GEOLOGICAL REPORT ON PRELIMINARY EXPLORATION (G3) FOR LIMESTONE IN HIWARDHARA-GANESHPURA 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

JULY-2025

CONTENTS

C O N T E N T S

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

LIST OF ANNEXURES

LIST OF PLATES

PLATE NO.	TITLE	R.F
I	Location Map of Hiwardhara-Ganeshpura Block, District: Yavatmal, Maharashtra	1:50,000
II	Generalised Geological map of the Pranhita Godavari (PG) valleys showing Hiwardhara-Ganeshpura Block (After Chaudhuri et al. 2012)	Not to scale
III	Topographical and Geological Map of Hiwardhara-Ganeshpura Block, District: Yavatmal, Maharashtra	1:4000
IV	Graphic Lithologs of Boreholes drilled by MECL in Hiwardhara-Ganeshpura Block, District: Yavatmal, Maharashtra	1:500
V	Polygon Map for SMS (LD) and Beneficial Grades of dolomite in Hiwardhara-Ganeshpura block, Dist Yavatmal, Maharashtra.	1:4000
VI	Geological Cross Sections along section line S1-S1' & S2-S2',N-S dip direction with quality data in Hiwardhara-Ganeshpura block, Dist Yavatmal, Maharashtra.	1:2000

LIST OF TABLES

LIST OF TEXT FIGURES

LIST OF PHOTOGRAPHS

LIST OF PHOTOMICROGRAPHS

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

SALIENT FEATURES

<table>
<tr><td>1.</td><td>Name of the block</td><td>Hiwardhara-Ganeshpura block,
Tehsil- Zari-Jamni and Wani &
Wani District – Yavatmal,
State – Maharashtra</td></tr>
<tr><td>2.</td><td>Mineral</td><td>Dolomite</td></tr>
<tr><td>3.</td><td>Total Area</td><td>5.72 sq.km.</td></tr>
<tr><td>4.</td><td>Area covered under present scheme</td><td>5.72 sq.km.</td></tr>
<tr><td>5.</td><td>Period of Exploration</td><td>March 2025 to June 2025.</td></tr>
<tr><td>6.</td><td>Meterage drilled by MECL</td><td>Total 300.00 m at G3 level</td></tr>
<tr><td>7.</td><td>No. of Boreholes drilled by MECL</td><td>Total 06 Nos. at G3 Level</td></tr>
<tr><td>8.</td><td>Thickness of Different Grade Dolomite</td><td>SMS LD Grade-Thickness min. 36m to max. 50m
Beneficial Grade- Thickness min. 2m to max. 14m</td></tr>
<tr><td>9.</td><td>Cut-off grade</td><td>Dolomite Grade Classification as per IBM,2018
<table>
<tr><th>Grade</th><th>CaO %</th><th>MgO %</th><th>SiO2 %</th><th>Al_2O_3 %</th><th>Fe_2O_3 %</th><th>Acid Insoluble %</th></tr>
<tr><td>*SMS (LD)</td><td>30-36</td><td>20-21</td><td>0.4-1.8</td><td>0.2-0.6</td><td>0.2-0.4</td><td>-</td></tr>
<tr><td>**SMS (OH)</td><td>30-34</td><td>15-21</td><td>0.9-2.5</td><td>-</td><td>-</td><td>0.74-2.8</td></tr>
<tr><td>Beneficial</td><td>29</td><td>15</td><td>6 (max)</td><td>-</td><td>-</td><td>12 (max)</td></tr>
</table>
*SMS (LD)- Steel Melting Shop (Linz-Donawitz)
**SMS (OH)- Steel Melting Shop (Open Hearth)</td></tr>
<tr><td>10.</td><td>Resources</td><td>SMS (LD) Grade Dolomite: 248.75 MT Gross (In-situ) Geological Resources with average grade 32.58%CaO, 19.12%MgO, 0.39%Al_2O_3, 1.27%SiO_2, 0.17% Fe_2O_3, 46.11% LOI.

Beneficial Grade Dolomite: 94.46 MT Gross (In-situ) Geological Resources with average grade 31.06% CaO, 16.88% MgO, 1.43% Al_2O_3, 5.63%SiO_2, 0.44% Fe_2O_3, 43.90% LOI.

*MT Million tonnes</td></tr>
<tr><td>11.</td><td>Grade</td><td>SMS(LD) & Beneficial (Steel) Grade Dolomite</td></tr>
<tr><td>12.</td><td>UNFC Category</td><td>Inferred Category (333)</td></tr>
<tr><td>13.</td><td>Report Submission</td><td>July 2025</td></tr>
</table>

चूना पत्थर के लिए प्रारंभिक गवेषण (G3 स्तर) पर भूवैज्ञानिक रिपोर्ट

हिवरधारा-गणेशपुरा ब्लॉक, जिला यवतमाल, माहाराष्ट्र

अध्याय-1

कार्यपालक सारांश

1.1.0 हिवरधारा-गणेशपुरा ब्लॉक का प्रस्ताव महाराष्ट्र सरकार द्वारा समाप्त पट्टों के आधार पर किया गया है, जिन्हें MMDR अधिनियम-2015 की धारा 10A(2)(b) के तहत स्वीकृत किया गया था। वर्ष 2021 में इस अधिनियम में संशोधन हुआ, जिसके तहत ऐसी सभी PL रिपोर्टों को अयोग्य घोषित किया गया तथा नीलामी की प्रक्रिया हेतु इन रिपोर्टों का मूल्यांकन करना अनिवार्य हुआ, जिससे खनिज तत्वों की पुष्टि (G4, G3 आदि गवेषण स्तरों में) सुनिश्चित की जा सके—जैसा कि खनिजों की सामग्री के प्रमाण नियम, 2015 में निर्धारित किया गया है।

1.1.1 महाराष्ट्र सरकार के भूविज्ञान एवं खनन निदेशालय (DGM) ने MECL से समाप्त 10A(2)(b) पट्टा क्षेत्रों में गवेषण कार्य संपादित करने का अनुरोध पत्र सं. Tech/1848/2023/3938, दिनांक 22.12.2023 के माध्यम से किया।

1.1.2 MECL ने यवतमाल जिले की तहसील ज़री-जामनी एवं वणी स्थित हिवरधारा-गणेशपुरा गाँव के आस-पास 300 मीटर ड्रिलिंग सहित 6 बोरहोल में G3 स्तर का गवेषण प्रस्ताव तैयार किया।

1.1.3 यह G3 गवेषण प्रस्ताव (क्षेत्रफल 5.72 वर्ग किमी) 70वीं TCC बैठक (दिनांक 24 व 25 अक्टूबर 2024) में प्रस्तुत किया गया, जिसमें समिति ने 10A(2)(b) मामलों और महाराष्ट्र सरकार के अनुरोध को संज्ञान में लिया। समिति ने परियोजना प्रस्ताव "हिवरधारा-गणेशपुरा ब्लॉक (5.72 वर्ग किमी), यवतमाल जिला, महाराष्ट्र में चूना पत्थर के लिए प्राथमिक गवेषण (G3 स्तर)" (परिशिष्ट VIII-A) की अनुशंसा की।

1.1.4 TCC की अनुशंसा पर NMET की 37वीं कार्यकारी समिति बैठक (दिनांक 29 नवम्बर 2024) ने इस परियोजना को ₹93.84 लाख की लागत के साथ स्वीकृति दी।

1.2.0 हिवरधारा-गणेशपुरा ब्लॉक यवतमाल जिले में स्थित है, जिसका कुल क्षेत्रफल 5.72 वर्ग किलोमीटर है। यह क्षेत्र E78°51'34.40085" से E78°53'18.53141" देशांतर और N19°49'00.76239" से N19°51'35.52964" अक्षांश के बीच स्थित है तथा इसमें गणेशपुर, मुकुटबन, खड़की, कोसरा, हिवरधारा एवं नेरड गाँव सम्मिलित हैं। यह क्षेत्र टोपोशीट संख्या 56 I/13 के अंतर्गत आता है।

1.3.0 NMET से स्वीकृति प्राप्त होने के पश्चात MECL ने इस ब्लॉक में G3 स्तर का गवेषण कार्य संपादित किया, जिसमें 1:4000 स्केल पर भूवैज्ञानिक मानचित्रण एवं स्थलाकृतिक सर्वेक्षण किया गया। इसके तहत 6 ऊर्ध्वाधर बोरहोल की ड्रिलिंग कर 102 कोर नमूनों का विश्लेषण किया गया, जिससे अधस्तल निरंतरता का

रेखांकन हुआ और खनिज संसाधनों का मूल्यांकन संभव हुआ।

1.4.0 क्षेत्रीय रूप से महाराष्ट्र के यवतमाल जिले में डेक्कन बेसाल्ट की प्रमुख उपस्थिति है, साथ ही गोंडवाना, लामेटा और पेंगंगा शैल समूह भी पाए जाते हैं। इस क्षेत्र की चूना पत्थर/डोलोमाइट संरचना पुतनूर-मंगुर्दा संरचना से संबंधित है, जिसमें परतदार चूना पत्थर/डोलोमाइट और शेल शामिल हैं, जो उथले समुद्री से नदी तटीय उत्पत्ति के हैं। यह संरचना सामान्यतः उत्तर-पश्चिम से दक्षिण-पूर्व दिशा में फैली हुई है, जिसमें पूर्वोत्तर दिशा की ओर 5° से 10° तक की कम ढलान पाई जाती है।

