargic clay with an average grade of 36.52% Al_2O_3 were estimated. Additionally, detailed investigation at 1:2000 scale by Z.G. Ghevariya in the Gaduli and Chhuger areas reported the occurrence of bentonite deposits over about 6,800 sq m area with an average thickness of approximately 1 m.

8.1.15 In the Umarsar–Guneri area, Gujarat Mineral Development Corporation Limited (GMDC) operates lignite mines and represents the principal lignite mining activity in the region. Geological Survey of India carried out several phases of geological investigations between 1981–82 and 2014–15, including detailed exploration involving drilling for lignite deposits. Subsequently, GMDC acquired mining leases in the vicinity of Umarsar village and commenced commercial mining operations. In addition, Ashapura Bentonite Clay Mines are operating in the Dhrang area, exploiting bentonite deposits associated with the Tertiary sedimentary formations. Apart from that laterite mines of Ultratech Limited situated about 8 km SW of the study area.

Table 8.1: Chronological Summary of Previous Investigations

Year / Period	Investigator / Organization	Nature of Work	Key Outcome
1948	Roy, B.C. (GSI)	Mineral resource study	Initial assessment of mineral resources in Lakhpat–Nakhatrana area
1953	Poddar & Venkatappayya (GSI)	Coal and lignite investigation	Documentation of lignite occurrences
1971	Biswas (ONGC)	Stratigraphic classification	Eight lithostratigraphic units of Tertiary rocks defined
1963–1991	Various workers	Glauconite studies	Identification of glauconite horizons in Mesozoic–Tertiary rocks
1978–79	Bhattacharya (GSI)	Lignite investigation	Identification of six lignite deposits
1979–82	Ghevariya (GSI)	Bentonite exploration	Mapping and delineation of bentonite and white clay deposits
1981–82	Vijaya Sarathi (GSI)	Geological mapping	Delineation of Tertiary lithostratigraphic units
1989–90	Baranwal et al.	Geophysical survey	Basement configuration and sediment thickness studied
1990–91	Gandhi (GSI)	Lignite exploration drilling	2618 m drilling in Umarsar area
1992–93	Prasad (GSI)	Palaeontological study	Biostratigraphic zonation of Jurassic–Cretaceous rocks
1994–95	Jain (GSI)	Potash investigation	Estimation of glauconite reserves
2002–03	Saxena & Fulzele (GSI)	Seismotectonic study	Neotectonic features along KMF identified
2011	Sarkar & Banerjee	Glauconite genesis	Authigenic origin of glauconite proposed
2014–15	Basheer & Kumar (GSI)	Potash investigation	Identification of glauconite and lateritic bauxite samples
2016–18	Sahu et al. (GSI)	Laterite–bauxite exploration	Bauxite resource estimation

Table 8.2: Mineral Exploration Summary in the Region

Mineral / Commodity	Area	Organization	Status
Lignite	Umarsar–Guneri	GSI / GMDC	Active mining
Bentonite	Guneri–southern block	GSI / Ashapura Mines	Active mining
Glauconite / Potash	Guneri region	GSI	Investigated
Laterite–Bauxite	TS 41A/13	GSI	Resource estimated

CHAPTER-9

DETAILS OF AERIAL, GROUND GEOPHYSICAL AND GEOCHEMICAL SURVEY

9.1.0 DETAILS OF AERIAL, GROUND GEOPHYSICAL AND GEOCHEMICAL SURVEY TAKEN UP AND THEIR RESULTS.

9.1.1. During the current exploration program, no Aerial/Geophysical surveys were not carried out.

CHAPTER-10

EXPLORATION UNDERTAKEN DURING CURRENT INVESTIGATION

10.1.0 INTRODUCTION

10.1.1 The importance of bauxite is well known in the production of Aluminium metal and also in other industries viz. abrasives, refractory, chemical and cement. The properties like lightness of metal aluminium, its high resistance to atmospheric corrosion and good electrical conductivity makes it a popular metal and is being used for making household utensils and therefore known as 'poor man's gold'. The aluminium metal being a good substitute for nonferrous metals like copper, zinc which are scarce and costly metals has further necessitated the development of aluminium industry throughout the world.

10.1.2 Resources of bauxite in the country as on 01.04.2020 as per Indian Mineral Year book 2022 are placed at 4,958 million tonnes. These resources include 646 million tonnes reserves and remaining 4,311 million tonnes remaining resources. By grades, about 79% resources are of Metallurgical grade (I, II & Mixed). The resources of Refractory and Chemical grades are limited and together account for about 4 %. States, Odisha alone accounts for 41% of country's resources of bauxite followed by Chhattisgarh 20%, Andhra Pradesh (12%), Gujarat (8%), Jharkhand (6%), Maharashtra (5%) and Madhya Pradesh (4%). Major bauxite resources are concentrated in the East Coast bauxite deposits in Odisha and Andhra Pradesh

10.1.3 The production of bauxite is 22,494 thousand tonnes in 2021-22 increased by 10% as compared to previous year (IBM Year BooK). There are 126 reporting mines in 2021-22 as against to 134 in the previous year. Ten principal producers having 41 mines contributed 91.40% of total production. NALCO is the leading producer and contributed 33% of the total production.

10.1.4 In view of the enactment of the MMDR Amendment Act-2015 and Mineral Auction Rule- 2015 by the Govt. of India, Commissioner of Geology and Mining (CGM), Gujarat had discussed with MECL to take up exploration work for Bauxite blocks in Kachchh district of Jharkhand for upgradation of these areas as per the MMDR Amendment Act and Mineral Auction Rule, 2015 which shall enable the state government for auctioning of the Bauxite blocks.

10.1.5 Based on the mineral potentiality of the prospect and previous work carried out by GSI and CGM Gujarat in the area, MECL formulated G-3 stage Exploration proposal and presented in the 5th meeting of TCC-II, NMET held on 27th – 29th January 2025. The Technical Cost committee has technically evaluated and recommended the exploration proposal for approval Executive Committee (EC) of NMEDT.

10.1.6 Consequently, the project was approved by 40th EC, NMET held on 21st February 2025 and the same was intimated to MECL vide MoM letter No. F.NO.23/582/2025-NMET/950 dated 5th March, 2025. Project was approved with the title "Preliminary Exploration (G-3) for Bauxite and associated minerals in Julrai Block, District Kachchh, Gujarat", with estimated cost of Rs 2.47 Cr including GST in time schedule of 14 months for carrying out the proposed work (Annexure- IX) and submission of report.

10.1.7 The present exploration drilling work in Julrai block commenced with geological mapping and exploratory drilling in Borehole No. MBJ-01 on 08.11.2025 and completed with the closure of Borehole No. MBJ-08 on 12.12.2025. As per approved quantum of work, a total 96.25 m drilling was completed in 07 nos. of boreholes. The allied field-works including Borehole survey, topographical survey, sampling and analytical work were completed simultaneously. The laboratory studies including chemical analysis and physical analysis i.e. petrographic and bulk density studies were carried out simultaneously in laboratories of MECL and other Govt. / NABL accredited laboratories.

10.1.8 The progress of the block, along with the analytical results of the seven boreholes core samples generated during the course of exploration, was reviewed in the 25th TCC-II meeting held on 17th and 18th March 2026. After due consideration of the analytical results and the overall exploration status, the Technical-cum-Cost Committee (TCC) observed that the extension of the bauxitic zones within the block is very limited with low grade bauxite, accordingly, recommended to closure of the exploration programme and submission of the Geological Report. Hence further drilling not taken up. TCC-II committee revised the project cost of Rs. 0.77 Cr., considering the reduced scope of drilling along with the corresponding decrease in sampling and chemical analysis (Annexure- X).

10.1.9 The details of the nature and quantum of work proposed Vs actual achievement is given in **Table-10.1.**

Table – 10.1
Approved Revised Quantum of Work vs. Achievement by MECL in Julrai block, District: Kachchh, State: Gujarat

S. No	Item details	Unit	Proposed Quantum	Achieved Quantum	Remarks
1	Geological Mapping (1:4000 scale)	Sq. Km.	8.12	8.12	
2	Topographic Survey (Contour interval 2m) at 1:4000 scale	Sq. Km.	8.12	8.12	
3	Pitting	cu. m	150	50	
4	Trenching	cu. m	50	0	
5	Bore Hole Fixation and determination of co-ordinates & Reduced Level (RL) of the boreholes and demarcation of lease hold boundary points by DGPS	Nos.	30+5=19	12	
6	Core drilling (400m x 400m grid).	m	900	96.25	7 Nos BH in phase I drilling
7	**Sampling & Chemical Analysis**				
A)	Primary samples to be analyzed for 7 radicals viz. Al_2O_3, SiO_2, Fe_2O_3, TiO_2, V, Ga, Sc & LOI				
i.	Bedrock samples	Nos.	50	50	
	Bedrock samples for Limestone	No.	3	3	
ii.	Trench/ Pit samples	Nos.	20	19	
iii.	Borehole Core samples	Nos.	247	89	
iv.	For Each additional Trace Element viz.V, Ga, Sc. (from BH Core Sample)	Nos.	178	89	
v.	Check samples (10% external)	Nos.	25	15	
8	**Physical Studies**				

a)	ICP-AES/ICPMS (sequential technique) for 34 elements i.e. 16 other elements viz. Li, Ga, In, Be, Ge, Mo, Ni, Cr, Ta, W, Ba, Co, Rb, Sr, Zr, Nb ;16 REE viz. La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Sc, Y; 02 Actinides viz. U, Th.	Nos.	20	20	
b)	X-RD studies for mineral identification	Nos.	5	5	
9	Petrographic Studies	Nos.	6	6	
10	Mineragraphic Studies	Nos.	4	4	
11	Preparation of Polished Section & Thin Section (05+05)	Nos.	10	10	
12	Bulk density	Nos.	5	3	
13	Combined determination of Trihydrate Alumina (THA-140°C), Monohydrate Alumina (MHA-240°C) & Reactive Silica	Nos.	8	5	
14	Proposal preparation	Nos.	1	1	
15	Geological Report Preparation {As per Mineral (Evidence of mineral contents) Rule-2015}	Nos.	1	1	

10.2.0 OBJECTIVES OF INVESTIGATION

10.2.1. The present exploration at G-3 stage has been formulated to fulfill the following objectives:

i) Preparation of detailed Geological map at 1:4000 scale to demarcate various lithounits like Bauxite, laterite, basalt (deccan volcanics), limestone etc. with their structural manifestation.

ii) Collection of 50 bedrock/chip samples from bauxite/ aluminous Laterite bearing zones.

iii) Pitting for delineating the bauxite/ aluminous Laterite zones prior to borehole drilling in 400mX400m interval.

iv) Topographical survey at 1:4000 scale will be carried out.

v) To prove the occurrences of Bauxite zone(s) and to delineate the depth continuity of it by planning systematic boreholes according to the MEMC norm i.e. 400mx400m interval.

vi) Two boreholes will be drilled up to the basement i.e. basalt (Deccan volcanics).

vii) To assess the quality and the thickness of Bauxite horizons in order to delineate the Bauxite resources at G-3 (333) level in the block as per UNFC norms.

viii) Along with Bauxite, resources of Titanium, Gallium, Vanadium and Associated Minerals will also be reported if encouraging values are encountered.

ix) To carry out exploration as per Minerals (Evidence of Mineral Contents) Rules, 2015, Mineral Auction Rule–2015 and MMDR Act–2015 as to facilitate the Government of Gujarat for auctioning of the Bauxite Block.

10.3.0 DETAILS OF PITTING, TRENCHING, DRILLING, ETC.

10.3.1 The approved scheme of Preliminary Exploration (G-3) work in Julrai Block includes geological mapping, Survey, drilling, core logging, Pitting, core sampling and associated laboratory studies

10.3.2 **Geological Mapping:** Geological mapping has been carried out in the block for the entire area of 8.12 sq. km on 1:4000 scale depicting the lithology, structure and mineralization signatures such as mineralized zones. Identification and demarcation of mineralized zones, thus helped in marking the geochemical sampling locales for channel sampling. Lithological units and litho-contacts have been mapped with the help of handheld GPS. Attitude and structural features of rocks like bedding, and joints has been recorded by Brunton Compass. The readings recorded in the field were plotted and produced in the form of geological map given as Plate IVA.

10.3.4 **Surface bed rock sampling:** During geological traverses, exposures with aluminous mineralisation/ aluminous laterites bands were identified. The sampling was carried out by chipping across the mineralized body of fresh surface exposures of 1m radius. The area was cleaned to remove the dusts before collection of samples.

During, geological traverses, MECL has carried out surface sampling and collected a total of 50 Primary bedrock samples. Location of the bedrock along with the Maximum values of SiO_2 and Al_2O_3 in each bedrock sample has been displayed on geological map is represented in Plate-IVC. All 19 Pit channel samples collected from 17 pits were analyzed for Al_2O_3, SiO_2, Fe_2O_3, TiO_2 and LOI (Annexure-IIIB). Out of

19 channel samples Al2O3 varies from > 30% to 56.41% and silica values ranging between 2.43%-23.59. % .

10.3.3 **Pitting:** During the course of detailed geological mapping, a total of 50 bedrock samples were collected from the exposed litho-units for geochemical analysis. Based on the analytical results and field observations, pitting was undertaken to further examine the occurrence and continuity of laterite–bauxite horizons within the block. Against the proposed 100 cu. m of pitting, a total of 50.00 cu. m of 20 nos. pitting was carried out, as the exposure of laterite and bauxite within the block was found to be limited, making it difficult to precisely identify potential bauxitic zones Photograph – 10.1 o 10.11 and Fig. 10.12 to 10.24.

The pits were excavated at approximately 400 m horizontal intervals upto a depth of maximum 2m, guided by the analytical results of bedrock samples and the prevailing lithological conditions. A total of 17 pits were excavated and sampled during the investigation. Most of the pits were located within laterite and basalt units with the objective of exposing the laterite–bauxite interface as well as the basal portion of the bauxite horizon, in order to understand the vertical extent and continuity of the mineralized zone. The location of pits showing on geological map presented in Plate-IVC.

In addition, a few pits were excavated in soil-covered areas to assess the possible subsurface occurrence of bauxite horizons where surface exposures were absent. The pitting programme facilitated evaluation of the presence, thickness, and vertical disposition of the lateritic–bauxitic profile within the mapped area.

Representative channel samples were collected systematically from the exposed lateritic horizons in the pits for chemical analysis. Where colour has been changed separates samples has been collected. The details of pit-wise lithology and analytical results are furnished in Annexure–IIIB.

JULRAI PITS	
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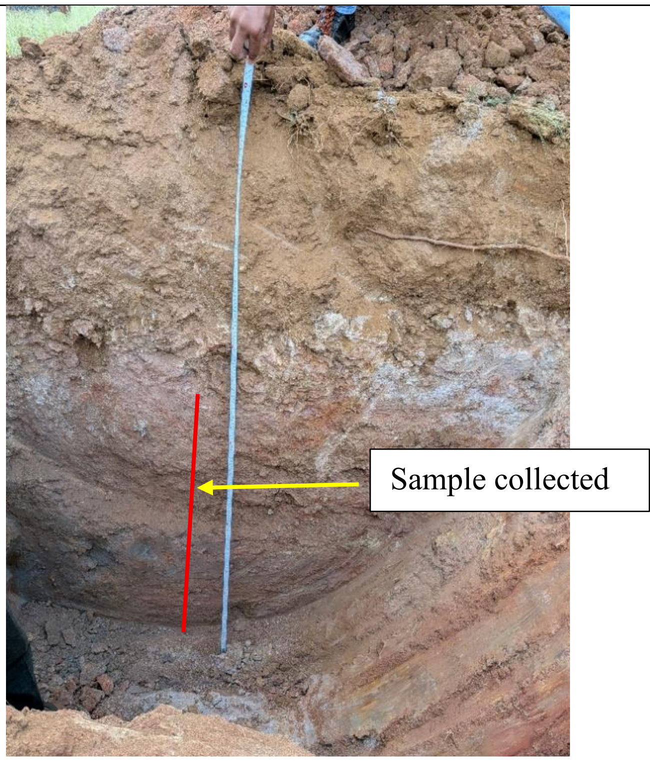
	
Demarcating the Dimension of Pit	Excavated Pit
	
Excavated Pit	Lithology of Pit

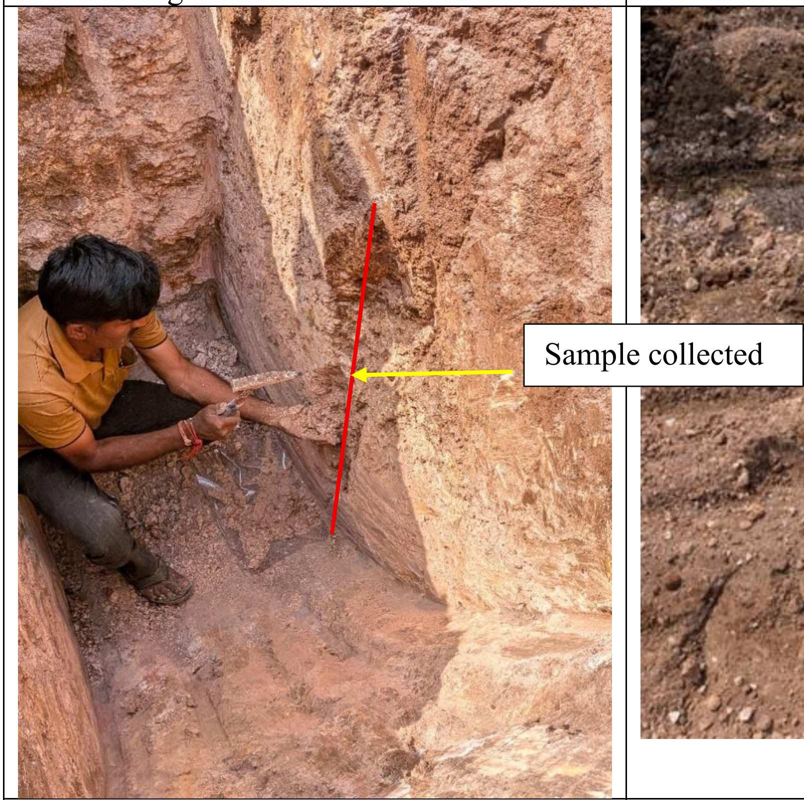
 Closing of Pit	

PIT NO.3

PIT NO.02

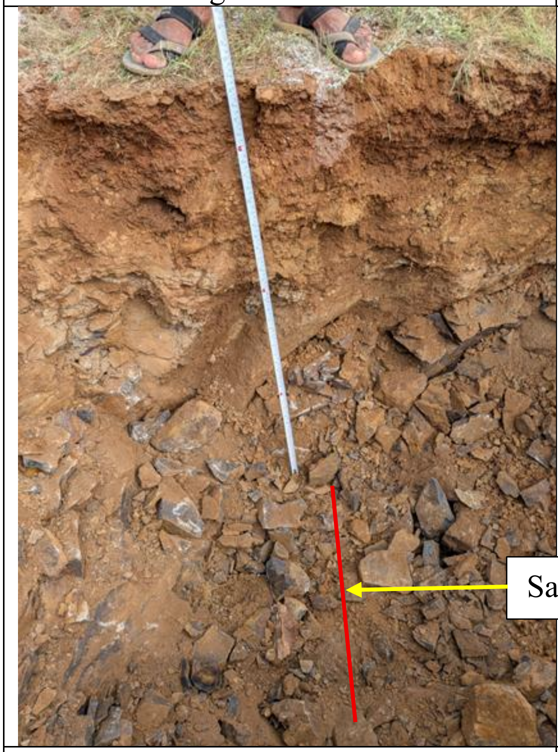
Demarcating the Dimension of Pit

Excavated Pit



Lithology of Pit

Closing of Pit

	
Demarcating the Dimension of Pit	Excavated Pit
	
Lithology of Pit	Closing of Pit

PIT NO.5

	
Demarcating the Dimension of Pit	Excavated Pit
	
Lithology of Pit	Closing of Pit

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</td><td></td></tr>
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<tr><td>Lithology of Pit</td><td>Closing of Pit</td></tr>
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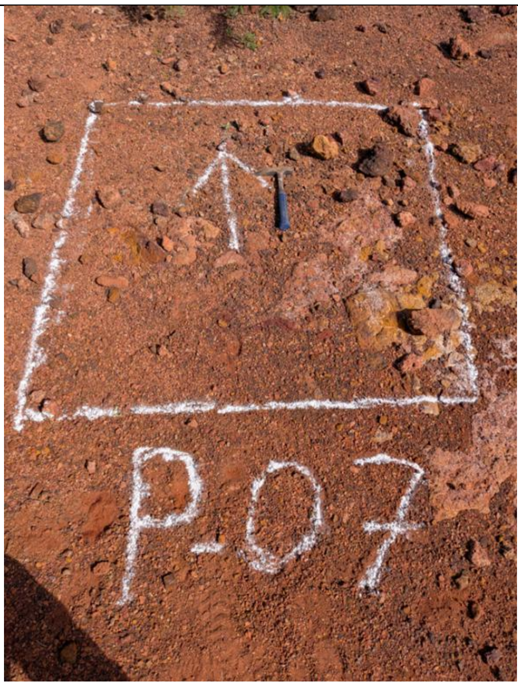
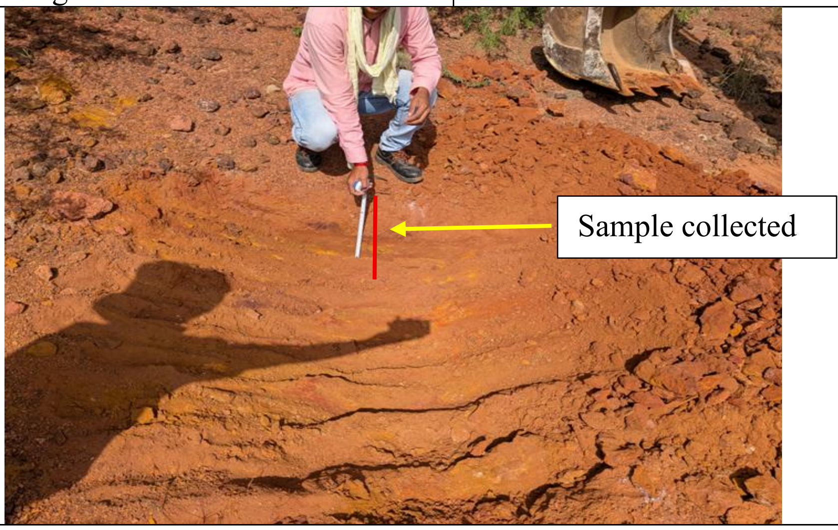
PIT NO.7



Demarcating the Dimension of Pit

Excavated Pit



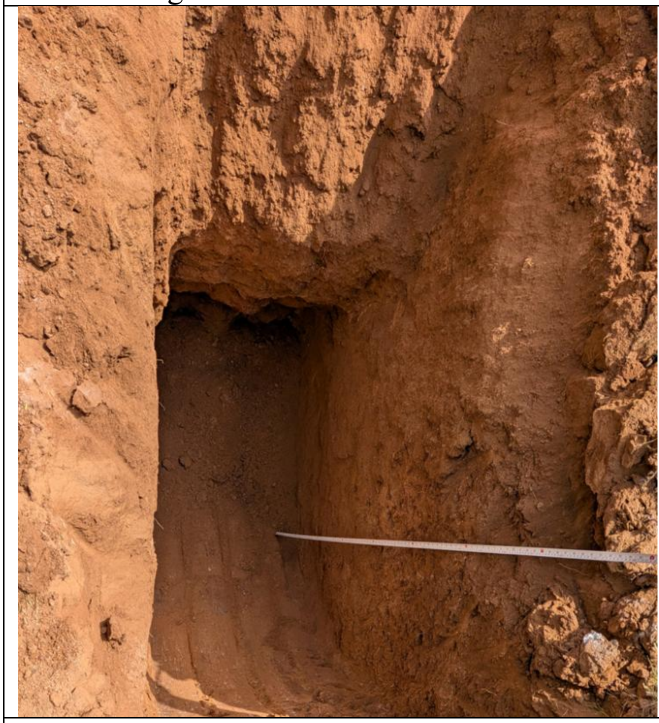
Closing of Pit

Closing of Pit

PIT -08

	
Demarcating the Dimension of Pit	Excavated Pit
	
Lithology of Pit	Closing of Pit

PIT NO.9

	
Demarcating the Dimension of Pit	Excavated Pit
	
Lithology of Pit	Closing of Pit

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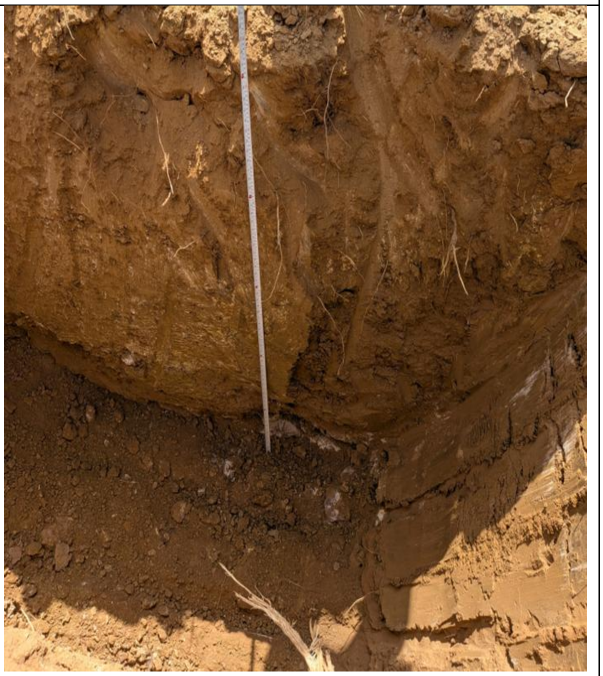
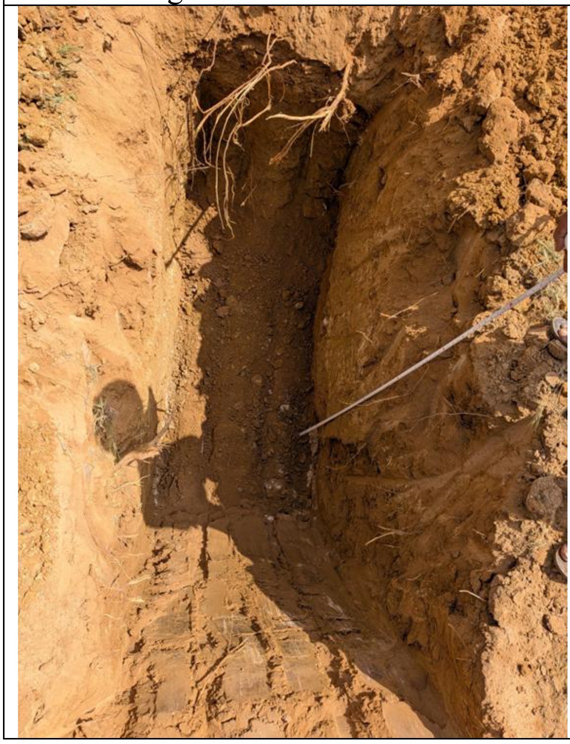
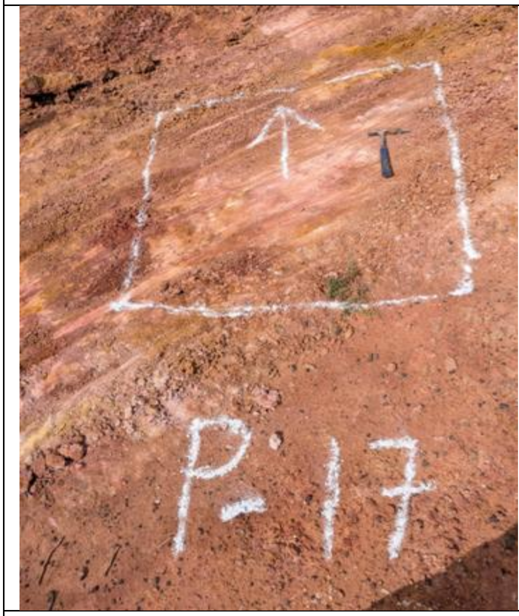
	
Demarcating the Dimension of Pit	Excavated Pit
	

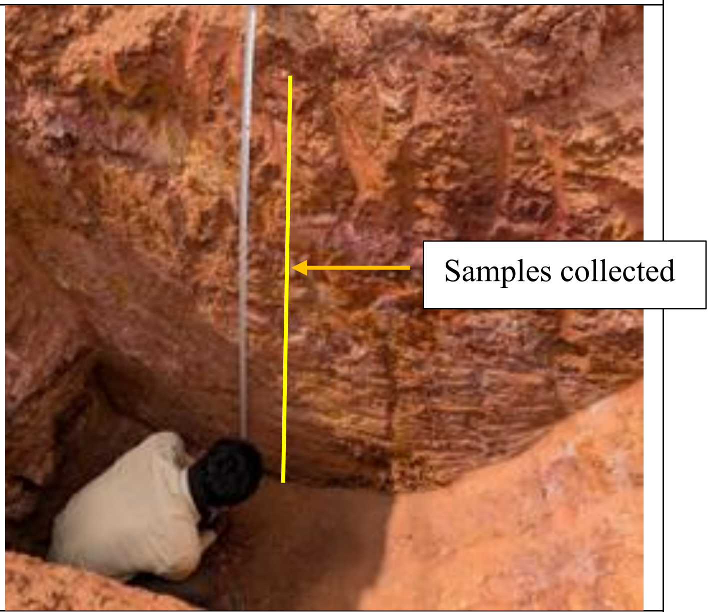
Lithology of Pit

PIT NO.14	
	
Demarcating the Dimension of Pit	Excavated Pit
	
Closing of Pit	

PIT NO.17



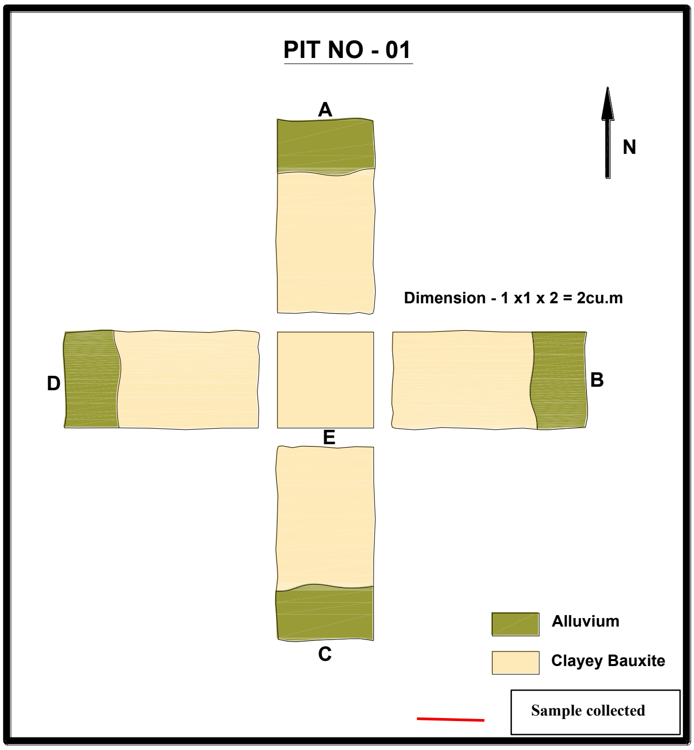
Demarcating the Dimension of Pit



Excavated Pit

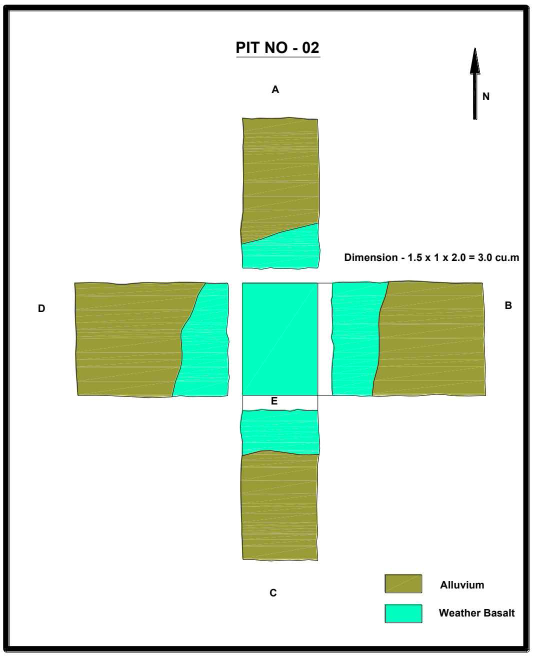
Closing of Pit

PITTING RECORDS

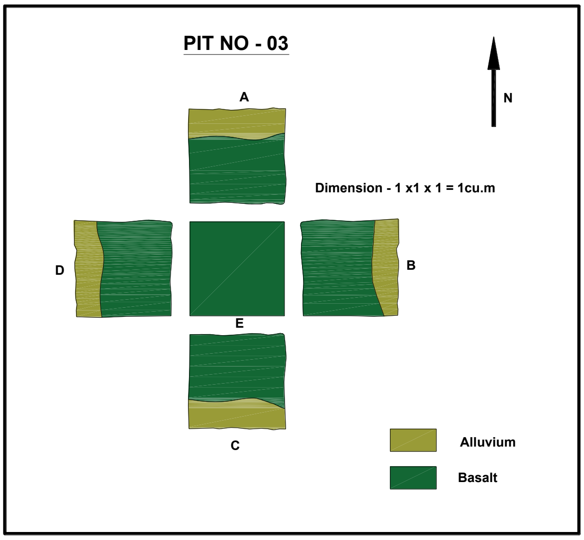
Name of the Investigation Julrai Block	Date of Commencement: 07.10.2025	
Pit No. - 01	Date Of Completion: 07.10.2025	
Location (Coordinates): Easting: 476697.00 Northing: 2598475.00		
Pit Measurements(mtrs):	1.0*1.0*2.0= 2. 00 cum	
Top Measurement	Bottom Measurement	
a. Length – 1.0m b. Width – 1.0m	a. Length – 1.0m b. Width – 1.0m c. Depth - 2.0m	
Recorded By: Utkarsh Singh & Hiresh Srirame		
Lithology Details: Soil: 0 – 0.53m, Clayey Bauxite: 0.53 – 2.0m		
Structural Details: Nil		
Log of Pit: A,BC,D are side section ,E is bottom		
Samples: Two Samples were collected MBJ/PT/01A & MBJ/PT/01B		

PITTING RECORDS

Name of the Investigation Julrai Block	Date of Commencement: 07.10.2025
Pit No. - 02	Date Of Completion: 07.10.2025
Location (Coordinates): Easting: 477063.00 Northing: 2598869.00	
Pit Measurements(mtrs):	1.5*1.0*2.0=3.0 cum
Top Measurement	Bottom Measurement
a. Length – 1.5m b. Width – 1.0m	c. Length – 1.5m d. Width – 1.0m e. Depth -2.0m
Recorded By: Hiresh Shrirame	
Lithology Details: Soil: 0 – 0.80m, Weather basalt + Soil (intermixed): 0.80 – 1.40m, Altered Basalt: 1.40 – 2.0m	
Structural Details:	
Log of Pit:	
Samples: One Samples were collected	

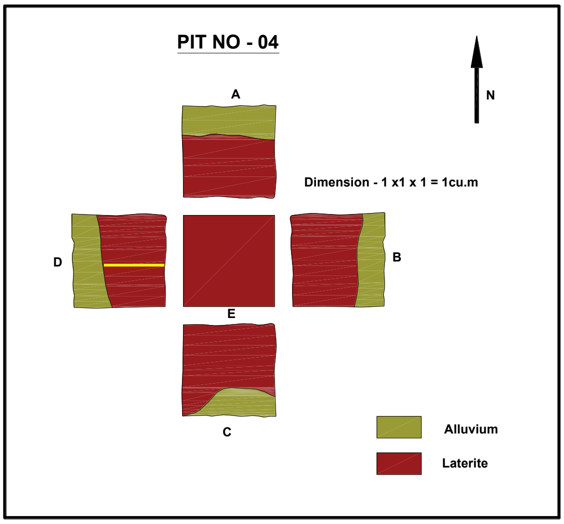


Name of the Investigation Julrai Block	Date of Commencement: 07.10.2025
Pit No. - 03	Date Of Completion: 07.10.2025
Location (Coordinates): Easting: 477776.00 Northing: 2599263.00	
Pit Measurements(mtrs):	1.0m*1.0m*1.0m=1.0cum
Top Measurement	Bottom Measurement
a. Length – 1.0m b. Width – 1.0m	c. Length – 1.1m d. Width – 1.0m e. Depth -1.0m
Recorded By: Hiresh Shrirame	
Lithology Details: Soil: 0 – 0.30m, Basalt: 0.30 – 0.80 m	
Structural Details:	
Log of Pit:	
Samples: No Samples were Collected as lateritic profile not encountered	

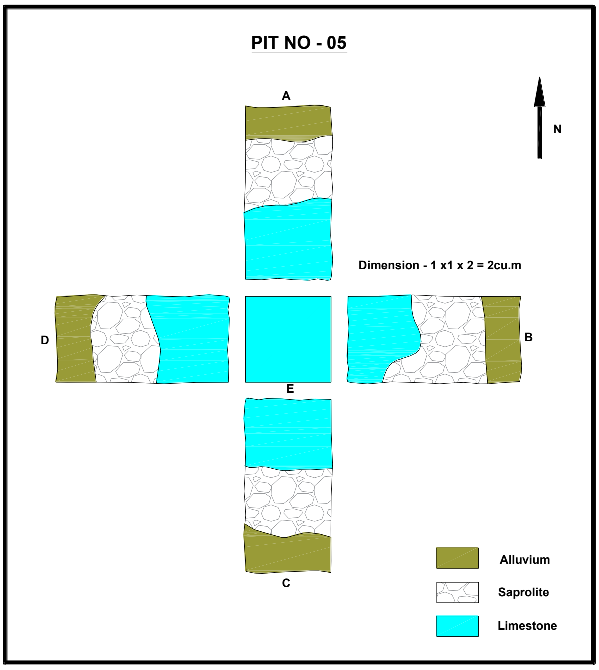


PITTING RECORDS

Name of the Investigation Julrai Block	Date of Commencement: 07.10.2025
Pit No. - 04	Date Of Completion: 07.10.2025
Location (Coordinates): Easting: 478346.00 Northing: 2598703.00	
Pit Measurements(mtrs):	1.0*1.0*1.0=1.0 cum
Top Measurement	Bottom Measurement
a. Length – 1.0m b. Width – 1.0m	c. Length – 1.0m d. Width – 1.0m e. Depth -1.0m
Recorded By: Utkarsh Singh	
Lithology Details: Soil: 0 – 0.30m, Laterite: 0.30 – 1.0m	
Structural Details:	
Log of Pit:	
Samples: One Sample Collected	

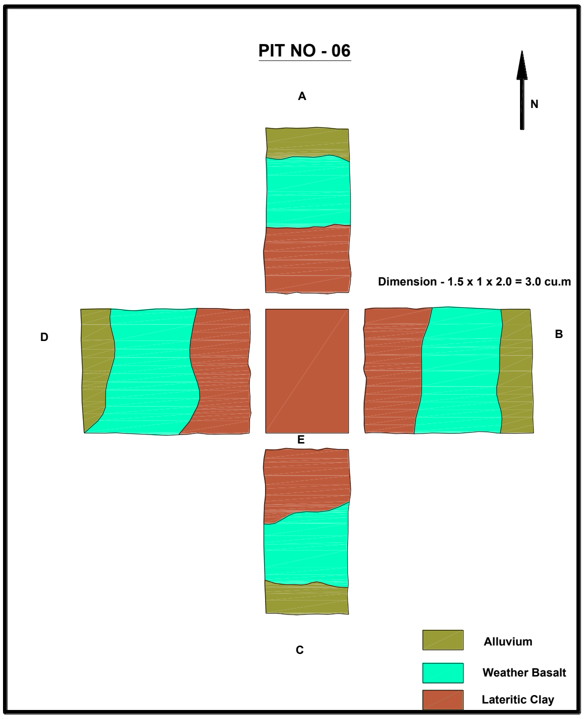


PITTING RECORDS	
Name of the Investigation Julrai Block	Date of Commencement: 07.10.2025
Pit No. - 05	Date Of Completion: 07.10.2025
Location (Coordinates): Easting: 477960.00 Northing: 2598142.00	
Pit Measurements(mtrs):	1.0*1.0*2.0= 2.0 cum
Top Measurement	Bottom Measurement
a. Length – 1.0m b. Width – 1.0m	c. Length – 1.0m d. Width – 1.0m e. Depth – 2.0m
Recorded By: Utkarsh Singh	
Lithology Details: Soil: 0 – 0. 40m, Weathered limestone: 0.40 – 1.18m Limestone: 1.18 – 2.0m	
Structural Details:	
Log of Pit:	
Samples: No samples were Collected as lateritic profile not encountered.	

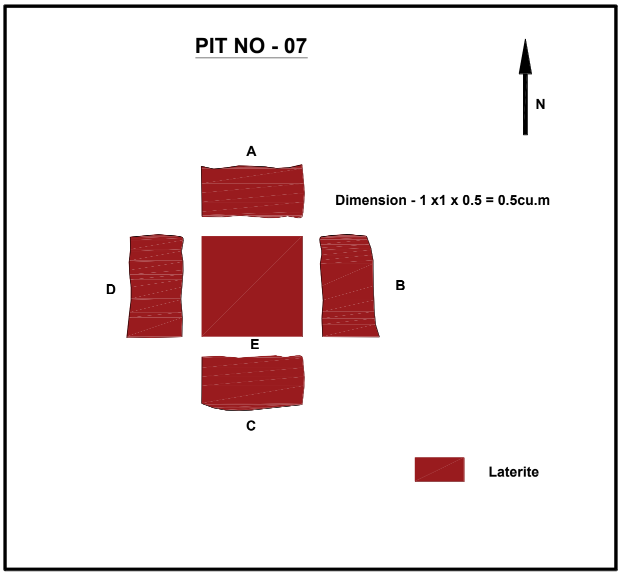


PITTING RECORDS

Name of the Investigation Julrai Block	Date of Commencement: 07.10.2025
Pit No. - 06	Date Of Completion: 07.10.2025
Location (Coordinates): Easting: 477933.00 Northing: 2600055.00	
Pit Measurements(mtrs):	1.5*1.0*1.9=2. 28 cum
Top Measurement	Bottom Measurement
a. Length – 1.5m b. Width – 1.0m	c. Length – 1.5m d. Width – 1.0m e. Depth -1.90m
Recorded By: Hiresh Shrirame	
Lithology Details: Soil: 0 – 0.26m, Lateritic soil: 0.26 – 1.20m, Lateritic Clay: 1.20 – 1.90m	
Structural Details:	
Log of Pit:	
Samples: One Sample was collected	

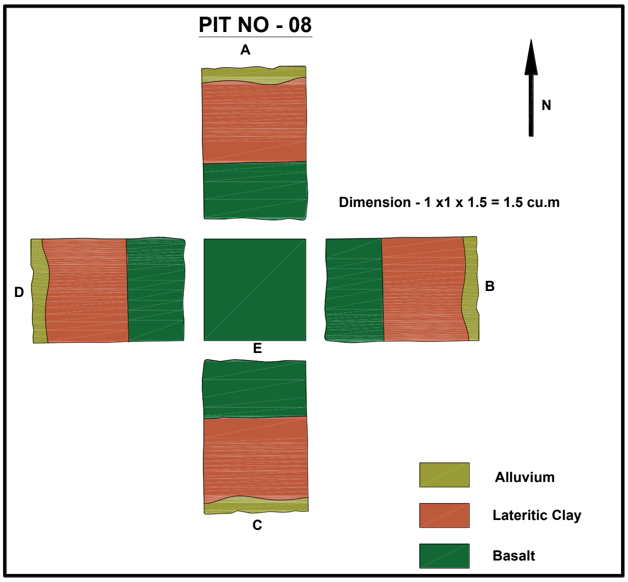


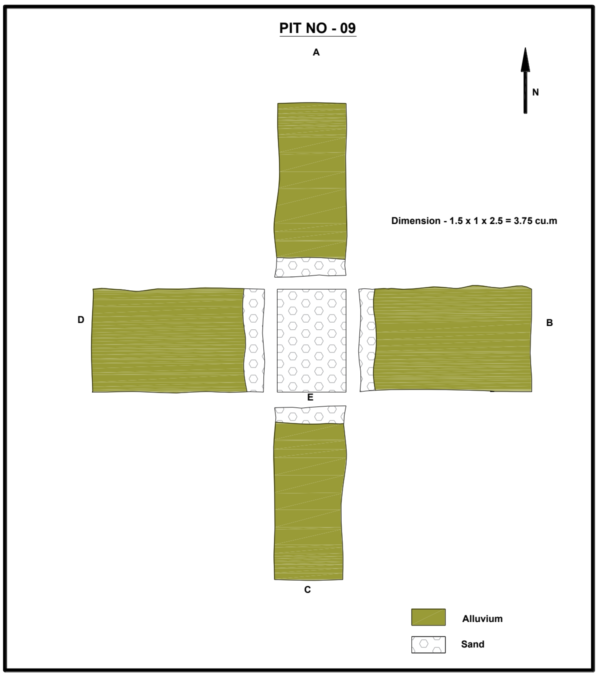
PITTING RECORDS	
Name of the Investigation Julrai Block	Date of Commencement: 08.10.2025
Pit No. - 07	Date Of Completion: 08.10.2025
Location (Coordinates): Easting: 479396.00 Northing: 2600558.00	
Pit Measurements(mtrs):	1.0*1.0*0.50=0.50m.cu
Top Measurement	Bottom Measurement
a. Length – 1.0m b. Width – 1.0m	c. Length – 1.0m d. Width – 1.0m e. Depth -0.50m
Recorded By: Hiresh Shrirame	
Lithology Details: Laterite: 0 – 0.50m Unable to dig further	
Structural Details:	
Log of Pit:	
Samples: One Sample was collected.	



