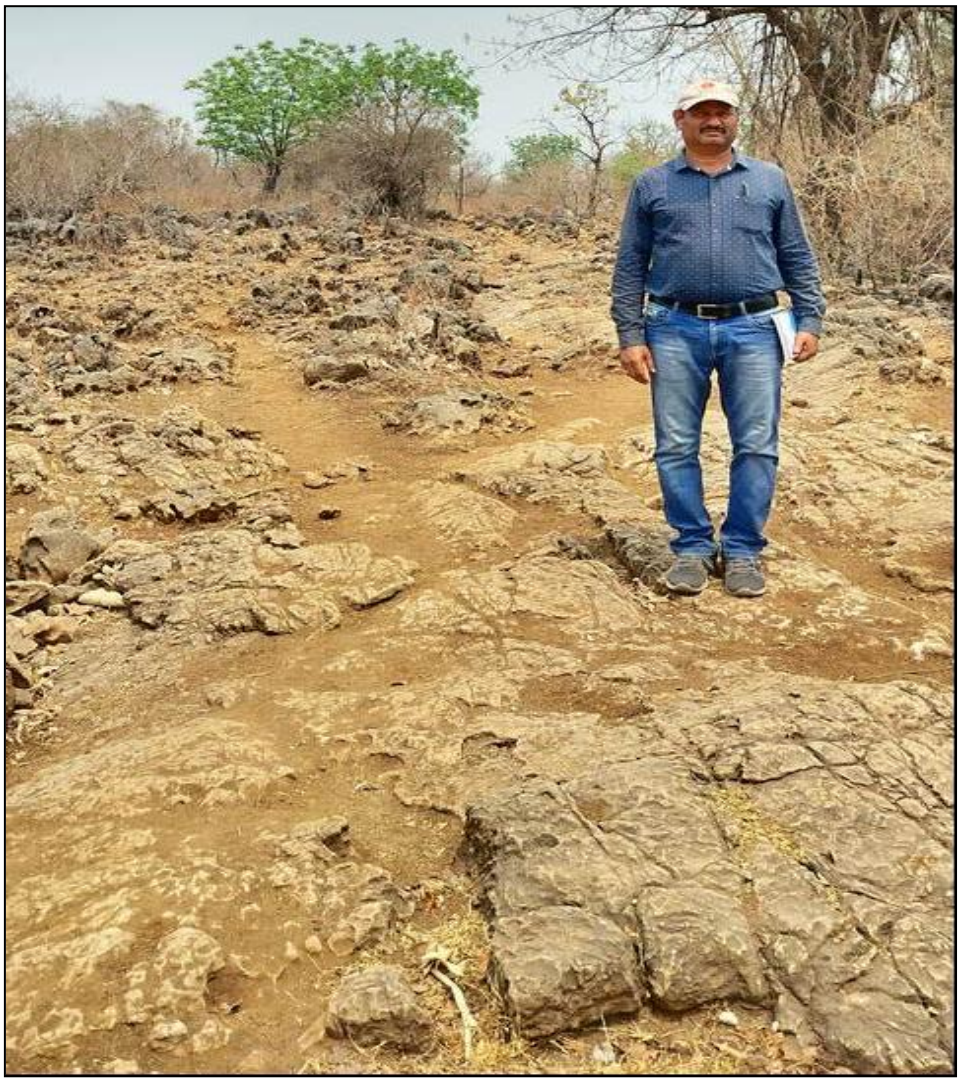
GEOLOGICAL REPORT ON PRELIMINARY EXPLORATION (G3)
FOR LIMESTONE IN

MUNDRA-CHILAI BLOCK

DISTRICT: YAVATMAL, MAHARASHTRA

(TEXT, ANNEXURES AND PLATES)



MINERAL EXPLORATION AND CONSULTANCY LIMITED
(Formerly known as Mineral Exploration Corporation Limited)
A Government of India Enterprise
CORPORATE OFFICE, NAGPUR

AUGUST-2025

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MECL

C O N T E N T S

GEOLOGICAL REPORT ON PRELIMINARY EXPLORATION (G3) FOR LIMESTONE IN MUNDRA-CHILAI BLOCK, DISTRICT: YAVATMAL, MAHARASHTRA

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प्रारंभिक गवेषण (जी3) के लिए मुंद्रा-चिलाई ब्लॉक में चूना पत्थर पर भूवैज्ञानिक रिपोर्ट, जिला: यवतमाल, महाराष्ट्र

अध्याय 1

1.0.0. कार्यकारी सारांश

1.1.0 मुंद्रा -चिलाई ब्लॉक का प्रस्ताव महाराष्ट्र राज्य सरकार द्वारा चिन्हित उन व्यपगत पट्टा क्षेत्रों के आधार पर किया गया है, जिन्हें मूल रूप से एमएमडीआर अधिनियम, 2015 की धारा 10ए(2)(बी) के तहत प्रदान किया गया था। हालाँकि, अधिनियम में 2021 के संशोधन के बाद, ऐसी सभी पूर्वेक्षण लाइसेंस (पीएल) रिपोर्टों को अयोग्य घोषित कर दिया गया, जिससे नीलामी के माध्यम से आवंटन अनिवार्य हो गया। इसके अलावा, खनिज (खनिज सामग्री के साक्ष्य) नियम, 2015 के प्रावधानों के अनुसार खनिज साक्ष्य (जी4, जी3, आदि) के स्तर की पुष्टि के लिए इन पीएल रिपोर्टों का मूल्यांकन किया जाना आवश्यक है।

1.2.0 भूविज्ञान और खनन निदेशालय (डीजीएम), महाराष्ट्र सरकार ने पत्र संख्या तक./1848/2023/260, दिनांक 23/01/2024 के तहत एमईसीएल से व्यपगत 10ए(2)(बी) खनन पट्टा क्षेत्रों में गवेषण करने का अनुरोध किया।

1.3.0 एमईसीएल द्वारा महाराष्ट्र के यवतमाल जिले के वानी तहसील के चिलाई गांव में और उसके आसपास गवेषण के जी3 स्तर पर 06 बोरहोल में 300 मीटर ड्रिलिंग से संबंधित गवेषण प्रस्ताव तैयार किया गया।

1.4.0 गवेषण प्रस्ताव (जी3) के लिए मुंद्रा-चिलाई ब्लॉक (4.38 वर्ग किमी) था प्रस्तुत और 24 और 25 अक्टूबर, 2024 को आयोजित 70वीं टीसीसी-1 बैठक में समिति ने 10ए(2)(बी) मामलों और एमईसीएल के माध्यम से इन पीएल क्षेत्रों के गवेषण के लिए महाराष्ट्र सरकार के अनुरोध पर विचार किया। तदनुसार, 70 वीं टीसीसी-1 समिति अनुशंसित परियोजना प्रस्ताव का शीर्षक "मुंद्रा-चिलाई ब्लॉक (4.38 वर्ग किमी), यवतमाल जिला, महाराष्ट्र में चूना पत्थर के लिए प्रारंभिक गवेषण (जी3 स्तर)" है।

1.5.0 70वीं टीसीसी-1 की सिफारिश पर, 37 वीं कार्यकारी समिति (ईसी), एनएमईटी की 29 नवंबर, 2024 को हुई बैठक में पत्र संख्या एफ.सं. 23/520/2024-एनएमईटी/570, दिनांक 12 दिसंबर, 2024 के तहत 90.63 लाख रुपये की लागत वाली परियोजना को मंजूरी दी गई।

1.6.0 महाराष्ट्र के यवतमाल जिले में स्थित मुंद्रा-चिलाई ब्लॉक, 4.38 वर्ग किमी में फैला है, जो देशांतर 78°53'58.94158" पूर्व से 78°55'42.80040" पूर्व और अक्षांश 19°50'08.28765" उत्तर से 19°51'08.04304" उत्तर तक घिरा है और तहसील वानी में चिलाई, टुंड्रा, कृष्णपुर, डुनकी, मुकुटबन

और गणेशपुर गांवों को शामिल करता है, जो टोपोशीट संख्या 56 I/13 के अंतर्गत आते हैं।

1.7.0 एनएमईटी से अनुमोदन प्राप्त होने के बाद, एमईसीएल ने मुंद्रा-चिलाई ब्लॉक में जी3 स्तर का गवेषण किया है। एमईसीएल ने ड्रिलिंग के साथ 1:4000 पैमाने पर भूवैज्ञानिक मानचित्रण और स्थलाकृतिक सर्वेक्षण किया 5 ऊर्ध्वाधर बोरहोल और 98 कोर नमूने का विश्लेषण (साथ ही 10 बाहरी जांच नमूने) जो कोर ड्रिलिंग भूमिगत निरंतरता को रेखांकित करने और खनिज संसाधनों का आकलन करने से जेनरेट हुई।

1.8.0 क्षेत्रीय रूप से महाराष्ट्र के यवतमाल जिले में दक्कन बेसाल्ट की प्रधानता को उजागर करता है और गोंडवाना, लेमेटा और पेनगंगा जैसी अन्य संरचनाएँ भी मौजूद हैं। इस क्षेत्र का चूना पत्थर समूह पेनगंगा समूह के पुटनूर-मंगुर्दा समूह से संबंधित है। इसमें उथले समुद्री से लेकर नदीय मूल के परतदार चूना पत्थर और शेल शामिल हैं। सामान्यतः, यह उत्तर-पश्चिम - दक्षिण-पूर्व की ओर एक क्षेत्रीय नतिलंब प्रदर्शित करता है, जिसमें उत्तर-पूर्व की ओर 5° से 10° तक का निम्न नति होता है।

1.9.0 मुंद्रा-चिलाई ब्लॉक क्षेत्र पुटनूर-मंगुर्दा संरचना का हिस्सा है, जो पेंगंगा समूह की एक कम ज्ञात लेकिन भूवैज्ञानिक रूप से दिलचस्प इकाई है। ये संरचनाएँ आमतौर पर प्रोटेरोज़ोइक से लेकर निम्न पुराजीवी अवसादी चट्टानों जैसे शेल, चूना पत्थर और डोलोमाइट से बनी हैं। इन बेड्स का नतिलंब N20° पश्चिम - S20° पूर्व है और उत्तर-पूर्व की ओर 5° से 20° तक नति है।

1.10.0 इस ब्लॉक में, लगभग 5 ऊर्ध्वाधर बोरहोल ड्रिल किए गए, जिनकी कुल माप 230 मीटर थी। कुल 98 प्राथमिक नमूने तैयार किए गए और CaO, MgO, SiO_2, Fe_2O_3, Al_2O_3, SO_3, P_2O_5, K_2O, Na_2O और & LOI के लिए उनका विश्लेषण किया गया। 10 नमूने बाह्य जांच विश्लेषण के लिए प्रस्तुत किए गए हैं। 5 नमूनों का पेट्रोलॉजिकल और 2 नमूनों का पुंज घनत्व के लिए अध्ययन किया गया है।

1.11.0 भूवैज्ञानिक संसाधनों का अनुमान मुख्य विधि के रूप में बहुभुज विधि और चेक विधि के रूप में क्रॉस सेक्शनल द्वारा MEMC नियम 2015 (संशोधित 2021) के अनुसार आईबीएम ग्रेड कट-ऑफ के वर्गीकरण के आधार पर डोलोमाइट के एसएमएस (एलडी) ग्रेड के लिए किया गया था, संसाधनों के आकलन के लिए 2.81 (कैलिपर विधि) के पुंज घनत्व पर विचार किया गया था।

1.12.0 एसएमएस (एलडी) ग्रेड डोलोमाइट बोरहोल संख्या एमएमसी-01, एमएमसी-02, एमएमसी-03 और एमएमसी-05 में पाया गया, जिनकी मोटाई क्रमशः 47.50 मीटर, 47 मीटर, 48 मीटर और 50 मीटर है। डोलोमाइट के अनुमानित सकल भूवैज्ञानिक संसाधन इस प्रकार हैं:

संसाधन श्रेणी	भूवैज्ञानिक सकल स्व-स्थाने संसाधन	CaO (%)	MgO (%)	SiO_2 (%)
एसएमएस (एलडी) ग्रेड डोलोमाइट	360.87 (मिलियन टन)	33.00	18.54	1.61

1.13.0 मुंद्रा-चिलाई ब्लॉक में एमईसीएल द्वारा किए गए प्रारंभिक गवेषण (जी3) से एसएमएस (एलडी) ग्रेड डोलोमाइट संसाधन प्राप्त हुए हैं, जिन्हें यूएनएफसी नामकरण के अनुसार 333 श्रेणी में रखा गया है । यह रिपोर्ट महाराष्ट्र सरकार को ब्लॉक की नीलामी में सुविधा प्रदान करेगी।

GEOLOGICAL REPORT ON PRELIMINARY EXPLORATION (G3) FOR LIMESTONE IN MUNDRA-CHILAI BLOCK, DISTRICT: YAVATMAL, MAHARASHTRA

CHAPTER-1

1.0.0 EXECUTIVE SUMMARY

1.1.0 The Mundra–Chilai Block has been proposed on the basis of lapsed lease areas identified by the State Government of Maharashtra, which were originally granted under Section 10A(2)(b) of the MMDR Act, 2015. However, following the 2021 amendment to the Act, all such Prospecting License (PL) reports were declared ineligible, mandating allocation through auction. Further, these PL reports are required to be evaluated to confirm the level of mineral evidence (G4, G3, etc.) as per the provisions of the Minerals (Evidence of Mineral Contents) Rules, 2015.

1.2.0 The Directorate of Geology and Mining (DGM), Government of Maharashtra requested MECL to take up the exploration in lapsed 10A(2)(b) mining lease areas vide letter no. Tech/1848/2023/260, Dated 23/01/2024.

1.3.0 MECL formulated exploration proposal involving 300m drilling in 06 boreholes at G3 level of exploration in and around Chilai village of Tehsil Wani, District: Yavatmal, Maharashtra.

1.4.0 Exploration Proposal (G3) for Mundra-Chilai Block (4.38 sq.km) was submitted and deliberated in 70th TCC-1 meeting held on 24th and 25th October, 2024. Committee, noted 10A(2)(b) cases and request of Govt. of Maharashtra for exploration of these PL areas through MECL. Accordingly, 70th TCC-1 committee recommended the project proposal titled as “Preliminary Exploration (G3 Level) for Limestone in Mundra-Chilai Block (4.38 sq.km), Yavatmal District, Maharashtra”.

1.5.0 On recommendation of 70th TCC-1, 38th Executive committee (EC), NMET meeting held on 29th Nov 2024, vide letter no F.No. 23/520/2024-NMET/570, Dated 12th December, 2024 approved the project with cost of INR 90.63 lakhs.

1.6.0 The Mundra-Chilai Block, located in Yavatmal District of Maharashtra, spans 4.38 sq.km, is bounded by Longitude 78°53'58.94158" E to 78°55'42.80040" E and Latitude 19°50'08.28765" N to 19°51'08.04304" N and encompasses the villages of Chilai, Kundra, Krishnapur, Dunki, Mukutban and Ganeshpur in Tehsil Wani, falling within Toposheet No. 56 I/13.

1.7.0 After receipt of approval from NMET, MECL has carried out G3 level exploration in Mundra-Chilai Block. MECL carried out geological mapping and topographical survey on 1:4000

scale with drilling 5 vertical boreholes and analysing 98 core samples (plus 10 external check samples) generated from core drilling to lineate subsurface continuity and assess mineral resources.

1.8.0 Regionally Yavatmal district in Maharashtra has exposures dominated by Deccan basalts alongwith presence of Gondwana, Lameta and Penganga beds also present. The limestone formation of the area belongs to Putnur-Mangurda formation of Penganga Group. It is comprising laminated limestones and shales of shallow marine to fluvial origin. The rocks, exhibit a regional strike of NW - SE with low dips ranging from 5° to 10° towards the northeast.

1.9.0 The Mundra-Chilai Block area belongs to the Putnur-Mangurda formation lesser-known but geologically intriguing unit of the Penganga Group. These formations typically consist of Proterozoic to Lower Palaeozoic sedimentary rocks like Shale, limestone and dolomite. The strike of the beds is $N20^0W$ - $S20^0E$ and dip varies from 5° to 20° towards northeast.

1.10.0 In this block, about 5 no. of vertical boreholes were drilled, with total meterage of 230m. A total of 98 no of samples analysed for CaO, MgO, SiO_2, Fe_2O_3, Al_2O_3, SO_3, P_2O_5, K_2O, Na_2O & LOI. 10 no. of samples analysed for external check analysis. 5 no. of samples are studied for petrological and 2 no. of samples for bulk density.

1.11.0 Geological resources were estimated by polygonal method as principal method and cross sectional as check method as per MEMC Rules 2015 (Amended 2021) for SMS (LD) Grade of Dolomite based on classification of IBM grade cut-off, bulk density of 2.81 gm/cc (Caliper Method) was considered for estimation of resources.

1.12.0 SMS (LD) Grade Dolomite was intersected in the borehole no MMC-01, MMC-02, MMC-03 & MMC-05, whose thickness is 47.50m, 47m, 48m & 50m respectively. Estimated geological gross in-situ resources of dolomite are as follows:

Category of Resources	**Geological Gross In-situ Resources**	**CaO (%)**	**MgO (%)**	**SiO_2 (%)**
SMS (LD) Grade Dolomite	360.87 (Million Tonnes)	33.00	18.54	1.61

1.13.0 Preliminary exploration (G3) carried out by MECL in Mundra-Chilai block established SMS (LD) grade dolomite resources, which are placed under 333 category as per UNFC nomenclature. This report will facilitate state Govt. of Maharashtra for auction of the block.

CHAPTER – 2

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

2.1.0 INVESTIGATING AGENCY

MINERAL EXPLORATION & CONSULTANCY LIMITED
(A Govt. of India Enterprise Miniratna PSE)
Dr. Babasaheb Ambedkar Bhavan, High Land Drive Road,
Seminary Hills, Nagpur-440006.

PERSONNEL ASSOCIATED WITH PRELIMINARY EXPLORATION (G3 STAGE) FOR LIMESTONE IN MUNDRA-CHILAI BLOCK, DISTRICT: YAVATMAL, MAHARASHTRA.

1	Overall guidance	Shri Shrikant Sharma, HOD (Exploration) Shri P. Ravindran, GM (Exploration) Rtd.
2	Overall Planning, Co-ordination & Supervision	Shri Shrikant Sharma, HOD (Exploration) Shri P. Ravindran, GM (Exploration) Rtd.
		Shri Naveen Kumar Pala, Sr. Manager (Geology)
3	Project Management	Shri Asheesh Layer, Project Manager, Gondkhairi Project
4	Physical Execution of work	
	a) Geology	Shri Lakshmanarao Kaddala, Sr. Manager (Geology)
	b) Survey	Shri Sudip Sasmal, S.T.A (S&D) Shri Sanilam Guha, S.T.A (S&D)
	c) Drilling	Shri Niranjan Mardo, A D O
5	Sample Processing	Shri Ankush Haridas Wagh, Sr. Tech. (Sampling) Mrs. Shika Sharma, Sr. Tech. (Sampling)
6	Chemical Laboratory	Shri Shrikant Sharma, HOD (Exploration)
		Shri Rohit Sharma, Manager (Chemistry)
		Dr Deepti Rahangdale, Manager (Chemistry)
7	Petrographic Studies	Shri Sayantan Pal, Manager (Geology)
8	Documentation	Shri Naveen Kumar Pala, Sr. Manager (Geology)
		Shri Lakshmanarao Kaddala, Sr. Manager (Geology)
9	Non-Coal Geological Report Cell	Shri Uday Patil, Sr. Computer Operator
		Shri N C S Reddy, Console Operator

10	Reprography and Printing	Shri Pradeep Negi, Assistant Survey & Map Officer
		Shri Durgesh Devarshee, Assistant Survey & Map Officer
11	Hindi Translation	Shri Shreekant Rai, Sr. Hindi Officer

CHAPTER – 3

3.0.0 TITLE OF THE REPORT & OWNERSHIP

3.1.0 TITLE OF THE REPORT

3.1.1 Geological Report on Preliminary Exploration (G3) for Limestone in Mundra-Chilai Block, District: Yavatmal, Maharashtra.

