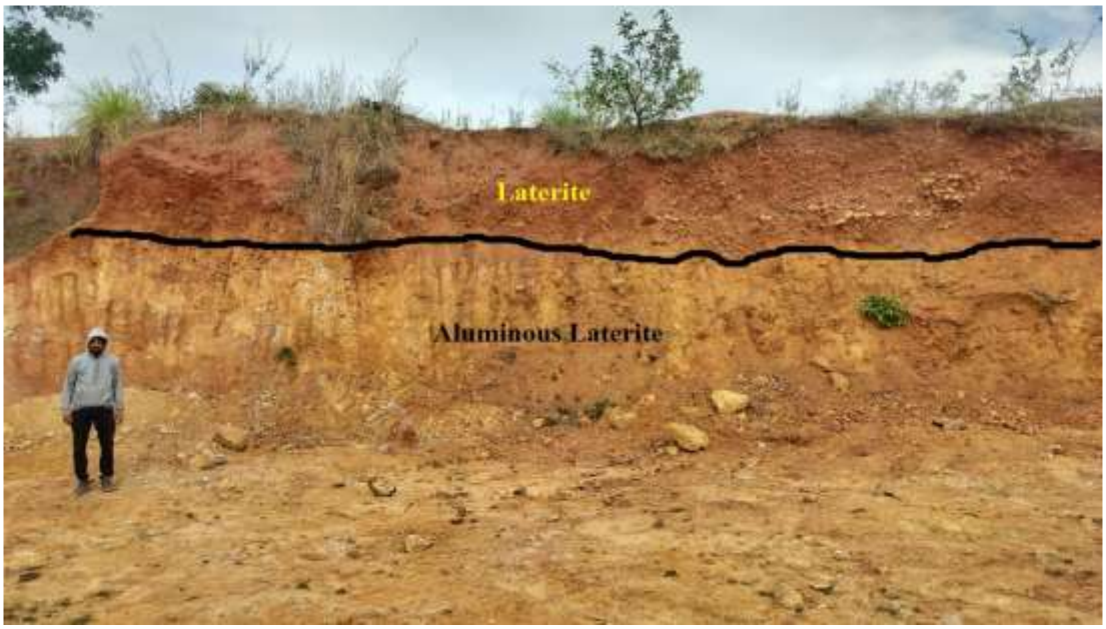
GEOLOGICAL REPORT ON PRELIMINARY EXPLORATION (G-3) FOR IRON AND BAUXITE ORE

AMOCH CHHAPRA BLOCK

DISTRICT- JABALPUR & KATNI, STATE- MADHYA PRADESH

TEXT, ANNEXURE, PLATES



Section of Lateritic profile in Amoch Chhapra block showing aluminous laterite overlain by laterite

MECL

MINERAL EXPLORATION AND CONSULTANCY LIMITED

(Formerly known as Mineral Exploration Corporation Limited)

A Government of India Enterprises

CORPORATE OFFICE, NAGPUR

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1.0 कार्यकारी सारांश

1.1 अमोच छपरा G-3 ब्लॉक, सलैया G-4 ब्लॉक से अलग किया गया है, जिसमें लौह (Iron) एवं बॉक्साइट (Bauxite) खनिजीकरण की संभावनाएँ हैं। इस ब्लॉक की अनुशंसा NMET की 65वीं TCC द्वारा मई 2024 में की गई थी तथा इसे NMET की 36वीं कार्यकारी समिति द्वारा (पत्र संख्या 23/481/2024-NMET/302, दिनांक 29 अगस्त 2024) 10 माह की समयसीमा के साथ अनुमोदित किया गया। यह ब्लॉक जबलपुर एवं कटनी वनमंडल की सीमाओं के भीतर आता है। तदनुसार, वन स्वीकृति हेतु आवेदन 19.10.2024 को परिवेश (PARIVESH) पोर्टल के माध्यम से किया गया। जबलपुर एवं कटनी वनमंडल के अधिकारियों के साथ संयुक्त क्षेत्रीय निरीक्षण के पश्चात, गैर-वन क्षेत्रों में क्षेत्रीय कार्य 24.08.2025 को प्रारंभ किया गया। जबलपुर वनमंडल के हिस्से हेतु वन अनुमति 15.10.2025 को प्राप्त हुई, जिसके बाद क्षेत्रीय कार्य 15.12.2025 तक जारी रहा। किंतु कटनी वनमंडल की अनुमति लंबित रहने के कारण 15.12.2025 से 11.02.2026 तक कार्य स्थगित करना पड़ा। तत्पश्चात, 08.02.2026 को कटनी वनमंडल की अनुमति प्राप्त होने पर कार्य पुनः आरंभ किया गया और अमोच–छपरा ब्लॉक में क्षेत्रीय गवेषण 01.03.2026 को पूर्ण हुआ।

यह ब्लॉक जबलपुर एवं कटनी जिलों में 4.86 वर्ग किलोमीटर क्षेत्र में फैला हुआ है तथा सर्वे ऑफ इंडिया के टोपोशीट संख्या 64A/02 में अंकित है। अध्ययन का मुख्य उद्देश्य लौह एवं बॉक्साइट संसाधनों को गवेषित करना था, साथ ही संबंधित खनिज जैसे टाइटेनियम (Ti), वैनाडियम (V) एवं अन्य प्रासंगिक निक्षपणों का भी गवेषण करना था।

अक्षांश एवं देशांतर (डिग्री–मिनट–सेकंड प्रारूप) में, WGS-84 डेटम के अनुसार क्षेत्र के सभी कॉर्नर बिंदुओं के निर्देशांक

क्र.सं.	ब्लॉक कार्डिनल बिंदु	Datum: WGS-84				आरएल
		भौगोलिक (DD°MM' SS.SS")		UTM (Zone- 44)		
		अक्षांश	देशांतर	पूर्वांक (मी.)	उतरांक (मी.)	(मी.)
1	A	23° 34' 55.078" N	80° 10' 48.937" E	416354.328	2608185.012	433.436
2	B	23° 34' 19.974" N	80° 11' 20.688" E	417248.204	2607100.271	410.262
3	C	23° 34' 42.326" N	80° 11' 59.846" E	418362.078	2607781.461	416.536
4	D	23° 34' 19.586" N	80° 12' 50.689" E	419799.464	2607074.147	424.629
5	E	23° 34' 29.061" N	80° 13' 16.682" E	420537.866	2607361.492	417.498
6	F	23° 35' 31.012" N	80° 12' 30.821" E	419248.401	2609273.888	447.077

1.2 भूवैज्ञानिक दृष्टि से, महाकोशल समूह के सुप्राक्रस्टल शैल क्षेत्र में प्रमुख रूप से विद्यमान हैं, विशेषकर अमोच, धंगावा, हरदुआ कलां, मझौली एवं डुंडी के आसपास। भू-आकृति का स्वरूप लेटराइटिक टीले, जलोढ़ निक्षेप, फिल्लाइट प्रसार एवं मेटाबेसाल्ट संरचनाओं से परिभाषित है, जिसमें लेटराइटिक खंड छोटे-छोटे पहाड़ी टीले निर्मित करते हैं। लेटराइटिक पिंडों की पहचान की गई है, जिनमें बॉक्साइट खनिजीकरण पिसोलिटिक बनावट प्रदर्शित करता है, जो व्यापक लेटराइटिक अपक्षय का संकेत है। यह निक्षेप पॉकेट-प्रकार का है, जो लेटराइटिक टीलों तक सीमित है, और पूर्व में खनन किए गए किंतु वर्तमान में परित्यक्त बॉक्साइट निक्षेपों के समान है।

1.3 अमोच छपरा ब्लॉक हेतु गवेषण योजना का उद्देश्य खनिजीकरण की संभावनाओं का आकलन करना है, विशेषकर बॉक्साइट एवं एल्यूमिनस लेटराइट के लिए, जो खनिज (खनिज सामग्री के साक्ष्य) नियम-2015 के अनुरूप है। 4.86 वर्ग किलोमीटर क्षेत्र में 1:4000 पैमाने पर भूवैज्ञानिक मानचित्रण कार्यक्रम संचालित किया गया, जिसमें शैल प्रकार, संरचनात्मक विशेषताएँ तथा अयस्क पिंडो के सतही संकेतों का अभिलेखन किया गया। एक गवेषणात्मक ड्रिलिंग कार्यक्रम तैयार किया गया, जिसमें उन्नीस (19) बोरहोल का विन्यास 400 मीटर ग्रिड पैटर्न पर किया गया, जो पहचाने गए लेटराइटिक पिंडों को लक्षित करता है। तथापि, भूमि अभिगम प्रतिबंधों के कारण एक बोरहोल का ड्रिलिंग नहीं किया जा सका। परिणामस्वरूप, अठारह (18) बोरहोल, कुल 330.60 मीटर ड्रिलिंग के साथ, किए गए हैं, जिनकी गहराई अधिकतम 20 मीटर तक रही, ताकि खनिजीकरण एवं संसाधन का मूल्यांकन किया जा सके।

अमोच छपरा (G3) ब्लॉक में एमईसीएल के द्वारा वेधित बोरहोल का विवरण

Sl. No.	Borehole No.	Section Line	Coordinates (Datum WGS-84)		RL (m)	Date of Commencem	Date of Closure	Type of drilling	Total Depth
			Easting	Northing					
1	MBAC-01	S3	417828.255	2608422.826	418.872	24.08.2025	30.08.2025	Dry Coring	16.60
2	MBAC-02	S4	418154.876	2608650.432	429.530	27.08.2025	03.09.2025	Dry Coring	20.00
3	MBAC-03	S4	418430.445	2608427.809	422.389	01.09.2025	06.09.2025	Dry Coring	20.00
4	MBAC-04	S5	419905.006	2607576.813	442.970	07.09.2025	11.09.2025	Dry Coring	20.00
5	MBAC-05	S5	419627.580	2607645.253	432.186	13.09.2025	17.09.2025	Dry Coring	10.00
6	MBAC-06	S4	419331.945	2607716.654	422.926	14.09.2025	18.09.2025	Dry Coring	20.00
7	MBAC-07	S4	418692.013	2608220.448	428.966	20.09.2025	27.09.2025	Dry Coring	20.00
8	MBAC-08	S1	417330.781	2608248.440	417.079	29.09.2025	03.10.2025	Dry Coring	20.00
9	MBAC-09	S2	416850.561	2608115.317	425.804	03.10.2025	07.10.2025	Dry Coring	20.00
10	MBAC-10	S5	419188.429	2608172.569	436.81	09.10.2025	12.10.2025	Dry Coring	14.00
11	MBAC-11	S3	418203.698	2608013.029	420.021	19.10.2025	25.10.2025	Dry Coring	15.00
12	MBAC-12	S1	417428.214	2607606.265	423.817	28.10.2025	08.11.2025	Dry Coring	15.00
13	MBAC-13	S2	417752.978	2607805.686	430.977	11.11.2025	22.11.2025	Dry Coring	20.00
14	MBAC-14	S5	418696.102	2608646.918	428.289	23.11.2025	03.12.2025	Dry Coring	20.00
15	MBAC-15	S4	418931.181	2607992.428	434.684	05.12.2025	15.12.2025	Dry Coring	20.00
16	MBAC-16	S5	418992.695	2608462.935	443.77	11.02.2026	13.02.2026	Dry Coring	20.00
17	MBAC-17	S5	419281.865	2608713.857	431.34	15.02.2026	22.02.2026	Dry Coring	20.00
18	MBAC-18	S6	419504.086	2608000.412	425.700	23.02.2026	01.03.2026	Dry Coring	20.00

1.4 संसाधन आकलन की सटीकता बढ़ाने हेतु ड्रिल किए गए बोरहोल के समीप थोक घनत्व (Bulk Density) का निर्धारण किया गया, जिससे विभिन्न लेटराइटिक क्षेत्रों में घनत्व में भिन्नता का पता चला। इसके अतिरिक्त, DGPS तकनीक द्वारा एक स्थलाकृतिक सर्वेक्षण किया गया, जिसमें ऊँचाई में परिवर्तन, बोरहोल स्थान, ब्लॉक सीमा स्थान तथा सतही विशेषताओं का मानचित्रण किया गया। खनिजीकरण लेटराइटिक टीलों तक सीमित है, जहाँ बॉक्साइट निक्षेप मुख्यतः लेटराइट आवरण में, जो एक मिट्टी की परत के ऊपर स्थित है, पाया गया। चूँकि ड्रिलिंग 20 मीटर तक ही सीमित रही, अतः इस गहराई से अधिक खनिजीकरण का गवेषण नहीं किया जा सका।

1.5 गवेषण हेतु नमूना संग्रह प्रक्रिया में 1–2 मीटर अंतराल पर आधे विभाजित ड्रिल कोर नमूनों को प्राथमिक नमूनों के रूप में संकलित किया गया, जिनका विश्लेषण प्रमुख तत्त्वों जैसे Fe%, Mn%, SiO_2%, Al_2O_3%, TiO_2, P_2O_5%, S%, Ga_2O_3, V_2O_5 के लिए किया गया। कुल 280 प्राथमिक नमूने अठारह बोरहोल से संकलित किए गए। विश्लेषणात्मक विश्वसनीयता सुनिश्चित करने हेतु इन नमूनों में से 10% (25 नमूने) को एक NABL मान्यता प्राप्त बाह्य प्रयोगशाला में सत्यापन हेतु बाह्य जाँच नमूनों के रूप में भेजा गया। इसके अतिरिक्त, 10 प्राथमिक नमूनों का चयन सूक्ष्म तत्त्वों (Ni, Co, Cd, Cr एवं Ti) के विश्लेषण हेतु किया गया तथा 10 मिश्रित नमूने प्लेटिनम समूह तत्त्वों (PGE) के विश्लेषण हेतु तैयार किए गए।

1.6 एल्यूमिनस लेटराइट (Al_2O_3 ≥ 20%), टाइटेनियम (Ti ≥ 2%) एवं वैनाडियम (V ≥ 500 ppm) के संसाधन आकलन हेतु दो विधियों का प्रयोग किया गया: प्राथमिक विधि के रूप में बहुभुजीय विधि (Polygonal Method) तथा सत्यापन हेतु क्रॉस-सेक्शनल विधि (Cross-Sectional Method)। बहुभुजीय विधि में प्रत्येक बोरहोल को एक विशिष्ट बहुभुजीय क्षेत्र आवंटित किया गया, जिसमें एल्यूमिनस लेटराइट की मोटाई एवं थोक घनत्व का उपयोग कर व्यवस्थित संसाधन गणना की गई। क्रॉस-सेक्शनल विधि में भूवैज्ञानिक खंडों के साथ बोरहोल आँकड़ों का सहसंबंध कर खनिजीकृत पिंड के आकार एवं आयतन को परिभाषित करते हुए संसाधन का आकलन किया गया।

1.7 बहुभुजीय विधि (Polygonal Method) द्वारा 36.34 मिलियन टन शुद्ध स्व- स्थाने एल्यूमिनस लेटराइट का आकलन किया गया, जिसमें औसत ग्रेड 28.38% Al_2O_3 पाया गया। इसी प्रकार 18.95 मिलियन टन शुद्ध स्व- स्थाने टाइटेनियम का आकलन किया गया, जिसका औसत ग्रेड 2.45% Ti है, तथा 29.06 मिलियन टन शुद्ध स्व- स्थाने वैनाडियम का आकलन किया गया, जिसका औसत ग्रेड 623.24 ppm V है। क्रॉस-सेक्शनल विधि (Cross-Sectional Method) द्वारा 33.98 मिलियन टन शुद्ध स्व- स्थाने एल्यूमिनस लेटराइट (औसत ग्रेड 28.24% Al2O3), 16.21 मिलियन टन शुद्ध स्व- स्थाने टाइटेनियम (औसत ग्रेड 2.41% Ti) तथा 26.27 मिलियन टन शुद्ध स्व- स्थाने वैनाडियम (औसत ग्रेड 653.62 ppm V) का आकलन किया गया। सभी आकलित संसाधनों को संयुक्त राष्ट्र फ्रेमवर्क वर्गीकरण (UNFC) दिशा-निर्देशों के अनुसार अनुमानित श्रेणी (333) में वर्गीकृत किया गया है।

1.8 अमोच छपरा ब्लॉक में प्रारंभिक गवेषण (G3) द्वारा एल्यूमिनस लेटराइट की उपस्थिति की पुष्टि हुई है, जिसमें उल्लेखनीय मात्रा में टाइटेनियम एवं वैनाडियम विद्यमान है। अनुमानित रूप से 36.34 मिलियन टन एल्यूमिनस लेटराइट, 18.95 मिलियन टन टाइटेनियम तथा 29.06 मिलियन टन वैनाडियम की पहचान की गई है, जिनमें क्रमशः 28.38% Al_2O_3, 2.45% Ti तथा 623.24 ppm V सम्मिलित है। इस गवेषण चरण की पूर्णता के साथ, यह ब्लॉक अब संयुक्त लाइसेंस (Composite License – CL) के अंतर्गत नीलामी हेतु पात्र है। आगे चलकर, क्रिटिकल मिनरलों के लिए अतिरिक्त गवेषण तथा लाभकारीकरण (Beneficiation) अध्ययन किए जाने चाहिए, जिससे संसाधन आकलन, ग्रेड मूल्यांकन एवं एल्यूमिनस लेटराइट में टाइटेनियम एवं वैनाडियम की पुनर्प्राप्ति क्षमता को और सुदृढ़ किया जा सके।

CHAPTER- 1

1.0 EXECUTIVE SUMMARY

1.1 The Amoch Chhapra G-3 block is carved out from Salaiya G-4 block, potential for Iron & Bauxite mineralization. This block is recommended by 65th TCC of NMET, in May, 2024 and approved by the 36th Executive Committee of NMET (Letter No. 23/481/2024-NMET/302, dated 29th August, 2024) with a 10-month timeline. The block falls within the forest boundaries of the Jabalpur and Katni Forest Divisions. Accordingly, forest clearance permission was applied for through the PARIVESH portal on 19.10.2024. Following a joint field visit with the forest officials of both the Jabalpur and Katni Forest Divisions, fieldwork in the non-forest areas commenced on 24.08.2025. Forest permission for the Jabalpur Forest Division portion was received on 15.10.2025, after which the fieldwork continued until 15.12.2025. However, due to the pending forest permission for the Katni Forest Division portion, fieldwork had to be discontinued from 15.12.2025 to 11.02.2026. Subsequently, after receiving forest permission for the Katni Forest Division on 08.02.2026, the fieldwork was resumed, and the field investigation in the Amoch–Chhapra Block was completed on 01.03.2026.

The block, spanning 4.86 square kilometers in Jabalpur & Katni district, is mapped under Survey of India Toposheet No. 64A/02. The primary objective of the study was to explore Iron and Bauxite resources, along with associated minerals such as Titanium (Ti), Vanadium (V), and other relevant deposits.

Coordinates of all corner points of the area in Latitude and Longitude (Degree Minutes Second) format WGS-84 Datum

Sl. No.	Block Cardinal Points	Datum: WGS-84				RL
		Geographic (DD°MM' SS.SS")		UTM (Zone- 44)		
		Latitude	Longitude	Easting (m)	Northing (m)	(m)
1	A	23° 34' 55.078" N	80° 10' 48.937" E	416354.328	2608185.012	433.436
2	B	23° 34' 19.974" N	80° 11' 20.688" E	417248.204	2607100.271	410.262
3	C	23° 34' 42.326" N	80° 11' 59.846" E	418362.078	2607781.461	416.536
4	D	23° 34' 19.586" N	80° 12' 50.689" E	419799.464	2607074.147	424.629
5	E	23° 34' 29.061" N	80° 13' 16.682" E	420537.866	2607361.492	417.498
6	F	23° 35' 31.012" N	80° 12' 30.821" E	419248.401	2609273.888	447.077

1.2 Geologically, the Mahakoshal Group supracrustals are prominent in the region, particularly around Amoch, Dhangawa, Hardua Kalan, Majhauli and Dundi. The terrain is characterized by lateritic mounds, alluvial deposits, phyllite exposures and metabasalt formations, with the lateritic patches forming small hillocks. Lateritic bodies have been identified, with bauxite mineralization displaying pisolitic texture, indicating extensive lateritic weathering. The deposit is pocket-type, restricted to lateritic mounds, similar to previously exploited but now abandoned bauxite deposits.