1.5.0 हिवरधारा-गणेशपुरा ब्लॉक क्षेत्र की भूवैज्ञानिक संरचना पेंगंगा समूह की एक कम ज्ञात लेकिन भूवैज्ञानिक दृष्टि से रोचक इकाई — पुतनूर-मंगुर्दा संरचना — से संबंधित है। यह संरचनाएं सामान्यतः निचले प्रोटेरोज़ोइक काल की तलछटी चट्टानों से बनी होती हैं। क्षेत्र में शैलों की दिशा पूर्व-पश्चिम (E-W) है और ढलान दक्षिण की ओर 5° से 20° तक परिवर्तित होती है।

1.6.0 एमईएमसी नियम 2015 (संशोधित 2021) के अंतर्गत, एसएमएस (एलडी) एवं लाभकारी ग्रेड डोलोमाइट के भूवैज्ञानिक संसाधनों का मूल्यांकन मुख्यतः बहुभुज विधि द्वारा किया गया, जबकि पुष्टि हेतु क्रॉस-सेक्शनल विधि अपनाई गई। मूल्यांकन भारतीय खान ब्यूरो (आईबीएम) के मानकों के अनुसार किया गया, जिसमें 2.84 ग्राम/घन सेंटीमीटर की थोक घनता (कैलीपर विधि से प्राप्त) को आधार माना गया।

1.7.0 एसएमएस (एलडी) ग्रेड डोलोमाइट बोरहोल MHG-03 एवं MHG-05 में 50 मीटर तथा 36 मीटर मोटाई के साथ इंटरसेप्ट किया गया । लाभकारी ग्रेड डोलोमाइट बोरहोल MHG-01, MHG-02 और MHG-06 में क्रमशः 23.70 मीटर, 6 मीटर और 17.50 मीटर मोटाई के साथ इंटरसेप्ट किया गया।

(क) कुल 248.75 मिलियन टन सकल (इन-सिटू) भूवैज्ञानिक अनुमानित संसाधन (333 श्रेणी) एसएमएस (एलडी) ग्रेड डोलोमाइट का आकलन किया गया है, जिसमें औसत ग्रेड 32.58% CaO, 19.12% MgO, 0.39% Al_2O_3, 1.27% SiO_2, 0.17% Fe_2O_3 और 46.11% LOI पाया गया है।

(ख) कुल 94.46 मिलियन टन सकल (इन-सिटू) भूवैज्ञानिक अनुमानित संसाधन (333 श्रेणी) लाभकारी ग्रेड डोलोमाइट का आकलन किया गया है, जिसमें औसत ग्रेड 31.06% CaO, 16.88% MgO, 1.43% Al_2O_3, 5.63% SiO_2, 0.44% Fe_2O_3 और 43.90% LOI पाया गया है।

1.8.0 MECL द्वारा G3 स्तर पर किया गया प्राथमिक गवेषण कार्य हिवरधारा-गणेशपुरा ब्लॉक में SMS (LD) ग्रेड तथा लाभकारी ग्रेड डोलोमाइट संसाधनों की पुष्टि करता है, जिन्हें UNFC नामकरण के अनुसार श्रेणी 333 में रखा गया है। यह रिपोर्ट महाराष्ट्र सरकार को संबंधित खनिज ब्लॉक की नीलामी प्रक्रिया हेतु सहयोग प्रदान करेगी।

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

CHAPTER-1

1.0.0 EXECUTIVE SUMMARY

1.1.0 Hiwardhara-Ganeshpura 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.

1.1.1 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/1848/2023/3938, dated 22/12/2023.

1.1.2 MECL formulated exploration proposal involving 300 m drilling in 06 boreholes at G3 level of exploration in and around Hiwardhara-Ganeshpura village of Tehsil- Zari-Jamni and Wani, District – Yavatmal, Maharashtra.

1.1.3 Exploration Proposal (G3) for Hiwardhara-Ganeshpura block (5.72 sq.km) was submitted and deliberated in 70th TCC 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 committee recommended (Annexure-VIII A) the project proposal titled as “Preliminary Exploration (G3 Level) for Limestone in Hiwardhara- Ganeshpura Block (5.72 sq. km), Yavatmal District, Maharashtra”.

1.1.4 On recommendation of 70th TCC, 38th Executive committee (EC), NMET meeting held on 29th Nov 2024 approved the project with cost of INR 93.84 lakhs.

1.2.0 The Hiwardhara- Ganeshpura Block, located in Yavatmal District of Maharashtra, spans 5.72sq.km, is bounded by Longitude E78°51'34.40085" to E78°53'18.53141" and Latitude N19°49'00.76239" to N19°51'35.52964" and encompasses the villages of Ganeshpur, Mukutban, Khadaki, Kosara, Hiwardhara and Nerad in Tehsil Zari-Jamni and Wani, falling within Toposheet No. 56 I/13.

1.3.0 After receipt of approval from NMET, MECL has carried out G3 level exploration in Hiwardhara-Ganeshpura Block. MECL carried out geological mapping and topographical survey on 1:4000 scale with drilling 6 vertical boreholes and analysing 102 core samples generated from core drilling to delineate subsurface continuity and assess mineral resources.

1.4.0 Regionally Yavatmal district in Maharashtra has exposures dominated by Deccan basalts, with other Formations like Gondwana, Lameta and Penganga beds also present. The limestone/dolomite Formation of the area belongs to Putnur-Mangurda Formation. It is comprising of laminated limestone/dolomite and shale of shallow marine to fluvial origin, generally exhibiting a regional strike of NW-SE with low dips ranging from 5° to 10° towards the northeast.

1.5.0 The Geological setting of the Hiwardhara-Ganeshpura block area belongs to the Putnur-Mangurda Formation lesser-known but geologically intriguing unit of the Penganga Group. These Formations typically consist of Lower Proterozoic sedimentary rocks. The strike of the beds is E-W and dip varies from 5° to 20° towards south.

1.6.0 Geological resources were estimated primarily using the polygonal method, with the cross-sectional method applied for validation, in accordance with MEMC Rules, 2015 (Amended 2021). The estimation pertains to SMS (LD) and Beneficial grade dolomite, classified as per IBM norms, considering a bulk density of 2.84 g/cm^3 determined through the Calliper Method.

1.7.0 SMS (LD) grade dolomite was intercepted in the borehole no MHG-03 and MHG-05, whose thickness is 50m and 36m respectively. However, Beneficial grade dolomite was intercepted in boreholes no MHG-01, MHG-02 and MHG-06 with cumulative thickness 23.70m, 6m and 17.50 m respectively.

a) Total 248.75 MT Gross (In-situ) Geological Inferred Resources (333) of SMS (LD) Grade Dolomite was estimated with an average grade of 32.58% CaO, 19.12 % MgO, 0.39% Al_2O_3, 1.27% SiO_2, 0.17% Fe_2O_3, 46.11% LOI.

b) Total 94.46 MT Gross (In-situ) Geological Inferred Resources (333) of Beneficial Grade Dolomite was estimated with an average grade of 31.06% CaO, 16.88% MgO, 1.43% Al_2O_3,5.63% SiO_2, 0.44% Fe_2O_3,43.90% LOI.

1.8.0 Preliminary exploration (G3) carried out by MECL in Hiwardhara-Ganeshpura block, established SMS (LD) grade and Beneficial grade dolomite resources which are placed under inferred category (333) as per UNFC nomenclature. This report will support the Government of Maharashtra in facilitating the auction of the block for mining licence.

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 HIWARDHARA-GANESHPURA 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 Nazimuddin Ahmad, Sr. T A (S & D)
	c) Drilling	Shri Niranjan Mardo, A D O
5	Sample Processing	Shri Ankush Wagh, Sr. Tech. (Sampling) Mrs. Shikha 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 Ashish Singh, Sr. Manager (Geology)
		Shri Lakshmanarao Kaddala, Sr. Manager (Geology)
9	Proposal Preparation	Md Intezar Alam, Manager Geology
		Mrs. Moumita Ghosh, Asst. Manager Geology

10	Non-Coal Geological Report Cell	Mrs. Swati Vidyarthi, Manager, Geology
		Mrs. Moumita Ghosh, Asst. Manager Geology
		Shri Uday Patil, Sr. Computer Operator
11	Reprography and Printing	Shri Pradeep Negi, Survey & Map Officer
		Shri Durgesh Devarshee, Asst. Survey & Map 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 Hiwardhara-Ganeshpura 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 12.03.2025 with the surveying and geological mapping on 1:4,000 scale over 5.72 sq.km area with completion of drilling operations on 10.06.2025. 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 – Miniratna – ICPSE
Qualification	M.Sc. / M. Sc. Tech. (Geology)
Experience	Professionals have more than 30 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

CHAPTER – 4

4.0.0 DETAILS OF THE AREA

4.1.0 LOCATION OF THE BLOCK

4.1.1 The Hiwardhara-Ganeshpura block has an area of 5.72sq.km, it is bounded by Latitude N19°49'00.76239" to N19°51'35.52964" and Longitude E78°51'34.40085" to E78°53'18.53141" which falls in part of Toposheet No. 56 I/13.Ganeshpur, Mukutban, Khadaki, Kosara, Hiwardhara and Nerad are villages in and around the block which belong to Tehsil- Zari-Jamni and Wani, District - Yavatmal, State - Maharashtra.

