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

MAJHAULI BLOCK

DISTRICT- JABALPUR, STATE- MADHYA PRADESH

TEXT, ANNEXURE, PLATES

Panoramic view of MECL drilling rig on Lateritic benches at borehole location MBM-4

MINERAL EXPLORATION AND CONSULTANCY LIMITED

(Formerly known as Mineral Exploration Corporation Limited)

A Government of India Enterprises

CORPORATE OFFICE, NAGPUR

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मझौली ब्लॉक, जिला- जबलपुर, मध्य प्रदेश में लौह और बॉक्साइट अयस्क के लिए प्रारंभिक गवेषण (जी-3) पर भूवैज्ञानिक रिपोर्ट

अध्याय 1

1.0 कार्यकारी सारांश

1.1 मझौली जी-3 ब्लॉक को सलैया जी -4 ब्लॉक से अलग किया गया है , जिसमें लौह और बॉक्साइट खनिज की संभावना है। इस ब्लॉक की सिफारिश एनएमईटी की 65वीं टीसीसी ने मई, 2024 में की है और एनएमईटी की 36वीं कार्यकारी समिति (पत्र संख्या 23/481/2024-एनएमईटी/301) ने 10 महीने की समयसीमा के साथ मंजूरी दी है । फील्ड वर्क 5 सितंबर, 2024 को शुरू हुआ और 30 जनवरी, 2025 को समाप्त हुआ। जबलपुर जिले में 4.43 वर्ग किलोमीटर में फैले इस ब्लॉक का सर्वेक्षण भारतीय सर्वेक्षण टोपोशीट संख्या 64ए/02 के तहत किया गया है । अध्ययन का प्राथमिक उद्देश्य लौह और बॉक्साइट संसाधनों के साथ-साथ टाइटेनियम (**Ti**), वैनेडियम (**V**) और अन्य प्रासंगिक निक्षेप जैसे संबंधित खनिजों का गवेषण करना था ।

क्षेत्र के सभी कॉर्नर बिंदुओं के निर्देशांक अक्षांश और देशांतर (डिग्री मिनट सेकंड) प्रारूप में WGS-84 डेटाम

क्रम सं.	ब्लॉक कार्डिनल बिंदु	दिनांक: WGS-84				आर एल
		भौगोलिक (DD°MM' SS.SS")		यूटीएम (जोन- 44)		
		अक्षांश	देशान्तर	ईस्टिंग (मी.)	नॉर्थिंग (मी.)	(मी)
1	ए	23° 32' 19.104" उ	80° 10' 30.075" पूर्व	415792.072	2603391.216	398.24
2	बी	23° 33' 7.869" उ	80° 10' 37.886" पूर्व	416022.141	2604889.657	396.46
3	सी	23° 34' 0.993" उ	80° 12' 3.416" पूर्व	418456.183	2606509.742	412.23
4	डी	23° 33' 46.817" उ	80° 12' 24.293" पूर्व	419045.606	2606070.467	421.08
5	इ	23° 33' 14.881" उ	80° 11' 59.37" पूर्व	418333.590	2605092.227	402.92
6	एफ	23° 32' 50.694" उ	80° 11' 27.653" पूर्व	417430.165	2604353.436	398.15
7	जी	23° 32' 9.413" उ	80° 10' 47.597" पूर्व	416287.189	2603090.323	396.47

1.2 भूवैज्ञानिक दृष्टि से, महाकोशल समूह के सुपरक्रस्टल इस क्षेत्र में प्रमुख हैं, विशेष रूप से अमोच , हरदुआ के आसपास कलान, मझौली और डुंडी । इस भूभाग की विशेषता लैटेराइट टीले, जलोढ़ निक्षेप, फ़िलाइट एक्सपोज़र और मेटाबेसाल्ट संरचनाएँ हैं, जिसमें लैटेराइट पैच छोटी-छोटी पहाड़ियों का निर्माण करते हैं ।

पाँच लैटेराइट पिंडों की पहचान की गई है, जिसमें बॉक्साइट खनिज पिसोलाइटिक बनावट प्रदर्शित करता है, जो व्यापक लैटेराइट अपक्षय का संकेत देता है । यह निक्षेप पॉकेट-प्रकार का है, जो लैटेराइट टीलों तक सीमित है , जो पहले शोषित लेकिन अब परित्यक्त बॉक्साइट निक्षेपों के समान है।

1.3 मझौली ब्लॉक के लिए गवेषण योजना का लक्ष्य खनिज (खनिज सामग्री के साक्ष्य) नियम-2015 के अनुसरण में खनिजकरण क्षमता, विशेष रूप से बॉक्साइट और एल्युमिनस लेटराइट का आकलन करना है। चट्टान के प्रकार, संरचनात्मक विशेषताओं और अयस्क पिंडों के सतही संकेतों को दस्तावेज करने के लिए 1:4000 पैमाने पर 4.43 वर्ग किमी को कवर करने वाला एक भूवैज्ञानिक मानचित्रण कार्यक्रम आयोजित किया गया था। पांच पहचाने गए लेटराइट पिंडों को लक्षित करते हुए 400 मीटर ग्रिड पैटर्न पर आठ बोरहोल लेआउट के साथ एक गवेषणात्मक ड्रिलिंग कार्यक्रम तैयार किया गया था। हालांकि, भूमि तक पहुंच के प्रतिबंधों के कारण , खनिजकरण का मूल्यांकन करने के लिए 20 मीटर की गहराई तक केवल पांच बोरहोल ड्रिल किए गए थे। अंतर्निहित मूल चट्टान और स्ट्रेटीग्राफी का विश्लेषण करने के लिए एक बोरहोल (एमबीएम-2) को इस गहराई से आगे बढ़ाया गया था ।

मझौली (जी3) ब्लॉक में एमईसीएल द्वारा ड्रिल किए गए बोरहोल का विवरण

SL. No.	Borehole No.	Coordinates		RL (m)	Date of Commencement	Date of Closure	Type of drilling	Total Depth (m)
		Easting	Northing					
1	MBM-1	418005.110	2605491.366	412.835	05.09.24	06.09.24	Dry Coring	20.00
2	MBM-2	417795.429	2605341.390	405.758	07.09.24	12.09.24	Dry Coring	52.50
3	MBM-3	417157.197	2604741.120	408.408	17.09.24	20.09.24	Dry Coring	11.50
4	MBM-4	416250.367	2603253.339	404.726	22.11.24	27.11.24	Dry Coring	20.00
5	MBM-5	416495.300	2603474.214	408.445	28.11.24	02.12.24	Dry Coring	20.00
						Total Drilling		**124.00**

1.4 संसाधन अनुमान सटीकता को बढ़ाने के लिए ड्रिल किए गए बोरहोल के पास एक थोक घनत्व निर्धारण किया गया था, जिससे विभिन्न लैटेराइट क्षेत्रों में घनत्व में भिन्नता का पता चला। इसके अतिरिक्त, DGPS तकनीक का उपयोग करके एक स्थलाकृतिक सर्वेक्षण ने ऊंचाई में परिवर्तन, बोरहोल के स्थान और सतह की विशेषताओं को मैप किया। खनिजकरण पाँच लैटेराइट टीलों तक सीमित है, जिसमें बॉक्साइट निक्षेप मुख्य रूप से मिट्टी की परत के ऊपर लैटेराइट कैपिंग तक सीमित है । चूँकि ड्रिलिंग 20 मीटर तक सीमित थी , इसलिए इस गहराई से परे खनिजकरण असत्यापित है ।

1.5 गवेषण के लिए नमूना लेने की प्रक्रिया में प्रमुख तत्वों जैसे Fe%, Mn%, SiO_2%, Al_2O_3%, TiO_2, P_2O_5%, S%, Ga_2O_3, V_2O_5 के विश्लेषण के लिए प्राथमिक नमूनों के रूप में 1 मीटर के अंतराल पर आधे-विभाजित ड्रिल कोर के नमूने एकत्र करना शामिल था । पांच बोरहोल से कुल 77 प्राथमिक नमूने एकत्र किए गए थे । विश्लेषणात्मक विश्वसनीयता सुनिश्चित करने के लिए, इनमें से 10% नमूने (8 नमूने)