1.3 The exploration plan for the Amoch Chhapra Block aims to assess the mineralization potential, particularly for bauxite and aluminous laterite, following the Minerals (Evidence of Mineral Contents) Rule-2015. A geological mapping program covering 4.86 sq. km was conducted at a 1:4000 scale to document rock types, structural features, and surface indications of ore bodies. An exploratory drilling program was formulated with nineteen (19) borehole layout on a 400-meter grid pattern, targeting identified lateritic bodies. However, due to land access restrictions, one borehole could not been drilled. Therefore, eighteen (18) boreholes, with a total of 330.60m drilling, have been taken up, reaching a depth up to 20 meters to evaluate mineralization and resource.

Details of the boreholes drilled by MECL in Amoch Chhapra (G3) block

Sl. No.	Borehole No.	Section Line	Coordinates (Datum WGS-84)		RL (m)	Date of Commencem	Date of Closure	Type of drilling	Total Depth
			Easting	Northing					
1	MBAC-01	S3	417828.255	2608422.826	418.872	24.08.2025	30.08.2025	Dry Coring	16.60
2	MBAC-02	S4	418154.876	2608650.432	429.530	27.08.2025	03.09.2025	Dry Coring	20.00
3	MBAC-03	S4	418430.445	2608427.809	422.389	01.09.2025	06.09.2025	Dry Coring	20.00
4	MBAC-04	S5	419905.006	2607576.813	442.970	07.09.2025	11.09.2025	Dry Coring	20.00
5	MBAC-05	S5	419627.580	2607645.253	432.186	13.09.2025	17.09.2025	Dry Coring	10.00
6	MBAC-06	S4	419331.945	2607716.654	422.926	14.09.2025	18.09.2025	Dry Coring	20.00
7	MBAC-07	S4	418692.013	2608220.448	428.966	20.09.2025	27.09.2025	Dry Coring	20.00
8	MBAC-08	S1	417330.781	2608248.440	417.079	29.09.2025	03.10.2025	Dry Coring	20.00
9	MBAC-09	S2	416850.561	2608115.317	425.804	03.10.2025	07.10.2025	Dry Coring	20.00
10	MBAC-10	S5	419188.429	2608172.569	436.81	09.10.2025	12.10.2025	Dry Coring	14.00
11	MBAC-11	S3	418203.698	2608013.029	420.021	19.10.2025	25.10.2025	Dry Coring	15.00
12	MBAC-12	S1	417428.214	2607606.265	423.817	28.10.2025	08.11.2025	Dry Coring	15.00
13	MBAC-13	S2	417752.978	2607805.686	430.977	11.11.2025	22.11.2025	Dry Coring	20.00
14	MBAC-14	S5	418696.102	2608646.918	428.289	23.11.2025	03.12.2025	Dry Coring	20.00
15	MBAC-15	S4	418931.181	2607992.428	434.684	05.12.2025	15.12.2025	Dry Coring	20.00
16	MBAC-16	S5	418992.695	2608462.935	443.77	11.02.2026	13.02.2026	Dry Coring	20.00
17	MBAC-17	S5	419281.865	2608713.857	431.34	15.02.2026	22.02.2026	Dry Coring	20.00
18	MBAC-18	S6	419504.086	2608000.412	425.700	23.02.2026	01.03.2026	Dry Coring	20.00

1.4 A bulk density determination was performed near the drilled boreholes to enhance resource estimation accuracy, revealing variations in density across different lateritic zones. Additionally, a topographic survey using DGPS technology mapped elevation changes, borehole locations, block boundary locations and surface features. The mineralization is confined to lateritic mounds, with bauxite deposits primarily restricted to laterite capping overlying a clay layer. Since drilling was limited to 20 meters, mineralization beyond this depth remains unexplored.

1.5 The sampling process for exploration involved collecting half-split drill core samples at 1-2 meter intervals as primary samples for analyzing key elements such as Fe%, Mn%, SiO_2%, Al_2O_3%, TiO_2, P_2O_5%, S%, Ga_2O_3, V_2O_5. A total of 280 primary samples were collected from eighteen boreholes. To ensure analytical reliability, 10% of these samples (25 samples) were sent to an NABL accredited external laboratory for verification as external check samples. Additionally, 10 samples were selected from the primary samples to analyze trace elements (Ni, Co, Cd, Cr & Ti) and 10 composite samples were prepared to analyze Platinum Group Elements (PGE).

1.6 The resource estimation for aluminous laterite ($Al_2O_3 \geq 20\%$), Titanium ($Ti \geq 2\%$) and Vanadium ($V \geq 500$ ppm), was conducted using two methods: the Polygonal Method as the primary approach and the Cross-Sectional Method as a validation measure. The Polygonal Method assigned each borehole a specific polygonal area, using aluminous laterite thickness and bulk density for systematic resource calculation. The Cross-Sectional Method estimated resources by correlating borehole data along geological sections to define the mineralized body's shape and volume.

1.7 The Polygonal Method estimated 36.34 million tonnes of net in-situ aluminous laterite with an average grade of 28.38% Al_2O_3 , 18.95 million tonnes of net in-situ Titanium with an average grade of 2.45% Ti, and 29.06 million tonnes of net in-situ Vanadium with an average grade of 623.24 ppm V. While the Cross-Sectional Method estimated 33.98 million tonnes of net in-situ aluminous laterite with an average grade of 28.24% Al_2O_3, 16.21 million tonnes of net in-situ Titanium with an average grade of 2.41% Ti and 26.27 million tonnes of net in-situ Vanadium with an average grade 653.62 ppm V content. All estimated resources have been classified under the Inferred Category (333) as per the United Nations Framework Classification (UNFC) guidelines.

1.8 Preliminary exploration (G3) in the Amoch Chhapra block has confirmed the presence of aluminous laterite with significant titanium and vanadium content. An estimated 36.34 million tonnes of aluminous laterite, 18.95 million tonnes of Titanium and 29.06 million tonnes of Vanadium has been identified, containing 28.38% Al_2O_3, 2.45% Ti and 623.24 ppm V. With the completion of this exploration phase, the block is now eligible for auction under a composite license (CL). Further exploration for critical elements, along with beneficiation studies, should be carried out to enhance resource estimation, grade assessment, and the recovery potential of titanium and vanadium within the aluminous laterite.

CHAPTER- 2

2.0 DETAILS OF THE QUALIFIED PERSON(S) / EXPLORATION AGENCY

2.1 Details of Exploration Agency

Name: Mineral Exploration and Consultancy Limited (Formerly Mineral Exploration Corporation Limited), A Govt. of India Enterprise-A Miniratna PSE

Address: Dr. Babasaheb Ambedkar Bhavan, High Land Drive Road, Seminary Hills, Nagpur-440006

Contact: 0712-2510310

Email ID: headbd@mecl.co.in

Affiliation: Ministry of Mines

2.2 Details of persons associated with various aspects of exploration assessment of resources and reserves

Different Aspects of Work	Name & Designation
General Supervision and Guidance	Shri Shrikant Sharma, HOD (Exploration)/ DGM (Exploration)
Overall palnning, co-ordination and Supervision	Shri Shrikant Sharma, HOD (Exploration)/ DGM (Exploration)
Field Operation	Shri Saptarshi Ghosh, Manager (Geology) Miss Khushboo Kumari, Executive Trainee (Geology) Shri Narendra Kumar, Sr. Tech. (Sampling)
Data processing, Interpretation and Report Writting	Shri Saptarshi Ghosh, AM (Geology)
Chemical Division	Shri Rohit Sharma, Manager (Chemical) Dr. Deepti R. Rahangdale, Manager (Chemical)
Non-coal Report Cell	Shri NCS Reddy, Sr. Console Operator Shri Shivananda, Sr. Computer Operator

CHAPTER- 3

3.0 TITLE AND OWNERSHIP

3.1 Title of the Report

Title: GEOLOGICAL REPORT ON PRELIMINARY EXPLORATION (G3) FOR IRON AND BAUXITE IN AMOCH CHHAPRA BLOCK, DISTRICT- JABALPUR & KATNI, MADHYA PRADESH

Ownership: Government of Madhya Pradesh

Name of Prospector: MINERAL EXPLORATION AND CONSULTANCY LIMITED (Formerly Mineral Exploration Corporation Limited)

Address of Prospector: Dr. Babasaheb Ambedkar Bhavan, High Land Drive Road, Seminary Hills, Nagpur, Pin- 440006

E-mail of Prospector: cmd@mecl.gov.in; gm-exploration@mecl.gov.in

Telephone numbers of Prospector: 0712-2510289; 0712-2511829

3.2 Details of period of prospecting

3.2.1 Background

The Mahakosal Supracrustal Belt is recognized for its mineral potential, particularly for iron, manganese, gold, graphite, base metals and dolomite/limestone. MECL conducted desktop studies using available geoscience data and identified the Sihora region in Jabalpur district as a key area for iron and manganese mining. This led to the formulation of a reconnaissance (G4) survey proposal for iron, manganese, and associated minerals in the Salaiya Block, Madhya Pradesh, covering the study area within Jabalpur, Katni, and Umaria districts.

The exploration proposal was submitted to the 50th TCC of NMET for discussion, aiming to assess iron and associated mineral deposits to support India's mineral sector and economic growth. The proposal received approval from the 50th TCC of NMET and was subsequently approved by the Executive Committee (EC) of NMET on April 3, 2023. The reconnaissance survey (G4) was conducted from June 20, 2023, to October 19, 2023.

Following the review in the 63rd TCC of NMET, the Final Geological Report (FGR) was submitted in March 2024. The survey identified two significant laterite bodies with iron and bauxite ore deposits: the Majhauli Sub-block and the Amoch Chhapra Sub-block. Based on these findings, systematic drilling was recommended in both sub-blocks to estimate resources, enabling the state government to proceed with mining lease (ML) auctions.

Among the two sub-blocks, a Preliminary Exploration (G3) proposal for the Amoch Chhapra Block has been presented in the 65th TCC of NMET. This proposal includes 380 meters of drilling across eighteen boreholes to further assess the iron and bauxite deposits.

3.2.2 Period of prospecting

The Preliminary Exploration for Iron and Bauxite in Amoch Chhapra block, Madhya Pradesh, received approval from the 36th Executive Committee of NMET through letter no. 23/481/2024-NMET/302, dated 29th August, 2024, with designated time duration of 10 months. The block falls within the forest boundaries of the Jabalpur and Katni Forest Divisions, for which forest clearance was applied through the PARIVESH portal on 19.10.2024. Following a joint field visit with officials of both forest divisions, fieldwork in the non-forest areas commenced on 24.08.2025. Permission for the Jabalpur Forest Division was received on 15.10.2025, allowing work to continue until 15.12.2025. However, due to pending permission for the Katni Forest Division, fieldwork remained suspended from 15.12.2025 to 11.02.2026. After receiving the Katni forest permission on 18.02.2026, fieldwork resumed and the investigation in the Amoch–Chhapra block was completed on 01.03.2026.

CHAPTER- 4

4.0 DETAILS OF AREA UNDER STUDY

4.1 Village, District, State

The Amoch Chhapra Block encompasses the region delineated in Survey of India Toposheet No. 64A/02, spanning an area of 4.86 square kilometers. This geographical expanse spans across portions of Jabalpur & Katni district within the state of Madhya Pradesh, and nearly 40 Km NNE of Jabalpur district. From a geological perspective, several pivotal villages lie within the confines of the Amoch Chhapra Block, including but not limited to Amoch, Chhapra, Dhangawa & Hardua Kala. The location plan of Amoch Chhapra block on part of toposheet no 64A/02 is presented as Text Figure- 1 and Plate-I.

4.2 Coordinates of all corner points of the study area in Latitude and Longitude (Degree Minutes Second) format WGS-84 Datum

Sl. No.	Block Cardinal Points	Datum: WGS-84				RL
		Geographic (DD°MM' SS.SS")		UTM (Zone- 44)		
		Latitude	Longitude	Easting (m)	Northing (m)	(m)
1	A	23° 34' 55.078" N	80° 10' 48.937" E	416354.328	2608185.012	433.436
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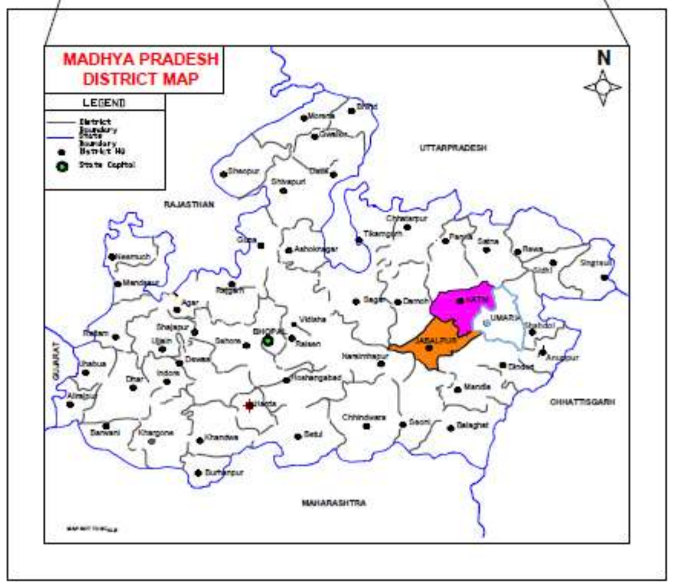
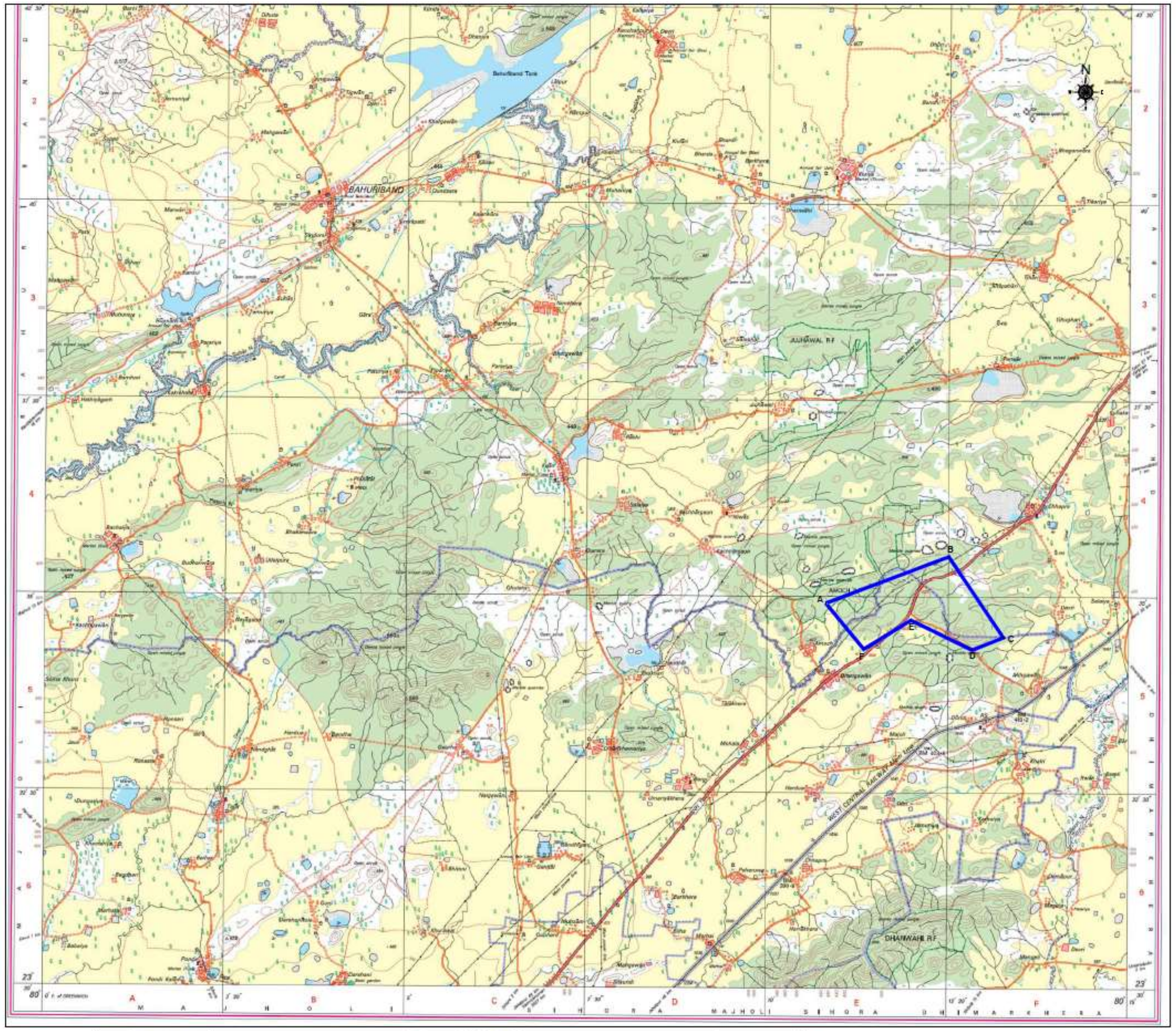
6	F	23° 35' 31.012" N	80° 12' 30.821" E	419248.401	2609273.888	447.077

Text Figure- 1: Map showing location of Amoch Chhapra block over toposheet no. 64A/02, District- Jabalpur & Katni, Madhya Pradesh





Sl. No.	Block Cardinal Points	Datum: WGS-84				RL
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Amoch Chhapra block boundary

MINERAL EXPLORATION & CONSULTANCY LIMITED

LOCATION MAP

PRELIMINARY EXPLORATION (G3 STAGE) FOR
IRON & BAUXITE IN AMOCH-CHHAPRA BLOCK (4.86 Sq.Km)

DISTRICT : JABALPUR & KATNI | STATE : MADHYA PRADESH

PART OF TOPOSHEET NO:-64A/02 | NOT TO SCALE

MECL/CHQ/EXPLORATION/MARCH-2024 | PLATE NO. I | 1

4.3 Cadastral details of the area with land use, area under forest with type of forest. In case the cadastral details are not available an indicative data of breakup of government, private and forest land

4.3.1 The total area of the Amoch–Chhapra block is 4.86 sq. km (486 ha). Out of this, approximately 170 ha falls under forest land, of which about 68 ha lies within the Jabalpur Forest Division (Protected Forest – PF-1) and around 102 ha within the Katni Forest Division, comprising Reserved Forest (RF-249), Protected Forest (PF-254), and Kh. No. 271 & 3. The remaining area of the block comprises revenue land, revenue forest, private commercial land, and agricultural land. In addition, National Highway-7 (NH-7) passes through a portion of the block area. The forested tracts within the block are mainly characterized by tropical dry deciduous forest vegetation, typical of the region.