3.1.2 **Ownership:** Department of Geology and Mining, Government of Maharashtra.

3.2.0 DETAILS ABOUT PERIOD OF PROSPECTING

3.2.1 The exploratory work in the block commenced on 20.02.2025 with the surveying and geological mapping on 1:4,000 scale over 4.38 sq.km area with completion of all field operations on 30.06.2025. The analytical / laboratory studies were also carried out simultaneously at laboratories of MECL in Nagpur and other NABL accredited laboratories.

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

Exploration Agency	Mineral Exploration and Consultancy Limited (Formerly Mineral Exploration Corporation Limited) A Govt. of India Enterprise – Mini Ratna – 1 CPSE
Qualification	M.Sc. / M. Sc. Tech. (Geology)
Experience	Professionals have more than 50 years of experience with inception of MECL since 1972
Address of the Prospector	Dr. Babasaheb Ambedkar Bhavan, High Land Drive Road, Seminary Hills, Nagpur, Pin- 440006
Email	cmd@gov.in; gm-exploration@mecl.gov.in
Phone No	0712-2510289; 0712-2511829

Sl.No.	Name of the Person	Designation	Qualification	Experience
1	Shri Shrikant Sharma	HOD (Exploration)	M.Sc., Geology	23 Years
2	Shri P. Ravindran	GM (Exploration) Rtd.	M.Sc., Geology	35 Years
3	Shri Naveen Kumar Pala	Sr. Manager (Geology)	M.Sc. (Tech.), Applied Geology	20 Years
4	Shri Asheesh Layer	Project Manager, Gondkhairi Project / Manager (Drilling)	B.Tech, Mechanical Engineering	11 Years
5	Shri Lakshmanarao Kaddala	Sr. Manager (Geology)	M.Sc. (Tech.), Applied Geology	19 Years
6	Shri Rohit Kumar Sharma	Manager (Labs)	M.Sc., Chemistry	15 Years

CHAPTER – 4

4.0.0 DETAILS OF THE AREA

4.1.0 LOCATION OF THE BLOCK

4.1.1 The Mundra-Chilai Block, located in Yavatmal District of Maharashtra, spans 4.38 sq.km, is bounded by Longitude 78°53'58.94158" E to 78°55'42.80040" E and Latitude 19°50'08.28765" N to 19°51'08.04304" N and encompasses the villages of Chilai, Kundra, Krishnapur, Dunki, Mukutban and Ganeshpur in Tehsil Wani, falling within Toposheet No. 56 I/13.

4.1.2 The block area is well connected to district headquarter, Yavatmal, via State Highways 237 and 234 via Ghatanji and Pandharkawada. The block also well connected with nearest town Wani.

4.1.3 The nearest railhead is Wani of Central Railway which is about 35 km north of the block. The nearest airport is Dr. Babasaheb Ambedkar International Airport, Nagpur (located about 170 km in northern direction of the block).

Table – 4.1
Co-ordinates of Cardinal Points of the block boundary, Mundra-Chilai Block, Dist - Yavatmal, Maharashtra

Block Cardinal Point No.	WGS 1984 DMS		UTM (Zone-44)	
	Latitude (N)	Longitude (E)	Northing (m)	Easting (m)
A	19°51'07.36249"	78°54'21.71199"	280718.169	2196469.933
B	19°50'57.44282"	78°54'50.83753"	281561.921	2196154.358
C	19°51'05.72000"	78°55'11.97791"	282180.234	2196401.319
D	19°51'08.04304"	78°55'39.35558"	282977.773	2196462.953
E	19°50'09.57090"	78°55'42.80040"	283055.934	2194663.474
F	19°50'08.28765"	78°53'58.94158"	280032.951	2194661.364
G	19°50'28.3322"	78°54'10.9283"	280389.452	2195273.481

4.2.0 CADASTRAL DETAILS OF THE AREA WITH LAND USE

Cadastral details are not available for the study area, however indicative data collected from NGDR portal, which is being given below:

Central and North West of part Mundra-Chilai Block area is covered with Open Scrub Forest, Wani Range, Pandharkawada Division, Yavatmal Circle and remaining area falls in Non-Forest Land (revenue and private land).

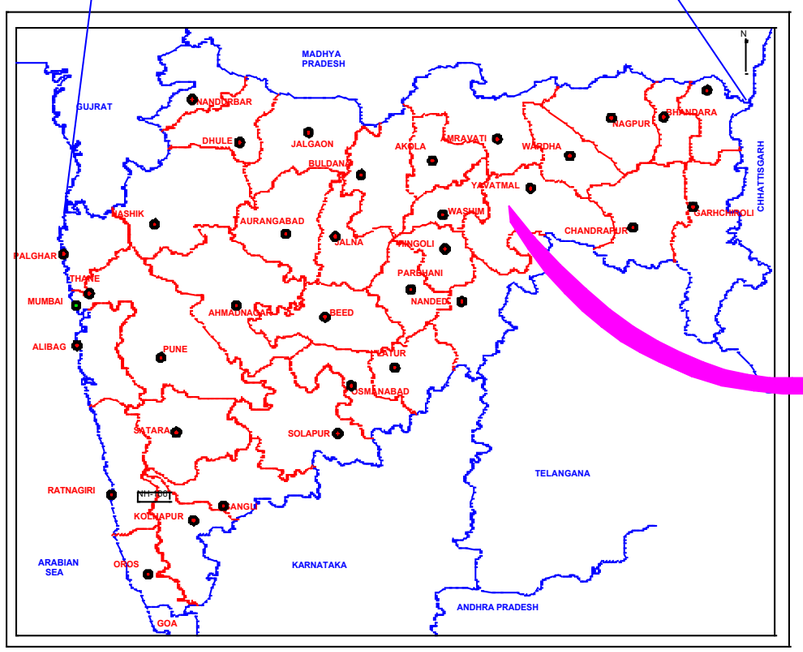
There are no major / minor mineral concession granted inside the block.

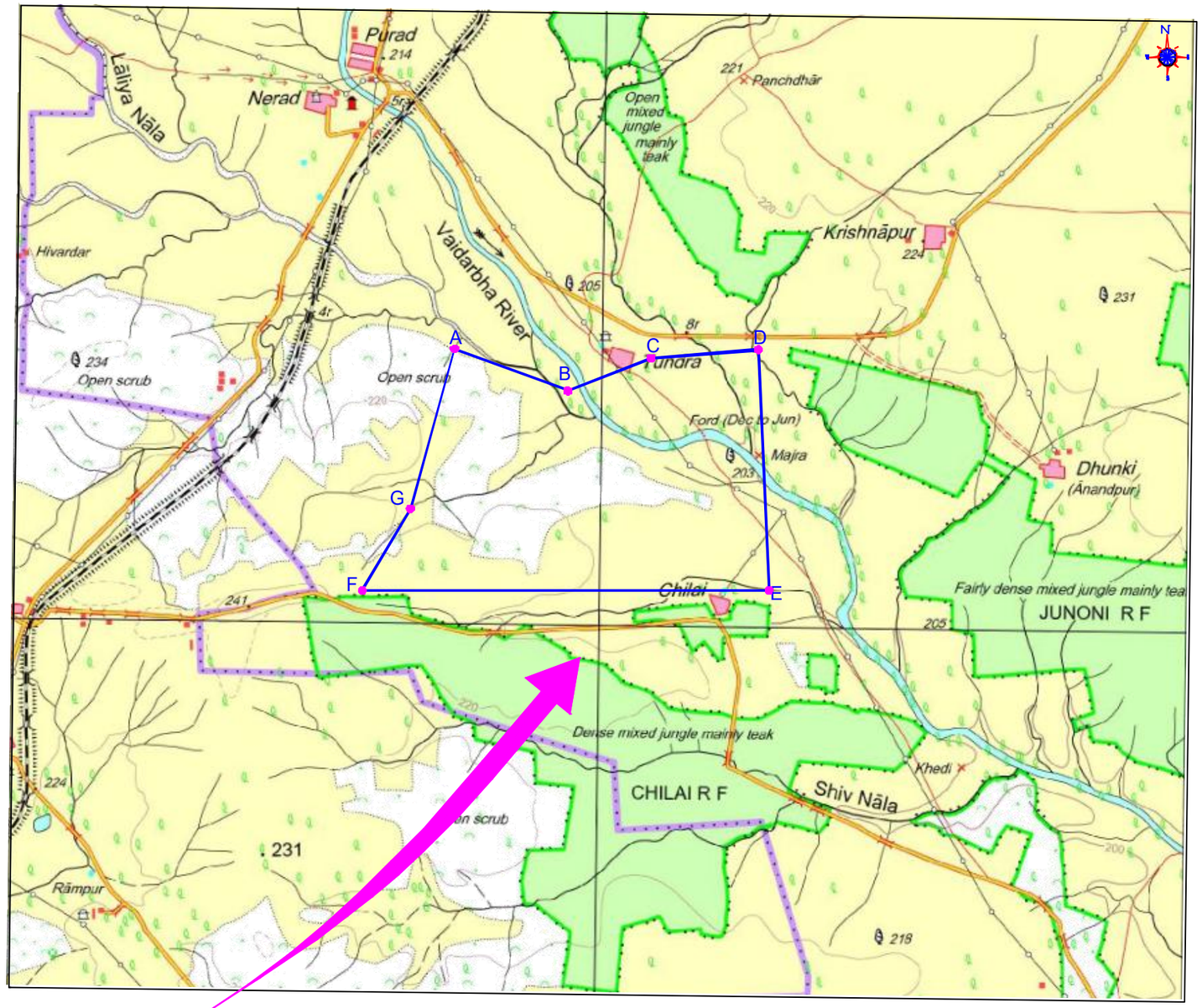
4.3.0` MINERAL(S) UNDER INVESTIGATION

LIMESTONE / DOLOMITE.

LOCATION MAP OF MUNDRA-CHILAI BLOCK (EXTENT - 04.38 Sq Km.)

MECL





Cardinal Point	Easting	Northing	Latitude	Longitude	Elevation
A	280718.169	2196469.933	N19°51'07.36249"	E78°54'21.71199"	203.837
B	281561.921	2196154.358	N19°50'57.44282"	E78°54'50.83753"	201.062
C	282180.234	2196401.319	N19°51'05.72000"	E78°55'11.97791"	204.717
D	282977.773	2196462.953	N19°51'08.04304"	E78°55'39.35558"	203.157
E	283055.934	2194663.474	N19°50'09.57090"	E78°55'42.80040"	202.215
F	280032.951	2194661.364	N19°50'08.28765"	E78°53'58.94158"	229.276
G	280389.452	2195273.481	N19°50'28.3322"	E78°54'10.9283"	216.475

TEXT FIGURE-1

F Block Boundary with Cardinal Points

Villages

CHAPTER - 5

5.0.0 PHYSIOGRAPHY AND ENVIRONMENT

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

5.1.1 The block area is characterized by a flat terrain with isolated mounds, rising up to about 10 m above the surface, mainly in the north-western part of the exploration area. The ground surface shows a gentle north-easterly slope, with elevations ranging from 196 m to 230 m above MSL. Drainage in the area is dendritic in nature. The southerly and south-easterly flowing streams drain into the Penganga River, located to the south of the block, while the easterly flowing streams join the Vaidarbha River, situated to the east of the block, which eventually merges with the Penganga River.

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

5.2.1 The exploration block is located in Wani Tehsil of Yavatmal district. The block area is well connected to district headquarter Yavatmal by State Highway 237 and 234 via Ghatanji and Pandharkawada.

5.2.2 The nearest railhead is Wani of Central Railway which is about 35 km north of the block.

5.2.3 There is no major electrical line passing through the block

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

5.3.1 According to Census 2011, There are a total 11787 no. of people living in the villages, viz., Chilai, Kundra, Krishnapur, Dunki, Mukutban and Ganeshpur which are falling in and around the part of explored block. Out of the total population, 5371 numbers are Male and 5248 numbers are female. Apart from adults, children below 6 years are about 24,992 in Tehsil Wani. (Source: https://villageinfo.in/maharashtra/yavatmal/wani)

5.4.0 SOCIO DEMOGRAPHIC PROFILE OF THE AREA AND NEARBY

5.4.1 Out of the total population in villages lying as given in para no. 5.3.1, total 5866 number of people are working in agriculture as owner, co-owner and labourers, as the main occupation is agriculture.

Out of the total 11787 no of populations 835 number belong to Scheduled Caste and 1632 number belong to Scheduled Tribe community.

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

5.5.1 No Archaeology and ASI site present inside the block.

No National Park, Wildlife Sanctuary falls inside the block.

No Eco Sensitive Zone inside the block.

No Monument falls inside the block.

No Archaeological sites present inside the block.

5.6.0 FOREST, SANCTUARIES, NATIONAL PARK AND WILD LIFE SANCTUARY

Part of the block is partially covered in central and north western part with open scrub forest area, Wani Range, Pandharkawada Division, Yavatmal Circle, Maharashtra.

5.7.0 FLORA AND FAUNA

5.7.1 Yavatmal district in Maharashtra is rich in biodiversity, with a variety of plant and animal species thriving in its forests and landscapes. The district has about 23% forest cover, which supports a diverse range of flora and fauna.

5.7.2 The local varieties like Sal, Babul and thorny bushes, shrubs are main vegetation in the area. Apart from the above, agricultural lands are there where one time crop is being cultivated. Wildlife in the area includes fox, wolf, monkeys, rabbit, both poisonous and non-poisonous snakes. Domesticated cattle are ox, buffalo, cow, sheep and goat are in villages in and around the block. Birds like myna, parrot, sparrow, cuckoo and owl are seen in the area.

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

Penganga and Vaidarbha are the two rivers flowing in the area. The southerly and south-easterly flowing drainages are merged into easterly flowing Penganga River. However, the easterly flowing drainages are merged into southerly flowing Vaidarbha River, which ultimately merged with Penganga River. The area has got dendritic pattern of drainage.

5.9.0 CLIMATIC CONDITIONS

5.9.1 The climate of the Yavatmal district is characterised by a hot summer and general dryness throughout the year except during the south-west monsoon season, i.e., June to September. The temperature rises rapidly after February till May, which is the hottest month of the year. The mean daily maximum temperature during month of May is 44°C and the mean daily minimum temperature during December is 15.1°C. The normal annual rainfall varies from about 850 to 1150 mm and it increases from NW to SE direction in the district and reaches maximum around Pandharkawada (Kelapur) (Source: CGWB, Aquifer Mapping and Management of Ground Water Resources Yavatmal District, Maharashtra, 2021-22).

5.10.0 OTHER PHYSIOGRAPHIC, SOCIAL AND ENVIRONMENT FACTOR

5.10.1 The block area is covered under undulating as well as flat terrain with a gentle southerly, south-easterly and easterly slope. Most of the block area belongs to agriculture land. Yavatmal district is endowed with three major economic resources, viz. agricultural land, mineral deposits and forest products. The chief major forest produces are timber and firewood and the chief minor produce is Tembhurani leaves and Hirda. Jowar and Cotton are the main crops of the district, other important cash crops are groundnut, pulses (Tur Dal) and soyabean. The chief export articles of the district are cotton and teakwood giving highest revenue to the district. In the vicinity there are several coal mines of M/s Western Coal Fields Limited and Limestone / Dolomite mines are catering for cement plants located in Chandrapur and Yavatmal districts.

CHAPTER - 6

6.0.0 INFRASTRUCTURE

6.1.0 LOCAL INFRASTRUCTURE DETAILS

6.1.1 Following public utilities available in the vicinity of the block which are listed below:

Following infrastructure facilities are available in the vicinity for the block area.

Facility	Location	Distance from the block (Appx.)
Police station	Mukutban	7 km
Bank facility	Mukutban	7 km
Hospital	Wani	35 km
Bus stand	Wani	35 km
Educational Institutes		
High School	Nerad	3.5 km
Post Office	Nerad	3.5 km

6.1.2 The nearest railhead is Wani of Central Railways which is about 35 km north of the block and nearest railway station is Mukutban, it is connected by a broad-gauge railway line. Specifically, it's part of the Wani-Adilabad broad gauge line, which links to Nagpur, Mumbai, and Chandrapur. The railway line serves as a crucial transportation route, including for transporting cement from a Birla/Adani group company's plant.

6.1.3 Yavatmal district is located in the southeastern part of Berar in Maharashtra, India. Yavatmal district in Maharashtra is known for its cotton and textile industries, with numerous cotton ginning, spinning, and weaving units. It also has a significant agro-based industry, particularly for soybean processing and oil production. Additionally, the district has coal mines and cement factories. The district is known for its agricultural activities, particularly cotton cultivation, and is a major cotton market in the Vaidarbha region.

CHAPTER - 7

7.0.0 GEOLOGY OF THE AREA

7.1.0 REGIONAL GEOLOGY

Regionally Yavatmal district in Maharashtra is predominantly underlain by by Deccan basalts & Lameta formation, these formations belongs to Gondwana and Penganga group. The limestone exposed in the area belongs to Putnur-Mangurda formation of Penganga group. It is comprised of laminated limestones and shales of shallow marine to fluvial origin. generally, exhibit a regional strike of NW - SE with low dips ranging from 5° to 10° towards the northeast.

The Stratigraphic succession around Yavatmal district, is given in Table-7.1.

Table No 7.1
Stratigraphic succession of the Penganga Group around Adilabad, Yavatmal Telangana and Maharashtra (Chaudhuri et al. 1989)

Age	Supergroup	Group	Formation	Lithologsy
Quaternary				Alluvium
Cenozoic				Laterite
Upper Cretaceous to Palaeocene	Deccan Trap	Sahyadri	Karanja	Basalt
			Buldhana	Basalt
			Chikhli	Basalt
			Ajanta	Basalt, Cherty limestone
			Mahur	Cherty limestone, Basalt, Chert, Sandstone
Upper Cretaceous		Lameta		Limestone, Sandstone
Late Permian	Gondwana	Lower Gondwana	Kamthi	Sandstone, medium to coarse grained
Early Permian			Barakar	Sandstone, medium grained
Late Carboniferrous to Early Permian			Talchir	Sandstone
Neoproterozoic	Penganga		Putnur-Mangurda	Limestone, laminated shale with limestone
			Takallapalli	
Archean to Palaeoprotorozoic	Peninsular Gneissic Complex-II			Hornblende Biotite Gneiss

7.1.1 Alluvium

Alluvium is exposed along the banks of Wardha, Vaidarbha and Penganga Rivers. Vaidarbha river is located in east side of the block which flows towards

South East direction and merges into the Penganga River. Penganga River is located south to the block, which flows towards east direction. Alluvium comprises of Sand, Gravels, Silt and clay. Alluvium is a geologically recent deposit of fine, loose sediments like sand, silt, clay, and gravel transported and deposited by flowing rivers of Wardha, Vaidarbha and Penganga Rivers.

7.1.2 Basalt

Regionally, basalt is found in five different formations viz., Karanja, Buldhana, Chikhli, Ajanta and Mahur belongs to Upper Cretaceous to Palaeocene age. Each formation represents a separate basalt flow, all of which are part of Sahyadri group of Deccan Traps.

Karanja basalt is exposed east of Yavatmal. These basalts are fine to medium grained texture. Rock is massive, hard and compact, dark grey in colour.

Buldhana basalt is exposed to the south and west of Yavatmal, as well as in southeast of Marawadi. This basalt is fine grained, sparsely to moderately porphyritic texture. Rock is hard and dark grey in colour.