बाहरी जांच नमूनों के रूप में सत्यापन के लिए एक बाहरी प्रयोगशाला में भेजे गए थे । इसके अतिरिक्त, ट्रेस तत्वों (Ni, Co, Cd, Ti, V) और प्लेटिनम समूह तत्वों (PGE) का विश्लेषण करने के लिए प्राथमिक नमूनों से आठ समग्र नमूने तैयार किए गए थे ।

1.6 एल्युमिनस लैटेराइट ($Al_2O_3 \geq 20\%$), जिसमें टाइटेनियम और वैनेडियम भी शामिल है, के लिए संसाधन अनुमान दो तरीकों का उपयोग करके आयोजित किया गया था : प्राथमिक दृष्टिकोण के रूप में बहुभुज विधि और सत्यापन उपाय के रूप में क्रॉस-सेक्शनल विधि । बहुभुज विधि ने प्रत्येक बोरहोल को एक विशिष्ट बहुभुज क्षेत्र सौंपा, व्यवस्थित संसाधन गणना के लिए एल्युमिनस लैटेराइट मोटाई और थोक घनत्व का उपयोग किया। क्रॉस-सेक्शनल विधि ने खनिजयुक्त निकाय के आकार और आयतन को परिभाषित करने के लिए भूवैज्ञानिक खंडों के साथ बोरहोल डेटा को सहसंबंधित करके संसाधनों का अनुमान लगाया।

1.7 पॉलीगोनल विधि ने 28.08% Al_2O_3, 4.82% TiO_2 , और 0.16% V_2O_5 के औसत ग्रेड के साथ 3.13 मिलियन टन शुद्ध इन-सीटू एल्युमिनस लेटराइट का अनुमान लगाया , जबकि क्रॉस-सेक्शनल विधि ने 3.01 मिलियन टन का अनुमान लगाया जिसमें थोड़ी अधिक Al_2O_3 (28.57%), TiO_2 (5.01%) और V_2O_5 (0.17%) सामग्री थी । सभी अनुमानित संसाधन UNFC दिशानिर्देशों के अनुसार अनुमानित श्रेणी (333) के अंतर्गत आते हैं ।

1.8 मझौली ब्लॉक में प्रारंभिक गवेषण (जी3) ने महत्वपूर्ण टाइटेनियम और वैनेडियम सामग्री के साथ एल्युमिनस लेटराइट की उपस्थिति की पुष्टि की है। अनुमानित 3.91 मिलियन टन एल्युमिनस लेटराइट की पहचान की गई है, जिसमें 28.01% Al_2O_3 , 4.82 % TiO_2 और 0.16% V2O5 है । इस गवेषण चरण के पूरा होने के साथ, ब्लॉक अब एक समग्र लाइसेंस (सीएल) के तहत नीलामी के लिए पात्र है। संसाधन आकलन, ग्रेड मूल्यांकन और एल्युमिनस लेटराइट के भीतर टाइटेनियम और वैनेडियम की पुनर्प्राप्ति क्षमता को बढ़ाने के लिए लाभकारी अध्ययन के साथ-साथ महत्वपूर्ण तत्वों के लिए आगे का गवेषण किया जाना चाहिए।

CHAPTER- 1

1.0 EXECUTIVE SUMMARY

1.1 The Majhauli 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/301, dated 29th August, 2024) with a 10-month timeline. Fieldwork commenced on 5th September 2024 and concluded on 30th January 2025. The block, spanning 4.43 square kilometers in Jabalpur 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° 32' 19.104" N	80° 10' 30.075" E	415792.072	2603391.216	398.24
2	B	23° 33' 7.869" N	80° 10' 37.886" E	416022.141	2604889.657	396.46
3	C	23° 34' 0.993" N	80° 12' 3.416" E	418456.183	2606509.742	412.23
4	D	23° 33' 46.817" N	80° 12' 24.293" E	419045.606	2606070.467	421.08
5	E	23° 33' 14.881" N	80° 11' 59.37" E	418333.590	2605092.227	402.92
6	F	23° 32' 50.694" N	80° 11' 27.653" E	417430.165	2604353.436	398.15
7	G	23° 32' 9.413" N	80° 10' 47.597" E	416287.189	2603090.323	396.47

1.2 Geologically, the Mahakoshal Group supracrustals are prominent in the region, particularly around Amoch, 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. Five 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 Majhauli 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 4.43 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 an eight-borehole layout on a 400-meter grid pattern, targeting five identified lateritic bodies. However, due to land access restrictions, only five boreholes were drilled, reaching a depth of 20 meters to evaluate mineralization. One borehole (MBM-2) was extended beyond this depth to analyze the underlying parent rock and stratigraphy.

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

SL. No.	Borehole No.	Coordinates		RL (m)	Date of Commencement	Date of Closure	Type of drilling	Total Depth (m)
		Easting	Northing					
1	MBM-1	418005.110	2605491.366	412.835	05.09.24	06.09.24	Dry Coring	20.00
2	MBM-2	417795.429	2605341.390	405.758	07.09.24	12.09.24	Dry Coring	52.50
3	MBM-3	417157.197	2604741.120	408.408	17.09.24	20.09.24	Dry Coring	11.50
4	MBM-4	416250.367	2603253.339	404.726	22.11.24	27.11.24	Dry Coring	20.00
5	MBM-5	416495.300	2603474.214	408.445	28.11.24	02.12.24	Dry Coring	20.00
						Total Drilling		**124.00**

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, and surface features. The mineralization is confined to five lateritic mounds, with bauxite deposits primarily restricted to laterite cappings 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-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 77 primary samples were collected from five boreholes. To ensure analytical reliability, 10% of these samples (8 samples) were sent to an external laboratory for verification as external check samples. Additionally, eight composite samples were prepared from the primary samples to analyze trace elements (Ni, Co, Cd, Ti, V) and Platinum Group Elements (PGE).

1.6 The resource estimation for aluminous laterite (Al_2O_3 ≥ 20%), which also contains Titanium and Vanadium, 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 3.13 million tonnes of net in-situ aluminous laterite with an average grade of 28.08% Al_2O_3, 4.82% TiO_2, and 0.16% V_2O_5, while the Cross-Sectional Method estimated 3.01 million tonnes with a slightly higher Al_2O_3 (28.57%), TiO_2 (5.01%) and V_2O_5 (0.17%) content. All estimated resources fall under the Inferred Category (333) according to UNFC guidelines.

1.8 Preliminary exploration (G3) in the Majhauli block has confirmed the presence of aluminous laterite with significant titanium and vanadium content. An estimated 3.91 million tonnes of aluminous laterite has been identified, containing 28.01% Al_2O_3, 4.82% TiO_2, and 0.16% V_2O_5. 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 P. Ravindran, GM (Exploration) Non-Energy Minerals
Overall palnning, co-ordination and Supervision	Shri P. Ravindran, GM (Exploration) Non-Energy Minerals Shri P. P. Kulkarni, Ex-DGM (Exploration) Non-Energy Minerals
Field Operation	Shri Saptarshi Ghosh, AM (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 MAJHAULI BLOCK, DISTRICT- JABALPUR, 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 Amoch-Chhapra Sub-block and the Majhauli 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 Majhauli Block has been presented in the 65th TCC of NMET. This proposal includes 160 meters of drilling across eight boreholes to further assess the iron and bauxite deposits.

3.2.2 Period of prospecting

The Preliminary Exploration for Iron and Bauxite in Majhauli block, Madhya Pradesh, received approval from the 36th Executive Committee of NMET through letter no. 23/481/2024-NMET/301, dated 29th August, 2024, with designated time duration of 10 months. Fieldwork was initiated on 5th September, 2024 and successfully concluded on 30th January, 2025.