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

4.1.3 The nearest railhead is Wani of Central Railway which is about 36 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 Hiwardhara Ganeshpura Block, Dist – Yavatmal, Maharashtra

Block Cardinal Point No.	WGS 1984 DMS		UTM (Zone-44)	
	Latitude (N)	Longitude (E)	Northing (m)	Easting (m)
A	N19°51'31.88399"	E78°52'12.44536"	2197271.194	276966.118
B	N19°51'35.52964"	E78°52'36.66086"	2197374.427	277672.161
C	N19°51'13.72480"	E78°52'28.11217"	2196706.959	277414.956
D	N19°51'04.10419"	E78°52'26.52221"	2196411.663	277364.959
E	N19°50'55.74052"	E78°52'47.85467"	2196146.626	277982.494
F	N19°50'30.37259"	E78°52'45.37486"	2195367.351	277900.523
G	N19°50'30.42211"	E78°52'47.93132"	2195367.939	277974.939
H	N19°50'33.19315"	E78°52'48.25864"	2195453.041	277985.535
I	N19°50'36.90751"	E78°52'49.66756"	2195566.760	278027.971
J	N19°50'45.82896"	E78°53'02.06668"	2195836.606	278392.240
K	N19°50'53.37807"	E78°53'03.24249"	2196068.347	278429.369
L	N19°50'51.31236"	E78°53'18.53141"	2195999.242	278873.482
M	N19°50'11.73107"	E78°52'38.50767"	2194796.550	277693.467
N	N19°50'09.89848"	E78°52'26.30436"	2194744.659	277337.611
O	N19°49'09.63890"	E78°52'10.28861"	2192897.267	276848.127

Block Cardinal Point No.	WGS 1984 DMS		UTM (Zone-44)	
	Latitude (N)	Longitude (E)	Northing (m)	Easting (m)
P	N19°49'00.76239"	E78°51'29.34100"	2192639.343	275652.857
Q	N19°50'26.23081"	E78°51'34.40085"	2195266.052	275833.456
R	N19°50'26.84478"	E78°52'03.42509"	2195274.240	276678.352
S	N19°51'09.27319"	E78°52'12.99453"	2196575.601	276973.314

4.2.0 CADASTRAL DETAILS OF THE AREA WITH LAND USE

Cadastral Details are not available for the study area; however indicative data collected during survey and mapping is being provided.

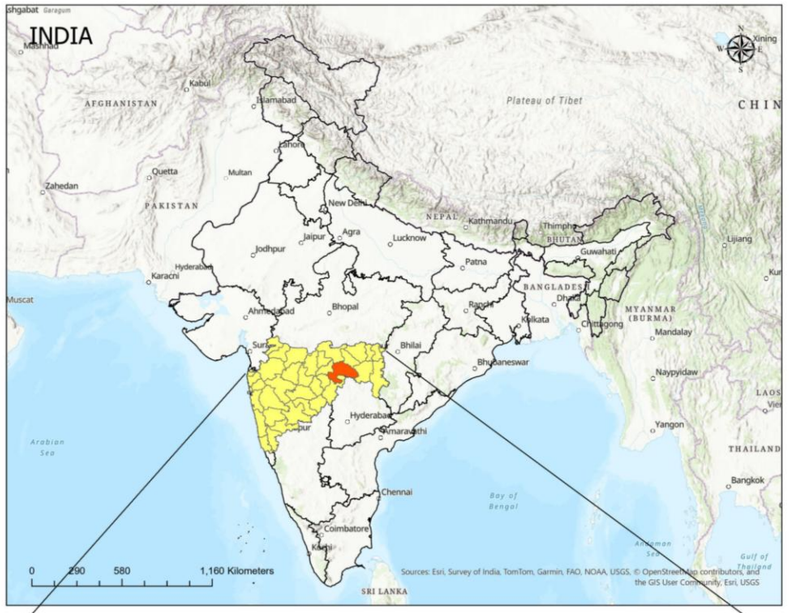
Southern part of Hiwardhara-Ganeshpura block area is covered with Ruikot Reserved Forest (approx. 2.094 sq km), Nagpur Region Circle, Yavatmal Division, Wani Range and remaining area falls in open scrub and agricultural land.

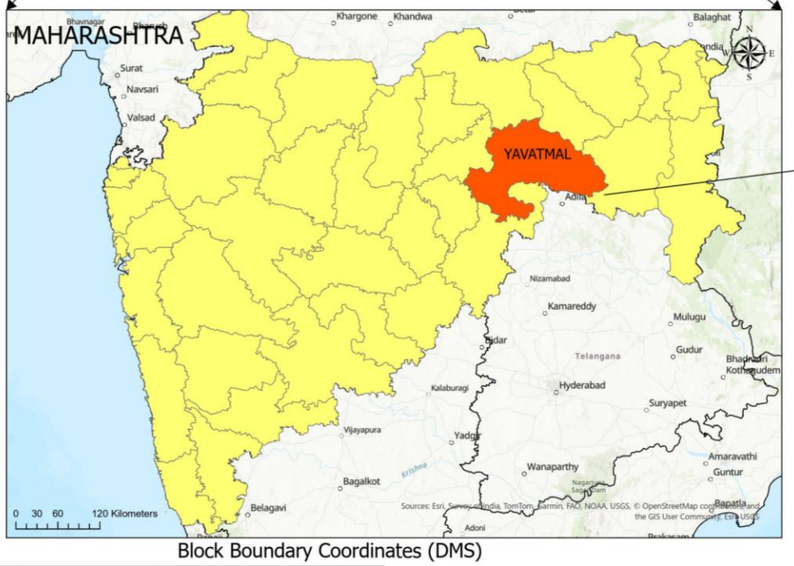
There is no major / minor mineral concession granted inside the block. However, existing mining leases are present in the vicinity.

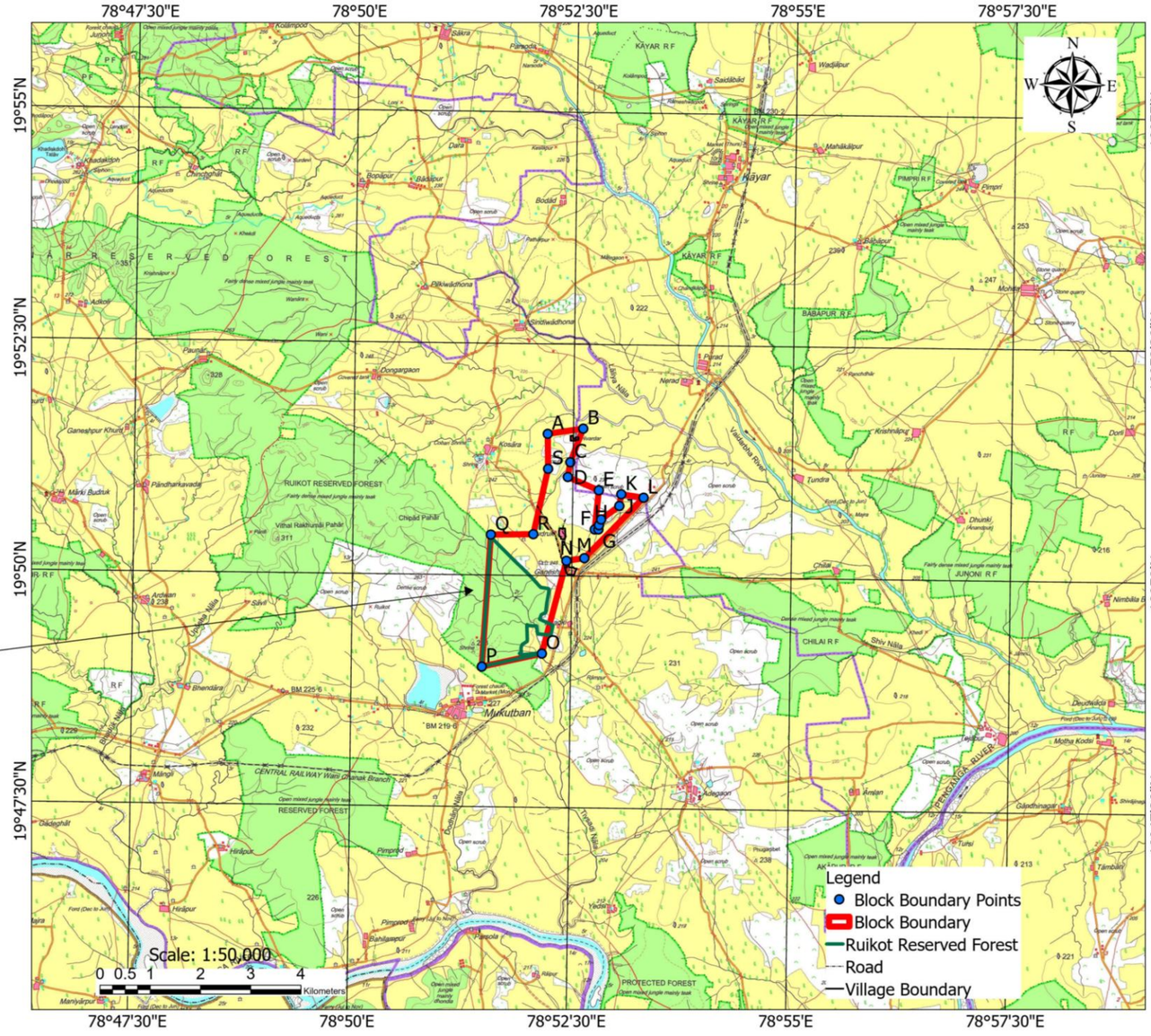
4.3.0 MINERAL(S) UNDER INVESTIGATION

4.3.1 LIMESTONE / DOLOMITE.

Location Map of Hiwardhara-Ganeshpura Block (area: 5.72 sq km)
Tehsil: Zari-Jamni & Wani, District: Yavatmal, Maharashtra
(Part of Toposheet no. 56I13)