Chikhli Basalt is exposed near Marawadi (V) extending South and East wards, west of Kalgaon village area and north of Karanji village. These basalts are fine to medium grained, hard, compact, massive, dark grey in colour, moderately porphyritic.

Ajanta Basalt is exposed near Marawadi (V) extending east and south east of Mahagaon. Cherty limestone is also exposed in the southeast part of Mahagaon (V). This basalt is fine to medium grained, sparse to highly porphyritic with inter-trappeans beds clay and cherty limestone which contain fossils gastropods. These are dark grey, massive, hard and compact.

Regionally the area is covered with Mahur Basalt, which is exposed in north of Maregaon, lying in north- west part of block area. This type of basalt is sparse to highly porphyritic with inter-trappeans beds clay and cherty limestone. It is fine to medium grained, dark grey in colour, massive, hard and compact.

7.1.3 Lameta Formation

The Lameta Formation is exposed north of the Wani area and primarily comprises limestone and sandstone. It dates back to the Upper Cretaceous age. The limestone is white to grey in colour, hard, compact, and cherty. The sandstone is variegated, unconsolidated, and features clay bands and current bedding.

7.1.4 Lower Gondwana

The Lower Gondwana Group in the region is subdivided into three key lithostratigraphic formations: Kamthi, Barakar and Talchir, each representing a distinct geological time span and depositional environment.

- K**amthi Formation**: This unit belongs to the Late Permian age and is prominently exposed in the northern part of the block area, including around Mukutban. It typically comprises sandstones, shales, and occasional coal seams, deposited in a fluvial to deltaic environment. The sedimentary structures observed in the formation reflect high-energy river systems during its deposition.

- **Barakar Formation**: The Barakar Formation is characterized by coarse-grained sandstones interbedded with significant coal seams, making it economically important. The sandstones are typically dirty white to grey in colour and often show cross-bedding, indicating deposition in a braided stream environment.

- **Talchir Formation**: Representing the oldest unit of the Lower Gondwana Group, the Talchir Formation ranges from the Late Carboniferous to Early Permian. It is distinguished by glacially influenced deposits, including pebbly beds, olive green shale, gritty yellow sandstone, thinly bedded soft rocks, and a basal conglomerate (boulder bed). These lithologsies reflect deposition in glacio-fluvial and glaciolacustrine environments, marking the onset of Gondwana sedimentation following extensive glaciation.

7.1.5 Penganga Group

This formation is present in the eastern reaches of the district (near borders with Chandrapur dist), dating back to the Lower Cretaceous. Penganga Formation is characterized by alternating beds of limestone and red shale, prominently exposed along the Penganga and Khuni river sections in the southern part of Yavatmal district. In this region, the formation forms a large inlier within the Deccan basalt cover, extending further south into Adilabad district, Telangana. Stratigraphically,

it comprises a lower limestone member and an upper shaly member. The limestone dominates exposures in the western and southwestern stretches along the Penganga River, whereas the shale member is more prevalent in the eastern and southeastern areas, particularly along the Penganga and Khuni rivers.

A notable outcrop of greenish-white dolomite, conformably overlying red shales between Piwardol and Matharjun—approximately 5 km northeast of Bori is interpreted as the uppermost horizon of this formation. The beds generally dip gently (5°–10°) towards the northeast and are relatively undisturbed. They are overlain by Deccan basalt flows on all sides, with the exception of the southern margin.

Limestone/Dolomite exposed in Mundra-Chilai Block belongs to Putnur-Mangurda formation.

7.1.6 Peninsular Gneissic Complex–II (PGC-II)

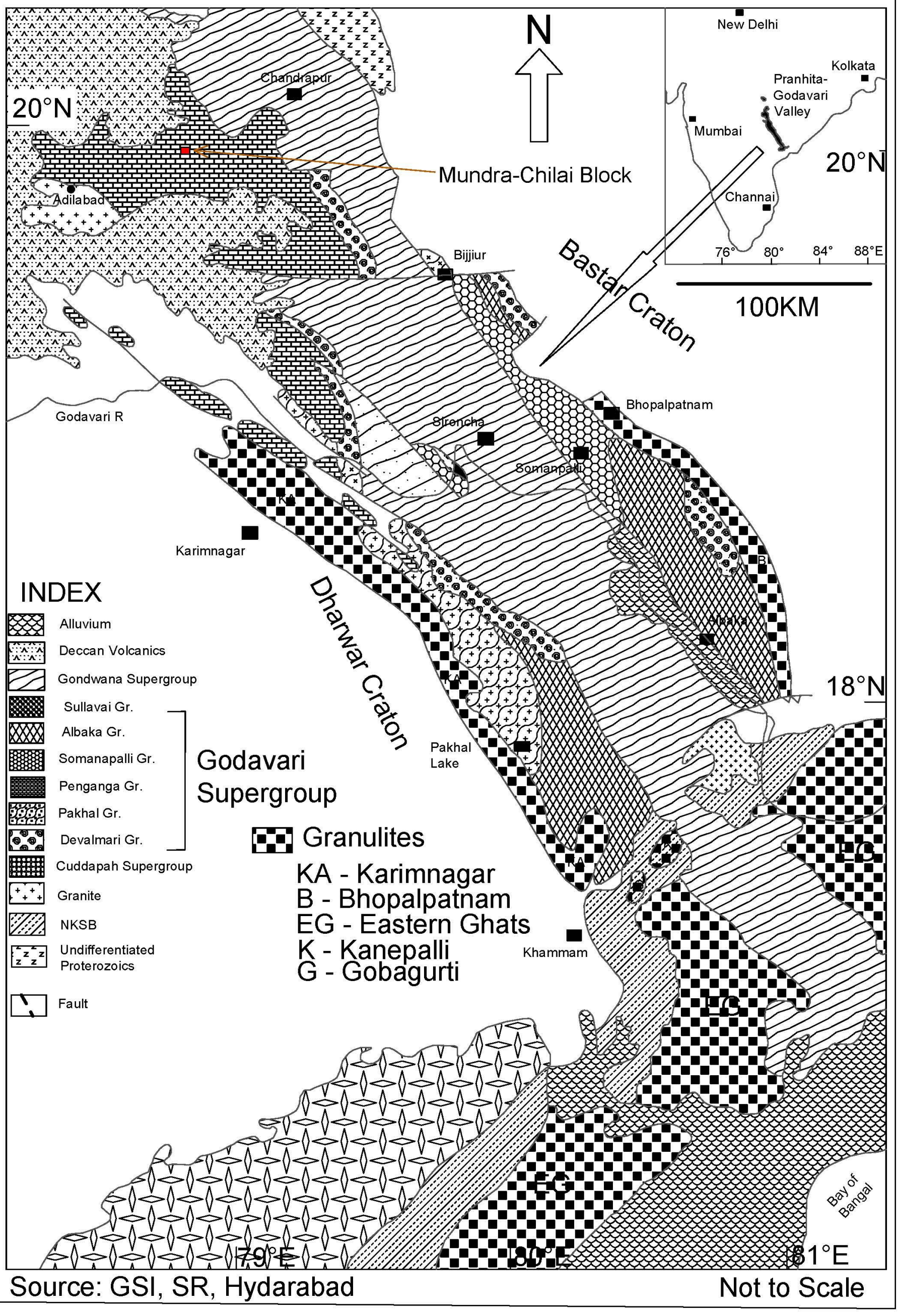
PGC-II represents some of the oldest crystalline basement rocks in the Indian subcontinent, dating back to the Archaean Eon (over 2.5 billion years ago). In the Yavatmal district, exposures of PGC-II are typically found in the eastern and southeastern parts, often forming the basement for younger sedimentary and volcanic sequences such as the Gondwana formations and Deccan Traps.

7.2.0 REGIONAL STRUCTURE

The Putnur–Mangurda Formation lies within the NW–SE trending Pranhita–Godavari Valley, a major tectonic corridor that preserves a thick sedimentary record spanning over 200 million years. The formation is often found in inliers windows of older rock exposed within younger cover sequences providing valuable insights into the basement architecture and early basin evolution.

In the Mangurda–Putnur area, these rocks are gently folded and exhibit low dips, indicating relatively mild tectonic deformation. Their preservation beneath the Deccan Traps and proximity to formations like the Penganga, Lameta and Gondwana sequences makes them crucial for reconstructing the pre-volcanic stratigraphy of the region.

Generalised Geological map of the Pranhita Godavari (PG) valley showing Mundra-Chilai Block (After Chaudhuri et al. 2012)



Source: GSI, SR, Hydarabad

Not to Scale

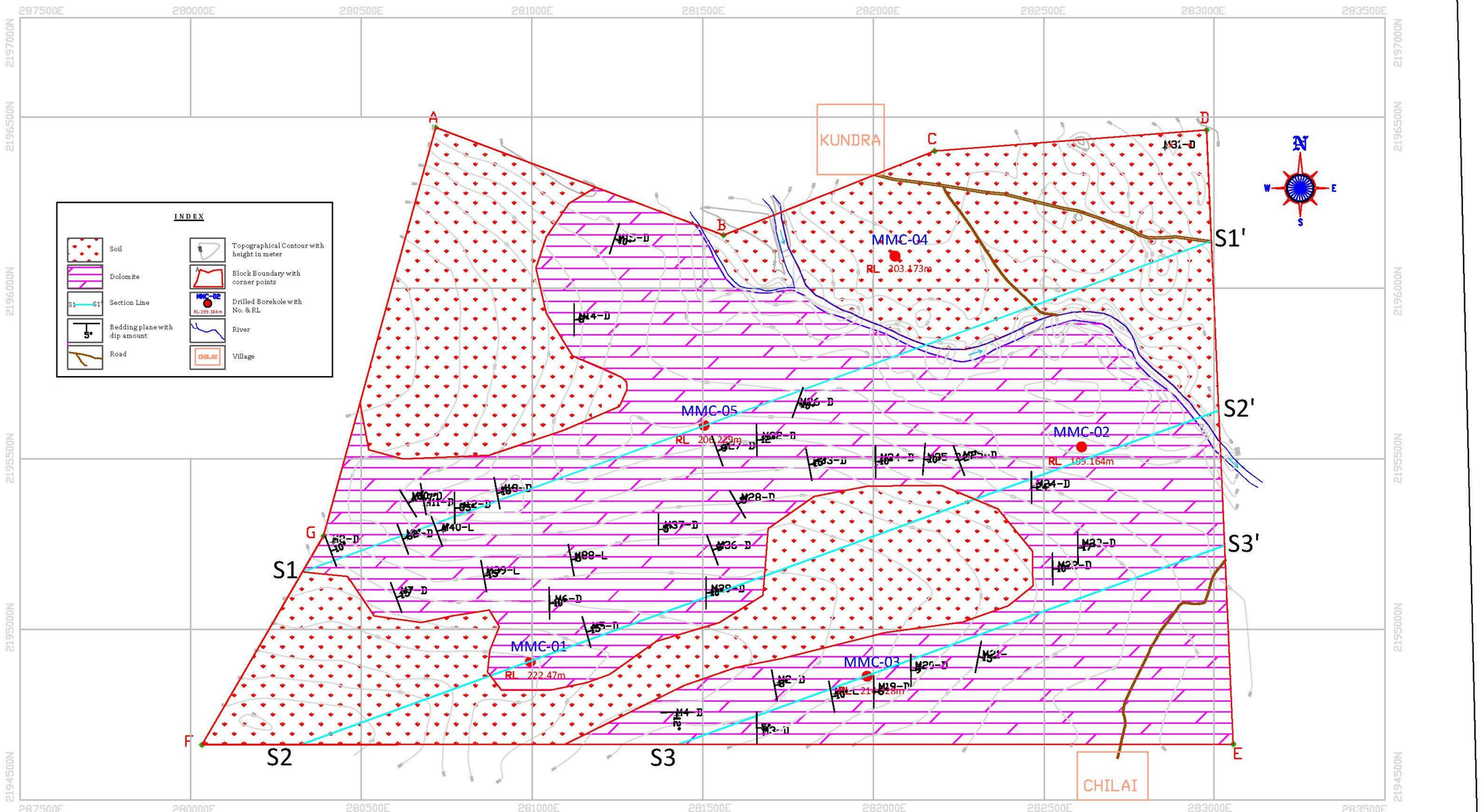
TEXT FIGURE-2

7.3.0 GEOLOGY OF THE BLOCK

7.3.1 The Mundra-Chilai Block, covering an area of 4.38 sq.km, was geologically mapped by MECL on 1:4000 scale, accompanied by a topographical survey. The majority of the area is blanketed by soil and with exposures of dolomite, which belongs to Putnur-Mangurda formation.

7.3.2 Generalized stratigraphy of explored block (after GSI) is given in below table 7.2. Geological map on 1:4000 scale is submitted as Plate-III and Text Figure-3.

Topographical & Geological Map of Mundra-Chilai Block (Over an extent of 4.38 sq.km)



TEXT FIGURE - 3

Table-7.2
Generalized stratigraphy of Mundra-Chilai Block, Dist: Yavatmal, Maharashtra.

Age	Supergroup	Group	Formation	Lithologsy
Quaternary				Alluvium
Upper Cretaceous to Palaeocene	Deccan Trap	Sahyadri	Karanja, Buldhana, Chikhli, Ajanta, Mahur	Basalt, Cherty limestone
Upper Cretaceous		Lameta		Limestone, Sandstone
Late Permian to Early Permian	Gondwana	Lower Gondwana	Kamthi, Barakar Talchir	Sandstone, medium to coarse grained
Neoproterozoic	Penganga		Putnur-Mangurda	Quartzite Shale Limestone/Dolomite Conglomerate
			Takallapalli	
Archean to Palaeoprotorozoic	Peninsular Gneissic Complex-II			Hornblende Biotite Gneiss

7.4.0 DESCRIPTION OF ROCK TYPES

The Litho-units of Mundra-Chilai Block area is described below.

7.4.1 SOIL

About 40 percent of the block area is covered by soil. Soil cover within the block area varies in thickness from 0.1m to 7m, colour is light grey to black. The thickness of the soil is not uniform in entire block. A maximum thickness of 7m is observed northeastern part and upto 3m in the eastern part of the block. Thickness of soil as intersected is maximum 7m in borehole no. MMC-04 and minimum thickness 0.10m in the borehole no. MMC-05.

PUTNUR–MANGURDA FORMATION

Exposures mapped in the block belongs to the Putnur-Mangurda formation lesser- known but geologically intriguing unit of the Penganga Group. These formations typically consist of Proterozoic to Lower Palaeozoic sedimentary rocks, including Shales, Limestone and Dolomite.

The Putnur–Mangurda sequence likely represents shallow marine to fluvial depositional environments and its exposures may be found in structurally controlled inliers or along river sections, particularly in areas like Mangurda village in Yavatmal district.

7.4.2 SHALE

The shale beds are dark grey to black in colour, often rich in organic matter, inter-bedded with sandstones, siltstones, and occasionally limestone.

These shales were deposited in low-energy environments, such as lacustrine (lake) or deltaic settings, where fine sediments could settle undisturbed. Their laminated structure and organic content suggest anoxic conditions. Outcrops of Shale are not exposed in the surface area however; shale beds are intersected very thin beds in the borehole no. MMC-02 & MMC-04,

whose thicknesses are 0.30 and 0.20m respectively.

7.4.3 LIMESTONE

The limestone outcrops are not available on the surface, however thin bands of limestone beds are intersected in the borehole no. MMC-02 & MMC-03 along with dolomite, whose thicknesses are 2m each. Limestone is greyish-white in colour and fine grained, bedded, fractured, hard and massive. When tested with dilute hydrochloric acid, it shows medium to high effervescence, indicating a significant carbonate content.

The regional geological trends and borehole correlations suggest a strike ranging from N20°W–S20°E to nearly North–South, with a gentle northeasterly dip of 5°–20°. Subsurface data from boreholes MMC-02 and MMC-03 confirm the presence of limestone along with dolomite, with intersected thicknesses of 2m each borehole.

Limestone intersected in the boreholes has analytical value ranging from 36.38% 39.11% CaO, 9.66% to 16.04% MgO & 1.79% to 7.55% SiO_2.

Figure 1: Photograph showing cores of limestone zone from 4.00m to 5.00m in Bh. MMC-03

7.4.4 DOLOMITE

Outcrops of dolomite are observed in the mapped area are predominantly Dolomite. One outcrop of dimensions 12 x 15m is located in the central part of the block area. These dolomite beds exhibit the structural trend of $N20^0W$ - $S20^0E$ to North - South with a gentle dip angle ranging from 5° to 20° due Northeasterly. The dolomite is typically fine-to medium-grained, with a white to light grey colour and characterized by elephant skin weathering with highly jointed nature.

Two active limestone/dolomite mines are located to the North east and south east of the block, indicating the economic relevance and continuity of these carbonate units in the area.

Two bedrock samples were collected whose location lies near boreholes MMC-01 & MMC-05 and 3 samples were collected from borehole cores (MMC-02, MMC-03 & MMC-05), Thus a total 5 no of samples were sent to petrology lab of MECL for petrological studies and confirmed that samples are dolomite. Details are given below Table 7.3.