PITTING RECORDS

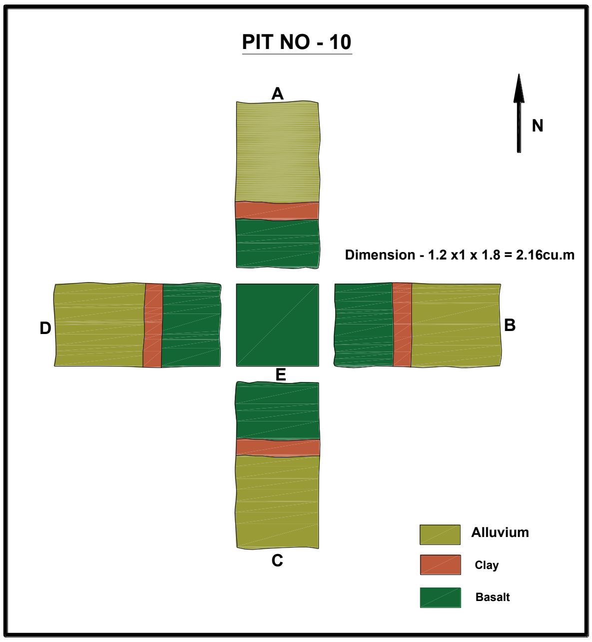
Name of the Investigation Julrai Block	Date of Commencement: 08.10.2025
Pit No. - 08	Date Of Completion: 08.10.2025
Location (Coordinates): Easting: 479939.00 Northing: 2600476.00	
Pit Measurements(mtrs):	1.0*1.0*1.50=1.8 m.cu
Top Measurement	Bottom Measurement
a. Length – 1.0m b. Width – 1.0m	c. Length – 1.0m d. Width – 1.0m e. Depth -1.50m
Recorded By: Utkarsh Singh	
Lithology Details: Soil: 0 – 0.16m, Lateritic Clay: 0.16 – 0.95m, Basalt (hard compact): 0.84 – 1.50m unable to dig further	
Structural Details:	
Log of Pit:	
Samples: No sample were Collected as clay with high silica	



PITTING RECORDS		
Name of the Investigation Julrai Block	Date of Commencement: 08.10.2025	
Pit No. - 09	Date Of Completion: 08.10.2025	
Location (Coordinates): Easting: 479987.00 Northing: 2600119		
Pit Measurements(mtrs):	1.5*1.0*2.50=3.75 cum	
Top Measurement	Bottom Measurement	
a. Length – 1.5m b. Width – 1.0m	c. Length – 1.5m d. Width – 1.0m e. Depth - 2.50m	
Recorded By: Hiresh Shrirame		
Lithology Details: Soil : 0 – 2.25m (Soil + Sand intermixed)		
Structural Details:		
Log of Pit:		
Samples: No Sample was collected		

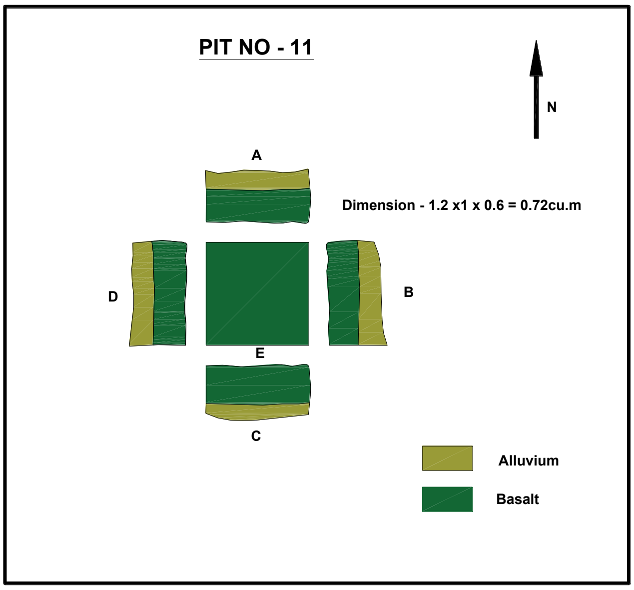
PITTING RECORDS

Name of the Investigation Julrai Block	Date of Commencement: 08.10.2025
Pit No. - 10	Date Of Completion: 08.10.2025
Location (Coordinates): Easting: 478749.00 Northing: 2599382.00	
Pit Measurements(mtrs):	1.2*1.0*1.8=2.16m.cu
Top Measurement	Bottom Measurement
a. Length – 1.2m b. Width – 1.0m	c. Length – 1.2m d. Width – 1.0m e. Depth -1.80m
Recorded By: Hiresh Shrirame	
Lithology Details: Soil: 0 – 1.10m, Clay: 1.10 – 1.30m, Basalt: 1.30 – 1.80m	
Structural Details:	
Log of Pit:	
Samples: NoSample was collected	



PITTING RECORDS

Name of the Investigation Julrai Block	Date of Commencement: 08.10.2025
Pit No. - 11	Date Of Completion: 08.10.2025
Location (Coordinates): Easting: 479500.00 Northing: 2599372.00	
Pit Measurements(mtrs):	1.2*1.0*0.6=0.72m.cu
Top Measurement	Bottom Measurement
a. Length – 1.2m b. Width – 1.0m	c. Length – 1.2m d. Width – 1.0m e. Depth -0.6m
Recorded By: Utkarsh Singh	
Lithology Details: Soil: 0 – 0.20m, Basalt: 0.20 – 0.60m Unable to dig further	
Structural Details:	
Log of Pit:	
Samples: No sample was Collected as lateritic profile not encountered.	



PITTING RECORDS

Name of the Investigation Julrai Block	Date of Commencement: 11.10.2025
Pit No. - 12	Date Of Completion: 11.10.2025
Location (Coordinates): Easting: 476944.00 Northing: 2598641.00	
Pit Measurements(mtrs):	1.2*1.0*2.30=2.76m.cu
Top Measurement	Bottom Measurement
a. Length – 1.2m b. Width – 1.0m	c. Length – 1.2m d. Width – 1.0m e. Depth -2.30m
Recorded By: Utkarsh Singh	
Lithology Details: Soil: 0 – 0.80m, weathered laterite with residual Basalt : 0.80-1.80m, Weather Basalt: 1.80-2.30 m	
Structural Details:	
Log of Pit:	
Samples: No samples were collected.	

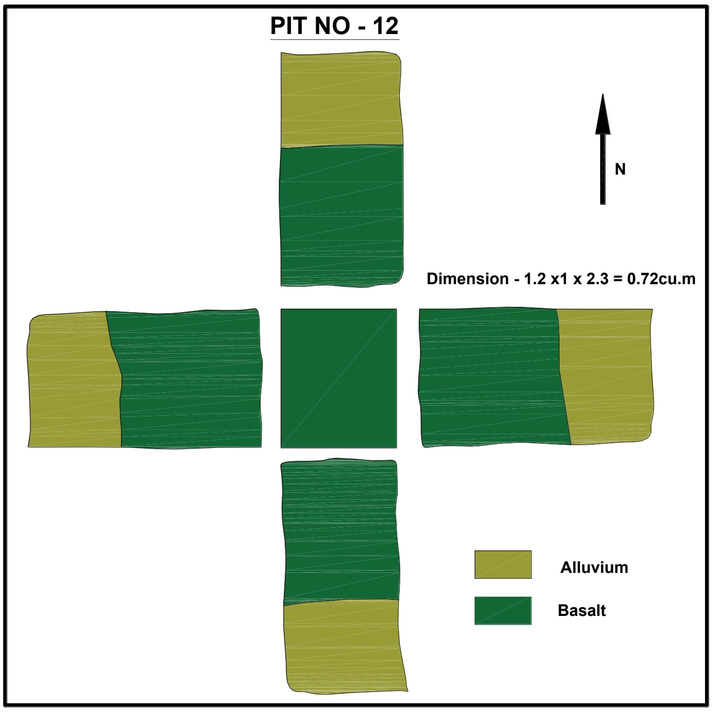


Table-10.2
Details of Boreholes drilled by MECL in Julrai block, District: Kachchh, State: Gujarat

Sl. No.	BH.No.	Northing (m)	Easting (m)	RL (m)	Date of Commencement	Date of Closure	Total Depth (m)
1	MBJ-01	2598393.01	476608.01	85.05	08-11-2025	13-11-2025	18.70
2	MBJ-02	2598189.31	477552.45	111.38	14-11-2025	19-11-2025	19.50
3	MBJ-04	2598603.04	478331.72	101.33	25-11-2025	28-11-2025	14.50
4	MBJ-05	2598888.76	478821.22	97.99	01-12-2025	02-12-2025	7.25
5	MBJ-06	2598868.55	477938.65	107.83	21-11-2025	24-11-2025	11.80
6	MBJ-07	2600132.60	479180.99	106.11	06.12.2025	08.12.2025	11.50
7	MBJ-08	2600461.10	479550.25	95.473	10.12.2025	12.12.2025	13.00
						Total:	**96.25**

10.3.5 Geological logging of borehole cores were properly done along with all the structural, lithological and mineralogical observations.(Annexure IIB and IIC). The associated laboratory studies i.e., chemical and physical have been completed simultaneously. In almost all the boreholes, has encountered Bauxite, Aluminous laterites, Lithomergic Clay and Bentonite clay. As far as Al_2O_3 values are concerned, results are encouraging for BH samples and getting anamoulus values for Al_2O_3, TiO_2, V, Sc and Ga. Bauxite zones are limited in nature ranges from encountered in all boreholes MBJ-01 to 08. While in all borehole bauxitic and aluminous laterite zones of 1-16m thickness for Gallium, Scandium and TiO_2 has been found. The TiO_2, V, Sc and Ga cut-off is considered as 2%, 500 ppm, 50 ppm and 50ppm respectively.

10.3.6 A total of 89 Primary BH samples from 7 boreholes were collected and analyzed for five oxides viz. Al_2O_3, SiO_2, Fe_2O_3, TiO2 & LOI and Elements Scandium, Vanadium and Gallium (Annexure-IIIC). The analytical results of the core samples obtained from different boreholes indicate considerable variation in the major oxides and trace element concentrations, reflecting the vertical transition from bauxite to aluminous laterite and ferruginous laterite horizons within the lateritic profile.

Borehole MBJ-01 shows Al_2O_3 values ranging from 31.10% to 49.45%, indicating the presence of both metallurgical grade bauxite and aluminous laterite horizons. SiO_2 content varies from 1.14% to 13.22%, generally increasing downward in the profile. Fe_2O_3 ranges between 11.22% and 38.32%, suggesting progressive ferruginisation towards the basal lateritic zones. TiO_2 values range from 4.12% to 8.18%, while LOI varies from 16.01% to 24.68%, reflecting hydration characteristics of the lateritic material. Trace element concentrations show Sc ranging from 15.97 to 44.71 ppm, V from 501.98 to 1248.23 ppm, and Ga from <1 to 84.09 ppm, indicating moderate enrichment of these elements within the bauxitic horizons.

In Borehole MBJ-02, Al_2O_3 values vary from 23.91% to 34.65%, representing predominantly aluminous laterite to low-grade bauxite horizons. SiO_2 ranges between 4.24% and 29.08%, while Fe_2O_3 varies from 23.69% to 38.32%, indicating ferruginous enrichment in the lower parts of the profile. TiO_2 content ranges from 4.21% to 6.12%, and LOI values range between 15.11% and 22.08%. Trace elements show Sc ranging from 12.80 to 44.63 ppm, V from 465.35 to 1008.73 ppm, and Ga from 32.17 to 59.54 ppm.

Borehole MBJ-04 represents relatively higher-grade bauxite horizons in the upper sections, with Al_2O_3 values ranging from 18.79% to 37.03%. SiO_2 varies from 5.11% to 37.87%, whereas Fe_2O_3 ranges between 8.07% and 50.67%, indicating gradational transition into ferruginous laterite. TiO_2 content ranges from 3.37% to 7.36%, and LOI varies from 13.52% to 22.47%. The trace element concentrations indicate Sc values between 20.37 and 66.87 ppm, V between 500.32 and 1191.70 ppm, and Ga between 39.24 and 64.00 ppm, with notable enrichment of vanadium in certain intervals.

Samples from Borehole MBJ-05 show Al_2O_3 values ranging from 25.24% to 45.35%, while SiO_2 varies widely between 5.07% and 18.32%. Fe_2O_3 content ranges from 16.66% to 42.64%, and TiO_2 varies from 3.69% to 8.37%, indicating variable titania enrichment within the lateritic profile. LOI ranges from 17.16% to 22.98%. Trace elements show Sc values between 20.99 and 41.14 ppm, V from 587.40 to 969.25 ppm, and Ga between 38.83 and 71.79 ppm, with locally high vanadium values suggesting secondary enrichment within ferruginous horizons.

Borehole MBJ-06 exhibits comparatively higher Al_2O_3 values ranging from 21.89% to 49.25%, indicating the presence of high-grade bauxite horizons in the upper part of the lateritic profile. SiO_2 values range between 3.87% and 34.79%, while Fe_2O_3 varies from 10.52% to 36.74%, suggesting relatively lower ferruginisation in the upper sections. TiO_2 content ranges from 3.90% to 9.47%, and LOI varies between 22.89% and 58.81%. Trace element concentrations show Sc values ranging from 22.89 to 61.01 ppm, V from 547.52 to 1397.39 ppm, and Ga from 42.13 to 52.35 ppm.

Borehole MBJ-07 exhibits comparatively lower Al_2O_3 values ranging from 20.79% to 26.39%, SiO_2 values range between 21.12% and 35.38%, while Fe_2O_3 varies from

12.63% to 38.85%, suggesting relatively lower ferruginisation in the upper sections. TiO_2 content ranges from 3.07% to 4.33%, and LOI varies between 22.89% and 58.81%. Trace element concentrations show Sc values ranging from 30.34 to 54.72 ppm, V from 411.18 to 682.17 ppm, and Ga from 42.13 to 52.35 ppm.

Borehole MBJ-08 exhibits comparatively lower Al_2O_3 values ranging from 14.21% to 26.73%, SiO_2 values range between 18.76% and 39.98%, while Fe_2O_3 varies from 12.99% to 45.94%, suggesting relatively lower ferruginisation in the upper sections. TiO_2 content ranges from 2.10% to 4.85%, and LOI varies between 13.65% and 16.64%. Trace element concentrations show Sc values ranging from 35.98 to 54.30 ppm, V from 333.56 to 591.88 ppm, and Ga from 30.54 to 38.21 ppm.

Overall, the geochemical data indicate a typical lateritic bauxite profile characterized by higher Al_2O_3 and lower Fe_2O_3 in the upper horizons and progressively increasing iron content downward towards the ferruginous laterite zone. Trace elements such as Sc, V and Ga show moderate enrichment within the lateritic profile, reflecting their association with alumina and iron-bearing phases. Graphic lithologs of the drilled boreholes presented in Plate-VA to VE.

10.3.5 The lateritic bauxite horizon was observed in four bands in the mapped area. For the ease of having a comparative understanding of behaviour of the various elements in block, the results are discussed in this section.

10.3.6 General weathering trends for the major and minor elements during laterite formation show strong depletion of alkalis, alkaline earths and silica and accumulation of iron, titanium and aluminium. The most strongly depleted elements were calcium, sodium and potassium, which were probably released into solution during the breakdown of plagioclase feldspar. Also strongly depleted were magnesium and manganese, which were most likely released from the initial breakdown of the ferromagnesian minerals specially the pyroxenes. The analytical results obtained from the core samples of different boreholes indicate a typical lateritic geochemical profile characterized by significant variation in alumina, silica, iron and associated trace elements. The variations reflect the vertical evolution of the laterite profile from high-grade bauxite in the upper horizons to aluminous and ferruginous laterite towards the basal part. The Al_2O_3 content in the analysed samples ranges from about 20.39% to 49.25%, indicating the presence of metallurgical grade-II bauxite, low-grade bauxite and aluminous laterite horizons within the profile. The higher alumina values (>45%) are generally observed in the upper portions of the lateritic profile in only two boreholes MBJ-01 and MBJ-02, representing relatively pure bauxitic zones developed due to intense lateritization and leaching of silica and iron. The SiO_2 content varies widely from about 1.14% to 39.98%, reflecting the degree of silica removal during lateritization. Low silica values (<5%) are typically associated with higher grade bauxite zones, whereas higher silica values occur in transitional horizons and lower parts of the lateritic profile, indicating the presence of clay minerals and relict parent rock components. The Fe_2O_3 content ranges from about 8.07% to 50.67%, showing a progressive increase towards the lower part of the lateritic profile. This enrichment of iron is characteristic of ferruginous laterite zones developed due to residual accumulation of iron oxides during intense weathering of the parent basaltic rocks. TiO_2 values range from approximately 4.12% to 8.18%, which is consistent with the presence of titanium-bearing minerals such as anatase and ilmenite commonly associated with lateritic profiles developed over basaltic parent rocks. The Loss on Ignition (LOI) values range between about 16.01% and 24.61%, reflecting the combined water content associated with hydroxyl-bearing minerals such as gibbsite, goethite and other hydrated iron oxides present within the lateritic profile.

10.3.7 The analytical results of the core samples indicate a well-developed lateritic weathering profile developed over the basaltic parent rock (Deccan Volcanics) in the study area. The lateritic profile exhibits distinct vertical geochemical zonation, which is reflected in the systematic variation of Al_2O_3, SiO_2, Fe_2O_3 and associated trace elements from top to bottom of the profile.

The upper part of the lateritic profile is generally characterized by high Al_2O_3 content and comparatively low Fe_2O_3 and SiO_2 values, representing the bauxite horizon formed due to intense lateritization and leaching of silica and iron during prolonged subaerial weathering. The enrichment of alumina in this zone is mainly attributed to the accumulation of aluminium hydroxide minerals such as gibbsite and boehmite, which form as residual products during the chemical weathering of the parent basaltic rocks.

Below the bauxite horizon, the profile gradually grades into aluminous laterite, where Al_2O_3 values decrease while Fe_2O_3 and SiO_2 contents increase. This transitional zone represents a partially altered lateritic horizon where iron oxides and clay minerals begin to dominate over alumina-bearing minerals.

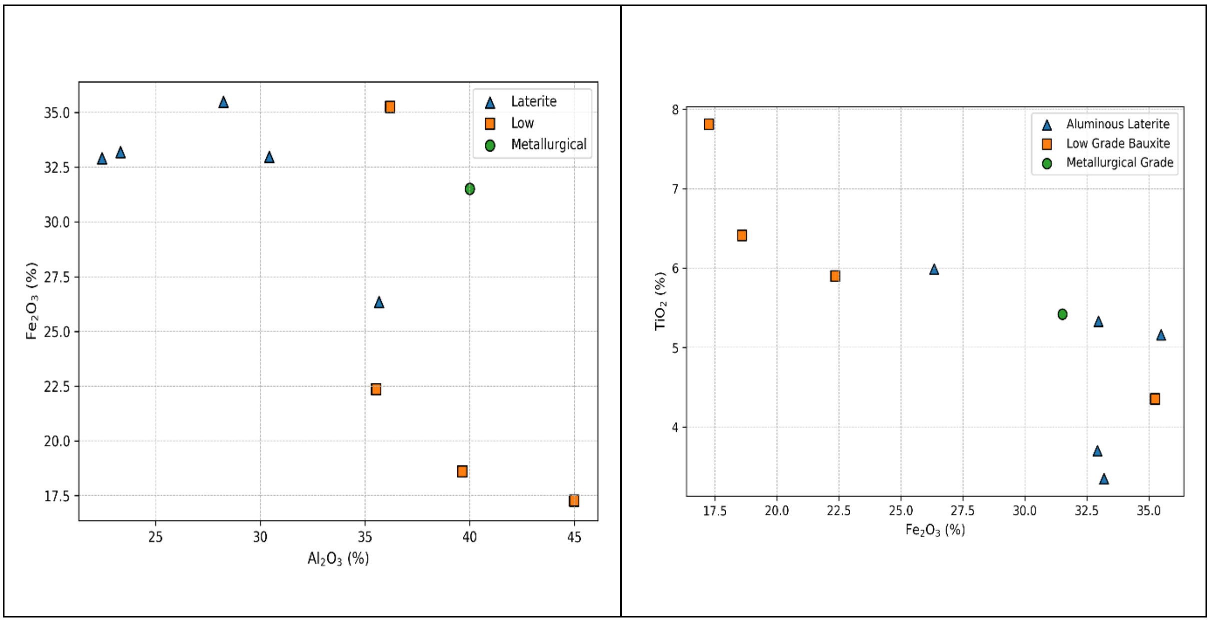
The lower part of the profile is dominated by ferruginous laterite, characterized by higher Fe_2O_3 content and comparatively lower Al_2O_3 values. This zone represents the residual accumulation of iron oxides such as hematite and goethite, which remain after progressive leaching of silica and aluminium during lateritization. In several boreholes, the increase in Fe_2O_3 towards the basal portion of the profile clearly reflects this ferruginous enrichment. The SiO_2 content shows an irregular but generally increasing trend downward, which may be attributed to the presence of relict silicate minerals, clay minerals and partial preservation of the parent rock texture within the lower lateritic zones. In some intervals, localized higher silica values may also indicate siliceous contamination or transitional horizons between bauxite and underlying weathered basalt.

Overall, the observed geochemical pattern clearly indicates that the lateritic bauxite deposits of the study area have evolved through intense lateritic weathering of basaltic parent rocks, resulting in the development of distinct bauxite, aluminous laterite and ferruginous laterite zones. The vertical geochemical zonation observed in the boreholes is consistent with typical tropical lateritic weathering profiles developed over basaltic terrains.

10.3.8 The Al_2O_3 vs Fe_2O_3 plot shows a clear inverse trend (Text Fig. 9), with metallurgical and low-grade bauxite plotting in the high alumina–low iron field, whereas aluminous laterite shifts toward lower alumina and higher iron values. This pattern reflects the progressive transition from bauxitic to ferruginous lateritic horizons within the weathering profile.

The TiO_2 vs Fe_2O_3 plot (Text Fig. 9) indicates that TiO_2 remains moderate to high across the profile, with several aluminous laterite samples showing relatively elevated Fe_2O_3. This suggests that titanium is retained during lateritization and is commonly associated with iron-rich lateritic horizons derived from the basaltic parent rock.

The Al_2O_3 vs SiO_2 binary diagram (Text Figure- 10) shows a clear negative relationship between alumina and silica contents. Samples classified as Metallurgical Grade Bauxite plot in the high Al_2O_3–low SiO_2 field, reflecting intense lateritization and effective leaching of silica during bauxite formation. Low Grade Bauxite and Bauxite samples occupy the intermediate field, indicating transitional zones within the lateritic profile where silica removal is incomplete. In contrast, Aluminous Laterite samples plot toward higher SiO_2 and lower Al_2O_3 values, suggesting increased clay and silicate mineral content within the lower lateritic horizons. The overall distribution pattern reflects the progressive vertical geochemical evolution from bauxite to aluminous laterite within the lateritic weathering profile developed over basaltic parent rocks.

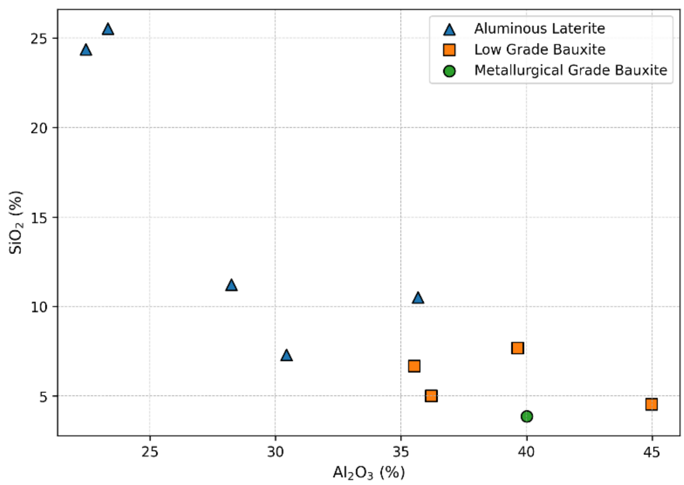


Text Figure No. 9: Binary diagrams showing the relationship between Al_2O_3 vs Fe_2O_3 and TiO_2 vs Fe_2O_3 for borehole samples from the Julrai Block. The diagrams illustrate the geochemical transition from high-grade bauxite to aluminous laterite within the lateritic profile

10.3.9 The Al_2O_3 vs Fe_2O_3 binary plot indicates a broad inverse compositional relationship between alumina and iron oxide. The metallurgical-grade bauxite sample plots at relatively higher Al_2O_3 with moderate Fe_2O_3, reflecting better alumina enrichment and comparatively lower ferruginization. Low-grade bauxite samples show moderate to high Al_2O_3 values with variable Fe_2O_3, indicating partial bauxitization and localized iron enrichment. The aluminous laterite samples are generally characterized by lower Al_2O_3 and higher Fe_2O_3, suggesting stronger ferruginization and comparatively weak alumina concentration. This distribution reflects the gradational transition from aluminous laterite to low-grade bauxite and finally to metallurgical-grade bauxite within the lateritic profile.

The TiO_2 vs Fe_2O_3 binary plot shows that TiO_2 values are moderately enriched across all sample categories, indicating residual concentration of titanium-bearing minerals during lateritic weathering. Low-grade bauxite samples show relatively higher TiO_2 in some cases, suggesting concentration of resistant Ti-bearing phases such as rutile/anatase during leaching and desilication. Aluminous laterite samples exhibit variable Fe_2O_3 with moderate TiO_2, indicating ferruginous enrichment associated with residual titanium concentration. The metallurgical-grade sample plots with moderate Fe_2O_3 and TiO_2, suggesting balanced alumina enrichment without excessive ferruginization.

Overall, both binary plots indicate that the bauxite–laterite profile of the area has evolved through progressive lateritization, desilication, ferruginization, and residual enrichment of relatively immobile constituents. The geochemical distribution supports a Residual lateritic origin of bauxite mineralization developed over basaltic parent rocks, with better-grade bauxite represented by higher Al_2O_3 and comparatively controlled Fe_2O_3, whereas aluminous laterite represents more ferruginous and less advanced bauxitization zones.



Text Figure No. 10: Binary diagrams showing the relationship between Al_2O_3 vs SiO_2 for borehole samples from the Julrai Block. The diagrams illustrate the geochemical transition from high-grade bauxite to aluminous laterite within the lateritic profile.

10.3.10 The Al_2O_3 vs SiO_2 binary diagram exhibits a well-defined inverse relationship between alumina and silica, indicating progressive desilication during the evolution of the lateritic–bauxitic profile.

The metallurgical grade bauxite sample is characterized by relatively high Al_2O_3 (~40%) and low SiO_2 (~4%), reflecting advanced leaching of silica and significant enrichment of alumina. This composition is indicative of well-developed bauxitization under favourable drainage and intense chemical weathering conditions.

The low-grade bauxite samples occupy an intermediate compositional field, with moderate to high Al_2O_3 (35–45%) and comparatively higher SiO_2 (4–8%). This suggests partial desilication and incomplete transformation of the parent material, representing transitional zones between aluminous laterite and high-grade bauxite.

The aluminous laterite samples plot towards lower Al_2O_3 and higher SiO_2, in some cases exceeding 20% SiO_2. This reflects the dominance of clay minerals, particularly kaolinite and lithomargic clay, indicating limited silica removal and relatively weak bauxitization. These compositions are typical of the lower or marginal zones of the lateritic profile.

The Al_2O_3–SiO_2 binary relationship demonstrates progressive desilication and enrichment of alumina within the profile, indicating that the bauxite mineralization is of residual lateritic origin formed under prolonged supergene weathering of Deccan Trap basalt, with well-developed vertical zonation from aluminous laterite to metallurgical grade bauxite.

10.3.11 Three representative bedrock chip samples of fossiliferous limestone were collected from exposed outcrops in the central part of the block. The analytical results indicate encouraging chemical composition, with CaO ranging from 51.85% to 53.22%, SiO_2 from 1.57% to 2.53%, and MgO from 0.44% to 0.51%. The detailed analytical data are furnished in Annexure–IIID.

10.4.0 DATA SPACING FOR REPORTING OF EXPLORATION RESULTS

10.4.1 During Phase–I exploration, a total of seven boreholes were drilled with variable spacing ranging from 600 m to 800 m, instead of a uniform 400 m grid. The deviation from the standard spacing was necessitated by the limited and discontinuous surface exposure of bauxitic laterite, with the primary objective of assessing the vertical continuity, thickness, and grade of the bauxite horizons.

The borehole locations were accordingly optimized based on available surface indications, resulting in localized variation in spacing. It was envisaged that, in the event of continuation into Phase–II, drilling would be undertaken on a closer grid of 400 m spacing to delineate the deposit more systematically.

However, in view of the restricted extent of bauxite mineralization and limited surface exposures, the Technical Committee (TCC) recommended closure of the project without undertaking further drilling.

10.4.2 Extract of MEMC Part III is as below

Exploration Norms for different types of deposits for **I. Bedded Stratiform and tabular deposits of regular and irregular habit:**

For limestone, bauxite, potash and salt beds the grid spacing of bore holes may be 800m or closer for deposits of regular habit and 400m or closer for irregular habit; for others the spacing may be 400m or closer for regular and 200m or closer for irregular habit.

Or

Provided that for deposits specified in Schedule II, 3 bore holes drilled so as to form a polygon in blocks of less than 100 hectares and 5 bore holes in blocks of more than 100 hectares may be sufficient. The lateral influence beyond the bore hole spacing may be limited to a maximum of 50 per cent. of the spacing depending on the results of surface geological mapping.

10.4.2 The mineral resources within the block have been estimated using the polygon method. For the purpose of resource estimation, an influence zone of 200 m radius around each borehole has been considered. The resources falling within this zone of influence have been classified under the Inferred Mineral Resource (333) category in accordance with the UNFC guidelines.

CHAPTER-11

LOCATION OF DATA POINTS

11.1.0 ACCURACY AND QUALITY OF SURVEY USED TO LOCATE DRILL HOLES

11.1.1 The surveyed block area is located near Mata no Madh village, lies in the Kachchh District. Julrai block covers an area of 8.12 sq.km, and falls in part of Survey of India Toposheet No. 41 A/14 & 15. Survey site is located 12 km west from Mata no Madh village and approximately 105 km from Bhuj, District headquarters, Gujarat.

Table No 11.1

Block Boundary coordinates of corner points for Julrai block, District - Kachchh, Gujarat as per DGPS Survey

		DMS (WGS-84)				
SR. NO.	CORNER POINT	LATITUDE	LONGITUDE	EASTING	NARTHING	RL (M)
1	A	23°29'20.64162"N	68°46'06.10761"E	476347.849	2597680.089	72.147
2	B	23°29'39.00811"N	68°46'05.58853"E	476334.037	2598244.919	82.041
3	C	23°30'50.73608"N	68°47'02.24515"E	477944.280	2600448.197	110.572
4	D	23°31'05.53014"N	68°48'38.23698"E	480667.042	2600899.302	90.479
5	E	23°29'17.93434"N	68°47'35.33712"E	478878.603	2597592.974	81.188

11.1.2 All the Borehole Drilled in Julrai block were surveyed in respect of their location with the help of DGPS Instrument for surveying.

11.1.2.1 **TECHNICAL SPECIFICATION OF DGPS**

MAKE	**TRIMBLE DGPS**
MODEL	**DA-2 Catalyst**
YEAR OF PURCHASE	**2025**

11.1.2.2 **MEASUREMENT ACCURACY**:

- Static Mode

Horizontal: 10 mm + 0.1 ppm or better

Vertical: 20 mm + 0.4 ppm or better

- RTX Mode
- Horizontal: 20 mm + 0.1 ppm or better
- Vertical: 30 mm + 0.4 ppm or better

11.1.2 A detailed contour survey of the Julrai Block was carried out to generate an accurate topographic base for geological mapping, borehole location fixing and resource estimation. The survey was conducted using a Differential Global Positioning System (DGPS), specifically the Trimble GNSS System (DA-2 Catalyst) operating in RTX correction mode, which enables high positional accuracy through satellite-based real-time correction services. In this mode, the receiver obtains correction data from the Trimble RTX global reference station network, which is supported by a network of continuously operating reference stations (CORS), including those maintained by the Survey of India, and other international reference stations. These base stations continuously track GNSS satellites and transmit correction data to the RTX system, which is then relayed via satellite to the field receiver, thereby enabling precise positioning without the requirement of establishing a local base station within the survey area.

During the survey, the GNSS receiver was connected to a field data collection device and positioned at predetermined locations across the block. At each survey point, the instrument recorded latitude, longitude and elevation data after achieving stable satellite lock and receiving RTX correction signals. The points were systematically collected to represent the terrain configuration of the block. The acquired DGPS data were subsequently processed using GIS and survey software to generate contour maps and digital elevation models (DEM) of the area. The resultant contour map served as the topographic framework for detailed geological mapping, and borehole location fixing, and integration of exploration data within the Julrai Block. Particulars of DGPS data are given as Annexure- I.

11.1.4 During the survey, surface features i.e., roads, Mining area, etc. have been picked up and the same have been depicted on topographical map of the block given as **Plate-III**. Topographical survey with 4m Contouring interval was carried out on 1:4000 scale in the block.

11.1.5 Total 07 boreholes were drilled by MECL i.e. MBJ-01 to MBJ-08 and all the boreholes were fixed by DGPS survey instrument. Borehole location co-ordinates & Reduced level (RL) of the borehole along with boundary pillar in Julrai block area. were surveyed by DGPS survey instrument. The borehole location and block boundary corner points are given in **Table no 11.1 and as Plate-III.**

11.2.0 QUALITY AND ADEQUACY OF TOPOGRAPHIC CONTROL

11.2.1 The topographic control for the Julrai Block was established using a Trimble GNSS System (DA-2 Catalyst) operating in RTX correction mode, ensuring high positional accuracy suitable for geological mapping and exploration activities at the G-3 stage of investigation. The system receives real-time satellite correction signals from the Trimble RTX global reference station network, supported by continuously operating reference stations including those maintained by the Survey of India, thereby providing reliable differential corrections without the requirement of a local base station. The survey points were recorded after achieving stable satellite lock and RTX convergence, ensuring accurate horizontal and vertical positioning. The generated coordinate data were used to prepare contour maps and digital elevation models, which served as the topographic base for geological mapping, borehole fixing and resource estimation. The accuracy and spatial distribution of the collected data are considered adequate and reliable for the scale of investigation (1:4000) at G-3 level.

CHAPTER-12

SAMPLING TECHNIQUE

12.1.0 NATURE AND QUALITY OF SAMPLING AND MEASURES TAKEN TO ENSURE SAMPLE REPRESENTATIVITY

12.1.1 The sampling and analysis were carried out for entire laterite/Bauxite zones intersected in the boreholes drilled. Borehole cuttings, the material which was obtained by dry drilling, was dried in sun and sampled for a uniform length of 1.00 m to 50cm keeping in view irregular and discontinuous nature of the deposit, the sampling was carried out according to lithological changes. Each sample thus obtained by standardized sample preparation techniques was crushed to (-) 200 mesh size and its quantity further reduced to 500 grams by progressive coning and quartering, including contamination-free processing, rigorous cleaning of equipment, and adherence to the coning and quartering method for sample reduction. Each final 500-gram sample was divided into three equal portions for primary analysis, check analysis, and future reference. The -200 mesh size ensured optimal fineness for laboratory testing by XRF. Two representative samples weighing about 100 grams each was taken from this, one of which was sent for primary analysis for five oxides Al_2O_3, SiO_2, Fe_2O_3, TiO_2 & LOI, Elements Vanadium (V), Scandiium (Sc) and Gallium (Ga) at Chemical Laboratory of MECL, Nagpur. The remaining 300 gms sample was used for preparation of composite samples for analysis of XRD, and reactive silica etc. for future reference. The details are attached as Annexure-VI & XII respectively.

12.1.2 During the present exploration, a total of 89 nos. of primary core samples were been generated and analysed for Al_2O_3, SiO_2, Fe_2O_3, TiO_2 & LOI, Elements Vanadium (V), Scandium (Sc) and Gallium (Ga). In addition to this, total 20 nos. of primary core samples collected from Saprolite/lithomarge were analyzed for TREE by ICP-MS method. The details of analysis of primary core samples for Al_2O_3, SiO_2, Fe_2O_3, TiO_2 & LOI and TREE, Elements Vanadium (V), Scandium (Sc) and Gallium (Ga) are given in Annexure III-C and IIIE.

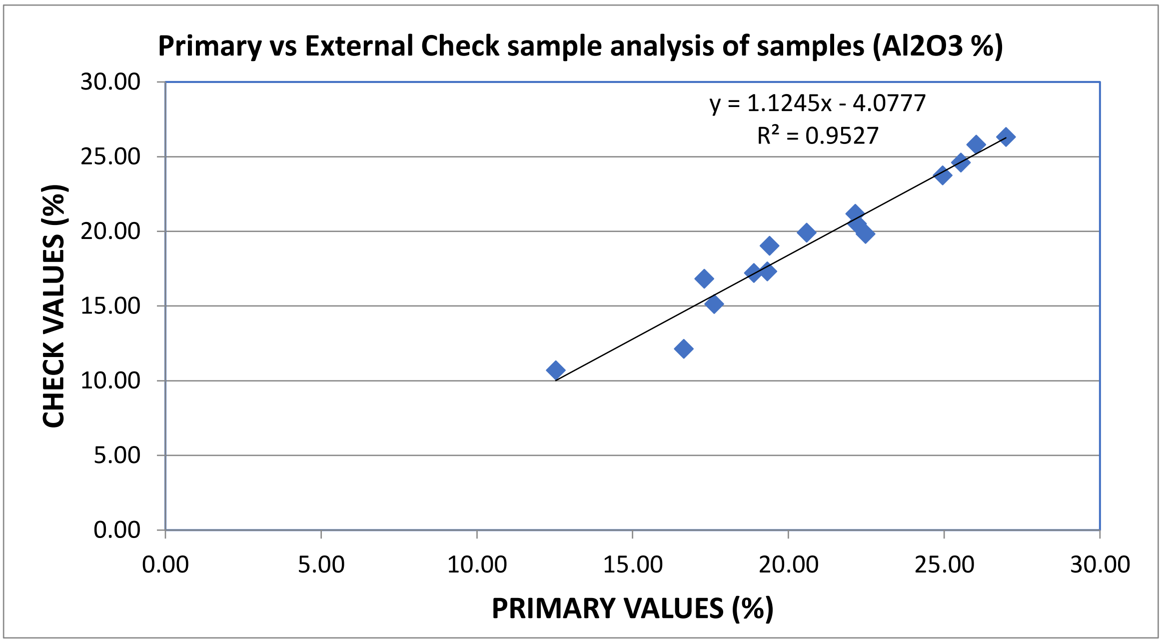
12.1.3 In order to check analytical bias if any, external (10%) check analysis have been carried out at external NABL accredited JNRDDC laboratory. Total 15 nos. of external check samples to be analyzed for Al_2O_3, SiO_2, Fe_2O_3, TiO_2 & LOI. The analysis of External check samples is placed as Annexure-IV.

12.1.4 A total of 15 paired primary and external check samples were evaluated to assess the accuracy and reliability of analytical results for Al_2O_3. The primary samples yielded an arithmetic mean of 36.69% Al_2O_3, while the corresponding external check samples returned a mean value of 39.08% Al_2O_3. The standard deviations of 6.49 and 5.87, respectively, indicate comparable variability in both datasets.

The correlation coefficient (R^2 = 0.980) demonstrates an excellent degree of agreement between the primary and external check analyses, indicating strong analytical reproducibility and consistency of the laboratory results. The mean absolute error of 0.121 and low standard deviation of error (0.658) further suggest that the deviations between paired analyses are minor and within acceptable limits.

The F-test value of 1.221 indicates that the variances of the two datasets are broadly comparable, suggesting no significant difference in analytical precision between the primary and check analyses. Although the paired t-test yielded a value of –14.104, indicating a systematic difference in mean values, the overall high correlation and low analytical error suggest that the observed variation is unlikely to materially affect the interpretation of grade distribution and resource estimation. Scatter plot of primary vs external check analysis for core samples for Al_2O_3% is provided in the Text figure-11.

Overall, the statistical parameters indicate satisfactory agreement between the primary and external check sample analyses, confirming the reliability, reproducibility, and acceptable quality of the analytical data generated during the investigation. The QA/QC results demonstrate that the analytical dataset is suitable for geological interpretation and resource estimation purposes.



Text Figure 11: Scatter Plot of Primary vs Check (External) sample analysis of Trench samples for Al_2O_3

Table-12.1
Statistical comparison of Primary and External Check sample analysis for Al_2O_3%

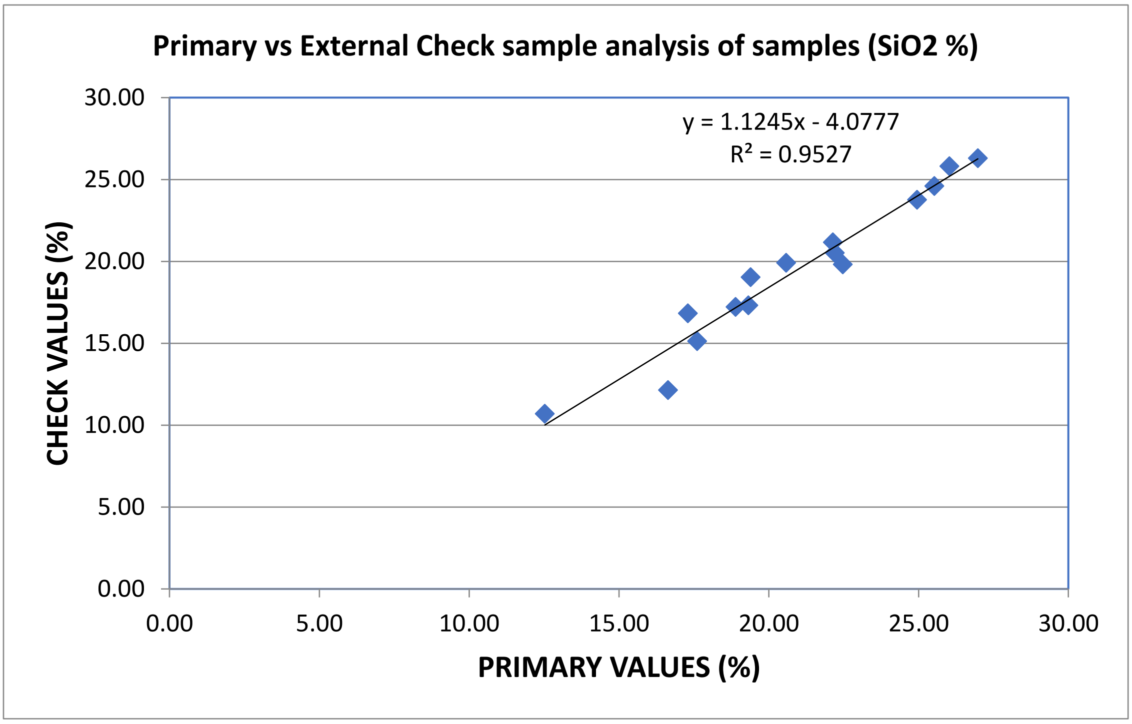
Comparison of Primary v/s External check sample analysis		
Comparison Index	**Total Al2O3 (%)**	
	Primary	**Check**
No. of sample pairs	15	
Arithmetic mean	36.685	39.079
Standard Deviation	6.492	5.874
Standard error of mean	1.676	1.517
Variance	42.148	34.507
Mean of deviation	-0.111	
Standard Deviation (Error)	0.658	
Correlation Co-efficient	0.980	
Mean absolute error	0.121	
Paired T-value	-14.104	
F- test value	1.221	

12.1.5 A total of 15 paired primary and external check samples were evaluated to assess the accuracy and precision of SiO_2 analyses. The primary samples yielded an arithmetic mean of 9.13% SiO_2, while the corresponding external check samples recorded a mean value of 8.97% SiO_2. The standard deviations of 0.92 and 0.66, respectively, indicate low dispersion and good consistency within both datasets.

The correlation coefficient (R^2 = 0.992) demonstrates an excellent degree of agreement between the primary and external check analyses, indicating a high level of analytical reproducibility and reliability. The mean deviation (0.007), mean absolute error (0.038), and standard deviation of error (0.223) are all very low, suggesting minimal analytical bias and close correspondence between paired sample results.

The F-test value of 1.963 indicates comparable variance between the two datasets, reflecting similar analytical precision for both primary and check analyses. Although the paired t-test value is 2.688, the overall statistical parameters, particularly the very high correlation coefficient and low analytical errors, indicate that the differences between the paired analyses are minor and do not materially influence the interpretation of silica distribution within the deposit. Scatter plot of primary vs external check analysis for core samples for SiO_2% is provided in the Text figure-12.

Overall, the statistical evaluation confirms satisfactory agreement between the primary and external check sample analyses for SiO_2. The QA/QC results demonstrate that the analytical data are reliable, reproducible, and suitable for geological interpretation, grade evaluation, and resource estimation.



Text Figure 12: Scatter Plot of Primary vs Check (External) sample analysis of Trench samples for SiO_2

Table-12.2
Statistical comparison of Primary and External Check sample analysis for SiO_2%

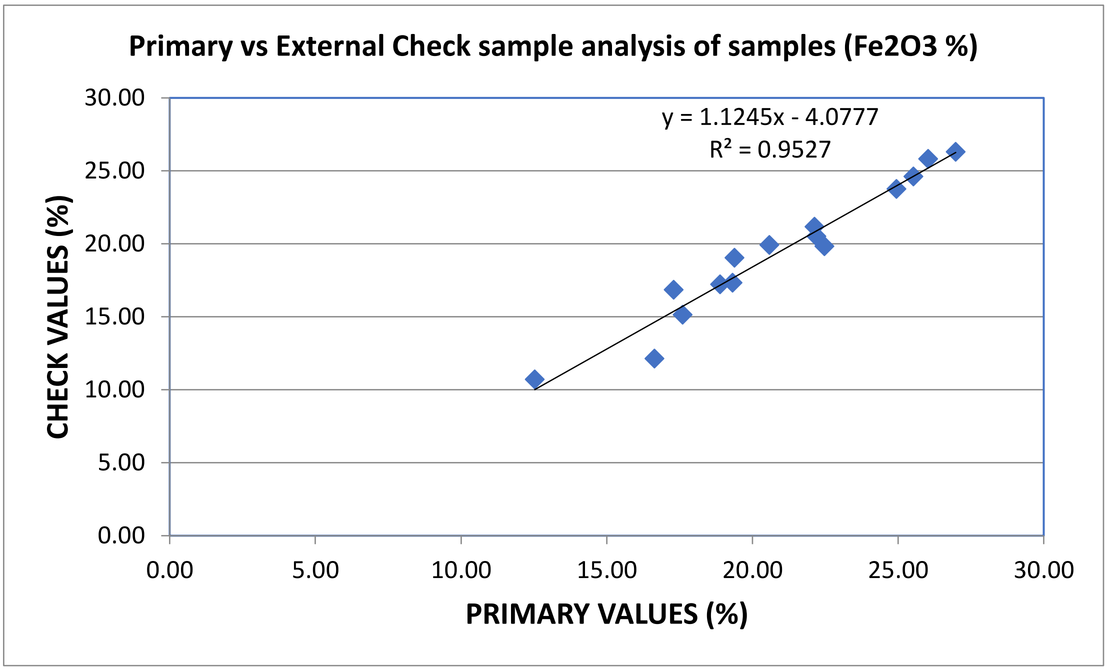
Comparison of Primary v/s External check sample analysis		
Comparison Index	**Total SiO2 (%)**	
	Primary	**Check**
No. of sample pairs	15	
Arithmetic mean	9.128	8.973
Standard Deviation	0.920	0.657
Standard error of mean	0.238	0.170
Variance	0.847	0.431
Mean of deviation	0.007	
Standard Deviation (Error)	0.223	
Correlation Co-efficient	0.992	
Mean absolute error	0.038	
Paired T-value	2.688	
F- test value	1.963	

12.1.6 A total of 15 paired primary and external check samples were statistically evaluated to assess the quality and reliability of Fe_2O_3 analytical data. The arithmetic mean of Fe_2O_3 in the primary samples is 23.98%, whereas the corresponding external check samples yielded a mean value of 23.43%. The standard deviations of 7.25 and 6.54, respectively, indicate comparable dispersion within the two datasets.

The correlation coefficient (R^2 = 0.993) indicates a strong positive correlation between the primary and external check sample analyses, demonstrating a high degree of consistency in the analytical results. The low values of mean deviation (0.026), mean absolute error (0.053), and standard deviation of error (0.306) suggest close agreement between the paired analytical data.

The F-test value of 1.230 indicates comparable variance between the primary and check datasets, reflecting similar analytical precision. The statistical comparison shows that the analytical results generated from the primary and external laboratories are broadly consistent and reproducible. Scatter Plot of Primary vs Check (External) sample analysis of Trench samples for Fe_2O_3 is provided in the Text Figure-13.

Overall, the QA/QC assessment indicates satisfactory correspondence between the primary and external check sample analyses for Fe_2O_3. The analytical data generated during the investigation are considered reliable and suitable for geological interpretation, grade evaluation, and resource estimation.



Text Figure 13: Scatter Plot of Primary vs Check (External) sample analysis of Trench samples for Fe_2O_3.