Block Boundary Coordinates (DMS)

Points	Latitude	Longitude
A	19° 51' 31.89" N	19° 51' 31.89" N
B	19° 51' 35.53" N	19° 51' 35.53" N
C	19° 51' 13.72" N	19° 51' 13.72" N
D	19° 51' 4.1" N	19° 51' 4.1" N
E	19° 50' 55.74" N	19° 50' 55.74" N
F	19° 50' 30.38" N	19° 50' 30.38" N
G	19° 50' 30.42" N	19° 50' 30.42" N
H	19° 50' 33.19" N	19° 50' 33.19" N
I	19° 50' 36.9" N	19° 50' 36.9" N
J	19° 50' 45.82" N	19° 50' 45.82" N

Points	Latitude	Longitude
K	19° 50' 53.38" N	19° 50' 53.38" N
L	19° 50' 51.31" N	19° 50' 51.31" N
M	19° 50' 11.73" N	19° 50' 11.73" N
N	19° 50' 9.89" N	19° 50' 9.89" N
O	19° 49' 9.64" N	19° 49' 9.64" N
P	19° 49' 0.76" N	19° 49' 0.76" N
Q	19° 50' 26.23" N	19° 50' 26.23" N
R	19° 50' 26.84" N	19° 50' 26.84" N
S	19° 51' 9.27" N	19° 51' 9.27" N

TEXT FIGURE-1

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 has small mounds gradually rising to about 10m from surface, Area has uneven northerly and southerly slope with flat terrain in the central part of the block. The elevation ranges from 206m to 246m above MSL. The southerly and south-easterly flowing drainages are collected by southerly flowing Penganga River. However, the easterly flowing drainages are collected by easterly flowing Vaidarbha River, which ultimately merges with Penganga River. Vaidarbha River lies towards east of the block and Penganga River towards south of the block. The area has got dendritic pattern of drainage.

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

5.2.1 The exploration block is located in Zari-Jamni and 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 36 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 There are a total 11109 no. of people living in the villages, viz., Ganeshpur, Mukutban, Khadaki, Kosara, Hiwardhara and Nerad which are falling in and around the part of explored block. Out of the total population, 5677 numbers are Male and 5432 numbers are female. Apart from adults, children below 6 years are about 1684 in number in Tehsil Zari-Jamni and Wani. Total no. of households in all the villages lying around block is 2659.

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 5744 number of people are working in agriculture as owner, co-owner and labourers, as the main occupation is agriculture.

5.4.2 Out of the total 11109 no of populations, 821 number belong to Scheduled caste and 1589 number belong to Scheduled tribe community. Total literate population is 7859 in and around villages lying in the block. In Zari-Jamni Tehsil, agriculture and forest-based livelihoods are common, especially among tribal communities. However, in Wani Tehsil, agriculture, coal mining, and small-scale industries is the primary occupation of the people.

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

5.6.1 Part of the block is partially covered in southern part with Ruikot Reserved Forest area, Nagpur Region Circle, Yavatmal Division, Wani Range.

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, hare (Lepusreficaudatus) and 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 Vidarbha are the two rivers flowing in the area. The southerly and south- easterly flowing drainages are collected by southerly flowing

Penganga River. However, the easterly flowing drainages are collected by easterly flowing Vaidarbha River, which ultimately merges with Penganga River. Vaidarbha River lies towards east of the block and Penganga River towards south of the block. 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 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 by undulating as well as flat terrain with a gentle southerly, south-easterly and easterly slope. Most of the block area belongs to forest (reserve and open scrub) with partly agriculture land. Yavatmal district is endowed with three major economic resources, viz. agricultural land, mineral deposits and forest produces. The chief major forest produces timber and firewood and the chief minor product is Tembhurani leaves and Hirda etc. 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.

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 block (Approx)
Police station	Mukutban	3 Km
Bank facility	Mukutban	3 Km
Hospital	Wani	35 Km
Bus stand, Educational Institutes	Wani	35 Km
High School	Mukutban	3 Km
Post Office	Nerad	3 Km

6.1.2 The nearest railhead is Wani of central railway 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 functions as a vital transportation corridor, facilitating the movement of cement from the Birla/Adani group company's manufacturing 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 of 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.

The Stratigraphic succession of the 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	Lithology
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, shale is laminated thinly banded 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.

7.1.2 Basalt (Deccan Traps)

Regionally, basalt is classified into five different Formations viz., Karanja, Buldhana, Chikhli, Ajanta, 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, semi consolidated, and features clay bands and current bedding.

7.1.4 Lower Gondwana

The Lower Gondwana Group in the region is subdivided into three lithostratigraphic Formations: namely, 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**: Dated to the Early Permian period, 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 with seasonal variations. This Formation reflects a transition from glacial conditions to warmer, more humid climates conducive to coal Formation.

- **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 lithologies reflect deposition in glacio-fluvial and glaciolacustrine environments, marking the onset of Gondwana sedimentation following extensive glaciation.

7.1.5 Penganga Formation

This Formation is located in the eastern part of the district, near the boundary with Chandrapur district, and dates back to the Neoproterozoic era. 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.

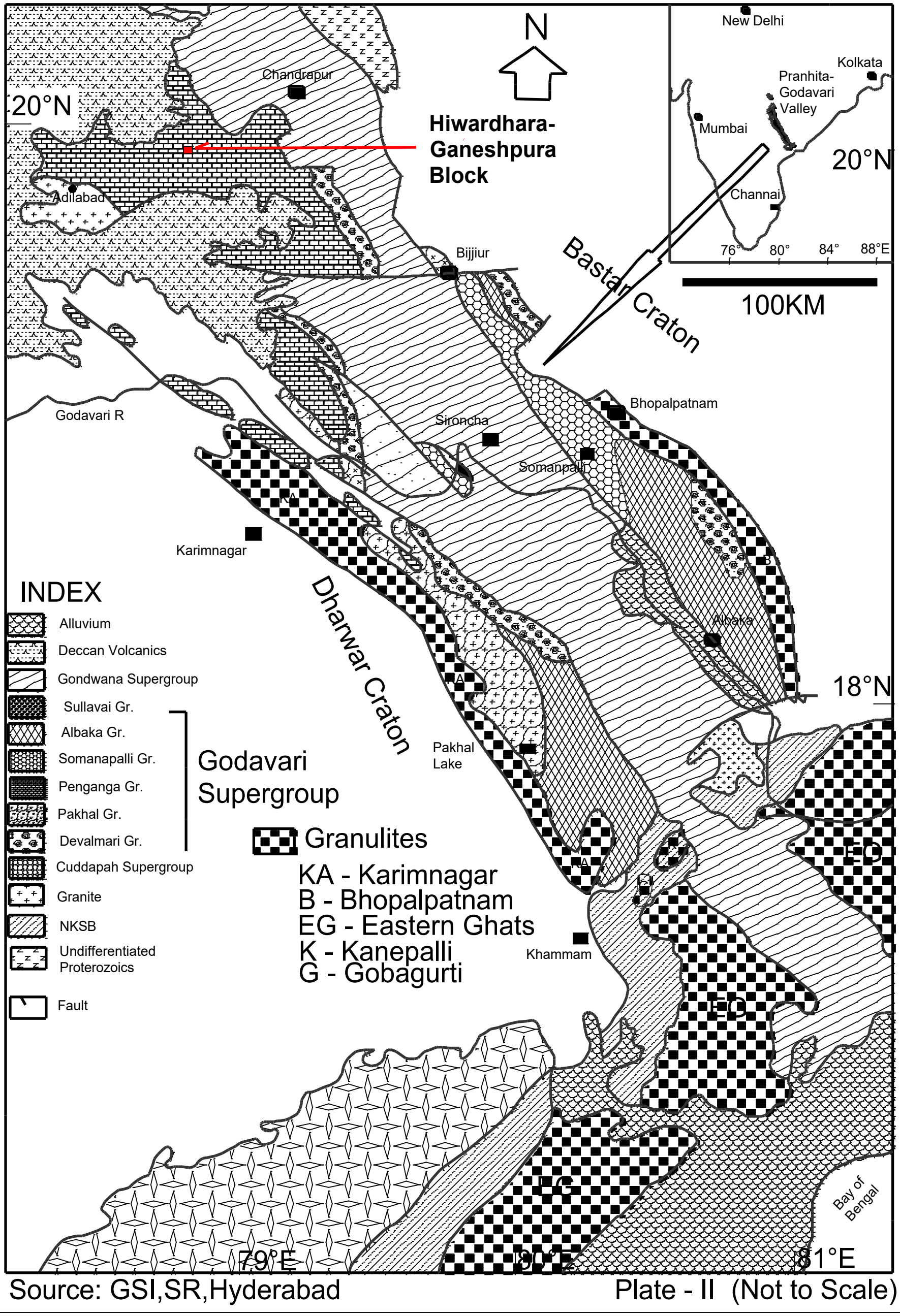
A notable outcrop of greenish-white dolomitic limestone, conformably overlying red shales between Piwardol and Matharjun—approximately 5 km northeast of Bori is interpreted as representing the uppermost horizon of this Formation. The beds generally dip gently (5°–10°) towards the northeast and are relatively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

Dolomite exposed in Hiwardhara-Ganeshpura 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 Yavatmal district, exposures of the PGC-II unit are predominantly observed in the eastern and southeastern sectors, where they constitute the basement complex underlying younger lithostratigraphic successions, including the Gondwana sedimentary assemblages and the Deccan volcanic province.