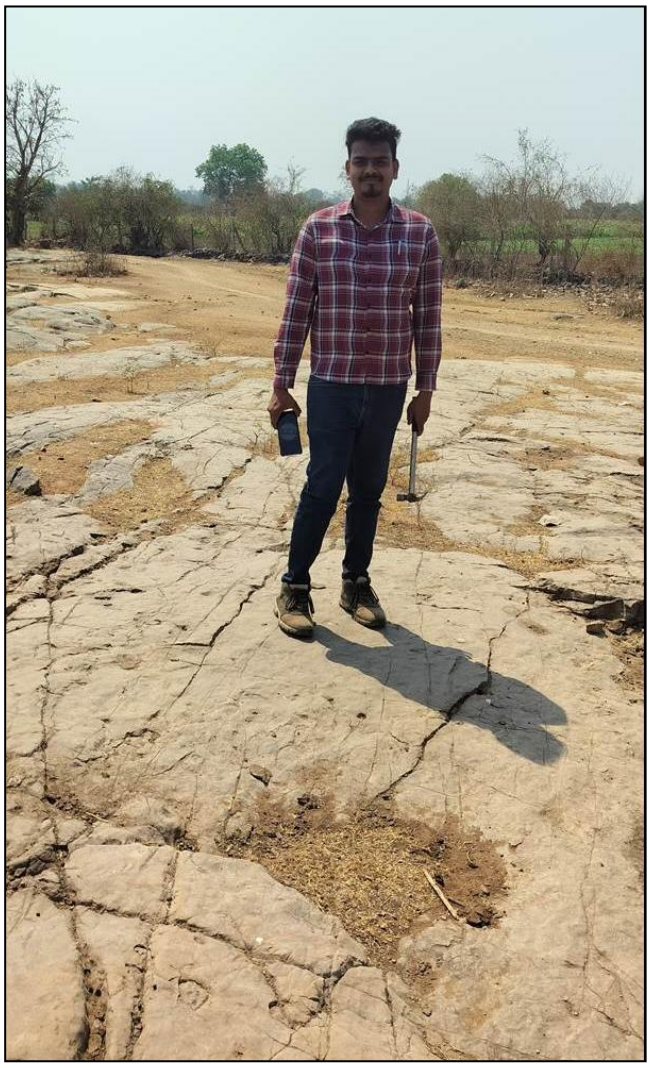
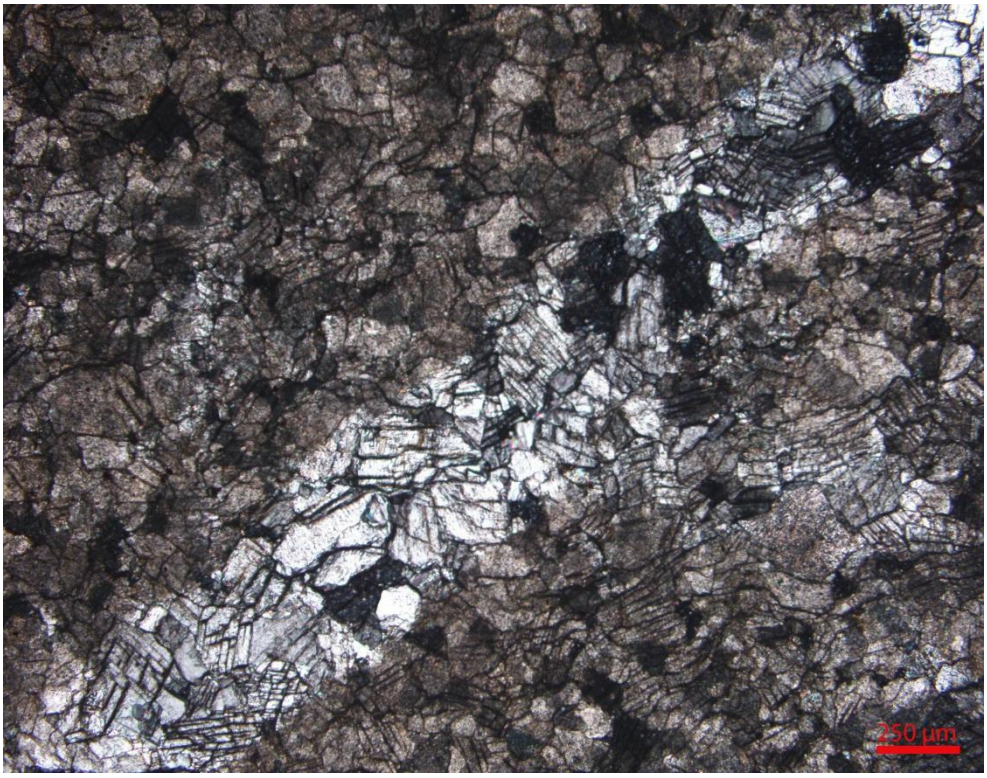


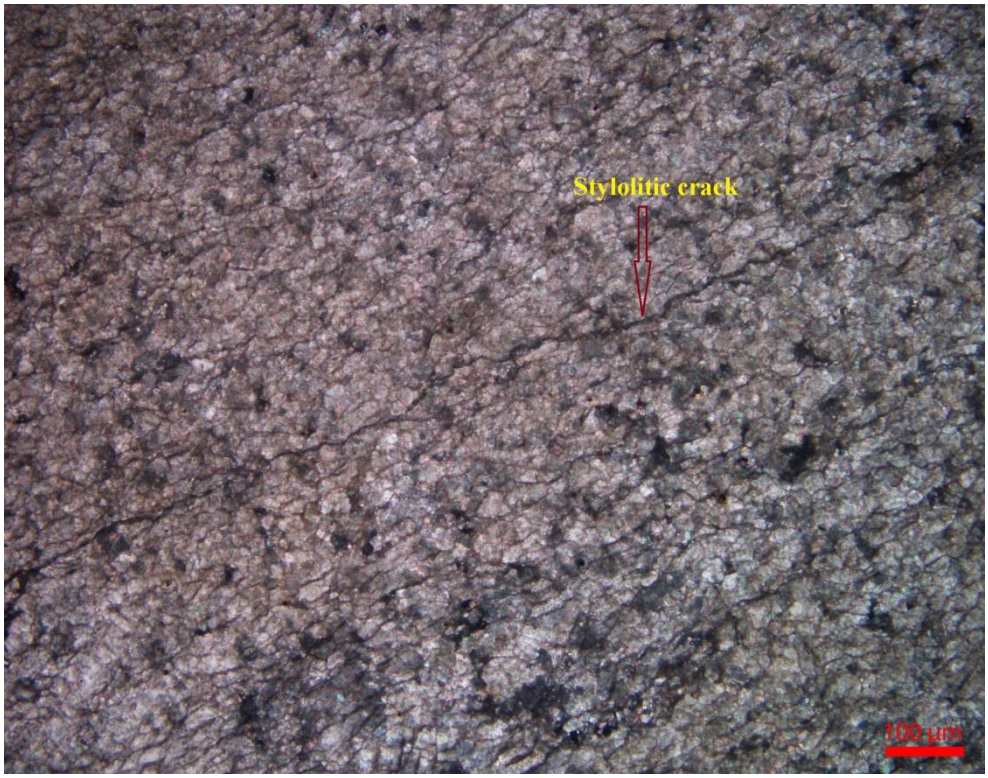
Figure 2: Photograph showing of outcrop of dolomite in the block area

Table No. 7.3
Summary of the petrographic study done by Petrology Laboratory, MECL

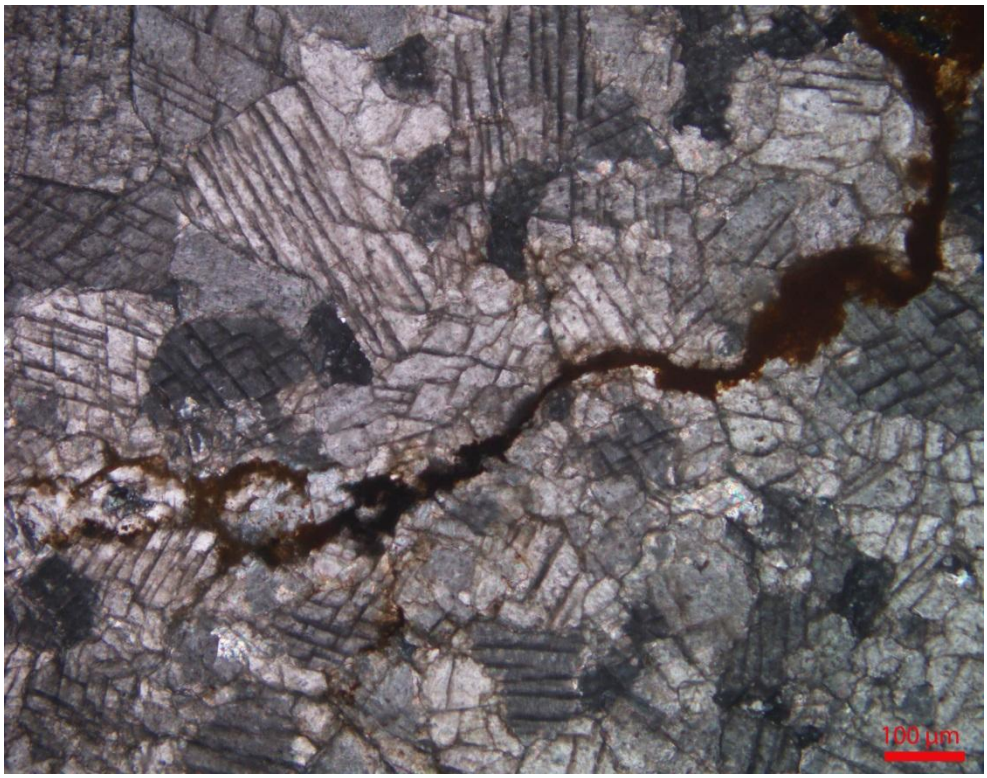
S No	Sample no	Borehole	From (m)	To (m)	Rock type identification
1	MC/PET/01	MMC-02	44.66	44.73	Dolostone (Dolomite)
2	MC/PET/02	MMC-03	26.75	26.80	Dolostone (Dolomite)
3	MC/PET/03	MMC-05	47.95	48.00	Dolostone (Dolomite)
4	MC/PET/04	BED ROCK	-	-	Dolostone (Dolomite)
5	MC/PET/05	BED ROCK	-	-	Dolostone (Dolomite)



Pmg-1: Photomicrograph showing very fine opaques segregated in zones in dolostone as seen under crossed nicols. (**Specimen No. : MC/PET/03, Magnification : 100X)**



Pmg-2: Photomicrograph showing stylolitic cracks within dolostone as seen under crossed nicols. **Specimen No.: MC/PET/03** **Magnification : 100X**



Pmg – 3: Photomicrograph showing ferruginous fillings within dolostone as seen under crossed nicols. **Specimen No. : MC/PET/04** **Magnification : 100X**

Dolomite was intersected in borehole MMC-01, MMC-02, MMC-03 & MMC-05. With interception of the maximum thickness of 50m in MMC-05 and minimum thickness of 41m in MMC-02. The analytical values ranges from 32.35 to 33.35 % CaO, 18.28 to 19.06% MgO and 0.74 to 1.96% SiO_2.

Figure 3: Photograph showing cores of dolomite zone from 10.00m to 15.00m in Bh. MMC-05

Figure 4: Dolomite exposures in the central part of the block

7.5.0 BLOCK STRUCTURE AND MINERALIZATION

7.5.1 The Dolomite beds block exhibit a consistent structural alignment with the associated units, maintaining a strike direction of $N20^0W$-$S20^0E$ to N–S and dipping 5° to 20° towards north east direction. This uniformity in orientation suggests that lithologsy was subjected to the same tectonic regime, likely during a regional phase of gentle folding or tilting.

7.6.0 BEDDING AND DIP CHARACTERISTICS

7.6.1 The gentle northeasterly dip indicates a monoclinal structure, where the strata have been tilted uniformly without significant folding or faulting.

7.6.2 The $N20^0W$-$S20^0E$ to N–S strike aligns with regional structural trends observed in the surrounding sedimentary basins, possibly influenced by basement lineaments or paleostress orientations.

7.6.3 Fracturing and Jointing

7.6.3.1 Surface exposures of dolomite show well-developed joint sets, often orthogonal to the bedding planes.

7.6.3.2 The presence of Mottled structure (elephant skin weathering) - a characteristic surface pattern caused by differential weathering along microfractures - further supports the idea of intensive surface fracturing and prolonged subaerial exposure.

Figure 5: Mottling structure and joints in the outcrop of Dolomite in the block area

Figure 6: The exposure shows a surface with distinct light-coloured, rounded to irregular patches within a grey carbonate matrix. These features represent stromatolitic/oolitic textures or diagenetic nodules, indicating shallow-marine depositional conditions

7.6.4 Structural Controls on Mineralization

7.6.4.1 The alignment of dolomite and limestone beds, along with the presence of two active mines to the north east and south east, suggests the structural continuity. One mine located in the north east direction towards up dip side and another mine is located south east direction and it is falls in down dip direction.

7.6.5 Tectonic Implications

7.6.5.1 The gentle dips and consistent strike direction imply that the area has experienced low-intensity tectonic deformation, possibly related to basin-wide subsidence or mild compressional forces during the Proterozoic or early Phanerozoic.

7.7.0 MINERALISATION IN THE BLOCK

7.7.1 The Mundra–Chilai Block predominantly hosts dolomite mineralization with minor limestone development. Drilling data indicates that dolomite was consistently intersected in four boreholes (MMC-01, 02, 03 & 05) with an average thickness of 48m, confirming its laterally persistent and regionally extensive nature.

Limestone horizons occur only in localized pockets, observed in boreholes MMC-02 (2m) and MMC-03 (2m), suggesting discontinuous and lensoidal development within the dolomite sequence. In the north-eastern part of the block, beyond the Vaidarbha River, coal (Gondwana formation) has been intersected in borehole MMC-04; therefore, limestone or dolomite is absent in this area.

The overall deposit shows a simple bedded character, where thick, laterally continuous dolomite horizons dominate the stratigraphy. The limestone intercalations are limited and patchy, not affecting the overall continuity of dolomite. This suggests that the mineralization style is stratiform, hosted within a relatively uniform lithologsical package, with no major structural complexity.

CHAPTER 8

8.0.0 PREVIOUS WORK

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

8.1.1 The earliest mention of limestone is by Jenkin (1833) and Voysey (1833) dealing with the geology and mineralogy of the Yavatmal area, Central provinces. The geology of the area was first studied by T.W.H. Hughes, in the year 1877 who mapped the limestone bands as Penganga beds in south of Yavatmal district as Vindhyans. B.N. Sinha mapped the toposheet no 56 I/13. Later workers like A.K.R. Hemmady (1964) considered the Penganga beds to be representing transitional state between Vindhyan and Cuddapah. R.K. Agarwal and V Subba Rao of Geological Survey of India, carried out systematic geological mapping in parts of toposheet no 56 I /09, 56 I/13 and 56 I/14 in field season 1984-85 and mapped the limestone bands as Penganga beds.

8.1.2 M/s Bajrang Sales Pvt. Ltd, Distt: Yavatmal was granted a prospecting License for Limestone over an area of 39.98 Ha. in the village Hiwardhara, Tehsil- Wani, District Yavatmal, Maharashtra. Prospecting work was conducted in the area, which includes reconnaissance survey followed by prospecting viz., geological mapping and pitting. Preliminary survey and geological mapping have indicated the potentiality of the limestone deposit in the area which has been confirmed by the prospecting. Total eight no of pits have been sunk in the current exploration area. The analysis of the samples is given below.

Pit No.	SiO_2	CaO	MgO	Fe_2O_3	Al_2O_3	LOI
1	5.1	31.90	17.30	0.20	0.80	43.91
2	6.5	47.20	3.50	0.13	0.68	41.00
3	2.8	50.50	2.60	0.10	0.50	42.55
4	3.2	51.00	2.00	0.15	0.65	42.30
5	3.0	30.50	19.30	0.20	0.70	45.00
6	8.0	44.50	5.40	0.30	1.00	40.50
7	7.0	46.10	4.10	0.25	0.90	40.70
8	4.5	48.20	4.60	0.15	0.75	41.80

8.1.0 Geologists from MECL has undertaken pre field visit in the proposed area for preparing exploration proposal, during the visit about 4 nos. of samples were collected and analyzed for 9 elements. The analysis of the samples are given below.

Sample No.	CaO%	MgO%	Al_2O_3%	SiO_2%	Fe_2O_3%	SO_3%	P_2O_5%	K_2O%	LOI%
S-9	52.05	1.32	0.59	3.59	0.57	0.20	0.03	0.28	41.09
S-14	54.50	0.89	0.26	0.81	0.28	0.04	0.03	0.03	42.97
S-15	34.27	16.62	0.54	1.76	0.34	0.02	0.05	0.07	46.02
S-16	52.51	0.69	0.91	3.68	0.41	0.08	0.01	0.22	41.38

CHAPTER - 9

9.0.0 AERIAL GROUND GEOPHYSICAL, GEOCHEMICAL EXPLORATION

9.1.0 During present investigation no Aerial, ground geophysical, geochemical exploration has been carried out.

CHAPTER - 10

10.0.0 EXPLORATION UNDERTAKEN DURING CURRENT INVESTIGATION

10.1.0 INTRODUCTION

10.1.1 The Mundra-Chilai Block falls in Survey of India Toposheet No. 56 I/13. Chilai, Kundra, Krishnapur, Mukutban, Ganeshpur and Dunki are villages in and around the block which belongs to Tehsil- Wani, District - Yavatmal, State - Maharashtra.

10.1.2 The Mundra–Chilai Block has been proposed on the basis of lapsed lease areas identified by the State Government of Maharashtra, which were originally granted under Section 10A(2)(b) of the MMDR Act, 2015. However, following the 2021 amendment to the Act, all such Prospecting License (PL) reports were declared ineligible, mandating allocation through auction. Further, these PL reports are required to be evaluated to confirm the level of mineral evidence (G4, G3, etc.) as per the provisions of the Minerals (Evidence of Mineral Contents) Rules, 2015.

10.1.3 The Directorate of Geology and Mining (DGM), Government of Maharashtra, requested MECL to take up the exploration in lapsed 10A(2)(b) lease mining lease areas vide letter no. Tech/1848/2023/260, Dated 23/01/2024.

10.1.4 MECL formulated exploration proposal involving 300m drilling in 06 boreholes at G3 level of exploration in and around Chilai & Kundra villages of Tehsil- Wani, District - Yavatmal.

10.1.5 Exploration Proposal (G3) for Mundra-Chilai Block (4.38 sq.km) was submitted and deliberated in 70th TCC-1 meeting held on 24th & 25th October, 2024. Committee, noted 10A(2)(b) cases and request of Govt of Maharashtra for exploration of these PL areas through MECL. Accordingly, 70th TCC-1 committee recommended (Annexure-VIII A) the project proposal titled as "Preliminary Exploration (G3 Level) for Limestone in Mundra-Chilai Block (4.38 sq.km), Yavatmal District, Maharashtra".

10.1.6 On recommendation of 70th TCC-1, 38th EC of NMET meeting held on 29th November 2024 approved this project with total cost of 90.63 lakh. (Annexure-VIII B).

10.2.0 OBJECTIVES OF INVESTIGATION

10.2.1 The preliminary exploration was proposed with following objectives in Mundra-

Chilai Block are as follows:

(a) To carry out detailed Topographical Survey and Geological mapping on 1:4000 scale over an extent of 4.38 sq.km.

(b) To delineate the strike and depth continuity of the limestone by drilling of vertical boreholes of 05 numbers on 800m strike interval.

(c) To carry out exploration as per Minerals (Evidence of Mineral Contents) Rule-2015 (Amended 2021) & Mineral (Auction) Rules-2015 (Amendments).

(d) The proposed exploration programme will demarcate limestone and dolomite zones of various grades, as per UNFC norms and estimation of limestone/dolomite resources which in turn will facilitate the State Govt. for auctioning of the block.

10.3.0 DETAILS OF WORK

10.3.1 After receipt of approval from NMET, MECL has carried out exploration activities in Mundra-Chilai Block. The details, nature and quantum of work proposed Vs achievement is given below

Table No. 10.1
Quantum of Work for Proposed Vs Achieved in Mundra-Chilai Block

Sl. No.	Item of Work	Unit	Target	Achieved
1	Topographic Survey & Geological Mapping on 1:4000 scale (Ha)	sq.km	4.38	4.38
2	Boundary and borehole demarcation with DGPS	Nos	13	12
3	Exploratory Drilling	m.	300.00 06 Bhs	230.00 05 Bhs
4	**Laboratory Studies**			
	i) Chemical Analysis; Primary samples for 9 radicals, CaO, MgO, SiO_2, Fe_2O_3, Al_2O_3, SO_3, P_2O_5, K_2O, Na_2O & LOI by XRF. (Borehole core samples)	Nos.	280	98
	ii) External Check (NABL) samples (10% of Primary samples) for analysis of for 9 radicals, CaO, MgO, SiO_2, Fe_2O_3, Al_2O_3, SO_3, P_2O_5, K_2O, Na_2O & LOI by XRF	Nos.	28	10
5	**Physical Studies**			
	b) Petrological Studies	Nos.	5	5
	b) Bulk Density Determinations	Nos.	2	2
6	Report Preparation (5 Hard copies with one soft copy)	Nos.	1	1

Sl. No.	Item of Work	Unit	Target	Achieved
7	Preparation of Exploration Proposal (5 Hard copies with a soft copy)	Nos.	1	1

10.4.0 EXPLORATION ACTIVITIES TAKEN UP

10.4.1 Exploration activities viz., Geological Mapping, Topographical Survey on 1:4000 scale, exploratory drilling in 05 no of boreholes were carried out along with associated analytical works.

10.4.2 MECL commenced exploration activities on 20.02.2025 and completed with all field activities on 30.06.2025.

10.4.3 Geological mapping was carried out at 1:4,000 scale for the entire area of 4.38 sq. km. depicting the lithologs, structure and surface mineralization signatures. Broad lithologsical units and litho-contacts have been mapped with the help of handheld GPS. Attitude and structural features of rocks like bedding, folds and joints has been recorded by Brunton Compass. General Strike of the litho-units $N20^0W$-$S20^0E$ to N-S with dip angle 5°- 20° due northeasterly. The readings recorded in the field were plotted in the geological map and submitted as (Plate III).