CHAPTER- 4

4.0 DETAILS OF AREA UNDER STUDY

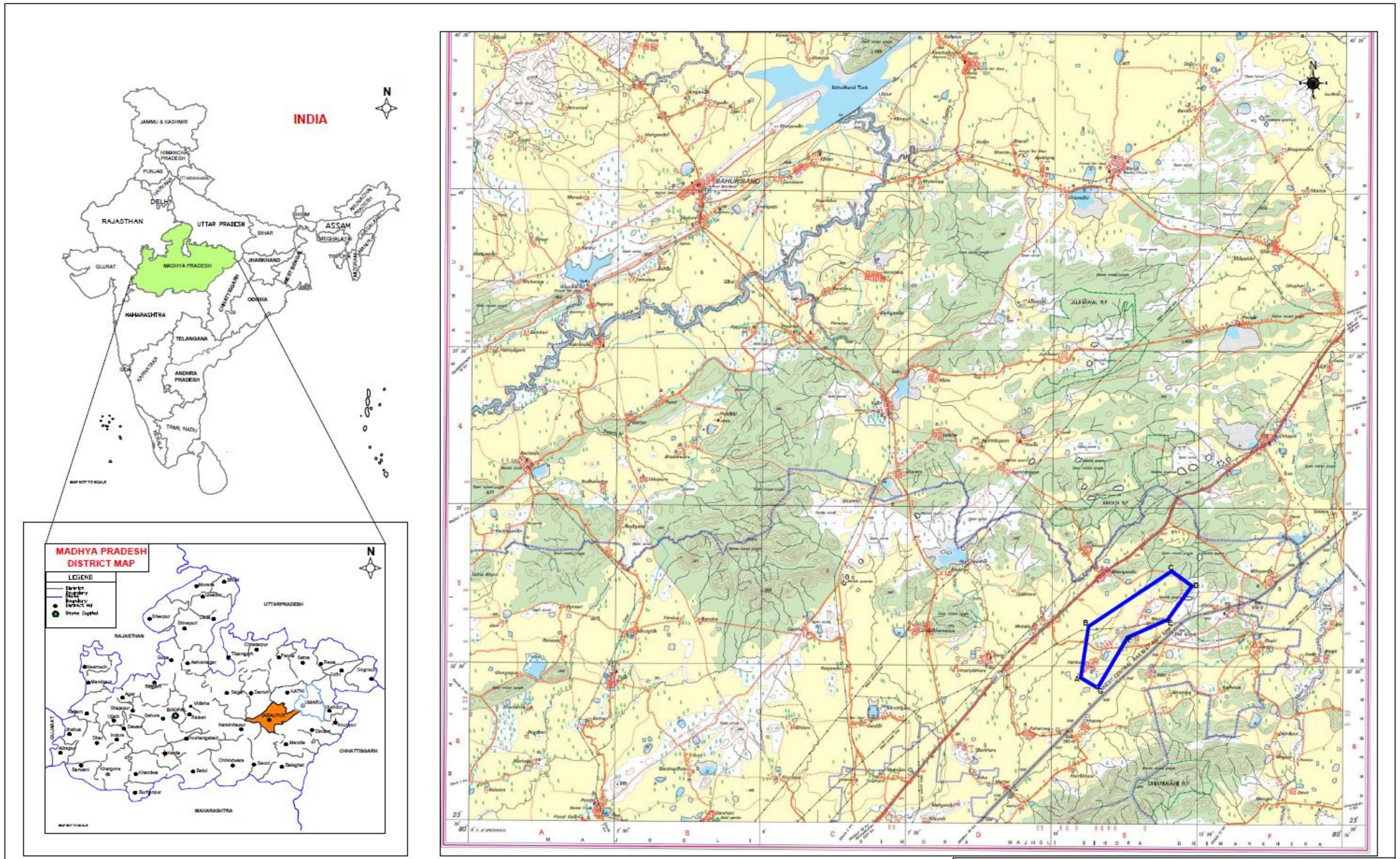
4.1 Village, District, State

The Majhauli Block encompasses the region delineated in Survey of India Toposheet No. 64A/02, spanning an area of 4.43 square kilometers. This geographical expanse spans across portions of Jabalpur 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 Majhauli Block, including but not limited to Majhauli and Hardua Kala. The location plan of Majhauli 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° 32' 19.104" N	80° 10' 30.075" E	415792.072	2603391.216	398.24
2	B	23° 33' 7.869" N	80° 10' 37.886" E	416022.141	2604889.657	396.46
3	C	23° 34' 0.993" N	80° 12' 3.416" E	418456.183	2606509.742	412.23
4	D	23° 33' 46.817" N	80° 12' 24.293" E	419045.606	2606070.467	421.08
5	E	23° 33' 14.881" N	80° 11' 59.37" E	418333.590	2605092.227	402.92
6	F	23° 32' 50.694" N	80° 11' 27.653" E	417430.165	2604353.436	398.15
7	G	23° 32' 9.413" N	80° 10' 47.597" E	416287.189	2603090.323	396.47

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



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Majhauli block (G3) boundary

MINERAL EXPLORATION & CONSULTANCY LIMITED

LOCATION MAP

PRELIMINARY EXPLORATION (G3 STAGE) FOR IRON & BAUXITE IN MAJHAULI BLOCK (4.43 Sq.Km)

DISTRICT : JABALPUR	STATE : MADHYA PRADESH
PART OF TOPOSHEET NO:-64A/02	NOT TO SCALE

Prepared by :
Survey & Map Section
Exploration Division, MECL, Nagpur

MECL/CHQ/EXPLORATION/MARCH-2025	TEXT FIGURE- 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 surroundings of Majhauli block exhibits a diverse land use, featuring scattered patches of forested areas, with noteworthy sections such as the Mihgawan Forest to the North of the block. Despite these pockets of forested terrain, the majority of the block is characterized by privately owned lands and Revenue lands. Notably, active mining leases are prevalent within the block, primarily concentrated to the north of Majhauli and in the vicinity of Dundi village.

4.4 Mineral(s) under investigation

4.4.1 The primary focus of the investigation in the Majhauli block revolves around the exploration of Iron and Bauxite resources. In addition to these key elements, the exploration also extends its scrutiny to associated minerals such as Titanium (Ti), Vanadium (V) and other relevant mineral deposits.

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 Majhauli 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 475m above MSL, are covered by scanty plantation. The Majhauli block itself is situated in a plain country with a gentle slope from north to south. The terrain becomes uneven north of Majhauli village, transitioning into a hilly area with long ridges trending ENE-WSW, alternating with valleys and nalas along the margins. The minimum elevation is 420m above M.S.L. To the Dundi part, the topography is undulatory, marked by ENE-WSW trending hillocks, with flat terrain mostly covered by dolomite & phyllite.

5.1.2 In and around of Majhauli 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 district 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. Sleemnabad railway station falls within the study area, which is approximately 70 Km from Jabalpur and 30 Km from Katni.

5.2.2 The Majhauli 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 Majhauli 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. This gives it a ranking of 180th in India (out of a total of 640). The district has a population density of 472 inhabitants per square kilometer. Its population growth rate over the decade 2001-2011 was 14.39%. Jabalpur has a sex ratio of 925 females for every 1000 males, and a literacy rate of 82.47%. 58.46% of the population lives in urban areas. Scheduled Castes and Tribes made up 14.13% and 15.23% 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 Jabalpur, with its iconic structures such as the Madan Mahal Fort and Rani Durgavati Museum, encapsulates the historical essence of the region. Additionally, the centuries-old Chausath Yogini Temple stands as a testament to the city's cultural heritage.

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 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. These areas serve as vital habitats for a plethora of flora and fauna, contributing to the region's biodiversity. 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 Majhauli 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.