Table-12.3

Statistical comparison of Primary and External Check sample analysis for Fe_2O_3%

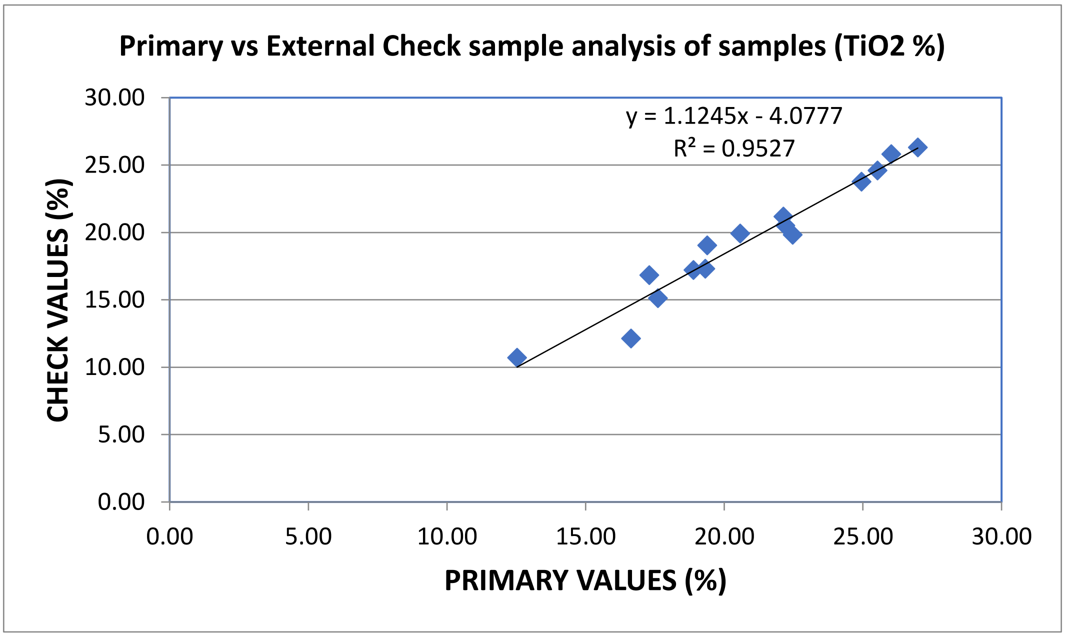
Comparison of Primary v/s External check sample analysis		
Comparison Index	**Total Fe2O3 (%)**	
	Primary	**Check**
No. of sample pairs	15	
Arithmetic mean	23.977	23.425
Standard Deviation	7.250	6.537
Standard error of mean	1.872	1.688
Variance	52.557	42.729
Mean of deviation	0.026	
Standard Deviation (Error)	0.306	
Correlation Co-efficient	0.993	
Mean absolute error	0.053	
Paired T-value	6.987	
F- test value	1.230	

12.1.6 A total of 15 paired primary and external check samples were statistically evaluated to assess the quality and reliability of TiO_2 analytical data. The arithmetic mean of TiO_2 in the primary samples is 5.59%, while the corresponding external check samples yielded a mean value of 5.39%. The standard deviations of 0.62 and 0.93, respectively, indicate comparable variability within the two datasets.

The correlation coefficient (R^2 = 0.972) indicates a strong positive correlation between the primary and external check sample analyses, reflecting a high degree of consistency and reproducibility of the analytical results. The low values of mean deviation (0.009), mean absolute error (0.014), and standard deviation of error (0.087) indicate close correspondence between the paired analytical data.

The F-test value of 2.293 suggests acceptable agreement in variance between the primary and external check datasets. The statistical comparison demonstrates that the analytical results obtained from the primary and external laboratories are broadly comparable and exhibit satisfactory analytical precision. Scatter Plot of Primary vs Check (External) sample analysis of Trench samples for Fe_2O_3 is provided in the Text Figure-14.

Overall, the QA/QC assessment indicates satisfactory agreement between the primary and external check sample analyses for TiO_2. The analytical data generated during the investigation are considered reliable and suitable for geological interpretation, grade characterization, and resource estimation.



Text Figure 14: Scatter Plot of Primary vs Check (External) sample analysis of Trench samples for TiO_2.

Table-12.4
Statistical comparison of Primary and External Check sample analysis for TiO_2%

Comparison of Primary v/s External check sample analysis		
Comparison Index	**Total TiO2 (%)**	
	Primary	**Check**
No. of sample pairs	15	
Arithmetic mean	5.587	5.394
Standard Deviation	0.616	0.932
Standard error of mean	0.159	0.241
Variance	0.379	0.869
Mean of deviation	0.009	
Standard Deviation (Error)	0.087	
Correlation Co-efficient	0.972	
Mean absolute error	0.014	
Paired T-value	8.610	
F- test value	2.293	

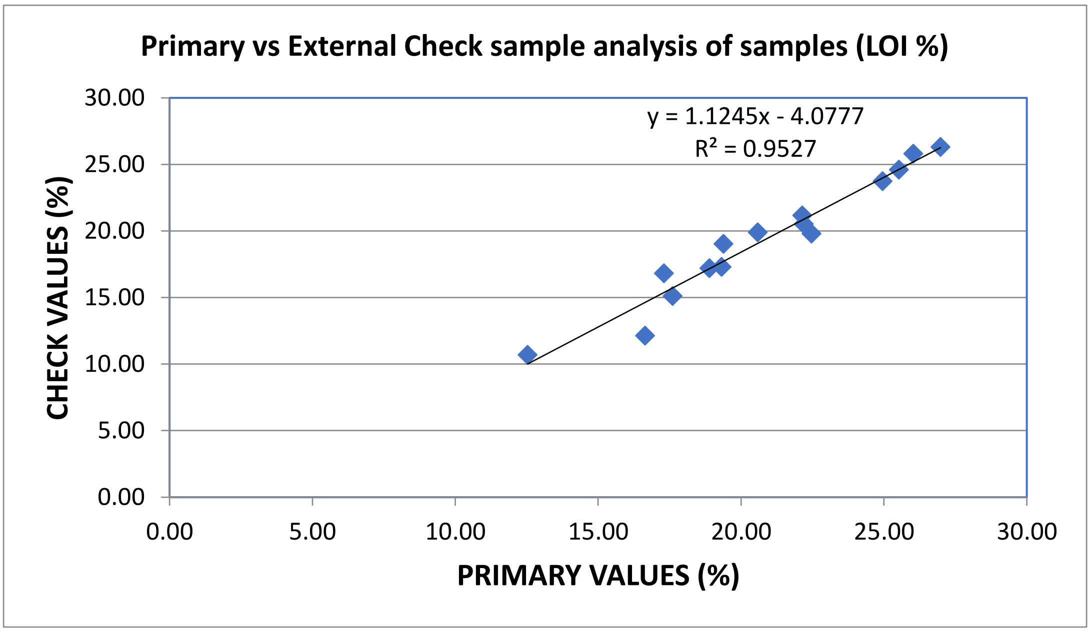
12.1.7 A total of 15 paired primary and external check samples were statistically evaluated to assess the quality and reliability of Loss on Ignition (LOI) data. The arithmetic mean of LOI in the primary samples is 20.84%, whereas the corresponding external check samples yielded a mean value of 19.35%. The standard deviations of 2.22 and 2.27, respectively, indicate comparable dispersion within the two datasets.

The correlation coefficient (R^2 = 0.976) indicates a strong positive correlation between the primary and external check sample analyses, demonstrating good reproducibility of the analytical results. The low values of mean deviation (0.069), mean absolute error (0.069), and standard deviation of error (0.391) suggest close agreement between the paired analytical data.

The F-test value of 1.045 indicates comparable variance between the primary and external check datasets, reflecting similar analytical precision. The statistical comparison shows that the analytical results generated by the primary and external laboratories are broadly consistent and exhibit satisfactory analytical quality.

Overall, the QA/QC assessment indicates satisfactory correspondence between the primary and external check sample analyses for LOI. The analytical data generated during the investigation are considered reliable and suitable for geological interpretation, grade characterization, and resource estimation.

The comparative statistical analysis of primary and external check sample data for Al_2O_3, SiO_2, Fe_2O_3, TiO_2, and LOI demonstrates a satisfactory level of analytical conformity between the two datasets. The consistently high correlation coefficients, coupled with low error statistics, indicate good analytical reproducibility and reliability of the generated results. The observed variance between the primary and check analyses remains within acceptable limits, reflecting comparable analytical precision in both laboratories. Sacatter plots of LOI provided in the Text fugure-54. The overall QA/QC evaluation establishes that the analytical dataset is internally consistent and suitable for geological interpretation, grade characterization, and resource estimation of the deposit.



Text Figure 15: Scatter Plot of Primary vs Check (External) sample analysis of Trench samples for LOI.

Table-12.5
Statistical comparison of Primary and External Check sample analysis for LOI%

Comparison of Primary v/s External check sample analysis		
Comparison Index	**Total LOI (%)**	
	Primary	**Check**
No. of sample pairs	15	
Arithmetic mean	20.837	19.353
Standard Deviation	2.219	2.269
Standard error of mean	0.573	0.586
Variance	4.926	5.148
Mean of deviation	0.069	
Standard Deviation (Error)	0.391	
Correlation Co-efficient	0.976	
Mean absolute error	0.069	
Paired T-value	14.707	
F- test value	1.045	

CHAPTER-13

DRILLING TECHNIQUES AND DRILL SAMPLING EMPLOYED

13.1.0 DRILLING TYPES AND DETAILS

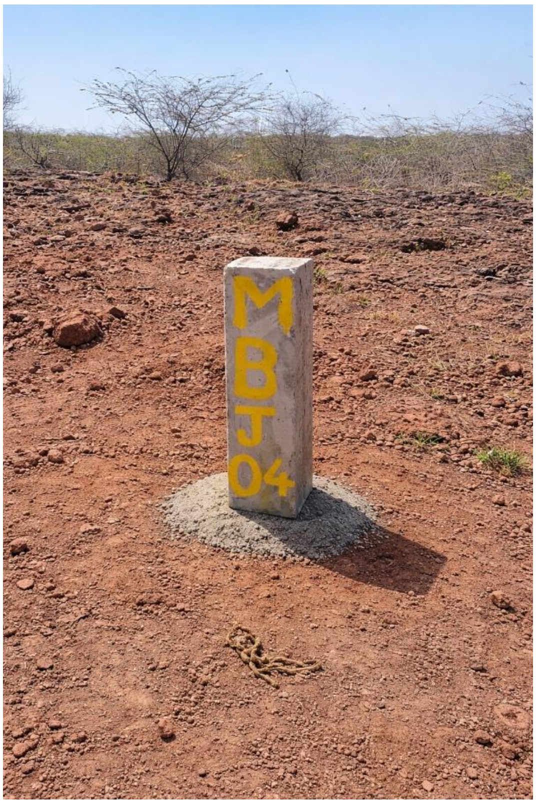
13.1.1 During the present investigation, MECL drilled total 07 nos. of boreholes with 96.25 m and the details of boreholes drilled by MECL are given in Annexure-IIA and summary of borehole is given in **Table-10.2**.

13.1.2 All boreholes were laid on 600m to 800m spacing as given in para no 10.4.1 and all boreholes are vertically drilled. Drilling operations were carried out by conventional wireline drill rig RD-60. Drilling in NQ size by dry coring method was the main tool for sub surface exploration. The length of individual run was generally kept as one meter or a fraction of one meter depending on lithological variations.

13.1.3 Drilling was carried out by dry drilling method using RD-60 drill (Photograph – 13.1) with NX and BX size of TC casing and TC shoe bit. The length of individual run was generally less than one meter and was essentially 20 to 50cm, depending on lithological variations. The core recovery was around 74 to 100%.

13.1.4 The core recovery in the mineralized zones is about 88-100% which is satisfactory. After closure, all the boreholes were properly plugged and sealed with cement pillars and its DGPS survey has been completed (Photograph- 13.2)-

Photograph No.13.1: RD60 drill Rig used for drilling operations



Photograph No.13.2: Pillars constructed on boreholes drilled in Julrai block by MECL.

13.1.5 The borehole cores were geologically logged recording textural, lithological, mineralogical and structural details. Each lithology was identified based on accepted nomenclature. Their colour, grain size, mineral variations and lithological changes etc meticulously recorded. Depth parameters of zones of weathering, oxidation and fracturing etc are recorded. Similarly, mineralisation zones, various physically identifiable ore minerals and their megascopic characteristics are identified. The core recovery figures, changes in recovery percentage with changes in lithology, weathering characteristics of respective rocks etc are also noted. Core samples have been logged, the mineralisation zones relogged after splitting of the core for additional information, that can support resource estimation.

13.2.0 WHETHER CORE AND CHIP SAMPLE RECOVERIES HAVE BEEN PROPERLY RECORDED AND RESULTS ASSAYED

13.2.1 The material obtained by way of dry drilling was stored in polythene bags (Photograph No. 13.3 and 13.4). The admixture of cuttings and powder was carefully examined and the details like colour, physical nature, and mineral constituents were recorded. The details of run wise log thus generated were consolidated and are presented in Annexure- II B.

Photograph No.13.3: Drilled core by dry drilling method

Photograph No.13.4: Drilled core by dry drilling

13.2.2 The material obtained by way of dry core drilling was stored in GI made core boxes. The core was carefully examined and the details like colour, physical nature, mineral constituents were recorded. The details of run wise log thus generated were consolidated and are presented in Annexure-IIC.

13.3.0 MEASURES TAKEN TO MAXIMIZE SAMPLE RECOVERY AND ENSURE REPRESENTATIVE NATURE OF THE SAMPLES.

13.3.1 The short runs were made during drilling for optimum core recovery.

13.4.0 WHETHER THE RELATIONSHIP EXISTS BETWEEN SAMPLE RECOVERY AND GRADE

13.4.1 The core recovery is about 98-99% approximately. The entire bauxite/laterite mineralized zones / length were recorded during the geological logging on visual basis. Since, the recovery percentage in the mineralized zones is high there is no any negative effect from the core recovery.

13.5.0 CORE LOGGING

13.5.1 Sub surface drilling reveals presence of lateritic soil, laterite, bauxite, variegated clay and Basalt in the order of stratigraphic sequence**.**

13.5.2 The logging was carried out run-wise for boreholes and the variation of lithounits i.e., Laterite, Bauxite and Saprolite/lithomarge were marked meticulously and detailed litholog is submitted as annexure IIB.

CHAPTER-14

SUB SAMPLING TECHNIQUES AND SAMPLE PREPARATION

14.1.0 WHETHER CUT OR DRAWN AND WHETHER QUARTER, HALF OR ALL CORE TAKEN

14.1.1 The details of sampling procedure are described in Para 12.1.0. Borehole cuttings, the material which was obtained by dry drilling, was dried in sun and sampled for a uniform length of 1.00 m to 50cm keeping in view irregular and discontinuous nature of the deposit, the sampling was carried out according to lithological changes. Each sample thus obtained, was crushed to (-) 200 mesh size and its quantity further reduced to 500 grams by progressive coning and quartering. The material was further crushed to (-) 200 mesh size. Two representative samples weighing about 100 grams each was taken from this, one of which was sent for primary analysis for five oxides Al_2O_3, SiO_2, Fe_2O_3, TiO_2 & LOI, Elements Scandium (Sc) Vanadium (V) and Gallium (Ga) at Chemical Laboratory of MECL, Nagpur.

14.2.0 NATURE, QUALITY AND APPROPRIATENESS OF THE SAMPLE PREPARATION TECHNIQUE

14.2.1 The sampling and analysis have been carried out for entire laterite/Bauxite zones intersected in the boreholes drilled on visual basis. The primary samples have been marked in the mineralized zones intersected in the borehole based on type and concentration of bauxite zone and in general the sample length has been kept as 1.0 m which varied in some instances because of variation in lithology and type and concentration of mineralisation.

14.3.0 QUALITY CONTROL PROCEDURES ADOPTED

14.3.1 Standard sampling procedure in supervision of qualified sampling technician has been adopted and the samples have been prepared at project sampling unit. Total 94 nos. of primary samples including bedrock, pits and core samples have been prepared and analysed for Al_2O_3, SiO_2, Fe_2O_3, TiO_2 & LOI at Chemical Laboratory of MECL, Nagpur. In order to check the sampling and analytical bias if any, a total of 16 numbers of external checks submitted to NABL accredited lab i.e., JNARDDC in Nagpur.

14.4.0 MEASURES TAKEN TO ENSURE THAT THE SAMPLING IS REPRESENTATIVE OF THE INSITU MATERIAL COLLECTED

14.4.1 All the primary samples have been marked and prepared from Bauxite/laterite mineralised cores. During the preparation of primary samples, the mineralised cores have been studied meticulously and samples have been marked properly. The proper marking of primary samples from drilled cores and following standard procedure for primary and composite sample preparation shows the representative samples have been collected from the in-situ materials.

14.5.0 WHETHER SAMPLE SIZES ARE APPROPRIATE TO THE GRAIN

14.5.1 The primary samples have been prepared in (–) 200 mesh size. As per the present practice for bauxite exploration, the (–) 200 mesh size is fitting for the liberation of mineral grains and analysis for Al_2O_3, SiO_2, Fe_2O_3, TiO_2 & LOI and associated elements in the block area.

CHAPTER-15

QUALITY OF ASSAY DATA AND LABORATORY TESTS

15.1.0 THE NATURE, QUALITY AND APPROPRIATENESS OF THE ASSAYING AND LABORATORY PROCEDURES

15.1.1 The chemical analysis of primary samples for bauxite was carried out under WD-XRF method with Primus-IV model machine and details are given below.

Make: Rigaku

Model: Primus-IV (WD-XRF)

Analytical range: Wavelength Dispersive X-ray Fluorescence spectrometer (WD-XRF) is capable of analyzing major, minor and trace elements in rocks/ores/minerals and geological materials as solid samples (pressed pallets and fusion beads) in % to ppm range

Accuracy and precision (standard deviation) for major oxides is excellent (<1%). For testing of the samples, pressed pallets of the powdered samples were made using hydraulic press. The XRF instrument was calibrated using suitable matrix matching CRMs. After calibration of the instrument the samples were analyzed and the values of the SiO_2, Al_2O_3, Fe_2O_3, TiO_2 were obtained. The Loss on Ignition was determined by calculating the loss in weight of the sample after igniting the sample taken in a Pt crucible at 1000°C in a muffle furnace.

The following **Precautions** were followed in the laboratory while doing chemical analysis.

(a) PPEs were used to avoid any contamination to the samples.

(b) Label all containers to identify their contents.

(c) Avoid touching hot objects. Be careful when using hot objects. Use suitable tongs to remove hot containers from the furnace.

(d) Properly dispose of waste chemicals.

15.2.0 NATURE OF QUALITY CONTROL PROCEDURES ADOPTED

15.2.1 The standard procedure for chemical analysis as per provision made in the proposal for QA/QC has been followed. All the primary samples have been analyzed in the Chemical Laboratory of MECL, Nagpur. In order to assess the bias and inaccuracies in analytical determination,

(i) Analysis of Certified reference materials/measurement standards (BCS CRM-395, GBAP-14, GBAP-16, NCSHC-28811)

(ii) Analysis of blind samples

(iii) Use of QC samples and control charts

(iv) Analysis in duplicates & Internal Check standards.

15.3.0 CHECK ANALYSIS FROM THIRD PARTY NABL ACCREDITED LABORATORY

15.3.1 The third-party external check samples analyses being carried out at JNARDDC, (NABL Accredited lab) Nagpur. Total of 15 numbers of external check samples for Al_2O_3, SiO_2, Fe_2O_3, TiO_2 , LOI, Sc, v & Ga, results are placed as Annexure-IV. Details of check samples to be discussed in chapter 12.

15.4.0 SECURITY AND CHAIN OF CONTROL OF SAMPLES SHOULD BE CLEARLY MENTIONED

15.4.1 The samples were prepared at the project sampling unit with proper labelling and tag packed in sealed polythene bags sent to chemical laboratory in supervision of qualified sampling technician. At the sampling unit, standard procedure was followed and all the precautionary measures were taken to avoid the contamination. The sampling unit is a separate unit from the chemical laboratory, so there is no possibility of contamination.

CHAPTER-16

MOISTURE

16.1.0 All the analysis for oxides i.e., Al_2O_3, SiO_2, Fe_2O_3, TiO_2 & LOI were carried out with natural moisture. However, Moisture analysis has not been done at this stage. Hence, no information can be provided.

CHAPTER-17

BULK DENSITY

17.1.0 BULK DENSITY ANALYSIS DETAILS

17.1.1 Bulk density (BD), in conjunction with volume, is a critical parameter for the accurate estimation of mineral resources and reserves. It is governed by both the intrinsic density of the constituent mineral particles and their spatial arrangement within the ore body, including the presence of inter-particulate voids and fractures. Bulk density is defined as the mass of material per unit volume, where the volume encompasses both solid material and associated pore spaces. It is typically expressed in grams per cubic centimeter (g/cm^3) or tones per cubic meter (t/m^3) and is an essential input parameter in tonnage calculations for resource evaluation.

17.2.0 BULK DENSITY DETERMINATION PROCEDURE

17.2.1 A total of two representative core samples was selected for bulk density determination to evaluate the physical characteristics of the Bauxite. The objective of this study was to obtain reliable bulk density values, which constitute a critical input parameter for resource estimation and tonnage calculations. The methodology and procedural steps adopted for bulk density measurement are described below.

17.2.2 **Applicability:** This method shall be applicable in hard litho units, where regular solid cylindrical drill cores are obtained during the course of drilling. The drill core samples to be used for the study should be of NQ or larger diameter.

17.2.3 **Sample Preparation:** Take a full cylindrical drill core sample of minimum ten (10) centimeters - length with both ends trimmed smoothly at right angle to the core axis using a mechanical core cutter to form a regular cylinder.

17.2.4 **Measurement:** Measure the length of the sample, at-least at four locations along its axis by suitably rotating the sample. Measure the diameter of the sample using a caliper scale, at least at four locations, preferably at regular interval. Weigh the air-dried sample in a platform balance.

17.2.5 **Calculation:** Take mean average of all the readings for length and diameter. Divide the average mean value of diameter by two to arrive at the radius of the sample. The volume of a core sample is obtained by using formulae: $V = \pi r^2 h$ (where V = volume, r = radius and h = height or length of the cylindrical core). The bulk density of the sample is determined by using the formula:

$$D = M/V$$

where B. D= bulk density, M= mass (weight) of the sample and V= volume of the sample.

17.2.6 **Number of Samples studied:** A total of three observations is carried out for each sample. The average of these observations results for each sample may be taken as the final bulk density for the purpose of estimation of resources of Bauxite and aluminous laterite. Bulk density determination results are mentioned below:

Sl.No.	Sample No.	Bulk Density
1	MBJ/BD/01	2.22
2	MBJ/BD/02	2.34
3	MBJ/BD/03	2.20
Average Specific Gravity		**2.25**

17.2.7 Average Bulk density as calculated is 2.25 g/cm^3, which is considered for calculation of ore resources of Bauxite and aluminous laterite.

CHAPTER-18

BENEFICIATION STUDIES

18.1.0 Beneficiation studies were not carried out as there is no scope of work in the present stage exploration stage.

CHAPTER-19

RESOURCE ESTIMATION TECHNIQUE

19.1.0 DISCUSSION ON DATA DENSITY TO ASSURE CONTINUITY OF MINERALISATION

19.1.1 Kachchh Basin is one of the main topographic units in the area with altitudes rising from 60m to 150 m MSL. On basin region laterite/bauxite is developed over the basaltic rock belonging to Deccan trap rocks.

19.1.2 Julrai block is over an area of 8.12 sq.km, The Julrai Block exhibits bauxite mineralization developed over the Deccan Trap basement through prolonged tropical weathering and lateritization. Mineralization occurs as a capping of bauxite-rich laterite characterized by pocket- to boulder-type deposits along the crest of hillocks localized along the north western sector of the Block area.

19.1.2 In accordance with the provisions of the Minerals (Evidence of Mineral Contents) Rules, 2015 (MEMC Rules, 2015) and based on the recommendations of the Technical-cum-Cost Committee (TCC), MECL has carried out exploratory drilling of 07 boreholes with a cumulative meterage of 96.25 m within the block. The drilling data generated during the present investigation have been utilized for geological interpretation, lithological correlation and resource estimation of bauxite and associated minerals in the area.

For the purpose of resource estimation, the bauxite resources have been classified following the Indian Bureau of Mines (IBM) end-use grade classification, wherein Metallurgical Grade-II Bauxite corresponds to Al_2O_3 > 40% and SiO_2 < 4% (total), Low Grade Bauxite corresponds to Al_2O_3 between 35–40% and SiO_2 < 10%, and Aluminous Laterite corresponds to Al_2O_3 > 20%. The analytical data obtained from drilling and sampling have been interpreted accordingly to delineate the resource categories within the block.

19.2.0 WHETHER PREVIOUS EXPLORATION DATA HAS BEEN USED

19.2.1 There is no previous data available on bauxite mineralization in the Julrai block. Abandoned adjacent mines were considered for correlation purpose.

19.3.0 THE NATURE AND APPROPRIATENESS OF THE ESTIMATION TECHNIQUE(S) APPLIED AND KEY ASSUMPTIONS

19.3.1 All boreholes were drilled as per MEMC rules 2015, amended upto 14th December 2021. Extract of Part III of MEMC rules is given below

Exploration Norms for different types of deposits for I. Bedded Stratiform and tabular deposits of regular and irregular habit: For bauxite, limestone etc. through systematic exploratory drilling at 800 m × 800 m grid spacing for depost of regular habit and at 400 m × 400 m grid spacing for deposit of irregular habit.

Provided that for deposits specified in Schedule II, 3 bore holes drilled so as to form a polygon in blocks of less than 100 hectares and 7 bore holes in blocks of more than 100 hectares may be sufficient. The lateral influence beyond the bore hole spacing may be limited to a maximum of 50 per cent. of the spacing depending on the results of surface geological mapping.

19.3.2 Accordingly, Bauxite, Titanium Oxide and other associated mineral resources are estimated by "**Polygon Method**". The polygonal map with geology is placed as Plate-VI.

19.4.0 THE BASIS FOR CLASSIFICATION OF THE MINERAL RESOURCES

19.4.1 As per MEMC rules 2015, amended upto 14th December 2021. Part III and given in para 19.3.1, the mineral resource in the block area is categorized as inferred Mineral Resource (333) code as per UNFC system.

19.5.0 THE ASSUMPTIONS MADE REGARDING RECOVERY OF BY PRODUCTS

19.5.1 During diagenesis, epigenesis and weathering processes leaching and dislocation of Si and Fe leads to continuous aluminium enrichment in lateritic bauxites and in bauxites formed over parent rock in duricrust and bauxite zones. The trace elements present in parent rock displaced several times during this process. In saprolite zone certain trace elements like Ti, Sc, Ga and V may become enriched to such an extent that they form deposits and are minable as by products. Elements like Cr and Zr become enriched in basal Saprolite horizon due to their association with weathering resistant chromites and zircon of parent rock, while Ni, Co and P concentrate via solution. Ga in particular precipitates in reducing environment and become enriched

19.5.2 Scandium, Vanadium (V) and Gallium (Ga) anomalous zones were demarcated based on >50ppm Sc, >500ppm V and >50ppm Ga, however samples below these anomalous values are also considered where zone is demarcated. Thus, from primary analytical data Scandium (Sc) has thickness ranging between Max 3.20m in BH MBJ-

06 and Min 1.00 in MBJ-08, Vanadium (V) anomalous zones have thickness ranging between Max 17.00m in BH MBJ-01 and Min 1.00 in MBJ-08 and for Gallium (Ga) anomalous zones has thickness ranging between Max 6.00 m in MBJ-06 and Min 1.00 in MBJ-04.

19.5.3 About 20 nos. of samples from lithomarge have been submitted for analysed for REE elements by ICPMS method, Total REE in these samples range from Min 14.30 ppm and Max 1203.42ppm, out of 20 nos of samples only 2 samples show more than 1000ppm. Details are submitted as Annexure -IIIE.

19.6.0 DETAILED DESCRIPTION OF THE METHOD USED AND THE ASSUMPTIONS MADE TO ESTIMATE TONNAGE AND GRADES

19.6.1 The Bauxite ore resource and grade have been estimated by "**Polygon Method**", and estimated resources placed under inferred (333) category of UNFC considering the following parameters and assumptions.

1. **Cut-off Grade**: This is the most significant artificial boundary demarcating low grade mineralization and techno economically viable ore that can be exploited at a profit**.** The cut off of bauxite was considered as per IBM End use classification.
2. **By products**: TiO_2, 2% is considered as a byproduct with bauxite/clay. Resource of Sc, Ga, V have been estimated at 50, 50 and 500ppm cut off criteria.
3. **Minimum Stopping Width and Maximum Parting:** For bulk minerals such as bauxite, the minimum stoppable thickness is generally considered to be 2 m. However, in the present study area, the bauxite horizons occur with comparatively lesser thickness and show irregular and discontinuous distribution. In view of these geological characteristics, the minimum stoppable thickness has been considered as 1.00m for the purpose of resource estimation in the block.
4. **Correlation of ore lodes:** Correlation of ore lodes were done along NS and EW section lines.
5. **Description of lodes:** The mineralised zones occur as i) irregular bedded and ii) boulder type with varying thickness.
6. **Preparation of LV sections:** Not Applicable
7. **Preparation of Level Plan:** Not Applicable
8. **Bulk Density: as given in chapter 17,** Average Bulk density i.e., 2.25 g/cm^3, is considered for calculation of bauxite ore resources
9. An overall deduction factor of 10% has been applied to the total gross tonnage to derive the net in-situ geological resources of the deposit. This deduction accounts

for inherent geological uncertainties and operational limitations associated with the exploration data. The factors considered include variations in core recovery during drilling, irregular and discontinuous nature of the bauxite horizons, and abrupt lateral and vertical changes in the thickness of the mineralized zones. Application of this deduction ensures a conservative and realistic estimation of resources, in accordance with standard geological resource estimation practices and UNFC-based reporting.

10. All boreholes were laid on 600 to 800m spacing as given in para no 10.4.1 and all boreholes are vertically drilled. The area of influence is taken as 50% where adjacent boreholes are positive or bauxite occurs as outcrop or nala or cliff sections or local quarry is present. Area of influence of positive boreholes restricted upto litho boundary of laterite/bauxitic horizon. So, the influence area for each Boreholoe is taken as 300 m and 400 m along strike direction and along the direction perpendicular to strike respectively on either side of the location point. The areas falling outside the direct influence of boreholes have not been considered for estimation of resources as the mineralization is very erratic and irregular in nature. The mineral resource estimated through polygon method but area of laterite boundary has been considered for resource estimation only. Wherever the mineralised zone is not continuing further, the area of influence is considered as the actual distance from the sample location measured. The area of influence is taken as the area of the polygon from which the sample has been collected.

11. Since the aluminous laterite and bauxite band is exposed on the surface with no overburden, the thickness of the bauxite band is measured from the exposed section in some place where only bed rock sample analysis available with no boreholes. Where ever the base of bauxite is not exposed, pits at the base are excavated to know the vertical continuity as well as thickness. The band with thickness less than 1 m thick has been discarded from resource calculation.

12. An intermediate bauxite zone exhibiting slightly higher silica content (>4%) and marginally lower Al_2O_3 values (<40%) has also been considered during resource estimation under the Metallurgical Grade-II bauxite category, wherever the average grade of the cumulative sample intervals within a borehole satisfies the prescribed grade criteria. Such intermediate grade material is considered mineable and can be suitably blended with higher grade bauxite occurring within the block to achieve the desired metallurgical specifications.

13. Similarly, for Low Grade Bauxite, zones exhibiting Al_2O_3 values marginally below 35% and silica slightly exceeding 10% have been included in the resource estimation where the average grade of the cumulative sample intervals conforms broadly to the classification limits. These zones have been considered on the basis that grade variation within lateritic bauxite deposits is often gradual and selective mining and blending practices can optimize the overall ore quality during beneficiation or utilization.

14. In areas where surface exposures of bauxite or aluminous laterite are present but no boreholes have been drilled, the resources and grade characteristics have been estimated based on data obtained from pits and bedrock/chip samples collected during detailed geological mapping and pitting operations. The thickness of the respective bauxite or aluminous laterite horizon in such areas has been inferred from the nearest boreholes or available geological sections in the adjoining areas. The lithological continuity observed in the field, together with the analytical results of these samples, has been used to reasonably infer the presence, thickness and quality of bauxite/aluminous laterite horizons for the purpose of resource estimation.

19.6.2 **Exploration Data for Resource Estimation:** During the present investigation, Geological Map prepared on 1:4000 scale, a total of 96.25 m drilling in 07 Boreholes was taken into consideration for evaluation of resources in the block.

19.6.3 Analysis of total 89 no of samples indicated that

(a) Average thickness of Metallurgical Grade II bauxite is intercepted in the 01 no boreholes drilled is 6.50m, with Min thickness of 0.40m (MBJ-06) and maximum 6.50m (MBJ-01). Depth of intersection of these zones varies from 0.00m (MBJ-01) to 2.50m (MBJ-06).

(b) In the Metallurgical Grade II bauxite zones demarcated, Al_2O_3 varies from Min 36.71% (MBJ-01) and Max 41.29% (MBJ-01) and SiO_2 varies from Min 1.14% (MBD-01) and Max 6.54% (MBJ-01).

(c) In the Low-Grade bauxite zones demarcated, Al_2O_3 varies from Min 35.53% (MBJ-05) and Max 44.98% (MBJ-06) and SiO_2 varies from Min 4.52% (MBJ-06) and Max 7.76% (MBJ-01).

(d) Average thickness of Aluminous Laterite is intercepted in the 07 no boreholes drilled by MECL is 5.97 m, with Min thickness of 0.50m (MBJ-06) and maximum 11.00m (MBJ-02). Depth of intersection of these zones varies from 0.00m (MBJ-02).

(e) TiO_2 is present in all the lithologies intercepted, hence 2% cut-off is considered for demarcating the zone.

(f) SC, V, Ga is present in all the lithologies intercepted, hence >50ppm,>50ppm and >500ppm respectively cut-off is considered for demarcating the zone.

(g) Details of Zone are given below.

(h) Table-19.1

(i) Details Of Metallurgical Grade II Bauxite zones from exploratory boreholes drilled by MECL in Julrai block, district - Kachchh, Gujarat

(j) Zones demarcated based on Al_2O_3>40**%** and SiO_2 ≤04**%**

Borehole	From (m)	To (m)	Thickness (m)	Al_2O_3 %	SiO_2 %	Fe_2O_3 %	TiO_2 %	LOI %	SC (ppm)	V (ppm)	Ga (ppm)
MBJ-01	1.00	7.50	6.50	40.00	3.85	31.51	5.42	17.79	21.72	632.76	41.91
Cumulative			**6.50**	**40.00**	**3.85**	**31.51**	**5.42**	**17.79**	**21.72**	**632.76**	**41.91**

Table-19.2

Details Of Low-Grade Bauxite zones from exploratory boreholes drilled by MECL in Julrai block, district - Kachchh, Gujarat

Zones demarcated based on Al_2O_3 35% to 40% and SiO2≤10%

Borehole	From (m)	To (m)	Thickness (m)	Al_2O_3 %	SiO_2 %	Fe_2O_3 %	TiO_2 %	LOI %	SC (ppm)	V (ppm)	Ga (ppm)
MBJ-01	0.00	1.00	1.00	36.20	5.00	35.25	4.35	17.30	18.79	696.47	57.66
	7.50	16.50	9.00	39.65	7.66	18.60	6.41	20.97	32.78	807.23	59.49
MBJ-05	0.00	5.90	5.90	35.53	6.65	22.35	5.90	19.44	27.06	768.99	58.30
MBJ-06	0.50	3.60	3.10	44.98	4.52	17.26	7.81	23.91	31.10	801.42	57.68
Cumulative			**19.00**	**39.06**	**6.70**	**20.42**	**6.37**	**20.78**	**30.00**	**788.58**	**58.73**

Table-19.3

Details of Aluminous Laterite zones from exploratory boreholes drilled by MECL in Julrai block, district - Kachchh, Gujarat

(Zones demarcated based on Al_2O_3 ≥20%)

Borehole	From (m)	To (m)	Thickness (m)	Al_2O_3 %	SiO_2 %	Fe_2O_3 %	TiO_2 %	LOI %	SC (ppm)	V (ppm)	Ga (ppm)
MBJ-02	0.00	11.00	11.00	30.43	7.30	32.97	5.33	19.95	20.40	693.65	43.52
MBJ-04	0.00	6.40	6.40	28.24	11.21	35.49	5.16	17.76	24.41	916.62	47.99
MBJ-06	0.00	0.50	0.50	35.67	10.51	26.34	5.99	18.89	22.89	857.17	54.68
MBJ-07	0.00	2.50	2.50	23.32	25.53	33.19	3.35	12.75	33.75	488.54	37.36
MBJ-08	0.00	2.00	2.00	22.45	24.38	32.92	3.70	14.82	43.01	536.42	38.42
Cumulative			**22.40**	**28.42**	**12.05**	**33.56**	**4.93**	**18.04**	**25.11**	**724.07**	**43.90**

Table-19.4
Details of TiO_2 zones from exploratory boreholes drilled by MECL in Julrai block, district - Kachchh, Gujarat
Zones demarcated based on Zones demarcated based on TiO_2 >2%

Borehole	From (m)	To (m)	Thickness (m)	Al_2O_3 %	SiO_2 %	Fe_2O_3 %	TiO_2 %	LOI %	SC (ppm)	V (ppm)	Ga (ppm)
MBJ-01	0.00	17.00	17.00	40.24	6.60	25.92	5.97	19.91	27.73	734.01	52.66
MBJ-02	0.00	12.70	12.70	29.85	10.21	31.73	5.19	19.35	23.64	665.12	42.34
MBJ-04	0.00	12.70	12.70	19.83	12.01	21.92	3.60	12.19	23.59	599.17	32.59
MBJ-05	0.00	6.90	6.90	36.67	9.22	25.89	5.92	20.59	31.42	789.34	37.74
MBJ-06	0.00	10.00	10.00	33.01	18.40	22.88	5.89	18.44	42.07	839.62	20.62
MBJ-07	0.00	8.00	6.00	25.02	30.64	25.24	3.80	13.18	43.86	562.87	37.03
MBJ-08	0.00	5.90	5.90	18.02	22.69	25.07	3.00	12.34	36.86	415.12	29.87
Cumulative			59.30	32.01	10.82	25.79	5.27	17.97	28.81	714.62	39.01

Table-19.5
Details of Scandium zones from exploratory boreholes drilled by MECL in Julrai block, district - Kachchh, Gujarat
Zones demarcated based on Zones demarcated based on Sc >50ppm

Borehole	From (m)	To (m)	Thickness (m)	Al_2O_3 %	Fe_2O_3 %	SiO_2 %	TiO_2 %	LOI %	SC (ppm)	V (ppm)	Ga (ppm)
MBJ-04	7.00	9.00	2.00	29.89	34.40	13.52	5.34	15.80	61.13	721.43	41.61
MBJ-06	6.80	10.00	3.20	28.75	32.81	17.84	5.39	14.06	56.96	984.55	44.54
MBJ-07	2.50	4.50	2.00	26.85	32.40	21.41	4.08	13.49	53.93	604.77	38.09
MBJ-08	1.00	2.00	1.00	24.76	26.78	28.68	3.69	14.66	50.04	591.88	38.61
Cumulative			8.20	28.08	32.36	18.98	4.85	14.42	56.40	779.86	41.53

Table-19.6
Details of Vanadium zones from exploratory boreholes drilled by MECL in Julrai block, district - Kachchh, Gujarat
Zones demarcated based on Zones demarcated based on V >500ppm

Borehole	From (m)	To (m)	Thickness (m)	Al_2O_3 %	SiO_2 %	Fe_2O_3 %	TiO_2 %	LOI %	SC (ppm)	V (ppm)	Ga (ppm)
MBJ-01	0.00	17.00	17.00	40.24	6.60	25.92	5.97	19.91	27.73	734.01	52.66
MBJ-02	0.00	12.70	12.70	29.85	10.21	31.73	5.19	19.35	23.64	665.12	42.34
MBJ-04	0.00	9.00	9.00	27.98	16.94	30.93	5.08	17.20	33.28	845.49	45.99
MBJ-05	0.00	6.90	6.90	36.67	9.22	25.89	5.92	20.59	31.42	789.34	56.05
MBJ-06	0.00	10.00	10.00	33.01	18.40	22.88	5.89	18.44	42.07	839.62	20.62
MBJ-07	1.50	8.00	4.50	25.84	32.98	21.70	3.96	7.63	39.73	597.40	36.82
MBJ-08	1.00	2.00	1.00	24.76	26.78	28.68	3.69	14.66	50.04	591.88	38.61

Borehole	From (m)	To (m)	Thickness (m)	Al_2O_3 %	SiO_2 %	Fe_2O_3 %	TiO_2 %	LOI %	SC (ppm)	V (ppm)	Ga (ppm)
	4.50	5.90	1.40	25.52	38.79	13.86	4.73	13.74	51.05	564.03	34.53
Cumulative			62.50	33.20	13.94	26.80	5.45	18.14	32.14	743.15	43.08

Table-19.7
Details of Gallium zones from exploratory boreholes drilled by MECL in Julrai block, district - Kachchh, Gujarat
Zones demarcated based on Zones demarcated based on Ga > 50ppm

Borehole	From (m)	To (m)	Thickness (m)	Al_2O_3 %	SiO_2 %	Fe_2O_3 %	TiO_2 %	LOI %	SC (ppm)	V (ppm)	Ga (ppm)
MBJ-01	0.00	2.00	2.00	37.22	4.47	35.37	4.68	17.00	18.94	694.73	65.61
MBJ-01	7.00	13.50	6.50	43.92	7.97	17.73	7.17	22.10	30.96	750.45	69.03
MBJ-02	0.00	1.50	1.50	33.27	11.90	29.91	5.02	18.21	16.87	899.55	53.26
MBJ-04	0.00	1.00	1.00	32.92	5.17	33.23	6.78	16.94	27.63	1063.59	60.96
MBJ-05	0.00	4.40	4.40	38.69	6.65	24.90	6.72	21.04	29.53	884.96	64.24
MBJ-06	0.00	5.00	5.00	39.05	7.76	22.63	6.82	22.18	33.48	805.38	56.08
Cumulative			**20.40**	**39.62**	**7.44**	**23.86**	**6.56**	**20.85**	**28.89**	**813.78**	**62.93**

19.7.0 METHODOLOGY ADOPTED IN POLYGON METHOD OF RESOURCE ESTIMATION

19.7.1 Following methodology has been adopted while computation of various grades of laterite/bauxite ore zones.

19.7.2 **POLYGON METHOD:**

The polygon method has been adopted for estimation of bauxite and aluminous laterite resources in the block. The principal objective of this method is to delineate the area of influence of each borehole intersecting the aluminous laterite/bauxite horizons and to estimate the corresponding resource within that defined influence zone.

The area of influence around each borehole has been determined by constructing polygons through perpendicular bisectors drawn between adjoining boreholes, thereby forming polygonal networks that define the limits of influence for each drilling point. The areas of influence of individual boreholes were calculated using AutoCAD software, ensuring accurate determination of polygonal blocks.

Within each polygonal block, the cumulative thickness of the bauxite horizon intercepted in the corresponding borehole has been considered for resource estimation.

In zones where borehole control is absent, the thickness of the lateritic bauxite horizon has been inferred from nearby geological sections, or surface exposures. For resource estimation, the area of each polygon was restricted to the mapped extent of the laterite–bauxite bodies and supported by geological and exploration evidence. No projection of mineralization beyond the established geological continuity was considered, thereby ensuring a conservative and geologically realistic assessment of resources.

The grade assigned to each polygon block corresponds to the weighted average grade of the bauxite samples obtained from the respective borehole. In areas where the influence of boreholes is absent, the analytical results of pit and bedrock samples have been considered for assigning grade values. Based on these parameters, the resources of bauxite and aluminous laterite have been estimated using the polygon method, applying the standard formula for resource calculation as given below:

$$R = P_A \times Th \times Bulk\ Density$$

Where, P_A = Area of Polygon

Th= Thickness of bauxite zone/ Aluminous Laterite

R= Resource/ Tonnage

19.8.0 DESCRIPTION OF THE GEOLOGICAL INTERPRETATION USED TO CONTROL THE RESOURCE ESTIMATES

19.8.1 The resource has been estimated by Polygon method as per MEMC Rules 2015. An overall deduction of 10% (as good recovery) is applied to the total gross tonnage to arrive at the geological net in-situ resource of Various Bauxite ores to account for data gaps, irregular nature of deposit and abrupt change in zone thickness etc.

19.8.2 The lateritic bauxite horizon in the study area occurs as surface exposures, generally devoid of significant overburden, except for a thin veneer of ironstone observed locally at a few places. The lateritic bauxite band is manifested as a series of elevated linear ridges within the block. These ridges exhibit variable orientation across different parts of the area, trending NNE–SSW in the north-western and western sectors, E–W in the eastern sector, and nearly N–S in the south-central part of the block.

19.8.3 In the South-western and central part of the block, the lateritic bauxite band extends for a strike length of approximately 1.00 km to 1.5 km, with a width ranging between

70 m and 176 m. The thickness of the bauxite horizon varies from about 1.00 m to 16.00 m, locally attaining a maximum thickness of up to 16 m in certain section.

19.8.4 In the eastern part of the block, the lateritic bauxite band exhibits a strike length of about 450 m, with the width varying from 60 m to 70 m. The thickness of the bauxite horizon in this sector ranges from 1.00 m to 3.00 m. Overall, the bauxite occurs as a lateritic cap forming low ridge-like geomorphological features, reflecting its resistance to erosion and its development over the underlying lithological units.

CHAPTER-20

REPORTING OF RESOURCES

20.1.0 RESOURCE AND GRADE

20.1.1 Assessment **of Bauxite:** The mineralized zones occur as i) irregular bedded with varying thickness type. Details of mineralized zone thickness are summarized in the table- 19.1 to 19.2. The resource estimated at IBM End use classification grade by Polygon method.

20.1.2 Metallurgical Grade II Bauxite net resources of **0.22 MT is estimated with an average grade of alumina 40.00% and SiO_2 3.85%, Fe_2O_3 31.51% TiO_2 5.42%, Sc 21.72 ppm, V 632.76** ppm and **Ga 41.91 ppm (Table 20.1).** The resource estimated at $Al_2O_3 \geq 40$ % and $SiO2 \leq 4\%$ cut-off.

20.1.3 Low Grade Bauxite net resources of **14.67 MT is estimated with an average grade of alumina 38.65% and SiO_2 6.38%, Fe_2O_3 20.66% TiO_2 6.41%, Sc 29.12 ppm, V 783.48** ppm and **Ga 58.43 ppm (Table 20.2).** The resource estimated at $Al_2O_3 \geq 35$ to 40% and SiO2 to $\leq 10\%$ cut-off.

20.1.3 Aluminous Laterite resources of **24.59 MT is estimated with an average grade of alumina 28.26% and SiO_2 12.43%, Fe_2O_3 33.68% TiO_2 4.89%, Sc 25.24 ppm, Ga 44.01** ppm and **V 730.74 ppm (Table 20.3).** The resource estimated at $Al_2O_3 \geq 20\%$ cut-off.