4.4 Mineral(s) under investigation

4.4.1 Although the exploration programme in the Amoch–Chhapra block was initially designed to assess the potential for iron ore and bauxite, the results of geochemical analysis indicate that no economically significant iron ore mineralization is present within the investigated area. As per the threshold values notified by IBM, Ministry of Mines, the minimum grade for iron ore is 35% Fe; however, none of the analyzed primary samples have attained this threshold. Similarly, no bauxite horizons meeting the prescribed grade criteria were encountered during the investigation. Instead, the area is characterized by the presence of aluminous laterite, and resource estimation has been carried out considering a cutoff grade of 20% Al_2O_3, in accordance with the IBM threshold guidelines. Thus, while iron and bauxite were part of the initial exploration objectives, the investigation has established that the mineralization in the block is restricted to aluminous laterite with associated Ti and V values, and does not include any economically viable iron ore occurrences.

CHAPTER- 5

5.0 PHYSIOGRAPHY AND ENVIRONMENT

5.1 Relief of the area with minimum and maximum elevation, drainage pattern, natural water courses, reservoirs, etc.

5.1.1 The Amoch Chhapra block and its surroundings present a diverse topography, characterized by a generally flat terrain with monotonous soil cover. To the south, ENE-WSE trending hill ranges, reaching a maximum height of 483m above MSL, are covered by scanty plantation. The Amoch Chhapra block itself is situated in a plain country with a gentle slope from north to south. The terrain becomes uneven north of Dhangawa village, transitioning into a hilly area with long ridges trending ENE-WSW, alternating with valleys and nalas along the margins. The minimum elevation is 408m above M.S.L. To the Majhgawa part, the topography is undulatory, marked by ENE-WSW trending hillocks, with flat terrain mostly covered by quartzite and phyllite.

5.1.2 In and around of Amoch Chhapra block features a diverse drainage pattern influenced by both structure and lithology. Small seasonal nalas originating from ENE-WSW running hill ranges flow through the plains in a north to north-west direction, feeding either small rivers or large tanks common in the region. The rectilinear and joint-controlled flow characterizes nalas from ridges, while flat terrains exhibit sub-parallel to trellis-type drainage.

5.2 Roads, railway track, electric transmission line, telephone line, etc., passing through the area or nearby

5.2.1 The study area spans portions of Jabalpur & Katni districts in Madhya Pradesh, conveniently located approximately 40km from Jabalpur on NH-7 and around 60km from Katni, also accessible via NH-7. The Sihora Road Railway Station, situated approximately 10km from the block, serves as the nearest rail link. The Jabalpur airport is the closest air transportation hub.

5.2.2 The Amoch Chhapra block is traversed by two significant power lines. One power line follows the alignment of NH7, providing a critical energy infrastructure corridor along this major transportation route. The second power line runs along the southern boundary of the block, reinforcing the electrical connectivity in the rural region.

5.3 Host population (local tribes), Human settlements within and nearby the area

5.3.1 In and around the Amoch Chhapra block, diverse tribal communities thrive, including the Gond, Baiga, Bhil, and Kol tribes. The Bhil tribe dominates with 37.7% of the total Scheduled Tribe (ST) population, followed by the Gond tribe at 35.6%. The Gond tribe, renowned for vibrant art, especially the famous Gond paintings, contributes significantly to the region's rich cultural heritage.

5.3.2 Several human settlements can be seen in and around the study area. Traditionally, rural households are made up of mud wall with single door and without ventilation window. Generally houses are one story and with a courtyard. Majority of the houses have no toilets.

5.4 Socio Demographic profile of the area and nearby

5.4.1 According to the 2011 Census, Jabalpur district has a population of 2,463,289, ranking 180th in India (out of 640 districts), with a population density of 472 persons per sq. km and a decadal growth rate (2001–2011) of 14.39%. The district records a sex ratio of 925 females per 1000 males and a literacy rate of 82.47%, with about 58.46% of the population residing in urban areas. Scheduled Castes and Scheduled Tribes constitute 14.13% and 15.23% of the population respectively. Katni district, on the other hand, has a population of 1,292,042, ranking around 379th in India, with a population density of 261 persons per sq. km and a decadal growth rate of 21.41%. The district has a sex ratio of 952 females per 1000 males and a literacy rate of 71.98%, with about 20.4% of the population living in urban areas, while Scheduled Castes and Scheduled Tribes account for approximately 12.05% and 24.59% of the population respectively.

5.4.2 The economic landscape in and around the study area is predominantly shaped by agricultural activities, serving as the primary source of livelihood for a significant portion of the population. The community relies heavily on cultivating crops and rearing livestock to sustain their households. In addition to agriculture, a substantial number of individuals in the vicinity find employment in the nearby marble industry as laborers. This industry provides an alternative source of income for many. Furthermore, a few entrepreneurial individuals have ventured into setting up their own small businesses.

5.5 Historical sites and archaeological monuments, places of worship, public utilities etc. within or near by

5.5.1 The Amoch–Chhapra block falls within parts of Jabalpur and Katni districts, both of which are historically and culturally significant regions of Madhya Pradesh. Jabalpur is known for several important historical monuments, including the Madan Mahal Fort, Rani Durgavati Museum, and the ancient Chausath Yogini Temple, which reflect the rich cultural and historical heritage of the region. In the vicinity of the block, an important religious site is the Shri Digambar Jain Atishay Kshetra, Bahoriband, located about 2 km from Bahoriband town. The temple complex houses a large ancient idol of Lord Shantinath (16th Tirthankara), believed to date back to the 11th–12th century during the Kalchuri period, and is an important pilgrimage centre for the Jain community as well as a site of archaeological importance. Another notable archaeological site in the Bahoriband area is the Tigawa (Tigwan) Temple Complex, which contains remains of Gupta-period temples (circa 400–425 CE), including the renowned Kankali Devi Temple, known for its early temple architecture and intricate stone carvings. The site is protected by the Archaeological Survey of India (ASI) and represents a significant cultural landmark of the region. Additionally, the Vijayraghavgarh Fort, located about 30–35 km from the block, is a prominent historical fortification that includes structures such as the Rangmahal Palace and a temple dedicated to Goddess Sharda, reflecting the architectural heritage of the area. In terms of public utilities, Katni town, the district headquarters, serves as an important administrative and railway junction, providing educational institutions, healthcare facilities, government offices, and other civic amenities. The region is well connected by National Highways NH-30 and NH-78, linking Katni with Jabalpur, Satna, and Rewa, while Bahoriband and nearby villages are connected through pucca and semi-pucca roads. Basic infrastructure such as electric transmission lines, hand pumps, and primary health centres are also available in the surrounding rural areas, facilitating access and communication within and around the Amoch–Chhapra block.

5.6 Forests, sanctuaries, national park and wild life sanctuaries; grazing land and gochar land within or near by the area with distance from periphery of the area explored

5.6.1 The Amoch–Chhapra block lies partly within the forest jurisdictions of the Jabalpur and Katni Forest Divisions, with approximately 170 ha of the total 486 ha block area falling under forest land. Of this, about 68 ha lies within the Jabalpur Forest Division (PF-1) and approximately 102 ha within the Katni Forest Division, comprising RF-249, PF-254 and Kh. No. 271 & 3. Apart from these forest tracts, the surrounding areas also include revenue forest patches, agricultural land and village grazing lands (gochar land).

5.6.2 The region encompassing Jabalpur & Umaria district in central India is endowed with diverse and ecologically significant landscapes, featuring lush forests, sanctuaries, national parks, and wildlife sanctuaries. Prominent among them is the Bandhavgarh National Park in Umaria district, renowned for its population of Bengal tigers and diverse wildlife. The Pench National Park, straddling the border of Madhya Pradesh and Maharashtra, adds to the ecological wealth of the region.

5.7 Flora and Fauna within and nearby

5.7.1 The study area, characterized by its diverse and vibrant ecosystem, hosts a rich variety of flora and fauna contributing to the region's ecological significance. Noteworthy floral species include Mango (*Mangifera Indica*), Sal (*Shorea robusta*), Sagon (*Tectona grandis*), Mahua (*Madhuka latifolia*), Tendu (*Disaphyros metamoxylon*), Imli (*Tamarindus indica*), Neem (*Azadirachta indica*), Bamboo (*Bambusa vulgaris*) and Bel (*Aegle marmacas*).

5.7.2 In terms of fauna, the study area boasts a diverse array of wildlife, including boars, cheetal, sambar, rabbits, snakes, foxes, wild bears, deer, and various antelopes. The area is also marked by the prevalence of large-sized jet-black to brownish-black scorpions, with brown-colored scorpions observed in the laterites of amoch village.

5.8 Water bodies such as river, nala, stream, reservoir, etc., within or nearby

5.8.1 The Narmada River, a lifeline of Central India, flows in proximity to Jabalpur, providing not only a scenic backdrop but also catering to various needs, including agriculture and domestic consumption. The Bargi Dam, a key reservoir in the region, stands as a testament to water resource management. Situated on the Narmada River, the Bargi Dam not only serves as a crucial water storage facility but also supports irrigation, hydropower generation, and provides a recreational haven for locals and tourists alike. In this area 3rd order Silpuri nala flows south to join Narmada river system. Also minor canals originating from local reservoirs/ water bodies in this area made for irrigation purpose. One such nala situated at the southern boundary of the block.

5.9 Climatic conditions

5.9.1 The study area is characterized by a subtropical climate, marked by distinct seasonal variations. Winters are relatively cool, with temperatures dropping to as low as 5°C, while summers can be hot and semi-dry, reaching up to 46°C. The region experiences an average annual rainfall of about 1560 mm, with the monsoon active from July to September, contributing significantly to the precipitation.

CHAPTER- 6

6.0 INFRASTRUCTURE

6.1 The Amoch Chhapra block, situated near the Jabalpur district of Madhya Pradesh, benefits from a robust network of infrastructure, enhancing its connectivity and industrial potential. The study area is positioned along National Highway 7, facilitating easy access to major cities such as Jabalpur, Katni and Nagpur. Additionally, Sihora Road, the nearest raiway station, is well-connected by the Indian Railways' West Central Main line, with the Jabalpur-Katni Railway line passing through the block area, providing efficient freight and passenger transportation.

6.2 The area is equipped with reliable electricity supply from the Madhya Pradesh Power Transmission Company Limited (MPPTCL), ensuring uninterrupted power for residential and industrial use. Furthermore, water supply is managed by the Public Health Engineering Department (PHED), guaranteeing access to clean and potable water for the local population.

6.3 The industrial landscape around the study area is characterized by sectors such as mining and manufacturing. Notable industries include the Marble Industry, which utilizes the abundant marble deposits in the region, and the Jabalpur Metal Industries, specializing in metal processing and fabrication. These industries contribute significantly to the local economy, providing employment opportunities and stimulating economic growth.

CHAPTER- 7

7.0 GEOLOGY

7.1 Brief regional geology of the area outlining the broad geological, stratigraphical and structural frame work

7.1.1 The central part of the Indian Precambrian Shield is characterized by the presence of two separate crustal provinces: the Northern Crustal Province, which includes the Bundelkhand region, and the Southern Crustal Province, known as Bastar. Within the Northern Crustal Province, there is a subdivision into the Bundelkhand Cratonic area and a more extensive zone of accretion to its south, following an ENE–WSW trend, recognized as the Central Indian Tectonic Zone (CITZ).

7.1.2 The Bastar Crustal Province exhibits distinctive features, including an Archean cratonic nucleus manifested by widely scattered older supracrustals, such as the Sukma Group and its equivalents. These supracrustals have undergone regional deformation and metamorphism, accompanied by a tonalite-trondhjemite-granodiorite (TTG) crust dating back to greater than 3.0 billion years. Additionally, within this province, there are younger supracrustals ranging from Neo-Archean to Meso-Proterozoic, organized into well-defined north-south trending volcanosedimentary belts. The geological landscape is further influenced by the intrusion of younger granitic bodies into both the older and more recent supracrustals.

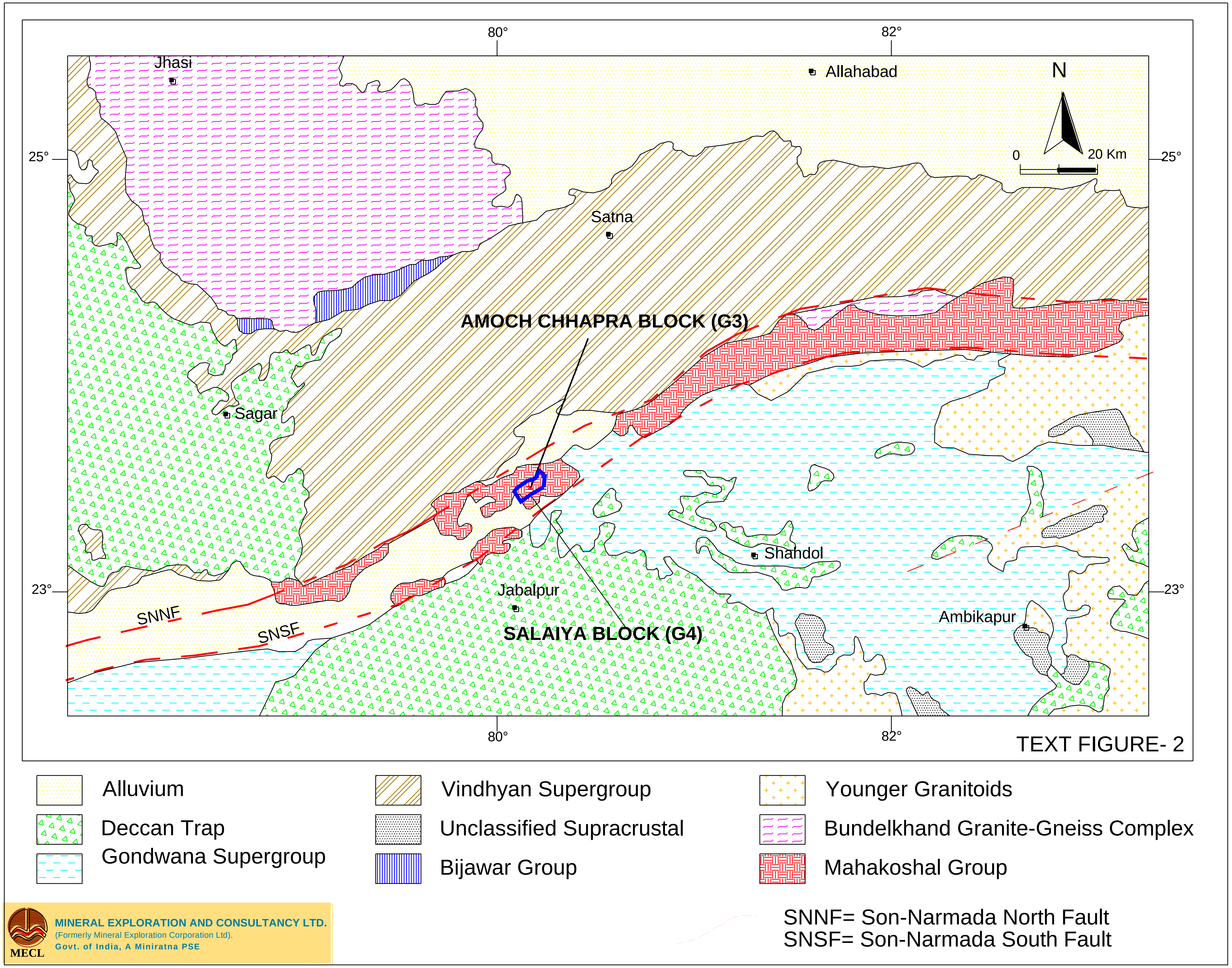
7.1.3 The Bundelkhand Crustal Province is characterized by a semicircular granite-gneiss massif, represents the Archean cratonic nucleus (> 3.0 Ga). This massif includes numerous older supracrustal enclaves. The southern and southeastern boundaries of the Bundelkhand massif are covered by the Paleo- to Meso-Proterozoic Bijawar Group, primarily composed of metasediments and associated volcanic rocks. In the northern part of the Bundelkhand massif, there is another metasedimentary unit called the Gwalior Group, considered to be time-equivalent with the Bijawar Group. The northern limit of the Bundelkhand massif is marked by the Indo-Gangetic alluvial cover. In the southern, southeastern, and western parts of the Bundelkhand craton, there is an unconformable overlay of Vindhyan sediments. This overlay causes a significant separation, at the present exposure level, from the Precambrian rocks (BGC-Aravalli-Delhi) of Western India, as well as the Mahakoshal belt of the Central Indian Tectonic

Zone (CITZ) lying to its south. This geological setting outlines the complex history and stratigraphic relationships within the Bundelkhand Crustal Province.

7.1.4 The Central Indian Tectonic Zone (CITZ), initially known as the Satpura Province in early literature, is delineated by the Son–Narmada North Fault (SNNF) in the north and the Central Indian Shear (CIS) in the south (Roy and Hanuma Prasad, 2003). Within the CITZ, there are several Proterozoic mobile belts (< 2.5 Ga) embedded in predominantly undifferentiated gneiss, featuring locally identified TTG (tonalite-trondhjemite-granodiorite) members and syn to post-kinematic K-rich granitic bodies. Large parts of this region are covered by the Vindhyan and Gondwana sequences, as well as the Deccan Trap rocks, limiting the exposure of the Precambrian basement. Despite this, three distinct supracrustal belts of varying ages stand out: Mahakoshal (2.2–1.8 Ga), Betul (> 1.55–0.85 Ga), and Sausar (1.1–0.95 Ga). These belts, extending from north to south, are each bounded by brittle–ductile/ductile shear zones. The CITZ is characterized by multiple brittle–ductile to ductile shear zones, with notable examples being the Son–Narmada North Fault (SNNF) running along the northern contact of the Mahakoshal belt with the Vindyans, and the Son–Narmada South Fault (SNSF) demarcating the southern boundary of the Mahakoshal belt.

7.1.5 The Mahakoshal supracrustal belt, oriented in an ENE–WSW to E–W direction, stretches approximately 600 km from the southwest of Jabalpur, Madhya Pradesh, to Palamau district in Jharkhand. It maintains an average width of about 20 km, covering an area of around 9000 sq km. This belt is characterized as a fault-controlled asymmetric rift basin, with the Son–Narmada North Fault (SNNF) and Son–Narmada South Fault (SNSF) bounding its northern and southern sides, respectively. The present area of study i.e. Amoch Chhapra block falls within this Mahakoshal belt. Regional Geological Map showing Amoch Chhapra block boundary on the Mahakoshal belt is presented as Text Figure- 2 and Plate- II.

7.1.6 To the north of the Mahakoshal belt, the Vindhyan Supergroup forms its border, except for a limited stretch in the Sidhi area where a linear belt of basement (Archean) Gneissic Complex intervenes. On the southern margin of the belt, there is an extensive presence of Proterozoic Granitic Intrusives, and in some areas, it is juxtaposed against the rocks of the Gondwana Supergroup, with the prominent Son–Narmada South Fault passing in between.



Text Figure- 2: Regional Geological map showing location of Amoch Chhapra block within Mahakoshal belt

7.1.7 The Mahakoshal Group comprises various rock types, with predominant meta-sediments such as quartzite, pelites, carbonates, greywacke, and banded iron formation (BIF). Additionally, there are subordinate metabasalt and ultramafic rocks, along with infrequent occurrences of acid tuffs, intrusive mafic dyke swarms, and granitoids. Occasional intrusions of albitite with alkane affinity, as well as reported carbonatite (?), add to the geological diversity.

7.1.8 Roy and Devrajan (2000) classified the supracrustal assemblages into three formations. In the lower part, exposed in the northern section of the belt, basaltic volcanic rocks are prominent, accompanied by minor volcanic and shallow marine sediments. This sediment association indicates characteristics of pre-rift shallow marine intertidal to shelf-slope facies sedimentation. Following this, there was a phase of limited rifting and emplacement of basic volcanic rocks with arc affinity. Overlying these formations are sediments of moderate to deeper water conditions, including BIF.