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



Source: GSI,SR,Hyderabad

Plate - II (Not to Scale)

TEXT FIGURE-2

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.

7.3.0 GEOLOGY OF THE BLOCK

7.3.1 The Hiwardhara-Ganeshpura block, covering an area of 5.72 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 with exposures of occasional sandstone of Kampti/Barakar/Talchir Formation of Gondwana Supergroup and shale and dolomite representing Putnur-Mangurda Formation of Penganga Supergroup. Younger intrusive of Dolerite dykes mapped in the east-central part of block area.

7.3.2 Exposures mapped in the block belongs mostly to the Putnur-Mangurda Formation lesser- known but geologically intriguing unit of the Penganga Supergroup. These Formations typically consist of Lower Proterozoic sedimentary rocks, including shale, dolomite.

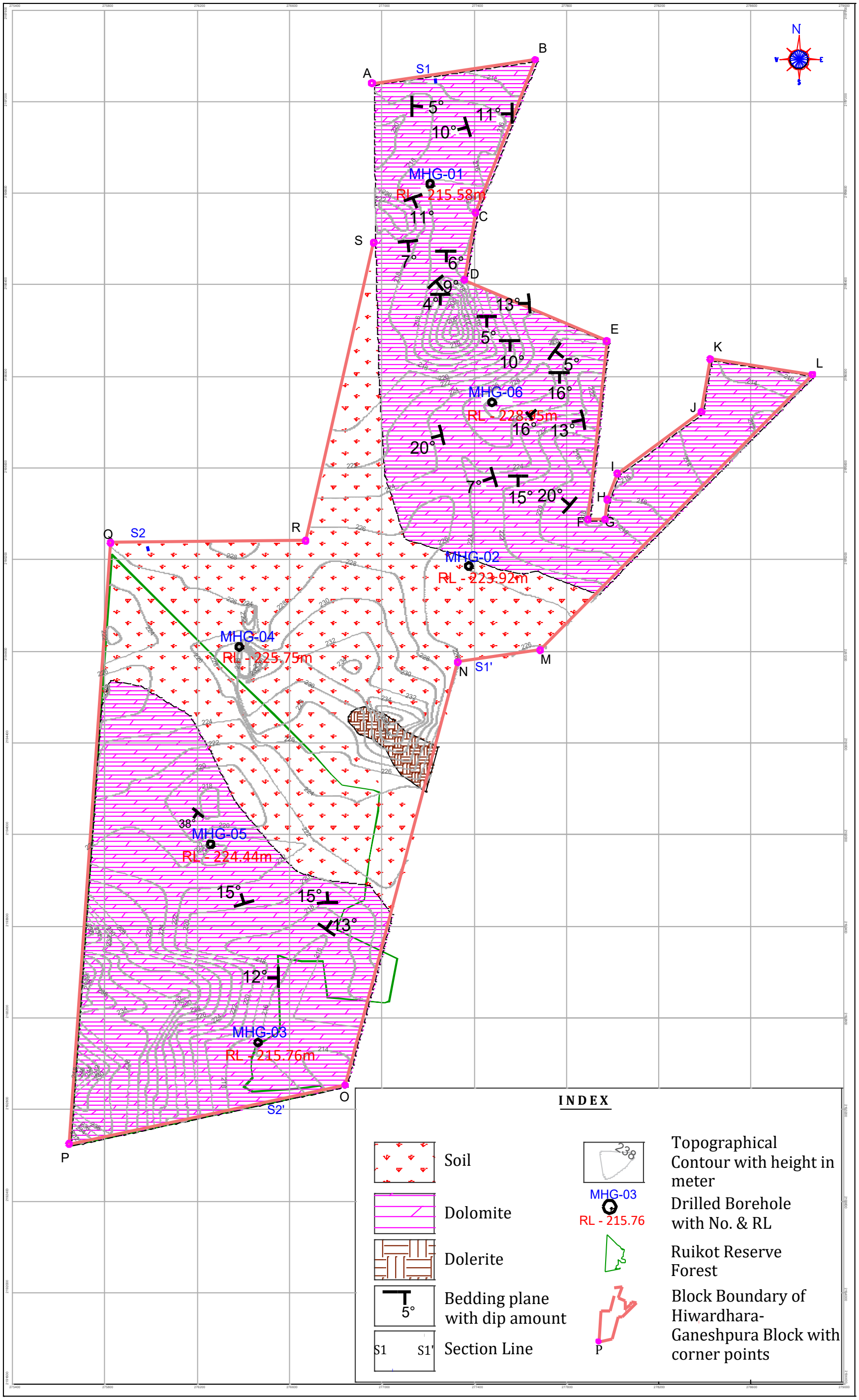
7.3.3 The Putnur–Mangurda sequence likely represents shallow marine to fluvial depositional environments, and its exposures may be found in structurally controlled inliers or along river sections, particularly in areas like Mangurda village in Yavatmal district.

7.3.4 Generalized local stratigraphic succession of explored block (after GSI) is given in below Table-7.2. Geological map on 1:4000 scale is given as Plate-III and Text Figure 3.

Table-7.2
Generalized Local Stratigraphy of Hiwardhara- Ganeshpura block, Dist: Yavatmal, Maharashtra.

Age	Supergroup	Group	Formation	Lithology
Quaternary				Alluvium
Upper Cretaceous to Palaeocene	Deccan Trap	Sahyadri	Karanja, Buldhana, Chikhli, Ajanta, Mahur	Basalt, Cherty limestone (Intertrappean)
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 Takallapalli	Quartzite Shale Limestone/Dolomite Conglomerate
Archean to Palaeoprotorozoic	Peninsular Gneissic Complex-II			Hornblende Biotite Gneiss

TOPOGRAPHICAL AND GEOLOGICAL MAP OF HIWARDHARA GANESHPURA BLOCK



TEXT FIGURE-3

7.4.0 DESCRIPTION OF ROCK TYPES

The Litho-units of Hiwardhara-Ganeshpura Block area is described below as per order of superposition.

7.4.1 SOIL

About forty percent of the block area is covered by soil. Soil cover within the block area varies in thickness from 0.50m to 11.20m, colour is light grey to black. Soil coverage is observed predominantly in the central part of the block. The thickness of the soil is not uniform in entire block. A maximum thickness of 11.20m is observed southern part and upto 6.00m in the northern part of the block. The maximum intercepted soil thickness is 11.20 m in borehole MHG-05, while boreholes MHG-01 and MHG-03 recorded no soil.

7.4.2 SANDSTONE

Sandstone was intercepted in boreholes MHG-04 and MHG-05. It is fine- to medium-grained, with coloration ranging from yellowish white to light grey. No surface exposure or outcrop of sandstone is observed within the block area. The sandstone bed recorded a thickness of 23 m in borehole MHG-04 (Photo-01).

Photo - 01: Core photograph showing sandstone from 27.40m to 31.60m in Borehole No. MHG-04.

7.4.3 SHALE

The shale beds are fine-grained and exhibit pronounced fissility, readily cleaving along thin laminae. Dark grey to black in colour, often rich in organic matter,

inter-bedded with sandstones, siltstones and dolomite.

The shales of the Putnur-Mangurda Formation were deposited in low-energy environments such as lacustrine or distal deltaic settings, where fine-grained sediments accumulated undisturbed. Their laminated texture and organic enrichment point to suboxic to anoxic depositional conditions, conducive to fossil preservation and potentially favorable for hydrocarbon generation under suitable thermal maturation. Although shale outcrops are absent in the mapped area, subsurface investigations reveal the presence of shale beds in boreholes MHG-01(Photo-02), MHG-02 and MHG-06, with cumulative thicknesses of 12.95 m, 7.00 m and 5.60 m respectively.

Photo - 02: Core photograph showing shale with calcite veins from 21.00m to 25.00m in Borehole No. MHG-01.

7.4.4 DOLOMITE

Mapped exposures in the area are predominantly composed of dolomite, with a notable outcrop measuring 25 × 14 m located in the northern part of the block. These dolomite beds exhibit strike orientations from ENE–WSW to East–West, with dip angles varying between 5° and 20° towards the south. The dolomite is typically fine- to medium-grained, white to light grey in color, and displays prominent mottling along with intense jointing.

The presence of an abandoned limestone/dolomite mine to the east of the block highlights the economic potential and geological persistence of these carbonate formations across the area.

Two BRS samples were collected in proximity to boreholes MHG-06 and MHG-05 along with two core samples retrieved from boreholes MHG-01 and MHG-05 for petrographic analysis. The studies confirmed that all samples are composed of dolomite. Summary of the petrographic study is given in Table No. 7.3.