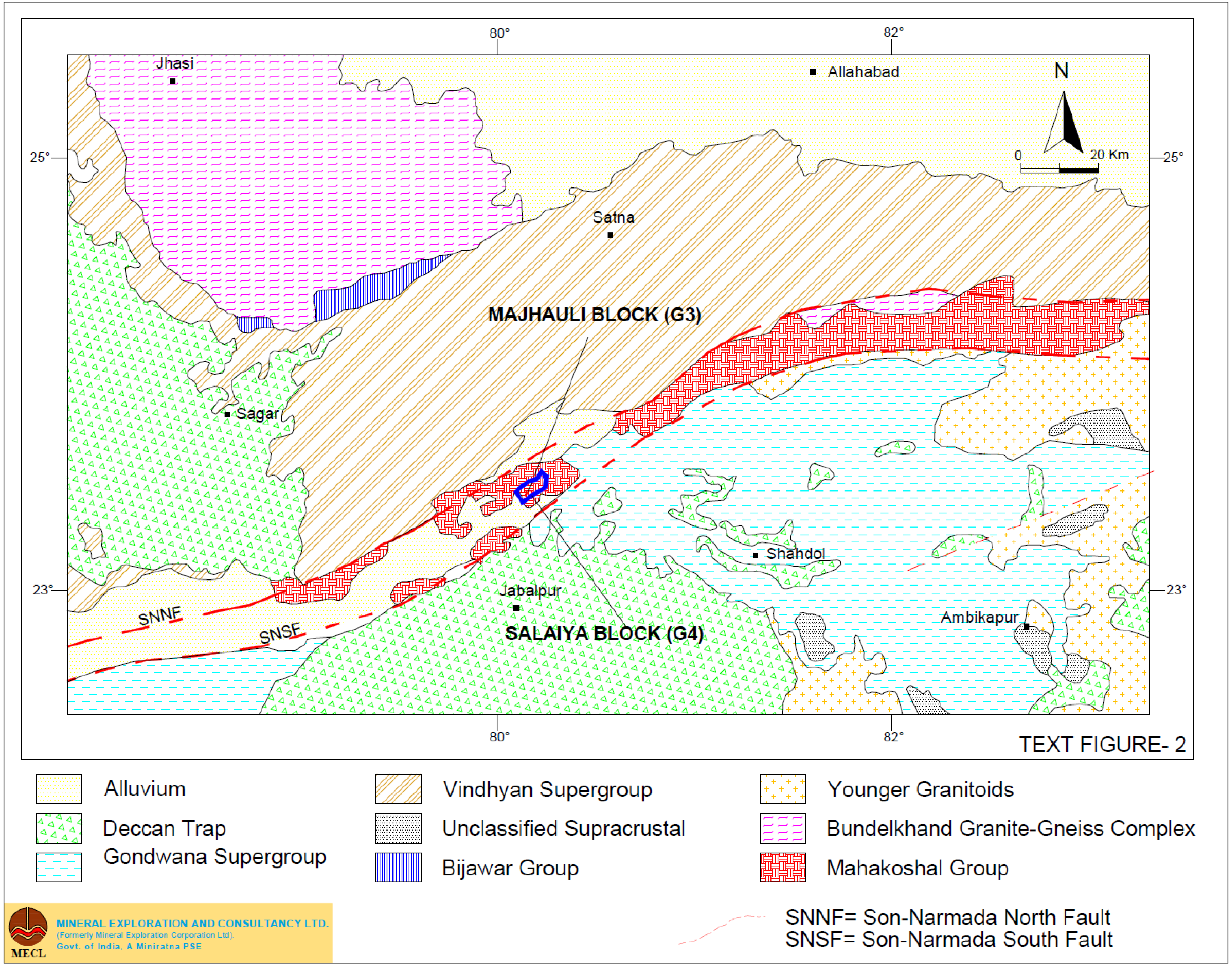
7.1.3 The Bundelkhand Crustal Province is characterized by a semicircular granite-gneiss massif, represents the Archean cratonic nucleus (> 3.0 Ga). This massif includes numerous older supracrustal enclaves. The southern and southeastern boundaries of the Bundelkhand massif are covered by the Paleo- 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. Majhauli block falls within this Mahakoshal belt. Regional Geological Map showing Majhauli 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 Majhauli 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.

General Stratigraphic succession of Mahakoshal Group, after Nair et. al. (1995)

Group	Formation	Litho units
MAHAKOSHAL GROUP	Vindhyan Supergroup and Jungel Group of Sediments	
	Uncomformable and Faulted Contact	
	Intrusives	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.
	Parsoi Formation	Tuffaceous and carbonaceous phyllites, felspathic quartzite and conglomerate, tuffaceous phyllite with metabasalt intercalations.
	Agori Formation or Sleemnabad Formation	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.
	Chitrangi Formation	Basic and ultrabasic plugs and dykes including periodtite and serpentinite, Agglomerates, metabasalt and peridotitic pillow lava.
Sidhi Gneissic Complex (Basement)		Gneissic Complex with associated mafic, ultramafic rocks and metasediments

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 Amoch, Hardua Kalan, Majhauli and west, south-west of Dundi and Mahagwan area. The intervening spaces are either covered by extensive Quaternary alluvial deposits or laterite, particularly around Hardua Kala, Majhauli and Dundi areas. In the central part of the block area, along the eastern margin, irregularly shaped lateritic patches stand out, forming small hillocks and mounds. Five such patches have been identified within the block and are numbered 1 to 5 from north to south. To the east of Laterite Patch 1, a large dolomite mine pit is present, accompanied by a few scattered dolomite exposures in its vicinity.

To the south and southwest 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 Majhauli 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 Majhauli 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 Majhauli 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 Majhauli and south of Hardua kala 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 Majhauli village. These laterites contain lumps of platy or biscuity hematite, cemented by a minimal ferruginous matrix. In specific locations, such as east of Majhauli 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).

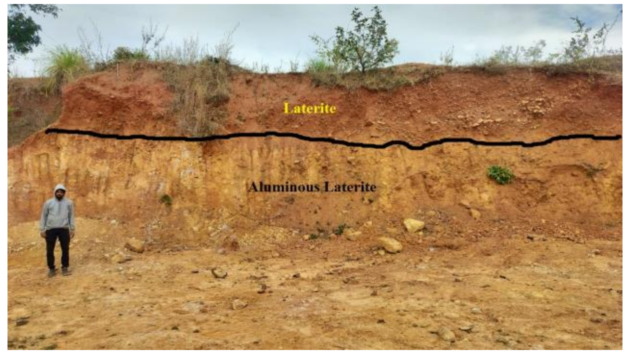
Bauxite mineralization is closely associated with lateritic environments. The extensive development of laterite mounds, provides favorable conditions for the formation of bauxite deposits. Laterites act as a weathering product, contributing to the concentration of aluminum-rich minerals like gibbsite. 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.

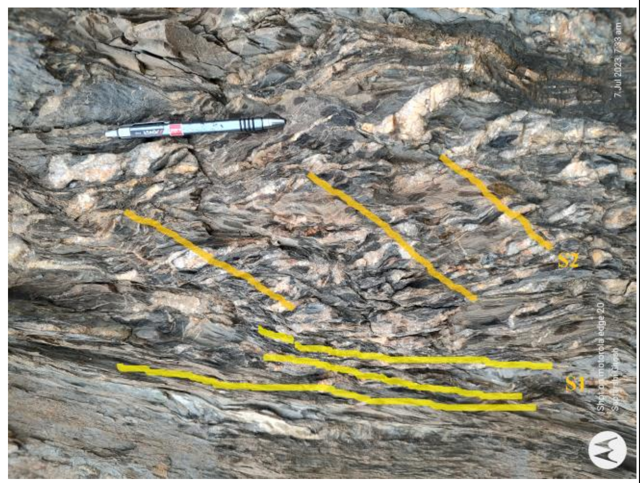
The ongoing private mining activities for bauxite in the region further highlight the economic interest in these deposits. The grade of the bauxite is reported to be approximately 30% Al_2O_3, which, while not exceptionally high, indicates that the mineralization may still be economically viable under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

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 Majhauli.