20.1.4 **Assessment of TiO_2:** TiO_2 has been recorded in all lithounits viz. Metallurgical Grade II bauxite, Low Grade bauxite, aluminous laterite and clay horizons. The average TiO_2% is 5.42 % in Metallurgical grade II bauxite Zone, 6.42% in low grade bauxite zone and 4.89% in Aluminous Laterite zone. A resource of **67.89 MT** has been estimated for TiO_2% cutoff of 2%, with average grade of 4.76% TiO2 in the Bauxite, Laterite and clay zone which has average alumina 28.39%, SiO_2 14.87% **(Table: 20.4).**

20.1.5 **Gallium (Ga)** resources of **16.92 MT is estimated with an average grade of Ga 61.27 ppm, Vanadium 845.76 ppm, Scandium 29.25 ppm, alumina 38.62% and silica 7.44%, TiO_2 6.58% (Table: 20.5).** The resource estimated at $Ga \geq 50$ppm cutoff. The Gallium resource includes Metallurgical Grade II bauxite, Low Grade bauxite, aluminous laterite and clay horizons.

20.1.6 **Scandium (Sc)** resources of **9.56 MT is estimated with an average grade of Sc 56.56 ppm, alumina 28.14% and silica 18.71%, TiO_2 4.84% and V 768.96 ppm (Table: 20.6).** The resource estimated at $Sc \geq 50$ppm cutoff. The scandium zones include Metallurgical Grade II bauxite, Low Grade bauxite, aluminous laterite and clay horizons

20.1.7 **Vanadium (V)** resources of **58.11 MT is estimated with an average grade of V 748.38 ppm, Ga 41.54 ppm, Sc 33.21 ppm, alumina 31.68% and silica 15.75%, TiO_2 5.33% (Table: 20.6).** The resource estimated at V≥ 500 ppm cutoff. The Vanadium zones include Metallurgical Grade II bauxite, Low Grade bauxite, aluminous laterite and clay horizons.

Table No.20.1

SUMMARY OF ESTIMATED POLYGON WISE, BOREHOLE WISE INFERRED CATEGORY OF RESOURCES (333) OF METALLURGICAL GRADE-II BAUXITE (POLYGONAL METHOD) IN JULRAI BLOCK, DISTRICT - KUCHCHH, GUJARAT.

(at IBM cut off for bauxite >40% Al2O3% and ≤4% SiO2%)

Bulk Density: 2.25

Sl. No.	BH No.	Polygon Area (m^2)	Thickness (m)	Volume (m^3)	Gross Geological Resources (tonnes)	Net Geological Resources (tonnes)	Average Quality							
							Al_2O_3 %	SiO_2 %	Fe_2O_3 %	TiO_2 %	LOI %	Sc (ppm)	V (ppm)	Ga (ppm)
1	MBJ-01	16639.49	6.50	108156.71	243352.60	219017.34	40.00	3.85	31.51	5.42	17.79	21.72	632.76	41.91
Total Geological resources of Bauxite with grade in tonnes					**243352.60**	**219017.34**	**40.00**	**3.85**	**31.51**	**5.42**	**17.79**	**21.72**	**632.76**	**41.91**
Total Geological resources for Bauxite with grade in million tonnes					**0.24**	**0.22**								

Table No.20.2

SUMMARY OF ESTIMATED POLYGON WISE, BOREHOLE WISE INFERRED CATEGORY OF RESOURCES (333) OF LOW-GRADE BAUXITE (POLYGONAL METHOD) IN JULRAI BLOCK, DISTRICT - KUCHCHH, GUJARAT.
(at IBM cut off for bauxite 35% to 40% Al2O3% and ≤10% SiO2%)

Sl. No.	BH No.	Polygon Area (m^2)	Thickness (m)	Volume (m^3)	Gross Geological Resources (tonnes)	Net Geological Resources (tonnes)	Average Quality							
							Bulk Density: 2.25							
							Al_2O_3 %	SiO_2 %	Fe_2O_3 %	TiO_2 %	LOI %	Sc (ppm)	V (ppm)	Ga (ppm)
1	MBJ-01	193048.66	1.00	193048.66	434359.48	390923.53	36.20	5.00	35.25	4.35	17.30	18.79	696.47	57.66
	MBJ-01	193048.66	9.00	1737437.91	3909235.29	3518311.76	39.65	7.66	18.60	6.41	20.97	32.78	807.23	59.49
5	MBJ-05	626175.13	5.90	3694433.26	8312474.84	7481227.35	35.53	6.65	22.35	5.90	19.44	27.06	768.99	58.30
6	MBJ-06	521951.48	3.10	1618049.59	3640611.57	3276550.42	44.98	4.52	17.26	7.81	23.91	31.10	801.42	57.68
Total Geological resources of Low-grade Bauxite in tonnes					**16296681.17**	**14667013.06**	**38.65**	**6.38**	**20.66**	**6.41**	**20.75**	**29.12**	**783.48**	**58.43**
Total Geological resources for Low grade bauxite in million tonnes					**16.30**	**14.67**								

Table No.20.3

SUMMARY OF ESTIMATED POLYGON WISE, BOREHOLE WISE INFERRED CATEGORY OF RESOURCES (333) OF ALUMINOUS LATERITE (POLYGONAL METHOD) IN JULRAI BLOCK, DISTRICT - KACHCHH, GUJARAT.
(at IBM cut off for Aluminous laterite min 20%)

Bulk Density: 2.25

Sl. No.	BH No.	Polygon Area (m^2)	Thickness (m)	Volume (m^3)	Gross Geological Resources (tonnes)	Net Geological Resources (tonnes)	Average Quality							
							Al_2O_3 %	SiO_2 %	Fe_2O_3 %	TiO_2 %	LOI %	Sc (ppm)	V (ppm)	Ga (ppm)
1	MBJ-02	482929.3	11.00	5312222.51	11952500.65	10757250.59	30.43	7.30	32.97	5.33	19.95	20.40	693.65	43.52
2	MBJ-04	625916.7	6.40	4005866.66	9013199.98	8111879.98	28.24	11.21	35.49	5.16	17.76	24.41	916.62	47.99
3	MBJ-06	521951.5	0.50	260975.74	587195.42	528475.87	35.67	10.51	26.34	5.99	18.89	22.89	857.17	54.68
4	MBJ-07	686437.4	2.50	1716093.47	3861210.32	3475089.29	23.32	25.53	33.19	3.35	12.75	33.75	488.54	37.36
5	MBJ-08	424374.5	2.00	848749.01	1909685.28	1718716.75	22.45	24.38	32.92	3.70	14.82	43.01	536.42	38.42
Total Geological resources of Aluminous Laterite with grade in tonnes					**27323791.65**	**24591412.48**	**28.26**	**12.43**	**33.68**	**4.89**	**17.83**	**25.24**	**730.74**	**44.01**
Total Geological resources for Aluminous Laterite with grade in million tonnes					**27.32**	**24.59**								

Table No.20.4

SUMMARY OF ESTIMATED POLYGON WISE, BOREHOLE WISE INFERRED CATEGORY OF RESOURCES (333) OF TiO_2 (POLYGONAL METHOD) IN JULRAI BLOCK, DISTRICT - KACHCHH, GUJARAT.

(at IBM cut off TiO_2 >2%)

Sl. No.	BH No.	Polygon Area (m^2)	Thickness (m)	Volume (m^3)	Gross Geological Resources (tonnes)	Net Geological Resources (tonnes)	Average Quality							
							Al_2O_3 %	SiO_2 %	Fe_2O_3 %	TiO_2 %	LOI %	Sc (ppm)	V (ppm)	Ga (ppm)
1	MBJ-01	193048.66	17.00	3281827.16	7384111.10	6645699.99	40.24	6.60	25.92	5.97	19.91	27.73	734.01	52.66
2	MBJ-02	482929.32	12.70	6133202.36	13799705.30	12419734.77	29.85	10.21	31.73	5.19	19.35	23.64	665.12	42.34
3	MBJ-04	625916.67	12.70	7949141.65	17885568.72	16097011.84	19.83	12.01	21.92	3.60	12.19	23.59	599.17	32.59
4	MBJ-05	626175.13	6.90	4320608.39	9721368.88	8749231.99	36.67	9.22	25.89	5.92	20.59	31.42	789.34	37.74
5	MBJ-06	521951.48	10.00	5219514.80	11743908.30	10569517.47	33.01	18.40	22.88	5.89	18.44	42.07	839.62	20.62
6	MBJ-07	686437.39	6.00	4118624.34	9266904.76	8340214.28	25.02	30.64	25.24	3.80	13.18	43.86	562.87	37.03
7	MBJ-08	424374.51	5.90	2503809.59	5633571.58	5070214.42	18.02	22.69	25.07	3.00	12.34	36.86	415.12	29.87
Total Geological resources of Titanim Oxide with grade in tonnes					**75435138.63**	**67891624.77**	**28.39**	**14.87**	**25.41**	**4.76**	**16.44**	**31.37**	**668.17**	**35.48**
Total Geological resources for Titainium Oxide with grade in million tonnes					**75.44**	**67.89**								

Table No.20.5

SUMMARY OF ESTIMATED POLYGON WISE, BOREHOLE WISE INFERRED CATEGORY OF RESOURCES (333) OF GALLIUM (Ga) (POLYGONAL METHOD) IN JULRAI BLOCK, DISTRICT - KACHCHH, GUJARAT.
(at cut off Ga ≥50ppm)

Bulk Density: 2.25

Sl. No.	BH No.	Polygon Area (m^2)	Thickness (m)	Volume (m^3)	Gross Geological Resources (tonnes)	Net Geological Resources (tonnes)	Average Quality							
							Al_2O_3 %	SiO_2 %	Fe_2O_3 %	TiO_2 %	LOI %	Sc (ppm)	V (ppm)	Ga (ppm)
1	MBJ-01	193048.66	8.50	1640913.58	3692055.55	3322849.99	42.34	7.14	21.88	6.58	20.90	28.13	737.34	68.22
2	MBJ-02	482929.32	1.50	724393.98	1629886.45	1466897.81	33.27	11.90	29.91	5.02	18.21	16.87	899.55	53.26
4	MBJ-04	625916.67	1.00	625916.67	1408312.50	1267481.25	32.92	5.17	33.23	6.78	16.94	27.63	1063.59	60.96
5	MBJ-05	626175.13	4.40	2755170.57	6199133.78	5579220.40	38.69	6.65	24.90	6.72	21.04	29.53	884.96	64.24
6	MBJ-06	521951.48	5.00	2609757.40	5871954.15	5284758.74	39.05	7.76	22.63	6.82	22.18	33.48	805.38	56.08
Total Geological resources of Gallium grade in tonnes					**18801342.43**	**16921208.18**	**38.62**	**7.44**	**24.66**	**6.58**	**20.81**	**29.25**	**845.76**	**61.27**
Total Geological resources for Gallium grade in million tonnes					**18.80**	**16.92**								

Table No.20.6

SUMMARY OF ESTIMATED POLYGON WISE, BOREHOLE WISE INFERRED CATEGORY OF RESOURCES (333) OF SCANDIUM (Sc) (POLYGONAL METHOD) IN IN JULRAI BLOCK, DISTRICT - KACHCHH, GUJARAT.
(at cut off Sc ≥50ppm)

Bulk Density: 2.25

Sl. No.	BH No.	Polygon Area (m^2)	Thickness (m)	Volume (m^3)	Gross Geological Resources (tonnes)	Net Geological Resources (tonnes)	Average Quality							
							Al_2O_3 %	Fe_2O_3 %	SiO_2 %	TiO_2 %	LOI %	Sc (ppm)	V (ppm)	Ga (ppm)
1	MBJ-04	625916.67	2.00	1251833.33	2816624.99	2534962.50	29.89	34.40	13.52	5.34	15.80	61.13	721.43	41.61
2	MBJ-06	521951.48	3.20	1670244.74	3758050.66	3382245.59	28.75	32.81	17.84	5.39	14.06	56.96	984.55	44.54
3	MBJ-07	686437.39	2.00	1372874.78	3088968.25	2780071.43	26.85	32.40	21.41	4.08	13.49	53.93	604.77	38.09
4	MBJ-08	424374.51	1.00	424374.51	954842.64	859358.38	24.76	26.78	28.68	3.69	14.66	50.04	591.88	38.61
Total Geological resources of Scandium with grade in tonnes					**10618486.55**	**9556637.89**	**28.14**	**32.57**	**18.71**	**4.84**	**14.41**	**56.56**	**768.96**	**41.35**
Total Geological resources for Scandium with grade in million tonnes					**10.62**	**9.56**								

Table No.20.7

SUMMARY OF ESTIMATED POLYGON WISE, BOREHOLE WISE INFERRED CATEGORY OF RESOURCES (333) OF VANADIUM (V) (POLYGONAL METHOD) IN JULRAI BLOCK, DISTRICT - KACHCHH, GUJARAT.
(at cut off V ≥500ppm)

Bulk Density: 2.25

Sl. No.	BH No.	Polygon Area (m^2)	Thickness (m)	Volume (m^3)	Gross Geological Resources (tonnes)	Net Geological Resources (tonnes)	Average Quality							
							Al_2O_3 %	SiO_2 %	Fe_2O_3 %	TiO_2 %	LOI %	Sc	V (ppm)	Ga (ppm)
1	MBJ-01	193048.66	17.00	3281827.16	7384111.10	6645699.99	40.24	6.60	25.92	5.97	19.91	27.73	734.01	52.66
2	MBJ-02	482929.32	12.70	6133202.36	13799705.30	12419734.77	29.85	10.21	31.73	5.19	19.35	23.64	665.12	42.34
4	MBJ-04	625916.67	9.00	5633249.99	12674812.48	11407331.23	27.98	16.94	30.93	5.08	17.20	33.28	845.49	45.99
5	MBJ-05	626175.13	6.90	4320608.39	9721368.88	8749231.99	36.67	9.22	25.89	5.92	20.59	31.42	789.34	56.05
6	MBJ-06	521951.48	10.00	5219514.80	11743908.30	10569517.47	33.01	18.40	22.88	5.89	18.44	42.07	839.62	20.62
7	MBJ-07	686437.39	4.50	3088968.25	6950178.57	6255160.71	25.84	32.98	21.70	3.96	7.63	39.73	597.40	36.82
8	MBJ-08	424374.51	2.40	1018498.82	2291622.34	2062460.10	25.20	33.79	20.04	4.29	14.12	50.63	575.63	36.23
Total Geological resources of V grade in tonnes					**64565706.96**	**58109136.26**	**31.68**	**15.75**	**26.92**	**5.33**	**17.56**	**33.21**	**748.38**	**41.54**
Total Geological resources for V grade in million tonnes					**64.57**	**58.11**								

20.2.0 COMPUTATION OF AVERAGE GRADE:

20.2.1 All calculations for grade estimation for bauxite zone are made by weighted average method. Since the sample interval was uniformly maintained along with different litho-units, the length of the sample was mostly maintained at 1.00m interval with the exception of litho-unit variations, and any structural implications. The, weighted average has been calculated by the following formula:

$$\text{Weighted average grade} = \frac{V1 \times G1 + V2 \times G2 + V3 \times G3 + \ldots\ldots\ldots\ldots + Vn \times Gn}{V1 + V2 + V3 + \ldots\ldots\ldots\ldots + Vn}$$

Here `V' = Volume of bauxite ore in individual borehole

`G'= Grade of the respective bauxite ore in the corresponding borehole

20.3.0 CATEGORY OF RESOURCE:

20.3.1 The bauxite in this area is relatively irregular and always not correlated with adjoining boreholes and Pit unequivocally in all the places, so the Total estimated resources in Julrai block are placed under "Inferred Mineral Resource" (333) category of UNFC.

20.3.2 The area under investigation falls under 333 categories of resources under UNFC nomenclature. However as per the Minerals (Evidence of Mineral Contents) Rules, 2015, amended upto 14th Dec 2021, a geological study report has been prepared conforming to Part IVA of Schedule-I."

CHAPTER-21

SUMMARY AND RECOMMENDATIONS

21.1.0 DISCUSSION ON THE OUTCOME OF THE EXPLORATION WORK DETAILING THE NATURE OF THE DEPOSIT

21.1.1 The Preliminary Exploration (G-3 stage) undertaken in the Julrai Block, District Kachchh, Gujarat, covering an area of approximately 8.12 sq. km, has successfully established the occurrence of lateritic bauxite mineralization developed over the Deccan Trap basaltic terrain. The exploration programme was carried out under the aegis of National Mineral Exploration Trust (NMET) with the objective of delineating the occurrence, thickness, grade characteristics and resource potential of bauxite and associated minerals within the block.

21.1.2 The exploration programme comprised detailed geological mapping on 1:4000 scale, topographical survey, exploratory drilling, systematic sampling, laboratory analysis, petrographic studies and bulk density determination, which collectively generated reliable geological and analytical data for interpretation of the deposit and estimation of mineral resources. As part of the approved scope of work, five boreholes were drilled with a cumulative meterage of about 96.25 m, along with systematic sampling of the laterite–bauxite horizons encountered during drilling.

21.1.3 Geologically, the study area forms part of the Kachchh Basin, where extensive lateritic weathering profiles have developed over the Deccan Trap basaltic basement. The bauxite mineralization in the block is of geochemical origin, formed through prolonged tropical weathering, de-silicification and residual enrichment processes acting upon the basaltic parent rocks. These processes have resulted in progressive removal of mobile constituents and enrichment of relatively immobile elements such as aluminium, iron and titanium, leading to the development of lateritic bauxite horizons within the weathering profile.

21.1.4 The bauxite mineralization within the block occurs predominantly as lateritic capping deposits developed over basaltic bedrock, forming ridge-like geomorphological features within the study area. The mineralized zones generally occur as irregular bedded bodies with variable thickness, reflecting the influence of geomorphology, structural controls and intensity of lateritic weathering.

21.1.5 In the South-western and central part of the block, the lateritic bauxite band extends for a strike length of approximately 1.00 km to 1.5 km, with a width ranging between 70 m and 176 m. The thickness of the bauxite horizon varies from about 1.00 m to 16.00 m, locally attaining a maximum thickness of up to 16 m in certain section.

21.1.6 In the eastern part of the block, the lateritic bauxite band exhibits a strike length of about 450 m, with the width varying from 60 m to 70 m. The thickness of the bauxite horizon in this sector ranges from 1.00 m to 3.00 m. Overall, the bauxite occurs as a lateritic cap forming low ridge-like geomorphological features, reflecting its resistance to erosion and its development over the underlying lithological units.

21.1.7 Lithologically, the lateritic weathering profile in the block comprises a sequence of laterite, bauxite, clayey bauxite, bauxitic clay, lithomargic clay and saprolitic zones, developed over the basaltic basement. The bauxite horizon generally occurs in the middle portion of the lateritic profile and represents the zone of maximum alumina enrichment.

21.1.8 Chemical analysis of the core samples indicates that the bauxite occurring within the block predominantly falls under Metallurgical Grade-II category as per IBM end-use classification, characterized by Al_2O_3 content exceeding 40% and relatively low silica content. In addition to metallurgical grade bauxite, the lateritic profile also hosts low-grade bauxite and aluminous laterite horizons, reflecting variations in the intensity of lateritization.

21.1.9 During the course of exploration, 89 primary core samples were generated and analysed for major oxides including Al_2O_3, SiO_2, Fe_2O_3, TiO_2 and LOI, along with trace elements such as Vanadium (V), Scandium (Sc) and Gallium (Ga). Analytical accuracy and data reliability were ensured through external check analysis carried out at NABL accredited laboratories, which showed excellent agreement with the primary analytical results.

21.1.9 For the purpose of resource estimation, the Polygon Method has been adopted in accordance with the provisions of the Minerals (Evidence of Mineral Contents) Rules, 2015 (MEMC Rules). The estimation considered the area of influence of individual boreholes, thickness of the mineralized horizon and average bulk density of 2.25 g/cm³, determined from representative core samples.

21.1.10 Based on the available geological, drilling and analytical data, the total geological resources of Metallurgical Grade-II Bauxite have been estimated at approximately 0.24 million tonnes, with an average Al_2O_3 grade of about 40.00% and SiO_2 around 3.85%. After applying standard geological deductions to account for irregularity of the deposit and possible data gaps, the net in-situ geological resource is estimated at approximately 0.22 million tonnes. Low Grade Bauxite have been estimated at approximately 12.68 million tonnes, with an average Al_2O_3 grade of about 38.37% and SiO_2 around 6.02%. After applying standard geological deductions to account for irregularity of the deposit and possible data gaps, the net in-situ geological resource is estimated at approximately 11.41 million tonnes.

21.1.11 Considering the limited borehole spacing and irregular nature of the mineralized zones, the estimated resources have been restricted under classification under Inferred Mineral Resource category (UNFC Code-333) only in accordance with the provisions of the MEMC Rules, 2015. The areas falling outside the direct influence of boreholes have not been considered for estimation of resources.

21.1.12 The exploration carried out in the Julrai Block thus establishes the presence of lateritic bauxite mineralization of metallurgical grade quality, occurring as residual lateritic caps developed over basaltic terrain, representing a typical lateritic bauxite deposit model.

21.1.13 The delineated bauxite mineralization within the block exhibits favourable grade characteristics and occurs in near-surface horizons with minimal overburden, which is a typical feature of lateritic bauxite deposits. The occurrence of metallurgical grade bauxite with comparatively high alumina content and moderate silica levels indicates potential suitability for alumina extraction and other industrial applications.

21.1.14 In addition, the presence of trace elements such as Scandium, Vanadium and Gallium within the lateritic profile enhances the strategic significance of the deposit, as these elements are increasingly recognized as critical minerals for advanced technologies and energy applications.

21.1.15 Apart from aluminium, the bauxite deposits of the Julrai Block show elevated value of several strategic elements including TiO_2, scandium (Sc), gallium (Ga) and vanadium (V). These elements are increasingly recognized as critical minerals due to their applications in advanced technologies, aerospace alloys, electronics and energy storage systems.

21.1.18 Scandium is widely used in high-strength aluminium alloys and solid oxide fuel cells, while gallium plays an important role in semiconductor and photovoltaic industries. Vanadium is an important component in steel alloys and vanadium redox batteries used for energy storage.

21.1.19 Metallurgical Grade II Bauxite net resources of **0.22 MT is estimated with an average grade of alumina 40.00% and SiO_2 3.85%, Fe_2O_3 31.51% TiO_2 5.42%, Sc 21.72 ppm, V 632.76** ppm and **Ga 41.91 ppm (Table 20.1).** The resource estimated at $Al_2O_3 \geq$ 40 % and SiO2≤ 4% cut-off.

21.1.20 Low Grade Bauxite net resources of **14.67 MT is estimated with an average grade of alumina 38.65% and SiO_2 6.38%, Fe_2O_3 20.66% TiO_2 6.41%, Sc 29.12 ppm, V 783.48** ppm and **Ga 58.43 ppm (Table 20.2).** The resource estimated at $Al_2O_3 \geq$35 to 40% and SiO2 to ≤ 10% cut-off.

21.1.21 Aluminous Laterite resources of **24.59 MT is estimated with an average grade of alumina 28.26% and SiO_2 12.43%, Fe_2O_3 33.68% TiO_2 4.89%, Sc 25.24 ppm, Ga 44.01** ppm and **V 730.74 ppm (Table 20.3).** The resource estimated at $Al_2O_3 \geq$ 20% cut-off.

21.1.22 **Assessment of TiO_2:** TiO_2 has been recorded in all lithounits viz. Metallurgical Grade II bauxite, Low Grade bauxite, aluminous laterite and clay horizons. The average TiO_2% is 5.42 % in Metallurgical grade II bauxite Zone, 6.42% in low grade bauxite zone and 4.89% in Aluminous Laterite zone. A resource of **67.89 MT** has been estimated for TiO_2% cutoff of 2%, with average grade of 4.76% TiO2 in the Bauxite, Laterite and clay zone which has average alumina 28.39%, SiO_2 14.87% **(Table: 20.4).**

21.1.23 **Gallium (Ga)** resources of **16.92 MT is estimated with an average grade of Ga 61.27 ppm, Vanadium 845.76 ppm, Scandium 29.25 ppm, alumina 38.62% and silica 7.44%, TiO_2 6.58% (Table: 20.5).** The resource estimated at Ga≥ 50ppm cutoff. The Gallium resource includes Metallurgical Grade II bauxite, Low Grade bauxite, aluminous laterite and clay horizons.

21.1.24 **Scandium (Sc)** resources of **9.56 MT is estimated with an average grade of Sc 56.56 ppm, alumina 28.14% and silica 18.71%, TiO_2 4.84% and V 768.96 ppm (Table: 20.6).** The resource estimated at Sc≥ 50ppm cutoff. The scandium zones include Metallurgical Grade II bauxite, Low Grade bauxite, aluminous laterite and clay horizons

21.1.25 **Vanadium (V)** resources of **58.11 MT is estimated with an average grade of V 748.38 ppm, Ga 41.54 ppm, Sc 33.21 ppm, alumina 31.68% and silica 15.75%, TiO_2 5.33% (Table: 20.6).** The resource estimated at V≥ 500 ppm cutoff. The Vanadium zones include Metallurgical Grade II bauxite, Low Grade bauxite, aluminous laterite and clay horizons.

21.1.26 The presence of these elements within the bauxite-laterite profile suggests that the deposits may hold additional economic significance beyond conventional aluminium production. Detailed geochemical investigation and metallurgical studies may therefore be undertaken in future exploration stages to evaluate the potential recovery of these associated critical elements.

21.2.0 RECOMMENDATIONS

21.2.1 Considering the geological characteristics, thickness variation and grade distribution of the bauxite horizons delineated during the present investigation, the following recommendations are proposed for further evaluation of the deposit.

21.2.2 The bauxite mineralization is very erratic and irregular in nature in Julrai Block. The south western lateritic bauxite showing encouraging results. The other part of the laterite not reveals any good grade of bauxitisation.

21.2.3 Considering the above geological setting and occurrence of lateritic bauxite horizons within the block, no further exploration for bauxite is recommended.

21.2.4 The central part of the block is characterized by the occurrence of good-quality fossiliferous limestone exhibiting encouraging chemical and lithological characteristics. In view of its observed continuity and potential economic significance, the limestone horizon may be considered for systematic exploration involving detailed geological mapping, exploratory drilling, and geochemical studies to evaluate its resource potential. However, such exploration may be taken up subject to the restoration of conducive field conditions and resolution of the prevailing local issues in the area.

CHAPTER-22

PLATES AND MAPS

22.1.0 As mentioned in Index.

CHAPTER-23

ANNEXURE / ENCLOSURES TO THE REPORT

23.1.0 The report includes all the relevant annexure and maps/plans, sections photographs and photomicrographs etc.

CHAPTER-24

ANY OTHER INFORMATION

24.1.0 No Such information is required to be mentioned additionally.

CHAPTER-25

CERTIFICATE FROM THE QUALIFIED PERSON WITH NAME, DATE AND SIGNATURE

This is to certify that the Preliminary Exploration (G3) for Bauxite, Titanium and Associated Minerals in the Julrai Block, District Kachchh, State Gujarat, has been carried out by Mineral Exploration & Consultancy Limited (MECL) in accordance with the prescribed technical standards, procedures, and guidelines laid down in: NMEDT/MECL-approved Exploration Methodology for G3 Stage

The exploration activities—including geological mapping, sampling, drilling, core logging, sample preparation, laboratory analysis, QA/QC validation and data processing—were executed under the supervision of qualified MECL geoscientists and technical personnel.

It is further certified that the geological data, borehole logs, analytical results, interpretations, and resource estimation incorporated in the present Geological Report are based on the primary exploration data generated during the course of investigation and have been verified to the extent possible through standard validation and quality control procedures.

The resource estimation presented in this report has been carried out in accordance with the prevailing UNFC and MEMC guidelines.

श्रीकान्त शर्मा
30/05/2026

NAME: SHRIKANT SHARMA

DESIGNATION: HoD (EXPLORATION)

DATE: 30-05-2026

HOD (Exploration)
M.E.C.L., Nagpur
विभाग प्रमुख (गवेषण)
एम.ई.सी.एल., नागपुर

LIST OF PERSONNEL ASSOCIATED WITH DETAILED EXPLORATION (G-3) FOR BAUXITE AND ASSOCIATED MINERALS IN JULRAI BLOCK (8.12 SQKM) DISTRICT-KACHCHH, GUJARAT

1	Overall guidance	Shri P. Ravindran, Retired GM (Exploration)/ Shrikant Sharma (HoD-Exploration)
2	Overall Planning, Co-ordination & Supervision	Shri Swarup Dhara, Sr. Manager (Geology)
3	Project Management	Shri Khusiram, Manager (Drilling) / Shri Anil Tiwary, Manager (Drilling)/ Project Manager
4	Physical Execution of work	
	Geological work	Shri Shubham Kumar, Senior Geologist Shri Hiresh Shrirame, Young Professional (Geology)
5	Sample Processing	Shri Ankush Wagh, Sampling Technician Shri Pushparaj Tiwary, Sampling Technician Smt. Shikha, Sampling Technician
6	Chemical Laboratory	Shri Rohit Sharma, Manager (Chemical Lab)
		Dr. Deepti Rahangdale, Manager (Chemical Lab)
7	Petrographic Studies	Shri Sayantan Pal, Manager (Geology)
8	Documentation	Swarup Dhara, Sr. Manager (Geology)
		Shri Shubham Kumar, Senior Geologist
		Smt. Moumita Ghosh, Asst. Manager (Geology)
		Shri Uday Patil, Sr. Computer Operator
10	Reprography and Printing	Shri Pratap Negi, OIC, Survey & Map Officer
		Shri Durgesh Devarshee, Assistant Survey & Map Officer
		Shri Punit Khandale, Sr. Technician (S & D)
11	Proposal Formulation	Smt. Moumita Ghosh, Asst. Manager (Geology)

LOCALITY INDEX

Sl. No.	Village	Latitude	Longitude	Toposheet
1	Kotda	23°28'56.83"N	68°54'43.74"E	41A/14
2	Mata no Madh	23°32'33.14"N	68°56'58.83"E	41A/14
3	Murchmana	23°30'41.61"N	68°52'31.78"E	41A/14
4	Suja Vandh	23°33'11.46"N	68°51'47.25"E	41A/14

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ABBREVIATIONS USED

SL. No.	Abbreviation	Full form
1	M / m	Meter
2	Cu m	Cubic Meter
4	RL	Reduced Level
5	mRL	Reduced Level in metre
6	M.S.L.	Mean sea level
7	IBM	Indian Bureau of Mines
8	GSI	Geological Survey of India
9	NMET	National Mineral Exploration Trust
10	TCC	Technical cum Cost Committee
11	EC	Executive Committee
12	MMDR	Mines and Minerals (Development and Regulation)
13	MEMC	Minerals (Evidence of Mineral Contents)
14	MECL	Mineral Exploration and Consultancy Limited
15	NABL	National Accreditation Board for Testing and Calibration Laboratories
16	QA/QC	Quality Assessment/ Quality Checks
17	WGS-84	World Geodetic System-84
18	DMS	Degree Minute Second
19	UTM	Universal Transverse Mercator
20	F.S.P.	Field Season Programme
21	DGPS	Differential Global Positioning System
22	XRF	X-ray Fluorescence
23	ICP-MS	Inductively Coupled Plasma Mass Spectrometry
24	BDL	Below Detection Limit
25	MT	Million Tonnes
26	XRD	X-ray Diffractometer

ANNEXURE

Statement Showing Coordinates of Corner Points for Julrai block, District - Kachchh, Gujarat

		DMS (WGS-84)				
SR. NO.	CORNER POINT	LATITUDE	LONGITUDE	EASTING	NARTHING	RL (M)
1	A	23°29'20.64162"N	68°46'06.10761"E	476347.849	2597680.089	72.147
2	B	23°29'39.00811"N	68°46'05.58853"E	476334.037	2598244.919	82.041
3	C	23°30'50.73608"N	68°47'02.24515"E	477944.280	2600448.197	110.572
4	D	23°31'05.53014"N	68°48'38.23698"E	480667.042	2600899.302	90.479
5	E	23°29'17.93434"N	68°47'35.33712"E	478878.603	2597592.974	81.188

ANNEXURE-II-A/1

Particulars of Boreholes Drilled by MECL (MBJ-01 To MBJ-08) in Julrai block, District-Kachchh, Gujarat

SR. No.	BH ID	DMS (WGS84)		UTM 42N (WGS84)		RL (M)
		LATITUDE	LONGITUDE	EASTING	NARTHING	
1	MBJ-01	23° 29' 43.83815" N	68° 46' 15.23996" E	476608.013	2598393.013	85.045
2	MBJ-02	23° 29' 37.26198" N	68° 46' 48.54977" E	477552.445	2598189.307	111.381
3	MBJ-04	23° 29' 50.75390" N	68° 47' 16.00346" E	478331.717	2598603.040	101.331
4	MBJ-05	23° 30' 00.06823" N	68° 47' 33.24810" E	478821.221	2598888.761	97.993
5	MBJ-06	23° 29' 59.36880" N	68° 47' 02.13037" E	477938.649	2598868.553	107.830
6	MBJ-07	23° 30' 40.53236" N	68° 47' 45.87104" E	479180.990	2600132.602	106.108
7	MBJ-08	23° 30' 51.23145" N	68° 47' 58.87587" E	479550.251	2600461.102	95.473
SURVEY OF INDIA (DAYAPAR)		2613490.249	489981.079	103.834		

Project file data		Coordinate System	
Name:		Name:	World wide/UTM
Size:		Zone:	42 North
Modified:		Datum:	WGS 1984
Time zone:		Global reference datum:	WGS 1984
Reference number:		Global reference epoch:	
Description:		Geoid:	EGM96 (Global)
Comment 1:		Vertical datum:	
Comment 2:		Calibrated site:	
Comment 3:			

DETAILED RUN-WISE LITHOLOGS OF BOREHOLES DRILLED BY MECL,JULRAI BLOCK, DISTRICT - KACHCHH, GUJARAT

Bore hole No. MBJ-01

Northing- 2598393.013 | **Date of Commencement: 08.11.2025**
Easting- 476608.013 | **Date of Closure: 13.11.2025**
R.L.(m): 85.045 | **Total Depth (m) :18.70**

Depth (m)		Run (m)	Recovery (m)	Recovery %	Colour	Lithology	Remarks
From	To						
0.00	0.50	0.50	0.45	90.00%	Pale Yellow	Bauxite	Pisolitic Texture
0.50	1.00	0.50	0.37	74.00%	Reddish Brown	Bauxite	Pisolitic Texture
1.00	1.60	0.60	0.51	85.00%	Reddish Brown	Bauxite	Pisolitic Texture
1.60	2.00	0.40	0.43	107.50%	Reddish Brown	Bauxite	Pisolitic Texture
2.00	2.30	0.30	0.19	63.33%	Reddish Brown	Bauxite/Lateritic Bauxite	Pisolitic Texture
2.30	2.60	0.30	0.24	80.00%	Reddish Brown	Bauxite/Lateritic Bauxite	Pisolitic Texture
2.60	2.90	0.30	0.28	93.33%	Reddish Brown	Bauxite/Lateritic Bauxite	Pisolitic Texture
2.90	3.10	0.20	0.20	100.00%	Reddish Brown	Bauxite/Lateritic Bauxite	Pisolitic Texture
3.10	3.50	0.40	0.48	120.00%	Reddish Brown	Bauxite/Lateritic Bauxite	Pisolitic Texture
3.50	4.00	0.50	0.42	84.00%	Reddish Brown	Bauxite/Lateritic Bauxite	Pisolitic Texture
4.00	4.50	0.50	0.44	88.00%	Dark Reddish	Bauxite/Lateritic Bauxite	Pisolitic Texture
4.50	5.00	0.50	0.45	90.00%	Reddish Brown	Bauxite/Lateritic Bauxite	Pisolitic Texture
5.00	5.50	0.50	0.50	100.00%	Reddish Brown	Bauxite/Lateritic Bauxite	Pisolitic Texture
5.50	6.00	0.50	0.50	100.00%	Pinkish	Bauxite	Pisolitic Texture
6.00	6.50	0.50	0.48	96.00%	Pinkish	Bauxite	Pisolitic Texture
6.50	7.00	0.50	0.50	100.00%	Pinkish	Bauxite	Pisolitic Texture
7.00	7.50	0.50	0.45	90.00%	Reddish Brown	Bauxite/Lateritic Bauxite	
7.50	8.00	0.50	0.50	100.00%	Buff/Earthy	Bauxite/Lateritic Bauxite	
8.00	8.50	0.50	0.50	100.00%	Buff/Earthy	Bauxite/Clayey Bauxite	
8.50	9.00	0.50	0.48	96.00%	Buff/Earthy	Bauxite/Clayey Bauxite	
9.00	9.50	0.50	0.47	94.00%	Buff/Earthy	Bauxite/Clayey Bauxite	
9.50	10.00	0.50	0.50	100.00%	Buff/Earthy	Bauxite/Clayey Bauxite	
10.00	10.50	0.50	0.50	100.00%	Buff/Earthy	Bauxite/Clayey Bauxite	
10.50	11.00	0.50	0.44	88.00%	Reddish	Bauxite/Clayey Bauxite	
11.00	11.50	0.50	0.49	98.00%	Reddish	Bauxite/Clayey Bauxite	

Depth (m)		Run (m)	Recovery (m)	Recovery %	Colour	Lithology	Remarks
From	To						
11.50	12.00	0.50	0.5	100.00%	Reddish	Bauxite/Clayey Bauxite	
12.00	12.50	0.50	0.44	88.00%	Reddish	Bauxite/Clayey Bauxite	
12.50	13.00	0.50	0.49	98.00%	Reddish	Laterite	
13.00	13.50	0.50	0.49	98.00%	Reddish	Laterite	
13.50	14.00	0.50	0.45	90.00%	Reddish	Laterite	
14.00	14.50	0.50	0.50	100.00%	Reddish	Laterite	
14.50	15.00	0.50	0.45	90.00%	Reddish	Laterite	
15.00	15.50	0.50	0.50	100.00%	Reddish	Laterite	
15.50	16.00	0.50	0.49	98.00%	Reddish	Laterite	
16.00	16.50	0.50	0.50	100.00%	Reddish Green/ Greenish	Laterite	
16.50	17.00	0.50	0.50	100.00%	Reddish Green/ Greenish	Laterite	
17.00	17.50	0.50	0.40	80.00%	Reddish Green/ Greenish	Saprolite	
17.50	18.00	0.50	0.50	100.00%	Reddish Green/ Greenish	Saprolite	
18.00	18.50	0.50	0.38	76.00%	Reddish Green/ Greenish	Saprolite	
18.50	18.70	0.20	0.2	100.00%	Reddish Green/ Greenish	Basalt	

Bore hole No. MBJ-02

Northing- 2598189.307
Easting- 477552.445
R.L.(m): 111.381

Date of Commencement: 14.11.2025
Date of Closure: 19.11.2025
Total Depth (m) :19.50

Depth (m)		Run (m)	Recovery (m)	Recovery %	Colour	Lithology	Remarks
From	To						
0.00	0.50	0.50	0.48	96.00%	Reddish Brown	Bauxite/Lateritic Bauxite	
0.50	1.00	0.50	0.49	98.00%	Reddish Brown	Bauxite/Lateritic Bauxite	
1.00	1.50	0.50	0.47	94.00%	Buff	Bauxite	
1.50	2.00	0.50	0.50	100.00%	Reddish Brown	Bauxite/Lateritic Bauxite	
2.00	2.50	0.50	0.50	100.00%	Reddish Brown	Bauxite/Lateritic Bauxite	
2.50	3.00	0.50	0.49	98.00%	Buff	Bauxite	
3.00	3.50	0.50	0.48	96.00%	Buff	Bauxite	
3.50	4.00	0.50	0.50	100.00%	Buff	Bauxite	
4.00	4.30	0.30	0.30	100.00%	Buff	Bauxite	
4.30	4.50	0.20	0.20	100.00%	Buff	Bauxite	
4.50	5.00	0.50	0.52	104.00%	Buff	Laterite/Aluminous laterite	
5.00	5.50	0.50	0.48	96.00%	Buff	Laterite/Aluminous laterite	
5.50	6.00	0.50	0.50	100.00%	Pinkish	Laterite/Aluminous laterite	
6.00	6.50	0.50	0.49	98.00%	Pinkish	Laterite/Aluminous laterite	
6.50	7.00	0.50	0.50	100.00%	Pinkish	Bauxite	
7.00	7.50	0.50	0.50	100.00%	Reddish/Pinkish	Bauxite	
7.50	8.00	0.50	0.50	100.00%	Reddish	Laterite	
8.00	8.50	0.50	0.49	98.00%	Reddish/Pinkish	Laterite	
8.50	9.00	0.50	0.49	98.00%	Reddish/Brownish	Laterite	
9.00	9.50	0.50	0.50	100.00%	Reddish/Brownish	Laterite	
9.50	10.00	0.50	0.43	86.00%	Reddish/Brownish	Laterite	
10.00	10.50	0.50	0.43	86.00%	Reddish/Brownish	Laterite	
10.50	11.00	0.50	0.50	100.00%	Reddish	Laterite	
11.00	11.50	0.50	0.41	82.00%	Brownish	Variegated Clay	

Depth (m)		Run (m)	Recovery (m)	Recovery %	Colour	Lithology	Remarks
From	To						
11.50	12.00	0.50	0.52	104.00%	Brownish	Variegated Clay	
12.00	12.50	0.50	0.5	100.00%	Varigated	Variegated Clay	
12.50	12.74	0.24	0.24	100.00%	Varigated	Variegated Clay	
12.74	12.80	0.06	0.06	100.00%	Yellow	Limonitic Clay	
12.80	13.10	0.30	0.3	100.00%	Yellow	Limonitic Clay	
13.10	13.40	0.30	0.30	100.00%	Yellow	Limonitic Clay	
13.40	13.70	0.30	0.29	96.67%	Yellow	Limonitic Clay	
13.70	14.00	0.30	0.30	100.00%	Yellow	Limonitic Clay	
14.00	14.25	0.25	0.24	96.00%	Yellow	Limonitic Clay	
14.25	14.50	0.25	0.23	92.00%	Yellow	Limonitic Clay	
14.50	14.75	0.25	0.24	96.00%	Yellow	Limonitic Clay	
14.75	15.00	0.25	0.25	100.00%	Yellowish	Clay with Laterite	
15.00	15.25	0.25	0.25	100.00%	Yellowish	Clay with Laterite	
15.25	15.50	0.25	0.20	80.00%	Yellowish	Clay with Laterite	
15.50	16.00	0.50	0.40	80.00%	Yellowish	Clay with Laterite	
16.00	16.30	0.30	0.30	100.00%	Yellowish	Clay with Laterite	
16.30	16.60	0.30	0.30	100.00%	Yellowish	Clay with Laterite	
16.60	16.80	0.20	0.20	100.00%	Varigated	Clay	
16.80	17.00	0.20	0.20	100.00%	Varigated	Clay	
17.00	17.50	0.50	0.40	80.00%	Greenish	Altered Basalt	
17.50	18.00	0.50	0.50	100.00%	Greenish	Altered Basalt	
18.00	18.50	0.50	0.50	100.00%	Greenish	Altered Basalt	
18.50	19.00	0.50	0.50	100.00%	Greenish	Altered Basalt	
19.00	19.50	0.50	0.40	80.00%	Black	Basalt	

Bore hole No. MBJ-04

Northing- 2598603.04
Easting- 478331.717
R.L.(m)- 101.331

Date of Commencement: 25.11.2025
Date of Closure: 28.11.2025
Total Depth (m) :14.50

Depth (m)		Run (m)	Recovery (m)	Recovery %	Colour	Lithology	Remarks
From	To						
0.00	0.50	0.50	0.49	98.00%	Reddish Pink	Bauxite	
0.50	1.00	0.50	0.48	96.00%	Reddish Pink	Bauxite	
1.00	1.50	0.50	0.50	100.00%	Reddish Pink	Laterite	
1.50	2.00	0.50	0.48	96.00%	Reddish Pink	Laterite	
2.00	2.30	0.30	0.29	96.67%	Reddish Pink	Laterite	
2.30	2.80	0.50	0.48	96.00%	Pinkish	Laterite	
2.80	3.10	0.30	0.30	100.00%	Pinkish	Laterite	
3.10	3.30	0.20	0.20	100.00%	Pinkish	Laterite	
3.30	3.50	0.20	0.20	100.00%	Reddish Pink	Laterite	
3.50	3.80	0.30	0.30	100.00%	Reddish	Laterite	
3.80	4.10	0.30	0.30	100.00%	Pinkish	Aluminous Laterite	
4.10	4.30	0.20	0.18	90.00%	Pinkish	Aluminous Laterite	
4.30	4.50	0.20	0.20	100.00%	Pinkish	Aluminous Laterite	
4.50	4.70	0.20	0.20	100.00%	Pinkish	Aluminous Laterite	
4.70	5.00	0.30	0.22	73.33%	Pinkish	Aluminous Laterite	
5.00	5.25	0.25	0.25	100.00%	Buff	Aluminous Laterite	
5.25	5.50	0.25	0.25	100.00%	Buff	Aluminous Laterite	
5.50	5.75	0.25	0.25	100.00%	Buff	Aluminous Laterite	
5.75	6.00	0.25	0.25	100.00%	Pinkish	Aluminous Laterite	
6.00	6.40	0.40	0.40	100.00%	Reddish Pink	Aluminous Laterite	
6.40	6.50	0.10	0.10	100.00%	Reddish	Lateritic Clay	
6.50	7.00	0.50	0.50	100.00%	Reddish	Laterite	
7.00	7.40	0.40	0.40	100.00%	Yellow	Limonitic Clay	
7.40	7.50	0.10	0.10	100.00%	Varigated	Limonitic Clay	
7.50	8.00	0.50	0.45	90.00%	Yellow	Limonitic Clay	
8.00	8.50	0.50	0.50	100.00%	Yellow	Limonitic Clay	
8.50	9.00	0.50	0.48	96.00%	Yellow	Limonitic Clay	
9.00	9.50	0.50	0.45	90.00%	Yellow	Limonitic Clay	

Depth (m)		Run (m)	Recovery (m)	Recovery %	Colour	Lithology	Remarks
From	To						
9.50	10.00	0.50	0.48	96.00%	Yellow	Limonitic Clay	
10.00	10.50	0.50	0.48	96.00%	Yellow	Limonitic Clay	
10.50	11.00	0.50	0.45	90.00%	Greenish	Clay/Altered Basalt	Clay with Grey Colour Pebble
11.00	11.50	0.50	0.46	92.00%	Yellow	Limonitic Clay	
11.50	12.00	0.50	0.50	100.00%	Blackish Yellow	Limonitic Clay	Limonitic Clay Intermixed with Altered Basalt
12.00	12.50	0.50	0.46	92.00%	Greenish	Saprolite	Limonitic Clay Intermixed with Altered Basalt
12.50	12.80	0.30	0.30	100.00%	Greenish	Saprolite	
12.80	13.00	0.20	0.20	100.00%	Greenish Yellow	Saprolite	
13.00	13.50	0.50	0.40	80.00%	Greenish Yellow	Altered Basalt	
13.50	13.90	0.40	0.40	100.00%	Grey	Altered Basalt	
13.90	14.00	0.10	0.10	100.00%	Greenish Brown	Basalt	Weather
14.00	14.30	0.30	0.24	80.00%	Greenish Brown	Basalt	Weather
14.30	14.50	0.20	0.17	85.00%	Greenish Brown	Basalt	

Borehole No. MBJ-05

Northing- 2598888.761
Easting- 478821.221
R.L.(m)- 97.993

Date of Commencement: 01.12.2025
Date of Closure: 02.112.2025
Total Depth (m) :7.25

Depth (m)		Run (m)	Recovery (m)	Recovery %	Colour	Lithology	Remarks
From	To						
0.00	0.25	0.25	0.22	88.00%	Pinkish	Bauxite	
0.25	0.50	0.25	0.22	88.00%	Pinkish	Bauxite	
0.50	0.80	0.30	0.30	100.00%	Pinkish	Bauxite	
0.80	1.00	0.20	0.28	140.00%	Pinkish	Bauxite	
1.00	1.20	0.20	0.22	110.00%	Pinkish	Bauxite	
1.20	1.40	0.20	0.20	100.00%	Pinkish	Bauxite	
1.40	1.60	0.20	0.20	100.00%	Pinkish	Bauxite	
1.60	2.00	0.40	0.40	100.00%	Pinkish/Greyish Brown	Bauxite	
2.00	2.25	0.25	0.24	96.00%	Pinkish/Greyish Brown	Bauxite	
2.25	2.50	0.25	0.24	96.00%	Pinkish Brown	Aluminous laterite	
2.50	2.75	0.25	0.25	100.00%	Pinkish Brown	Aluminous laterite	
2.75	3.00	0.25	0.24	96.00%	Pinkish Brown	Aluminous laterite	
3.00	3.25	0.25	0.25	100.00%	Pinkish Brown	Laterite	
3.25	3.50	0.25	0.23	92.00%	Pinkish Brown	Laterite	
3.50	3.75	0.25	0.25	100.00%	Reddish Brown	Laterite	
3.75	4.00	0.25	0.24	96.00%	Reddish Brown	Laterite	
4.00	4.20	0.20	0.20	100.00%	Reddish Brown	Laterite	
4.20	4.40	0.20	0.20	100.00%	Reddish Brown	Laterite	
4.40	4.60	0.20	0.20	100.00%	Off White to Reddish	Clayey Bauxite/ Bauxite	
4.60	4.80	0.20	0.20	100.00%	Light Pink to dull Grey	Clayey Bauxite/ Bauxite	
4.80	5.00	0.20	0.20	100.00%	Light Pink to dull Grey	Clayey Bauxite/ Bauxite	
5.00	5.30	0.30	0.30	100.00%	Light Pink to dull Grey	Clayey Bauxite/ Bauxite	
5.30	5.60	0.30	0.30	100.00%	Light Pink to dull Grey	Clayey Bauxite/ Bauxite	
5.60	5.90	0.30	0.30	100.00%	Red to Brown	Bauxite	
5.90	6.20	0.30	0.30	100.00%	Cherry Red	Aluminous Clay	
6.20	6.50	0.30	0.28	93.33%	Brown to Reddish	Aluminous Clay	
6.50	6.75	0.25	0.20	80.00%	Cherry Red to Grey	Aluminous Clay	
6.75	7.00	0.25	0.25	100.00%	Cherry Red to Grey	Aluminous Clay	
7.00	7.25	0.25	0.22	88.00%	Greenish	Basalt	

Borehole No. MBJ-06

Northing- 2598868.553
Easting- 477938.649
R.L.(m)- 107.83

Date of Commencement: 21.11.2025
Date of Closure: 24.11.2025
Total Depth (m) :11.80

Depth (m)		Run (m)	Recovery (m)	Recovery %	Colour	Lithology	Remarks
From	To						
0.00	0.20	0.20	0.20	100.00%	Pinkish/Brownish	Bauxite	
0.20	0.50	0.30	0.27	90.00%	Pinkish/Brownish	Bauxite	
0.50	0.80	0.30	0.27	90.00%	Pinkish/Brownish	Bauxite	
0.80	1.10	0.30	0.30	100.00%	Pinkish/Brownish	Bauxite	
1.10	1.40	0.30	0.30	100.00%	Pinkish/Brownish	Bauxite	
1.40	1.60	0.20	0.20	100.00%	Pinkish/Brownish	Bauxite	
1.60	2.00	0.40	0.35	87.50%	Pinkish/Brownish	Bauxite	
2.00	2.25	0.25	0.25	100.00%	Pinkish/Brownish	Bauxite	
2.25	2.50	0.25	0.25	100.00%	Pinkish/Brownish	Bauxite	
2.50	2.75	0.25	0.25	100.00%	Pale Yellow	Bauxite	
2.75	3.00	0.25	0.25	100.00%	Pale Yellow	Bauxite	
3.00	3.25	0.25	0.25	100.00%	Pale Yellow	Bauxite	
3.25	3.50	0.25	0.25	100.00%	Pale Yellow	Bauxite	
3.50	3.75	0.25	0.25	100.00%	Pale Yellow	Bauxite with Limonite	
3.75	4.00	0.25	0.25	100.00%	Pale Yellow	Bauxite with Limonite	
4.00	4.30	0.30	0.27	90.00%	Pale Yellow	Bauxite with Limonite	
4.30	4.50	0.20	0.20	100.00%	Pale Yellow	Bauxite with Limonite	
4.50	4.80	0.30	0.27	90.00%	Reddish	Laterite	
4.80	5.00	0.20	0.20	100.00%	Reddish	Laterite	
5.00	5.20	0.20	0.20	100.00%	Reddish	Laterite	
5.20	5.50	0.30	0.27	90.00%	Reddish	Laterite	
5.50	6.00	0.50	0.49	98.00%	Reddish	Laterite	
6.00	6.50	0.50	0.47	94.00%	Reddish	Laterite	
6.50	6.90	0.40	0.40	100.00%	Reddish	Laterite	
6.90	7.00	0.10	0.10	100.00%	Yellow	Limonite	
7.00	7.30	0.30	0.28	93.33%	Yellow	Limonite	
7.30	7.40	0.10	0.10	100.00%	Yellow	Limonite	
7.40	7.50	0.10	0.10	100.00%	Varigated	Varigated Clay	
7.50	8.00	0.50	0.49	98.00%	Varigated	Varigated Clay	

Depth (m)		Run (m)	Recovery (m)	Recovery %	Colour	Lithology	Remarks
From	To						
8.00	8.50	0.50	0.48	96.00%	Varigated	Varigated Clay	
8.50	9.00	0.50	0.48	96.00%	Varigated	Varigated Clay	
9.00	9.50	0.50	0.47	94.00%	Varigated	Varigated Clay	
9.50	10.00	0.50	0.49	98.00%	Varigated	Varigated Clay	
10.00	10.40	0.40	0.39	97.50%	Varigated	Varigated Clay	
10.40	10.50	0.10	0.10	100.00%	Grey	Clay/Altered Basalt?	
10.50	11.00	0.50	0.49	98.00%	Grey	Clay/Altered Basalt?	
11.00	11.30	0.30	0.30	100.00%	Grey	Clay/Altered Basalt?	
11.30	11.60	0.30	0.30	100.00%	Reddish Grey	Clay/Altered Basalt?	
11.60	11.80	0.20	0.17	85.00%	Greenish	Clay/Altered Basalt?	