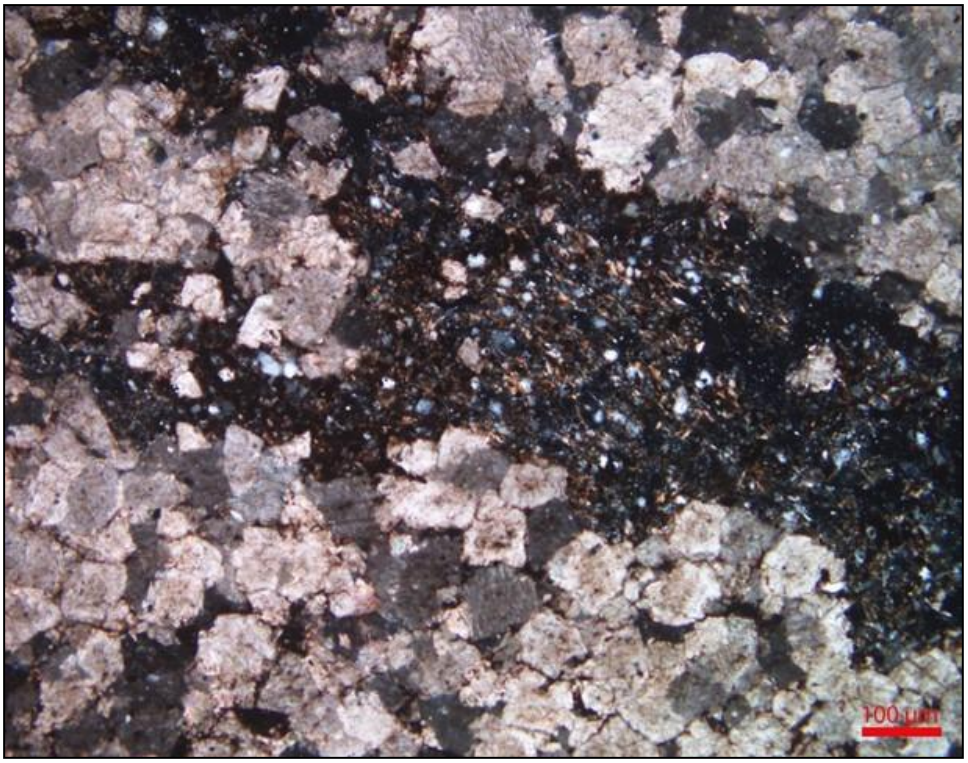
Table No. 7.3
Summary of the petrographic study done by Petrology Laboratory, MECL

Sl.No.	Sample No.	Borehole No.	From (m)	To (m)	Rock type identification
1	HG-PET-01	MHG-01	43.60	43.70	Dolostone (Dolomite)
2	HG-PET-03	MHG-05	21.20	21.25	Dolostone (Dolomite)
3	HG-PET-04	Bedrock	---		Dolostone (Dolomite)
4	HG-PET-05	Bedrock	---		Dolostone (Dolomite)

Photo-03: Photograph showing dolomite exposures near the borehole no. MHG-06

Dolomite (**HG/PET/01)** occurs as fine subhedral rhombic and anhedral grains showing granular texture and grain size coarsening in areas. Stylolitic cracks are common in the specimen and are mostly filled with opaques/ ferruginous matter. Opaques/ ferruginous matter is also present as fillings along grains contacts, very fine specks, patches and as stains over dolomite, at places. Illite/ sericite and quartz, together occur as very fine shaly aggregates in lenses and also seen intruded as fillings. Thin calcite fillings have seen intruded in areas

comprising fine anhedral grains. Gypsum is noted as very fine flaky grains in accessories.



Pmg – 1: Photomicrograph showing shaly lenses within dolostone as seen under crossed nicols. (Specimen No. : HG/PET/01 Magnification : 100X)

Dolomite was intercepted in five boreholes, with the maximum zone thickness of 50 m recorded in MHG-03 and a minimum cumulative zone thickness of 6 m in MHG-02. Geochemical analysis reveals CaO content ranging from 30.37% to 32.83%, MgO from 16.05% to 19.28%, and SiO_2 from 1.16% to 5.98%.

7.4.5 DOLERITE

Dolerite exposure is mapped in the east-central part of the block, with surface exposures measuring approximately 420 × 120 m. The exposure is oriented along NW–SE direction. MHG-04 which was drilled north west to the dolerite exposure has an intersection of around 18.00m of dolerite. Drillholes MHG-02 and MHG-05 were drilled to the north and south of the surface-exposed dolerite, respectively; however, no dolerite was intersected in either hole. Additionally, few boreholes were drilled within the adjacent Adegaon Limestone Block of MECL. These boreholes are distributed around the

surface-exposed dolerite, yet none have intersected a dolerite column. Based on subsurface data and spatial distribution, the dolerite is interpreted as a dyke. The dolerite is medium-grained, massive and hard in texture, and it displays a characteristic light green coloration.

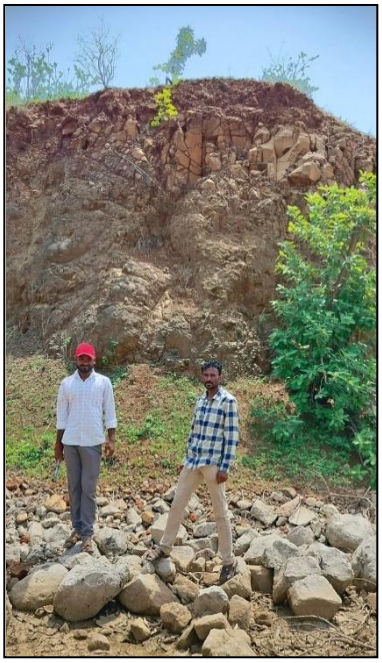
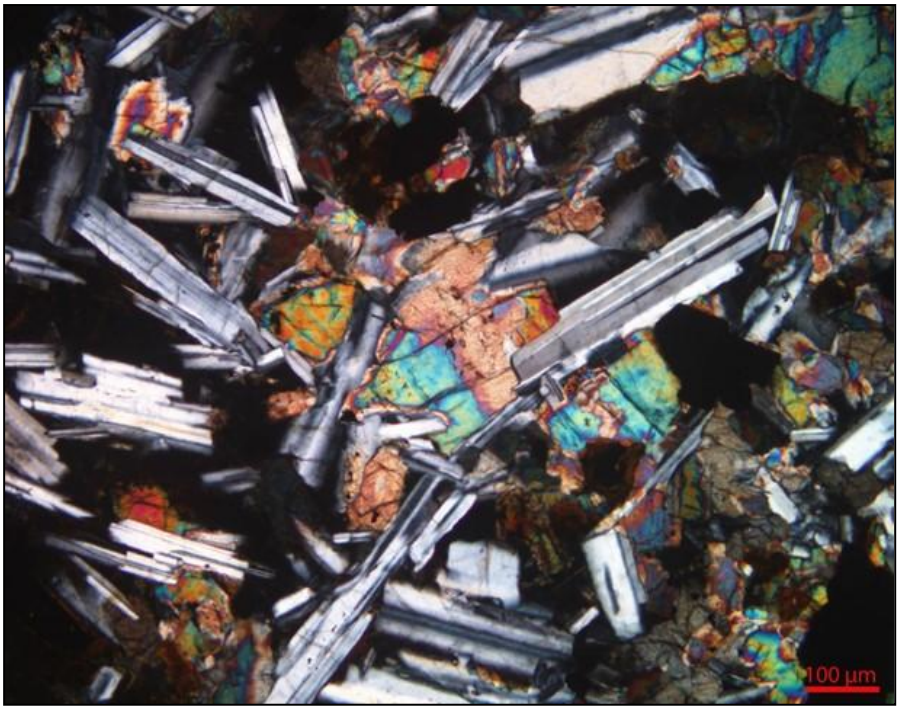


Photo 04 (a), (b): (a) Photograph showing Dolerite boulders in east-central part of the block, (b) Core photograph showing dolerite from 20.00m to 23.00m in Borehole No. MHG-04

Dolerite **(HG/PET/02)** thin section study indicates, plagioclase occurs as medium to fine subhedral prismatic laths and augite occurs as medium to fine subhedral to anhedral grains, together showing sub-ophitic and intergranular texture. Medium to moderately coarse brownish volcanic glass is seen present in the specimen. Opaques occur as fine to medium subhedral to anhedral patchy disseminated grains. Pores and cavities are noted, mostly filled by carbonate and chalcedony patches.



Pmg – 2: Photomicrograph showing sub-ophitic and intergranular texture within dolerite as seen under crossed nicols. **(Specimen No.: HG/PET/02 Magnification: 100X)**

7.5.0 BLOCK STRUCTURE

The dolomite beds within the block exhibit a consistent structural alignment with adjacent lithological units, maintaining a strike direction from ENE–WSW to East–West and dip angles ranging between 5° and 20° towards the south. However, localized structural changes have been observed due to folding in the north and dolerite dyke intrusion in the central part of the block.

7.5.1 Bedding and Dip characteristics

7.5.1.1 The ENE–WSW strike aligns with regional structural trends observed in the surrounding sedimentary basins, possibly influenced by basement lineaments or paleostress orientations.

7.5.1.2 Localised folding may be present within the block area, as indicated by variations in strike and dip observed at several locations. The strike changes are confined to a zone approximately 50–100 meters wide, suggesting the presence of localised structural folding. Additionally, a dolerite dyke intrusion trending NW–SE, with an approximate width of 120 meters, traverses the area. This intrusion likely induced dolomitisation of in-situ limestone and may have contributed to the observed deformation patterns.

7.5.2 Fracture and Joint

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

7.5.2.2 The presence of mottling, a characteristic surface pattern caused by differential weathering along microfractures, further supports the idea of intensive surface fracturing and prolonged subaerial exposure.

Photo-05: Photograph showing mottling in Dolomite exposure in the northern part of the block area.