In the Majhauli area, the laterite appears to have primarily developed over phyllite 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. These formations have been analyzed and show iron content ranging from 13.09 to 40.43% 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 & Majhauli. 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 five 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. The dimensions of the identified lateritic bodies are provided below, offering insights into their spatial distribution and potential resource estimation.

Lateritic Body No.	Dimension
1	370m X 170m
2	400m X 240m
3	350m X 340m
4	340m X 140m
5	580m X 160m

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 <u>Geological Survey of India (GSI)</u>

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 - Majhauli 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 - Majhauli 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 Majhauli 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.

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 Majhauli 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 4.43 square kilometers in and around Majhauli 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, 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 Majhauli 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 <u>Topographic Survey</u>

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 five boreholes, have been drilled in Majhauli 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.

Details of the Lateritic Bodies and Drilling Plan

The exploration plan and corresponding drilling activities for each lateritic body are outlined in the table below:

Lateritic Body No.	Dimension	No. of boreholes planned	Remarks
1	370m X 170m	2	Falls within lease area, hence, no boreholes drilled
2	400m X 240m	2	MBM-1 & MBM-2 taken up
3	350m X 250m	1	MBM- 3 taken up
4	340m X 140m	1	Falls within private land, owner did not allow for drilling
5	580m X 180m	2	MBM-4 & MBM-5 taken up

Initially, the drilling program aimed to execute a total of **eight boreholes** as per the approved plan. However, due to various constraints, including land access restrictions, only **five boreholes** could be completed.

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.

Additionally, one borehole, **MBM-2**, was drilled beyond the planned 20-meter depth. The primary objective of extending this borehole was to examine the parent rock underlying the lateritic formation and to establish a more comprehensive understanding of the regional stratigraphy. This deeper drilling aimed to provide crucial insights into the geological framework, including the nature of the bedrock and the transition between laterite and the underlying lithological units.

Since the investigation area lies within a lateritized zone with irregular laterite bodies overlying phyllite and metabasalt, a total of five 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. However, to ascertain the parent rock of the aluminous laterite, one borehole (MBM-2) was extended to 52.50 meters. In total, five scout boreholes were drilled, covering a cumulative meterage of 124.00 meters.

MECL drilled five 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 wooden core boxes lined with a polythene sheet to prevent the loss of fine material through openings or adhesion to the wood.

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 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, 77 primary samples and 8 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 the drilled boreholes, ensuring that each bulk density measurement directly correlates with the 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
1	BD PIT-1	418024.46	2605476.38	MBM-1
2	BD PIT-2	417731.56	2605438.66	MBM-2
3	BD PIT-3	416207.13	2603262.65	MBM-4
4	BD PIT-4	416478.62	2603465.54	MBM-3
5	BD PIT-5	417209.89	2604739.01	MBM-5

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

Sl. No.	ITEMS OF WORK	UNIT	Proposed Quantum for Majhauli Block	Achieved till date
			G3	
1	Geological Mapping (1:4000 scale)	Sq. Km	3.94	4.43
2	Topographic Survey (2m contour interval)	Sq. Km	3.94	4.43
3	Borehole fixation and Block boundary demarcation DGPS Survey	Nos.	15 (8 Bhs + 7 Boundary points)	12 (7 block boundary + 5 Bhs)
4	Excavation (Pitting)	Cu.m	10	10
5	Drilling (Core)	m.	160 (8 Bhs)	124 (5 bhs)
7	Primary 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.	140	77
8	Check Sample 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.	14	8
9	Primary Sample for PGE by ICP-MS method		10	8
10	Primary Sample for Ni, Co, Cd, Cr & Ti by AAS method	Nos.	10	8
11	Bulk Density	Nos.	5	5
12	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 Majhauli block

Field Photograph 11: Core logging performed at drill site

Field Photograph 12: Sampling at sample shade

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 5 to 10 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. Additionally, low vegetation cover and clear weather conditions further contributed to the overall quality and accuracy of the topographic survey.

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 Majhauli 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 Majhauli 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, 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, adherence to standard operating procedures is paramount. Iron samples are powdered to -100 mesh size, using a mortar and pestle. 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 coning and quartering method. This technique involves pouring the bulk sample onto a flat surface, forming a cone, and systematically dividing it into four quadrants. Two opposite quadrants are selected for further processing, and the method is repeated, reducing the sample size while preserving representativity. The resulting 300 grams 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, one borehole (MBM-2) was extended to 52.50 meters to examine the parent rock and establish stratigraphic continuity.

SL. No.	Borehole No.	Coordinates		RL (m)	Date of Commencement	Date of Closure	Type of drilling	Total Depth (m)
		Easting	Northing					
1	MBM-1	418005.110	2605491.366	412.835	05.09.24	06.09.24	Dry Coring	20.00
2	MBM-2	417795.429	2605341.390	405.758	07.09.24	12.09.24	Dry Coring	52.50
3	MBM-3	417157.197	2604741.120	408.408	17.09.24	20.09.24	Dry Coring	11.50
4	MBM-4	416250.367	2603253.339	404.726	22.11.24	27.11.24	Dry Coring	20.00
5	MBM-5	416495.300	2603474.214	408.445	28.11.24	02.12.24	Dry Coring	20.00
						Total Drilling		**124.00**

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 77 nos. of primary samples has been collected from the drill cores of 5 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 8 such samples are analyzed as external check sample in JNARDDC, Nagpur.

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

Laterite often contains anomalous trace elements and Platinum Group Elements (PGE). To assess their presence, eight composite samples were prepared from drill core primary samples. The 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 trace element and PGE analysis.

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 a mortar and pestle, 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 77 primary samples and 8 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, V & 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