Borehole No. MBJ-07

Northing- 2600132.602
Easting- 479180.99
R.L.(m)- 106.108

Date of Commencement: 06.12.2025
Date of Closure: 08.12.2025
Total Depth (m) :11.50

Depth (m)		Run (m)	Recovery (m)	Recovery %	Colour	Lithology	Remarks
From	To						
0.00	0.20	0.20	0.20	100.00%	Reddish Brown	Lateritic Clay	Pinkish Brown to Reddish
0.20	0.50	0.30	0.30	100.00%	Reddish Brown	Lateritic Clay	Violet to off White, Pinkish White, Clay Feel
0.50	0.80	0.30	0.30	100.00%	Varigated	Aluminous Clay	Violet to off White, Pinkish White, Clay Feel
0.80	1.10	0.30	0.30	100.00%	Varigated	Aluminous Clay	Violet to off White, Pinkish White, Clay Feel
1.10	1.40	0.30	0.30	100.00%	Varigated	Aluminous Clay	Violet to off White, Pinkish White, Clay Feel
1.40	1.70	0.30	0.30	100.00%	Varigated	Aluminous Clay	Violet to off White, Pinkish White, Clay Feel
1.70	2.00	0.30	0.30	100.00%	Varigated	Aluminous Clay	Violet to off White, Pinkish White, Clay Feel
2.00	2.25	0.25	0.25	100.00%	Varigated	Aluminous Clay	Violet to off White, Pinkish White, Clay Feel
2.25	2.50	0.25	0.25	100.00%	Yellow to Varigated	Aluminous/ Limonitic Clay	Violet to off White, Pinkish White, Clay Feel
2.50	2.75	0.25	0.25	100.00%	Varigated	Varigated Clay	Violet to Light Pink to Reddish
2.75	3.00	0.25	0.25	100.00%	Varigated	Varigated Clay	Violet to Light Pink to Reddish

Depth (m)		Run (m)	Recovery (m)	Recovery %	Colour	Lithology	Remarks
From	To						
3.00	3.25	0.25	0.25	100.00%	Varigated	Varigated Clay	Violet to Light Pink to Reddish
3.25	3.50	0.25	0.25	100.00%	Light Yellow	Limonitic Clay	Light Yellow
3.50	3.75	0.25	0.25	100.00%	Varigated	Varigated Clay	
3.75	4.00	0.25	0.25	100.00%	Varigated	Varigated Clay	
4.00	4.25	0.25	0.25	100.00%	Varigated	Varigated Clay	
4.25	4.50	0.25	0.25	100.00%	Light Yellow	nonitic Clay/ Aluminous Clay	
4.50	4.75	0.25	0.25	100.00%	Light Yellow	nonitic Clay/ Aluminous Clay	
4.75	5.00	0.25	0.25	100.00%	Light Yellow	nonitic Clay/ Aluminous Clay	
5.00	5.30	0.30	0.30	100.00%	Light Yellow	nonitic Clay/ Aluminous Clay	
5.30	5.60	0.30	0.30	100.00%	Off White to Light Green	Clay	Seems like Clay extended on Altered Basalt Flow
5.60	5.90	0.30	0.30	100.00%	Off White to Light Green	Clay	Seems like Clay extended on Altered Basalt Flow
5.90	6.20	0.30	0.30	100.00%	Off White to Light Green	Clay	Seems like Clay extended on Altered Basalt Flow
6.20	6.50	0.30	0.30	100.00%	Varigated	Varigated Clay	Seems like Clay extended on Altered Basalt Flow
6.50	7.00	0.50	0.50	100.00%	Varigated	Varigated Clay	
7.00	7.25	0.25	0.25	100.00%	Reddish	Ferrugenous Clay	
7.25	7.50	0.25	0.24	96.00%	Varigated	Varigated Clay	
7.50	7.75	0.25	0.27	108.00%	Light Green	Bentonite?	
7.75	8.00	0.25	0.25	100.00%	Light Green	Bentonite?	Light Green Crystal embedded on Core, soft, Soapy Feel
8.00	8.50	0.50	0.48	96.00%	Light Green	Bentonite?	
8.50	8.80	0.30	0.30	100.00%	Light Green	Bentonite?	
8.80	9.10	0.30	0.30	100.00%	Light Yellow to Off White	Lithomarge Clay	
9.10	9.40	0.30	0.27	90.00%	Light Yellow to Off White	Lithomarge Clay	
9.40	9.70	0.30	0.30	100.00%	Light Yellow to Off White	Lithomarge Clay	
9.70	10.00	0.30	0.28	93.33%	Light Yellow to Off White	Lithomarge Clay	
10.00	10.30	0.30	0.30	100.00%	Light Yellow	Lithomarge Clay	
10.30	10.80	0.50	0.50	100.00%	Light Yellow to Green	Lithomarge Clay	
10.80	11.00	0.20	0.20	100.00%	Light Yellow	Saprolite	
11.00	11.50	0.50	0.50	100.00%	Green	Basalt	

Borehole No. MBJ-08

Northing- 2600461.102
Easting- 479550.251
R.L.(m)- 95.473

Date of Commencement: 10.12.2025
Date of Closure: 12.12.2025
Total Depth (m) :13.00

Depth (m)		Run (m)	Recovery (m)	Recovery %	Colour	Lithology	Remarks
From	To						
0.00	0.40	0.40	0.40	100.00%	Earthy to Reddish Brown	Lateritic Clay	
0.40	0.60	0.20	0.17	85.00%	Earthy to Reddish Brown	Lateritic Clay	
0.60	1.00	0.40	0.30	75.00%	Earthy to Reddish Brown	Lateritic Clay	
1.00	1.20	0.20	0.20	100.00%	Earthy to Reddish Brown	Lateritic Clay	
1.20	1.40	0.20	0.18	90.00%	Pinkish Red/Brown	Lateritic Clay	
1.40	1.60	0.20	0.18	90.00%	Pinkish Red/Brown	Lateritic Clay	
1.60	2.00	0.40	0.28	70.00%	Pinkish Red/Brown	Lateritic Clay	
2.00	2.25	0.25	0.25	100.00%	Yellowish Grey/Brown	Lateritic Clay	Iron Chunk embedded on core Yellow Soil/Dust.
2.25	2.50	0.25	0.25	100.00%	Yellowish Grey/Brown	Lateritic Clay	
2.50	2.75	0.25	0.20	80.00%	Yellowish Grey/Brown	Lateritic Clay	
2.75	3.00	0.25	0.25	100.00%	Yellowish Grey/Brown	Lateritic Clay	
3.00	3.25	0.25	0.20	80.00%	Yellowish Grey/Brown	Lateritic Clay	
3.25	3.50	0.25	0.25	100.00%	Yellowish Grey/Brown	Lateritic Clay	
3.50	3.75	0.25	0.22	88.00%	Reddish Brown	rrugenous Clay/Lateritic Clay	
3.75	4.00	0.25	0.24	96.00%	Reddish Brown	rrugenous Clay/Lateritic Clay	
4.00	4.20	0.20	0.18	90.00%	Light Yellow	rrugenous Clay/Lateritic Clay	
4.20	4.40	0.20	0.20	100.00%	Varigated	rrugenous Clay/Lateritic Clay	
4.40	4.60	0.20	0.20	100.00%	Varigated	rrugenous Clay/Lateritic Clay	
4.60	4.80	0.20	0.20	100.00%	Varigated	rrugenous Clay/Lateritic Clay	
4.80	5.00	0.20	0.20	100.00%	Light Green to Yellow	Limonitic Clay	Crystal like appearance, light green with light yellow Crystal seen.
5.00	5.30	0.30	0.30	100.00%	Light Green to Yellow	Limonitic Clay	
5.30	5.60	0.30	0.30	100.00%	Light Yellow to Pale Brown	Limonitic Clay	Pale Yellow, Some Crystal like Chips Seen
5.60	5.90	0.30	0.28	93.33%	Light Yellow to Pale Brown	Limonitic Clay	Embedding of other mineral Chips Seen. Pale Yellow to Brown Some Filling of Off White Colour Seen.
5.90	6.20	0.30	0.25	83.33%	Light Yellow to Pale Brown	Limonitic Clay	

Depth (m)		Run (m)	Recovery (m)	Recovery %	Colour	Lithology	Remarks
From	To						
6.20	6.50	0.30	0.30	100.00%	Pale Yellow to Off White	Limonitic Clay	Yellow to Pale Yellow with Soapy Feel, Some Grain embedded filling.
6.50	6.75	0.25	0.25	100.00%	Pale Yellow to Off White	Limonitic Clay	Yellow to Pale Yellow with Soapy Feel, Some Grain embedded filling.
6.75	7.00	0.25	0.25	100.00%	Pale Yellow to Off White	Limonitic Clay	Yellow to Pale Yellow with Soapy Feel, Some Grain embedded filling.
7.00	7.50	0.50	0.5	100.00%	Pale Yellow	Limonitic Clay	Yellow to Pale Yellow with Soapy Feel, Some Grain embedded filling.
7.50	7.75	0.25	0.25	100.00%	Pale Yellow	Limonitic Clay	
7.75	8.00	0.25	0.24	96.00%	Pale Yellow	Limonitic Clay	
8.00	8.50	0.50	0.47	94.00%	Pale Yellow	Limonitic Clay	
8.50	8.80	0.30	0.3	100.00%	Greenish Brown	Limonitic Clay	
8.80	9.10	0.30	0.3	100.00%	Greenish Brown	Limonitic Clay	
9.10	9.50	0.40	0.4	100.00%	Greenish Brown	Limonitic Clay	
9.50	10.00	0.50	0.48	96.00%	Greenish Brown	Limonitic Clay	
10.00	10.50	0.50	0.48	96.00%	Cherry Red to Greenish Brown	Limonitic Clay	Embedded crystal seen of Green Colour
10.50	11.00	0.50	0.50	100.00%	Pale Yellow to Greenish	Limonitic Clay	
11.00	11.25	0.25	0.25	100.00%	Cherry Red to Green	Limonitic Clay	
11.25	11.50	0.25	0.24	96.00%	Cherry Red to Green	Lithomerge	
11.50	11.75	0.25	0.25	100.00%	Cherry Red to Green	Lithomerge	
11.75	12.00	0.25	0.23	92.00%	Cherry Red to Green	Lithomerge	
12.00	12.25	0.25	0.24	96.00%	Light Green	Saprolite	
12.25	12.50	0.25	0.23	92.00%	Light Green	Saprolite	
12.50	13.00	0.50	0.47	94.00%	Green	Basalt	

ANNEXURE-II-C/1

DETAILS OF SUMMARIZED LITHOLOGS OF BOREHOLES DRILLED BY MECL IN JULRAI BLOCK, DISTRICT - KACHCHH, GUJARAT

BH No	From (m)	To (m)	Zone Thickness (m)	Lithology
MBJ-01	0.00	8.00	8.00	Bauxite
	8.00	9.00	1.00	Clayey Bauxite
	9.00	10.00	1.00	Bauxite
	10.00	12.50	2.50	Clayey Bauxite
	12.50	17.00	4.50	Laterite
	17.00	18.50	1.50	Saprolite
	18.50	18.70	0.20	Basalt

BH No	From (m)	To (m)	Zone Thickness (m)	Lithology
MBJ-02	0.00	2.50	2.50	Laterite
	2.50	4.50	2.00	Bauxite
	4.50	6.50	2.00	Laterite/Aluminous laterite
	6.50	7.50	1.00	Bauxite
	7.50	11.00	3.50	Laterite
	11.00	12.74	1.74	Variegated Clay
	12.74	14.75	2.01	Limonitic Clay
	14.75	16.60	1.85	Lateritic Clay
	16.60	17.00	0.40	Variegated Clay
	17.00	19.00	2.00	Saprolite
	19.00	19.50	0.50	Basalt

BH No	From (m)	To (m)	Zone Thickness (m)	Lithology
MBJ-04	0.00	1.00	1.00	Bauxite
	1.00	3.80	2.80	Laterite
	3.80	6.40	2.60	Aluminous Laterite
	6.40	7.00	0.60	Lateritic Clay
	7.00	12.00	5.00	Limonitic Clay
	12.00	13.90	1.90	Saprolite
	13.90	14.50	0.60	Basalt

BH No	From (m)	To (m)	Zone Thickness (m)	Lithology
MBJ-05	0.00	2.25	2.25	Bauxite
	2.25	3.00	0.75	Aluminous Lateite
	3.00	4.40	1.40	Laterite
	4.40	5.40	1.00	Clayey Bauxite
	5.40	7.00	1.60	Aluminous Clay
	7.00	7.25	0.25	Basalt

BH No	From (m)	To (m)	Zone Thickness (m)	Lithology
MBJ-06	0.00	0.20	0.20	Clayey Bauxite
	0.20	3.60	3.40	Bauxite
	3.60	6.00	2.40	Laterite
	6.00	8.00	2.00	Limonitic Clay
	8.00	10.50	2.50	Variegatetd Clay
	10.50	11.60	1.10	Saprolite
	11.60	11.80	0.20	Basalt

BH No	From (m)	To (m)	Zone Thickness (m)	Lithology
MBJ-07	0.00	0.50	0.50	Lateritic Clay
	0.50	2.50	2.00	Aluminous Clay
	2.50	4.25	1.75	Variegated Clay
	4.25	7.50	3.25	Limonitic Clay/ Aluminous Clay
	7.50	8.80	1.30	Bentonite
	8.80	11.00	2.20	lithomerge
	11.00	11.50	0.50	Basalt

BH No	From (m)	To (m)	Zone Thickness (m)	Lithology
MBJ-08	0.00	3.50	3.50	Lateritic Clay
	3.50	4.80	1.30	Ferrugenous Clay/Lateritic Clay
	4.80	11.25	6.45	Limonitic Clay
	11.25	12.00	0.75	Lithomerge
	12.00	12.50	0.50	Saprolite
	12.50	13.00	0.50	Basalt

Details of Chemical Analysis for Al_2O_3, SiO_2, Fe_2O_3, TiO_2 & LOI of Primary bedrock samples collected by MECL in Julrai block, District-Kachchh, Gujarat

		UTM-42N (WGS84)							
S.N.	Sample No.	Easting	Northing	Al_2O_3%	SiO_2%	Fe_2O_3%	TiO_2%	LOI %	Lithology
1	MBJ/BR/01	478520.39	2597787.96	46.01	3.94	14.02	5.11	25.53	Bauxite
2	MBJ/BR/02	478577.52	2598567.99	52.45	2.96	8.20	9.79	23.33	Pisolitic Bauxite
3	MBJ/BR/03	478696.8	2598090.3	34.32	15.90	26.67	3.03	18.58	Laterite
4	MBJ/BR/04	478697.33	2597752.64	48.46	6.41	14.39	6.57	23.32	Clayey Bauxite
5	MBJ/BR/05	479088.46	2598987.02	54.75	1.90	4.28	5.70	29.34	Bauxite
6	MBJ/BR/06	478891.99	2597970.83	45.96	9.62	17.00	4.92	21.02	Aluminous Laterite
7	MBJ/BR/07	479008.93	2598462.38	34.98	1.19	32.40	3.47	21.32	Laterite/Bauxite(Gibbsitic)
8	MBJ/BR/08	479288.4	2598737.09	36.83	1.38	29.57	3.98	24.81	Bauxite(Gibbsitic)
9	MBJ/BR/09	479404.19	2598671.24	35.50	4.24	28.40	8.40	18.53	Ferrugenous Bauxite
10	MBJ/BR/10	480312.53	2600805.18	51.64	5.68	10.89	6.84	23.78	Pisolitic Bauxite
11	MBJ/BR/11	479445.34	2599009.4	49.88	3.17	10.17	5.87	26.98	Pisolitic Bauxite
12	MBJ/BR/12	479503.54	2598889.38	58.74	1.60	4.08	6.02	28.63	Bauxite
13	MBJ/BR/13	479237.03	2599596.81	35.98	10.67	24.92	3.65	22.37	Laterite
14	MBJ/BR/14	479237.74	2599857.16	28.32	4.44	25.72	5.07	21.62	Laterite
15	MBJ/BR/15	478922.12	2600224.6	48.69	5.42	17.11	11.69	15.76	Pisolitic Bauxite
16	MBJ/BR/16	480348.58	2600403.26	33.55	3.09	27.26	5.47	23.78	Laterite
17	MBJ/BR/17	480516.82	2600634.97	39.79	4.62	26.65	5.57	20.58	Pisolitic Bauxite
18	MBJ/BR/18	480480.33	2600829.31	24.59	14.07	37.62	4.78	17.35	Laterite
19	MBJ/BR/19	480066.2	2600704.76	32.12	11.55	29.22	5.23	19.23	Aluminous Laterite
20	MBJ/BR/20	480104.11	2600805.64	28.65	7.63	29.39	6.01	20.71	Aluminous Laterite/Laterite
21	MBJ/BR/21	479816.12	2600112.08	50.76	6.44	11.47	5.55	24.55	Pisolitic Bauxite
22	MBJ/BR/22	479846.75	2599870.33	30.81	1.88	25.70	4.61	24.95	Laterite +Bauxite
23	MBJ/BR/23	479568.82	2599945.26	50.67	6.30	12.08	5.14	24.81	Bauxite

		UTM-42N (WGS84)							
S.N.	Sample No.	Easting	Northing	Al_2O_3%	SiO_2%	Fe_2O_3%	TiO_2%	LOI %	Lithology
24	MBJ/BR/24	479559.2	2600368.17	32.14	7.17	25.32	7.44	19.87	Aluminous Laterite
25	MBJ/BR/25	477361.26	2599312.11	49.42	0.65	1.86	4.18	32.84	Bauxite
26	MBJ/BR/26	477610.25	2598895.1	57.27	2.65	3.54	5.83	29.15	Aluminous Laterite/Clayey Bauxite
27	MBJ/BR/27	478052.48	2599323.98	38.03	7.24	17.98	9.06	22.80	Bauxite
28	MBJ/BR/28	477959.21	2598630.17	54.49	4.73	8.59	5.03	26.11	Pisolite Bauxite
29	MBJ/BR/29	478148.99	2598540.03	40.42	4.35	23.40	5.50	21.40	Pisolitic Bauxite
30	MBJ/BR/30	478163	2600020	33.77	9.78	29.46	4.82	20.52	Aluminous laterite
31	MBJ/BR/31	476624	2598388	54.05	5.22	3.41	9.11	24.92	Bauxite
32	MBJ/BR/32	477534	2598125	48.44	6.61	14.14	6.36	23.27	Bauxite
33	MBJ/BR/33	477455	2598049	45.59	7.45	13.83	5.64	24.25	Bauxite
34	MBJ/BR/34	477511	2597814	46.92	8.33	15.30	5.10	23.02	Ferrugenous Bauxite
35	MBJ/BR/35	476768.96	2597764.43	23.18	11.39	40.53	2.96	17.89	Laterite
36	MBJ/BR/36	477294.68	2597809.33	36.96	5.71	24.85	4.67	21.85	Aluminous Laterite
37	MBJ/BR/37	477919.79	2599098.45	44.93	1.51	17.03	6.63	22.57	Ferrugenous Bauxite
38	MBJ/BR/38	478293.86	2598943.34	41.10	3.98	20.62	6.64	21.29	Ferrugenous Bauxite
39	MBJ/BR/39	479251.93	2600434.85	22.68	15.31	43.01	3.52	13.26	Laterite
40	MBJ/BR/40	479079.48	2600057.25	45.07	3.28	13.81	3.84	27.95	Bauxite(Gibbsitic)
41	MBJ/BR/41	479486.14	2600196.68	32.87	13.97	26.52	3.86	18.98	Aluminous laterite
42	MBJ/BR/42	478133.88	2599822.04	23.80	17.08	38.93	4.97	13.22	Clay
43	MBJ/BR/43	478232.09	2599379.62	39.70	3.08	10.72	6.40	26.03	Bauxite
44	MBJ/BR/44	476346	2598203	1.32	1.39	4.09	0.20	41.16	Variegated Clay,Kaolinite
45	MBJ/BR/45	476624	2598388	0.49	0.73	0.88	0.05	42.42	Claystone
46	MBJ/BR/46	478339	2597673	1.51	2.85	2.12	0.21	41.21	Limestone
47	MBJ/BR/47	477937	2597681	39.07	4.51	30.39	3.70	18.28	Pisolitic Bauxite
48	MBJ/BR/48	478236	2597751	32.47	7.72	32.74	6.18	15.88	Aluminous Laterite
49	MBJ/BR/49	477966	2597749	2.33	2.96	2.66	0.29	40.11	Laterite

		UTM-42N (WGS84)							
S.N.	Sample No.	Easting	Northing	Al_2O_3%	SiO_2%	Fe_2O_3%	TiO_2%	LOI %	Lithology
50	MBJ/BR/50	478081	2597974	2.08	4.13	3.54	0.29	39.94	Laterite

Details of Chemical Analysis for Al_2O_3, SiO_2, Fe_2O_3, TiO_2 & LOI of Primary pit samples collected by MECL in Julrai block, District-Kachchh, Gujarat

S.N.	Pit No	UTM 42N (WGS84) Easting	UTM 42N (WGS84) Northing	Sample Collected	Sample No	Al_2O_3%	SiO_2%	Fe_2O_3%	TiO_2%	LOI %	Lithology
1	PT1	476697.00	2598475.00	2	MBJ/PT/01A	28.42	8.17	6.94	4.62	27.11	Soil: 0 - 53cm, Clayey Bauxite: 53 - 190cm
					MBJ/PT/01B	43.76	9.23	4.63	6.78	28.25	
2	PT2	477063.00	2598869.00	1	MBJ/PT/02A	39.02	11.90	4.62	2.99	26.71	Soil: 0 - 80cm, Weathered basalt + Soil (intermixed): 80 - 110cm, Altered Basalt : 110 - 200cm
3	PT3	477776.00	2599263.00	N/A							Soil: 0 - 20cm, Basalt: 20 - 80 cm
4	PT4	478346.00	2598703.00	1	MBJ/PT/04	38.16	8.69	24.01	7.15	19.32	Soil: 0 - 30cm, Pisolitic Bauxite: 30 - 80cm
5	PT5	477960.00	2598142.00	N/A							Soil: 0 - 30cm, Weathered limestone: 30 - 118cm, Limestone: 118 - 160cm
6	PT6	477933.00	2600055.00	1	MBJ/PT/06	22.19	20.61	30.61	3.18	18.95	Soil: 0 - 26cm, Weathered Basalt: 26 - 120cm, Laterite: 120 - 190cm
7	PT7	479396.00	2600558.00	1	MBJ/PT/07	16.66	1.96	20.45	4.37	22.19	Laterite: 0 - 50cm Unable to dig further
8	PT8	479939.00	2600476.00	N/A							Lateritic Soil: 0 - 16cm, Weathered Basalt: 16 - 84cm, Basalt(hard compact): 84 - 150 unable to dig further
9	PT9	479987.00	2600119.00	N/A							Soil : 0 - 225cm (Soil + Sand intermixed)

		UTM 42N (WGS84)									
S.N.	Pit No	Easting	Northing	Sample Collected	Sample No	Al_2O_3%	SiO_2%	Fe_2O_3%	TiO_2%	LOI %	Lithology
10	PT10	478749.00	2599382.00	N/A							Soil: 0 - 110cm, Clay: 110 - 130, Basalt: 130 - 180
11	PT11	479500.00	2599372.00	N/A							Soil: 0 - 20cm, Basalt: 20 - 60 cm Unable to dig further
12	PT12	476944.00	2598641.00	N/A							Soil: 0 - 80cm, weathered laterite with residual Basalt : 80-180cm, Weather Basalt: 180-230 cm
13	PT13	477508.00	2598687.00	N/A							Soil: 0 - 25cm, Ferruginous Clay: 25 -100 cm, Limonitic clay: 100 - 400
14	PT14	477709.00	2598892.00	1	MBJ/PT/14	27.04	9.40	21.48	5.16	23.66	Soil: 0 - 80cm, Laterite: 80 - 100cm, unable to dig further
15	PT15	478360.00	2597797.00	2	MBJ/PT/15B	30.37	6.96	8.35	2.62	36.77	Soil: 0 - 13cm, Weathered Limestone: 13 - 70cm, Limestone: 70 - 180cm, Ferruginous Altered Layer: 180 - 220cm, Clayey Bauxite: 220 - 280cm
16	PT16	477773.00	2599869.00	2	MBJ/PT/16A	27.03	31.40	8.01	2.55	21.57	Soil: 0 - 15cm, Weathered Laterite: 15 - 60cm, Ferruginous Clay: 60 - 140cm, Clay: 140 - 230cm
17	PT17	478149.00	2599841.00	2	MBJ/PT/17A	30.75	25.50	15.86	4.59	19.33	Soil: 0 - 20cm, Weathered Laterite: 20 - 80, Limonitic layer: 80 - 170
					MBJ/PT/17B	29.52	20.61	15.96	5.02	22.70	

DETAILS OF CHEMICAL ANALYSIS FOR Al_2O_3, SiO_2, Fe_2O_3, TiO_2, LOI, SC,V & Ga ON PRIMARY BOREHOLE SAMPLES DRILLED BY MECL IN JULRAI BLOCK, DISTRICT - KACHCHH, GUJARAT

BH.No. MBJ-01

Sl. No.	Sample No.	Depth (m)		Thick (m)	Al_2O_3 (%)	SiO_2 (%)	Fe_2O_3 (%)	TiO_2 (%)	LOI (%)	SC (PPM)	V (PPM)
		From	To								
1	MBJ-01/01	0.00	1.00	1.00	36.20	5.00	35.25	4.35	17.30	18.79	696.47
2	MBJ-01/02	1.00	2.00	1.00	38.24	3.93	35.49	5.00	16.69	19.08	693.00
3	MBJ-01/03	2.00	3.00	1.00	39.25	3.28	34.33	5.33	16.01	23.89	570.77
4	MBJ-01/04	3.00	4.00	1.00	36.71	2.12	38.32	4.47	16.67	22.99	534.71
5	MBJ-01/05	4.00	4.50	0.50	37.22	1.14	36.93	4.81	18.01	15.97	714.68
6	MBJ-01/06	4.50	5.00	0.50	41.29	3.11	29.02	5.73	19.39	21.69	808.22
7	MBJ-01/07	5.00	5.50	0.50	37.73	6.54	30.62	5.49	17.77	20.60	776.24
8	MBJ-01/08	5.50	6.00	0.50	40.78	6.39	26.59	5.81	18.94	18.96	582.45
9	MBJ-01/09	6.00	7.00	1.00	45.37	4.16	22.44	6.45	20.46	23.43	552.05
10	MBJ-01/10	7.00	7.50	0.50	43.84	5.85	25.27	6.14	17.48	26.35	643.24
11	MBJ-01/11	7.50	8.00	0.50	41.29	6.49	26.23	4.86	20.18	17.92	667.83
12	MBJ-01/12	8.00	9.00	1.00	46.90	7.55	14.21	7.20	22.83	29.02	578.22
13	MBJ-01/13	9.00	10.00	1.00	49.45	6.35	11.22	7.67	24.68	26.85	501.98
14	MBJ-01/14	10.00	10.50	0.50	44.35	8.92	14.73	7.87	22.94	28.34	620.16
15	MBJ-01/15	10.50	11.50	1.00	42.82	9.35	16.65	8.18	21.85	34.91	819.46
16	MBJ-01/16	11.50	12.50	1.00	41.80	7.52	19.72	7.79	22.14	44.71	1248.23
17	MBJ-01/17	12.50	13.50	1.00	39.76	10.38	20.36	6.31	21.82	29.47	764.40
18	MBJ-01/18	13.50	14.50	1.00	37.73	8.11	25.07	5.62	22.20	23.45	731.33
19	MBJ-01/19	14.50	15.00	0.50	37.73	6.95	26.75	5.92	21.15	40.69	956.25
20	MBJ-01/20	15.00	16.00	1.00	36.71	8.54	26.35	5.61	21.05	38.19	959.29
21	MBJ-01/21	16.00	17.00	1.00	31.10	13.22	33.21	4.12	16.88	41.38	943.67

BH.No.MBJ-02

Sl. No.	Sample No.	Depth (m)		Thick (m)	Al_2O_3 (%)	SiO_2 (%)	Fe_2O_3 (%)	TiO_2 (%)	LOI (%)	SC (PPM)	V (PPM)
		From	To								
1	MBJ-02/01	0.00	0.50	0.50	31.28	17.17	26.86	5.09	17.61	15.78	883.14
2	MBJ-02/02	0.50	1.00	0.50	33.89	9.50	31.01	4.75	19.21	15.87	806.78
3	MBJ-02/03	1.00	1.50	0.50	34.65	9.01	31.85	5.21	17.81	18.95	1008.73
4	MBJ-02/04	1.50	2.50	1.00	30.99	9.16	35.51	4.73	17.58	17.93	783.29
5	MBJ-02/05	2.50	3.00	0.50	34.10	5.66	30.07	6.29	20.35	16.54	788.39
6	MBJ-02/06	3.00	3.50	0.50	33.33	5.19	29.68	6.19	20.59	12.80	604.96
7	MBJ-02/07	3.50	4.50	1.00	30.93	4.24	26.02	6.51	22.69	22.71	564.47
8	MBJ-02/08	4.50	5.50	1.00	27.99	5.80	31.66	5.51	21.72	18.47	556.29
9	MBJ-02/09	5.50	6.50	1.00	29.99	5.43	31.79	6.12	20.72	14.50	566.43
10	MBJ-02/10	6.50	7.50	1.00	33.36	4.51	29.80	5.09	22.08	18.08	575.95
11	MBJ-02/11	7.50	8.50	1.00	30.98	7.43	35.01	4.58	19.25	26.05	659.84
12	MBJ-02/12	8.50	9.50	1.00	29.61	7.40	37.34	5.47	18.52	25.63	724.40
13	MBJ-02/13	9.50	10.50	1.00	23.91	8.92	41.61	4.35	19.15	27.57	784.08
14	MBJ-02/14	10.50	11.00	0.50	26.79	8.25	38.32	4.96	19.95	26.90	738.68
15	MBJ-02/15	11.00	12.00	1.00	26.44	28.96	23.69	4.30	15.11	44.63	491.20
16	MBJ-02/16	12.00	12.70	0.70	25.54	29.08	23.77	4.21	15.89	44.61	465.35
17	MBJ-02/17	12.70	13.70	1.00							
18	MBJ-02/18	13.70	14.70	1.00							
19	MBJ-02/19	14.70	16.50	1.80							
20	MBJ-02/20	16.50	17.50	1.00							
21	MBJ-02/21	17.50	18.50	1.00							

BH.No.MBJ-04

Sl. No.	Sample No.	Depth (m)		Thick (m)	Al_2O_3 (%)	SiO_2 (%)	Fe_2O_3 (%)	TiO_2 (%)	LOI (%)	SC (PPM)	V (PPM)
		From	To								
1	MBJ-04/01	0.00	0.50	0.50	34.72	5.11	28.82	6.20	18.53	22.61	935.48
2	MBJ-04/02	0.50	1.00	0.50	31.12	5.22	37.64	7.36	15.34	32.64	1191.70
3	MBJ-04/03	1.00	1.50	0.50	20.88	8.98	49.61	4.36	13.52	24.69	1026.31
4	MBJ-04/04	1.50	2.00	0.50	19.03	10.63	50.67	4.01	13.77	25.05	1100.30
5	MBJ-04/05	2.00	2.30	0.30	21.24	13.36	44.87	3.18	15.60	25.52	967.48
6	MBJ-04/06	2.30	2.80	0.50	22.56	13.36	41.84	3.57	16.78	23.75	912.46
7	MBJ-04/07	2.80	3.50	0.70	29.77	11.87	33.85	4.85	18.10	20.37	723.45
8	MBJ-04/08	3.50	3.80	0.30	20.39	14.40	41.40	4.14	17.81	22.22	897.06
9	MBJ-04/09	3.80	4.10	0.30	28.79	13.13	32.89	4.73	18.96	22.48	878.42
10	MBJ-04/10	4.10	5.00	0.90	32.60	11.94	29.38	5.60	19.18	23.38	848.78
11	MBJ-04/11	5.00	5.75	0.75	37.03	12.13	20.01	7.19	22.47	24.59	816.22
12	MBJ-04/12	5.75	6.40	0.65	26.96	14.90	33.75	4.37	18.75	26.19	889.02
13	MBJ-04/13	6.40	7.00	0.60	18.79	19.87	40.31	3.37	15.84	35.12	500.32
14	MBJ-04/14	7.00	8.00	1.00	27.51	30.93	18.98	4.70	16.74	55.39	667.15
15	MBJ-04/15	8.00	9.00	1.00	32.27	37.87	8.07	5.97	14.86	66.87	775.71
16	MBJ-04/16	9.00	10.00	1.00							
17	MBJ-04/17	10.00	11.00	1.00							
18	MBJ-04/18	11.00	12.00	1.00							
19	MBJ-04/19	12.00	13.00	1.00							
20	MBJ-04/20	13.00	14.00	1.00							

MECL

ANNEXURE-III-C/4

BH.No.MBJ-05											
Sl. No.	Sample No.	Depth (m)		Thick (m)	Al_2O_3 (%)	SiO_2 (%)	Fe_2O_3 (%)	TiO_2 (%)	LOI (%)	SC (PPM)	V (PPM)
		From	To								
1	MBJ-05/01	0.00	1.00	1.00	43.98	8.98	16.05	7.45	22.20	22.63	879.97
2	MBJ-05/02	1.00	1.60	0.60	45.35	5.55	16.66	8.37	22.98	20.99	840.08
3	MBJ-05/03	1.60	2.50	0.90	41.82	5.68	22.41	7.60	21.30	25.41	969.25
4	MBJ-05/04	2.50	3.00	0.50	39.23	6.95	24.64	6.94	20.61	34.03	961.05
5	MBJ-05/05	3.00	4.00	1.00	31.25	5.07	33.98	5.30	19.99	39.14	843.64
6	MBJ-05/06	4.00	4.40	0.40	26.30	8.20	42.64	3.69	17.80	39.18	783.27
7	MBJ-05/07	4.40	5.40	1.00	39.42	10.00	22.30	5.27	22.15	29.73	643.23
8	MBJ-05/08	5.40	5.90	0.50	36.29	12.11	26.17	4.18	20.33	32.04	587.40
9	MBJ-05/09	5.90	6.90	1.00	25.24	18.32	33.71	3.94	17.16	41.14	615.70

BH.No.MBJ-06

Sl. No.	Sample No.	Depth (m)		Thick (m)	Al_2O_3 (%)	SiO_2 (%)	Fe_2O_3 (%)	TiO_2 (%)	LOI (%)	SC (PPM)	V (PPM)
		From	To								
1	MBJ-06/01	0.00	0.50	0.50	35.67	10.51	26.34	5.99	18.89	22.89	857.17
2	MBJ-06/02	0.50	1.00	0.50	40.95	4.40	23.95	6.44	22.26	24.04	830.04
3	MBJ-06/03	1.00	1.40	0.40	43.39	3.87	20.50	6.32	23.31	23.54	717.95
4	MBJ-06/04	1.40	2.00	0.60	43.58	4.23	19.59	6.65	23.60	30.73	744.72
5	MBJ-06/05	2.00	2.50	0.50	45.78	4.23	16.49	8.27	24.34	36.95	825.02
6	MBJ-06/06	2.50	3.00	0.50	46.05	5.29	14.05	9.34	24.49	38.19	868.88

Details of Chemical Analysis for CaO, MgO, Al_2O_3, SiO_2, Fe_2O_3, SO3, P2O5, K2O, Na2O & LOI of Primary bedrock samples of Limestone collected by MECL in Julrai block, District-Kachchh, Gujarat

S.N.	Sample No.	CaO%	MgO%	Al_2O_3%	SiO_2%	Fe_2O_3%	SO_3%	P_2O_5%	K_2O%	Na_2O%	LOI%
1	MKJ-01	52.44	0.45	1.17	2.13	1.09	0.05	0.02	0.05	0.02	42.40
2	MKJ-02	53.22	0.44	0.83	1.57	1.18	0.04	0.01	0.04	0.01	42.47
3	MKJ-03	51.85	0.51	0.79	1.65	3.12	0.08	0.23	0.09	0.02	41.27

DETAILS OF CHEMICAL ANALYSIS FOR REE ON LITHOMERGE AND SAPROLITE ZONES OF THE PITS AND BOREHOLE SAMPLES DRILLED BY MECL IN JULRAI BLOCK, DISTRICT - KACHCHH, GUJARAT

Sl. No.	Sample No	From (m)	To (m)	Thick-ness (m)	Li	Be	Sc	Cr	Co	Ni	Ga	Ge	Rb	Sr	Y	Zr	Nb	Mo	In	Ba	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Ta	W	Th	U	∑REE
					PPM (LOD = 0.1 PPM)																																		
1	MBJ/PR/01B		N/A		50.62	0.23	63.43	161.78	8.38	25.27	17.19	0.64	3.53	0.21	77.87	0.12	54.58	0.49	0.24	383.51	16.92	49.68	6.23	31.42	7.89	2.62	10.03	2.19	15.59	3.28	8.37	1.08	5.57	0.62	4.67	6.14	5.97	1.51	161.49
2	MBJ/PR/10		N/A		73.96	1.08	30.04	118.35	37.58	54.25	5.43	1.04	62.80	415.52	37.62	403.50	24.02	0.74	0.06	92.31	29.65	66.92	7.79	31.84	6.83	1.78	7.03	1.35	8.49	1.68	4.59	0.72	4.21	0.62	1.21	20.15	9.41	1.99	173.49
3	MBJ/PR/12A		N/A		22.80	1.45	60.83	32.49	128.77	87.48	5.20	1.17	8.76	154.12	54.54	703.02	29.35	0.32	0.08	35.68	33.84	71.51	8.56	33.98	7.40	2.59	8.72	1.81	11.75	2.47	6.55	0.98	5.75	0.81	1.66	2.58	6.28	1.10	196.72
4	MBJ/PR/13A		N/A		19.57	0.65	14.61	126.59	6.91	20.74	4.58	1.19	44.30	109.15	27.54	617.72	49.56	0.34	0.04	88.04	34.14	69.32	7.68	29.28	5.69	1.25	5.07	0.87	5.31	1.10	3.27	0.55	3.68	0.56	2.20	3.08	12.84	3.19	167.78
5	MBJ/PR/13B		N/A		8.76	0.74	12.98	107.12	6.57	17.47	3.52	0.29	37.07	136.84	29.31	690.01	49.93	0.50	0.05	67.06	25.28	53.08	6.00	23.87	5.10	1.10	4.77	0.87	5.43	1.10	3.30	0.56	3.64	0.58	2.28	3.14	11.84	2.94	134.69
6	MBJ/PR/14		N/A		106.57	0.18	21.97	208.95	21.95	42.10	11.53	0.88	1.63	174.56	10.75	0.12	55.74	0.38	0.28	57.71	22.38	29.44	5.05	18.59	3.44	0.91	2.68	0.47	2.68	0.51	1.44	0.22	1.51	0.22	3.52	5.00	11.55	1.96	89.52
7	MBJ/PR/16B		N/A		34.11	0.16	19.39	100.40	4.85	18.92	6.07	44.81	4.16	221.07	20.05	707.65	44.31	0.47	0.10	36.41	15.79	27.02	4.08	17.73	4.63	1.39	4.45	0.89	5.64	1.11	3.12	0.49	3.09	0.47	3.03	3.44	5.58	2.25	89.91
8	MBJ/PR/17B		N/A		127.18	0.81	81.13	139.14	9.16	56.11	8.67	0.67	1.50	433.29	6.37	871.38	42.31	1.00	0.16	119.98	7.82	47.53	2.84	12.42	2.28	0.61	1.77	0.33	2.04	0.38	1.03	0.17	1.17	0.17	3.80	3.35	4.48	0.77	80.57
9	MBJ-02/19	14.70	16.50	1.80	146.82	1.87	72.08	149.75	37.90	92.27	6.42	1.85	5.29	68.71	70.64	718.92	46.03	2.90	BDL	46.15	11.88	61.44	4.62	23.25	8.19	3.03	10.40	2.33	15.56	3.18	9.05	1.43	8.85	1.29	1.90	2.69	3.14	0.91	164.52
10	MBJ-02/21	17.50	18.50	1.00	39.22	1.87	63.67	147.41	99.58	192.71	9.65	3.21	5.27	127.91	722.88	774.21	37.70	4.28	BDL	128.07	210.31	215.21	43.70	204.78	52.19	20.67	90.23	16.74	107.42	21.95	53.66	7.44	38.15	5.33	1.88	1.79	3.04	0.66	1087.78
11	MBJ-04/17	10.00	11.00	1.00	53.98	3.98	84.54	283.13	110.60	370.07	9.39	3.38	9.17	95.72	516.45	973.82	50.12	11.91	BDL	72.46	135.29	292.10	62.74	310.45	72.78	26.14	82.93	15.95	96.39	18.17	44.68	6.37	34.82	4.62	3.04	2.30	3.72	0.79	1203.42
12	MBJ-04/18	11.00	12.00	1.00	9.68	2.87	53.78	305.43	216.80	452.73	6.17	1.49	5.52	183.64	187.08	644.33	24.34	20.52	BDL	52.18	75.62	149.95	26.00	130.17	36.02	12.75	42.35	7.99	47.76	8.60	20.15	2.88	15.51	2.01	1.34	1.59	2.54	0.44	577.74
13	MBJ-06/16	10.00	11.00	1.00	90.51	4.31	96.19	174.09	72.60	255.93	11.39	2.89	1.24	90.12	546.08	0.11%	63.30	2.40	BDL	95.86	208.00	265.52	36.82	155.29	36.46	14.48	57.71	11.25	75.30	15.83	40.60	5.79	30.79	4.42	2.99	2.42	3.82	1.12	958.27
14	MBJ-07/06	4.50	5.50	1.00	32.49	0.51	74.68	155.74	40.12	98.84	9.43	0.57	7.88	88.74	9.70	832.46	28.03	4.14	BDL	124.68	2.18	2.99	0.55	2.51	0.69	0.25	1.00	0.20	1.45	0.31	0.91	0.15	0.98	0.14	1.74	1.62	2.86	0.62	14.30
15	MBJ-07/08	6.50	7.50	1.00	57.02	1.80	63.88	138.20	37.38	63.31	7.80	1.40	4.89	56.44	185.04	917.94	28.54	1.68	BDL	45.97	7.03	9.12	1.28	5.44	1.91	0.94	5.02	1.36	12.62	3.59	12.09	1.97	10.93	1.89	1.99	1.23	3.30	0.93	75.18
16	MBJ-07/10	8.00	9.00	1.00	18.06	1.71	62.50	95.62	71.35	104.01	5.64	0.72	2.58	94.47	28.33	699.93	31.04	1.96	BDL	21.55	17.46	45.58	7.20	31.33	8.10	2.54	6.95	1.34	7.67	1.34	3.38	0.49	2.93	0.41	1.54	1.28	2.66	0.53	136.71
17	MBJ-07/12	10.00	11.00	1.00	35.78	3.14	72.31	214.08	118.91	227.66	40.84	3.09	4.54	106.88	410.02	692.76	12.08	1.24	0.25	81.39	102.16	257.97	30.81	148.04	39.28	14.05	49.16	10.00	70.49	14.93	40.51	5.92	33.47	4.99	2.73	5.27	3.20	0.67	821.79
18	MBJ-08/05	3.50	4.50	1.00	62.34	1.20	74.13	227.85	22.56	71.45	8.43	1.01	2.33	56.23	10.49	943.36	46.53	5.71	BDL	58.41	2.72	4.44	0.89	3.89	1.30	0.46	1.38	0.35	2.56	0.56	1.61	0.28	1.82	0.28	3.12	1.65	3.80	0.94	22.52
19	MBJ-08/09	6.90	7.90	1.00	14.04	0.84	51.26	130.98	80.98	126.08	5.30	0.90	4.61	138.71	132.93	605.72	17.17	4.21	BDL	38.12	77.00	99.23	14.28	66.17	16.35	6.08	23.22	4.33	26.22	5.10	12.39	1.70	8.65	1.22	1.24	1.21	2.34	0.54	361.92
20	MBJ-08/14	11.50	12.50	1.00	12.32	1.04	41.26	97.15	167.18	104.71	5.53	0.96	8.83	293.41	70.77	378.57	12.42	3.03	BDL	76.12	17.79	29.87	5.53	25.44	6.82	2.40	8.58	1.75	11.70	2.41	6.71	1.05	5.92	0.92	0.93	1.69	1.80	0.49	126.88