10.4.4 Topographical survey, exploratory drilling and borehole core sampling was carried out concurrently. The analytical / laboratory studies were carried out in laboratories of MECL and JNARDDC, Nagpur (NABL accredited laboratory).

10.4.5 Exploratory boreholes core was systematically logged as per geological characters i.e., grain size, rock type, structural, lithologsical and mineralogical. Detailed lithologs and summarized lithologs are submitted as Annexure - IIA, IIB.

10.5.0 DETAILS OF SURFACE SAMPLING, DRILLING ETC.

10.5.1 Geologists from MECL has undertaken pre field visit in the proposed area for preparing exploration proposal, during the visit about 4 nos. of samples were collected and analyzed for 9 elements.

10.5.2 MECL has collected 2 no of bedrock samples in the block for petrographic studies.

10.5.3 Total 98 numbers of primary core samples are generated from the drilled boreholes, which were analysed for 10 radicals i.e., CaO, MgO, SiO_2, Fe_2O_3, Al_2O_3, SO_3, P_2O_5, K_2O, Na_2O & LOI by XRF method and compiled as

Annexure-IIIA.

10.5.4 10% samples of primary drill core samples, about 10 nos. were submitted for external check analysis samples for 10 radicals i.e. CaO, MgO, SiO_2, Fe_2O_3, Al_2O_3, SO_3, P_2O_5, K_2O, Na_2O & LOI by XRF method. Analytical results are placed at Annexure-IIIB.

10.5.5 A total of 5 no. of samples were studied for petrological and 2 no. of samples for bulk density determination which is enclosed as Annexure-V and VI respectively.

CHAPTER - 11

11.0.0 LOCATION OF DATA POINTS

11.1.0 ACCURACY AND QUALITY OF SURVEY USED TO LOCATE BLOCK BOUNDARY AND DRILL HOLES

11.1.1 The entire survey work has been carried out with the help of DGPS (Make-Trimble DGPS, Model-R8S). With the help of DGPS, Co-ordinates of surface features i.e. roads, village boundaries, water bodies, base station and block co-ordinates i.e. 7 nos. of block boundary cardinal points with R.L. has been determined (Annexure IA) and topography along with geological map is presented (Plate-III). Contour interval in topographical map is kept at 2m. The topographical survey was done in PPK (Post Precision Kinematics) mode. Positional (horizontal) accuracy of the survey is 3mm while the elevation accuracy is 2.5mm in PPK mode.

11.1.2 DGPS survey was carried out for boreholes drilled by MECL (Annexure IB). The base station was utilized for the fixing of the boreholes on the ground level. The coordinates of base station is given in Table-11.1.

Table No. 11.1
Co-ordinates of the base station for DGPS survey of Mundra-Chilai Block

Point Name	UTM Zone-45North		Elevation (Meter)
	Easting (Meter)	Northing (Meter)	
GB-1	2194298.229	277365.508	229.101

11.2.0 QUALITY AND ADEQUACY OF TOPOGRAPHIC CONTROL

11.2.1 Block boundary co-ordinates, the surface features, contour points and borehole points were surveyed by DGPS. The topographical survey was done in PPK (Post Precision Kinematics) mode. Positional (horizontal) accuracy of the survey is 3mm while the elevation accuracy is 2.5mm in PPK mode.

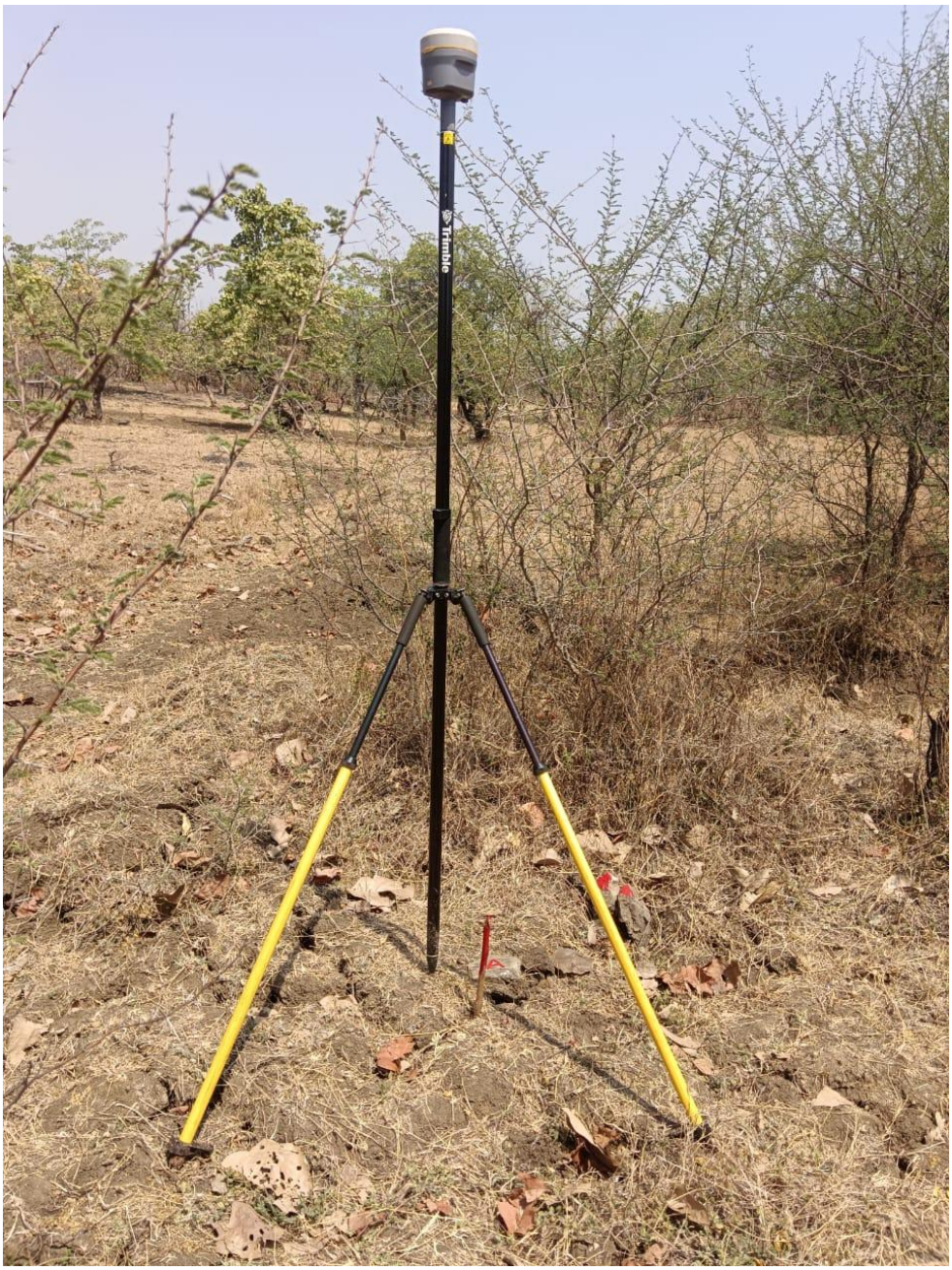


Figure 7: Fixing of block boundary corner point “A” with the help of DGPS

CHAPTER - 12

12.0.0 SAMPLING TECHNIQUES

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

12.1.1 The present work has been formulated to undertake Preliminary Exploration (G3 stage) for limestone in the Mundra–Chilai Block. Given that nearly 40% of the block is soil covered with scanty outcrops, exploration was largely dependent on subsurface core drilling to evaluate lithologsy and mineralization. A total of five boreholes were drilled for 230 m cumulative depth, intersecting dolomite as the dominant litho unit with localized limestone horizons. In addition, two bedrock samples were collected from surface exposures for petrographical studies.

12.1.2 A total of 98 core samples and 10 nos. external check samples were generated and analysed for 10 radicals, CaO, MgO, SiO_2, Fe_2O_3, Al_2O_3, SO_3, P_2O_5, K_2O, Na_2O & LOI by XRF method. Further 3 no of core samples were studied for petrological and 2 no of core samples for bulk density.

12.1.3 Borehole core sampling work has been carried out in the presence of qualified geologist and sampling technician. Geologist marked the limestone/dolomite zones for sample preparation and under supervision of sampling technical sample was generated.

CHAPTER - 13

13.0.0 DRILLING TECHNIQUES AND DRILL SAMPLING EMPLOYED

13.1.0 DRILLING TYPES AND DETAILS

13.1.1 MECL has executed core drilling using RD 60 (MEC 347 & 353) coring drill rigs, A total 5no. of vertical boreholes with a cumulative meterage of 230.00 were drilled. The details coordinates of boreholes are given in Annexure IB and summary of borehole is given in Table-13.1.

Table No. 13.1
Details of Co-ordinates (in WGS-84), Reduced Levels of boreholes drilled by MECL, Mundra-Chilai Block

Sl. No.	Borehole No	Northing (m)	Easting (m)	Elevation (m)	Date of Commencement	Date of Closure	Total Depth (m)
1	MMC-01	280995.781	2194905.050	222.470	20.02.2025	01.03.2025	50.00
2	MMC-02	282611.194	2195534.208	199.164	03.03.2025	13.03.2025	50.00
3	MMC-03	281982.667	2194862.294	214.528	29.03.2025	04.04.2025	50.00
4	MMC-04	282064.605	2196093.037	203.173	14.04.2025	17.04.2025	30.00
5	MMC-05	281504.915	2195597.263	206.229	19.04.2025	29.04.2025	50.00
Total Drilling meterage							**230.00**

13.1.2 Drilling was carried out using NQ size with single barrel wire line, wet core drilling method. In each borehole, as NW casing was set from initial 3.00m and upto 26.00m to stabilize the upper loose strata before advancing drilling in NQ size upto final depth.

13.1.3 All the boreholes except MMC-04 were drilled to a vertical depth of 50m RL as per approved NQT of NMET, No deviation survey was undertaken as boreholes were vertically drilled.

Figure 8: Picture showing Conventional drill rig MEC- 352 (RD- 60) at drill site for Bh. MMC-03

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

13.2.1 The core samples have been recorded properly and the detailed borehole wise run wise lithologs and summarized lithologs for boreholes are given in Annexure-IIA and Annexure-IIB respectively. The run wise lithologs of drilled core as well as the cuttings from boreholes have helped in discerning the physical characters like colour, shape, size and nature of the mineralisation as well as texture, structural features and identification of different litho units.

13.2.2 The mineralised zones /length recorded during the geological core logging have been sampled for Limestone/Dolomite and analysed for 10 radicals. The primary samples had been marked in the mineralized zones intersected in the borehole based on visual inspection/lithologsy and in general the sample length has been kept as 2.00 m for all the boreholes. The details of analysis of primary core samples are given in Annexure-IIIA.

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

13.3.1 The entire core drilling has been done by NQ size diamond drill bit with single barrel wire line, wet core drilling method to optimize sample recovery. To stabilize the upper loose formation NW casing was set in each borehole ranging from 3.00m to 26.00m depending on lithologsical conditions. The polymer was used as drilling fluid to flush out the cuttings and stabilize the borehole wall. The drilling fluid also works as a coolant to avoid burning of drill bits. Core recovery was consistently maintained in limestone/dolomite horizon, however in case of weathered, loose and fractured zone and in solution cavities, the core recovery was low. Whenever core recovery is less, the grade of the recovered portion has been extrapolated over the non-recovered section. However, all the precautions like modulated water pressure, proper liner, optimum head pressure and the hands of an expert drilling technician had been taken to maintain the quality of drilling.

13.4.0 ROCK QUALITY DESIGNATION STUDIES

13.4.1 Rock Quality designation (RQD) is a modified measure of the degree of jointing or fracture in a rock mass, measured as a percentage of the drill core in lengths of 10 cm or more. High- quality rock has an RQD of more than 75%, low quality of less than 50%. Rock quality designation (RQD) has several definitions. The most widely used definition was developed in 1964 by D.U.Deere. It is the borehole core recovery percentage incorporating only pieces of solid core longer than 100 mm in length measured along the centre line of the core.

13.4.2 Deere (1964) defined Rock Quality designation (RQD) as the sum of the length of all core pieces more than 10cm long as a percentage of the total core length.

RQD%=(Length (m) of core pieces ≥10 cm/Total length(m) core run)×100

13.4.3 When calculating RQD, it is important to consider only naturally occurring discontinuities (bedding, fracture, faults, joints, shear zones etc.) in the rock mass. In weakened / addition, only sound bedrock is used in the calculation of RQD, excluding or weathered rock. It is specified that a minimum of NQ size core obtained with double tube core barrel for determination of RQD.

13.4.4 The basic classification comparing RQD with a qualitative rock quality and description of the rock is given in Table- 13.2.

Table 13.2:
Classification Comparing RQD with qualitative rock quality

Rock Quality	RQD (%)	Description of Rock
Excellent	90-100	Intact rock
Good	75-90	Massive
Fair	50-75	Blocky and foliated
Poor	25-50	Shattered, very blocky and foliated
Very Poor	0-25	Crushed

13.4.5 **Total Core Recovery (TCR)**

Total core recovery (TCR) is defined sum of all measurable core recovered over one drill run. The mensuration is given below:

Recovery = [Measurable core recovered length (m)/Drill run length (m)]×100

13.4.6 The RQD conducted on all 5 no. of boreholes, which has been given in Table 13.3 The average of RQD is falls in "Poor" category as per D.U.Deere classification.

Table 13.3:

Borehole wise RQD as per Deere classification

Sl.No.	Borehole No.	Soil thickness	Thickness of litho	RQD Thickness	RQD %	Category
1	MMC-01	2.50	47.50	22.05	46.42	Poor
2	MMC-02	3.00	47.00	5.48	11.66	Very Poor
3	MMC-03	1.00	49.00	14.12	28.82	Poor
4	MMC-04	7.00	23.00	8.97	39.00	Poor
5	MMC-05	0.00	50.00	10.82	21.64	Very Poor

13.5.0 WHETHER THE RELATIONSHIP EXISTS BETWEEN SAMPLE RECOVERY AND GRADE

13.5.1 Core recovery in limestone/dolomite horizon is >90%, hence grade analysed for Limestone/dolomite zone is reliable.

13.6.0 CORE LOGGING

13.6.1 The entire core recovered by drilling was logged systematically in detail describing lithologsical units that can be observed by visual inspection. The details of lithologsy, grain size, colour, texture, structural features, presence of intercalations and cavities have been recorded. Wherever the recovery is less, extrapolations of drilled depth were done on proportionate basis considering the physical characteristics of individual units recovered. All the cores were kept and preserved properly in the GI core boxes of specifications given by NMET following “Book Pattern”. The detailed run wise lithologs and summarized lithologs for boreholes are given in Annexure IIA and Annexure IIB respectively.

CHAPTER - 14

14.0.0 SUB SAMPLING TECHNIQUES AND SAMPLE PREPARATIONS

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

14.1.1 The core sampling has been carried out for entire mineralized limestone/dolomite zones/length intersected in the boreholes. Samples were marked and drawn from limestone/dolomite zones marked on the basis of visual basis. Then the core has been split into two equal halves by hydraulic core splitter in such a way that the core is uniformly split into two equal halves. The whole quantity of half portion of the sample as marked while logging is crushed to (-) 200 mesh size and about 500g representative sample of (-) 200 mesh was drawn by coning and quartering method of gradual size reduction with the help of crusher and pulveriser. Out of 500gm, 100gm each were drawn for Primary Chemical analysis of 10 radicals (CaO, MgO, Al_2O_3, SiO_2, Fe_2O_3, SO_3, P_2O_5, K_2O, Na_2O and LOI) at Chemical Laboratory, MECL Nagpur. The remaining 400g fraction was kept for external check sample analysis and future reference purpose.

14.1.2 During the present exploration, a total of 98 nos. of primary samples, 10 nos. of external check samples for limestone/dolomite mineralization were prepared. 10 numbers of external check samples for same 10 radicals have been analysed at Jawaharlal Nehru Aluminium Research Development and Design Centre (JNARDDC) Nagpur (A NABL accredited Laboratory), the results along with comparison with primary core samples are placed in Annexure-IIIB. The details of analysis of primary core samples are given in Annexure- IIIA.

14.2.0 NATURE, QUALITY AND APPROPRIATENESS OF THE SAMPLE PREPARATION TECHNIQUE

14.2.1 The details of sampling procedure for primary samples are described in para 14.1.0. Quality of the sample preparation is maintained by proper cleaning, maintenance of the equipment and proper crushing, sieving and coning and quartering of samples. For sample preparation, proper technique and expertise has been used.

14.2.2 The adopted methodology is consistent with standard exploration practices prescribed by NMET and international sampling protocols (e.g., UNFC). The

combination of half-core sampling, controlled splitting, fine pulverization, and coning & quartering minimizes sampling bias and enhances reproducibility of results. The inclusion of external check samples further strengthens the **QA/QC framework**, ensuring analytical accuracy and comparability.

14.3.0 QUALITY CONTROL PROCEDURES ADOPTED

14.3.1 Systematic quality control measures were implemented throughout the exploration program to ensure the reliability and accuracy of results. The primary core samples were collected from the entire mineralized zones intersected in the boreholes and prepared at a centralized mechanized sampling unit under the strict supervision of qualified sampling technicians, following standard sampling protocols. Similarly, all external check samples were generated under the same controlled conditions to maintain uniformity and minimize bias. Prior to sampling, all boreholes were thoroughly logged for lithologsy, texture, structure, and mineralization, and core samples were collected at controlled intervals of approximately 2m or along lithologsical boundaries. Each sample was properly sealed, labeled, and documented with depth coordinates to establish a clear chain of custody.

14.4.0 MEASURES TAKEN TO ENSURE THE SAMPLING IS REPRESENTATIVE OF THE IN-SITU MATERIAL COLLECTED

14.4.1 All the primary samples have been marked and prepared from mineralised cores. During the preparation of primary samples, the mineralised cores have been studied meticulously and samples have been marked properly. These mineralised cores are subjected for preparation of primary samples as per the sampling procedure for primary samples are described in Para 14.1.0. The proper marking of primary samples from drilled cores and following standard procedure for sample preparation and >90% of core recovery shows the representative samples have been collected from the in-situ materials.

14.5.0 WHETHER SAMPLE SIZES ARE APPROPRIATE TO THE GRAIN SIZE OF THE MATERIAL BEING SAMPLED

14.5.1 The primary samples have been prepared (-) 200 mesh size and all the other samples have been prepared from primary samples. As per the previous studies in the area, (–) 200 mesh size is appropriate for the analysis of limestone/dolomite etc. mineralization in the block area.

CHAPTER - 15

15.0.0 QUALITY OF ASSAY DATA AND LABORATORY TESTS

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

15.1.1 The primary samples from limestone/dolomite mineralized zones have been analyzed for 10 radicals i.e. CaO, MgO, Al_2O_3, SiO_2, Fe_2O_3, SO_3, P_2O_5, K_2O, Na_2O and LOI by XRF method at Chemical Laboratory of MECL, Nagpur and External check samples for same 10 radicals have been analysed at Jawaharlal Nehru Aluminium Research Development and Design Centre, (JNARDDC) Nagpur (A NABL accredited Laboratory).