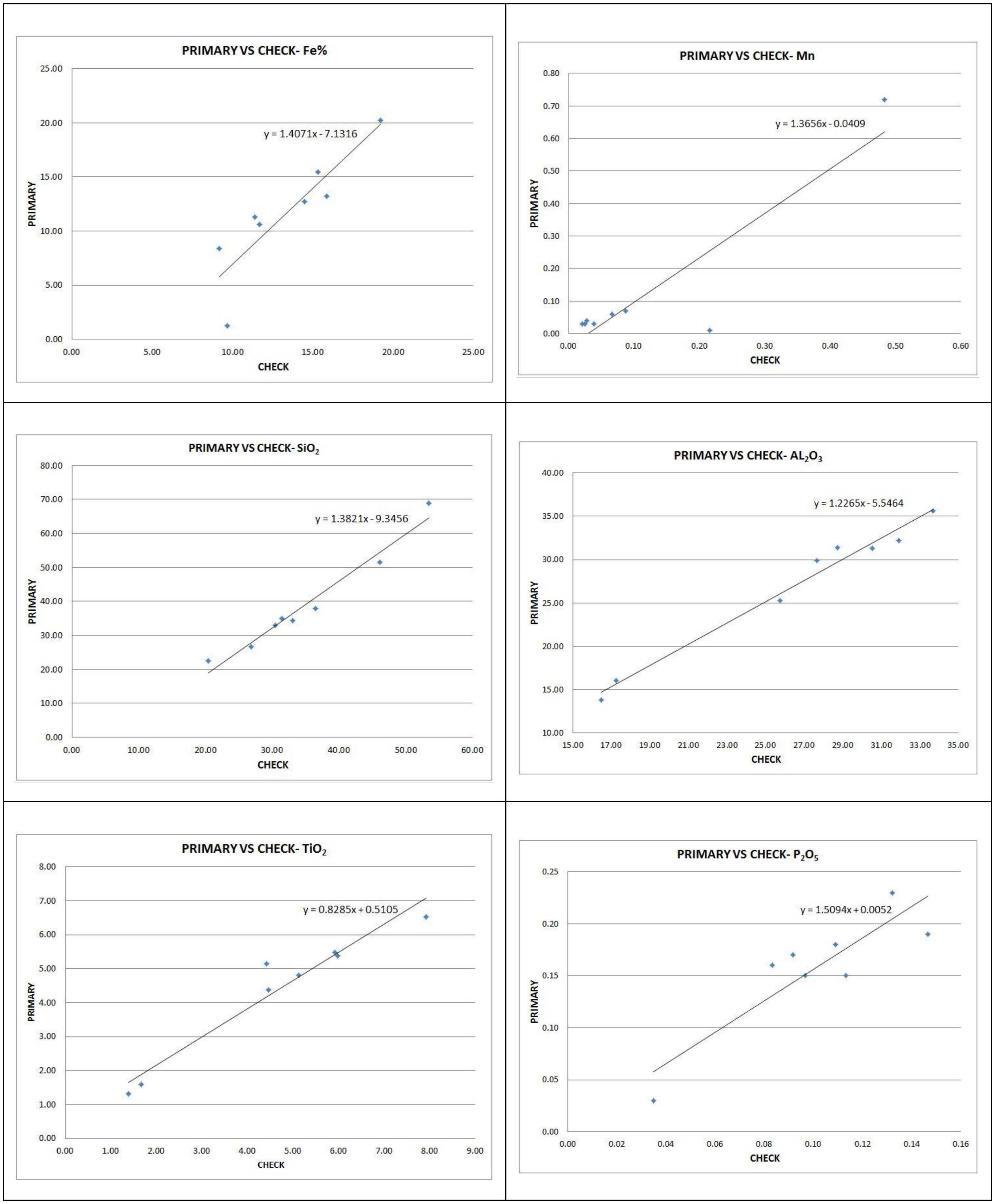
15.3.1 To verify the reliability of chemical analysis conducted in the in-house laboratory, 8 primary samples (10%) were analyzed at JNARDDC, an NABL-accredited laboratory, as external check samples. These samples were randomly selected from the duplicate set of primary samples. To ensure unbiased testing, 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 9 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 of Primary v/s External Check sample 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	8		8		8		8		8		8	
Arithmetic mean	13.35	11.65	0.12	0.12	34.78	38.72	26.50	26.95	4.61	4.33	0.10	0.16
Standard Deviation	3.452	5.499	0.160	0.242	10.567	14.879	6.435	7.972	2.202	1.882	0.034	0.058
Standard error of mean	1.221	1.944	0.057	0.085	3.736	5.260	2.275	2.819	0.778	0.665	0.012	0.020
Variance	11.92	30.24	0.03	0.06	111.67	221.37	41.41	63.56	4.85	3.54	0.00	0.00
Mean of deviation	1.70		0.00		-3.94		-0.45		0.28		-0.06	
Standard Deviation (Error)	2.94		0.12		4.94		1.84		0.60		0.03	
Correlation Co-efficient	0.88		0.90		0.98		0.99		0.97		0.88	
Mean absolute error	1.99		0.06		3.97		1.53		0.46		0.06	
Mean relative random error	17.55		38.33		9.81		6.44		8.62		56.11	
Paired T-value	1.64		-0.08		-2.26		-0.70		1.33		-5.01	
F- test	2.54		2.28		1.98		1.53		1.37		2.91	



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 fully 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

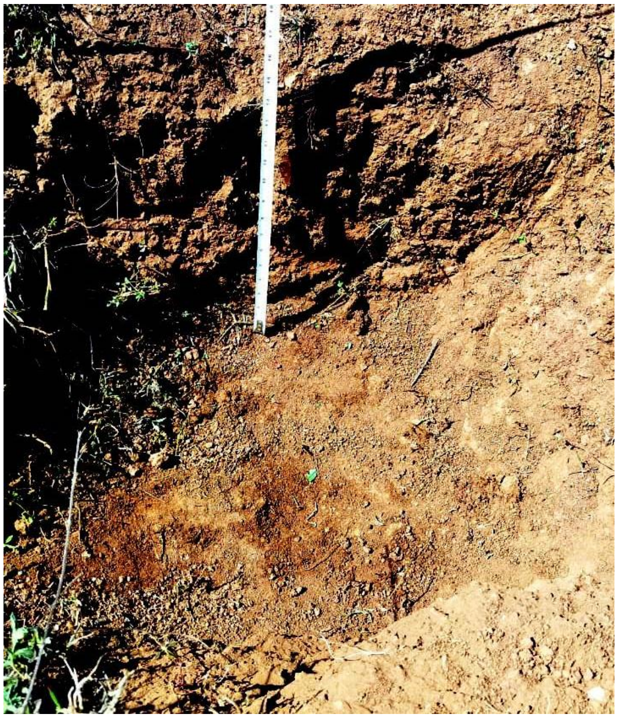
- Weigh the empty container (W1).
- Weigh the container with the excavated material (W2).
- Fill the excavated pit with a known volume of homogeneous sand (preferably ≤ 20 mesh size) to determine the exact volume of the pit.

Calculation

- 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	418024.46	2605476.38	263.12	0.26312	0.17	**1.548**
2	BD PIT-2	417731.56	2605438.66	319.08	0.31908	0.23	**1.387**
3	BD PIT-3	416207.13	2603262.65	370.12	0.37012	0.25	**1.480**
4	BD PIT-4	416478.62	2603465.54	239.40	0.27062	0.22	**1.230**
5	BD PIT-5	417209.89	2604739.01	270.62	0.23940	0.18	**1.330**

 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 Majhauli 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 4.43 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 ($Al_2O_3 \geq 20\%$) which, other than alumina, contains resource of Titanium and Vanadium.

19.2.3 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 1.00m 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.

19.2.4 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.

19.2.5 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.

19.2.6 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-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, 77 primary samples and 8 external check samples were generated.

19.3.2 Chemical analysis

A total of 77 nos. of primary core samples in Majhauli (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. 8 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, 8 nos. of composite samples were analyzed.

19.3.3 Cut-off grade

The resource estimation for aluminous laterite in the Majhauli 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, mineralized zones have been identified which are furnished in the table below:

Statement Showing Zone detais with respect to Al_2O_3 ≥ 20%, Ti ≥ 2% and V ≥ 500 ppm, Majhauli (G-3) Block for Iron and Bauxite, Distt.- Jabalpur, Madhya Pradesh

Sl. No.	BH No.	From (m)	To (m)	Thickness (m)	Al_2O_3%	Ti %	V (ppm)
1	MBM-1	0.00	20.00	20.00	31.08	3.33	744.66
2	MBM-2	0.00	12.00	12.00	27.93	3.33	984.26
3	MBM-3	0.00	2.00	2.00	22.06	2.86	421.14
4	MBM-4	0.00	20.00	20.00	25.64	2.42	735.50

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 a nearby borehole, enhancing the accuracy of resource estimation and providing a reliable foundation for tonnage calculations.

Sl. No.	Pit No.	Easting	Northing	Corresponding borehole	Measured bulk density (t/m^3)
1	BD PIT-1	418024.46	2605476.38	MBM-1	1.548
2	BD PIT-2	417731.56	2605438.66	MBM-2	1.387
3	BD PIT-3	416207.13	2603262.65	MBM-4	1.480
4	BD PIT-4	416478.62	2603465.54	MBM-5	1.230
5	BD PIT-5	417209.89	2604739.01	MBM-3	1.330

19.4 Methodology adopted for Cross Sectional method for resource estimation

19.4.1 The block boundary contains five distinct lateritic patches, which serve as host bodies for the aluminous laterite resource. However, out of these five patches, only three were accessible for borehole drilling—Lateritic Body 2, Lateritic Body 3, and Lateritic Body 5.

Lateritic Body 2, measuring approximately 400m × 240m, is elongated, and two boreholes (MBM-1 and MBM-2) were drilled along its long axis, connected by section line S1-S1’. Lateritic Body 3, with dimensions of 350m × 250m, is relatively smaller and roughly circular, so a single borehole (MBM-3) was drilled along section line S3-S3’. Lateritic Body 5, which spans 580m × 170m, was investigated by drilling boreholes MBM-4 and MBM-5, aligned along section line S2-S2’. These three section lines—S1-S1’, S2-S2’, and S3-S3’—correspond to Lateritic Bodies 2, 5, and 3, respectively. Geological cross-sections were prepared by correlating lithology and Al_2O_3 grade to delineate the shape of the aluminous laterite body, with profiles generated using GDM software.