ANNEXURE-IV/1

DETAILS OF PRIMARY SAMPLE ANALYSIS Vs EXTERNAL CHECK SAMPLE ANALYSIS FOR AL_2O_3, SiO_2, Fe_2O_3, TiO_2 & LOI AND ASOCIATED ELEMENTS IN JULRAI BLOCK, DISTRICT - KACHCHH, GUJARAT

Sl. No.	Sample No	From (m)	To (m)	Thick-ness (m)	Al_2O_3 %	SiO_2 %	Fe_2O_3 %	TiO_2 %	LOI %	Sc PPM	V PPM	Ga PPM	Sample No	Al_2O_3 %	SiO_2 %	Fe_2O_3 %	TiO_2 %	LOI %	Sc PPM	V PPM	Ga PPM	Al_2O_3 %	Fe_2O_3 %	SiO_2 %	TiO_2 %	LOI %	Sc %	Va %	Ga %
	Primary Samples												External Check Samples									Difference							
1	MBJ/BR/01	NA	NA	NA	46.01	3.94	14.02	5.11	25.53	NA	NA	NA	MBJ/CH/01	46.75	3.69	14.49	4.82	24.61	NA	NA	NA	-0.74	0.25	-0.47	0.29	0.92	NA	NA	NA
2	MBJ/BR/11	NA	NA	NA	49.88	3.17	10.17	5.87	26.98	NA	NA	NA	MBJ/CH/02	52.32	2.79	8.54	5.01	26.31	NA	NA	NA	-2.44	0.38	1.63	0.86	0.67	NA	NA	NA
3	MBJ/BR/17	NA	NA	NA	39.79	4.62	26.65	5.57	20.58	NA	NA	NA	MBJ/CH/03	43.28	4.33	24.83	5.39	19.91	NA	NA	NA	-3.49	0.29	1.82	0.18	0.67	NA	NA	NA
4	MBJ/BR/22	NA	NA	NA	30.81	1.88	25.70	4.61	24.95	NA	NA	NA	MBJ/CH/04	35.53	2.49	23.06	3.67	23.76	NA	NA	NA	-4.72	-0.61	2.64	0.94	1.19	NA	NA	NA
5	MBJ/BR/43	NA	NA	NA	39.70	3.08	10.72	6.40	26.03	NA	NA	NA	MBJ/CH/05	38.95	3.52	10.67	6.56	25.81	NA	NA	NA	0.75	-0.44	0.05	-0.16	0.22	NA	NA	NA
6	MBJ/PT/04	NA	NA	NA	38.16	8.69	24.01	7.15	19.32	NA	NA	NA	MBJ/CH/06	40.10	8.76	24.14	7.08	17.32	NA	NA	NA	-1.94	-0.07	-0.13	0.07	2.00	NA	NA	NA
7	MBJ-01/01	0.00	1.00	1.00	36.20	5.00	35.25	4.35	17.30	18.79	696.47	57.66	MBJ/CH/07 & MBJ/CH/16	36.99	4.35	35.83	4.43	16.84	29.0	591.5	28.0	-0.79	0.65	-0.58	-0.08	0.46	-10.21	104.97	29.66
8	MBJ-01/06	4.50	5.00	0.50	41.29	3.11	29.02	5.73	19.39	21.69	808.22	26.13	MBJ/CH/08 &MBJ/CH/17	42.97	2.85	28.05	5.66	19.04	33.5	688.0	37.5	-1.68	0.26	0.97	0.07	0.35	-11.81	120.22	-11.37
9	MBJ-01/16	11.50	12.50	1.00	41.80	7.52	19.72	7.79	22.14	44.71	1248.23	57.97	MBJ/CH/09 & MBJ/CH/18	46.30	6.37	17.72	7.17	21.17	55.0	1022.0	48.0	-4.50	1.15	2.00	0.62	0.97	-10.29	226.23	9.97
10	MBJ-02/01	0.00	0.50	0.50	31.28	17.17	26.86	5.09	17.61	15.78	883.14	49.08	MBJ/CH/10 & MBJ/CH/19	33.75	16.45	27.46	5.29	15.13	21.0	965.0	39.5	-2.47	0.72	-0.60	-0.20	2.48	-5.22	-81.86	9.58
11	MBJ-04/11	5.00	5.75	0.75	37.03	12.13	20.01	7.19	22.47	24.59	816.22	45.40	MBJ/CH/11 & MBJ/CH/20	41.83	11.09	19.07	6.99	19.82	29.0	815.0	31.0	-4.80	1.04	0.94	0.20	2.65	-4.41	1.22	14.40
12	MBJ-05/01	0.00	1.00	1.00	43.98	8.98	16.05	7.45	22.20	22.63	879.97	71.89	MBJ/CH/12 & MBJ/CH/21	48.64	7.47	14.82	7.09	20.52	24.0	818.0	49.5	-4.66	1.51	1.23	0.36	1.68	-1.37	61.97	22.39
13	MBJ-06/01	0.00	0.50	0.50	35.67	10.51	26.34	5.99	18.89	22.89	857.17	54.68	MBJ/CH/13 & MBJ/CH/22	40.46	9.38	24.89	5.93	17.22	25.0	824.0	34.0	-4.79	1.13	1.45	0.06	1.67	-2.11	33.17	20.68
14	MBJ-07/03	1.50	2.50	1.00	24.45	28.37	29.19	3.40	12.53	37.40	532.38	36.92	MBJ/CH/14 & MBJ/CH/23	24.93	29.79	29.21	3.44	10.70	38.0	489.0	23.5	-0.48	-1.42	-0.02	-0.04	1.83	-0.60	43.38	13.42
15	MBJ-08/04	3.00	3.50	0.50	14.21	18.76	45.94	2.10	16.64	41.32	333.56	30.54	MBJ/CH/15 & MBJ/CH/24	13.39	21.27	48.60	2.38	12.14	48.5	329.5	17.5	0.82	-2.51	-2.66	-0.28	4.50	-7.18	4.06	13.04

MECL

ANNEXURE-V-A/1

DETAILS OF METALLURGICAL GRADE-II BAUXITE ZONES FROM EXPLORATORY BOREHOLES DRILLED BY MECL IN JULRAI BLOCK, DISTRICT - KACHCHH, GUJARAT

Bauxite Zones demarcation based on Al_2O_3 - >40% and SiO_2 - 4%(max)

Borehole	From (m)	To (m)	Thickness (m)	Al_2O_3 %	SiO_2 %	Fe_2O_3 %	TiO_2 %	LOI %	SC (ppm)	V (ppm)	Ga (ppm)	THA %	MHA %	RS %
MBJ-01	1.00	7.50	6.50	40.00	3.85	31.51	5.42	17.79	21.72	632.76	41.91	24.79	10.56	3.06
Cummulative			**6.50**	**40.00**	**3.85**	**31.51**	**5.42**	**17.79**	**21.72**	**632.76**	**41.91**	**24.79**	**10.56**	**3.06**

DETAILS OF LOW GRADE BAUXITE ZONES FROM EXPLORATORY BOREHOLES DRILLED BY MECL IN JULRAI BLOCK, DISTRICT - KACHCHH, GUJARAT

Bauxite Zones demarcation based on Al_2O_3 - 35% to 40% and SiO_2 - 10%(max)

Borehole	From (m)	To (m)	Thickness (m)	Al_2O_3 %	SiO_2 %	Fe_2O_3 %	TiO_2 %	LOI %	SC (ppm)	V (ppm)	Ga (ppm)	THA %	MHA %	RS %
MBJ-01	0.00	1.00	1.00	36.20	5.00	35.25	4.35	17.30	18.79	696.47	57.66	24.79	10.56	3.06
	7.50	16.50	9.00	39.65	7.66	18.60	6.41	20.97	32.78	807.23	59.49	35.24	2.98	3.33
MBJ-05	0.00	5.90	5.90	35.53	6.65	22.35	5.90	19.44	27.06	768.99	768.99	30.45	9.14	8.41
MBJ-06	0.50	3.60	3.10	44.98	4.52	17.26	7.81	23.91	31.10	801.42	57.68	42.23	0.69	4.27
Cummulative			**19.00**	**39.06**	**6.70**	**20.42**	**6.37**	**20.78**	**30.00**	**788.58**	**279.42**	**34.34**	**4.92**	**5.05**

DETAILS OF ALUMINOUS LATERITE ZONES FROM EXPLORATORY BOREHOLES DRILLED BY MECL IN JULRAI BLOCK, DISTRICT - KACHCHH, GUJARAT

Zones demarcation Based on Al_2O_3 - 20%(min)

Borehole	From (m)	To (m)	Thickness (m)	Al_2O_3 %	SiO_2 %	Fe_2O_3 %	TiO_2 %	LOI %	SC (ppm)	V (ppm)	Ga (ppm)
MBJ-02	0.00	11.00	11.00	30.43	7.30	32.97	5.33	19.95	20.40	693.65	43.52
MBJ-04	0.00	6.40	6.40	28.24	11.21	35.49	5.16	17.76	24.41	916.62	47.99
MBJ-06	0.00	0.50	0.50	35.67	10.51	26.34	5.99	18.89	22.89	857.17	54.68
MBJ-07	0.00	2.50	2.50	23.32	25.53	33.19	3.35	12.75	33.75	488.54	37.36
MBJ-08	0.00	2.00	2.00	22.45	24.38	32.92	3.70	14.82	43.01	536.42	38.42
Cummulative			**22.40**	**28.42**	**12.05**	**33.56**	**4.93**	**18.04**	**25.11**	**724.07**	**43.90**

MECL

ANNEXURE-V-D/1

DETAILS OF TiO2 ZONES FROM EXPLORATORY BOREHOLES DRILLED BY MECL IN JULRAI BLOCK, DISTRICT - KACHCHH, GUJARAT

Zones demarcation based on TiO_2 ≥2% and V ≥500ppm

Borehole	From (m)	To (m)	Thickness (m)	Al_2O_3 %	SiO_2 %	Fe_2O_3 %	TiO_2 %	LOI %	SC (ppm)	V (ppm)	Ga (ppm)
MBJ-01	0.00	17.00	17.00	40.24	6.60	25.92	5.97	19.91	27.73	734.01	52.66
MBJ-02	0.00	12.70	12.70	29.85	10.21	31.73	5.19	19.35	23.64	665.12	42.34
MBJ-04	0.00	12.70	12.70	19.83	12.01	21.92	3.60	12.19	23.59	599.17	32.59
MBJ-05	0.00	6.90	6.90	36.67	9.22	25.89	5.92	20.59	31.42	789.34	37.74
MBJ-06	0.00	10.00	10.00	33.01	18.40	22.88	5.89	18.44	42.07	839.62	20.62
MBJ-07	0.00	8.00	6.00	25.02	30.64	25.24	3.80	13.18	43.86	562.87	37.03
MBJ-08	0.00	5.90	5.90	18.02	22.69	25.07	3.00	12.34	36.86	415.12	29.87
Cummulative			71.20	36.33	16.18	30.84	5.96	20.53	36.92	812.88	45.73

DETAILS OF Sc ZONES FROM EXPLORATORY BOREHOLES DRILLED BY MECL IN JULRAI BLOCK, DISTRICT - KACHCHH, GUJARAT

Zones demarcation based on SC ≥ 50PPM

Borehole	From (m)	To (m)	Thickness (m)	Al_2O_3 %	SiO_2 %	Fe_2O_3 %	TiO_2 %	LOI %	SC (ppm)	V (ppm)	Ga (ppm)
MBJ-04	7.00	9.00	2.00	29.89	34.40	13.52	5.34	15.80	61.13	721.43	41.61
MBJ-06	6.80	10.00	3.20	28.75	32.81	17.84	5.39	14.06	56.96	984.55	44.54
MBJ-07	2.50	4.50	2.00	26.85	32.40	21.41	4.08	13.49	53.93	604.77	38.09
MBJ-08	1.00	2.00	1.00	24.76	26.78	28.68	3.69	14.66	50.04	591.88	38.61
Cumulative			8.20	28.08	32.36	18.98	4.85	14.42	56.40	779.86	41.53

DETAILS OF V ZONES FROM EXPLORATORY BOREHOLES DRILLED BY MECL IN JULRAI BLOCK, DISTRICT - KACHCHH, GUJARAT

Zones demarcation based on V ≥ 500PPM

Borehole	From (m)	To (m)	Thickness (m)	Al_2O_3 %	SiO_2 %	Fe_2O_3 %	TiO_2 %	LOI %	SC (ppm)	V (ppm)	Ga (ppm)
MBJ-01	0.00	17.00	17.00	40.24	6.60	25.92	5.97	19.91	27.73	734.01	52.66
MBJ-02	0.00	12.70	12.70	29.85	10.21	31.73	5.19	19.35	23.64	665.12	42.34
MBJ-04	0.00	9.00	9.00	27.98	16.94	30.93	5.08	17.20	33.28	845.49	45.99
MBJ-05	0.00	6.90	6.90	36.67	9.22	25.89	5.92	20.59	31.42	789.34	56.05
MBJ-06	0.00	10.00	10.00	33.01	18.40	22.88	5.89	18.44	42.07	839.62	20.62
MBJ-07	1.50	8.00	4.50	25.84	32.98	21.70	3.96	7.63	39.73	597.40	36.82
MBJ-08	1.00	2.00	1.00	24.76	26.78	28.68	3.69	14.66	50.04	591.88	38.61
	4.50	5.90	1.40	25.52	38.79	13.86	4.73	13.74	51.05	564.03	34.53
Cumulative			**62.50**	**33.20**	**13.94**	**26.80**	**5.45**	**18.14**	**32.14**	**743.15**	**43.08**

DETAILS OF Ga ZONES FROM EXPLORATORY BOREHOLES DRILLED BY MECL IN JULRAI BLOCK, DISTRICT - KACHCHH, GUJARAT

Zones demarcation based on Ga ≥ 50PPM

Borehole	From (m)	To (m)	Thickness (m)	Al_2O_3 %	SiO_2 %	Fe_2O_3 %	TiO_2 %	LOI %	SC (ppm)	V (ppm)	Ga (ppm)
MBJ-01	0.00	2.00	2.00	37.22	4.47	35.37	4.68	17.00	18.94	694.73	65.61
MBJ-01	7.00	13.50	6.50	43.92	7.97	17.73	7.17	22.10	30.96	750.45	69.03
MBJ-02	0.00	1.50	1.50	33.27	11.90	29.91	5.02	18.21	16.87	899.55	53.26
MBJ-04	0.00	1.00	1.00	32.92	5.17	33.23	6.78	16.94	27.63	1063.59	60.96
MBJ-05	0.00	4.40	4.40	38.69	6.65	24.90	6.72	21.04	29.53	884.96	64.24
MBJ-06	0.00	5.00	5.00	39.05	7.76	22.63	6.82	22.18	33.48	805.38	56.08
Cummulative			**20.40**	**39.62**	**7.44**	**23.86**	**6.56**	**20.85**	**28.89**	**813.78**	**62.93**

ANNEXURE-VI/1

STATEMENT SHOWING XRD STUDIES CARRIED OUT BY MECL IN JULRAI BLOCK, DISTRICT - KACHCHH, GUJARAT

Sl. No.	Sample Number	Major (≥ 5 %)	Minor (≤ 5 % to ≥ 1 %)	Trace (≤ 1 %)
1	MBJ-01/01	Gibbsite, Hematite	Magnetite, Diaspore, Anatase, Goethite, Boehmite, Kaolinite	Ilmenite, Muscovite, Rutile
2	MBJ-01/02	Gibbsite	Calcite, Hematite, Goethite, Anatase, Magnetite, Diaspore	Ilmenite, Rutile
3	MBJ-01/03	Gibbsite, Goethite, Anatase	Kaolinite, Dickite, Hematite, Boehmite, Phlogopite, Diaspore	Ilmenite, Magnetite
4	MBJ-05/01	Gibbsite, Goethite, Anatase	Muscovite, Boehmite, Hematite, Diaspore, Ilmenite, Kaolinite	Biotite, Magnetite
5	MBJ-06/01	Gibbsite, Goethite, Anatase	Boehmite, Biotite	Diaspore, Hematite, Dickite
Note 1: Only crystalline phases of the samples are recorded. Amorphous phases are out of the scope of XRD and hence excluded.				

JULRAI BLOCK
PETROGRAPHIC STUDY RESULTS

Sl. No.	Sample Number & Location	Texture	Mineral Composition			Description
			Major >5%	Minor <5%->1%	Accessory <1%	
1	MBJ/P/01	It is a reddish brown coloured weathered and altered rock showing pisolites, pores, cavities and fillings. It reacts instantly with cold and dilute HCl.	Gibbsite Calcite Ferruginous matter Cliachite	Opaques Clay minerals	….	Gibbsite occurs as very fine to fine pisolites, disseminated grains, segregated patches and as cavity fillings comprising very fine to fine prismatic grains. Calcite has intruded as patchy filings throughout the specimen. Ferruginous matter is present as reddish patches and amorphous aggregates. Cliachite is noted as fine pisolites and patchy relicts being replaced by gibbsite. Opaques occur as fine to very fine blades, anhedral patches and as relicts within ferruginous patches. Clay minerals are seen associated with ferruginous patches in areas. The specimen is a **bauxite with calcite fillings.**
2	MBJ/P/02	It is a reddish brown coloured weathered and altered rock showing whitish patches, pisolites, pores and cavities.	Gibbsite Clay minerals Ferruginous matter	Cliachite Opaques	….	Gibbsite occurs as very fine granular dissemination and as pisolites and cavity fillings comprising fine to medium prismatic aggregates. Clay minerals are present as very fine aggregates, segregated patches and as very fine pisolites. Ferruginous natter is present as amorphous aggregates, patches and stains over clayey matrix, It also seen present as fine pisolites in areas.

						Cliachite is noted as very fine to moderately coarse pisolites, often showing concentric rings and cracks filled by very fine gibbsite fillings. Opaques occur as patches and as patchy relicts within ferruginous patches. The specimen is a **bauxite.**
3	MBJ/P/03	It is a dark grey coloured massive rock with visible fine to medium bio-clasts, pores and cavities. It reacts instantly with cold and dilute HCl.	Calcite Ferruginous matter/ Opaques	Glauconite	Quartz	The specimen is mostly made up of very fine to medium sized circular, ellipsoidal, sinuous, elongated, curvilinear etc. shaped bio-clasts/ fossils, which are mostly composed of very fine micro-crystalline micrite. Inter-clastic spaces and voids are mostly filled by fine to very fine granular aggregates of sparry calcite. Very fine peloids are noted in areas. Reddish ferruginous matter occurs as patches and stains over calcitic matrix, associating patchy opaques with it, at places. Glauconite occurs as fine to very fine subrounded pellets. Quartz is noted as very fine silt sized clasts in accessories. The specimen is a **glauconite bearing bio-sparite with ferruginous stains**.
4	MBJ/P/04	It is a whitish grey coloured weathered and altered rock showing fine to medium pisolites, pores, cavities and reddish patches and stains.	Clay minerals Ferruginous matter Opaques	Cliachite Gibbsite	….	The specimen is made up of very fine to fine pisolitic aggregates of clay minerals. It also occurs as segregated patches often stained by reddish ferruginous matter. Ferruginous mater occurs as moderately coarse patches, amorphous aggregates and stains. Opaques occur as anhedral patches and patchy relicts within ferruginous patches. Cliachite is noted as fine to medium pisolites often being replaced by very fine granular gibbsite. Gibbsite is

						also seen present as fine cavity fillings and patches comprising very fine to fine prismatic aggregates. The specimen is a **<u>bauxite bearing clayey laterite.</u>**
5	MBJ/P/05	It is a whitish grey coloured massive rock with fine moderately coarse pisolites.	Clay minerals Cliachite	Ferruginous matter Gibbsite/ Boehmite Opaques	….	The specimen is made up of fine to moderately coarse cliachitic pisolites set in very fine dirty clayey matrix often accompanied by reddish ferruginous matter. Cliachite pisolites are showing concentric rings and contraction cracks which are often filled by very fine gibbsite/ boehmite fillings. Very fine clayey pisolites are also common in the specimen. Ferruginous matter is present as reddish patches, fillings and amorphous aggregates in association with clay minerals. Opaques occur as very fine disseminated grains, anhedral patches and as relicts within ferruginous patches. The specimen is a **<u>clay rich bauxite.</u>**
6	MBJ/P/06	It is a whitish grey coloured massive rock with reddish patches, stains and cavity fillings.	Clay minerals Gibbsite Ferruginous matter	Calcite Opaques	Quartz	Clay minerals are present as dirty semi-opaque patches, mostly stained by reddish ferruginous matter. Gibbsite occurs as very fine to fine granular aggregates patches and as cavity fillings. Ferruginous matter is also seen present as reddish patches and fillings. Calcite has intruded as very thin to thin fillings. Opaques occur as very fine specks and as patchy relicts within ferruginous patches. Quartz is noted as fine to medium anhedral grains set in clayey matrix. The specimen is a **<u>clay rich bauxite with calcite</u>**

						fillings.
7	MBJ/P/07	It is a very fine grained light buff grey coloured massive rock.	Clay minerals Ferruginous matter Opaques	Gibbsite/ Boehmite	….	The specimen is made up of very fine clayey aggregates and segregated patches. It also seen present as very fine secondary fillings often associating very fine micro-crystalline gibbsite/ boehmite with it. Ferruginous matter occurs as very fine amorphous aggregates and stains over clayey matrix and as fine disseminated patches. Opaques are noted as very fine disseminated specks. The specimen is a **clay stone.**
8	MBJ/P/08	It is a reddish brown coloured weathered and altered rock showing whitish patches, pisolites, pores and cavities.	Gibbsite Ferruginous matter	Clay minerals Opaques	Cliachite	The specimen is made up of very fine to fine granular aggregates of gibbsite supported by clay mixed reddish ferruginous matrix. It also occurs as fine to moderately coarse patches, pisolites and cavity fillings, comprising fine to medium prismatic grains. Clay minerals are also seen present as very fine to fine pisolites. Opaques occur as very fine to fine disseminated grains and patches. Cliachite is noted as patchy relicts within gibbsite pisolites in areas. The specimen is a **bauxite.**

JULRAI BLOCK
MINERAGRAPHIC STUDY RESULTS

Sl. No.	Sample No. & Location	% of ore minerals in polished section	ORE MINERAL COMPOSITION				Description
			Major >5%	Minor <5% - >1%	Accessory <1% - >0.1%	Traces <0.1%	
1.	MBJ/M/01	*	Hematite-Goethite Limonite Anatase Chalcopyrite	….	….	….	Hematite-goethite together occurs as intermixed patches and patchy fillings. Limonite occurs as reddish amorphous aggregates, patches and stains throughout the specimen. Anatase is present as very fine amorphous to micro-crystalline granular aggregates in pockets. Chalcopyrite is noted as very fine specks in traces.
2.	MBJ/M/02	*	Hematite-Goethite Limonite Leucoxene/ Anatase	….	….	….	Hematite-goethite together occurs as intermixed disseminated grains, patches and patchy fillings. Limonite is present as reddish amorphous aggregates, patches and fillings in areas. Leucoxene/ anatase are noted as fine pseudomorphic grains/ patches and as very fine amorphous aggregates in pockets.
3.	MBJ/M/03	*	Anatase/ Rutile Limonite Hematite	….	….	….	Anatase/ rutile occur as very fine bladed dissemination and as amorphous to micro-crystalline and granular aggregates in pockets, especially within clayey patches/ pisolites. Limonite is seen present as very fine reddish amorphous aggregates and patches in areas. Hematite is noted as very fine grains/ specks, mostly in association with anatase.

4.	MBJ/M/04	*	Anatase/ Rutile Limonite Hematite Pyrite	….	….	….	Anatase/ rutile occur as very fine bladed and amorphous/ granular dissemination throughout the specimen and as well as seen segregated in pockets. Limonite is present as very fine reddish amorphous aggregates and patches. Hematite occurs as very fine grains/ specks in accessories. Pyrite is noted as very fine specks in traces.
5.	MBJ/M/05	*	Hematite-Goethite Leucoxene Limonite Anatase	….	….	….	Hematite and goethite together occur as intermixed patches and patchy fillings. Hematite also seen present as fine bladed disseminations, often being replaced by goethite. Leucoxene is noted as fine to very fine patches in association with hematite. Limonite occurs as reddish amorphous aggregates, patches and stains. Anatase is found present as very fine amorphous and bladed/ granular segregations in pockets.
6.	MBJ/M/06	*	Hematite-Goethite Limonite Anatase Chalcopyrite	….	….	….	Hematite and goethite together occur as intermixed and as well as separated patches and patchy fillings, often showing compositional zoning and colloform texture. Limonite is present as reddish amorphous aggregates, patches and fillings, mostly in association with hematite-goethite patches. Anatase is noted as very fine amorphous aggregates in areas. Chalcopyrite is observed as very fine specks in traces.
7.	MBJ/M/07	*	Anatase Limonite Hematite	….	….	….	Anatase occurs as very fine micro-crystalline to granular aggregates, often seen segregated in pockets. Limonite is present as reddish amorphous aggregates, patches and stains in areas. Hematite is noted as very fine specks, blades and as hairline filings

N.B.: * Those specimens are having ore minerals are mostly dispersed as amorphous matter &/ or present as stains throughout the specimen, thus conventional modal calculation may mislead. Hence, % of ore minerals calculation is avoided.

STATEMEMT SHOWING BULK DENSITY DETERMINATION RESULTS IN JULRAI BLOCK, DISTRICT - KACHCHH, GUJARAT

Sl.No.	Sample No.	Specific Gravity
1	MBJ/BD/01	2.22
2	MBJ/BD/02	2.34
3	MBJ/BD/03	2.20
Average Specific Gravity		**2.25**

ANNEXURE-VIII-B/1

STATEMEMT SHOWING BOREHOLE WISE INFERRED CATEGORY OF RESOURCES (333) OF BAUXITE ESTIMATED BY POLYGONAL METHOD IN JULRAI BLOCK, DISTRICT - KACHCHH, GUJARAT
{at IBM cut off for Metallurgical Grade II Bauxite (+)40% Al_2O_3% and SiO_2% 4% (max)}

Bulk Density: 2.25

Sl. No	BH No.	Polygon Area (m^2)	Thickness (m)	Volume (m^3)	Gross Geological Resources (tonnes)	Net Geological Resources (tonnes)	Average Quality							
							Al_2O_3 %	SiO_2 %	Fe_2O_3 %	TiO_2 %	LOI %	Sc (ppm)	V (ppm)	Ga (ppm)
1	MBJ-01	16639.49	6.50	108156.71	243352.60	219017.34	40.00	3.85	31.51	5.42	17.79	21.72	632.76	41.91
Total Geological resources of Bauxite with grade in tonnes					**243352.60**	**219017.34**	**40.00**	**3.85**	**31.51**	**5.42**	**17.79**	**21.72**	**632.76**	**41.91**
Total Geological resources for Bauxite with grade in million tonnes					**0.24**	**0.22**								

STATEMEMT SHOWING BOREHOLE WISE INFERRED CATEGORY OF RESOURCES (333) OF ALUMINOUS LATERITE ESTIMATED BY POLYGONAL METHOD IN JULRAI BLOCK, DISTRICT - KACHCHH, GUJARAT
{at IBM cut off for Low Grade Bauxite Al2O3 - 35% to 40% and SiO2 - 10%(max)}

Bulk Density: 2.25

Sl. No.	BH No.	Polygon Area (m^2)	Thickness (m)	Volume (m^3)	Gross Geological Resources (tonnes)	Net Geological Resources (tonnes)	Average Quality							
							Al_2O_3 %	SiO_2 %	Fe_2O_3 %	TiO_2 %	LOI %	Sc (ppm)	V (ppm)	Ga (ppm)
1	MBJ-01	176651.53	1.00	176651.53	397465.94	357719.35	36.20	5.00	35.25	4.35	17.30	18.79	696.47	57.66
	MBJ-01	16397.13	9.00	147574.14	332041.81	298837.62	39.65	7.66	18.60	6.41	20.97	32.78	807.23	59.49
2	MBJ-05	626175.13	5.90	3694433.26	8312474.84	7481227.35	35.53	6.65	22.35	5.90	19.44	27.06	768.99	768.99
3	MBJ-06	521951.48	3.10	1618049.59	3640611.57	3276550.42	44.98	4.52	17.26	7.81	23.91	31.10	801.42	57.68
Total Geological resources of Aluminous Laterite with grade in tonnes					**12682594.16**	**11414334.74**	**38.37**	**6.02**	**21.20**	**6.42**	**20.70**	**28.11**	**777.03**	**523.94**
Total Geological resources for Aluminous Laterite with grade in million tonnes					**12.68**	**11.41**								

MECL

ANNEXURE-VIII-D/1

STATEMEMT SHOWING POLYGON WISE, BOREHOLE WISE INFERRED CATEGORY OF RESOURCES (333) OF ALUMINOUS LATERITE ESTIMATED BY POLYGONAL METHOD IN JULRAI BLOCK, DISTRICT - KACHCHH, GUJARAT
{at IBM cut off for Aluminous Laterite Al2O3 - 20%(min)}

Bulk Density: 2.25

Sl. No.	BH No.	Polygon Area (m^2)	Thickness (m)	Volume (m^3)	Gross Geological Resources (tonnes)	Net Geological Resources (tonnes)	Average Quality							
							Al_2O_3 %	SiO_2 %	Fe_2O_3 %	TiO_2 %	LOI %	Sc (ppm)	V (ppm)	Ga (ppm)
1	MBJ-02	482929.32	11.00	5312222.51	11952500.65	10757250.59	30.43	7.30	32.97	5.33	19.95	20.40	693.65	43.52
2	MBJ-04	625916.67	6.40	4005866.66	9013199.98	8111879.98	28.24	11.21	35.49	5.16	17.76	24.41	916.62	47.99
3	MBJ-06	521951.48	0.50	260975.74	587195.42	528475.87	35.67	10.51	26.34	5.99	18.89	22.89	857.17	54.68
4	MBJ-07	686437.39	2.50	1716093.47	3861210.32	3475089.29	23.32	25.53	33.19	3.35	12.75	33.75	488.54	37.36
5	MBJ-08	424374.51	2.00	848749.01	1909685.28	1718716.75	22.45	24.38	32.92	3.70	14.82	43.01	536.42	38.42
Total Geological resources of Aluminous Laterite with grade in tonnes					**27323791.65**	**24591412.48**	**28.26**	**12.43**	**33.68**	**4.89**	**17.83**	**25.24**	**730.74**	**44.01**
Total Geological resources for Aluminous Laterite with grade in million tonnes					**27.32**	**24.59**								

STATEMEMT SHOWING BOREHOLE WISE INFERRED CATEGORY OF RESOURCES (333) OF TITANIUM OXIDE ESTIMATED BY POLYGONAL METHOD IN JULRAI BLOCK, DISTRICT - KACHCHH, GUJARAT (at IBM cut off TiO_2 >2%)

Bulk Density: 2.25

Polygon No.	BH No.	Polygon Area (m^2)	Thickness (m)	Volume (m^3)	Gross Geological Resources (tonnes)	Net Geological Resources (tonnes)	Average Quality							
							Al_2O_3 %	SiO_2 %	Fe_2O_3 %	TiO_2 %	LOI %	Sc (ppm)	V (ppm)	Ga (ppm)
1	MBJ-01	193048.66	17.00	3281827.16	7384111.10	6645699.99	40.24	6.60	25.92	5.97	19.91	27.73	734.01	52.66
2	MBJ-02	482929.32	12.70	6133202.36	13799705.30	12419734.77	29.85	10.21	31.73	5.19	19.35	23.64	665.12	42.34
4	MBJ-04	625916.67	12.70	7949141.65	17885568.72	16097011.84	19.83	12.01	21.92	3.60	12.19	23.59	599.17	32.59
5	MBJ-05	626175.13	6.90	4320608.39	9721368.88	8749231.99	36.67	9.22	25.89	5.92	20.59	31.42	789.34	37.74
6	MBJ-06	521951.48	10.00	5219514.80	11743908.30	10569517.47	33.01	18.40	22.88	5.89	18.44	42.07	839.62	20.62
7	MBJ-07	686437.39	6.00	4118624.34	9266904.76	8340214.28	25.02	30.64	25.24	3.80	13.18	43.86	562.87	37.03
8	MBJ-08	424374.51	5.90	2503809.59	5633571.58	5070214.42	18.02	22.69	25.07	3.00	12.34	36.86	415.12	29.87
Total Geological resources of Titanim Oxide with grade in tonnes					**75435138.63**	**67891624.77**	**28.39**	**14.87**	**25.41**	**4.76**	**16.44**		**668.17**	**35.48**
Total Geological resources for Titainium Oxide with grade in million tonnes					**75.44**	**67.89**								

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ANNEXURE-VIII-F/1

STATEMEMT SHOWING POLYGON WISE, BOREHOLE WISE INFERRED CATEGORY OF RESOURCES (333) OF ALUMINIUM CLAY ESTIMATED BY POLYGONAL METHODIN JULRAI BLOCK, DISTRICT - KACHCHH, GUJARAT (at cut off Sc >50ppm)

Bulk Density: 2.25

Sl. No.	BH No.	Polygon Area (m^2)	Thickness (m)	Volume (m^3)	Gross Geological Resources (tonnes)	Net Geological Resources (tonnes)	Average Quality							
							Al_2O_3 %	Fe_2O_3 %	SiO_2 %	TiO_2 %	LOI %	Sc (ppm)	V (ppm)	Ga (ppm)
1	MBJ-04	625916.67	2.00	1251833.33	2816624.99	2534962.50	29.89	34.40	13.52	5.34	15.80	61.13	721.43	41.61
2	MBJ-06	521951.48	3.20	1670244.74	3758050.66	3382245.59	28.75	32.81	17.84	5.39	14.06	56.96	984.55	44.54
3	MBJ-07	686437.39	2.00	1372874.78	3088968.25	2780071.43	26.85	32.40	21.41	4.08	13.49	53.93	604.77	38.09
4	MBJ-08	424374.51	1.00	424374.51	954842.64	859358.38	24.76	26.78	28.68	3.69	14.66	50.04	591.88	38.61
Total Geological resources of Aluminous Clay with grade in tonnes					**10618486.55**	**9556637.89**	**28.14**	**32.57**	**18.71**	**4.84**	**14.41**	**56.56**	**768.96**	**41.35**
Total Geological resources for Aluminous Clay with grade in million tonnes					**10.62**	**9.56**								

ANNEXURE-VIII-G/1

STATEMEMT SHOWING BOREHOLE WISE INFERRED CATEGORY OF RESOURCES (333)
OF VANADIUM ESTIMATED BY POLYGONAL METHOD IN JULRAI BLOCK, DISTRICT - KACHCHH, GUJARAT
(at cut off V >500ppm)

Bulk Density: 2.25

Sl. No.	BH No.	Polygon Area (m^2)	Thickness (m)	Volume (m^3)	Gross Geological Resources (tonnes)	Net Geological Resources (tonnes)	Average Quality							
							Al_2O_3 %	SiO_2 %	Fe_2O_3 %	TiO_2 %	LOI %	Sc	V (ppm)	Ga (ppm)
1	MBJ-01	193048.656	17.00	3281827.16	7384111.10	6645699.99	40.24	6.60	25.92	5.97	19.91	27.73	734.01	52.66
2	MBJ-02	482929.319	12.70	6133202.36	13799705.30	12419734.77	29.85	10.21	31.73	5.19	19.35	23.64	665.12	42.34
3	MBJ-04	625916.666	9.00	5633249.99	12674812.48	11407331.23	27.98	16.94	30.93	5.08	17.20	33.28	845.49	45.99
4	MBJ-05	626175.129	6.90	4320608.39	9721368.88	8749231.99	36.67	9.22	25.89	5.92	20.59	31.42	789.34	56.05
5	MBJ-06	521951.48	10.00	5219514.80	11743908.30	10569517.47	33.01	18.40	22.88	5.89	18.44	42.07	839.62	20.62
6	MBJ-07	686437.39	4.50	3088968.25	6950178.57	6255160.71	25.84	32.98	21.70	3.96	7.63	39.73	597.40	36.82
7	MBJ-08	424374.507	2.40	1018498.82	2291622.34	2062460.10	25.20	33.79	20.04	4.29	14.12	50.63	575.63	36.23
Total Geological resources of V grade in tonnes					**64565706.96**	**58109136.26**	**31.68**	**15.75**	**26.92**	**5.33**	**17.56**	**33.21**	**748.38**	**41.54**
Total Geological resources for V grade in million tonnes					**64.57**	**58.11**								

ANNEXURE-VIII-H/1

STATEMEMT SHOWING BOREHOLE WISE INFERRED CATEGORY OF RESOURCES (333) OF GALLIUM ESTIMATED BY POLYGONAL METHOD IN JULRAI BLOCK, DISTRICT - KACHCHH, GUJARAT (at cut off Ga >50ppm)

Bulk Density: 2.25

Sl. No.	BH No.	Polygon Area (m^2)	Thickness (m)	Volume (m^3)	Gross Geological Resources (tonnes)	Net Geological Resources (tonnes)	Average Quality							
							Al_2O_3 %	SiO_2 %	Fe_2O_3 %	TiO_2 %	LOI %	Sc (ppm)	V (ppm)	Ga (ppm)
1	MBJ-01	25321.87	8.50	215235.85	484280.67	435852.60	42.34	7.14	21.88	6.58	20.90	28.13	737.34	68.22
2	MBJ-02	28622.63	1.50	42933.94	96601.36	86941.23	33.27	11.90	29.91	5.02	18.21	16.87	899.55	53.26
3	MBJ-04	68859.99	1.00	68859.99	154934.99	139441.49	32.92	5.17	33.23	6.78	16.94	27.63	1063.59	60.96
4	MBJ-05	65027.46	4.40	286120.83	643771.87	579394.68	38.69	6.65	24.90	6.72	21.04	29.53	884.96	64.24
5	MBJ-06	80166.50	5.00	400832.48	901873.08	811685.77	39.05	7.76	22.63	6.82	22.18	33.48	805.38	56.08
Total Geological resources of Gallium grade in tonnes					**2281461.97**	**2053315.77**	**38.98**	**7.32**	**24.14**	**6.66**	**21.06**	**30.13**	**834.92**	**61.17**
Total Geological resources for Gallium grade in million tonnes					**2.28**	**2.05**								

Government of India
Ministry of Mines
National Mineral Exploration Trust
****

Sanction Order

F.No.23/582/2025-NMET/ 950 **New Delhi, 05th March, 2025**

Subject: Approval of mineral exploration project and release of 1st Advance from Grant-in-Aid (General) for the project "Preliminary Exploration (G-3) for Bauxite and associated minerals in Julrai Block, District: Kachchh, Gujarat."

Agency: - MECL

On the recommendation of Technical-cum-Cost Committee (TCC) of NMET, the Executive Committee (EC) in its 40th meeting held on 21st February, 2025 has approved mineral exploration project to be executed by MECL. The details of the project are given below:-

S. No.	Project/Block Name	Commodity	Stage	Duration (Months)	Approved Cost (Including GST)
1	Preliminary Exploration (G-3) for Bauxite and associated minerals in Julrai Block, District: Kachchh, Gujarat	Bauxite and associate minerals	G-3	14 Months (up to 04.05.2026)	₹2,46,49,379/-

2. The mineral exploration project will be funded by NMET as per the cost recommended by the TCC and approved by the EC. The Implementing Agency shall complete the same as per the approved cost estimates and time schedule, enclosed in **Annexure,** as summarized below: -

•	**Field Mobilization**	01st month (up to 04.04.2025).
•	**Exploration** (Sampling, Survey, Drilling, Camp winding)	02nd to 13th month (up to 04.04.2026).
•	**Laboratory Studies**	04th to 14th month (up to 04.05.2026)
•	**Report Writing with Peer Review and submission to NMET**	13th to 14th month (up to 04.05.2026)

3. The Implementing Agency shall submit progress on monthly basis to NMET Secretariat. The TCC, NMET shall review the progress of project and provide update to the Executive Committee.

4. Sanction is also hereby conveyed for release of the 1st instalment of 40% of the approved project cost i.e. **₹ 98,59,752/- (₹Ninety Eight Lakh Fifty Nine Thousand Seven Hundred Fifty Two only)** as an advance in terms of conditions stipulated in this office letter no. 42/1/2017-NMET/176 dated 16th December 2021 and letter no. 42/1/2017-NMET/217 dated 19th January 2022 regarding "*Release of funds to State Government / NEAs for mineral exploration*".

5. The expenditure will be debited to '2853' Non-Ferrous Mining and Metallurgical Industries (Major Head) 02-Regulation and Development of Mines (Sub-Major head) 102-Mineral Exploration (Minor Head) 05-National Mineral Exploration Trust Fund Activities (Sub-Head) 00- National

Mineral Exploration Trust Fund Activities (Detailed-Head) 05.00. 31-Grant-in-aid (General) under Demand No. 69, Ministry of Mines during the financial year 2024-25.

6. Certified that the pattern of assistance, under which the Grants-in-Aid (General) has been sanctioned, has the prior approval of Ministry of Finance.

7. MECL is a registered agency on EAT module of PFMS. In terms of **Rule 230, 235, 236 and 238 of GFR,** MECL should maintain subsidiary accounts of the Government Grants and furnish the same to the Principal Accounts Office of the Ministry. The account shall be open to inspection by the Sanctioning Authority and audit, both by the Comptroller and Auditor General of India and internal audit by the Principal Accounts Office of the Ministry of Mines, whenever the Organization is called upon to do so.

8. The exploration agency has to furnish the utilization certificate in respect of amount disbursed as Grant-in-aid for the project on utilization of disbursed amount or after completion of one year from the date of disbursement of advance, whichever is earlier. The next instalment of advance will be released after submission of utilization certificate and progress report in respect of the 1st instalment.

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

10. Shri Arun Kumar Chail, Section Officer in the Ministry will be the Drawing and Disbursing Officer for this purpose. It is requested that the payment of **₹ 98,59,752/- (₹Ninety Eight Lakh Fifty Nine Thousand Seven Hundred Fifty Two only)** may kindly be made to the Mineral Exploration and Consultancy Ltd, Dr. Babasaheb Ambedkar Bhawan, Seminary Hills, Nagpur – 440006 through RTGS in State Bank of India, Industrial Finance Branch, Nagpur (IFSC Code – SBIN0000432, Account No. 10374783387)

11. This has concurrence of JS & FA, Mines vide Note# 12 dated 04.03.2025 (E file No. 3077674).

Yours faithfully,

(Geetika Sharma)
Deputy Secretary & HoD, NMET

To
The Pay & Accounts Officer,
Pay & Accounts Office,
Ministry of Mines, New Delhi

Copy for information and further necessary action:

1. The Chairman & Managing Director, Mineral Exploration and Consultancy Ltd. (MECL), Dr. Babasaheb Ambedkar Bhawan, Seminary Hills, Nagpur – 440006.
2. I.F. Division, Ministry of Mines, Shastri Bhawan, New Delhi.
3. Executive Committee (EC) Meeting file (F.No.6/2/2015-NMET)
4. The Chairman, TCC, NMET.
5. Grant-in aid Sanction order file.