7.5.3 Structural Controls on Mineralization

7.5.3.1 The alignment of dolomite beds, alongwith the presence of an abandoned limestone/dolomite mine to the east of the block highlights the economic potential and geological persistence of these carbonate Formations across the area.

7.5.4 Tectonic Implications

7.5.4.1 The gentle to moderate 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.

7.6.0 MINERALISATION IN THE BLOCK

7.6.1 In the Hiwardhara–Ganeshpura exploration block, approximately 40% of the area is covered by soil with limited rock exposures. To evaluate the extent of mineralization, six boreholes were drilled to a vertical depth of 50 m.

The dolomite horizons intercepted in the boreholes are part of the stratigraphic sequence of the Putnur–Mangurda Formation. These dolomites likely formed through the dolomitization of precursor limestones, a diagenetic process involving the replacement of calcium by magnesium in the carbonate minerals. This transformation was likely driven by magnesium-rich hydrothermal fluids,

associated with the emplacement of a dolerite dyke—identified through geological mapping and intersected in borehole MHG-04. The presence of such metasomatic alteration indicates that the Hiwardhara–Ganeshpura block may spatially lie along the margin of Putnur–Mangurda carbonate basin where interaction between magmatic intrusions and carbonate rocks may have enhanced fluid flow and facilitated extensive dolomitization.

Dolomite was intercepted in five boreholes—MHG-01, MHG-02, MHG-03, MHG-05, and MHG-06—with respective cumulative zone thicknesses of 23.70 m, 6.00 m, 50.00 m, 36.00 m and 17.50 m respectively (Photo-06 a, b, c, d and e).

Photo- 6a: Core photograph showing dolomite zone from 25.00m to 28.50m in Bh. No. MHG-01

Photo- 6b: Core photograph showing dolomite zone from 34.00m to 36.00m in Bh. No. MHG-02

Photo- 6c: Core photograph showing dolomite zone from 24.00m to 28.00m in Bh. No. MHG-03

Photo- 6d: Core photograph showing dolomite zone (highly fractured) from 45.00m to 50.00m in Bh. No. MHG-05.

Photo- 6e: Core photograph showing dolomite zone from 35.00m to 40.00m in Bh. No. MHG-06.

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 55 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, 55 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 Licence 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 includes reconnaissance survey followed by 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 carried out. Total eight pits have been carried out for exploration in the 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

8.1.3 There was a field visit conducted by MECL geologists outside the Hiwardhara Ganeshpura Block (on the eastern side). They reported the limestone in the area and collected 3 nos. of samples. The analysis of the samples is given below.

Sample No.	**CaO%**	**MgO%**	**Al_2O_3%**	**SiO_2%**	**Fe_2O_3%**	**SO_3%**	**P_2O_5%**	**K_2O%**	**LOI%**
S-6	52.10	0.70	1.00	3.94	0.42	0.07	0.02	0.20	41.46
S-7	50.50	0.90	1.57	5.78	0.84	0.40	0.04	0.42	39.60
S-8	37.34	9.03	2.56	8.60	1.03	0.09	0.07	0.52	40.57

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 Hiwardhara-Ganeshpura Block falls in Survey of India Toposheet No. 56 I/13. Ganeshpur, Mukutban, Khadaki, Kosara, Hiwardhara and Nerad are villages in and around the block which belongs to Tehsil- Zari-Jamni and Wani, District - Yavatmal, State - Maharashtra.

10.1.2 Hiwardhara-Ganeshpura 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.

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 Hiwardhara-Ganeshpur villages of Tehsil- Zari-Jamni and Wani, District – Yavatmal.

10.1.5 Exploration Proposal (G3) for Hiwardhara- Ganeshpura block (5.72sq.km) was submitted and deliberated in 70th TCC 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, the 70th TCC Committee recommended the proposed quantum outlined in Annexure-VIII A for the project titled 'Preliminary Exploration (G3 Level) of Limestone in the Hiwardhara-Ganeshpura Block (5.72 sq. km), Yavatmal District, Maharashtra".

10.1.6 On recommendation of 70th TCC, 38th EC of NMET meeting held on 29th November 2024 approved this project with total cost of 93.84 lakh. (Annexure-VIII B).

10.2.0 OBJECTIVES OF INVESTIGATION

10.2.1 The preliminary exploration was proposed with following objectives in Hiwardhara-Ganeshpura Block are as follows:

(a) To carry out detailed Topographical Survey and Geological mapping on 1:4000 scale over an extent of 5.72 sq.km.

(b) To delineate the strike and depth continuity of the limestone by drilling of vertical boreholes of 06 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 Hiwardhara-Ganeshpura 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 Hiwardhara-Ganeshpura Block

Sl. No.	Item of Work	Unit	Target	Achieved
1	Topographic Survey & Geological Mapping on 1:4000 scale	sq.km	5.72	5.72
2	Boundary and borehole demarcation with DGPS	Nos	25	25
3	Exploratory Drilling	m.	300.00 06 Bhs	300.00 06 Bhs
4	**Laboratory Studies**			
	i) Primary 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.	Nos.	280	102
	ii) External Check (NABL) samples (10% of Primary samples) for analysis of 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.	Nos.	28	10
5	**Physical Studies**			
	a) Petrological Studies	Nos.	5	5
	b) Bulk Density Determinations	Nos.	2	2
6	Report Preparation (4 Hard copies with one soft copy)	Nos.	1	1

10.4.0 EXPLORATION ACTIVITIES TAKEN BY MECL

10.4.1 Exploration activities viz., Geological Mapping, Topographical Survey on 1:4000 scale, over 5.72 sq.km area, exploratory drilling in 06 no of boreholes were carried out with associated analytical works.

10.4.2 MECL commenced exploration activities on 12.03.2025 and completed on 10.06.2025.

10.4.3 Geological mapping was carried out at 1:4,000 scale for the entire area of 5.72 sq. km. depicting the lithology, structure, and surface mineralization signatures. Broad lithological 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 ENE-WSW to E-W with dip angle 5°–20° due south. The readings recorded in the field were plotted in the Topographical and Geological map (Plate III).

10.4.4 Topographical survey work and exploratory drilling, 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, lithological 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 MECL has collected 02 no of bedrock samples in the block for petrographic studies.

10.5.2 A total 06 no of exploratory boreholes were drilled with total meterage of 300m. Total 102 numbers of primary core samples are generated from the drilled cores, which were analysed for 10 number of oxides i.e., CaO, MgO, SiO_2, Fe_2O_3, Al_2O_3, SO_3, P_2O_5, Na_2O, K_2O & LOI by XRF method and compiled as Annexure-IIIA.

10.5.3 10% samples of primary drill core samples, about 10 nos. were submitted for external check analysis samples for 10 radicals, CaO, MgO, SiO_2, Fe_2O_3, Al_2O_3, SO_3, P_2O_5, Na_2O, K_2O & LOI by XRF method (Annexure-IIIB).

10.5.4 A total of 5 no. of samples were studied for petrological and 2 no. of samples for bulk density study, the study reports have been incorporated in the Annexure-V and VI respectively.

CHAPTER - 11

11.0.0 LOCATION 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). The borehole coordinates, reduced levels (RL), and surface features—including roads, village boundaries, water bodies, and base station—along with the block coordinates comprising 19 cardinal boundary points with RL, have been determined. These details are provided in Annexure IA. Additionally; the topographical and geological maps are presented in Plate-III. Contour interval in topographical map is kept at 2m. The topographic survey was done in PPK (Post Precision Kinematics) mode. Positional (horizontal) accuracy of the survey is 3mm while the elevation accuracy is 3.5mm in PPK mode.

11.1.2 DGPS survey was carried out for 06 nos. boreholes drilled by MECL (Annexure IB). The base station was utilized for the fixing of the boreholes on the ground level. The coordinate of base station is given in Table-11.1.

Table No. 11.1
Co-ordinates of the base station for DGPS survey of Hiwardhara-Ganeshpura 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 were surveyed by DGPS). The topographic survey was done in PPK (Post Precision Kinematics) mode. Positional (horizontal) accuracy of the survey is 3mm while the elevation accuracy is 3.5mm in PPK mode. The detailed topographical map of Hiwardhara-Ganeshpura Block has been prepared on 1:4,000 scale.

Photo 07: Photograph showing fixing of Block Boundary point through 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 take up the Preliminary exploration (G3 stage) for limestone in Hiwardhara-Ganeshpura Block. 02 nos of bed rock samples collected from the block for petrographical studies. There was no provision for trenching and pitting in the block as per the approved quantum of exploration proposal. Hence no pit and trench samples were generated in the block.

12.1.2 Exploratory drilling of 300m carried out in 06 no of boreholes. A total of 102 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. Three numbers of core samples were studied for petrological and two numbers 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 dolomite zone for sample preparation and under the supervision of sampling technician and sample was generated. Core recovery in nearly all boreholes exceeded 90%, despite the highly fractured nature of the lithologies. Consequently, the samples obtained provide a reliable and representative profile of the drilled lithology.

Photo 08: Photograph showing conventional drill rig (RD- 60) MEC- 347 at Borehole no. MHG-01.

CHA PTER - 13

13.0.0 DRILLING TECHNIQUES AND DRILL SAMPLING EMPLOYED

13.1.0 DRILLING TYPES AND DETAILS

13.1.1 MECL has carried out core drilling in 6 no. of vertical exploratory boreholes with a cumulative meterage of 300.00m. The details co-ordinates of boreholes are given in Annexure IB and summary of boreholes is given in Table-13.1.