19.4.2 For resource estimation, the sectional area of aluminous laterite 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. Given that the lateritic bodies have irregular but rounded shapes, and boreholes were aligned along their long axes, the sectional influence was determined by dividing the total area of each lateritic body by its long axis length. This approach provided an estimate of the short axis of the irregularly shaped lateritic bodies, which was then used as the sectional influence in the resource estimation process.

19.4.3 To calculate the volume of aluminous laterite, the sectional area corresponding to each borehole was multiplied by the sectional influence. This method ensured an accurate representation of the lateritic 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 Majhauli block was conducted using the Polygonal Method, considering the three main lateritic bodies—Lateritic Body 2, Lateritic Body 3, and Lateritic Body 5—as master polygons. These lateritic bodies represent the mineralized zones within which resource calculations were performed. The polygonal method involves defining individual borehole influence areas within these mineralized zones, ensuring that the estimated resources are systematically allocated based on spatial distribution and geological continuity.

19.5.2 For Lateritic Bodies 2 and 5, each polygon contains two boreholes. To determine the polygonal area corresponding to each borehole, the total polygonal area of the lateritic body was divided by a perpendicular bisecting line drawn between the two boreholes. This method effectively assigned equal areas of influence to each borehole, ensuring an unbiased spatial representation of the lateritic deposit. The polygonal resource map, as depicted in Plate-V, provides a visual representation of these borehole influences. In contrast, for Lateritic Body 3, which contains only a single borehole (MBM-3), the entire polygonal area was assigned to that borehole, as there were no adjacent boreholes to define a shared influence zone.

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 zone 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 resource for each borehole. The sum of resources from all boreholes provided the total in-situ geological resource for the Majhauli block. This method ensures an accurate and systematic assessment of the lateritic resource, facilitating further economic evaluation and potential extraction planning.

CHAPTER- 20

20.0 REPORTING OF RESOURCE

20.1 The resource estimation for aluminous laterite 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, aluminous laterite 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 A total of **3.13 million tonnes** of net in-situ geological resource of aluminous laterite has been estimated using the **Polygonal Method**, with an average grade of 28.08% Al_2O_3, 4.82% TiO_2, and 0.16% V_2O_5. As a validation measure, the **Cross-Sectional Method** was employed, estimating **3.01 million tonnes** of net in-situ geological resource with an average grade of 28.57% Al_2O_3, 5.01% TiO_2, and 0.17% V_2O_5. 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.

Polygonal Resource Table

Statement showing estimation of Aluminous Laterite resources at 20% Al_2O_3 cut-off, Titanium (Ti) resource at 2% cut-off & Vanadium (V) resource at 500 ppm cut-off, by Polygonal method, at Majhauli (G3) block, Dist.- Jabalpur, Madhya Pradesh											
Polygon No.	BH.No.	Depth of Intersection(m)			Polygonal Area (m^2)	Bulk Density (t/m^3)	Gross Resources Tonnes	Net Resources Tonnes	Al_2O_3 %	TiO_2 %	V_2O_5 %
		From	To	Thick.							
1	MBM-1	0.00	20.00	20.00	52506.2122	1.548	1625592.330	1300473.864	31.08	5.49	0.19
2	MBM-2	0.00	12.00	12.00	40048.3872	1.387	666565.357	533252.285	27.93	5.50	0.18
3	MBM-3	0.00	2.00	2.00	117358.387	1.330	312173.310	249738.648	22.06	2.86	0.10
4	MBM-4	0.00	20.00	20.00	44212.6845	1.480	1308695.461	1046956.369	25.64	4.12	0.12
TOTAL RESOURCES							**3913026.458**	**3130421.166**	**28.01**	**4.82**	**0.16**

Cross sectional Resource Table

Statement showing estimation of Aluminous Laterite resources at 20% Al_2O_3 cut-off, Titanium (Ti) resource at 2% cut-off & Vanadium (V) resource at 500 ppm cut-off, by Geological Cross Sectional method, at Majhauli (G3) block, Dist.- Jabalpur, Madhya Pradesh												
Section No.	BH.No.	Depth of Intersection(m)			Sectional Area (m^2)	Sectional Influence (m)	Bulk Density (t/m^3)	Gross Resources (Tonnes)	Net Resource (Tonnes)	Al_2O_3 %	TiO_2 %	V_2O_5 %
		From	To	Thick.								
S1-S1'	MBM-1	0.00	20.00	20.00	5113.5281	233.00	1.548	1844367.769	1475494.215	31.08	5.49	0.19
	MBM-2	0.00	12.00	12.00	2669.5752	233.00	1.387	862729.287	690183.430	27.93	5.50	0.18
S2-S2'	MBM-4	0.00	20.00	20.00	3218.58	165.00	1.480	785977.236	628781.789	25.64	4.12	0.12
S3-S3'	MBM-3	0.00	2.00	2.00	848.667	242.00	1.330	273151.961	218521.568	22.06	2.86	0.10
TOTAL RESOURCES								**3766226.253**	**3012981.002**	**28.57**	**5.01**	**0.17**

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:

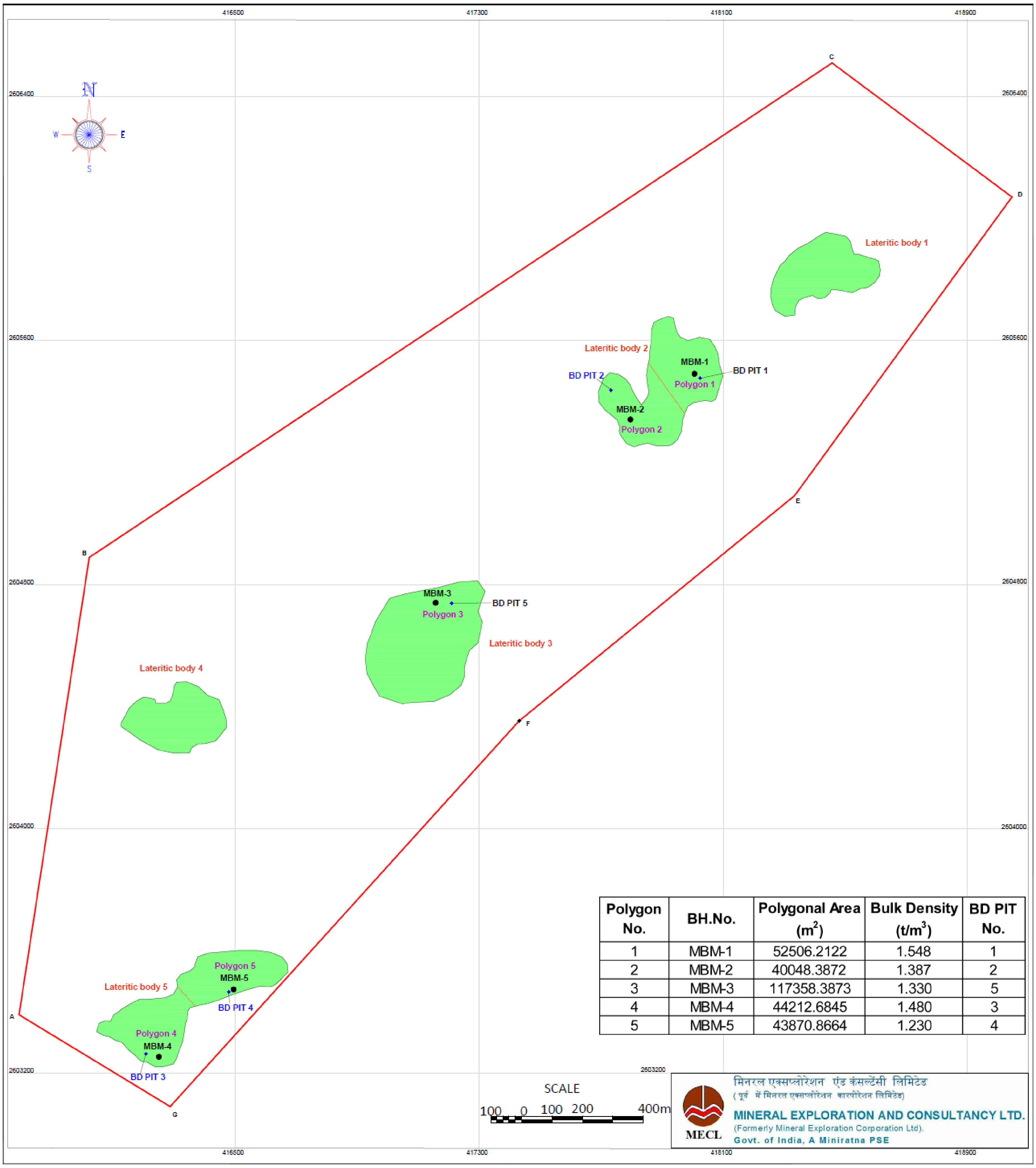
$$\text{Weighted average grade} = \frac{V1XG1 + V2XG2 + V3XG3 + ----------- + VnXGn}{V1 + V2 + V3 + ----------- + Vn}$$