15.2.0 PRIMARY AND CHECK SAMPLE STUDIES OF BOREHOLE SAMPLES

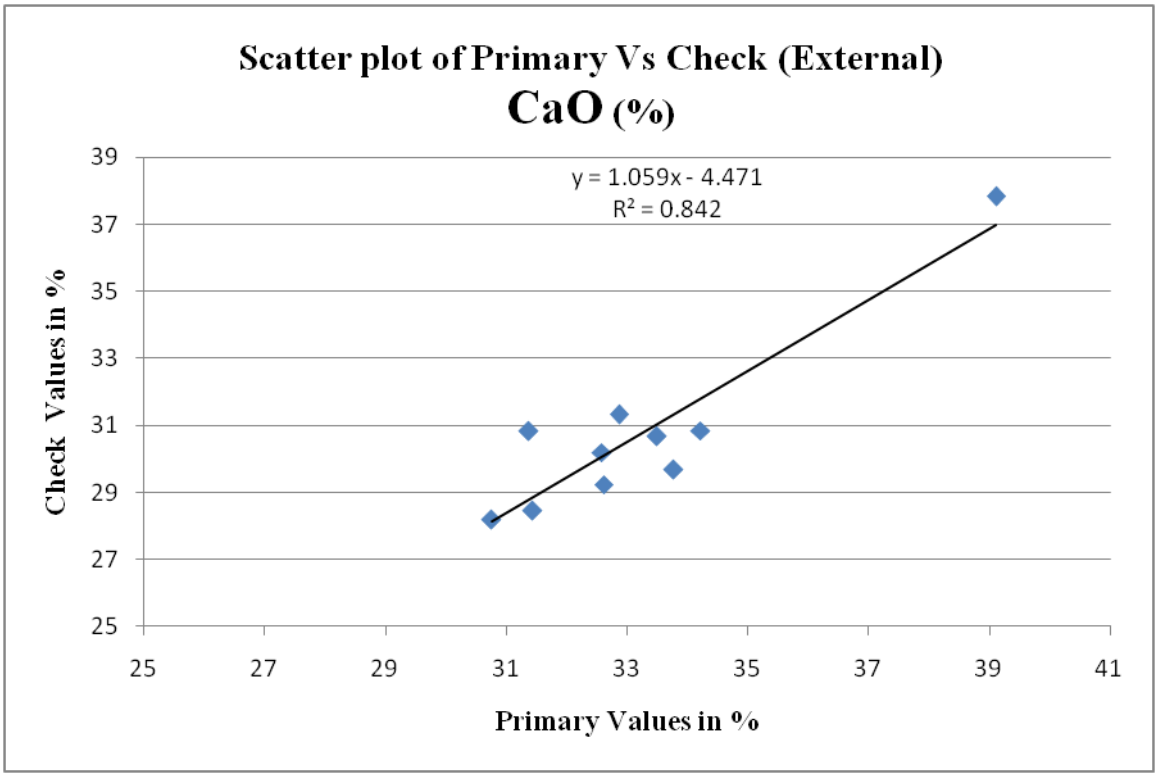
15.2.1 A total of 10 samples as external check samples were analyzed in the Chemical Laboratory of Jawaharlal Nehru Aluminium Research Development and Design Centre, for 10 radicals (CaO, MgO, Al2O3, SiO2, Fe2O3, SO3, P2O5, K2O, Na2O and LOI by XRF). Results and comparison with primary samples are provided in the Annexure-IIIB.

15.2.2 In order to assess the bias and inaccuracies in analytical determination as well as to check the repeatability of analysis, 04 borehole samples were analysed for external check analysis out of 98 primary samples for limestone/dolomite. The comparative studies for CaO external check samples are tabulated in Table-15.1 and scatter plot are represented as Text Figure-4.

15.2.3 The R^2 value = 0.842, which is very close to 1. This means that 91.8% of the variation in the check values can be explained by the primary values. It indicates a strong linear correlation between the two datasets. Since the slope is close to 1 and R^2 is high, the check samples are highly consistent with the primary values. The small deviation (slope slightly <1) suggests that the check values tend to be slightly lower than the primary values on average. This could indicate minor systematic differences between primary and check sample analyses, such as small lab measurement biases.

Table-15.1
Comparison of Primary vs. External Check samples for CaO in Mundra-Chilai (G3) Block, District Yavatmal, Maharashtra

COMPARISON INDEX	CaO %	
	Primary	Check
No. of Sample Pairs	10	
Arithmetic Mean	33.22	30.726
Standard Deviation	2.228	2.572
Std. Error of Mean	0.704	0.813
Variance	4.963	6.616
Mean of Deviation	2.494	
Standard Deviation (Error)	1.03	
Correlation Coefficient	0.918	
Mean Absolute Error	2.494	
Mean Relative Random Error	7.508%	
Paired T value	7.654	
F - test value	0.75	



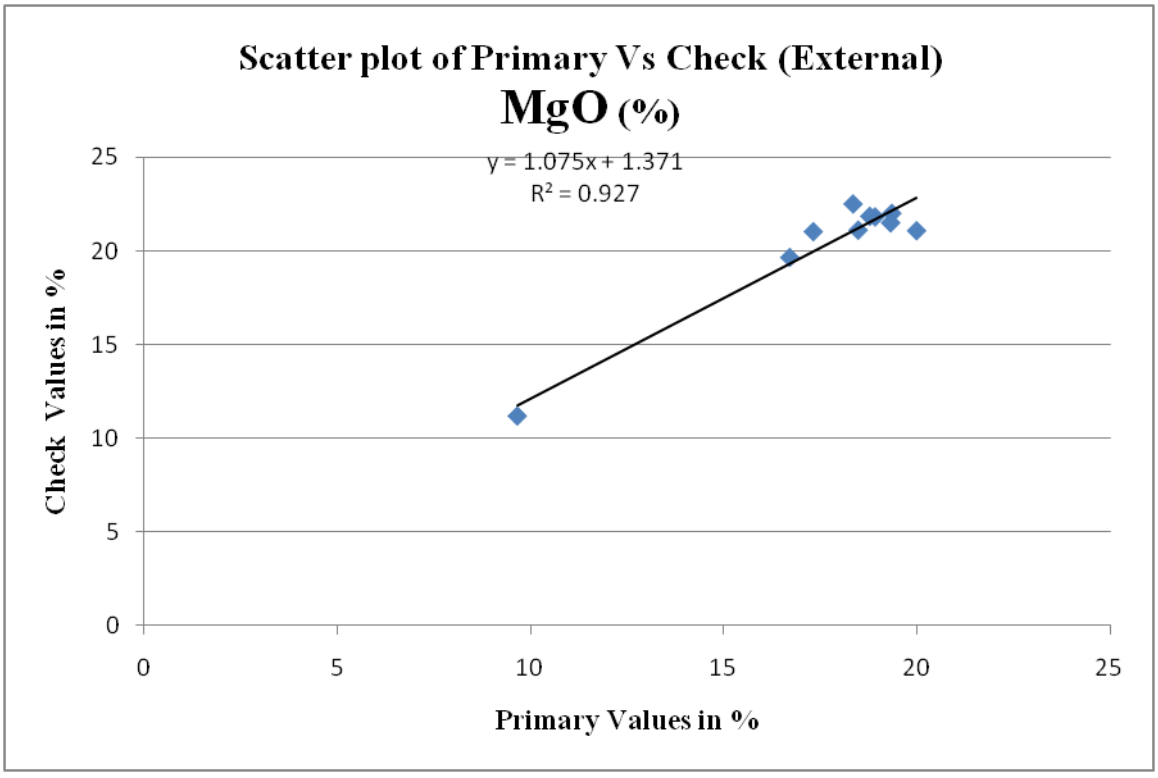
Text Figure 4: Scatter Plot of Primary and External Check Samples for CaO%

15.2.4 The data set for primary Vs external check analysis comprises 10 pairs of samples. The Table-15.1 shows that the difference in arithmetic mean is negligible. Correlation coefficient is 0.918, which is in the range of 0.90-1.00 which is very high positive co-relation and indicates a good correlation in

primary and external check analysis.

Table-15.2
Comparison of Primary vs. External Check samples for MgO in Mundra-Chilai (G3) Block, District Yavatmal, Maharashtra

COMPARISON INDEX	MgO %	
	Primary	Check
No. of Sample Pairs	10	
Arithmetic Mean	17.679	20.382
Standard Deviation	2.827	3.157
Std. Error of Mean	0.894	0.998
Variance	7.992	9.967
Mean of Deviation	-2.703	
Standard Deviation (Error)	0.878	
Correlation Coefficient	0.963	
Mean Absolute Error	2.703	
Mean Relative Random Error	15.291%	
Paired T value	-9.735	
F - test value	0.802	



Text Figure 5: Scatter Plot of Primary and External Check Samples for MgO%

15.2.5 The R^2 value = 0.927, which is very close to 1. This means that 96.3% of the variation in the check values can be explained by the primary values. It indicates a strong linear correlation between the two datasets. Since the slope is close to 1 and R^2 is high, the check samples are highly consistent with the primary values.

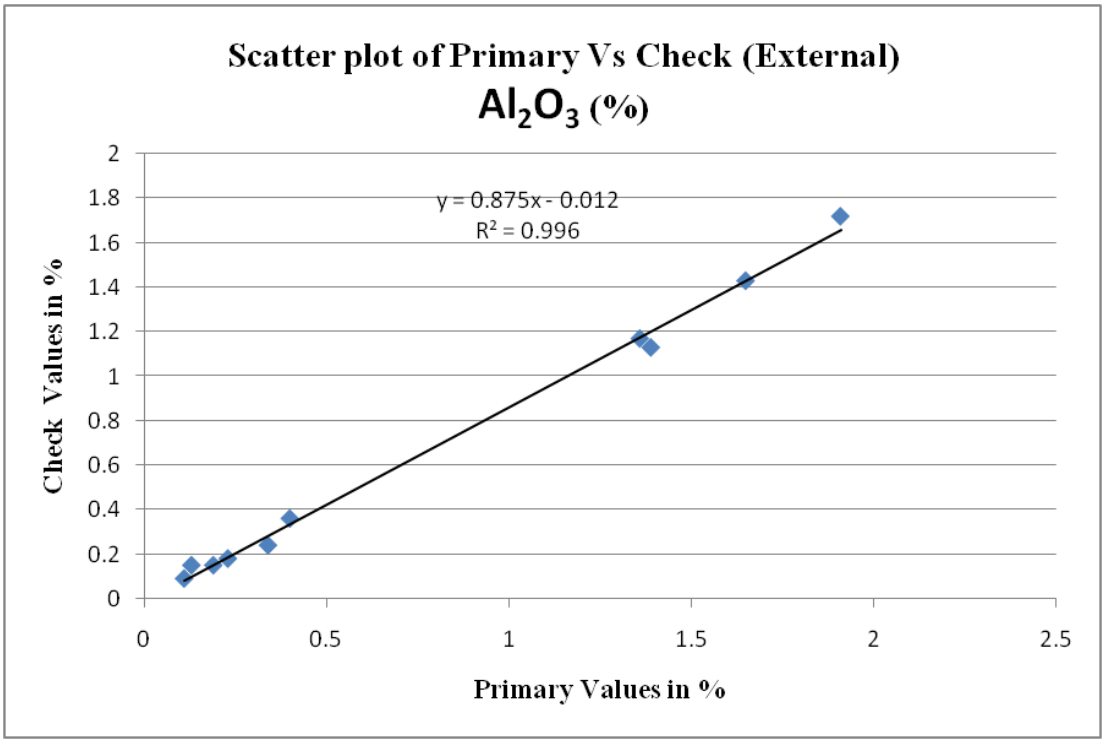
The small deviation (slope slightly <1) suggests that the check values tend to be slightly lower than the primary values on average. This could indicate minor systematic differences between primary and check sample analyses, such as small lab measurement biases.

15.2.6 The data set for primary Vs external check analysis comprises 10 pairs of samples. The Table-15.2 shows that the difference in arithmetic mean is negligible. Correlation coefficient is 0.963, which is in the range of 0.90-1.00 which is very high positive co-relation and indicates a good correlation in primary and external check analysis.

Table-15.3
Comparison of Primary vs. External Check samples for Al_2O_3 in Mundra-Chilai (G3) Block, District Yavatmal, Maharashtra

COMPARISON INDEX	Al_2O_3 %	
	Primary	Check
No. of Sample Pairs	10	
Arithmetic Mean	0.771	0.662
Standard Deviation	0.678	0.595
Std. Error of Mean	0.215	0.188
Variance	0.46	0.354
Mean of Deviation	0.109	
Standard Deviation (Error)	0.093	
Correlation Coefficient	0.998	
Mean Absolute Error	0.113	
Mean Relative Random Error	14.656%	
Paired T value	3.719	
F - test value	1.3	

15.2.7 The R^2 value = 0.996, which is very close to 1. This means that 99.8% of the variation in the check values can be explained by the primary values. It indicates a strong linear correlation between the two datasets. Since the slope is close to 1 and R^2 is high, the check samples are highly consistent with the primary values. The small deviation (slope slightly <1) suggests that the check values tend to be slightly lower than the primary values on average. This could indicate minor systematic differences between primary and check sample analyses, such as small lab measurement biases.

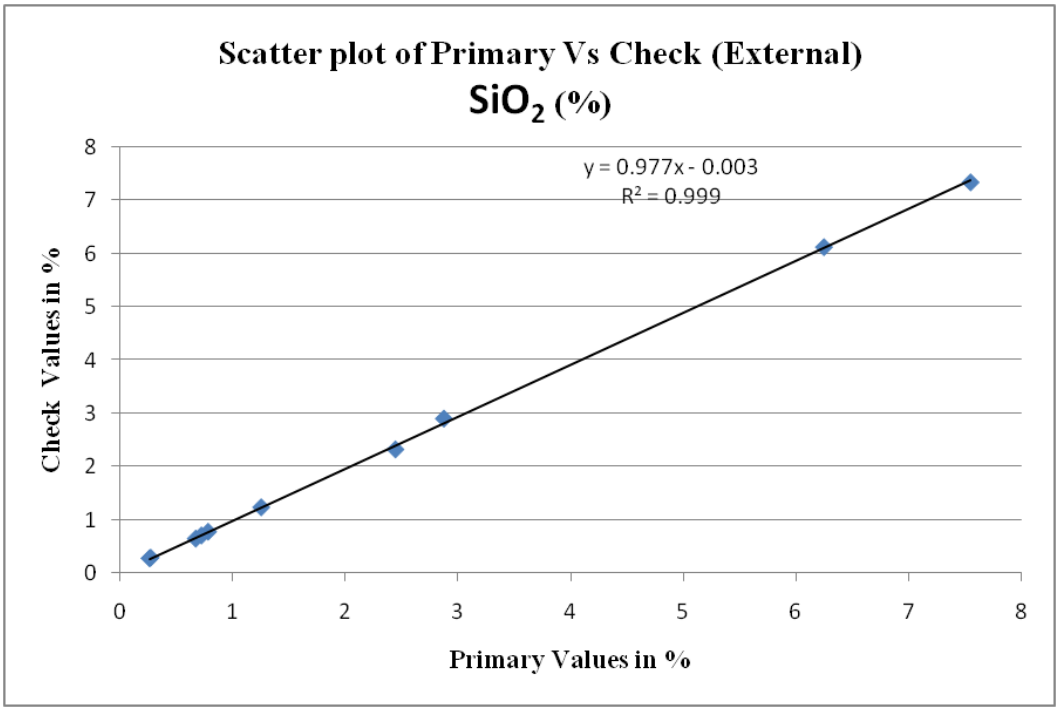


Text Figure 6: Scatter Plot of Primary and External Check Samples for Al_2O_3%

15.2.8 The data set for primary Vs external check analysis comprises 10 pairs of samples. The Table-15.3 shows that the difference in arithmetic mean is negligible. Correlation coefficient is 0.998, which is in the range of 0.90-1.00 which is very high positive co-relation and indicates a good correlation in primary and external check analysis.

Table-15.4
Comparison of Primary vs. External Check samples for SiO_2 in Mundra-Chilai (G3) Block, District Yavatmal, Maharashtra

COMPARISON INDEX	SiO_2 %	
	Primary	Check
No. of Sample Pairs	10	
Arithmetic Mean	2.314	2.259
Standard Deviation	2.453	2.398
Std. Error of Mean	0.776	0.758
Variance	6.017	5.752
Mean of Deviation	0.055	
Standard Deviation (Error)	0.067	
Correlation Coefficient	1.000	
Mean Absolute Error	0.059	
Mean Relative Random Error	2.55%	
Paired T value	2.586	
F - test value	1.046	



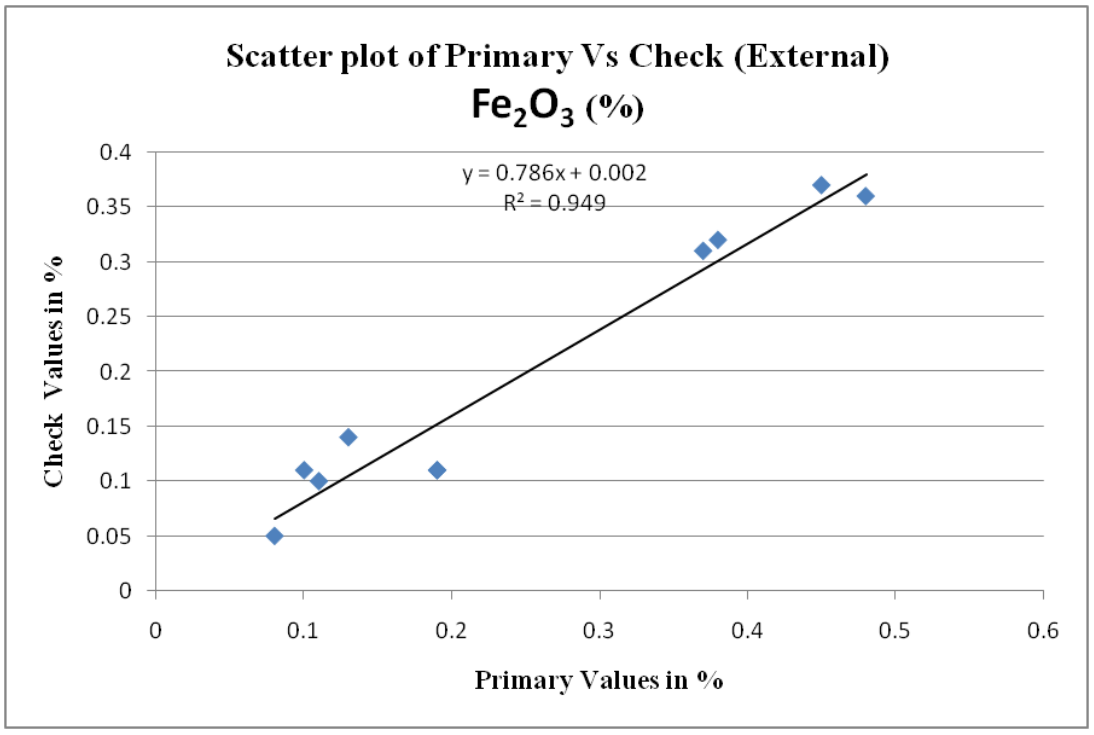
Text Figure 7: Scatter Plot of Primary and External Check Samples for SiO_2%

15.2.9 The R^2 value = 0.999, which is very close to 1. This means that 1% of the variation in the check values can be explained by the primary values. It indicates a strong linear correlation between the two datasets. Since the slope is close to 1 and R^2 is low, the check samples are highly consistent with the primary values. The small deviation (slope slightly <1) suggests that the check values tend to be slightly lower than the primary values on average. This could indicate minor systematic differences between primary and check sample analyses, such as small lab measurement biases.

15.2.10 The data set for primary Vs external check analysis comprises 10 pairs of samples. The Table-15.4 shows that the difference in arithmetic mean is negligible. Correlation coefficient is 0.999, which is in the range of 0.90-1.00 which is very high positive co-relation and indicates a good correlation in primary and external check analysis.