7.1.9 Nair et. at. (1995) categorized Mahakoshal group of rocks into three formations based on lithological characteristics, which is very similar to the classification proposed by Roy and Devrajan (2000). The lowermost Chitrangi Formation consists of a volcanic assemblage, including basic and ultrabasic lavas with associated dykes and ultrabasic plugs. Situated in the anticlinal valleys in the northern half of the belt, this formation features peridotitic lava, pillow metabasalt, epidiorite, agglomerate and calc-chlorite schist in the lower horizons, transitioning to minor andesitic lavas towards the upper part of the lava pile.

7.1.10 The middle formation, known as the Agori Formation or Sleemnabad Formation, follows volcanic activity in the basin and incorporates clastic and non-clastic sediments along with minor volcanics. It includes tuffs with metabasic lenses, lenticular bodies of dolomite and impure marble, banded hematite quartzite, banded magnetite quartzite, jasperite and quartzite. This formation, primarily found in the northern half of the basin along the limbs of anticlines, features ridges of quartzite and BHQ/BMQ trending ENE-WSW, extending across the basin as lenticular bands. Depositional structures like load casts, bedding, and color banding are observed in the BHQ/BMQ.

7.1.11 Throughout the Agori Formation, Banded Iron Formations (BIF) are present with gradational contacts with marbles and other members. The BIF, forming long linear ridges, is thinly bedded. Along the strike, there is a transition to chert and cherty quartzite, evolving into brecciated quartzite/jasper.

7.1.12 The Parsoi Formation, the youngest lithounit in the Mahakoshal Group, is developed in a broad synclinorium in the southern half of the belt. It is characterized by tuffaceous phyllites with intercalations of felspathic quartzite bands. Some phyllites are carbonaceous and sedimentary structures like graded bedding, current bedding, convolute laminations, and slump structures are observed. The Parsoi Formation carries a significant intrusion of quartz veins parallel to the fold axes.

<u>General Stratigraphic succession of Mahakoshal Group, after Nair et. al. (1995)</u>

<table>
<tr><th>Group</th><th>Formation</th><th>Litho units</th></tr>
<tr><td rowspan="7">MAHAKOSHAL GROUP</td><td colspan="2">Vindhyan Supergroup and Jungel Group of Sediments</td></tr>
<tr><td colspan="2">Uncomformable and Faulted Contact</td></tr>
<tr><td>Intrusives</td><td>Dunite, gabbro, dolerite, quartz- porphyry and quartz veins, syenite and associated alkaline dykes, carbonatites, barite veins and lamprophyres/ trachytes and associated intrusives. Barambaba granite and equivalents.</td></tr>
<tr><td>Parsoi Formation</td><td>Tuffaceous and carbonaceous phyllites, felspathic quartzite and conglomerate, tuffaceous phyllite with metabasalt intercalations.</td></tr>
<tr><td>Agori Formation or Sleemnabad Formation</td><td>Banded hematite/magnetite quartzite and jasperiod with associated tuffs and ash beds.
Impure marble, dolomite and inter- bedded calc-chlorite schist with occasional metabasalt lenses, conglomerate.</td></tr>
<tr><td>Chitrangi Formation</td><td>Basic and ultrabasic plugs and dykes including periodtite and serpentinite, Agglomerates, metabasalt and peridotitic pillow lava.</td></tr>
<tr><td colspan="2">Sidhi Gneissic Complex (Basement)</td><td>Gneissic Complex with associated mafic, ultramafic rocks and metasediments</td></tr>
</table>

7.1.13 The Mahakoshal belt is framed by two major faults: the Son–Narmada North Fault (SNNF) in the north and the Son–Narmada South Fault (SNSF) in the south. These large faults have been reactivated multiple times during the Mahakoshal orogeny and subsequent periods. The Mahakoshal Group of rocks bears evidence of several phases of deformation (D1, D2, and D3). Among these, D1 and D2 are particularly intense, and their combined effects have led to the elongation of the belt in an ENE–WSW direction.

7.1.14 The geometry of D1 and D2 folds indicates a predominant flattening type of strain in response to north-south compression. As flattening progressed, a distinct ductile shear zone developed along the southern margin of the belt, coinciding with the SNSF. This shear zone exhibits a reverse slip movement with a direction towards the north.

7.2 Local geological setting detailing the common rock types, controls of mineralization, details of old workings if any, surface exposures, etc., of the area under study also of adjoining nearby areas, if the information is likely to have an impact on the area under study

7.2.1 Geological Setting

In the study area, the supracrustals of Mahakoshal Group are distributed around Dhangawa, Hardua Kalan, Amoch, Chhapra and north of Mahagwan area. The intervening spaces are either covered by extensive Quaternary alluvial deposits or laterite, particularly around Hardua Kala, Amoch, Chhapra and Dhangawa areas. In the central part of the block area, along the southern margin and in the eastern part, irregularly shaped lateritic patches stand out, forming small hillocks and mounds.

To the west of the block, phyllite exposures are visible along road sections. Adjacent to these, metabasalt formations appear as discontinuous hillocks, predominantly aligned in an ENE-WSW direction, with noticeable offsets in their alignment. Additionally, several small phyllite bodies, often too minor to be mapped, can be traced along the regional ENE-WSW trend.

The supracrustal sequence of the Mahakoshal Group in the surrounding of Amoch Chhapra block area consists of thick quartzite/chert bands and associated minor dolomite, phyllite (manganiferous in some areas), and banded quartzite chert/jasper. While the entire range of supracrustal sequences is not exposed within the confines of the block boundary, detailed studies have been conducted beyond this limit to comprehensively analyze the stratigraphic sequence. These extended investigations provide valuable insights into the continuity, distribution, and structural characteristics of the formations present in the region. In the Amoch, Mahagawan and Dhngawan, areas where these lithotypes are exposed, the initial phase of sedimentation is marked by the deposition of non-clastic sediments, massive cherts and minor dolomites. This chemical precipitate-dominated unit transitions continuously, without any breaks, into a clastic-dominated unit, featuring phyllite-BIF components in the younger unit, indicating ongoing sedimentation without any unconformity. Based on the above observations, the following local stratigraphic column can be established:

Local stratigraphic column established after geological mapping in and around Amoch Chhapra block

<table>
<tr><th>Group</th><th colspan="2">Lithounits</th></tr>
<tr><td rowspan="2">Qarternary</td><td colspan="2">Alluvium</td></tr>
<tr><td colspan="2">Laterite</td></tr>
<tr><td rowspan="5">Mahakoshal</td><td rowspan="5">Sleemnabad Formation</td><td>Metabasalt</td></tr>
<tr><td>BIF</td></tr>
<tr><td>Phyllite</td></tr>
<tr><td>Chert, Cherty quartzite</td></tr>
<tr><td>Carbonates, Dolomite</td></tr>
<tr><td colspan="3">----- Base Not Exposed -----</td></tr>
</table>

7.2.2 Common Rock Types

In the study area, metasedimentary litho-units encompass both clastic and non-clastic compositions. The clastic components consist of Phyllite and BIF, while the non-clastic components are primarily dolomite with minor occurrences of cherts. Massive to foliated metabasalts of the uppers Mahakoshal group has also been identified. Laterite cover is evident along the eastern boundary and central parts. Detailed descriptions of each observed rock type in the study area are provided in the following paragraphs.

Phyllite: Extensive exposures of phyllite are visible in the road section of Hardua kala village. Also, scattered exposures can be traced all over the block area, following the regional trend. Primary banding is rarely observed in these rocks, with only an ENE-WSW trending pervasive foliation present. Garnets are sporadically noticed in these phyllites. The rock is light to dark grey in color, fine-grained, and schistose. It exhibits two different generations of quartz veins, with the first being syngenetic and forming along with the phyllitic deformation. This generation creates alternate phyllite and quartz bands. The second generation quartz vein is post-deformation and fills fractures/joints. Shearing is evident in the phyllite, manifesting as the development of phyllitic fish and augen-shaped primary quartz. The sense of shearing is sinistral, and a crude crenulation has formed due to this shearing (Field Photograph- 1). The attitude of the phyllitic plane strikes at 70° with a 50° dip towards the south.

Near the dolomite mine area, phyllite is present as interbands within marble. Frequent intercalation of thin bands of argillites within the carbonates is a characteristic feature of the Sleemanabad Formation (Field Photograph- 2). It appears greenish-grey, well-foliated with a phyllitic sheen. The phyllite exhibits either sericitic or chloritic characteristics and in some instances, appears arenaceous, resembling a micaceous quartzite.

Dolomite: The rock, ranging from pale yellow to milky white colour, is fine to medium-grained. Noteworthy exposures are observed around lateritic patch 1, NE of Amoch Chhapra village. Dolomite powder exhibits effervescence when comes in contact with diluted HCl. Its strike is approximately E-W, with a steep dip ranging from 55° to 65° towards the south. Mineral lineation, influenced by preferentially oriented biotite, is evident, along with the persistence of thin quartz veins. Numerous quartz veins intrude along joint and fracture planes, creating a cross-cutting pattern that results in elephant skin weathering—a characteristic feature of dolomite (Field Photograph- 3). In some areas, the intruded quartz veins appear smoky.

The phyllites within dolomite are generally light grey to greenish-grey, well-foliated, and show a variable degree of compaction. A phyllite sheen is observable on the cleavage plains of unweathered rocks.

Metabasalt: These fine-grained rocks exhibit a spectrum of green to greyish-green colors and feature fine to large vesicles, filled with secondary material, creating an amygdaloidal appearance (Field Photograph- 4). Characterized by hardness and compactness, the rock also displays secondary quartz and epidote veins within fractures. Crude schistosity is evident along the metabasalt margins, particularly at the contact with phyllite. The conformable nature of the metabasalts indicates that these are syn-depositional flows. A gradational transition with the associated phyllite is noted, often showcasing impregnations of sulphides, primarily pyrite. Notable exposures are observed in Hardua Kala village.

Laterite: Extensive laterite cover dominates the central and southern parts, especially along the eastern boundary of the mapped area, particularly around the north of Amoch, Chhapra and north of Dhangawa, Majhgawa village. The laterite displays a spectrum of colors ranging from yellow to brick-red. Various types of laterites, including massive/laminated, concretionary, vermicular, and vesicular, are observed, showcasing inhomogeneity and density (Field Photograph- 5).

In naked-eye observations, goethite and hematite are discernible, indicating a high iron content. Alumina concentration is notable in and around Amoch Chhapra village. These laterites contain lumps of platy or biscuity hematite, cemented by a minimal ferruginous matrix. In specific locations, such as east of Amoch village, yellow ochre pockets are visible in these laterites, commercially exploited for their valuable content. It is plausible that the laterite formation was not uniform but rather pocket-type.

Laterite formations present as isolated hillocks and mounds across the study area, characterized by high aluminous content and often associated with ferruginous layers. Low-grade bauxite, displaying a pisolitic texture, is observed at select locations.

 Field Photograph 1: Sinistral sense of shearing in phyllite	 Field Photograph 2: Intercalation of shale in dolomite, with shear fracture
 Field Photograph 3: Elephant skin weathering texture in dolomite	 Field Photograph 4: Secondary infillings in vesicles creating amygdaloidal texture in Basalt

7.2.3 Controls of mineralization

Bauxite (Aluminous Laterite)

The control of bauxite mineralization in the studied area is influenced by various geological factors, weathering processes, and the nature of underlying rocks. The presence of low-grade ferruginous bauxite and aluminous laterite associated with laterites is observed in all the lateritic bodies within the study area (Field Photograph- 6).

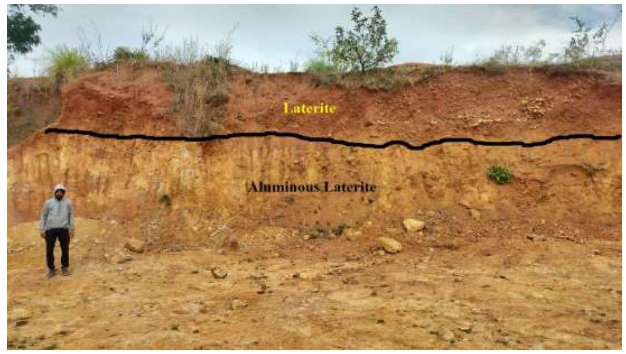
Bauxite mineralization is closely associated with lateritic environments. The extensive development of laterite mounds, provides favorable conditions for the formation of bauxite deposits. Laterites act as a weathering product, contributing to the concentration of aluminum-rich minerals like gibbsite. The presence of bauxite showing a pisolitic texture indicates a specific mode of formation. Pisolitic bauxite typically forms through the precipitation of aluminum-rich minerals in rounded nodules or pellets. This texture is often associated with lateritic weathering processes.

The type and composition of underlying rocks play a significant role in bauxite mineralization. In the study area, where bauxite caps are being quarried, the underlying rock is phyllite, contributing to the low Al_2O_3 content in the bauxite, but enough to be designated as Aluminous laterite. This suggests a relationship between the composition of underlying rocks and the characteristics of the overlying bauxite deposits.

The presence of highly weathered basic rocks in the southern area suggests a connection to bauxite mineralization. Weathering processes break down the original rock, liberating aluminum-rich minerals that contribute to the formation of bauxite deposits. The specific type of weathering influences the quality and composition of the bauxite.

The ongoing private mining activities for bauxite in the region further highlight the economic interest in these deposits. The grade of the bauxite is reported to be approximately 30% Al_2O_3, which, while not exceptionally high, indicates that the mineralization may still be economically viable under certain conditions.

Field Photograph 5: Laterite along the slopes



Field Photograph 6: Aluminous laterite overlained by lateritic cap

Field Photograph 7: Carbonate banded hematite chert (jasper) sequence

Field Photograph 8: S1-S2 foliation in phyllite

7.2.4 Old Workings

In the past decade, bauxite occurrences in the area have been subject to exploitation, although they currently stand abandoned. The cessation of mining activities is attributed to the discovery of poor-grade ore, which has rendered the operations economically unviable. The abandoned mines of bauxite, situated near west of Amoch village, further illustrate the challenges faced in mining endeavors. In this area, the exploitation of bauxite reached below the groundwater level, contributing to the abandonment of these mining operations.

7.3 Structural details of the area such as dip, strike, folds, faults, etc.

7.3.1 The predominant structural feature identified in the region is bedding, particularly evident in the phyllite and dolomite formations. Bedding is characterized by alternating layers of different composition. In metapelites, this structural arrangement presents as compositional layering, featuring thin silica-rich bands alternating with thicker layers rich in mica, typically measuring 2 to 4 centimeters in thickness. Within the dolomites, thin chert and phyllite layers are discernible, indicating the presence of bedding planes.

7.3.2 The general orientation of the bedding planes is ENE-WSW, with a steep dip ranging from 55° to 65° towards the south. Notably, the Chemogenic rocks of the Sleemanabad Formation exhibit well-developed primary stratification, particularly in the carbonate banded hematite chert (jasper) sequence (Field Photograph- 7) and carbonate with thin-bedded phyllite (Field Photograph- 2). Primary bedding planes in these formations are often marked by distinct changes in color within the rock.

In addition to the above, the carbonate banded hematite chert (BHC) exposed within the block occurs as discontinuous bands with an observed thickness ranging from ~1 to 5 m. These bands show lateral persistence over tens to a few tens metres along strike, following the regional ENE–WSW trend. The BHC is characterized by alternating hematite-rich and siliceous (cherty/jaspery) layers, typically varying from a few millimetres to centimetres in thickness.

7.3.3 The metabasalts of the Sleemanabad Formation exhibit vesicles at various locations, showcasing effects of flattening along the regional fabric (Field Photograph- 4). Additionally, some metabasalts display an amygdular nature with secondary developments such as quartz and chlorite. This indicates a complex geological history and metamorphic processes that have influenced the rock formations in the area.

7.3.4 The dominant diastrophic structures in the area encompass foliation, mesoscopic folds, and minor folds. The regional fabric is predominantly characterized by a pervasive foliation, which primarily trends ENE-WSW. However, it is noteworthy that trends of NE-SW and E-W have also been documented in certain locations. The dip of the foliation is either vertical or steeply inclined towards the south.

7.3.5 This pervasive foliation is considered significant as it serves as the S1 axial planar feature to the F1 folds. This indicates a correlation between the orientation of the foliation and the primary folding structures in the region. The presence of mesoscopic and minor folds further contributes to the overall complexity of the diastrophic history in the area, suggesting multiple deformation events that have influenced the geological framework.

7.3.6 The volcano-sedimentary sequence of Mahakoshal has experienced three distinct phases of folding, with the first two being the most intense. During the initial deformational event, folds were generated that are doubly plunging, upright to slightly overturned, with axial planes oriented ENE-WSW and steeply dipping towards the south. These folds exhibit steep plunges either to the ENE or WSW. The pervasive schistosity developed in pelitic rocks during this first deformation event is evident in thin sections, marked by the parallel development of muscovite, sericite, and biotite. Mafic rocks display varying degrees of fabric intensity, with common observations including the flattening of amygdules and the development of spaced schistosity.

7.3.7 The second deformational event also produced upright to northerly overturned, doubly plunging folds, with axial planes striking ENE-WSW and steeply dipping to the south. These folds plunge at shallow angles either to the ENE or WSW. Notably, the F1 and F2 folds are co-planar and nearly coaxial. In pelitic rocks, the second deformation event is characterized by a spaced crenulation cleavage, with no complete transposition of the earlier fabric observed (Field Photograph- 8).

7.3.8 The third deformational event has resulted in broad warps with axial planes trending North-South. The overall map pattern of the volcano-sedimentary rocks is predominantly influenced by the combined effects of the first two deformation events. This complex history of folding and deformation suggests a dynamic geological evolution in the Mahakoshal region, with each phase contributing to the development of the observed structural features.

7.4 A discussion on the type of the deposit based on the style of mineralisation and minerals under investigation. Suggested exploration plan with spacing of the sampling points and depth of exploration commensurate with the stage of exploration.

7.4.1 Type of deposits

Lateritic Ore: The presence of laterite capping over the supracrustals is a distinctive feature in the mapped region. Studies reveal that this laterite has developed over metabasalt & phyllite formations. Ongoing mining activities for bauxite & aluminous laterite are observed in the Mahgwan and Khalari areas, with abandoned mine pits visible in the laterite-capped mounds of Amoch Chhapra.

In the Amoch Chhapra area, the laterite appears to have primarily developed over BIF bands. On ridges featuring the lateritic cap, the soil cover is minimal, ranging from 0.5 to 1.0 meters thick, while the thickness of the lateritic profile varies between 3 to 5 meters. Within this duricrust, pockets of iron & bauxite ore are identified, presenting in the form of lumps with platy, laminated, or biscuity hematite, often cemented by a minimal laterite matrix. The observed iron-rich pockets within the duricrust are highly localized in nature, typically ranging from a few centimetres up to about 1 m in length and width. These occurrences are sporadic and lack lateral continuity. In comparison to the overall thickness and aerial extent of the lateritic profile, their volume and distribution are insignificant and do not constitute any mappable or economically viable iron ore zone. These formations have been analyzed and show iron content up to 33.03% Fe.

In the Hardua Kala area, laterite is observed to have developed over phyllite and metabasalt. Lumps of haematite are rare or even absent in this region. Presently, exploitation activities focus on pockets of yellow ochre and bauxite underlying the duricrust. Additionally, yellow ochre pockets occur within the laterite, where various trial pits are evident.

Bauxite: The bauxite mineralization in the studied area also exhibits characteristics associated with lateritic environments. Bauxite mineralization is extensive with development of laterite mounds in the central part between Hardua kala & Amoch Chhapra. Pisolitic texture in bauxite, characterized by rounded nodules or pellets, suggests extensive weathering processes. Here also, the lateral extension is limited to the lateritic mounds only, suggesting a pocket type aluminous laterite deposit.