Annexure 4A

Estimate cost for Preliminary Exploration (G3) for Bauxite and Associated Minerals in Julrai Block (8.12 sq. km) Kachchh District, Gujarat.
[Block area- 8.12 sq. km; Schedule timeline- 14 months; BH-30 nos;BH depth - 30 m, Drilling- 900m; Review- After 6 months]
Name of the Agency – MECL

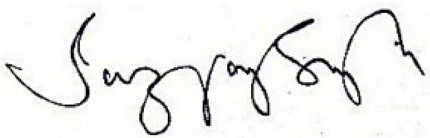
S. No.	Item of Work	Unit	Rates as per NMET SoC 2020-21		Estimated Cost of the Proposal		Remarks
			SoC-Item - Sl No.	Rates as per SoC	Qty.	Amount (Rs)	
A	**GEOLOGICAL WORK (1:4000 scale) & TOPOGRAPHICAL SURVEY (1:4000 scale)**						
i	Charges for one Geologist- Field	day	1.3	11,000	180	19,80,000	
ii	Charges for one Geologist per- HQ	day	1.3	9,000	60	5,40,000	
iii	2 labours/ party (As per rates of Central Labour Commissioner)	day	5.7	526	360	1,89,360	Amount will be reimburse as per the notified rates by the Central Labour Commissioner or respective State Govt. whichever is higher
iv	Sampling party days-1 Samplers Labour charge not included	day	1.5.2	5,100	181	9,23,100	
v	4 labours/ party (As per rates of Central Labour Commissioner)	day	5.7	526	724	3,80,824	Amount will be reimburse as per the notified rates by the Central Labour Commissioner or respective State Govt. whichever is higher
vi	Survey Party Days for topographical contour survey, block boundary and borehole points fixation	day	1.6. 1a	8,300	40	3,32,000	
vii	4 labours for surveyor	day	5.7	526	160	84,160	
	Sub Total- A					**44,29,444**	
B	**PITTING AND TRENCHING**						
i	Pitting	Cu m	2.1.2	3800	150	5,70,000	
ii	Trenching	Cu m	2.1.1	3330	50	1,66,500	

	Sub Total- B					**7,36,500**	
C	**LABORATORY STUDIES**						
1	**Chemical Analysis**						
i	**Primary & Check samples for Bauxite BRS/Chip/Channel/Trench/BH samples)**						
	a. Primary Samples for 5 radicals i.e. Al2O3, SiO2, Fe2O3, TiO2 & LOI-XRF	Nos	4.1.15a	4,200	700	29,40,000	BH-600, BRS-50, Pit/Trench-50
	b. For each additional trace elements viz. V, Sc & Ga- XRF	Nos	4.1.15b	1,263	600	7,57,800	From BH primary 3 samples
	c.External (10%) Check samples for 5 radicals i.e. Al2O3, SiO2, Fe2O3, TiO2 & LOI	Nos	4.1.15a	4,200	70	2,94,000	
	d. External (10%) Check samples for each additional trace elements viz. V & Ga	Nos	4.1.15b	1,263	60	75,780	
2	**Physical,Petrological, Mineralogical Studies**						
i	Preparation of thin section	Nos	4.3.1	2,353	10	23,530	
ii	Complete petrographic study report	Nos	4.3.4	4,232	10	42,320	
iii	Preparation of polished section	Nos	4.3.2	1,549	10	15,490	
iv	Complete mineragraphic study report	Nos	4.3.4	4,232	10	42,320	
v	Digital Photographs	Nos	4.3.7	280	10	2,800	
vi	X-RD studies for mineral identification	Nos	4.5.1	4,000	10	40,000	

vii	ICP-AES/ICPMS (sequential technique) for 34 elements i.e. 16 other elements viz. Li, Ga, In, Be, Ge, Mo, Ni, Cr, Ta, W, Ba, Co, Rb, Sr, Zr, Nb ;16 REE viz. La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Sc, Y; 02 Actinides viz. U, Th.	Nos	4.1.14	7,731	20	1,54,620	Samples to be taken from the lithomerge & Bentonite clay. Orientation survey for REE zone from pits.
viii	Bulk density determination	Nos	4.10	3540	10	35,400	
ix	Combined determination of Trihydrate Alumina (THA-140°C), Monohydrate Alumina (MHA-240°C) & Reactive Silica	Nos	4.1.17a	6700	10	67,000	
	Sub Total- C					**44,91,060**	
D	**DRILLING**						
i	Drilling upto 300m (Soft Rock) (1 rigs)	m	2.2.1.1b	7,168	900	64,51,200	First 8 boreholes will be taken up during the 1st phase of exploration. Rest 22 bhs will be taken up after review by NMET committee. MoC Rate
ii	Land / Crop Compansation	per BH	5.6	20,000	30	6,00,000	
iii	Construction of concrete Pillar (12"x12"x30")	per borehole	2.2.7a	2,000	30	60,000	
iv	Transportation of Drill Rig & Truck associated per drill- 2 rigs	Km	2.2.8	36	5,160	1,85,760	As per actuals (To and Fro for 2 rigs)
v	Monthly Accomodation Charges for drilling Camp (up to 2 Rigs)	month	2.2.9	50,000	5	2,50,000	
vi	Drilling Camp Setting Cost	Nos	2.2.9a	2,50,000	2	5,00,000	
vii	Drilling Camp Winding up Cost	Nos	2.2.9b	2,50,000	2	5,00,000	
viii	Approach Road Making	Km	2.2.10a	22,020	2	44,040	Road Making will be considered as per the requirement and Road Making Charges will be reimbursed for max. 4 km.

ix	Bore Hole Fixation and determination of co-ordinates & Reduced Level of the boreholes by DGPS	Nos	1.6.2	19,200	35	6,72,000	30 Boreholes+ 5 Block Boundary points
x	Drill core preservation: One complete borehole plus mineralised cores of all the remaining Bhs	m	5.3	1,590	500	7,95,000	This amount will be reimbursed after successful delivery of the cores to concerned libraries/authorities
	Sub Total- D					**1,00,58,000**	
E	**Total A to D**					**1,97,15,004**	
F	**Geological Report Preparation**		**5.2**	For the projects having cost exceeding Rs. 150 lakhs but less than Rs.300 lakhs - A minimum of Rs. 7.5 lakhs or 3% of the value of work whichever is more		**7,50,000**	Reimbursement will be made after submission of the final Geological Report in Hard Copies (5 Nos) and the soft copy to NMET.
G	**Peer review Charges**		**As per EC decision**			**30,000**	
H	**Preparation of Exploration Proposal**	**5 Hard copies with a soft copy**	**5.1**	2% of the Cost or Rs. 5.0 Lakhs whichever is lower		**3,94,300**	EA has to submit the final proposal along with Maps and Plan as suggested by the TCC-NMET in its meeting while clearing the proposal.
I	**Total Estimated Cost without GST**					**2,08,89,304**	

J	**Provision for GST (18% of I)**	**37,60,074.73**	GST will be reimburse as per actual and as per notified prescribed rate
K	**Total Estimated Cost with GST**	**2,46,49,378.81**	
	or Say Rs. In Lakhs	**246.49**	
Note:			
1	Strict adherence to the Ministry of Finance's and GFR guidelines is mandatory. Every transaction must adhere to GFR rule 21.		
2	In case of delay/non- performance, the appropriate action will be taken by competent authority against delinquent agency as per prevailing govt. of India rules/guidelines on procurement.		
3	If any part of the project is outsourced, the amount will be reimbursed as per the Paragraph 3 of NMET SoC and Item no. 6 of NMET SoC. In case of execution of the project by NEA on its own, a Certificate regarding non outsourcing of any component/project is required.		
4	Necessary efforts should be made to minimize any adverse impact on the environment during exploration activities.		
5	Any item of work not mentioned above shall be added as per SoC.		
6	All the Geological Reports and data are to be uploaded on NGDR as per MERT template by the agency.		



Annexure 4B

Time Schedule/ Action plan for Preliminary Exploration (G3) for Bauxite and Associated Minerals in Julrai Block (8.12 sq. km) Kachchh District, Gujarat

S. No.	Particulars	Months/ Days	1	2	3	4	5	6		7	8	9	10	11	12	13	14
1	Camp Setting	months															
2	Geological Mapping & BR sampling	months															
3	Survey days (Topographic survey & BH/BB survey)	days															
4	Pitting/Trenching	cu.m															
5	Drilling (2 rigs)	m															
6	Geologist days	days							Review								
7	Sampling days, BRS, Pit & Core Sampling	days															
8	Camp winding	months															
9	Laboratory Studies	months															
10	Geologist days, HQ	days															
11	Report Writing with Peer Review	months															

Ministry of Mines
National Mineral Exploration & Development Trust
Minutes of 25th meeting of Technical-cum-Cost Committee - II (TCC - II)
held on 17th and 18th March 2026

The 25th meeting of Technical-cum-Cost Committee–II (TCC-II) of National Mineral Exploration and Development Trust (NMEDT) was convened through video conferencing under the Chairmanship of Shri Pradeep Singh, Deputy Director General (DDG), Geological Survey of India (GSI) and Chairman, TCC-II, NMEDT held on 17th and 18th March 2026.

Members of TCC-II, NMEDT and representatives from M/s Kartikay Exploration & Mining Services Private Limited, M/s Envirogreen Consultants (India) Private Limited, DGM Nagaland, M/s Maheshwari Mining Private Limited (MMPL), DMG Rajasthan, M/s GEMS Project Private Limited, M/s Geo Marine Solutions Private Limited, DMR Meghalaya, M/s Critical mineral trackers (CMT), Central Mine Planning & Design Institute Limited (CMPDI), M/s Natural Resources Division-Tata Steel Limited, M/s Vardan Environet LLP, M/s United Exploration India Private Limited, M/s PRB Infraprojects Private Limited, Mineral Exploration and Consultancy Limited (MECL), M/s UNISED Research Consultants Private Limited, M/s Shijay Projects India Private Limited, M/s APC Drilling & Construction Private Limited, M/s Enkay Enviro Services Private Limited, M/s Ocean Drilling and Exploration Private Limited, DGM Odisha, DGM Jharkhand, etc. have attended the meeting through video conferencing mode.
The list of participants is at **Annexure-1.**

Shri Pradeep Singh, DDG, GSI and Chairman, TCC-II, NMEDT warmly welcomed all TCC-II members and every participant representing from State DGMs/DMGs, Notified Exploration Agencies (NEAs) and Notified Private Exploration Agencies (NPEAs).

Shri Pradeep Singh informed all exploration agencies that the *Checklist for Exploration Agencies for Submission of Exploration Project Proposals* has been issued as Annexures 7 & 8 of the Minutes of the 7th Joint Meeting of the Technical-cum-Cost Committees held on 20th February 2026 and available on NMEDT website. All agencies are required to adhere to the checklist, as this will help streamline the evaluation process and save time.

25.1 Technical Evaluation of New Project Proposals

Agenda 25.1.1 Preliminary exploration (G3) for Limestone in Ratanpura Kamba – Waghs block, Aravali and Mahisagar district, Gujarat (8.89 sq. km)
[Implementing Agency: M/s Kartikay Exploration & Mining Services Pvt. Ltd.]

a) The proposed area of 8.89 sq. km for preliminary exploration (G3), falls in the survey of India toposheet No. 46E/08 and lies within Aravali and Mahisagar districts, Gujarat.
b) The table containing the comments is given below

S.N.	Agency	Comment
1	GSI	No previous work in the area. No ongoing Reconnaissance or Exploration projects pertaining to limestone or any other mineral exists in the proposed area.
2	DMG	The proposed block is overlapping with the MB7 Ranjitpura Manganese Block (G4 level, area: 7.18 sq.km). NOC issued to CGM/GMRDS. A solar park is observed within the proposed Limestone Ratanpur Kampa–Waghas block.

c) The TCC-II noted that the geological map presented lacks adequate structural data. The agency is directed to revise and resubmit the geological map incorporating complete and detailed structural information for the entire project area.

Recommendation TCC

The Committee deferred the review of the proposal to the next TCC-II meeting. The agency was advised to prepare the geological map with all structural data of the project area.

Agenda 25.2.25: Preliminary Exploration (G3) for Bauxite and Associated Minerals in Julrai block, District-Kachchh, Gujarat.

[Implementing Agency: Mineral Exploration and Consultancy Limited (MECL)]

a) The project was recommended in 5th TCC-II meeting held on 27th, 28th and 29th January, 2025 and approved in the 4th EC Meeting held on 21st February 2025. The sanction order was issued on 05th March 2025 with timeline of 14 months up to 04th May 2026 with an approved cost of ₹246.49/- Lakh (including GST). Review of the project was scheduled after 6 months. Drilling of 8 Boreholes of 30m depth in Phase-I was decided to be done, remaining 22 boreholes will be taken up after review.
b) MECL informed that geological mapping on 1:4000 scale of 8.12 sq. km. area has been done. In phase -1 total 7 nos. of boreholes have been drilled, in which MBJ7 and MBJ8 did not encounter any Bauxite and/or Aluminous Laterite. Also, SiO_2 content is more i. e. about 20%. However, metallurgical grade Bauxite have been encountered in borehole MBJ1. The agency requested conclusion of the project in view of the limited Bauxite occurrence and prevailing field constraints. The agency requested approval for submission of the final geological report.
c) Considering the facts, the TCC-II agreed for conclusion of the project. The revised cost sheet was evaluated and the same was recommended for approval of PSC.

Recommendation TCC

The Committee recommended the proposal for approval of PSC for "revised cost ₹77.23 Lakh (including GST) against the approved cost of ₹246.49 Lakh (including GST) as Annexure-10 due to pre-closure of the project".

Annexure-10										
Revised Estimated cost for Preliminary Exploration (G-3) for Bauxite and associated minerals in Julrai Block, Districts: Kachchh, State: Gujarat [Block area- 8.12 sq. km; Schedule timeline- 14 months; BH-30 nos.; Drilling- 900m; Review- After 6 months]										
S. No.	**Item of Work**	**Unit**	**Rates as per NMEDT SoC 2020-21**		**Estimated Cost of the Proposal**		**Revised Estimated Cost of the Project**		**Remarks**
			SoC-Item -Sl No.	**Rates as per SoC**	**Qty.**	**Amount (Rs)**	**Qty.**	**Amount (Rs)**	
A	**GEOLOGICAL WORK (1:4000 scale) & TOPOGRAPHICAL SURVEY (1:4000 scale)**								
i	Charges for one Geologist-Field	day	1.3	11,000	180	19,80,000	100	11,00,000	
ii	Charges for one Geologist per-HQ	day	1.3	9,000	60	5,40,000	40	3,60,000	
iii	2 labours/ party (As per rates of Central Labour Commissioner)	day	5.7	526	360	1,89,360	200	1,05,200	Amount will be reimburse as per the notified rates by the Central Labour Commissioner or respective State Govt. whichever is higher
iv	Sampling party days-1 Samplers Labour charge not included	day	1.5.2	5,100	181	9,23,100	65	3,31,500	
v	4 labours/ party (As per rates of Central Labour Commissioner)	day	5.7	526	724	3,80,824	260	1,36,760	Amount will be reimburse as per the notified rates by the Central Labour Commissioner or respective State

									Govt. whichever is higher
vi	Survey Party Days for topographical contour survey, block boundary and borehole points fixation	day	1.6. 1a	8,300	40	3,32,000	40	3,32,000	
vii	4 labours for surveyor	day	5.7	526	160	84,160	160	84,160	
	Sub Total- A					**44,29,444**		**24,49,620**	
B	**PITTING AND TRENCHING**								
i	Pitting	Cu m	2.1.2	3800	150	5,70,000	50	1,90,000	
ii	Trenching	Cu m	2.1.1	3330	50	1,66,500	-		
	Sub Total- B					**7,36,500**		**1,90,000**	
C	**LABORATORY STUDIES**								
1	**Chemical Analysis**								
i	**Primary & Check samples for Bauxite BRS/Chip/Channel/Trench/BH samples)**								
	a. Primary Samples for 5 radicals i.e. Al2O3, SiO2, Fe2O3, TiO2 & LOI	Nos	4.1.15a	4,200	700	29,40,000	247	10,37,400	BH-178, BRS-50, Pit/Trench-19
	b. For each additional trace elements viz. V, Sc & Ga	Nos	4.1.15b	1,263	600	7,57,800	178	2,24,814	From BH primary samples
	c. External (10%) Check samples for 5 radicals i.e.	Nos	4.1.15a	4,200	70	2,94,000	25	1,05,000	

	Al2O3, SiO2, Fe2O3, TiO2 & LOI								
	d. External (10%) Check samples for each additional trace elements viz. V, Sc & Ga	Nos	4.1.15b	1,263	60	75,780	18	22,734	
	a. Primary Samples for 10 radicals i.e. CaO, MgO, Al2O3, SiO2, Fe2O3, SO3, P2O5, K2O, Na2O & LOI	Nos	4.1.15a	4,200	-	-	3	12,600	To know te grade of Limestone
2	**Physical, Petrological, Mineralogical Studies**								
i	Preparation of thin section	Nos	4.3.1	2,353	10	23,530	6	14,118	
ii	Complete petrographic study report	Nos	4.3.4	4,232	10	42,320	6	25,392	
iii	Preparation of polished section	Nos	4.3.2	1,549	10	15,490	4	6,196	
iv	Complete mineragraphic study report	Nos	4.3.4	4,232	10	42,320	4	16,928	
v	Digital Photographs	Nos	4.3.7	280	10	2,800	10	2,800	
vi	X-RD studies for mineral identification	Nos	4.5.1	4,000	10	40,000	5	20,000	
vii	ICP-AES/ICPMS (sequential technique) for 34 elements i.e. 16 other elements viz. Li, Ga, In, Be, Ge, Mo, Ni, Cr, Ta, W, Ba, Co, Rb, Sr, Zr, Nb ;16 REE viz. La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Sc, Y; 02 Actinides viz. U, Th.	Nos	4.1.14	7,731	20	1,54,620	20	1,54,620	

viii	Bulk density determination	Nos	4.10	3540	10	35,400	3	10,620	
ix	Combined determination of Trihydrate Alumina (THA-140°C), Monohydrate Alumina (MHA-240°C) & Reactive Silica	Nos	4.1.17a	6700	10	67,000	8	53,600	
					Sub Total- C	**44,91,060**		**17,06,822**	
D	**DRILLING**								
i	Drilling up to 300m (Soft Rock) (1 rigs)	m	2.2.1.1b	7,168	900	64,51,200	96	6,89,920	Only 7Bh drilled in Phase-I
ii	Land / Crop Compensation	per BH	5.6	20,000	30	6,00,000	-	-	
iii	Construction of concrete Pillar (12"x12"x30")	per borehole	2.2.7a	2,000	30	60,000	7	14,000	
iv	Transportation of Drill Rig & Truck associated per drill	Km	2.2.8	36	5,160	1,85,760	5,160	1,85,760	
v	Monthly Accommodation Charges for drilling Camp (up to 2 Rigs)	month	2.2.9	50,000	5	2,50,000	2	1,00,000	
vi	Drilling Camp Setting Cost	Nos	2.2.9a	2,50,000	2	5,00,000	1	2,50,000	
vii	Drilling Camp Winding up Cost	Nos	2.2.9b	2,50,000	2	5,00,000	1	2,50,000	
viii	Approach Road Making	Km	2.2.10a	22,020	2	44,040	1	22,020	
ix	Bore Hole Fixation and determination of co-ordinates & Reduced Level of the boreholes by DGPS	Nos	1.6.2	19,200	35	6,72,000	12	2,30,400	30 Boreholes (7)+ 5 Block Boundary points
x	Drill core preservation: One complete borehole plus	m	5.3	1,590	500	7,95,000	-	-	

	mineralised cores of all the remaining Bhs								
	Sub Total- D					**1,00,58,000**		**17,42,100**	
E	**Total A to D**					**1,97,15,004**		**60,88,542**	
F	**Geological Report Preparation**		**5.2**	For the projects having cost exceeding Rs. 150 lakhs but less than Rs.300 lakhs - A minimum of Rs. 7.5 lakhs or 3% of the value of work whichever is more		**7,50,000**		**3,04,427**	Reimbursement will be made after submission of the final Geological Report in Hard Copies and the soft copy to NMEDT.
G	**Peer review Charges**		**As per EC decision**			**30,000**		**30,000**	
H	**Preparation of Exploration Proposal**	**5 Hard copies with a soft copy**	**5.1**	2% of the Cost or Rs. 5.0 Lakhs whichever is lower		**3,94,300**		**1,21,771**	Bill already raised after commencement of the block
I	**Total Estimated Cost without GST**					**2,08,89,304**		**65,44,740**	
J	**Provision for GST (18% of I)**					**37,60,074.73**		**11,78,053.19**	GST will be reimbursed as per actual and as per notified prescribed rate
K	**Total Estimated Cost with GST**					**2,46,49,378.81**		**77,22,793.13**	
	or Say Rs. In Lakhs					**246.49**		**77.23**	
Note									

1	Strict adherence to the ministry of finance's and GFR guidelines is mandatory. Every transaction must adhere to GFR rule-21
2	In case of delay/non-performance, the appropriate action will be taken by competent authority against delinquent agency as per prevailing govt of India rules/guidelines on procurement.
3	If any of the project is outsourced, the amount will be reimbursed as per the paragraph 3 of 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

Peer review comments and suggestions incorporated in Geological report on Preliminary exploration (G-3 Level) for Bauxite and associated Minerals in Julrai Block District: Kachchh, State-Gujarat

Suggestions based on the scientific and technical content of the report from the quality angle:

Geological Report

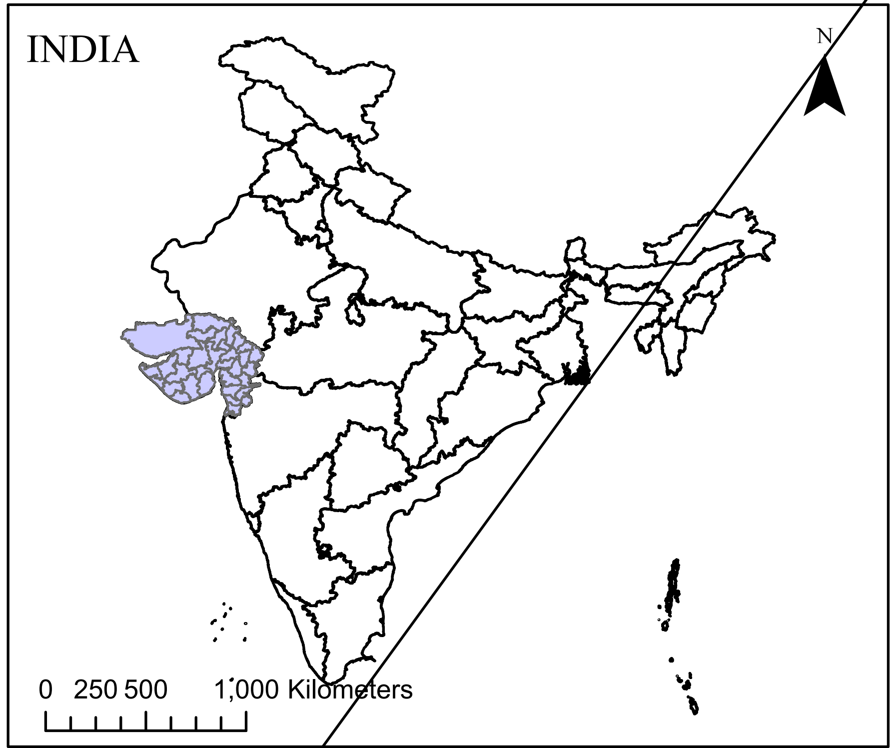
Sr. No.	Comments from Peer reviewer	Response of MECL
1	The Geological Report on Preliminary Exploration (G-3) for Bauxite and associated minerals is nicely written and comprehensive document prepared in accordance with the requirements of G-3 level of exploration.	Thank you
2	The exploration team has carried out systematic field investigations, compilation of primary and secondary data, and interpretation of geological and analytical results with due diligence. The effort made by the team in preparation of the report in alignment with the provisions of Part-IVA of MEMC Rules, 2021 is appreciable.	Thank you
3	Certain sections of the report appear lengthy and make it in narrative form. The text may be made more concise and crisper wherever indicated in the marked hard copy, without compromising the technical content.	The correction mentioned is attended.
4	Repetition of text part at few places as indicated in the body of the report to be deleted.	The correction mentioned in the text are attended.
5	Some of the field photographs are not referred in the text part. The field photographs which are not referred in the text part to be referred in text part at proper place.	The correction mentioned is attended.
6	Annexures and plates may be cross-checked with the list of annexures and plates to ensure completeness.	Annexures and plates have been cross-checked with the list of annexures and plates
7	A plate showing construction of polygon may be added as it is missing in the report.	Plate showing polygon has been prepared and included in the report.
8	Resource estimation may be thoroughly checked as the area of polygons are not	The resource estimation thoroughly checked and

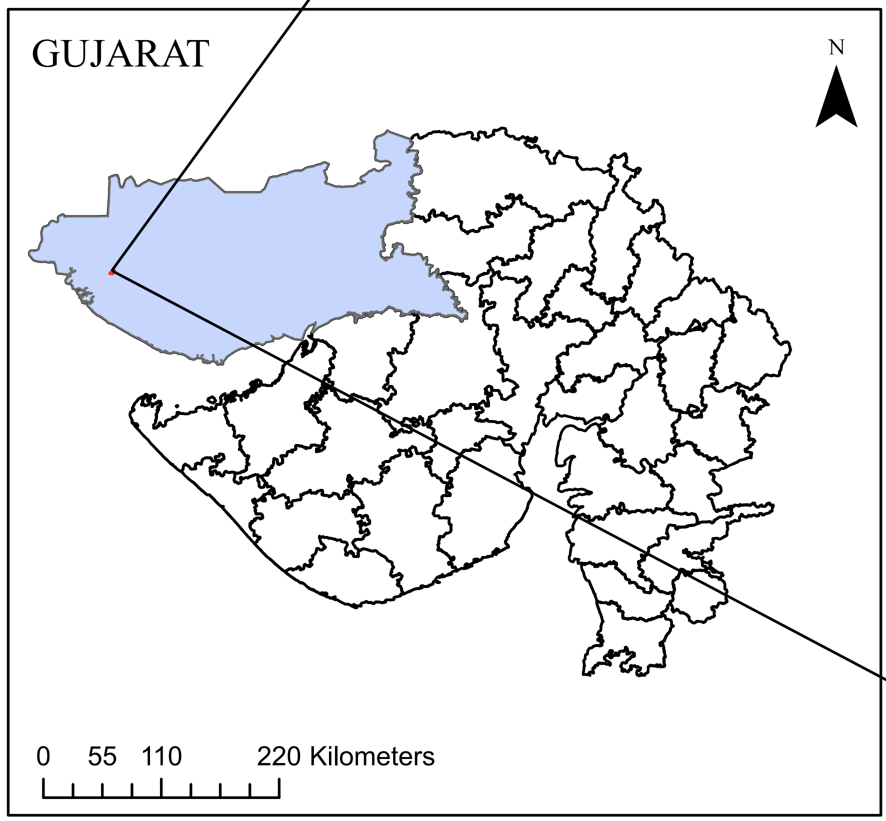
Sr. No.	Comments from Peer reviewer	Response of MECL
	matching for the same bore hole in different resource computation tables.	attended.
9	Author is advised for strict adherence to the assumptions made for logical estimation of resources.	Assumption made logically and accordingly attended.
10	Editorial, typographical corrections, other technical details as required and indicated on relevant page and formatting improvements suggested in the hard copy of the Geological Report (including text, annexures, and plates) may kindly be attended.	The correction mentioned are attended.
11	The spelling of district may be written as per state gazette notification.	The correction mentioned are attended. The spelling of District Kachchh maintain throughout the geological Report.
12	Location Index of the study area may be given in the respective section of the GR.	Location Index placed at respective Section
13	Plate numbering, cross-references between text, tables, figures, photographs and plates, and legend descriptions may be checked once again to ensure consistency.	All cross reference in text, tables, figures, photographs and plates has been checked and ensure consistency.

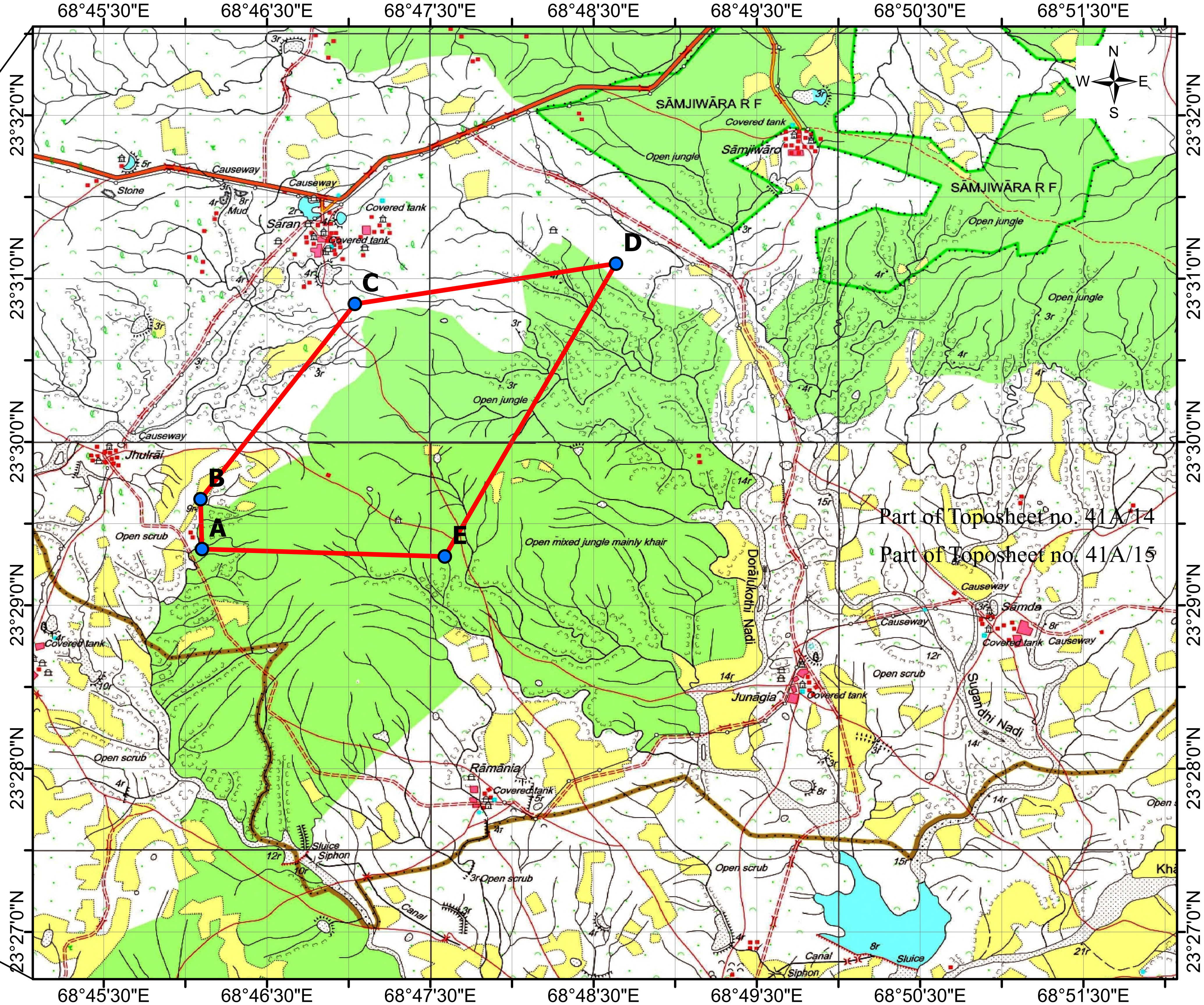
Sr. No.	Comments from Peer reviewer	Response of MECL
14	The final report should have the following folder Structure, along with Georeff Images, GIS files, Images, Tables and Text in the prescribed schema of MERT format of NGDR, so that it can be directly uploaded to NGDR portal. i) Text folder should have one single pdf (cover to cover) and one single doc file. ii) Table folder should have all the tables and annexures as per the content of the report. iii) Image folder should contain all the images, maps/plates and figures, field photographs etc. available in the report. iv) GeoRef images folder should have the geotiff files of all the vectorised maps. v) and as GIS files folder should contain the vector files of the plates/maps in gdb format per the LSM/DM schema. Only those maps/plates with LSM/ DM scale (1:12,500 or larger) may be prepared as per the provided schema. Other maps with are not related to large scale mapping and detailed mapping, for example location maps, regional scale maps, any other small-scale map etc., may not be digitized as per the schema.	The Report is aligned with MERT format of NGDR and map are in GIS format containing the vector files of the plates/maps in. gdb format. Final file to be uploaded to NGDR portal immediately after final submission of Geological Report.

The Geological Report was reviewed by Shri Jayant Kumar, Retd. Dy GM, MECL as nominated Peer Reviewer by NMEDT.

PLATES







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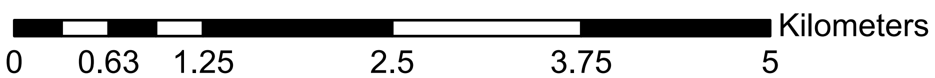


Co-ordinate of the Corner Points of Julrai Block					
S.No	Corner Point	UTM Zone 42		Latitude	Longitude
		Easting	Northing		
		m	m	DMS	DMS
1	A	476347.92	2597680.96	23° 29' 20.67" N	068° 46' 6.11" E
2	B	476333.79	2598244.67	23° 29' 39.0" N	068° 46' 5.58" E
3	C	477944.70	2600448.62	23° 30' 50.75" N	068° 47' 2.26" E
4	D	480667.13	2600899.30	23° 31' 5.53" N	068° 48' 38.24" E
5	E	478878.12	2597593.15	23° 29' 17.94" N	068° 47' 35.32" E

MECL

MINERAL EXPLORATION & CONSULTANCY LIMITED

LOCATION MAP

JULRAI BLOCK

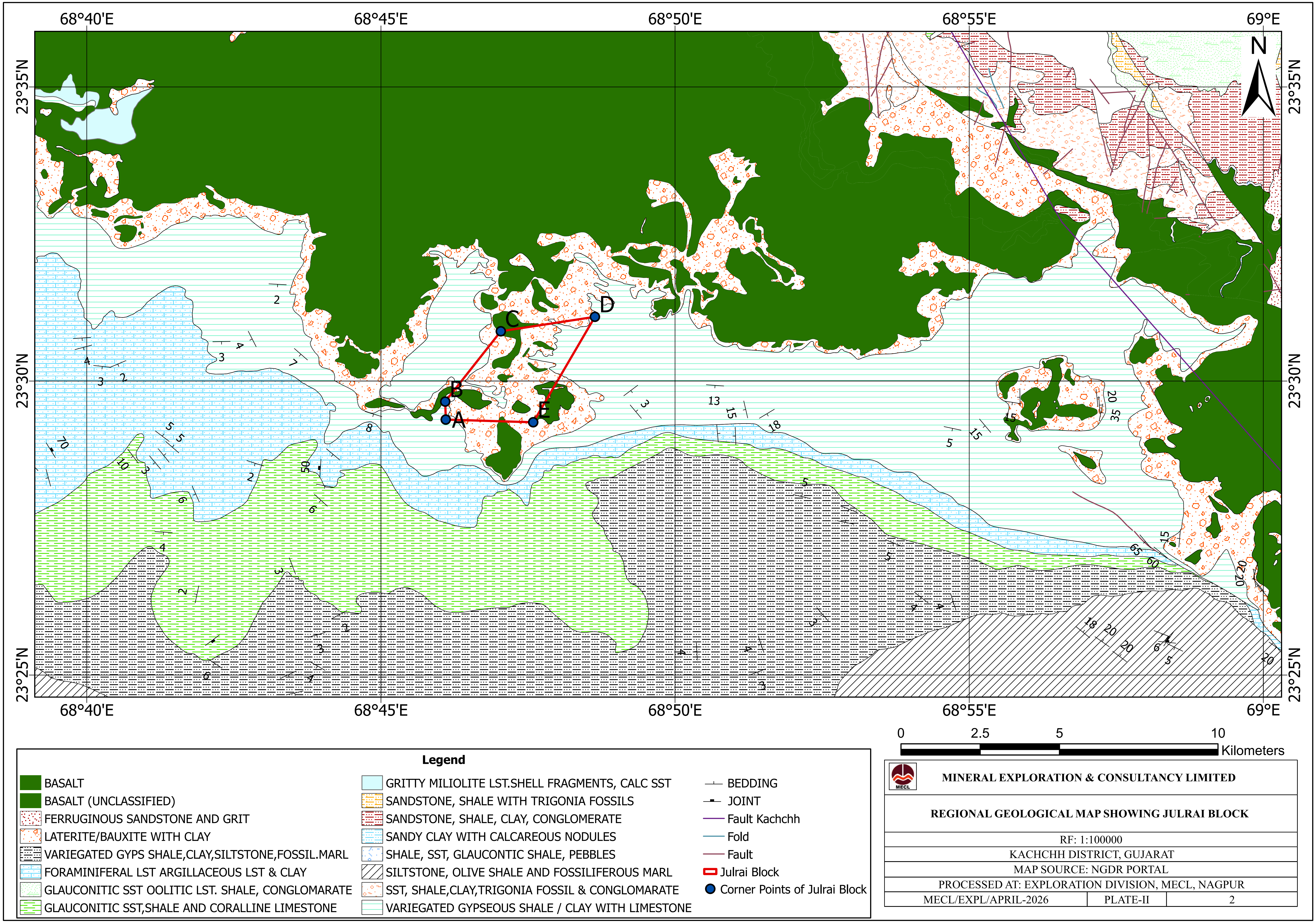
(AREA: 8.12 SQ KM)

KACHCHH DISTRICT, GUJARAT

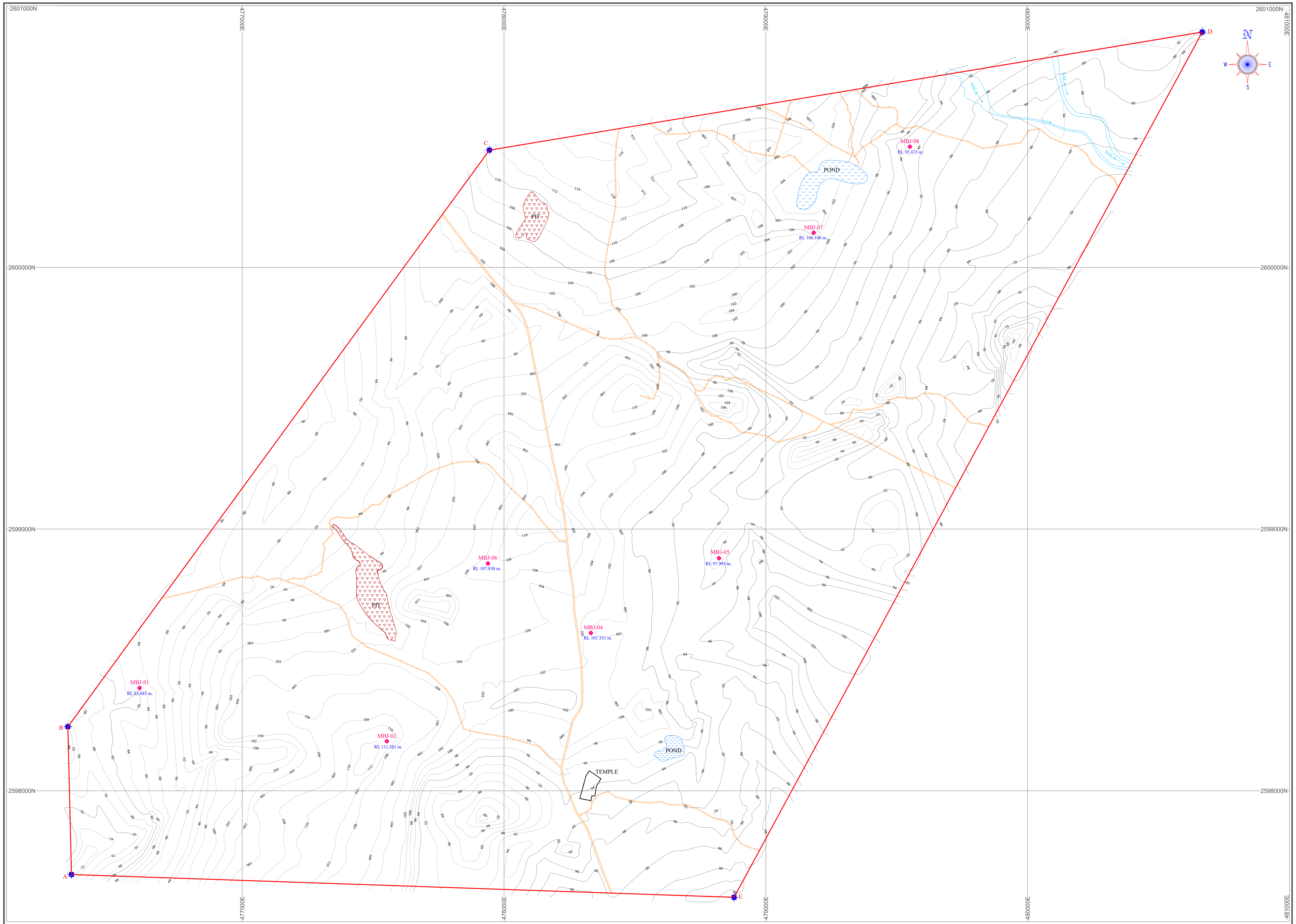
(PART OF TOPOSHEET NO. 41A14 & 41A15)

PROCESSED AT: EXPLORATION DIVISION, MECL, NAGPUR

MECL/EXPL/APRIL-2026	PLATE-I	1



68°40'E
68°45'E
68°50'E
68°55'E
69°E
23°35'N
23°30'N
23°25'N
N
A
B
C
D
E
0
2.5
5
10
Kilometers
Legend
BASALT
BASALT (UNCLASSIFIED)
FERRUGINOUS SANDSTONE AND GRIT
LATERITE/BAUXITE WITH CLAY
VARIEGATED GYPS SHALE,CLAY,SILTSTONE,FOSSIL.MARL
FORAMINIFERAL LST ARGILLACEOUS LST & CLAY
GLAUCONITIC SST OOLITIC LST. SHALE, CONGLOMARATE
GLAUCONITIC SST,SHALE AND CORALLINE LIMESTONE
GRITTY MILIOLITE LST.SHELL FRAGMENTS, CALC SST
SANDSTONE, SHALE WITH TRIGONIA FOSSILS
SANDSTONE, SHALE, CLAY, CONGLOMERATE
SANDY CLAY WITH CALCAREOUS NODULES
SHALE, SST, GLAUCONTIC SHALE, PEBBLES
SILTSTONE, OLIVE SHALE AND FOSSILIFEROUS MARL
SST, SHALE,CLAY,TRIGONIA FOSSIL & CONGLOMARATE
VARIEGATED GYPSEOUS SHALE / CLAY WITH LIMESTONE
BEDDING
JOINT
Fault Kachchh
Fold
Fault
Julrai Block
Corner Points of Julrai Block
MINERAL EXPLORATION & CONSULTANCY LIMITED
REGIONAL GEOLOGICAL MAP SHOWING JULRAI BLOCK
RF: 1:100000
KACHCHH DISTRICT, GUJARAT
MAP SOURCE: NGDR PORTAL
PROCESSED AT: EXPLORATION DIVISION, MECL, NAGPUR
MECL/EXPL/APRIL-2026
PLATE-II
2



INDEX

- Block Boundary with Corner Points
- Boreholes drilled by MECL
- Nala
- Roads: UnMetalled
- Roads: Metalled
- Contours with values
- Pond
- Pit
- Temple

BOREHOLE CO-ORDINATES OF JULRAI BLOCK IN UTM ZONE 42N(WGS84)						
SR. No.	POINT ID	LATITUDE	LONGITUDE	EASTING	NORTHING	RL (M)
1	MBJ-01	23° 29' 43.83815" N	68° 46' 15.23996" E	476608.013	2598393.013	85.045
2	MBJ-02	23° 29' 37.26198" N	68° 46' 48.54977" E	477552.445	2598189.307	111.381
3	MBJ-04	23° 29' 50.75390" N	68° 47' 16.00346" E	478331.717	2598603.040	101.331
4	MBJ-05	23° 30' 00.06823" N	68° 47' 33.24810" E	478821.221	2598888.761	97.993
5	MBJ-06	23° 29' 59.36880" N	68° 47' 02.13037" E	477938.649	2598868.553	107.830
6	MBJ-07	23° 30' 40.53236" N	68° 47' 45.87104" E	479180.990	2600132.602	106.108
7	MBJ-08	23° 30' 51.23145" N	68° 47' 58.87587" E	479550.251	2600461.102	95.473

BLOCK BOUNDARY CO-ORDINATES OF JULRAI BLOCK IN UTM ZONE 42N(WGS84)						
SR. No.	POINT ID	LATITUDE	LONGITUDE	EASTING	NORTHING	RL (M)
1	BB-A	23°29'20.64162"N	68°46'06.10761"E	476347.849	2597680.089	72.147
2	BB-B	23°29'39.00811"N	68°46'05.58853"E	476334.037	2598244.919	82.041
3	BB-C	23°30'50.73608"N	68°47'02.24515"E	477944.280	2600448.197	110.572
4	BB-D	23°31'05.53014"N	68°48'38.23698"E	480667.042	2600899.302	90.479
5	BB-E	23°29'17.93434"N	68°47'35.33712"E	478878.603	2597592.974	81.188

0m 100 200 300 400 500

MINERAL EXPLORATION AND CONSULTANCY LIMITED
(Formerly Mineral Exploration Corporation Limited)

TOPOGRAPHICAL MAP
JULRAI BLOCK (EXTENT - 8.12 Sq Km.)
DISTRICT : KACHCHH STATE : GUJRAT

RF. 1:4,000

PROCESSED AT :
SURVEY AND MAP SECTION,
MECL, NAGPUR.