Table-15.5
Comparison of Primary vs. External Check samples for Fe_2O_3 in Mundra-Chilai (G3) Block, District Yavatmal, Maharashtra

COMPARISON INDEX	Fe_2O_3 %	
	Primary	Check
No. of Sample Pairs	10	
Arithmetic Mean	0.248	0.198
Standard Deviation	0.147	0.119
Std. Error of Mean	0.047	0.038
Variance	0.022	0.014
Mean of Deviation	0.05	
Standard Deviation (Error)	0.041	
Correlation Coefficient	0.975	
Mean Absolute Error	0.054	
Mean Relative Random Error	21.774%	
Paired T value	3.835	
F - test value	1.533	



Text Figure 8: Scatter Plot of Primary and External Check Samples for Fe_2O_3%

15.2.11 The overall statistical studies for primary Vs external check samples show the repeatability of the analysis i.e. insignificant differences between both the analyses.

15.2.12 R^2 value = 0.949, which is very close to 1. This means that 97.5% of the variation in the check values can be explained by the primary values. It indicates a strong linear correlation between the two datasets. Since the slope is close to 1

and R^2 is high, the check samples are highly consistent with the primary values. The small deviation (slope slightly <1) suggests that the check values tend to be slightly lower than the primary values on average. This could indicate minor systematic differences between primary and check sample analyses, such as small lab measurement biases.

15.2.13 The data set for primary Vs external check analysis comprises 10 pairs of samples. The Table-15.5 shows that the difference in arithmetic mean is negligible. Correlation coefficient is 0.975, which is in the range of 0.90-1.00 which is very high positive co-relation and indicates a good correlation in primary and external check analysis.

15.3.0 STANDARD OPERATING PROCEDURE (SOP) FOR THE ANALYSIS BY MECL LAB, NAGPUR

15.3.1 The assaying and laboratory procedures adopted in the present exploration program were designed to ensure accuracy, reliability and scientific appropriateness of results in line with standard mineral exploration practices.

SOP for Chemical analysis carried out by XRF pellet method.

(a) Sample Particle Size: The Sample is ground to a particle size <75µm, but <50µm is ideal.

(b) Sample preparation: Pellets preparation - The process of making pressed pellets for XRF analysis includes grinding the sample to fine particle size and pressing the sample at pressure of between 15 to 35 ton.

(c) Instrumentation procedure

(i) X-ray irradiates the sample, (ii) Sample emits secondary X-ray characteristic of a particular element. (iii) Analyzing sample rotates to accurately diffract each wavelength and satisfy Bragg's Law. (iv) Detector measures position and intensity of XRF peaks.

Figure 9: Photograph of WD- XRF instrument (Rigaku, Japan) at Chemical Lab, MECL, Nagpur.

15.3.2 STANDARD OPERATING PROCEDURE (SOP) FOR THE DETERMINATION OF LOSS ON IGNITION (L.O.I.) AT MECL LAB.

Procedure:

1. Weigh 1 gm of dry sample in silica or platinum crucible.
2. Place this crucible in muffle furnace at a temperature below 300°C. Raise the temperature of the furnace to 1000°C. Keep this at this temperature for about 30 minutes.
3. Cool the crucible in desiccators and weigh the crucible.
4. Find the loss in weight.
5. % Loss on Ignition (LOI) = (Loss in weight / Weight of the sample) x 100.

15.4.0 STANDARD OPERATING PROCEDURE (SOP) FOR THE ANALYSIS BY JNARDDC, NAGPUR

15.4.1 Following Procedure followed for XRF pellet method with preparation sample pellet from homogenized 100gm sample with hydraulic compressor, following are steps followed

1. XRF (Model- Axiosm Ax, Make-Panalytical).
2. CRM used- NCSDC-16006.
3. Procedure for Preparation of Pellets by Hydraulic Press:
4. For XRF measurement a sample must be homogenized, pulverized to -200

mesh and pressed into pellet.

5. Weigh accurately 5 gm of sample and used 10 gm of boric acid as a binder.
6. Press the sample at a pressure of around 20-22 tons on a hydraulic press (Pallet Making Machine) with a diameter of 40 mm.
7. Calibrate the XRF equipment using known standards for elements present in limestone (Calcium, MMCnesium etc.).
8. Ensure the instrument is set up correctly according to standard guidelines
9. Place the prepared pellet into the sample holder.
10. Ensure the sample cup is positioned correctly in the instrument for carrying out analysis.
11. Start the XRF analysis using software and initiate the analysis process automatically.
12. Allow the XRF instrument to scan the sample. It will emit X-rays onto the sample, causing the atoms to emit fluorescence.
13. Record the results in a report, including elemental concentrations and any relevant information about the analysis conditions.
14. Intermediate check also performed using bead with inbuilt software.

15.4.2 Procedure for determination of LOSS ON IGNITION (LOI).

Weighed quantity of sample (duly dried at 110°C) is placed in platinum crucible and heated to 1000°C for about an hour. Sample is again weighed after it is cooled. Difference in weight expressed in percentage as LOI.

15.5.0 **NATURE OF QUALITY CONTROL PROCEDURES ADOPTED**

15.5.1 In order to ensure the accuracy of the analysed samples, BCS-CRM No. 393 has been used as certified reference material (CRM) for limestone and NCS DC 28201 has been used as CRM for dolomite at Chemical lab, MECL. The Certified Reference Material (CRM) was processed under similar conditions as samples and run after every 20 samples.

15.5.2 Quality control (QC) ensures accuracy, precision, and reliability of analytical results in XRF Analysis. It involves systematic procedures to monitor and maintain data integrity. Running blanks, duplicates, and CRMs after every 20 samples ensures data quality, detects contamination, checks precision, and validates accuracy, which are critical for reliable XRF results.

15.5.3 A total 10 nos. of External Check samples have been sent to JNARDDC, Nagpur

to analyse 10 radicals i.e. CaO, MgO, Al_2O_3, SiO_2, Fe_2O_3, SO_3, P_2O_5, K_2O, Na_2O and LOI analysis.

15.5.4 In order to assess the bias and inaccuracies in analytical determination as well as to check the repeatability of analysis, 10 borehole samples were analysed for external check analysis out of 98 primary samples.

15.6.0 SECURITY AND CHAIN OF CONTROL OF SAMPLES SHOULD BE CLEARLY MENTIONED.

15.6.1 The samples have been prepared at centralized mechanized sampling unit with proper labelling and tag and sent to chemical laboratory in supervision of qualified sampling technician. At the sampling unit, standard procedure has been followed and all the precautionary measures have been taken to avoid the contamination. The MECL sampling unit in Nagpur is part of the chemical laboratory.

15.6.2 Sample collection – under supervision of qualified geologist

Type of sample collection	Supervision
Bedrock/Soil/Stream	Qualified Geologist
Pitting Sample	N/A
Drill Core Sample Marking	Qualified Geologist
Sample processing. Packing, labelling	Sample Technician
Analysis	Assistant Manager Chemical
Sampling unit/Chemical Lab	Manager Chemical Lab

CHAPTER - 16

16.0.0 MOISTURE

16.1.0 All the analysis of borehole core samples has been carried out with in-situ moisture.

CHAPTER - 17

17.0.0 BULK DENSITY

17.1.0 BULK DENSITY ANALYSIS DETAILS

17.1.1 A total 2 no. of core samples are subjected to bulk density studies detailed procedure is given below:

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

b. **Sample Preparation:** Take a full cylindrical drill core sample of minimum fifteen (15) centimeters - length with both ends trimmed smoothly at right angle to the core axis using a mechanical core cutter to form a regular cylinder.

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

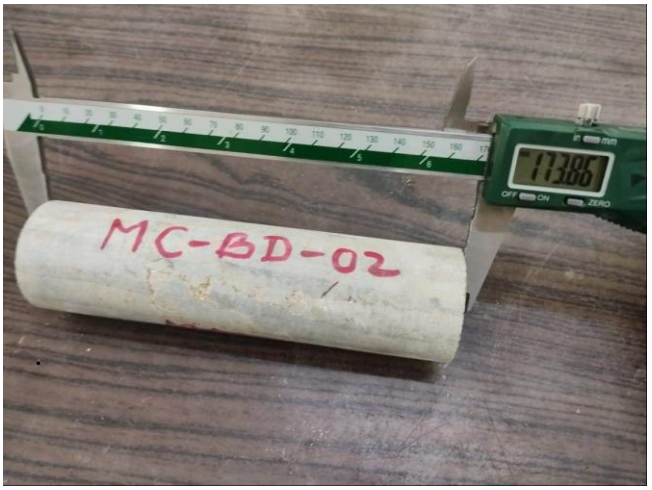
d. **Calculation:** Take mean average of all the readings for length and diameter. Divide the average mean value of diameter by two to arrive at the radius of the sample. The volume of a core sample is obtained by using formulae: $V = \pi r^2 h$ (where V = volume, r = radius and h = height or length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

17.1.2 **Number of Samples studied:** Total 2 no. of core samples are studied, where a total of five observations are carried out for each sample. The average of these observations results for each sample may be taken as the final bulk density for the purpose of estimation of resources. Bulk density determination results are mentioned below:

Sl.No.	Sample No.	Bulk Density (gm/cc)
1	MC-BD-01	2.81
2	MC-BD-02	2.81
Average Bulk Density		**2.81**

17.1.0 Average bulk density of limestone/dolomite calculated as 2.81 gm/cc. calculated value has been considered for estimation of resources. The details of Bulk density determination results are given in Annexure-VI.

17.1.1 .



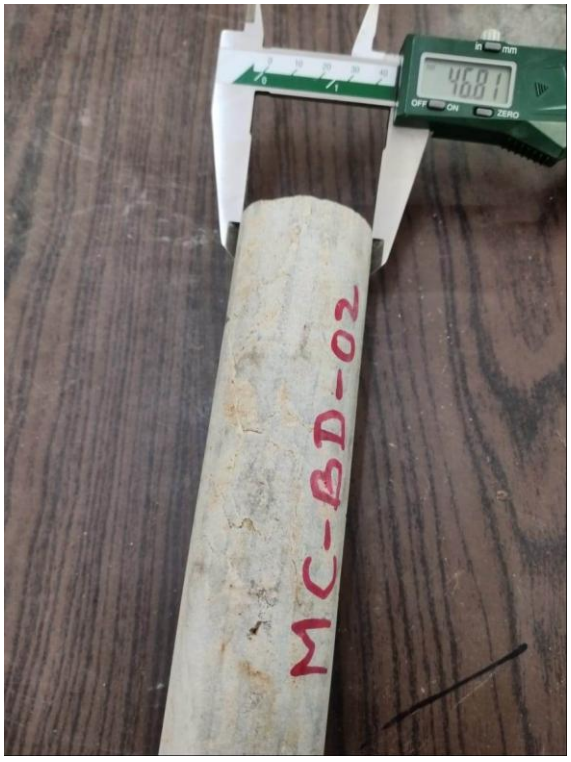


Figure 10: Photographs showing procedure of determination of length, diameter and weight of sample number MC-BD-02 for bulk density calculation

CHAPTER – 18

18.0.0 BENEFICIATION STUDIES

18.1.0 Beneficiation studies have not been carried out in the present level of exploration.

CHAPTER – 19

19.0.0 RESOURCE ESTIMATION TECHNIQUE

19.1.0 GENERAL

19.1.1 Estimation of geological resources is the scientific and technical process of determining the quantity, quality and economic value. Following data was considered for resource estimation (1) Geological mapping (2) Exploratory drilling (3) Core logging (4) Chemical analysis and collating geological data of adjacent areas.

19.1.2 Grades and resources were categorized based on end-use grade classification given by IBM threshold in following categories for Limestone and Dolomite are presented in Annexure-XA & XB.

Table 19.1

Threshold limits of different grades of Limestone/Dolomite for resource classification as per MEMC 2015 (Amended in 2021)

Grade	CaO	MgO	SiO_2	Al_2O_3	Fe_2O_3	Insoluble Total (SiO_2+ Al_2O_3 + Fe_2O_3)
	%	%	%	%	%	
Cement Limestone	44-52	3.5 (max)	-	-	-	-
Blendable Limestone	38-44	5 (max)	-	-	-	-
Threshold Limestone	34 (min)	5 (max)	-	-	-	-
SMS (LD) Dolomite	30 (min)	20-21	0.4-0.8	0.2-0.6	0.2-0.4	--
Beneficial Dolomite	30-32	15	6 (max)	-	-	12 (max)

Resources have been estimated by polygonal method as per MEMC Rules 2015 (Amended 2021) and placed under Inferred Resources category (333).

19.2.0 EVALUATION OF MINERALISATION ZONES

19.2.1 The evaluation of mineralization zones in the Mundra–Chilai Block has been carried out on the basis of core drilling, systematic sampling and subsequent laboratory analysis. The lithologsical units intersected in the boreholes confirm the presence of limestone and dolomite horizons with significant mineralisation potential. Core recovery exceeding 90% in most boreholes has ensured reliability of the dataset. It is noted that Threshold Grade Limestone is interbedded within dolomite as lensoid whose thickness are 6.00m in MMC-02 and 2m in MMC-03. Limestone is confined to the south eastern part of the

explored area.

19.2.2 A total 98 samples were generated from 230m of drilling of 5 no. of exploratory boreholes, out of which two boreholes i.e. MMC-02 & MMC-03 have intersected threshold grade limestone interbedded within dolomite with thickness is 2m each borehole, it has not been considered resources estimation due to high MgO values. SMS (LD) grade dolomite intersected in four boreholes MMC- 01, 02, 03 & 05 with thickness 47.50m, 47m, 48m and 50m respectively.

19.2.3 It is noted that threshold grade limestone is interbedded within dolomite as lensoid whose thickness is 2.00m in MMC-02 and MMC-03.

19.2.4 SMS (LD) Grade Dolomite was intersected in exploratory boreholes MMC-01, 02, 03 & 05 drilled by MECL in the block. The details are given below in Table no 19.3.

Table 19.2
SMS (LD) Grade Dolomite demarcated as per IBM threshold for entire primary sample analysis of exploratory boreholes drilled in Mundra-Chilai Block, District: Yavatmal, Maharashtra

BH. No.	From (m)	To (m)	Thickness (m)	CaO %	MgO %	Al_2O_3 %	SiO_2 %	Fe_2O_3 %	GRADE
MMC-01	2.50	50.00	47.50	32.35	18.92	0.41	1.03	0.18	SMS (LD) GRADE DOLOMITE
MMC-02	3.00	50.00	47.00	33.36	18.23	0.48	2.52	0.21	
MMC-03	2.00	50.00	48.00	32.73	18.85	0.72	1.95	0.27	
MMC-05	0.00	50.00	50.00	33.45	18.30	0.36	0.72	0.18	

SMS (LD) – Steel Melting Shops (Linz-Donawitz) Grade Dolomite.

19.3.0 RESOURCES ESTIMATION METHODS

19.3.1 Dolomite occurs as a gently dipping body in the block area, strike in direction of $N20^0W$- $S20^0E$ with varying dips of 5° to 20º Northeasterly, all the boreholes were drilled vertically to estimate dolomite resources upto a vertical depth of 50mRL except MMC-04. Dolomite resources were estimated by Polygonal method and validated with cross sectional method (check method).

19.4.0 ASSUMPTIONS FOR RESOURCE ESTIMATION

19.4.1 Resource was computed by "polygonal method" as per MEMC Rule, 2015 (Amended 2021). Certain axiomatic assumptions are inherently involved in estimating overall grade and resource of a deposit, are given below:

19.4.2 For Dolomite resource, SMS (L.D) grade dolomite is taken consideration.

19.4.3 Minimum thickness of 2m for the demarcated grade was considered for resource estimation.

19.4.4 The average bulk density of dolomite has been taken as 2.81 gm/cc as

determined by Caliper's method from 2 core samples in MECL Laboratory, Nagpur. This value is taken for computation of resources for SMS (L.D) Grade Dolomite.

19.5.0 PARAMETERS OF RESOURCE ESTIMATION

19.5.1 CUT-OFF GRADE

Resources estimated for SMS grade Dolomite intersected are calculated as per IBM threshold grade classification as given in Table no 19.1

19.5.2 BULK DENSITY

A total of 2 nos. of limestone/dolomite core samples from MECL boreholes were subjected to bulk density determination by **Caliper Method** in Petrology laboratory, MECL, Nagpur. The average bulk density of these 2 samples has been determined as 2.81 gm/cc and the same have been considered for estimation of resources. The results of bulk density determination are presented in Annexure-VI. The procedure of determining the bulk density discussed in Chapter 17.

19.5.3 OVER BURDEN/SOIL

Overburden varies from 0.10m to 7.00m in thickness in all the boreholes, except for borehole number MMC-05 where the soil cover is negligible. The average thickness of the overburden in the block is around 4.00m.

Minimum (m)	Maximum (m)
0.10 (MMC-05)	7.00 (MMC-04)

19.6.0 METHODOLOGY

The resources of dolomite have been estimated by polygonal method as per MEMC rules, 2015 (Amended 2021). The methodology adopted, keeping the above assumptions in view, for resource estimation are described further.

19.7.0 METHODOLOGY ADOPTED IN POLYGONAL METHOD (PRINCIPAL METHOD) FOR RESOURCE ESTIMATION

The main objective of this method is to demarcate the area of influence of the dolomite intersected by a particular borehole. The influence area has been obtained by constructing polygons by drawing perpendicular bisector of triangles, rectangles that connect the adjoining boreholes. The area of the influence of zones has been ascertained by Auto-Cad software. The area of non-development of respective zones is shown on the geological plan. The height of

polygons is the cumulative thickness of limestone/dolomite horizon/bands encountered by the corresponding borehole. The entire dolomite body in block is divided into 4 number of polygons. The grade wise borehole wise resource estimation by Polygonal method for possible SMS (LD) Grade Dolomite of this block are calculated. The grade assigned to the polygon blocks is same as the weighted average grade of the corresponding boreholes. The area of non-development of particular grade in borehole has been deducted.

The formula of resource estimation is as follows:

$R = P_A$ X Th X Bulk Density

Where, P_A = Area of Polygon
Th = Thickness of Dolomite

19.7.1 The resources are estimated grade wise, borehole wise and presented as Annexures- VIIA.

19.7.2 The weighted average grades for 10 radicals i.e. CaO, MgO, SiO_2, Al_2O_3, Fe_2O_3, SO_3, P2O5, K2O, Na2O & LOI has been calculated. Thus, average grade of the block is calculated for SMS (LD) Grade of Dolomite.

19.8.0 METHODOLOGY ADOPTED IN CROSS SECTIONAL METHOD (CHECK METHOD) FOR RESOURCE ESTIMATION

19.8.1 Resources has estimated with cross sectional method (check method) for SMS (LD) Grade Dolomite, the resources presented in Annexures – VIIB.

A total no of 5 boreholes which are falling in 3 parallel cross section lines S1-S1', S2-S2'and S3-S3' in Mundra-Chilai block, have been drawn along N 70°E/ S 70°W direction which is marked on Plate No. III.

19.8.2 The dolomite intersected in 4 boreholes (MMC-01, 02, 03 & 05). Efforts were made to pass these sections through drilled borehole locations wherever possible. The boreholes which have not fallen on section lines are projected on to the nearest section line. Since the beds are generally low dip of 5° to 20° due NE direction and boreholes drilled are all vertical hence true thickness will be the same as thickness intersected in the exploratory boreholes. Geological cross sections are generated by GDM software. Cross sectional area on each section has been measured with the help of Auto CAD map 2025 software and recorded systematically. Strike influence between two section lines and boreholes has been taken up-to half way distance. However, the influence is up to block boundary has been taken in section S3-S3' and S1-S1' up to 400m in 333

category. Each of these areas has been multiplied with sectional influence / strike influence of the section lines to give volume. The volume is then multiplied with average bulk density, to estimate geological gross in-situ resources.