7.5 The extent and variability of the mineralisation expressed as length (in meter) (along strike or otherwise), plan width, and depth below surface to the upper and lower limits of the Mineral Resource

The mineralization of interest within this block is **aluminous laterite**, which is exclusively confined to the lateritic mounds demarcated within the block boundary. In certain areas, the aluminous laterite is overlain by a capping of laterite or lateritic soil. The form, shape, and extent of these mounds define the lateral distribution of the aluminous laterite within the block. At depth, the aluminous laterite is underlain by a clay layer, marking a distinct lithological boundary.

Since the exploratory drilling has been limited to a depth of 20 meters from the surface, the available information regarding mineralization is restricted to this depth. Beyond 20 meters, the continuity and extent of the aluminous laterite at deeper levels remain unexplored.

CHAPTER- 8

8.0 PREVIOUS EXPLORATION

8.1 Name and address of prospecting agency or permit holder or licensee involved in the exploration of the area with year and period of exploration

The following prospecting agencies involved in the exploration in and around the study area.

A. Geological Survey of India (GSI)

B. Directorate of Geology and Mining (DGM), Madhay Pradesh

C. Mineral Exploration and Consultancy Limited (MECL)

8.2 Brief details of the exploration carried out

8.2.1 Geological Survey of India (GSI)

In the rich geological history of the Son-Narmada valley, the supracrustal rocks have been subjects of extensive study and exploration by both individual researchers and the Geological Survey of India (GSI). Over the years, these investigations have contributed to our understanding of the complex stratigraphy and composition of the Mahakoshal Group.

The earliest significant survey dates back to 1833 when F.R. Mallet & Hughes conducted a comprehensive examination of the Jabalpur District. Their findings identified iron ore deposits associated with Banded Iron Formation (BIF) and laterites, noting variations in the thickness of iron ore bands.

In the mid-20th century, Mathur (1951) and Kedar Narain (1955) played pivotal roles in attempting to establish a stratigraphic sequence for the Mahakoshal Group. They classified the group into lower psammopelitic sequence (Parsoi Formation) and upper mafic BIF sequence (Agori Formation). This early work laid the groundwork for subsequent studies.

The 1960s witnessed mapping efforts by Sharma R.K. (1962-63) and Tiwari R.K. (1964-65) around the Sihora - Amoch Chhapra area. These efforts revealed the presence of banded quartzite, dolomite, phyllite and epidiorite, forming an unclassified unit. Sharma's work further outlined a sequence of sedimentary deposition, with clastic sediments preceding chemogenic sediments, chert, dolomites, and intermittently basic lavas. Sharma also reported deposits of refractory clay, bauxite, red-ochre, fluorite, dolomite etc.

The redesignation of the supracrustal rocks as the Mahakoshal Group by Narain and Thambi in 1970 marked a significant milestone. This name persists in contemporary geological discussions.

During field session 1977-78, RK Gour & ND Gupta investigated the dolomites of Sleemnabad area and estimated around 1.97 mT of massive and bedded dolomite resource up to 4m depth.

In 1983, Jha and Gurusiddappa conducted a detailed study of the Mahakoshal Group in the Sihora - Amoch Chhapra area. Their findings included the occurrence of BIF, phyllite, and a lateritic cap over the supracrustals, hosting several iron ore pockets.

Throughout the late 20th century, various workers, including Bandyopadhyay and Roy (1987), Nair et al. (1995), and Devarajan and Shrivastava (1996), Singhai and Prasad (1997-98) provided valuable insights into the stratigraphy and composition of the Mahakoshal Group. These contributions ranged from classifications into different formations to proposals of threefold classifications, reflecting the complexity of the geological processes at play.

Singhai and Prasad, during field session 1997-98, conducted specialized thematic mapping around Sihora and Amoch Chhapra area and expressed possibilities of Iron ore in BHC, classified as protore and recommended for small scale mining.

Fast-forwarding to the 21st century, the Geological Survey of India continued its exploration endeavors. The field season project (FSP) from 2015 to 2017 specifically focused on investigating iron ore in the Sihora and Gosalpur areas in the Jabalpur district.

8.2.2 Directorate of Geology and Mining (DGM), Madhay Pradesh

In the mid-1960s, geologists from the Directorate of Geology and Mining (DGM), Madhya Pradesh conducted a survey, mapping, and preliminary estimation of iron ore deposits around Sihora in the Jabalpur district.

8.2.3 Mineral Exploration and Consultancy Limited (MECL)

Mineral Exploration Corporation Limited (MECL) has conducted systematic exploration in the Mahakosal Supracrustal Belt, identifying significant deposits of iron, manganese, gold, graphite, base metals, and dolomite/limestone. A preliminary desktop study pinpointed the Sihora region in Jabalpur district as a key mining area, leading to the proposal and approval of a reconnaissance (G4) survey in the Salaiya Block, covering Jabalpur, Katni, and Umaria districts. The 50th Technical-cum- Cost Committee (TCC) of the National Mineral Exploration Trust (NMET) approved the survey, with execution from June 20, 2023, to October 19, 2023, to assess the mineral potential.

MECL's survey followed the Minerals (Evidence of Mineral Contents) Rule-2015 and spanned 110.56 sq. km. It involved geological mapping, surface geochemical sampling, bedrock sampling, whole rock analysis and petrological studies. The findings identified two promising sub-blocks: **Amoch-Chapra Sub block (4.86 sq. km)** and **Majhauli Sub block (4.43 sq. km),** both rich in aluminous lateritic iron ore. These areas showed high alumina content (up to 47.14% Al_2O_3) and iron content (up to 51.25% Fe). To determine the depth continuity and grade distribution, drilling operations were recommended, with the goal of upgrading the blocks from G4 to G3 classification.

During the Reconnaissance Survey (G4) carried out in the Salaiya block, a total of 35 channel samples were collected and analyzed for iron, bauxite and associated elements. Out of these, 13 samples fall within the present boundary of the Amoch–Chhapra block. The analytical results of these samples have been considered as baseline data and are summarized below.

Channel No.	Sample No	Easting	Northing	Rock Type	Fe%	Al_2O_3%	P_2O_5%	SiO_2%
Channel-02	MBS/CH-02/01	418516	2607928	Laterite	42.70	14.62	0.17	13.73
	MBS/CH-02/02	418526	2607938	Aluminous Laterite	29.17	23.33	0.14	21.39
Channel-03	MBS/CH-03/01	418769	2608115	Aluminous Laterite	31.24	21.78	0.43	19.38
	MBS/CH-03/02	418760	2608116	Aluminous Laterite	31.40	21.61	0.31	19.05
	MBS/CH-03/03	418751	2608118	Aluminous Laterite	28.50	23.22	0.20	20.82
Channel-04	MBS/CH-04/01	418921	2608348	Laterite	43.44	10.94	0.85	8.72
	MBS/CH-04/02	418921	2608356	Aluminous Laterite	26.01	24.69	0.41	21.04
	MBS/CH-04/03	418920	2608365	Aluminous Laterite	23.61	25.86	0.49	22.21
	MBS/CH-04/04	418920	2608372	Aluminous Laterite	34.81	20.35	0.37	17.28
	MBS/CH-04/05	418918	2608385	Aluminous Laterite	29.53	27.84	0.10	25.95
	MBS/CH-04/06	418917	2608395	Aluminous Laterite	29.63	23.20	0.14	20.49
Channel-05	MBS/CH-05/01	419516	2608124	Aluminous Laterite	31.46	21.71	0.25	19.50
	MBS/CH-05/02	419517	2608117	Laterite	42.20	14.86	0.23	12.85
	MBS/CH-05/03	419519	2608104	Laterite	33.46	19.93	0.46	16.75
Channel-06	MBS/CH-06/01	419919	2607549	Aluminous Laterite	6.20	34.54	0.13	32.82
	MBS/CH-06/02	419920	2607535	Aluminous Laterite	7.80	36.19	0.10	34.10
	MBS/CH-06/03	419930	2607520	Aluminous Laterite	31.76	29.74	0.24	4.47
Channel-07	MBS/CH-07/01	418409	2608130	Aluminous Laterite	33.11	26.03	0.25	7.82
	MBS/CH-07/02	418429	2608221	Aluminous Laterite	30.14	32.13	0.17	5.56
	MBS/CH-07/03	418393	2608088	Aluminous Laterite	33.15	24.81	0.23	9.54
Channel-08	MBS/CH-08/01	417876	2607699	Aluminous Laterite	21.94	40.96	0.10	3.79
	MBS/CH-08/02	417844	2607756	Aluminous Laterite	27.40	36.52	0.09	3.02
	MBS/CH-08/03	417789	2607796	Aluminous Laterite	27.03	24.51	0.20	20.94
	MBS/CH-08/04	417774	2607859	Laterite	40.61	15.74	0.11	13.75
	MBS/CH-08/05	417761	2607918	Aluminous Laterite	28.98	33.27	0.26	2.86
	MBS/CH-08/06	417750	2607962	Laterite	37.00	17.30	0.44	14.35
Channel-11	MBS/CH-11/01	417317	2607621	Laterite	36.78	17.70	0.48	14.23
	MBS/CH-11/02	417358	2607620	Aluminous Laterite	32.88	20.42	0.29	17.32
	MBS/CH-11/03	417523	2607625	Aluminous Laterite	29.40	22.98	0.28	20.00
	MBS/CH-11/04	417383	2607620	Aluminous Laterite	13.09	34.21	0.18	26.34
	MBS/CH-11/05	417457	2607635	Aluminous Laterite	28.29	23.84	0.19	20.90
	MBS/CH-11/06	417281	2607620	Aluminous Laterite	27.84	23.54	0.19	20.43
Channel-12	MBS/CH-12/01	417846	2608480	Aluminous Laterite	31.61	21.29	0.24	18.44
	MBS/CH-12/02	417842	2608499	Aluminous Laterite	31.38	22.23	0.18	19.67
	MBS/CH-12/03	417837	2608517	Aluminous Laterite	31.26	22.34	0.19	19.28
	MBS/CH-12/04	417833	2608544	Aluminous Laterite	32.49	20.78	0.18	17.83
	MBS/CH-12/05	417828	2608570	Laterite	42.67	15.15	0.18	13.84
	MBS/CH-12/06	417817	2608600	Laterite	36.32	18.70	0.30	14.55
Channel-13	MBS/CH-13/01	418170	2608689	Laterite	51.25	7.24	0.70	5.55
	MBS/CH-13/02	418163	2608710	Laterite	48.61	8.79	0.48	6.29
	MBS/CH-13/03	418191	2608658	Laterite	43.57	12.97	0.31	10.93
Channel-31	MBS/CH-31/01	417423	2608220	Aluminous Laterite	21.69	39.09	0.59	2.08
	MBS/CH-31/02	417422	2608213	Lateritic Bauxite	32.70	27.74	0.29	2.65
	MBS/CH-31/03	417419	2608207	Aluminous Laterite	24.44	34.93	0.24	2.82
	MBS/CH-31/04	417416	2608205	Aluminous Laterite	28.59	33.13	0.30	1.83
Channel-32	MBS/CH-32/01	417414	2608201	Aluminous Laterite	31.35	29.94	0.34	2.96
	MBS/CH-32/02	417412	2608196	Aluminous Laterite	23.12	38.25	0.23	2.34
	MBS/CH-32/03	417409	2608193	Aluminous Laterite	18.24	41.72	0.47	1.88
	MBS/CH-32/04	417407	2608189	Aluminous Laterite	25.19	33.59	0.36	2.23
	MBS/CH-32/05	417401	2608186	Aluminous Laterite	24.38	30.66	0.34	2.04
Channel-33	MBS/CH-33/01	417399	2608180	Aluminous Laterite	29.57	31.25	0.39	1.52
	MBS/CH-33/02	417396	2608176	Aluminous Laterite	24.60	34.91	0.42	1.96
	MBS/CH-33/03	417392	2608173	Aluminous Laterite	31.82	28.70	0.58	1.63
	MBS/CH-33/04	417390	2608170	Aluminous Laterite	28.46	32.92	0.41	2.15
	MBS/CH-33/05	417389	2608166	Aluminous Laterite	19.82	39.27	0.58	2.05

8.3 Reserves or resources estimated, if any, during the previous exploration campaign with quantity and grade under various categories

8.3.1 Iron Ore

The findings, summarized by Shrivastava and Ghosh in 1965, and Ghosh in 1966, provided valuable insights into the potential iron ore resources in the region.

Preliminary Estimates of Iron Ore Deposits in Sihora Area by DGM, Madhya Pradesh (1965)

Name of the locality	Deposit (in mT)	Remarks
Pratappur-Sarauli Tikaria-Dubiyar-Agaria-Sindursi	19.01	Laterite ore Assumed average Thickness is 30 feet. 85% of analysed samples contain 70% Fe_2O_3 Average percent of mine recovery is 50%.
Lora Range (Sihora-Darauli-Khitola)	0.285	Avg. L, W & thickness-3 miles, 30ft & 20 ft respectively.
Dhanwahi-Mangeli	10.047	Avg. L.W & thickness 1 mile 30ft, 100 ft respectively. Present recovery of hematite from BHC is 30%. Tonnage factor for micaceous hematite is 10.

CHAPTER- 9

9.0 AERIAL OR GROUND GEOPHYSICAL OR GEOCHEMICAL DATA

9.1 Details of aerial, ground geophysical and geochemical survey taken up and their results

No aerial, ground geophysical and geochemical survey has been taken up.

CHAPTER- 10

10.0 EXPLORATION UNDERTAKEN DURING CURRENT INVESTIGATION

10.1 Details of pitting, trenching, drilling, etc., with spacing and distribution of the sample points along with geographical co-ordinates.

10.1.1 Scheme of Exploration

To align with the defined objectives for the preliminary exploration (G3) of the Amoch Chhapra block, a structured exploration program is proposed, adhering to the guidelines outlined in the Minerals (Evidence of Mineral Contents) Rule-2015. The outlined scheme of exploration aims to systematically achieve the specified objectives, with detailed activities elaborated in the subsequent paragraphs.

The detailed objectives of the preliminary exploration are furnished below:

1. To check the lateral and depth continuity of Laterite and Bauxite ore by detailed mapping, topographic survey and systematic drilling up to 20m depth.

2. To estimate preliminary mineral resource (333) and grade for Iron and bauxite ore as per UNFC and MEMC- 2015.

3. To facilitate the State Government to auction the block as a mining lease.

10.1.2 Detailed Geological Mapping

The exploration scheme involved detailed geological mapping (on 1:4000 scale) in an area of 4.86 square kilometers in and around Amoch Chhapra block. The mapping aimed to determine the lithological contact and stratigraphic succession of various litho units and to identify potential mineralized zones and their characteristics. Geological traverses were conducted within and around the study area to decipher the lithological associations, structural features, and traces of potential mineralization. Hand-held GPS devices were used to identify and mark the lithological contacts between larger litho-units.

Conduct preliminary field reconnaissance survey to identify key geological features, including the distribution of supracrustals of Mahakoshal Group around Majhauli, Amoch, Dhangawa, Hardua Kala, Dundi and Mahagwan areas. Note the locations of intervening spaces covered by Quaternary alluvial deposits and laterite. Systematically mapped the elevated mounds composed of laterite in the central to eastern boundary of the block area. Document the locations of dolomite mines and the ongoing mining of dolomitic marble. This information is crucial for understanding the economic potential and geological context of these areas. Dolomites of the north of Amoch Chhapra area are intercalated with phyllites and intruded by shear & fracture controlled secondary quartz veins.

Mapping the outcrop area and thickness of the laterite cover on the tops and slopes of the ferruginous ridges is a deliberate and crucial step in the geological mapping process. This activity is undertaken with the specific objective of understanding the weathering processes and their influence on the underlying geological formations. Systematically document exposures of phyllite observed in road sections, along with occurrences of metabasalt forming discontinuous hillocks. Pay attention to any noticeable offsets in the alignment of metabasalts, indicating structural complexities.

All the data and information collected during the fieldwork were plotted, analyzed, and presented in the form of a geological map, which is provided as Plate-III.

10.1.3 Topographic Survey

The triangulation network had been laid down in the block area with the help of DGPS (Field Photograph- 10) & Total Station and the same have been tied up with the GTS triangulation station present in the nearby area. Where a GTS triangulation station is not available or could not be located, a base station has been established using Differential Global Positioning System (DGPS). This ensures accurate geospatial referencing and provides a reliable control point for the survey. All the surface features have been picked up and marked on a map on 1: 4000 scale. The entire area has been covered by doing contouring at 2m interval. The block boundary and drilled boreholes have been surveyed by DGPS & total station in WGS-84 Datum for demarcation of Block Boundary points and ancillary area to facilitate the State Governments for auctioning of the Block.

10.1.4 Exploratory drilling

Based on the encouraging analytical results of surface samples collected by MECL during the Reconnaissance Survey (G4) of the parent Salaiya block, a total of eighteen boreholes, have been drilled in Amoch Chhapra block. These boreholes target the approachable and feasible lateritic bodies within the exploration block to confirm the presence of bauxite/aluminous laterite zones and aid in the estimation of available resources. The drilling layout follows a grid pattern of approximately 400 meters, ensuring systematic coverage of the region.

Drilling Depth and Objectives

The boreholes were designed to investigate mineralization up to a depth of 20 meters from the borehole collar. This depth was considered sufficient to assess the lateral and vertical extent of bauxite and aluminous laterite deposits.

Since the investigation area lies within a lateritized zone with irregular laterite bodies overlying phyllite and metabasalt, a total of eighteen (18) boreholes were drilled using the dry core drilling method with the RD 100 drill machine. The RD 100 is a skid-mounted, three-leg derrick, mechanical drill machine specifically suited for such geological conditions (Field Photograph- 9).

As the bauxite column in the area is limited and considering the feasibility of open-cast mining, the exploratory drilling depth was restricted to 20 meters. Beyond this depth, open-cast mining would be impractical due to increased waterlogging. In total, eighteen boreholes were drilled, covering a cumulative meterage of 330.60 meters.

MECL drilled 18 vertical boreholes using the wireline drilling method. Initially, drilling commenced with NW-size drill rods for the first few meters, followed by the setting of casing. Thereafter, drilling continued using NQ-size drill rods and a BX-TC bit to ensure efficient core recovery. The boreholes had an approximate diameter of 76 mm, while the recovered core diameter measured around 65 mm. Short runs were drilled at an interval of 0.50 or 1.00m so that optimum core recovery is maintained. The detailed borehole information is provided in Annexure-IB, and their locations have been accurately marked on the topographical/geological plan, which is presented as Plate No-III.

10.1.5 Core Logging

The material obtained through dry core drilling, typically a mixture of core, powder, and fragments, was systematically stored run-wise in GI core boxes lined with a polythene sheet to prevent the loss of fine material through openings or adhesion to the GI sheet.

Each core, fragment, and cutting was carefully examined, with detailed observations recorded on color, lithology, physical characteristics, ore mineral constituents/assemblage, and the mode of ore mineral occurrence (Field Photograph-11). Additionally, a visual estimate of Al_2O_3 % was made, allowing classification into distinct rock or ore types based on these characteristics. The detailed borehole core log is provided as Annexure-II.

10.1.6 Core Sampling

For sample preparation, the borehole core was split into two equal halves using a core splitter. One half was powdered to (-) 100 mesh size for chemical analysis, while the other half was preserved for future studies. The length of the samples are taken at 1m to 2m interval (Field Photograph- 12).

The powdered material was thoroughly mixed and homogenized, after which approximately 100 grams of sample was obtained for chemical analysis through successive coning and quartering, designated as the primary sample. The remaining (-100 mesh size) material was retained as a duplicate half for future reference. In total, 280 primary samples and 25 external check samples were generated. The detailed analysis of primary samples and external check samples is provided in Annexure-IIIA & IIIB, respectively.