Surveyed by : Mukesh Vishwakarma, Tech. (Survey)
Prepared by : Punit Khandale, Sr. Tech. (Survey)
Checked by : Swarup Dhara, Sr. Manager (Geology)
Approved by : Shrikant Sharma, HOD, Exploration

MECL/EXPL./APR-2026 | PLATE NO.- III | 3

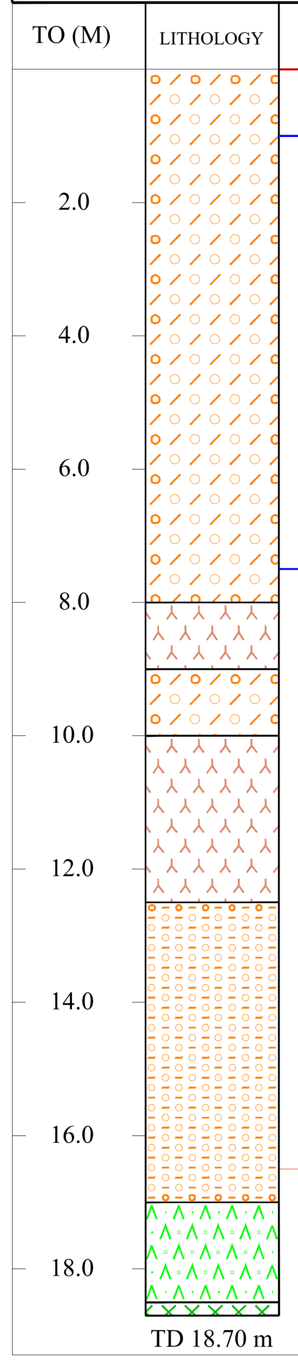

68°47'E
68°48'E
68°49'E
23°31'N
23°30'N
N
S
E
W
A
B
C
D
E
12
7
8
50
Legend
Cardinal Point
Block Boundary
Bedding
Joint
Old workings
Lithology
Soil
Gypseous Shale-Siltstone-Limestone with Clay
Limestone
Laterite
Aluminous Laterite
Clayey Bauxite
Bauxitic Clay
Bauxite
Basalt
Scale: 1:4,000
0
0.25
0.5
1
Kilometers
MINERAL EXPLORATION & CONSULTANCY LIMITED
DETAILED GEOLOGICAL MAP
JULRAI BLOCK
(AREA: 8.12 SQ KM)
RF: 1:4000
KACHCHH DISTRICT, GUJARAT
MAPPED BY: SHUBHAM KUMAR, GEOLOGIST
CHECKED BY: SWARUP DHARA, SR. MANAGER (GEOLOGY)
APPROVED BY: SHRIKANT SHARMA, HOD, EXPLORATION
PROCESSED AT: EXPLORATION DIVISION, MECL, NAGPUR
MECL/EXPL/APRIL-2026
PLATE-IVA
4

MINERAL EXPLORATION & CONSULTANCY LIMITED		
DETAILED GEOLOGICAL MAP SHOWING BEDROCK SAMPLES WITH ANALYSIS		
JULRAI BLOCK (AREA: 8.12 SQ KM)		
RF: 1:4000		
KACHCHH DISTRICT, GUJARAT		
MAPPED BY: SHUBHAM KUMAR, GEOLOGIST CHECKED BY: SWARUP DHARA, SR. MANAGER (GEOLOGY) APPROVED BY: SHRIKANT SHARMA, HOD, EXPLORATION		
PROCESSED AT: EXPLORATION DIVISION, MECL, NAGPUR		
MECL/EXPL/APRIL-2026	PLATE-IVB	5


68°47'E
68°48'E
68°49'E
23°31'N
23°30'N
N
S
E
W
A
B
C
D
E
PT7 16.6586/1.9594
PT8
PT9
PT6 22.1888/20.6099
PT16 27.0336/31.4022
29.5152/20.6127 PT17
PT10
PT11
PT3
12
PT14
PT2 39.0154/11.8982
PT13
PT4 38.1582/8.694
PT12
7
PT1 28.4161/8.1688
43.7599/9.2336
PT5
50
8
PT15 30.3666/6.9632
Legend
Cardinal Point
Block Boundary
Bedding
Joint
Old workings
Pit showing Al2O3 / SiO2 values
Lithology
Soil
Gypseous Shale-Siltstone-Limestone with Clay
Limestone
Laterite
Aluminous Laterite
Clayey Bauxite
Bauxitic Clay
Bauxite
Basalt
Scale: 1:4,000
0 0.25 0.5 1
Kilometers
MINERAL EXPLORATION & CONSULTANCY LIMITED
DETAILED GEOLOGICAL MAP SHOWING PIT SAMPLES WITH ANALYSIS
JULRAI BLOCK
(AREA: 8.12 SQ KM)
RF: 1:4000
KACHCHH DISTRICT, GUJARAT
MAPPED BY: SHUBHAM KUMAR, GEOLOGIST
CHECKED BY: SWARUP DHARA, SR. MANAGER (GEOLOGY)
APPROVED BY: SHRIKANT SHARMA, HOD, EXPLORATION
PROCESSED AT: EXPLORATION DIVISION, MECL, NAGPUR
MECL/EXPL/APRIL-2026
PLATE-IVC
6

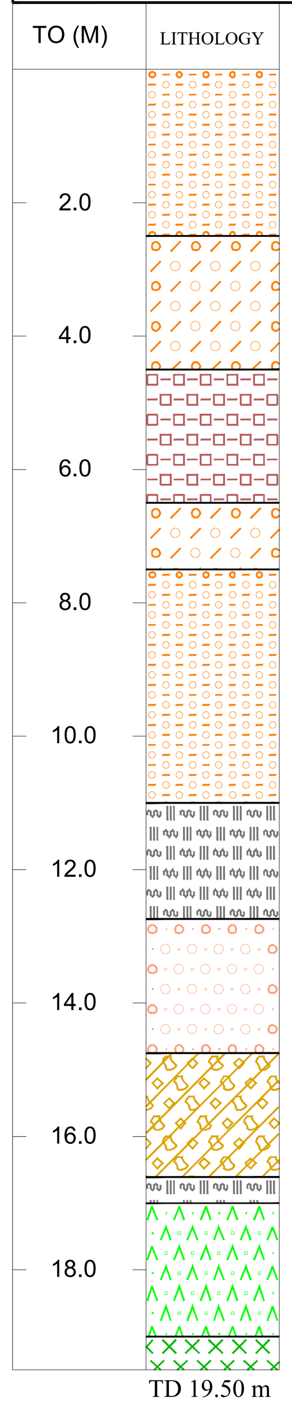
68°47'E
68°48'E
68°49'E
23°31'N
23°30'N
N
S
E
W
A
B
C
D
E
MBJ-01
MBJ-02
MBJ-04
MBJ-05
MBJ-06
MBJ-07
MBJ-08
12
50
7
8
Legend
Cardinal Point
Block Boundary
Joint
Bedding
Old workings
Boreholes
Lithology
Soil
Gypseous Shale-Siltstone-Limestone with Clay
Limestone
Laterite
Aluminous Laterite
Clayey Bauxite
Bauxitic Clay
Bauxite
Basalt
Scale: 1:4,000
0 0.25 0.5 1 Kilometers
MINERAL EXPLORATION & CONSULTANCY LIMITED
DETAILED GEOLOGICAL MAP SHOWING BOREHOLE LOCATION
JULRAI BLOCK
(AREA: 8.12 SQ KM)
RF: 1:4000
KACHCHH DISTRICT, GUJARAT
MAPPED BY: SHUBHAM KUMAR, GEOLOGIST
CHECKED BY: SWARUP DHARA, SR. MANAGER (GEOLOGY)
APPROVED BY: SHRIKANT SHARMA, HOD, EXPLORATION
PROCESSED AT: EXPLORATION DIVISION, MECL, NAGPUR
MECL/EXPL/APRIL-2026
PLATE-IVD
7

Drill hole name MBJ-01
Scale 1 / 100
Depth portion 0.00 M - 18.70 M
Printing date 5/02/26

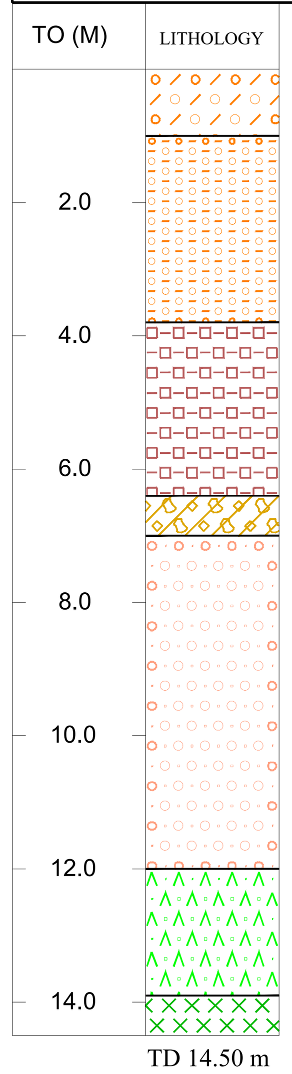


THICKNESS (m)	Al_2O_3 %	SiO_2 %	Fe_2O_3 %	TiO_2 %	LOI %	Sc (PPM)	V (PPM)	Ga (PPM)
1.00	36.20	5.00	35.25	4.35	17.30	18.79	696.47	57.66
6.50	40.00	3.85	31.51	5.42	17.79	21.72	632.76	41.91
9.00	39.65	7.66	18.60	6.41	20.97	32.78	807.23	59.49

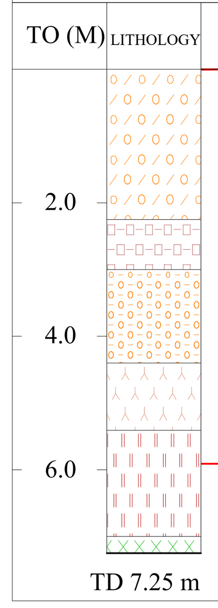
Drill hole name MBJ-02
Scale 1 / 100
Depth portion 0.00 M - 19.50 M
Printing date 5/04/26



Drill hole name MBJ-04
Scale 1 / 100
Depth portion 0.00 M - 14.50 M
Printing date 5/04/26

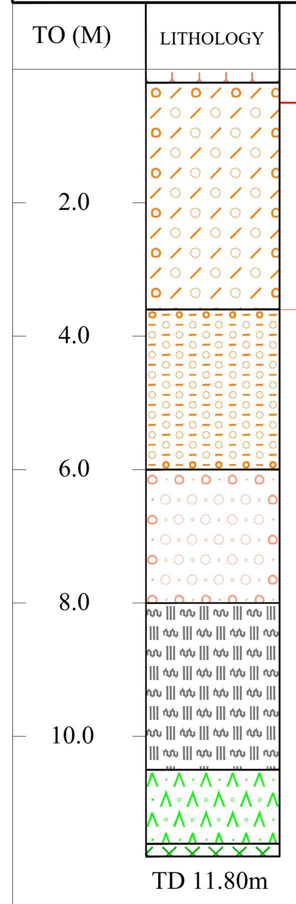


Drill hole name MBJ-05
Scale 1 / 100
Depth portion 0.00 M - 7.25 M
Printing date 5/02/26



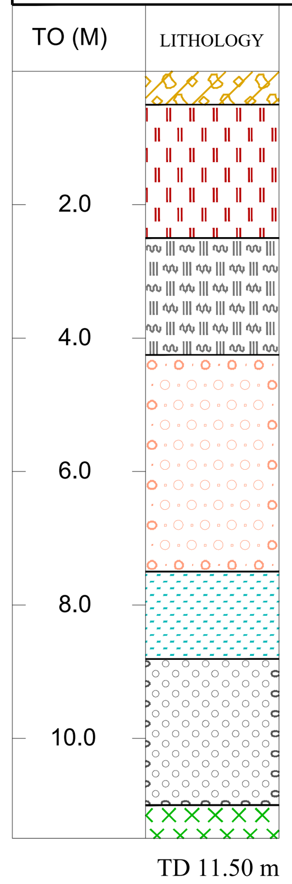
THICKNESS (m)	Al_2O_3 %	SiO_2 %	Fe_2O_3 %	TiO_2 %	LOI %	Sc (PPM)	V (PPM)	Ga (PPM)
5.90	35.53	6.65	22.35	5.90	19.44	27.06	768.99	58.30

Drill hole name MBJ-06
Scale 1 / 100
Depth portion 0.00 M - 11.80 M
Printing date 5/02/26

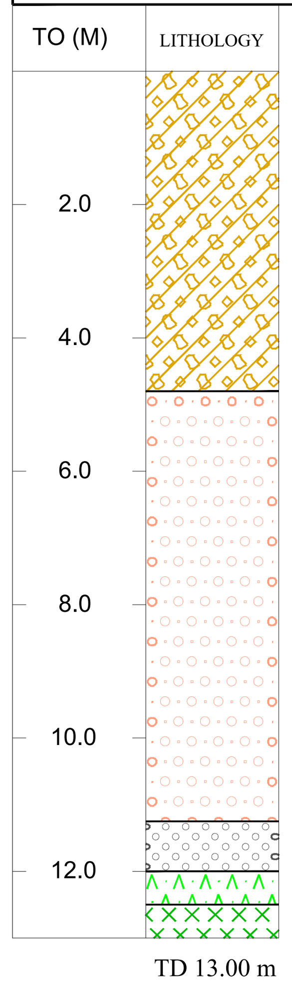


THICKNESS (m)	Al_2O_3 %	SiO_2 %	Fe_2O_3 %	TiO_2 %	LOI %	Sc (PPM)	V (PPM)	Ga (PPM)
3.10	44.98	4.52	17.26	7.81	23.91	31.10	801.42	57.68

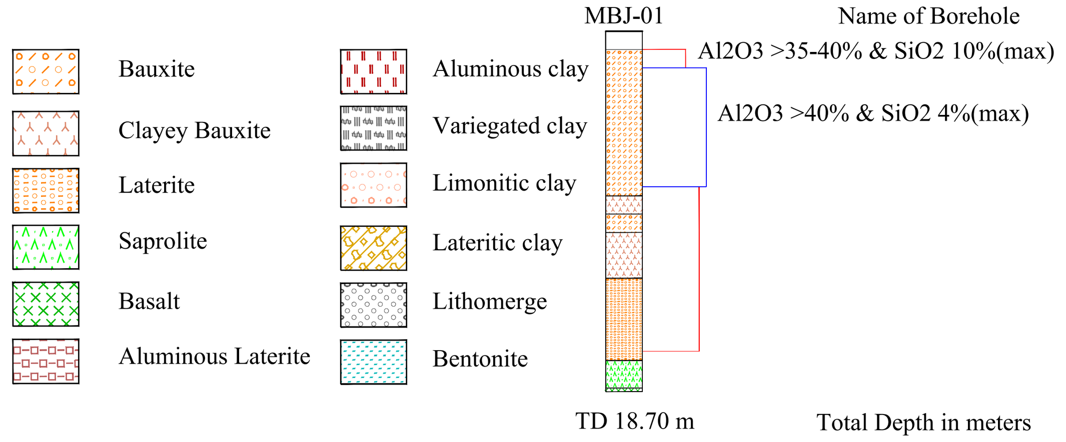
Drill hole name MBJ-07
Scale 1 / 100
Depth portion 0.00 M - 11.50 M
Printing date 5/04/26



Drill hole name MBJ-08
Scale 1 / 100
Depth portion 0.00 M - 13.00 M
Printing date 5/04/26



INDEX



MINERAL EXPLORATION AND CONSULTANCY LIMITED

LITHOLOG OF BOREHOLES (showing zones at Al_2O_3 >35-40% & SiO_2 10%(max) & Al_2O_3 >40% & SiO_2 4%(max) cut-off)

JULRAI BLOCK

DISTRICT : KACHCHH **STATE : GUJARAT**

R.F. 1:100

Processed at :
Non-Coal Geological Report
Cell MECL, Nagpur.

Prepared By : Moumita Ghosh, Asst. Manager (Geology)
Checked By : Swarup Dhara, Sr. Manager (Geology)
Approved By : Shrikant Sharma, HOD (Exploration)

MECL/EXPL./MAY-2026 | PLATE NO.- VA | 8

Drill hole name MBJ-01
Scale 1 / 100
Depth portion 0.00 M - 18.70 M
Printing date 5/04/26

TO (M)	LITHOLOGY	THICKNESS (m)	Al_2O_3 %	SiO_2 %	Fe_2O_3 %	TiO_2 %	LOI %	Sc (PPM)	V (PPM)	Ga (PPM)
		17.00	40.24	6.60	25.92	5.97	19.91	27.73	734.01	52.66

TD 18.70 m

Drill hole name MBJ-02
Scale 1 / 100
Depth portion 0.00 M - 19.50 M
Printing date 5/04/26

TO (M)	LITHOLOGY	THICKNESS (m)	Al_2O_3 %	SiO_2 %	Fe_2O_3 %	TiO_2 %	LOI %	Sc (PPM)	V (PPM)	Ga (PPM)
		12.70	29.85	10.21	31.73	5.19	19.35	23.64	665.12	42.34

TD 19.50 m

Drill hole name MBJ-04
Scale 1 / 100
Depth portion 0.00 M - 14.50 M
Printing date 5/04/26

TO (M)	LITHOLOGY	THICKNESS (m)	Al_2O_3 %	SiO_2 %	Fe_2O_3 %	TiO_2 %	LOI %	Sc (PPM)	V (PPM)	Ga (PPM)
		12.70	19.83	12.01	21.92	3.60	12.19	23.59	599.17	32.59

TD 14.50 m

Drill hole name MBJ-05
Scale 1 / 100
Depth portion 0.00 M - 7.25 M
Printing date 5/04/26

TO (M)	LITHOLOGY	THICKNESS(m)	Al_2O_3 %	SiO_2 %	Fe_2O_3 %	TiO_2 %	LOI %	Sc (PPM)	V (PPM)	Ga (PPM)
		6.90	36.67	9.22	25.89	5.92	20.59	31.42	789.34	37.74

TD 7.25 m

Drill hole name MBJ-06
Scale 1 / 100
Depth portion 0.00 M - 11.80 M
Printing date 5/04/26

TO (M)	LITHOLOGY	THICKNESS(m)	Al_2O_3 %	SiO_2 %	Fe_2O_3 %	TiO_2 %	LOI %	Sc (PPM)	V (PPM)	Ga (PPM)
		10.00	33.01	18.40	22.88	5.89	18.44	42.07	839.62	20.62

TD 11.80m

Drill hole name MBJ-07
Scale 1 / 100
Depth portion 0.00 M - 11.50 M
Printing date 5/04/26

TO (M)	LITHOLOGY	THICKNESS(m)	Al_2O_3 %	SiO_2 %	Fe_2O_3 %	TiO_2 %	LOI %	Sc (PPM)	V (PPM)	Ga (PPM)
		6.00	25.02	30.64	25.24	3.80	13.18	43.86	562.87	37.03

TD 11.50 m

Drill hole name MBJ-08
Scale 1 / 100
Depth portion 0.00 M - 13.00 M
Printing date 5/04/26

TO (M)	LITHOLOGY	THICKNESS (m)	Al_2O_3 %	SiO_2 %	Fe_2O_3 %	TiO_2 %	LOI %	Sc (PPM)	V (PPM)	Ga (PPM)
		5.90	18.02	22.69	25.07	3.00	12.34	36.86	415.12	29.87

TD 13.00 m

INDEX

Bauxite
Clayey Bauxite
Laterite
Saprolite
Basalt
Aluminous Laterite
Aluminous clay
Variegated clay
Limonitic clay
Lateritic clay
Lithomerge
Bentonite

MBJ-01 — Name of Borehole
zones at TiO_2 ≥2% cut-off
TD 18.70 m — Total Depth in meters

0 m SCALE 1:100 5 m

MINERAL EXPLORATION AND CONSULTANCY LIMITED

LITHOLOG OF BOREHOLES (showing zones at TiO_2 ≥2% cut-off)

JULRAI BLOCK

DISTRICT : KACHCHH **STATE : GUJARAT**

R.F. 1:100

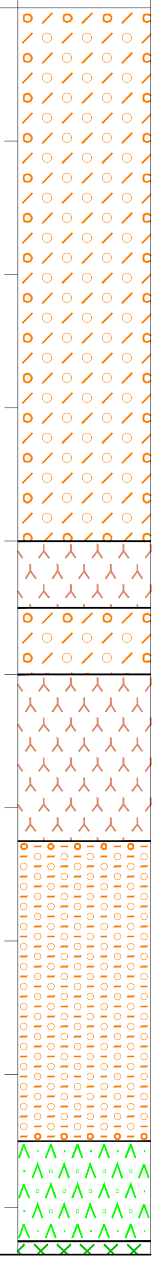
Processed at :
Non-Coal Geological Report Cell MECL, Nagpur.

Prepared By : Moumita Ghosh, Asst. Manager (Geology)
Checked By : Swarup Dhara, Sr. Manager (Geology)
Approved By : Shrikant Sharma, HOD (Exploration)

MECL/EXPL./MAY-2026 PLATE NO.- VB 9

Drill hole name MBJ-01
Scale 1 / 100
Depth portion 0.00 M - 18.70 M
Printing date 5/04/26

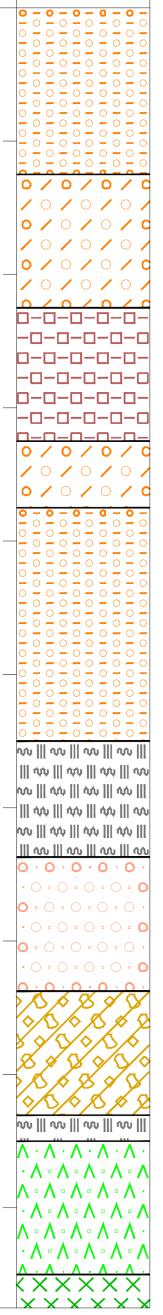
TO (M)	LITHOLOGY
2.0	
4.0	
6.0	
8.0	
10.0	
12.0	
14.0	
16.0	
18.0	



TD 18.70 m

Drill hole name MBJ-02
Scale 1 / 100
Depth portion 0.00 M - 19.50 M
Printing date 5/04/26

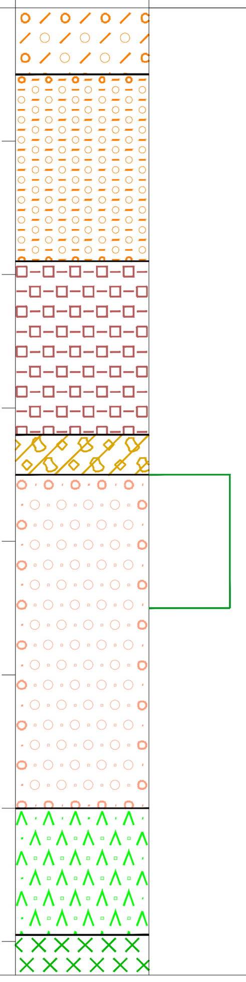
TO (M)	LITHOLOGY
2.0	
4.0	
6.0	
8.0	
10.0	
12.0	
14.0	
16.0	
18.0	



TD 19.50 m

Drill hole name MBJ-04
Scale 1 / 100
Depth portion 0.00 M - 14.50 M
Printing date 5/04/26

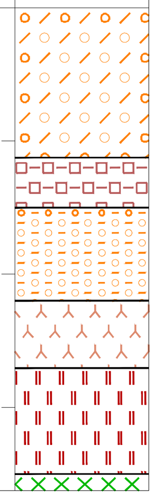
TO (M)	LITHOLOGY	THICKNESS (m)	Al_2O_3 %	SiO_2 %	Fe_2O_3 %	TiO_2 %	LOI %	Sc (PPM)	V (PPM)	Ga (PPM)
2.0										
4.0										
6.0										
8.0		2.00	29.89	34.40	13.52	5.34	15.80	61.13	721.43	41.61
10.0										
12.0										
14.0										



TD 14.50 m

Drill hole name MBJ-05
Scale 1 / 100
Depth portion 0.00 M - 7.25 M
Printing date 5/04/26

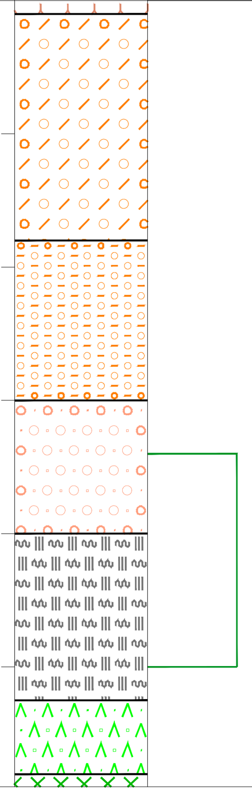
TO (M)	LITHOLOGY
2.0	
4.0	
6.0	



TD 7.25 m

Drill hole name MBJ-06
Scale 1 / 100
Depth portion 0.00 M - 11.80 M
Printing date 5/04/26

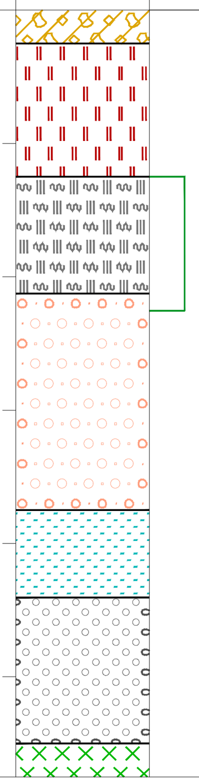
TO (M)	LITHOLOGY	THICKNESS (m)	Al_2O_3 %	SiO_2 %	Fe_2O_3 %	TiO_2 %	LOI %	Sc (PPM)	V (PPM)	Ga (PPM)
2.0										
4.0										
6.0										
8.0		3.20	28.75	32.81	17.84	5.39	14.06	56.96	984.55	44.54
10.0										



TD 11.80m

Drill hole name MBJ-07
Scale 1 / 100
Depth portion 0.00 M - 11.50 M
Printing date 5/04/26

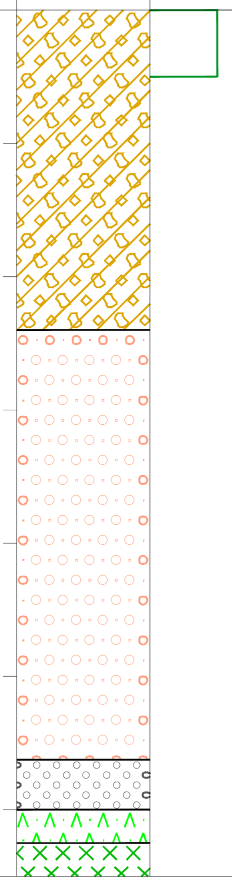
TO (M)	LITHOLOGY	THICKNESS (m)	Al_2O_3 %	SiO_2 %	Fe_2O_3 %	TiO_2 %	LOI %	Sc (PPM)	V (PPM)	Ga (PPM)
2.0										
4.0		2.00	26.85	32.40	21.41	4.08	13.49	53.93	604.77	38.09
6.0										
8.0										
10.0										



TD 11.50 m

Drill hole name MBJ-08
Scale 1 / 100
Depth portion 0.00 M - 13.00 M
Printing date 5/04/26

TO (M)	LITHOLOGY	THICKNESS (m)	Al_2O_3 %	SiO_2 %	Fe_2O_3 %	TiO_2 %	LOI %	Sc (PPM)	V (PPM)	Ga (PPM)
		1.00	24.76	26.78	28.68	3.69	14.66	50.04	591.88	38.61
2.0										
4.0										
6.0										
8.0										
10.0										
12.0										



TD 13.00 m

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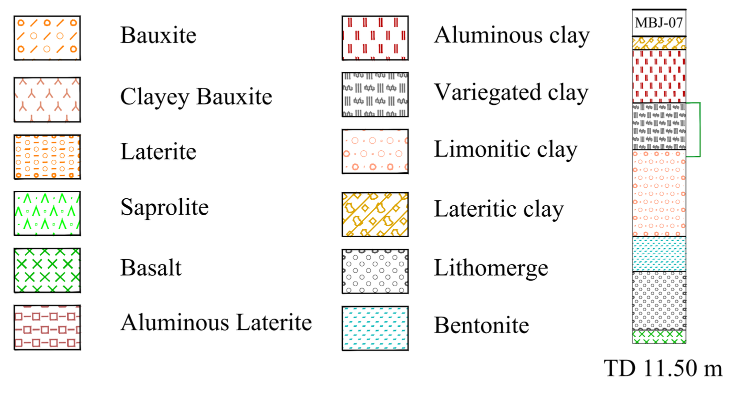
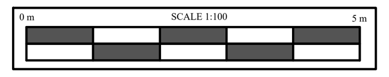




MINERAL EXPLORATION AND CONSULTANCY LIMITED

LITHOLOG OF BOREHOLES (showing zones at Sc ≥50 PPM cut-off)

JULRAI BLOCK

DISTRICT : KACHCHH **STATE : GUJARAT**

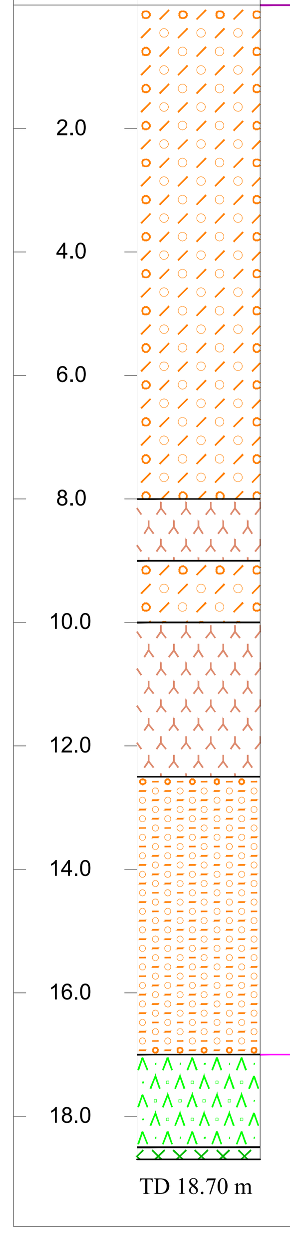
R.F. 1:100

Processed at :
Non-Coal Geological Report Cell MECL, Nagpur.

Prepared By : Moumita Ghosh, Asst. Manager (Geology)
Checked By : Swarup Dhara, Sr. Manager (Geology)
Approved By : Shrikant Sharma, HOD (Exploration)

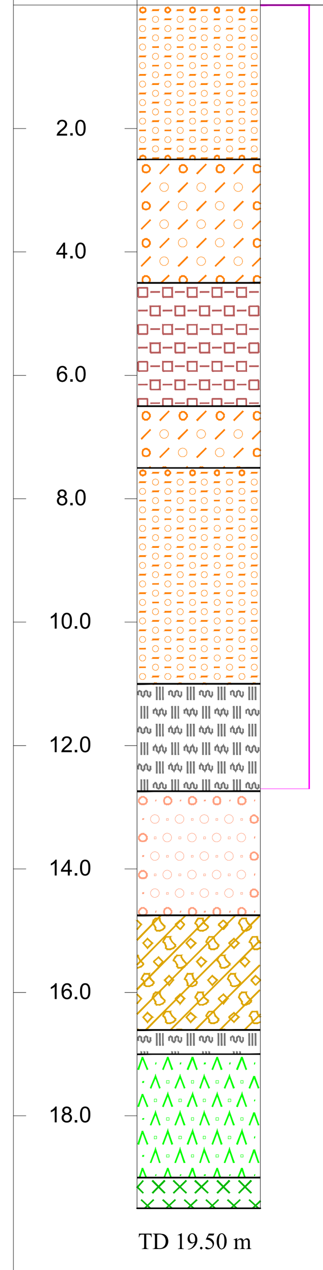
MECL/EXPL./MAY-2026 | PLATE NO.- VC | 10

Drill hole name MBJ-01
Scale 1 / 100
Depth portion 0.00 M - 18.70 M
Printing date 5/04/26



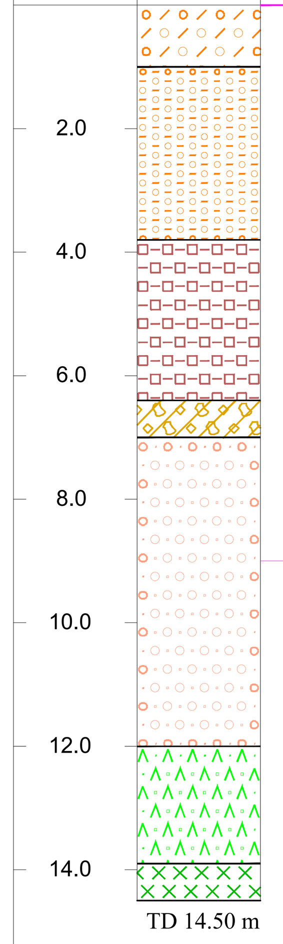
THICKNESS (m)	Al_2O_3 %	SiO_2 %	Fe_2O_3 %	TiO_2 %	LOI %	Sc (PPM)	V (PPM)	Ga (PPM)
17.00	40.24	6.60	25.92	5.97	19.91	27.73	734.01	52.66

Drill hole name MBJ-02
Scale 1 / 100
Depth portion 0.00 M - 19.50 M
Printing date 5/04/26



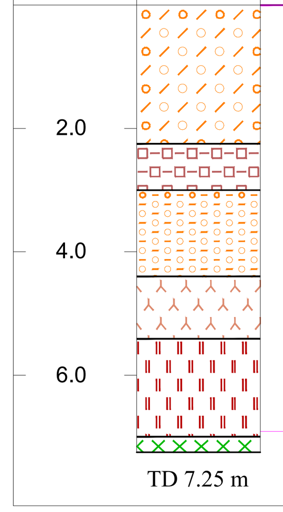
THICKNESS (m)	Al_2O_3 %	SiO_2 %	Fe_2O_3 %	TiO_2 %	LOI %	Sc (PPM)	V (PPM)	Ga (PPM)
12.70	29.85	10.21	31.73	5.19	19.35	23.64	665.12	42.34

Drill hole name MBJ-04
Scale 1 / 100
Depth portion 0.00 M - 14.50 M
Printing date 5/04/26



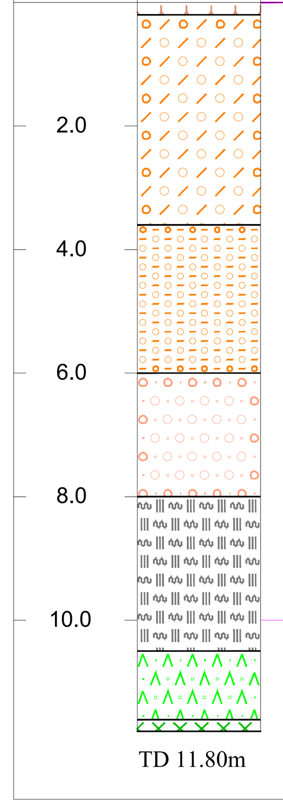
THICKNESS (m)	Al_2O_3 %	SiO_2 %	Fe_2O_3 %	TiO_2 %	LOI %	Sc (PPM)	V (PPM)	Ga (PPM)
9.00	27.98	16.94	30.93	5.08	17.20	33.28	845.49	45.99

Drill hole name MBJ-05
Scale 1 / 100
Depth portion 0.00 M - 7.25 M
Printing date 5/04/26



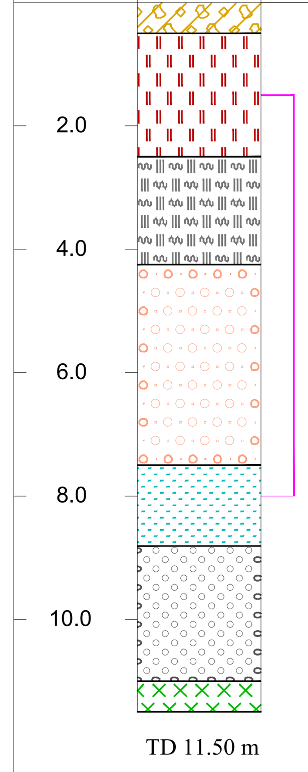
THICKNESS(m)	Al_2O_3 %	SiO_2 %	Fe_2O_3 %	TiO_2 %	LOI %	Sc (PPM)	V (PPM)	Ga (PPM)
6.90	36.67	9.22	25.89	5.92	20.59	31.42	789.34	56.05

Drill hole name MBJ-06
Scale 1 / 100
Depth portion 0.00 M - 11.80 M
Printing date 5/04/26



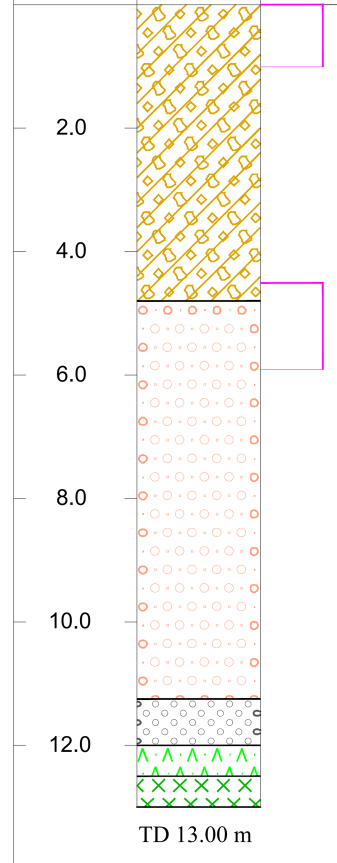
THICKNESS(m)	Al_2O_3 %	SiO_2 %	Fe_2O_3 %	TiO_2 %	LOI %	Sc (PPM)	V (PPM)	Ga (PPM)
10.00	33.01	18.40	22.88	5.89	18.44	42.07	839.62	20.62

Drill hole name MBJ-07
Scale 1 / 100
Depth portion 0.00 M - 11.50 M
Printing date 5/04/26



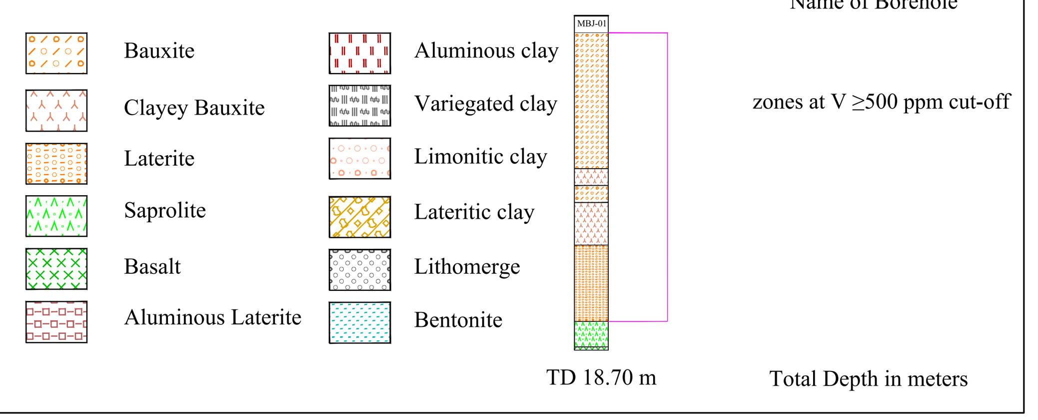
THICKNESS(m)	Al_2O_3 %	SiO_2 %	Fe_2O_3 %	TiO_2 %	LOI %	Sc (PPM)	V (PPM)	Ga (PPM)
4.50	25.84	32.98	21.70	3.96	7.63	39.73	597.40	36.82

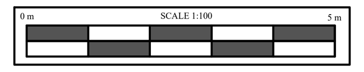
Drill hole name MBJ-08
Scale 1 / 100
Depth portion 0.00 M - 13.00 M
Printing date 5/04/26



THICKNESS (m)	Al_2O_3 %	SiO_2 %	Fe_2O_3 %	TiO_2 %	LOI %	Sc (PPM)	V (PPM)	Ga (PPM)
1.00	24.76	26.78	28.68	3.69	14.66	50.04	591.88	38.61
1.40	25.52	38.79	13.86	4.73	13.74	51.05	564.03	34.53

INDEX





MINERAL EXPLORATION AND CONSULTANCY LIMITED

LITHOLOG OF BOREHOLES (showing zones at V ≥500 PPM cut-off)

JULRAI BLOCK

DISTRICT : KACHCHH **STATE : GUJARAT**

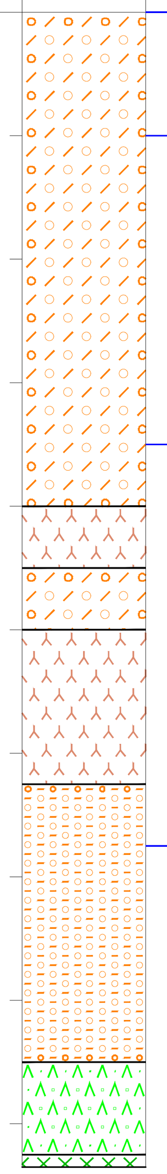
R.F. 1:100

Processed at :
Non-Coal Geological Report Cell MECL, Nagpur.

Prepared By : Moumita Ghosh, Asst. Manager (Geology)
Checked By : Swarup Dhara, Sr. Manager (Geology)
Approved By : Shrikant Sharma, HOD (Exploration)

MECL/EXPL./MAY-2026 PLATE NO.- VD 11

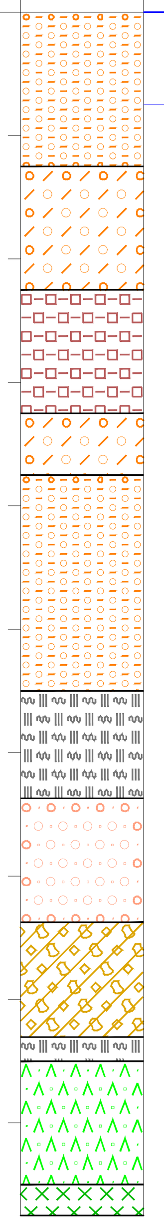
Drill hole name MBJ-01
Scale 1 / 100
Depth portion 0.00 M - 18.70 M
Printing date 5/04/26



TD 18.70 m

TO (M)	THICKNESS (m)	Al_2O_3 %	SiO_2 %	Fe_2O_3 %	TiO_2 %	LOI %	Sc (PPM)	V (PPM)	Ga (PPM)
2.0	2.00	37.22	4.47	35.37	4.68	17.00	18.94	694.73	65.61
4.0, 6.0, 8.0, 10.0, 12.0	6.50	43.92	7.97	17.73	7.17	22.10	30.96	750.45	69.03
14.0, 16.0, 18.0									

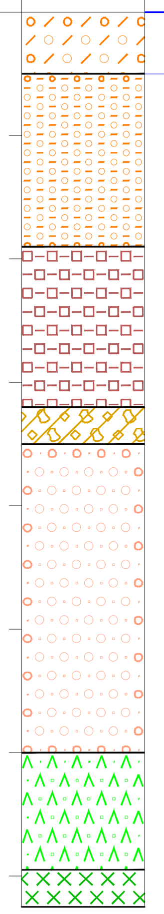
Drill hole name MBJ-02
Scale 1 / 100
Depth portion 0.00 M - 19.50 M
Printing date 5/04/26



TD 19.50 m

TO (M)	THICKNESS (m)	Al_2O_3 %	SiO_2 %	Fe_2O_3 %	TiO_2 %	LOI %	Sc (PPM)	V (PPM)	Ga (PPM)
	1.50	33.27	11.90	29.91	5.02	18.21	16.87	899.55	53.26
2.0, 4.0, 6.0, 8.0, 10.0, 12.0, 14.0, 16.0, 18.0									

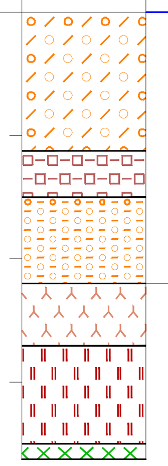
Drill hole name MBJ-04
Scale 1 / 100
Depth portion 0.00 M - 14.50 M
Printing date 5/04/26



TD 14.50 m

TO (M)	THICKNESS (m)	Al_2O_3 %	SiO_2 %	Fe_2O_3 %	TiO_2 %	LOI %	Sc (PPM)	V (PPM)	Ga (PPM)
	1.00	32.92	5.17	33.23	6.78	16.94	27.63	1063.59	60.96
2.0, 4.0, 6.0, 8.0, 10.0, 12.0, 14.0									

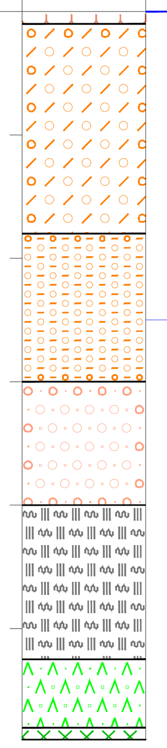
Drill hole name MBJ-05
Scale 1 / 100
Depth portion 0.00 M - 7.25 M
Printing date 5/04/26



TD 7.25 m

TO (M)	THICKNESS(m)	Al_2O_3 %	SiO_2 %	Fe_2O_3 %	TiO_2 %	LOI %	Sc (PPM)	V (PPM)	Ga (PPM)
2.0, 4.0	4.40	38.69	6.65	24.90	6.72	21.04	29.53	884.96	64.24
6.0									

Drill hole name MBJ-06
Scale 1 / 100
Depth portion 0.00 M - 11.80 M
Printing date 5/04/26

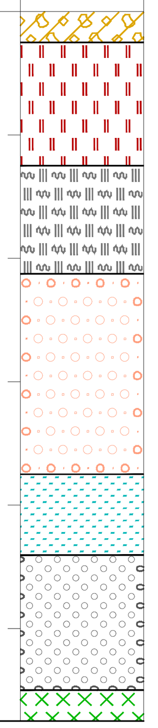


TD 11.80m

TO (M)	THICKNESS(m)	Al_2O_3 %	SiO_2 %	Fe_2O_3 %	TiO_2 %	LOI %	Sc (PPM)	V (PPM)	Ga (PPM)
2.0, 4.0	5.00	39.05	7.76	22.63	6.82	22.18	33.48	805.38	56.08
6.0, 8.0, 10.0									

Drill hole name MBJ-07
Scale 1 / 100
Depth portion 0.00 M - 11.50 M
Printing date 5/04/26

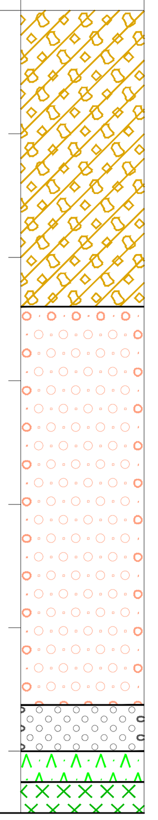
TO (M) | LITHOLOGY



TD 11.50 m

Drill hole name MBJ-08
Scale 1 / 100
Depth portion 0.00 M - 13.00 M
Printing date 5/04/26

TO (M) | LITHOLOGY



TD 13.00 m

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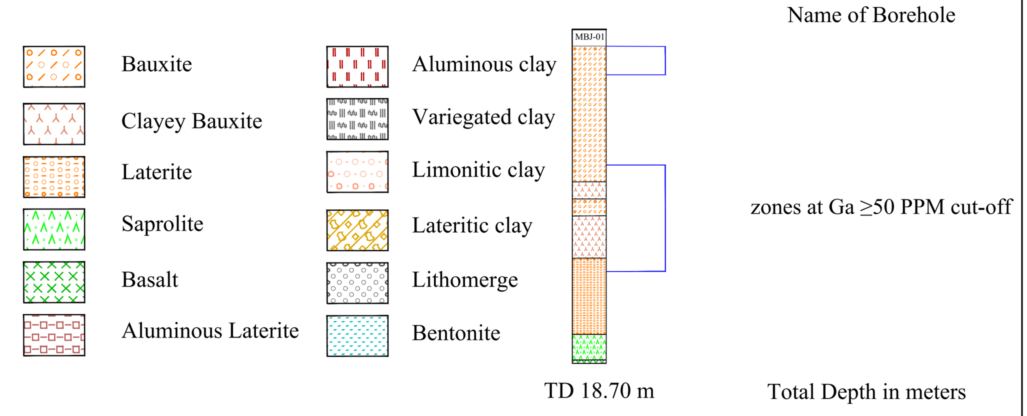

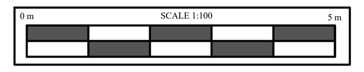

MINERAL EXPLORATION AND CONSULTANCY LIMITED

LITHOLOG OF BOREHOLES (showing zones at Ga ≥50 PPM cut-off)

JULRAI BLOCK

DISTRICT : KACHCHH	**STATE : GUJARAT**
R.F. 1:100	
Processed at : Non-Coal Geological Report Cell MECL, Nagpur.	Prepared By : Moumita Ghosh, Asst. Manager (Geology) Checked By : Swarup Dhara, Sr. Manager (Geology) Approved By : Shrikant Sharma, HOD (Exploration)
MECL/EXPL./MAY-2026	PLATE NO.- VE 12

68°47'E
68°48'E
68°49'E
23°31'N
23°30'N
N
S
E
W
A
B
C
D
E
RL 95.473 m.
Area 910174.9220 Sq m
MGB NZ
LGB NZ
RL 106.108 m.
Area 1639113.6865 Sq m
MGB NZ
LGB NZ
RL 107.830 m.
Area 1473956.3345 Sq m
MGB NZ
LGB 3.10m 44.98% Al2O3 , 4.52% SiO2 , 17.26% Fe2O3
RL 97.993 m.
Area 1323456.5815 Sq m
MGB NZ
LGB 5.90m 35.53% Al2O3 , 6.65% SiO2 , 22.35% Fe2O3
RL 101.331 m.
Area 921485.6431 Sq m
MGB NZ
LGB NZ
RL 85.045 m.
Area 821678.0782 Sq m
MGB 6.50m 40.00% Al2O3 , 3.85% SiO2 , 31.51% Fe2O3
LGB 1.00m 36.20% Al2O3 , 5.00% SiO2 , 35.25% Fe2O3
9.00m 39.65% Al2O3 , 7.66% SiO2 , 18.60% Fe2O3
RL 111.381 m.
Area 1048467.4499 Sq m
MGB NZ
LGB NZ
Legend
Cardinal Point
Block Boundary
Polygon Area
Lithology
Soil
Gypseous Shale-Siltstone-Limestone with Clay
Limestone
Laterite
Aluminous Laterite
Clayey Bauxite
Bauxitic Clay
Bauxite
Basalt
MGB- METALLURGICAL GRADE BAUXITE ZONES
LGB- LOW GRADE BAUXITE ZONES
NZ- NO ZONE
Scale: 1:4,000
0
0.25
0.5
1
Kilometers
MINERAL EXPLORATION & CONSULTANCY LIMITED
POLYGON MAP
JULRAI BLOCK
RF: 1:4000
KACHCHH DISTRICT, GUJARAT
MAPPED BY: SHUBHAM KUMAR, GEOLOGIST
PROCESSED AT: EXPLORATION DIVISION, MECL, NAGPUR
MECL/EXPL/APRIL-2026
PLATE-VI
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