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

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

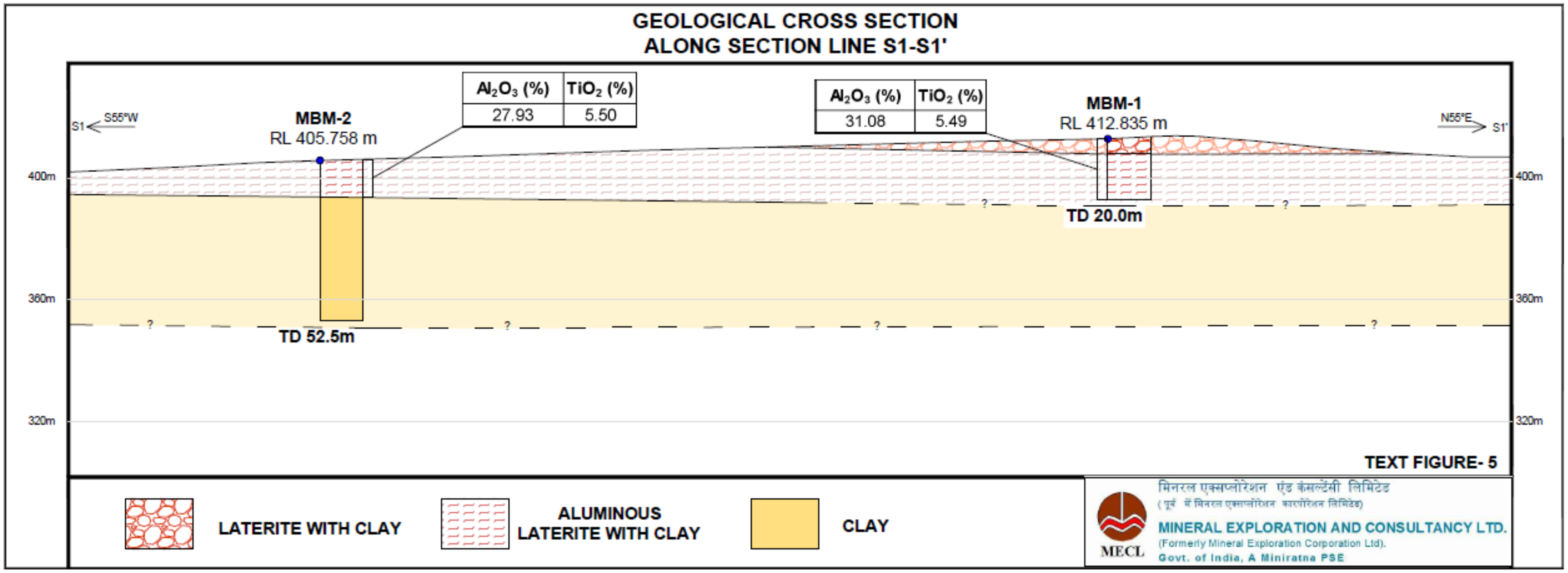
20.5 The aluminous laterite resource estimates obtained through the Polygonal Method and Cross-Sectional Method were compared to assess the confidence level of the estimation. The Polygonal Method, used as the principal approach, yielded a resource estimate 3.83% higher than the Cross-Sectional Method, which served as a validation check. This variance falls within the permissible limits, confirming the reliability and accuracy of the resource estimation.

POLYGON MAP OF MAJHAULI BLOCK (G3), DISTRICT - JABALPUR, MADHYA PRADESH



Polygon No.	BH.No.	Polygonal Area (m^2)	Bulk Density (t/m^3)	BD PIT No.
1	MBM-1	52506.2122	1.548	1
2	MBM-2	40048.3872	1.387	2
3	MBM-3	117358.3873	1.330	5
4	MBM-4	44212.6845	1.480	3
5	MBM-5	43870.8664	1.230	4

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 S1-S1'

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 mineralization within the block is hosted in five 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. Lateritic Body 2, measuring approximately 400m × 240m, is elongated in shape, while Lateritic Body 3, with dimensions of 350m × 250m, is relatively smaller and more circular. Lateritic Body 5 spans 580m × 170m and has an irregular but elongated form. The remaining two lateritic bodies, Body 1 and Body 4, measure 370m × 170m and 340m × 140m, respectively, both exhibiting irregular yet rounded shapes. These dimensions define the spatial extent of aluminous laterite mineralization within the block, providing a basis for estimating the resource potential.

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. One borehole, MBM-2, was extended beyond the planned 20-meter depth to examine the underlying parent rock and enhance the understanding of regional stratigraphy. 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

The aluminous laterite resource estimation was conducted using the Polygonal Method as the principal approach and the Cross-Sectional Method for validation. A 20% deduction from Gross in-situ resources was applied to account for geological uncertainties such as core recovery, cavities, and structural features. The Polygonal Method estimated 3.13 million tonnes of net in-situ resource with an average grade of 28.08% Al_2O_3, 4.82% TiO_2, and 0.16% V_2O_5, while the Cross-Sectional Method estimated 3.01 million tonnes with an average grade of 28.57% Al_2O_3, 5.01% TiO_2, and 0.17% V_2O_5. All resources fall under the Inferred Category (333) as per UNFC classification.

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 Majhauli block has confirmed the presence of aluminous laterite with significant titanium and vanadium content. An estimated 3.91 million tonnes of aluminous laterite has been identified, containing 28.01% Al_2O_3, 4.82% TiO_2, and 0.16% V_2O_5. 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 Majhauli block for Iron and Bauxite (4.43 Sq. Km) Districts-Jabalpur, Madhya Pradesh is given as Plate-I.

22.2 Regional Geological Map of Majhauli block for Iron and Bauxite (4.43 Sq. Km) Districts- Jabalpur, Madhya Pradesh is given as Plate-II

22.3 Geological Map of Majhauli block for Iron and Bauxite (4.43 Sq. Km) Districts-Jabalpur, Madhya Pradesh is given as Plate-III.

22.4 Geological Cross Sections along S1-S1', S2-S2' & S3-S3' of Majhauli Block for Iron and Bauxite (4.43 Sq. Km) Districts- Jabalpur, Madhya Pradesh is given as Plate-IVA, B & C respectively.

22.5 Polygonal Resource map of Majhauli Block for Iron and Bauxite (4.43 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 Majhauli block, District- Jabalpur, Madhya Pradesh at G3 level for exploration for Iron and Bauxite by Mineral Exploration and Consultancy Limited (MECL) on behalf of National Mineral Exploration Trust. 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.

GENERAL MANAGER (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
Majhauli	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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