10.1.7 Pitting (Bulk Density)

Pitting was conducted to excavate lateritic material for bulk density determination. A total of five pits were excavated for this purpose. The locations of these pits were strategically planned to correspond with few of the adjacent drilled boreholes, ensuring that each bulk density measurement directly correlates with few adjacent borehole for improved accuracy in resource estimation.

The specific locations of the pits are provided below, aligning with the borehole positions to maintain consistency in geological interpretation and density evaluation.

Sl. No.	Pit No.	Easting	Northing	Corresponding Borehole No.
1	BD PIT-1	418148.4402	2608651.455	MBAC-1, 2, 3, 14 & 18
2	BD PIT-2	419898.392	2607591.507	MBAC- 4, 5, 6 & 16
3	BD PIT-3	418694.7972	2608219.07	MBAC- 7, 17, 15, 10
4	BD PIT-4	416831.0847	2608180.55	MBAC- 8 & 9
5	BD PIT-5	417728.5649	2607806.813	MBAC- 11, 12 & 13

10.1.8 The table below provides details of achieved quantum of work against approved quantum in Amoch Chhapra (G3) block.

Sl. No.	ITEMS OF WORK	UNIT	Proposed Quantum	Achieved Quantum
			G3	
1	Geological Mapping (1:4000 scale)	Sq. Km	4.86	4.86
2	Topographic Survey (2m contour interval)	Sq. Km	4.86	4.86
3	Borehole fixation and Block boundary DGPS Survey	Nos.	25 (19 Bhs + 6 Boundary points)	24
4	Excavation (Pitting)	Cu.m	10	10
5	Drilling (Core)	m.	380 (19 Bhs)	330.60 (18 Bhs)
7	Primary + Check Sample (Core) for 8 radicals (Fe, Mn, SiO_2, Al_2O_3, TiO_2, P_2O_5, S, Ga_2O_3 & V_2O_5) by XRF technique	Nos.	300	305 (18 Bhs)
10	Primary Sample for PGE by ICP-MS method	Nos.	10	10
11	Primary Sample for Ni, Co, Cd, V & Ti by AAS method	Nos.	10	10
12	Bulk Density	Nos.	5	5
13	Exploration Report [As per Mineral (Evidence of Mineral Contents) Rule-2015] /UNFC	Nos.	1	1

Field Photograph 9: MECL in-house RD-100 drill site

Field Photograph 10: DGPS survey at Amoch Chhapra block

Field Photograph 11: Core logging performed at drill site

Field Photograph 12: Sampling at sample shed

CHAPTER- 11

11.0 LOCATION OF DATA POINT

11.1 Accuracy and quality of surveys used to locate drill holes (collar and down-hole surveys, azimuth, inclination, coordinates of bore holes etc), trenches, mine workings and other locations used in mineral resource estimation.

11.1.1 The accuracy and quality of surveys are crucial components in mineral investigation, ensuring reliable data collection and precise mapping of geological features. In the present investigation, the BAP Precision S Series S812H model GPS has been employed as the primary tool for detailed mapping.

11.1.2 The specified accuracy of the GPS, ranging from 2 to 5 meters, implies that the positional information provided by the device is within this margin of error. In the context of geological mapping conducted at a scale of 1:4000, where the minimum map plotable unit is 4 meters, the GPS accuracy is suited for the purpose.

11.1.3 Since the minimum map plotable unit is 4 meters, the GPS accuracy falls comfortably within this range. This means that the GPS is capable of delineating and recording the geographic coordinates of geological elements with a precision that aligns with or exceeds the minimum plotable unit on the geological map.

11.1.4 To accurately locate drill holes, block boundaries, and surface features, a DGPS (Differential Global Positioning System) instrument was utilized. DGPS is a high-precision surveying tool and its maintenance and calibration are conducted to the highest standards to ensure optimal accuracy. For geodetic control, the WGS84 datum was used as the reference system, ensuring consistency and reliability in positioning. Additionally, a properly established DGPS base station was set up to further enhance accuracy and minimize positional errors in the survey data.

11.2 Quality and adequacy of topographic control

11.2.1 For the topographic survey, a DGPS instrument (Trimble make, R8s GNSS system) was used to ensure high-precision mapping. The instrument's maintenance and calibration are conducted to the highest standards, enhancing survey accuracy. To establish proper geodetic control, the WGS84 datum was used as the reference system, and a properly established DGPS base station was set up to further improve positional accuracy.

Given the comparatively small block size and the need for a detailed survey in preliminary exploration, a scale of 1:4000 with a 2-meter contour interval was chosen, ensuring adequate topographic representation. The ground-based survey was conducted with multiple measurements and cross-checks, significantly improving data quality. Survey control points were laid out in adequate numbers and evenly spaced to ensure precision.

CHAPTER- 12

12.0 SAMPLING TECHNIQUE

12.1 Nature and quality of sampling (eg. cut channels, random chips, etc.) and measures taken to ensure sample representation.

12.1.1 During the Reconnaissance Survey (G4) of the Salaiya block, the parent block of the Amoch Chhapra block, surface sampling was conducted in the form of channel sampling. Based on the encouraging analytical results from these channel samples, the potential area within the Amoch Chhapra block was identified for further investigation. As a result, a Preliminary Exploration (G3) program was undertaken, involving the drilling of boreholes to assess mineralization. At this stage of exploration, surface sampling was not conducted, as the focus was primarily on subsurface investigation through drilling. The geological report of the Salaiya block (G4) has been submitted in March, 2024.

In the geochemical sampling process during the reconnaissance stage, both bedrock and channel samples are meticulously collected from outcrops. Channel samples are sourced from iron-bearing formations, focusing on laterites and ferruginous quartzite. To ensure sample quality, the initial step involves removing weathered portions, opting for sampling from the fresh sections of the outcrop. For unbiased representation, bedrock samples are systematically taken from multiple parts of an outcrop, exercising caution to prevent contamination and mixing with other rock types. Approximately 1 to 1.5 kg samples are carefully selected for each sample and packed in high-quality cotton bags.

12.1.2 During sample preparation, for both surface and drill core samples, adherence to standard operating procedures is paramount. Iron samples are powdered to -100 mesh size, using Jaw Crusher and Pulverizer. Rigorous cleaning procedures, including the mortar, pestle, sample tray, brush, and all tools, are implemented after each sample is processed, maintaining a contamination-free environment.

12.1.3 Following the initial crushing, representative samples of around 100 grams are drawn through successive reduction using the RSD (Rotary Sample Divider). It is designed for precise, automated sample reduction in lab settings. RSD (Rotary Sample Divider) is a precision instrument used for obtaining representative sub-samples from bulk geological samples. It divides a bulk sample into multiple equal and unbiased portions, ensuring that each sub-sample accurately represents the original material—critical for reliable analytical results. The dried and homogenized sample is fed at a controlled rate into a rotating system consisting of multiple collection containers arranged in a circular pattern. As the sample falls, the rotating mechanism distributes it uniformly into these containers. Each fraction collected is statistically representative of the whole sample. The resulting sub-samples are then packed into three separate packets, each containing 100 grams, for primary and check analyses. The remaining powdered samples are carefully stored for future reference, with preventive measures in place to avoid sample mixing. Thorough cleaning of all tools used in the sampling, drawing, and packaging processes further ensures the integrity of the collected samples.

CHAPTER- 13

13.0 DRILLING TECHNIQUE AND DRILL SAMPLING EMPLOYED

13.1 The investigation area, located within a lateritized zone with irregular laterite bodies overlying phyllite and metabasalt, required a systematic drilling approach to ensure optimal core recovery and geological accuracy. A total of five boreholes were drilled using the wireline dry core drilling method with the RD 100 drill machine, which is a skid-mounted, three-leg derrick, mechanical drill rig well-suited for such geological formations.

13.2 Drilling Technique

13.2.1 Drill Rod & Casing Setup

- NW-size drill rods were used for the initial few meters to stabilize the borehole.
- After setting the casing, drilling continued with NQ-size drill rods to ensure minimal borehole deviation and better core recovery.

13.2.2 Core Recovery Optimization

- A BX-TC bit was used for drilling, which is effective in penetrating laterite and aluminous laterite formations.
- Short drilling runs of 0.50m to 1.00m intervals were implemented to maximize core recovery and reduce sample loss.
- Frequent clearing of the borehole was carried out to avoid material blockage and maintain drilling efficiency.
- The overall recovery was above 90%, which ensures proper sample representation and negates the relation between sample recovery and grade.

13.2.3 Borehole Dimensions & Logging

- The borehole diameter was approximately 76 mm, while the core diameter was around 65 mm, ensuring an adequate sample size for analysis.
- Systematic geological logging of the recovered core was conducted, recording color, lithology, mineralization, and structural characteristics.
- All the boreholes drilled were vertical and the depth of the boreholes are also very less, hence, deviation survey was not carried out.

13.2.4 Drilling Depth & Stability Considerations

- The drilling depth was limited to 20 meters, considering the feasibility of open-cast mining and potential waterlogging issues.
- However, MBAC-12 has to close prematurely, at depth of 15 meters due to drilling difficulties.

Sl. No.	Borehole No.	Section Line	Coordinates (Datum WGS-84)				RL (m)	Date of Commencement	Date of Closure	Type of drilling	Total Depth (m)
			Easting	Northing	Latitude	Longitude					
1	MBAC-01	S3	417828.255	2608422.826	23° 35' 3.083" N	80° 11' 40.887" E	418.872	24.08.2025	30.08.2025	Dry Coring	16.60
2	MBAC-02	S4	418154.876	2608650.432	23° 35' 10.543" N	80° 11' 52.364" E	429.530	27.08.2025	03.09.2025	Dry Coring	20.00
3	MBAC-03	S4	418430.445	2608427.809	23° 35' 3.354" N	80° 12' 2.13" E	422.389	01.09.2025	06.09.2025	Dry Coring	20.00
4	MBAC-04	S5	419905.006	2607576.813	23° 34' 35.949" N	80° 12' 54.315" E	442.970	07.09.2025	11.09.2025	Dry Coring	20.00
5	MBAC-05	S5	419627.580	2607645.253	23° 34' 38.125" N	80° 12' 44.515" E	432.186	13.09.2025	17.09.2025	Dry Coring	10.00
6	MBAC-06	S4	419331.945	2607716.654	23° 34' 40.394" N	80° 12' 34.072" E	422.926	14.09.2025	18.09.2025	Dry Coring	20.00
7	MBAC-07	S4	418692.013	2608220.448	23° 34' 56.659" N	80° 12' 11.399" E	428.966	20.09.2025	27.09.2025	Dry Coring	20.00
8	MBAC-08	S1	416850.561	2608115.317	23° 34' 52.904" N	80° 11' 6.457" E	425.804	29.09.2025	03.10.2025	Dry Coring	20.00
9	MBAC-09	S2	417330.781	2608248.440	23° 34' 57.321" N	80° 11' 23.371" E	417.079	03.10.2025	07.10.2025	Dry Coring	20.00
10	MBAC-10	S5	419188.429	2608172.569	23° 34' 55.192" N	80° 12' 28.92" E	436.813	09.10.2025	12.10.2025	Dry Coring	14.00
11	MBAC-11	S3	418203.698	2608013.029	23° 34' 49.827" N	80° 11' 54.213" E	420.021	19.10.2025	25.10.2025	Dry Coring	15.00
12	MBAC-12	S1	417428.214	2607606.265	23° 34' 36.459" N	80° 11' 26.937" E	423.817	28.10.2025	08.11.2025	Dry Coring	15.00
13	MBAC-13	S2	417752.978	2607805.686	23° 34' 43.003" N	80° 11' 38.354" E	430.977	11.11.2025	22.11.2025	Dry Coring	20.00
14	MBAC-14	S5	418696.102	2608646.918	23° 35' 10.527" N	80° 12' 11.459" E	428.289	23.11.2025	03.12.2025	Dry Coring	20.00
15	MBAC-15	S4	418931.181	2607992.428	23° 34' 49.289" N	80° 12' 19.881" E	434.684	05.12.2025	15.12.2025	Dry Coring	20.00
16	MBAC-16	S5	419504.086	2608000.412	23° 34' 49.651" N	80° 12' 40.09" E	425.700	11.02.2026	13.02.2026	Dry Coring	20.00
17	MBAC-17	S5	418992.695	2608462.935	23° 35' 4.598" N	80° 12' 21.959" E	443.767	15.02.2026	22.02.2026	Dry Coring	20.00
18	MBAC-18	S6	419281.865	2608713.857	23° 35' 12.809" N	80° 12' 32.111" E	431.343	23.02.2026	01.03.2026	Dry Coring	20.00

13.2.5 Quality Control & Data Accuracy

- Core handling and preservation were prioritized to avoid contamination or loss of material.
- Proper geospatial referencing was ensured using DGPS to precisely locate the boreholes.

This drilling methodology ensured efficient core recovery, accurate geological interpretation, and reliable resource estimation while adapting to the geological constraints of the lateritized zone.

13.3 Sampling employed

13.3.1 Primary sample

Half splitted drill core samples, drawn at 1m interval, are considered as primary samples for analysis of Fe, Mn, SiO_2, Al_2O_3 , TiO_2, P_2O_5, S, Ga_2O_3 & V_2O_5 . A total of 280 nos. of primary samples has been collected from the drill cores of 18 boreholes.

13.3.2 External check sample

To check the reliability of analysis of primary samples, 10% of them are sent to an external chemical laboratory. Around 25 such samples are analyzed as external check sample in JNARDDC, Nagpur.

13.3.3 Primary sample for Trace element (Ni, Co, Cd, Cr & Ti) & PGE

Laterite often contains anomalous trace elements and Platinum Group Elements (PGE). To assess the presence of Trace elements (Ni, Co, Cd, Cr & Ti), ten (10) samples were selected from drill core primary samples and sent to chemical lab for analysis by AAS method. The dataset comprises 10 primary samples, for which TiO_2 values were converted to Ti using a theoretical conversion factor (0.60), and the results were compared with Ti values obtained through AAS analysis.

For PGE elements, ten (10) composite samples were prepared from the primary samples. Composite sample preparation involved mixing sample-length weighted portions of the powdered primary samples thoroughly. From this homogenized mixture, a 100-gram sample was drawn using the coning and quartering method, ensuring representativity and accuracy for PGE analysis by IC-PMS method.

CHAPTER- 14

14.0 SUB-SAMPLING TECHNIQUES AND SAMPLE PREPARATION

14.1 Core Sampling Methodology

The borehole core was split into two equal halves using a core splitter. One half was powdered to (-)100 mesh size for chemical analysis, while the other half was preserved for future studies. The sample length was taken at 1-meter intervals, ensuring consistent sampling. As core recovery exceeded 90%, there is no doubt that the collected material accurately represents the in-situ formation.

14.2 Sample Preparation Technique

The sample preparation process followed standard operating procedures to maintain accuracy and reliability. The core samples were powdered to (-) 100 mesh size using jaw crusher and pulverizer, ensuring a uniform particle size for chemical analysis. The process was performed in a contamination-free environment, with strict adherence to cleaning protocols to prevent cross-contamination between samples.

14.3 Quality Control Procedures

- Stringent quality control measures were implemented at all stages of sub-sampling to ensure representativeness and accuracy:
- Cleaning of all tools (mortar, pestle, sample tray, brush, and other equipment) after processing each sample to prevent contamination.
- Coning and quartering technique was used for sample reduction, ensuring that the final sample size maintains representatively of the bulk material.
- The final 300-gram sample was divided into three equal portions (100 grams each) for primary analysis, check analysis, and storage as a reference sample.

14.4 Representativeness of Sampling

- The sampling methodology ensured that all collected material accurately represents the in-situ deposit:

- The high core recovery (>90%) guarantees minimal loss of material.
- Consistent sampling intervals (1m) were maintained to avoid bias.
- The coning and quartering method was used for sub-sample selection, reducing bias and maintaining homogeneity.

14.5 Sample Size Appropriateness

- The sample size was appropriate for the grain size of the material:
- The -100 mesh size ensured that the powdered sample was sufficiently fine for chemical analysis.
- The final 100-gram sample size was adequate for accurate laboratory testing while preserving enough material for duplicate and future reference analyses.

14.6 A total of 280 primary samples and 25 external check samples were generated. The detailed analytical results of primary samples and external check samples are provided in Annexure-IIIA & IIIB, respectively.

CHAPTER- 15

15.0 QUALITY OF ASSAY DATA AND LABORATORY TESTS

15.1 The nature, quality and appropriateness of the assaying and laboratory procedures used and whether the technique is considered partial or total

15.1.1 Two types of assay have been performed in the in-house chemical laboratory of MECL. Analysis of Iron and other major oxides (Fe, Mn, SiO_2, Al_2O_3, TiO_2, P_2O_5, S, Ga_2O_3 & V_2O_5) have been carried out in RIGAKU MAKE ZSX PRIMUS IV XRF instrument and trace elements (Ni, Co, Cd, Cr & Ti) have been analysed in Agilent make ICPMS 7800 instrument.

15.1.2 Major Oxide Analysis by XRF

XRF, a non-destructive technique, was employed for the elemental analysis of major oxides, including Fe, Mn, SiO_2, Al_2O_3, TiO_2, P_2O_5, S, Ga_2O_3 & V_2O_5 using a RIGAKU ZSX PRIMUS IV XRF instrument.

Sample Preparation: Powdered samples were pelletized using a hydraulic press. The XRF instrument was calibrated using matrix-matching Certified Reference Materials (CRMs). After calibration, the samples were analyzed, and software provided the values for major oxides.

15.1.3 Trace Element Analysis by ICP-MS

ICP-MS (Inductively Coupled Plasma Mass Spectrometer), a technique for detecting trace elements, involved the generation of a high-temperature plasma (around 10,000 K) by introducing argon into an RF coil. Liquid samples were introduced using a nebulizer, and the resulting ions were separated and detected in a mass spectrometer (Agilent ICPMS 7800).

Sample Preparation: A simple HCL-HF-HNO_3 dissolution in screw-top Teflon bombs was employed in a microwave digester for sample preparation.

Instrument Calibration: ICP-MS instrumental sensitivity was measured using external solutions (Agilent tuning solution). Surrogate calibration for four elements (Li, Co, Y, Tl) was performed. Matrix correction was achieved through standard CRM addition.

Accuracy and precision (standard deviation): Accuracy and precision (standard deviation) for 34 elements were assessed, showing either excellent (<5%) or good (5–10%) performance.

15.2 Nature of quality control procedures adopted (eg. standards, blanks, duplicates, external laboratory checks) and whether acceptable levels of accuracy (ie. lack of bias) and precision have been established

Typical Quality Control procedures adopted during the chemical analysis

(i) Analysis of Certified reference materials/measurement standards

(ii) Analysis of blind samples

(iii) Use of QC samples and control charts

(iv) Analysis of blanks

(v) Analysis of spiked samples

(vi) Analysis in duplicates & Internal Check standards.

Accuracy and precision (standard deviation): Accuracy and precision (standard deviation) for 34 elements were assessed, showing either excellent (<5%) or good (5–10%) performance.