R = Sv (X) T (X) Avg Bulk Density

Where in,

R	=	Resource / Tonnage
Sv	=	Sectional area of limestone
T	=	Influence between successive section lines
B. D.	=	Bulk Density of limestone / Dolomite

19.8.3 Resources are estimated by cross sectional method (check method) and borehole wise resources presented as Annexures- VIIB.

CHAPTER - 20

20.0.0 REPORTING OF RESOURCES

20.1.0 RESOURCE ESTIMATION

20.1.1 Resources are estimated by polygon method.

20.1.2 The grade assigned to the polygon blocks is same as the weighted average grade of the corresponding boreholes. The area of non-development of particular grade in borehole has been deducted.

Block	Polygon No.	Borehole No.	Polygonal Area (m^2)
MUNDRA-CHILAI	P2	MMC-01	556290.50
	P4	MMC-02	794415.30
	P3	MMC-03	641595.63
	P1	MMC-05	677345.64

20.1.3 A total 360.87 MT of SMS (LD) Grade dolomite resources estimated by polygonal method with an average grade of 33.00 % CaO, 18.54% MgO and 1.61% SiO_2. The Polygon-wise, grade wise, borehole-wise resource estimation by Polygonal method for SMS (LD) Grade dolomite are given in Table number 20.2. (Annexure – VIIA).

20.2.0 RELIABILITY OF RESOURCE

Geological resources estimated for SMS (LD) Grade Dolomite classification by the polygonal method and cross-sectional methods were compared to ascertain the confidence level of estimation by relative difference method. The relative difference in Geological Resources by two methods comes to 2.88%. As per the industrial requirements the relative difference for geological resource falls in the category of “Excellent”. Comparison of resources with both the methods i.e. Polygonal Method (Principal Method) and Cross Sectional Method (Check Method) is presented at Table number 20.1.

Table 20.1

Comparison of Geological Gross In-situ Resources: Polygonal Method (Principal Method) with Cross Sectional Method (Check Method) in Mundra-Chilai Block, District: Yavatmal, Maharashtra

Sl.No.	Category of Resources	Polygonal Method (MT)	Cross Sectional Method (MT)	Relative Difference %
1	SMS (LD) Grade Dolomite	360.87	350.64	2.88

Table 20.2

Polygon wise, Borehole wise Resources (333) estimated for SMS (LD) Grade Dolomite by Polygonal Method for Mundra-Chilai Block, Dist. Yavatmal, Maharashtra

Bulk Density: 2.81 gm/cc

Polygon No.	BH No.	Polygonal Area (m^2)	From (m)	To (m)	Thick. (m)	Volume (m^3)	Geological Gross in-situ Resources (tonnes)	Average Quality									
								CaO %	MgO %	Al_2O_3 %	SiO_2 %	Fe_2O_3 %	SO_3 %	P_2O_5 %	K_2O %	Na_2O %	LOI %
P2	MMC-01	556290.50	2.50	50.00	47.50	26423798.75	74250874.49	32.35	18.92	0.41	1.03	0.18	0.02	0.15	0.04	0.05	46.62
P4	MMC-02	794415.30	3.00	50.00	47.00	37337519.10	104918428.67	33.36	18.23	0.48	2.52	0.21	0.03	0.09	0.07	0.04	44.78
P3	MMC-03	641595.63	2.00	50.00	48.00	30796590.24	86538418.57	32.73	18.85	0.72	1.95	0.27	0.02	0.06	0.11	0.04	45.04
P1	MMC-05	677345.64	0.00	50.00	50.00	33867282.00	95167062.42	33.35	18.28	0.37	0.74	0.18	0.02	0.04	0.06	0.04	46.72
Total Geological Gross in-situ Resources of SMS (LD) Grade Dolomite in Tonnes							**360874784.15**	**33.00**	**18.54**	**0.49**	**1.61**	**0.21**	**0.03**	**0.08**	**0.07**	**0.04**	**45.73**
Total Geological Gross in-situ Resources of SMS (LD) Grade Dolomite in Million Tonnes							**360.87**										

Table 20.3

Geological Gross In-situ Resources (G3) estimated for SMS (LD) Grade Dolomite by Cross Sectional Method for Adegaon bock, Dist: Yavatmal, Maharashtra

Bulk Density: 2.81 gm/cc

BH.No.	Section Line	Sectional Area (m^2)	Strike Influence (m)	Volume (m^3)	Geological Gross In-situ Resources (tonnes)	Average Quality									
						CaO %	MgO %	Al_2O_3 %	SiO_2 %	Fe_2O_3 %	SO_3 %	P_2O_5 %	K_2O %	Na_2O%	LOI %
MMC-01	S3-S3'	108489.68	475.96	51636748.09	143550159.70	32.35	18.92	0.41	1.03	0.18	0.02	0.15	0.04	0.05	46.62
MMC-02	S3-S3'	61652.24	360.38	22218236.02	61766696.13	33.36	18.23	0.48	2.52	0.21	0.03	0.09	0.07	0.04	44.78
MMC-03	S2-S2'	76479.21	377.89	28900728.48	80344025.17	32.73	18.85	0.72	1.95	0.27	0.02	0.06	0.11	0.04	45.04
MMC-05	S2-S2'	46042.73	507.66	23374050.64	64979860.77	33.45	18.30	0.36	0.72	0.18	0.02	0.05	0.06	0.04	46.62
Total Geological Gross In-situ Resources of SMS (LD) Grade Dolomite in Tonnes					**350640741.76**	**32.82**	**18.67**	**0.49**	**1.44**	**0.20**	**0.03**	**0.10**	**0.07**	**0.05**	**45.94**
Total Geological Gross In-situ Resources of SMS (LD) Grade Dolomite in Million Tonnes					**350.64**										

20.3.0 COMPUTATION OF AVERAGE GRADE

All calculations for grade estimation are made by weighted average method. Since the sample interval was maintained at 1.00m and 2m interval with the exception of minor variations or structural implications, the weighted average method of calculation is made by the following formula.

$$\text{Weighted average grade} = \frac{VIXG1+V2XG2+V3XG3+\text{----------}+VnXGn}{V1+V2+V3+\text{----------}+Vn}$$

Where `V' = Volume of Limestone/Dolomite in individual borehole

`G'= Grade of the respective Limestone/Dolomite in the corresponding borehole

CHAPTER – 21

21.0.0 SUMMARY AND RECOMMENDATIONS

21.1.0 SUMMARY

21.1.1 The Mundra-Chilai Block over an area of 4.38 sq.km, is bounded by Longitude 78°53'58.94158" E to 78°55'42.80040" E and Latitude 19°50'08.28765" N to 19°51'08.04304" N located in Toposheet No.56 I/13 in Chilai, Kundra, Mukutban, Ganeshpur, Krishnapur and Dunki villages of Tehsil - Wani, District - Yavatmal, State – Maharashtra.

21.1.2 Mundra-Chilai Block is proposed on the basis of lapsed lease areas by State Government of Maharashtra which was granted as per section 10A(2)(b) of the MMDR Act-15. In Year 2021 amendment to MMDR Act with a stipulation stated that all such PL reports stand ineligible and to conduct auction and PL Reports required to be evaluated to confirm mineral contents (G4, G3 etc stages of exploration) as per the stipulations under Minerals (Evidence of Mineral Contents) Rules, 2015.

21.1.3 The Directorate of Geology and Mining (DGM), Government of Maharashtra, requested MECL to take up the exploration in lapsed 10A(2)(b) lease mining lease areas vide letter no. Tech/1848/2023/260, dated 23-01-2024.

21.1.4 Exploration Proposal (G3) was submitted and discussed in 70th TCC-1 meeting held on 24th & 25th October, 2024 and committee recommended the project proposal titled as “Preliminary Exploration (G3 Level) for Limestone in Mundra-Chilai Block, Yavatmal District, Maharashtra”.

21.1.5 On recommendation of 70th TCC-1, 38th Executive committee (EC), NMET meeting held on 29th November, 2024 approved the project with cost of INR 90.63 lakhs.

21.1.6 MECL carried out exploration with objective to establish sub surface continuity of limestone / dolomite by drilling 5 no of exploratory boreholes and to estimate geological resource under (333) category under UNFC nomenclature as per MEMC rules, 2015 (Amended upto 2021).

21.1.7 Yavatmal district is situated in central part of Maharashtra. Yavatmal district in Maharashtra has exposures dominated by Deccan basalts with other formations like Gondwana, Lameta and Penganga beds also present. The limestone formation of the area belongs to Putnur-Mangurda formation.

21.1.8 Exposures mapped in the block belong to the Putnur-Mangurda formation lesser-known but geologically intriguing unit of the Penganga Group. These formations typically consist of Proterozoic to Lower Palaeozoic sedimentary rocks, including Shale, Limestone, Dolomite. The Putnur–Mangurda sequence likely represents shallow marine to fluvial depositional environments, and its exposures may be found in structurally controlled inliers or along river sections, particularly in areas like Mangurda village in Yavatmal district.

21.1.9 The strike of the limestone / dolomite beds is $N20^0W$-$S20^0E$ and dip varies from 5° to 20° towards northeasterly.

21.1.10 A total of 98 nos. of samples are generated in 5 no. of boreholes drilled in Mundra-Chilai Block which were analysed 10 radicals.

21.1.11 Dolomite zones are demarcated based on End use classification of IBM.

21.1.12 A total of 2 nos. of limestone /dolomite core samples from drilled boreholes were subjected to bulk density determination by **Caliper Method**. The average bulk density of these 2 samples has been determined as 2.81 gm/cc and the same have been considered for estimation of resources.

21.1.13 Average soil cover in the block is 4m.

21.1.14 Geological Gross In-situ resources were estimated by polygonal method.

21.1.15 **A total 360.87 MT of SMS (LD) Grade Dolomite** was estimated with an average grade of 33.00% CaO, 18.54% MgO, 1.61% SiO2.

21.2.0 RECOMMENDATIONS

21.2.1 MECL has carried out Preliminary exploration (G3) over 4.38 sq.km of Mundra-Chilai Block and established resources of SMS (LD) Grade Dolomite as per MEMC rules 2015 (Amended 2021).

21.2.2 Estimated resources are considered under 333 category as per UNFC nomenclature. This report will facilitate state Government of Maharashtra to auction the block for mining lease.

CHAPTER - 22

22.0.0 LIST OF PLATES

22.1.0 Location Map of Mundra-Chilai Block, District: Yavatmal, Maharashtra in 1:50000 scale (Plate-I).

22.2.0 Regional Geological Map of Mundra-Chilai Block, District: Yavatmal, Maharashtra Not to scale (Plate-II).

22.3.0 Topographical and Geological Map of Mundra-Chilai Block, District: Yavatmal, Maharashtra in 1:4000 scale (Plate-III).

22.4.0 Graphical lithologs of all the boreholes showing SMS (LD) grade dolomite on 1:1000 scale (Plate-IV).

22.5.0 Geological Cross Sections along section lines S1-S1', S2-S2' and S3-S3' along N 70^0 E -S70^0W direction with quality data on 1:2000 scale (Plate- V).

22.6.0 Polygonal map with area of polygon and thickness of intersected zone of SMS (LD) Grade Dolomite on 1:4000 scale (Plate-VI).

CHAPTER - 23

23.0.0 ANNEXURES / ENCLOSURES TO THE REPORT

23.1.0 The report includes all the relevant annexures, maps/ plans, sections, photographs & photomicrograph etc. List of annexures, tables, maps/plans/ sections, photographs, Text figures & photomicrograph etc. are provided before the start of the text part of the Geological Report.

CHAPTER - 24

24.0.0 UTILISATION ASPECTS AND MINEABILITY (AS PER NATIONAL COUNCIL FOR CEMENT AND BUILDING MATERIALS)

24.1.0 The specifications of limestone for various industrial used are as follows

1. CEMENT INDUSTRY SPECIFICATION

Table 24.1
Cement Industry Specification for Limestone

CaO 46%	:	44% (min.) to 46%
MgO	:	3.50% (max.)
Silica	:	16% (max.)
Al_2O_3	:	2 (max.)
Fe_2O_3	:	2% (max.)
SO_3	:	1.75% (max.)

Lime Saturation Factor (LSF) (ideal to be at 0.66 to 1.02)

$$\frac{CaO}{2.8\,(SiO_2) + 1.2\,(Al_2O_3) + 0.65\,(Fe_2O_3)}$$

Silica Modules = $\frac{SiO_2}{Al_2O_3 + Fe_2O_3}$ = ideal at (1.2 to 4.0)

Iron Modules = $\frac{}{SiO_2+Al_2O_3+Fe_2O_3}$ = ideal at (1.7 to 2.4)

Hydraulic Modules = $\frac{Al_2O_3}{Fe_2O_3}$ = ideal at (0.65 (min.))

2. B. I. S. (BUREAU OF INDIAN STANDARDS) SPECIFICATION

Table 24.2
B. I. S. (Bureau of Indian Standards) Specification for Limestone

CaO (Min)	42%
MgO (Max.)	2.5%
SiO_2 (Max.)	15%
P_2O_5 (Max.)	1.5 %
FeS_2 (Max.)	2%

3. IRON AND STEEL INDUSTRY:

Table 24.3
Iron and Steel Industry for Specification for Limestone

Elements	BF Grade	SMS Grade	LD Grade
CaO	42% (Min.)	48% (Min.)	52% (Min.)
MgO	4% (Max.)	3% (Max.)	2% (Max.)
SiO_2	9% (Max.)	4% (Max.)	1% (Max.)
SiO_2+ Al_2O_3	11.5% (Max.)	-	-
Total Insoluble	12%	-	-
Acid Insoluble	-	6.5% (Max.)	-

4. CHEMICAL INDUSTRY SPECIFICATION

BIS Specifications (1S:3204-1978, Reaffirmed-2003)

Table 24.4
Chemical Industry Specification for Limestone

Characteristics	Requirement in percent by mass for			
	Calcium carbide	Bleaching Powder	Caustic soda	Sugar
CaO (Min.)	54.0	54.0	53.0	50.0
MgO (Max.)	0.8	2.0	1.0	1.0
SiO_2 (Max.)	1.0	0.75	-	2.0
Fe_2O_3 (Max.)	0.25	0.15	-	-
Mn_2O_3 (Min.)	-	0.06	-	-
CO_2 (Min.)	42.00	42.00	42.00	41.00
Loss on Ignition (LOI)	46.00	46.00	46.00	44.00
S (Max.)	0.10	-	-	-
P (Max.)	0.01	-	-	-
Al_2O_3+ Fe_2O_3 (Max.)	0.50	-	-	1.5
SiO_2+ Al_2O_3 + Fe_2O_3 (Max.)	-	-	3.0	-

5. FERTILIZER INDUSTRY SPECIFICATION

$CaCO_3$+ $MgCO_3$: 85% (Min)
SiO_2 : 5% (Max.)

6. GLASS INDUSTRY SPECIFICATION

$CaCO_3$: 94.5 %
$CaCO_3$ + $MgCO_3$: 97.5 %
Fe_2O_3 : 0.20 % (Max.)

BIS Specifications (1S:997-1973, Reaffirmed-1998)

CaO : 53.0 %
SiO_2 : 2.5 %
Fe_2O_3 : 0.10 %
CaO + MgO : 54.50 %

7. FOUNDRY INDUSTRY SPECIFICATION

BIS Specifications (1S:4149-1978, Re-affirmed-2008)

Table No: 24.5

Foundry Industry Specification for Limestone

Characteristics	Grade-1	Grade-2	Grade-3
CaO (Min.)	52 %	50 %	45 %
SiO_2 (Max)	1.5 %	3 %	5 %
R_2O_3 (Al_2O_3 + Fe_2O_3) Max.	1 %	1 %	2 %
MgO	2 %	3 %	5 %
Insoluble matter	0.5	1	2
Sulphur and Phosphorus	Traces	Traces	Traces

8. CEMENT, IRON AND STEEL AND CHEMICAL INDUSTRY SPECIFICATION

Table No: 24.6

Cement, Iron and Steel and Chemical Industry Specification for Limestone

Constituents	Cement Industry (Specification)	Iron and Steel Industry (Specification)			Chemical Industry BIS Specifications (1S:3204-1978, Reaffirmed-2003) Requirement in percent by mass for			
		BF Grade	SMS- OH Grade	SMS-LD	Calcium carbide	Bleaching Powder	Caustic soda	Sugar
CaO (Min.)	44% (Min.) to 48% (Max)	42% (Min.)	48% (Min.)	52% (Min.)	54.0	54.0	53.0	50.0
MgO	3.50% (Max.)	4%	3%	2%	0.8	2.0	1.0	1.0
SiO_2 (Max.)	16 % (Max.)	9%	4%	1%	1.0	0.75	-	2.0
Fe_2O_3	2% (Max.)				0.25	0.15	-	-
Mn_2O_3	--	--	--	--	-	0.06	-	-
CO_2 (Min.)	--	--	--	--	42.00	42.00	42.00	41.00
Loss on Ignition	--	--	--	--	46.00	46.00	46.00	44.00
S (Max.)	--	--	--	--	0.10	-	-	-
P (Max.)	--				0.01	-	-	-
Al_2O_3+ Fe_2O_3	2%				0.50	-	-	1.5
SiO_2+ Al_2O_3 + Fe_2O_3	--	11.5% (Max.)			-	-	3.0	-
Acid Insoluble			6.5% (Max.)					

CERTIFICATE FROM THE QUALIFIED PERSON WITH NAME, DATE AND SIGNATURE

This is to certify that Geological Report on "Preliminary exploration (G3 level) for Limestone in Mundra-Chilai Block, District: Yavatmal, Maharashtra" has been prepared by Mineral Exploration and Consultancy Limited (MECL) on behalf of National Mineral Exploration Trust (NMET). The report has been prepared in accordance with the Minerals (Evidence of Mineral Contents) Rule 2015 specified under Mineral Auction Rule, 2015 and amended up to 2021.

NAME: **SHRIKANT SHARMA**
DESIGNATION: **HOD (EXPLORATION)**

DATE:

ABBREVIATIONS USED

SL. No.	Abbreviation	Full form
1	MECL	Mineral Exploration and Consultancy Limited
2	GSI	Geological Survey of India
3	CGWB	Central Ground Water Board
4	CPSE	Central Public Sector Enterprise
5	NMET	National Mineral Exploration Trust
6	TCC-1	Technical cum Cost Committee - One
7	EC	Executive Committee
8	DGM, MP	Directorate of Geology and Mining, Maharashtra
9	UNFC	United Nation Framework Classification
10	NMI	National Mineral Inventory
11	DGCO	Directorate General Camp Office
12	NABL	National Accreditation Board for Testing and Calibration Laboratories
13	JNARDDC	Jawaharlal Nehru Aluminium Research Development and Design Centre
14	F.S.P.	Field Season Programme
15	MEMC	Minerals (Evidence of Mineral Contents)
16	MMDR	Mines & Minerals (Development and Regulation)
17	NH	National Highway
18	WGS-84	World Geodetic System-84
19	UTM	Universal Transverse Mercator
20	RL	Reduced Level
21	cu m	Cubic Meter
22	DGPS	Differential Global Positioning System
23	DMS	Degree Minute Second
24	M / m	Meter
25	mt / MT	Million Tonnes
26	Sq. km/sq.km	Square Kilometer
27	M. Sc.	Master of Science
28	M. Sc. Tech	Master of Science Technology
29	NDDP	Net District Domestic Product
30	mRL	Reduced Level in metre
31	XRF	X-ray Fluorescence
32	ML	Mining Lease
33	CRM	Certified Reference Material
34	CL	Composite License
35	SMS (LD)	Steel Melting Shops (Linz-Donawitz)
36	R.F.	Representative Fraction

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