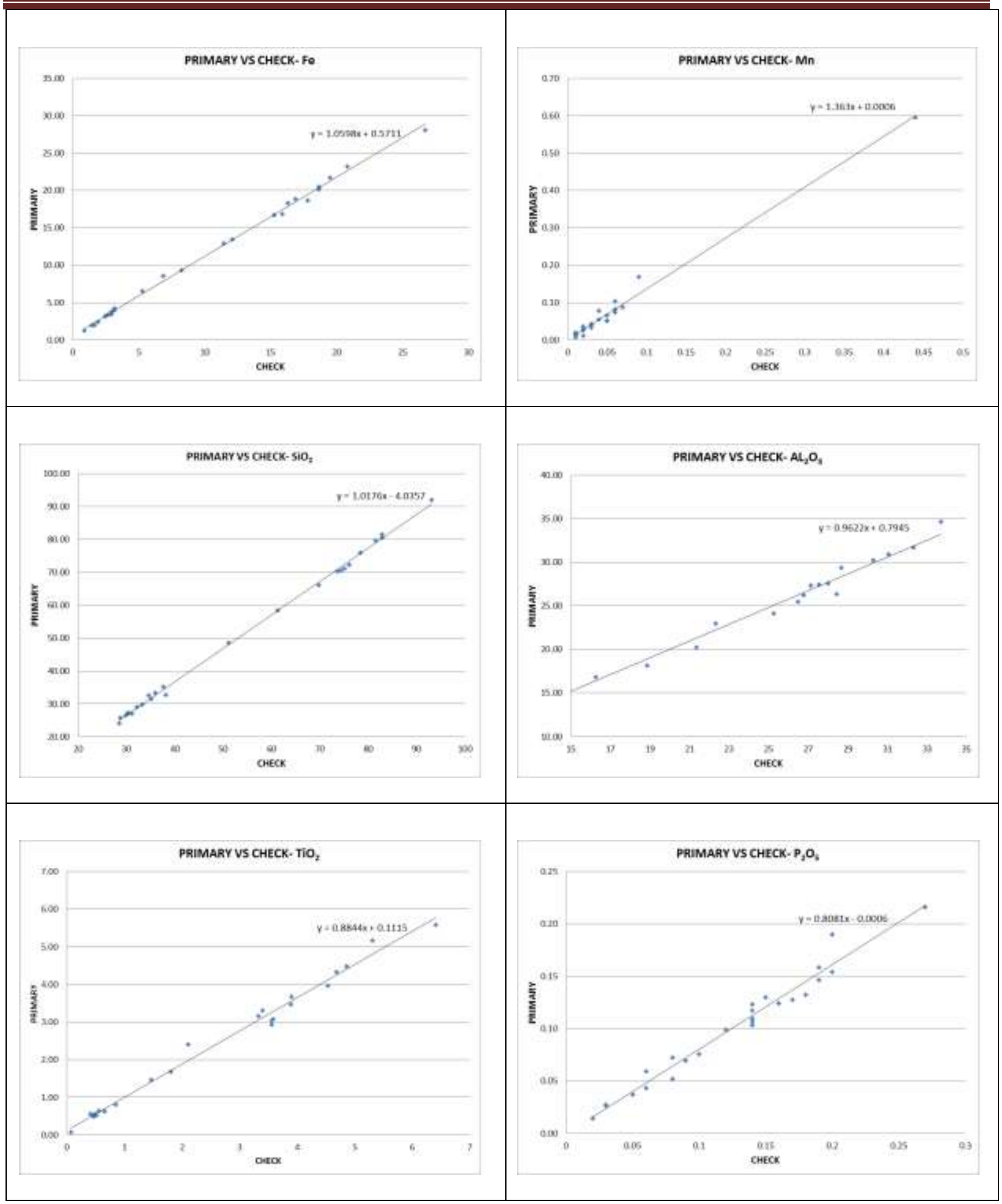
15.3 Check analysis of at least 10% of samples should be analyzed from third party National Accreditation Board for Testing and Calibration Laboratories (NABL) accredited or Department of Science and Technology (DST) or Bureau of Indian Standards (BIS) recognized laboratories or government laboratories for assessing the acceptable levels of accuracy

15.3.1 To verify the reliability of chemical analysis conducted in the in-house laboratory, 25 primary samples (10%) were analyzed at JNARDDC, an NABL-accredited laboratory, as external check samples. These samples were randomly selected from the duplicate set of primary samples. To ensure unbiased testing, the sample numbers were altered, with only the concerned geologist maintaining the record. The selected samples were then securely packed and sent to the external laboratory for analysis.

15.3.2 The dataset for the Primary vs. External Check analysis consists of eight sample pairs. A statistical comparison has been conducted for nearly all elements. However, in some samples, certain elements were present in quantities too low for detection by the instrument. As a result, statistical evaluation could not be performed for those elements, viz. S, Ga_2O_3 & V_2O_5.

15.3.3 The table below shows that the differences in arithmetic mean, manifested by low "mean of deviation" for all the 6 major constituents, are insignificant. The calculated paired-T value is less than t-table value, which again proves that the difference in mean is insignificant. Standard deviation of error is also very less showing good reliability of analyzed data. Correlation coefficient is above 0.90, which is also confirmed by Primary vs Check scatter plot (Annexure- III B). It shows good correlation between primary and check analysis. As the F-test value for all 9 major constituents is close to 1, it also advocates about good correlation among two set of sample analysis. All these statistical data certify the good quality of sample preparation as well as chemical analysis.

Comparision Index	Fe%		Mn%		SiO_2		Al_2O_3		TiO_2		P_2O_5	
	Primary	Check	Primary	Check	Primary	Check	Primary	Check	Primary	Check	Primary	Check
No. of sample pairs	25		25		25		25		25		25	
Arithmetic mean	11.32	10.15	0.07	0.05	49.95	53.05	20.74	20.73	2.28	2.46	0.10	0.13
Standard Deviation	8.340	7.861	0.115	0.084	23.306	22.886	8.632	8.937	1.709	1.922	0.052	0.064
Standard error of mean	1.668	1.572	0.023	0.017	4.661	4.577	1.726	1.787	0.342	0.384	0.010	0.013
Variance	69.56	61.80	0.01	0.01	543.18	523.76	74.52	79.87	2.92	3.69	0.00	0.00
Mean of deviation	1.18		0.02		-3.10		0.01		-0.17		-0.02	
Standard Deviation (Error)	0.613		0.033		0.987		0.827		0.280		0.015	
Correlation Co-efficient	0.999		0.992		0.999		0.996		0.995		0.985	
Mean absolute error	1.177521678		0.020340183		3.101552		0.655824		0.229132		0.024576	
Mean relative random error	14.49126352		29.64229778		8.080909494		3.819658706		9.321014473		25.42285606	
Paired T-value	9.608		2.907		-15.709		0.066		-3.078		-8.043	
F- test	1.126		1.886		1.037		1.072		1.266		1.485	



Text Figure- 3: Graph showing comparison between primary and check analysis of different elements

15.4 Security and chain of control of samples should be clearly mentioned

15.4.1 The security and chain of control of samples from the Burhar project's sampling unit to the chemical laboratory exemplify a meticulous and well-organized process. The samples were initially prepared at the sampling unit, where a qualified sampling technician oversaw the entire process. The samples were meticulously labeled and tagged before being sent to the chemical laboratory under the direct supervision of the technician. During transportation, the samples were securely sealed in bags, and the integrity of the seals was verified at the sampling unit before the bags were opened. Adhering to standard procedures, the sampling unit implemented robust precautionary measures to prevent any potential contamination, ensuring the reliability of the sample analysis. Additionally, the remaining samples were appropriately preserved and tagged for future reference, highlighting a commitment to maintaining a secure and traceable chain of control under the company's custody.

CHAPTER- 16

16.0 MOISTURE

Moisture analysis has not been done at this reconnaissance stage. Hence, no information can be provided.

CHAPTER- 17

17.0 BULK DENSITY

17.1 Bulk density (BD) is a critical parameter, along with volume, for accurately estimating the tonnage of mineral resources and reserves. It depends on both the density of individual particles and their spatial arrangement within the ore body. Bulk density is defined as the ratio of the mass of a material to its volume, including the contribution of inter-particulate void spaces. It is commonly expressed in grams per cubic centimeter (g/cm^3) or tonnes per cubic meter (T/m^3).

17.2 Ore bodies can occur in various forms such as massive, hard, friable, laminated, or powdery, and the exploration techniques used to recover in-situ material vary accordingly. For lateritic ore bodies, where the material is relatively soft and exposed, the Cubical Opening (Pit) Method is adopted for bulk density determination.

17.3 Cubical Opening (Pit) Method

Sample Preparation

- Pits of 1m × 1m × 1m were excavated in locations where the ore body was exposed.
- The pit walls were made as smooth as possible, and precautions were taken to prevent caving from the sides.
- The entire excavated material was collected in a pre-weighed empty container, ensuring that the natural moisture of the material was retained.
- Special care was taken to prevent any material loss during excavation.

Procedure

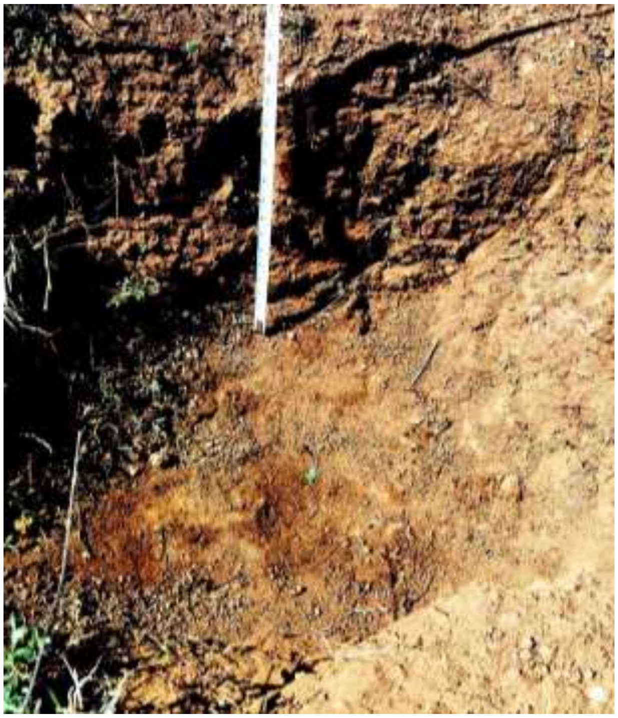
- Weigh the empty container (W1).
- Weigh the container with the excavated material (W2).
- Fill the excavated pit with a known volume of homogeneous sand (preferably ≤ 20 mesh size) to determine the exact volume of the pit.

Calling

- Weight of the excavated material (W): W = W2 – W1
- Bulk Density (BD) Calculation: BD = W / V
- W = Weight of the excavated material (in tonnes)
- V = Volume of sand used to fill the pit (in cubic meters)

17.4 A total of five pits were excavated for bulk density determination. The locations of these pits were strategically planned to correspond with adjacent boreholes, ensuring that each bulk density measurement directly correlates with the nearby borehole. This alignment improves accuracy in resource estimation, providing a reliable basis for tonnage calculations. The details of the bulk density determination are provided in Annexure- V and also furnished below:

Sl. No.	Pit No.	Easting	Northing	Weight of excavated material (Kg)	Weight of excavated material (tonnes)	Volume of pit filled by fine sand (m^3)	Bulk Density (t/m^3)
1	BD PIT-1	418148.4402	2608651.455	266.40	0.2664	0.18	1.48
2	BD PIT-2	419898.392	2607591.507	301.40	0.3014	0.22	1.37
3	BD PIT-3	418694.7972	2608219.07	374.40	0.3744	0.26	1.44
4	BD PIT-4	416831.0847	2608180.55	246.00	0.2208	0.20	1.23
5	BD PIT-5	417728.5649	2607806.813	220.80	0.2460	0.16	1.33



Field Photograph 13: Excavation of Pit

Field Photograph 14: Measurement of excavated material mass

Field Photograph 15: Measurement of sand volume

Field Photograph 16: Pit filling with sand

CHAPTER- 18

18.0 BENEFICIATION STUDIES

Beneficiation study has not been done at this reconnaissance stage. Hence, no information can be provided.

CHAPTER- 19

19.0 RESOURCE ESTIMATION TECHNIQUES

19.1 General

19.1.1 MECL conducted a preliminary exploration in the Amoch Chhapra block to establish the vertical and lateral continuity, thickness, and grade of bauxite (aluminous laterite). The exploration involved drilling five vertical boreholes on an approximate 400m × 400m grid within a 4.86 sq. km area. The primary objective was to conduct a systematic assessment of bauxite (aluminous laterite) grades and estimate the inferred resource (Category 333).

19.1.2 As no prior exploratory drilling had been carried out within the block boundary, the data obtained from these five boreholes serve as the primary dataset for resource estimation.

19.2 Assumptions for resource estimation

19.2.1 Resource was computed by “**Cross-sectional method**” as well as by “**Polygonal method**”. Certain axiomatic assumptions are inherently involved in estimating overall grade and resource of a deposit, are given below.

19.2.2 Resources estimated for aluminous laterite at Al_2O_3 ≥ 20% Cut-off, Titanium at 2% Ti Cut-off and Vanadium at 500 ppm V cut-off.

19.2.3 For establishing the Ti cut-off, 10 primary samples were analyzed for Ti using the AAS method, and corresponding Ti values were also derived from TiO_2 using a conversion factor of 0.60. A detailed statistical comparison between the calculated and analyzed Ti values was carried out to assess the reliability of the conversion. The results show close agreement in mean values, comparable dispersion, strong correlation, and statistically acceptable differences, indicating consistency between the two datasets. Based on this evaluation, the conversion relationship is considered reliable and can be confidently applied to convert TiO_2 to Ti for the remaining samples. This ensures uniform estimation of Ti content across the dataset and facilitates accurate zone demarcation.

19.2.4 The zones of have been demarcated from the values of primary sample analysis as per threshold value set Ministry of Mines (IBM) for Aluminous Laterite. The minimum thickness of 2.00m of aluminous laterite has been considered for resource calculation in both methods. The zones of aluminous laterite also correspond with high value of Titanium and Vanadium, for which resources have also been calculated.

19.2.5 As per MEMC Amendment Rule, 2021, For G3 stage exploration for limestone, bauxite, 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.

19.2.6 A total of five pits were excavated for bulk density determination. The locations of these pits were strategically planned to correspond with adjacent boreholes, ensuring that each bulk density measurement directly correlates with the nearby borehole.

19.2.7 A deduction of 20% from Gross in-situ resources has been made to arrive at Net-in-situ resources by Geological Cross-Section and Polygon method for unseen geological factors i.e. nature of core, recovery factor, cavities/caverns and other structural features.

19.3 **Parameters for resource estimation**

19.3.1 Sampling procedure

The core sampling methodology ensured accurate representation of the in-situ formation, with borehole cores split into two equal halves—one powdered to (-)100 mesh size for chemical analysis and the other preserved for future studies. Sampling was conducted at consistent 1 to 2 meter intervals, and core recovery exceeded 90%, minimizing material loss and ensuring reliability. Standardized sample preparation techniques were followed, including contamination-free processing, rigorous cleaning of equipment, and adherence to the coning and quartering method for sample reduction. Each final 300-gram sample was divided into three equal portions for primary analysis, check analysis, and future reference. The -100 mesh size ensured optimal fineness for laboratory testing, while the sample size was appropriate for accurate chemical analysis. In total, 280 primary samples and 25 external check samples were generated.

19.3.2 Chemical analysis

A total of 280 nos. of primary core samples in Amoch Chhapra (G-3 stage) block were analyzed by in-house chemical lab of MECL, Nagpur. For reliability of the primary analysis, 10% of primary samples, i.e. 25 nos. of samples have been analyzed in an NABL approved external chemical lab. To check the trace element and PGE content within the aluminous laterite, 10 nos. of samples were analyzed for both.

19.3.3 Cut-off grade

The resource estimation for aluminous laterite in the Amoch Chhapra block has been conducted based on the threshold values set by the Ministry of Mines. The minimum threshold value for aluminous laterite is 20% Al_2O_3. Additionally, considering the high Titanium (Ti) and Vanadium (V) content in the deposit, a cut-off grade of ≥ 2% Ti and ≥ 500 ppm V has been applied to refine the resource estimation.

Based on these cut-off grades, below mentioned mineralized zones have been identified

Zone details with Al_2O_3 ≥ 20% Cut off

Sl. No.	BH No.	From (m)	To (m)	Thickness (m)	Al_2O_3%
1	MBAC-1	0.00	11.00	11.00	25.78
2	MBAC-2	0.00	19.00	19.00	27.82
3	MBAC-3	1.00	20.00	19.00	29.62
4	MBAC-4	0.00	12.00	12.00	28.73
5	MBAC-7	0.00	15.00	15.00	25.27
6	MBAC-10	0.00	10.00	10.00	23.08
7	MBAC-12	0.00	15.00	15.00	27.73
8	MBAC-13	0.00	20.00	20.00	29.80
9	MBAC-14	0.00	20.00	20.00	31.72
10	MBAC-15	0.00	20.00	20.00	28.30
11	MBAC-16	0.00	20.00	20.00	27.90
12	MBAC-17	0.00	20.00	20.00	28.96
13	MBAC-18	0.00	20.00	20.00	28.97

Zone details with Ti ≥ 2% Cut off

Sl. No.	BH No.	From (m)	To (m)	Thickness (m)	Ti%
1	MBAC-2	6.00	18.00	12.00	2.38
2	MBAC-3	1.00	4.00	3.00	2.47

3	MBAC-3	8.00	18.00	10.00	2.24
4	MBAC-4	0.00	20.00	20.00	2.62
5	MBAC-7	7.00	15.00	8.00	2.11
6	MBAC-12	2.00	5.00	3.00	2.35
7	MBAC-12	12.00	15.00	3.00	2.66
8	MBAC-13	12.00	17.00	5.00	2.32
9	MBAC-14	6.00	20.00	14.00	2.44
10	MBAC-15	8.00	14.00	6.00	2.06
11	MBAC-16	4.00	12.00	8.00	2.26
12	MBAC-17	4.00	14.00	10.00	2.28
13	MBAC-18	8.00	18.00	10.00	2.99

Zone details with V ≥ 500 ppm Cut off

Sl. No.	BH No.	From (m)	To (m)	Thickness (m)	V (ppm)
1	MBAC-2	0.00	18.00	18.00	522.52
2	MBAC-3	1.00	5.00	4.00	815.84
3	MBAC-4	2.00	14.00	12.00	622.08
4	MBAC-7	0.00	17.00	17.00	653.82
5	MBAC-11	0.00	6.00	6.00	868.98
6	MBAC-12	0.00	15.00	15.00	632.35
7	MBAC-13	0.00	20.00	20.00	583.59
8	MBAC-14	0.00	20.00	20.00	680.20
9	MBAC-15	0.00	8.00	8.00	666.54
10	MBAC-15	16.00	20.00	4.00	701.97
11	MBAC-16	2.00	20.00	18.00	551.54
12	MBAC-17	0.00	20.00	20.00	579.08
13	MBAC-18	0.00	10.00	10.00	648.22
14	MBAC-18	14.00	20.00	6.00	661.31

19.3.4 Bulk density

Five pits were excavated for bulk density determination, with their locations carefully planned to align with adjacent boreholes. This strategic placement ensures that each bulk density measurement directly corresponds to few nearby boreholes, enhancing the accuracy of resource estimation and providing a reliable foundation for tonnage calculations.

Sl. No.	Pit No.	Easting	Northing	Corresponding Borehole No.	Bulk Density
1	BD PIT-1	418148.4402	2608651.455	MBAC-1, 2, 3, 14 & 18	1.48
2	BD PIT-2	419898.392	2607591.507	MBAC- 4, 5, 6 & 16	1.37
3	BD PIT-3	418694.7972	2608219.07	MBAC- 7, 17, 15, 10	1.44

4	BD PIT-4	416831.0847	2608180.55	MBAC- 8 & 9	1.23
5	BD PIT-5	417728.5649	2607806.813	MBAC- 11, 12 & 13	1.33

19.4 **Methodology adopted for Cross Sectional method for resource estimation**

19.4.1 The block area comprises distinct lateritic patches that act as host bodies for the aluminous laterite mineralization. Section lines were laid out perpendicular to the while those located nearby were appropriately projected onto the respective sections. After fixing the borehole positions, lithological sections were constructed considering geological disposition and lateral continuity. Distinct zones corresponding to aluminous laterite, titanium, and vanadium mineralization were identified and delineated within these sections.regional geological trend (ENE–WSW), resulting in section orientations of N50°W–S50°E. A total of six (06) parallel section lines were established in such a manner that the maximum number of boreholes could be accommodated along them.

Based on detailed survey data, topographical profiles were prepared along each section line. Boreholes falling directly on the section lines were plotted on the profiles,

19.4.2 For resource estimation, the sectional areas of aluminous laterite, Titanium and Vanadium mineralization, corresponding to a particular borehole was defined. Cross sectional area on each section has been measured with the help of Auto CAD map 2018 software and recorded systematically. On one side, the influence of each borehole extended halfway to the adjacent borehole, while on the other side, it was limited to the boundary of the lateritic body. In cases where only one borehole existed on a section line, the aluminous laterite influence was restricted entirely to the boundary of the lateritic body on both sides. The zone of sectional influence was considered up to the midpoint between adjacent section lines. For section lines located at the extreme ends of the block, the influence was restricted up to the lateritic boundary delineated through geological mapping.

19.4.3 To calculate the volume of aluminous laterite, Titanium and Vanadium mineralization, the sectional area corresponding to each borehole was multiplied by the sectional influence. This method ensured an accurate representation of the respective mineralized volume associated with each borehole. Once the volume was determined, it was multiplied by the bulk density of the corresponding borehole to derive the resource estimate. Bulk density values were obtained through systematic measurements, ensuring reliable tonnage calculations.

19.4.4 Finally, the total in-situ geological resource was determined by summing the individual resource estimates from all boreholes. This methodology ensures a systematic and accurate assessment of the aluminous laterite resource within the block, providing a solid foundation for further geological and economic evaluations.

19.5 Methodology adopted for Polygonal method for resource estimation

19.5.1 The resource estimation for aluminous laterite in the Amoch–Chhapra block was carried out using the Polygonal Method. Individual polygons were constructed around each borehole by drawing perpendicular bisectors (mid-lines) between adjacent boreholes. These polygons represent the respective zones of influence of each borehole within the mineralized area.

19.5.2 Within these defined zones, resource calculations were performed by assigning thickness and grade parameters based on the corresponding borehole data. The method ensures a systematic distribution of resources, taking into account the spatial disposition of boreholes and geological continuity of the mineralized zones.

19.5.3 The polygonal areas for each borehole were precisely measured using AutoCAD Map 2018 software, allowing for accurate delineation of mineralized zones. Once the polygonal area corresponding to each borehole was determined, it was multiplied by the measured thickness of the aluminous laterite, Titanium and Vanadium mineralized zones in that borehole to calculate the volume of lateritic material. This approach ensures that the volumetric estimation reflects both the areal extent and stratigraphic thickness of the aluminous laterite deposit.

19.5.4 Finally, the calculated volume for each borehole was multiplied by the respective bulk density values obtained through systematic in-field measurements. This step converted the volume into tonnage, yielding the estimated aluminous laterite, titanium and vanadium resource for each borehole. The sum of resources from all boreholes provided the total in-situ geological resource for the Amoch Chhapra block.

CHAPTER- 20

20.0 REPORTING OF RESOURCE

20.1 The resource estimation for Aluminous laterite, Titanium and Vanadium was conducted using two methods: the **Polygonal Method** as the principal method and the **Cross-Sectional Method** as a check method. In the **Polygonal Method**, resources were estimated on a borehole-wise and polygon-wise basis. Each borehole was assigned a specific polygonal area, determined by spatial distribution within the mineralized lateritic bodies. The estimated resource for each borehole was calculated based on its corresponding polygonal area, mineralized zone thickness, and bulk density, ensuring systematic and reliable assessment. In the **Cross-Sectional Method**, resources were estimated on a borehole-wise and section-wise basis, following the specifications and basic assumptions established earlier. This method involved delineating geological cross-sections along designated section lines, correlating lithology and Al_2O_3 grade to define the aluminous laterite body's shape and volume. By comparing results from both methods, the accuracy and reliability of the resource estimation were validated.

20.2 A deduction of 20% from Gross in-situ resources has been made to arrive at Net-in-situ resources by geological cross-section and, polygon method for unseen geological factors i.e. nature of core, recovery factor, cavities/caverns and other structural features.

20.3 The Polygonal Method estimated 36.34 million tonnes of net in-situ aluminous laterite with an average grade of 28.38% Al_2O_3 , 18.95 million tonnes of net in-situ Titanium with an average grade of 2.45% Ti, and 29.06 million tonnes of net in-situ Vanadium with an average grade of 623.24 ppm V. While the Cross-Sectional Method estimated 33.98 million tonnes of net in-situ aluminous laterite with an average grade of 28.24% Al_2O_3, 16.21 million tonnes of net in-situ Titanium with an average grade of 2.41% Ti and 26.27 million tonnes of net in-situ Vanadium with an average grade 653.62 ppm V content. All estimated resources have been classified under the Inferred Category (333) as per the United Nations Framework Classification (UNFC) guidelines. The details of estimation of resource by polygonal method and cross sectional method are furnished at Annexure- VI A & VI B respectively.

Resource Summary Table

Method	Net Resource (million tonnes) Average grade		
	Al_2O_3 @ 20%	**Ti @ 2%**	**V @ 500 ppm**
Polygonal Method	36.34 28.38%	18.95 2.45%	29.06 623.24 ppm
Cross Sectional Method	33.98 28.24%	16.21 2.41%	26.27 653.62 ppm

20.4 All calculations for grade estimation are made by weighted average method. Since the sample interval was uniformly maintained at 1.00m interval with the exception of minor variations or structural implications, the weighted average method of calculation is made by the following formula:

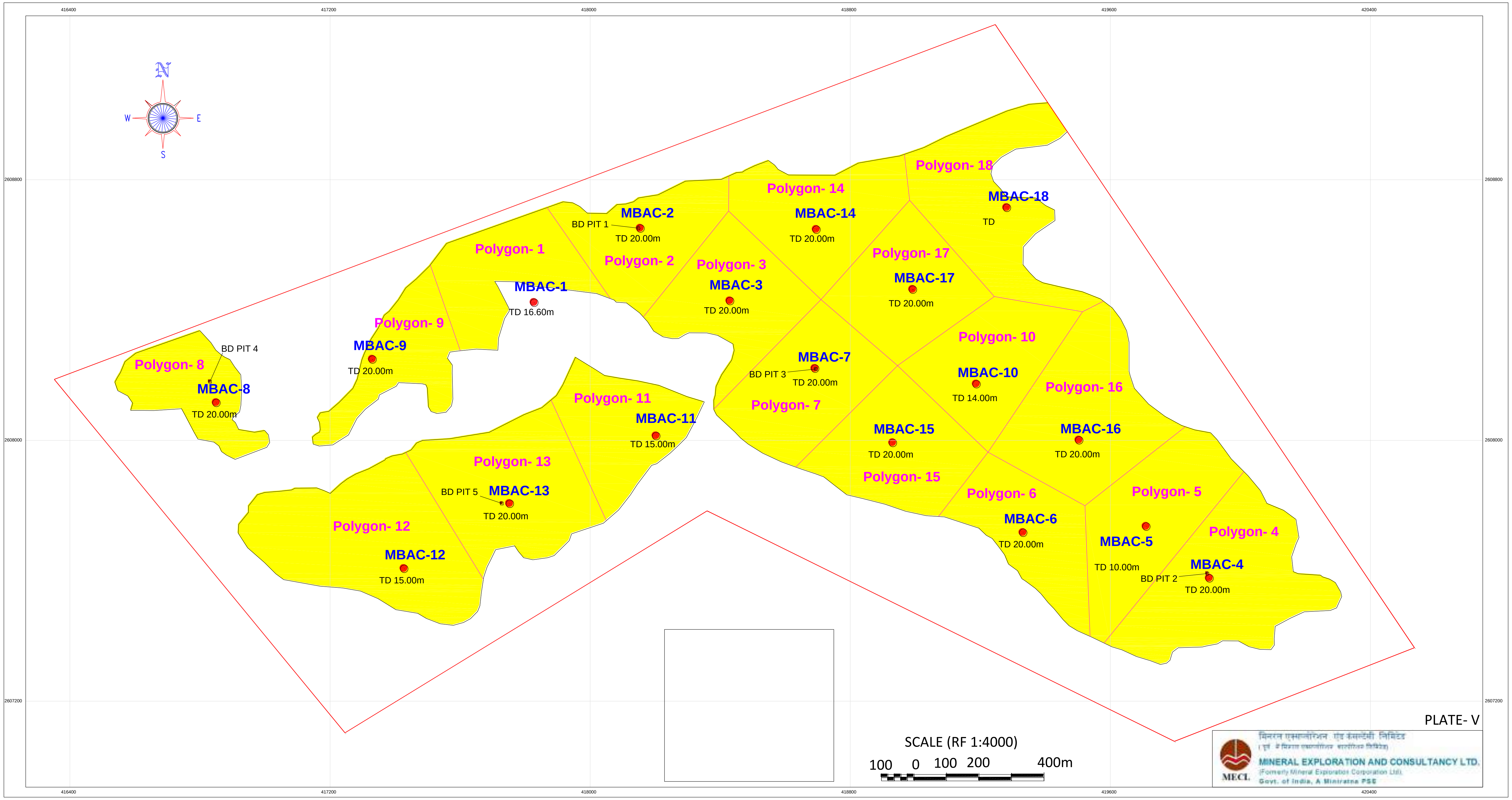
$$\text{Weighted average grade} = \frac{V1XG1 + V2XG2 + V3XG3 + ----------- + VnXGn}{V1 + V2 + V3 + ----------- + Vn}$$

Where `V' = Volume of aluminous laterite in individual borehole

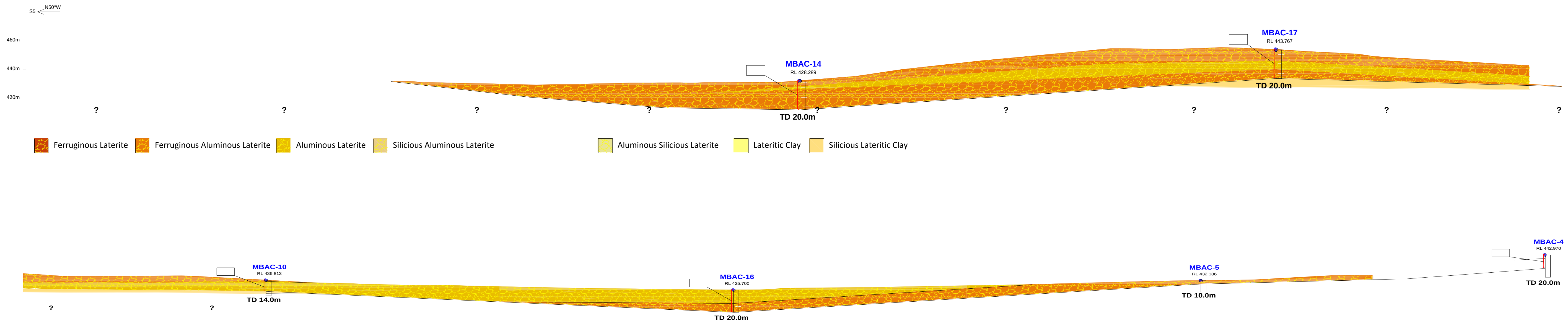
`G' = Grade of the respective aluminous laterite in the corresponding borehole.

20.5 The resource estimates obtained through the Polygonal Method and Cross-Sectional Method were compared to assess the confidence level of the estimation. The Polygonal Method, used as the principal approach, yielded a resource estimate 6.49% higher than the Cross-Sectional Method, which served as a validation check. This variance falls within the permissible limits, confirming the reliability and accuracy of the resource estimation.

Text Figure- 4: Polygonal resource map, showing different polygons corresponding to boreholes and bulk density with polygonal area



Text Figure- 5: Geological cross section along section line S5-S5’



CHAPTER- 21

21.0 SUMMARY AND RECOMMENDATIONS

21.1 A discussion on the outcome of the exploration work detailing the nature of the deposit, the dimension of the deposit, general structural trend, depth of occurrence and depth up to which exploration has been done, possibility of continuity of mineralisation beyond the depth of exploration and future exploration requirements, if any.

21.1.1 Bauxite mineralization in the study area is closely linked to lateritic environments, where extensive laterite mounds provide ideal conditions for aluminum-rich minerals like gibbsite to concentrate. The presence of pisolitic bauxite indicates a specific formation process involving the precipitation of aluminum-rich nodules. The composition of the underlying rocks significantly influences bauxite quality. In this region, phyllite underlies the bauxite caps, resulting in lower Al_2O_3 content, classifying it as aluminous laterite. Additionally, highly weathered basic rocks in the southern area contribute to bauxite formation, as weathering releases aluminum-rich minerals, impacting deposit composition and quality.

21.1.2 The aluminous laterite, titanium and vanadium mineralization within the block is hosted in distinct lateritic patches, forming small hillocks and mounds along the eastern margin. These lateritic bodies exhibit varying dimensions and shapes, which influence the distribution and extent of the resource.

21.1.3 The exploratory drilling for aluminous laterite within the block was designed to assess mineralization up to a depth of 20 meters from the borehole collar. This depth was considered sufficient for evaluating both the lateral and vertical extent of bauxite and aluminous laterite deposits. The available data from these boreholes provide insights into the mineralization within this defined depth range. However, since the majority of drilling was confined to 20 meters, information regarding mineralization beyond this depth remains unverified.

21.2 The resources estimated under various classes with grade

21.2.1 The resource estimation of the Amoch–Chhapra block was carried out using both the **Polygonal Method** and the **Cross-Sectional Method** to ensure reliability and comparative assessment of the mineralized zones.

21.2.2 The **Polygonal Method** yielded an estimated **36.34 million tonnes** of net in-situ aluminous laterite with an average grade of **28.38% Al_2O_3**. In addition, it indicated **18.95 million tonnes of titanium-bearing material** with an average grade of **2.45% Ti**, and **29.06 million tonnes of vanadium-bearing material** with an average grade of **623.24 ppm V**.

21.2.3 In comparison, the **Cross-Sectional Method** resulted in slightly lower estimates, with **33.98 million tonnes** of net in-situ aluminous laterite at an average grade of **28.24% Al_2O_3**, **16.21 million tonnes of titanium** at **2.41% Ti**, and **26.27 million tonnes of vanadium** at an average grade of **653.62 ppm V**.

21.2.4 The variation between the two methods reflects differences in the approach to spatial continuity and volume estimation, with the polygonal method generally providing slightly higher tonnage due to its area-based allocation of influence. However, the grade values obtained from both methods remain broadly comparable, indicating consistency in the geochemical dataset.

21.2.5 All estimated resources have been categorized under the **Inferred Resource (333) category** in accordance with the **UNFC guidelines**, considering the stage of exploration and data density. Detailed calculations and methodology for both estimation techniques are provided in **Annexure VI-A (Cross sectional Method)** and **Annexure VI-B (Polygonal Method)**.

21.3 The possibility of economic extraction based on present technological, environmental, social and market conditions

The extraction of Al_2O_3 (alumina) from aluminous laterite typically involves beneficiation followed by chemical processing. Beneficiation, such as washing and screening, may be used to remove impurities before leaching. The Bayer Process, commonly used for bauxite, has limited effectiveness for aluminous laterite due to its high iron and silica content. In this method, the ore is digested with NaOH at high temperatures, dissolving Al_2O_3, which is later precipitated as $Al(OH)_3$ and calcined to obtain alumina. Alternatively, acid leaching (using H_2SO_4 or HCl) is employed for lateritic ores with high impurity levels. This process dissolves alumina while minimizing the dissolution of unwanted elements, followed by purification and precipitation. Another approach, the Pedersen Process, involves smelting the ore with lime to produce a calcium aluminate slag, which is then leached with sodium carbonate to extract alumina. Finally, the purified Al_2O_3 is calcined for use in aluminum production.

21.4 Recommendations

21.4.1 Preliminary exploration (G3) in the Amoch Chhapra block has confirmed the presence of aluminous laterite with significant titanium and vanadium content. It estimated 36.34 million tonnes of net in-situ aluminous laterite with an average grade of 28.38% Al_2O_3, 18.95 million tonnes of net in-situ Titanium with an average grade of 2.45% Ti, and 29.06 million tonnes of net in-situ Vanadium with an average grade of 623.24 ppm V. With the completion of this exploration phase, the block is now eligible for auction under a composite license (CL). Further exploration for critical elements, along with beneficiation studies, should be carried out to enhance resource estimation, grade assessment, and the recovery potential of titanium and vanadium within the aluminous laterite.

CHAPTER- 22

22.0 PLATES AND MAPS

22.1 Location Map of the Amoch Chhapra block for Iron and Bauxite (4.86 Sq. Km) Districts- Jabalpur & Katni, Madhya Pradesh is given as Plate-I.

22.2 Regional Geological Map of Amoch Chhapra block for Iron and Bauxite (4.86 Sq. Km) Districts- Jabalpur & Katni, Madhya Pradesh is given as Plate-II

22.3 Geological Map of Amoch Chhapra block for Iron and Bauxite (4.86 Sq. Km) Districts- Jabalpur & Katni, Madhya Pradesh is given as Plate-III.

22.4 Geological Cross Sections of Amoch Chhapra Block for Iron and Bauxite (4.86 Sq. Km) Districts- Jabalpur & Katni, Madhya Pradesh is given as Plate- IVA, B, C, D, E & F.

22.5 Polygonal Resource map of Amoch Chhapra Block for Iron and Bauxite (4.86 Sq. Km) Districts- Jabalpur, Madhya Pradesh is given as Plate-V.

CHAPTER- 23

23.0 ANNEXURES OR ENCLOSURES TO THE REPORT

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

CHAPTER- 24

24.0 ANY OTHER INFORMATION

All the relevant information regarding this preliminary exploration has been documented in this report. There is no additional information available can be inferred in the block.

CHAPTER- 25

25.0 CERTIFICATE FROM THE QUALIFIED PERSON

This is to certify that geological report has been prepared in respect of Amoch Chhapra block, Districts- Jabalpur & Katni, Madhya Pradesh at G3 level for exploration for Iron and Bauxite by Mineral Exploration and Consultancy Limited (MECL) on behalf of National Mineral Exploration & Development Trust (NMEDT). The report has been prepared in accordance with the Minerals (Evidence of Mineral Contents) Rule 2015, Amendment upto 2021 specified under Mineral Auction Rule, 2015 and amended up to 2021.

HOD (EXPLORATION)

Locality Index

Village Name	Latitude	Longitude
Chhapra	23° 36' 10.83" N	80° 13' 37.51" E
Amoch	23° 34' 24.43" N	80° 10' 39.36" E
Nimas	23° 36' 19.48" N	80° 10' 40.88" E
Khachhargaon	23° 34' 11.37" N	80° 9' 13.98" E
Mohla	23° 33' 14.49" N	80° 9' 50.19" E
Dhagawan	23° 33' 58.85" N	80° 10' 53.86" E
Amoch Chhapra	23° 33' 6.24" N	80° 11' 30.02" E
Dundi	23° 32' 21.4" N	80° 11' 38.1" E
Hardua Kala	23° 33' 18.14" N	80° 13' 15.44" E
Mahagwan	23° 33' 50.6" N	80° 13' 37.62" E

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