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

Sl. No.	Borehole No	Northing (m)	Easting (m)	Elevation (m)	Date of Commencement	Date of Closure	Total Depth (m)
1	MHG - 01	2196831.868	277217.787	215.580	12.03.2025	18.03.2025	50.000
2	MHG - 02	2195163.321	277386.279	223.924	16.03.2025	21.03.2025	50.000
3	MHG - 03	2193083.605	276472.151	215.758	20.03.2025	29.03.2025	50.000
4	MHG - 04	2194810.382	276391.514	225.747	23.03.2025	27.03.2025	50.000
5	MHG - 05	2193948.481	276267.031	224.437	31.03.2025	13.04.2025	50.000
6	MHG - 06	2195878.300	277486.014	228.950	16.04.2025	29.04.2025	50.000
Total Drilling meterage							**300.00**

13.1.2 The Drilling operation in the block was performed by RD 60 (MEC 347 & 352) coring drill rigs All boreholes within the block were drilled using NQ-size single barrel wireline technique, employing the wet core drilling method. As the lithological Formations encountered in almost all the boreholes were highly fractured, the NW casing length varied from 1m in borehole no MHG-03 to 34m in borehole no MHG-05. After setting NW casing, drilling advanced in NQ size till completion of borehole.

13.1.3 All boreholes were drilled vertically to a depth of 50 meters, adhering to the approved NQT guidelines prescribed by NMET. Deviation surveys were not carried out for the coring boreholes.

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 litholog and summarized litholog for boreholes are given in Annexure-IIA and Annexure-IIB respectively. The run wise litholog of drilled core as well as the cuttings from boreholes have helped in describing the physical characters like colour, shape, size and nature of the mineralization as well as texture, structural features and identification of different lithounits with demarcating the mineralizes zones

13.2.2 The mineralized zones /length recorded during the geological core logging have been sampled for Dolomite and analysed for 10 radicals. The primary sample had been marked in the mineralized zones intersected in the borehole based on visual interpretation/lithology and in general the sample length has been kept as 2.00 m for borehole nos. MHG-01, 02, 03, 05 & 06. However, no sampling was carried out in borehole no. MHG-04 due to non-intersection mineralized zones. 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 as discussed in para 13.1.2. 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 properly maintained in dolomite horizon, however in case of weathered, loose and fractured zone and in solution cavities, the core recovery was low (as in bh MHG-05 where the total core recovery is 74.70% for the Formation were loose and highly fractured). Whenever core recovery is less, the grade of the recovered portion has been extrapolated over the non-recovered section. All necessary precautions, such as modulated water pressure, appropriate liner placement, optimal head pressure, and the expertise of a skilled drilling technician were diligently observed to ensure high-quality drilling.

13.4.0 WHETHER THE RELATIONSHIP EXISTS BETWEEN SAMPLE RECOVERY AND GRADE

13.4.0 Core recovery in all the dolomite horizon is >90% (except bh no MHG-05), hence grade analysed for Dolomite zone is reliable. The borehole wise core recovery is given below in Table No. 13.2

Table No. 13.2

Borehole wise core recovery

Bh.No	Core Recovery (%)	Remarks
MHG-01	94.60	NA
MHG-02	92.30	NA
MHG-03	94.80	NA
MHG-04	91.96	NA
MHG-05	74.70	Loose and highly fractured Formation
MHG-06	97.80	NA
Average Core Recovery in all boreholes 91.03%		

13.5.0 CORE LOGGING

13.5.1 The entire core recovered by drilling was logged systematically in detail describing lithological units that can be observed by visual inspection. The details of lithology, 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 litholog and summarized litholog 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 longitudinal equal halves. The entire marked half of the core sample was crushed to a (-) 72 mesh size. Subsequently, approximately 500 grams of representative material of (-) 200 mesh size was prepared using the coning and quartering method of gradual size reduction, employing a 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 102 nos. of primary samples and 10 nos. of external check samples for dolomite mineralization were prepared. External check samples for same radicals have been sent to Jawaharlal Nehru Aluminium Research Development and Design Centre (JNARDDC) Nagpur (A NABL accredited Laboratory) for which the results are awaited. 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.

14.3.0 QUALITY CONTROL PROCEDURES ADOPTED

14.3.1 The primary core samples have been collected from entire mineralized zones/length intersected in the boreholes drilled and the samples have been prepared at centralized mechanized sampling unit. The standard sampling procedure in supervision of qualified sampling technician has been adopted to control the quality of samples. Similarly, external check samples have also been prepared under the supervision of qualified sampling technician following the standard sampling procedure.

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 mineralized cores. During the preparation of primary samples, the mineralized cores have been studied meticulously and samples have been marked properly. These mineralized 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

15.1.1 102 nos. of primary samples from limestone/dolomite mineralization 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, Na2O and LOI by XRF method at Chemical Laboratory of MECL, Nagpur and 10 nos. of external check samples for same 10 radicals have been sent to Jawaharlal Nehru Aluminium Research Development and Design Centre, (JNARDDC) Nagpur (A NABL accredited Laboratory).

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

15.2.1 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

Photo 09: Photograph of WD- XRF instrument (Rigaku, Japan) at Chemical Lab, MECL, Nagpur.

15.2.2 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.

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

15.3.1 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, Magnesium 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.

15.3.2 Procedure for determination of Loss on Ignition (LOI)

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

15.4.0 NATURE OF QUALITY CONTROL PROCEDURES ADOPTED

15.4.1 In order to ensure the accuracy of the analysed samples, NCS DC 28201 has been used as certified reference material (CRM) for dolomite at Chemical lab, MECL. The CRM was processed under similar conditions as samples and run after every 20 samples.

15.4.2 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.

15.5.0 CHECK ANALYSIS FROM THIRD PARTY NABL ACCREDITED LABORATORY

15.5.1 A total 10 nos. of External Check samples have been sent to JNARDDC, Nagpur 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 analysis. Comparison of chemical analysis of external check samples with primary samples are provided in the Annexure -IIIB.

15.5.2 In order to assess the bias and inaccuracies in analytical determination as well as to check the repeatability of analysis, 10 borehole samples were analyzed for external check analysis out of 108 primary samples. External check sample results of M/s JNARDDC Laboratory have been compared with primary sample results for 10 radicals i.e. CaO, MgO, Al_2O_3, SiO_2, Fe_2O_3, SO_3, P_2O_5, K_2O, Na_2O & LOI and found no major or significant difference between the results.

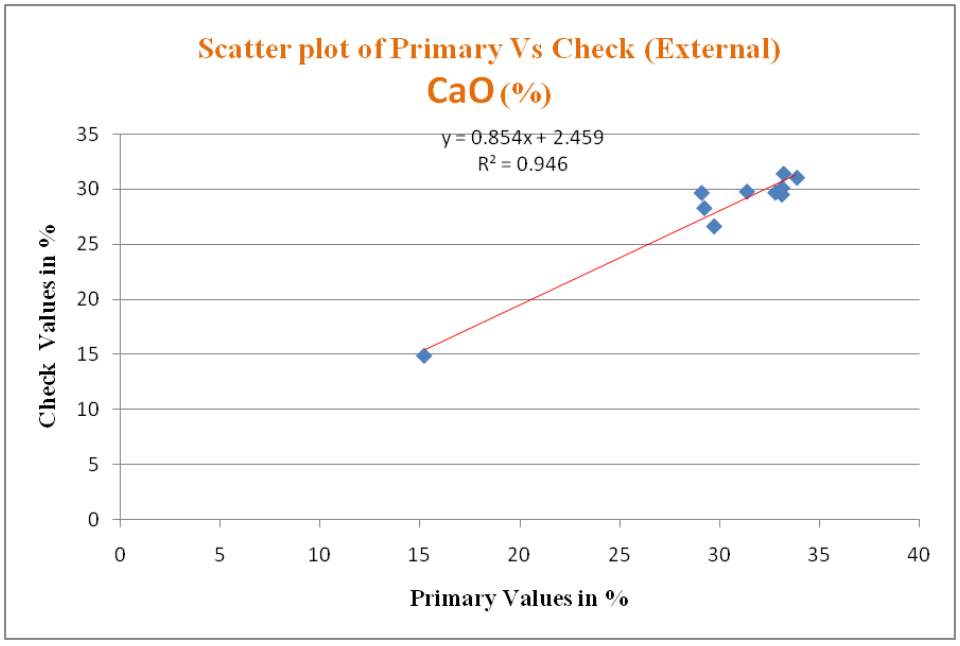
The comparative studies for dolomite primary Vs external check samples are tabulated in Annexure -IIIB.

15.5.3 The comparative studies of Primary Vs External check analysis of borehole core samples for CaO is given in Table-15.1 and scatter plots is represented as Text Figure- 4.1.

Table-15.1

Comparison of Primary vs. External Check of Dolomite samples for CaO

Comparison Index	CaO%	
	Primary	Check
No. of Sample Pairs	10	
Arithmetic Mean (%)	30.052	28.141
Standard Deviation	5.229	4.594
Standard Error of Mean	1.654	1.453
Variance	27.341	21.103
Mean of Deviation	1.911	
Standard Deviation (Error)	1.309	
Correlation Coefficient	0.973	
Mean Absolute Error	2.037	
Mean Relative Random Error	6.778%	
Paired T Value	4.615	
F-Test Value	1.296	



Text Figure-4.1: Scatter Plot of Primary Vs Check (External) Analysis of CaO

15.5.3.1 The data set for primary Vs External check analysis comprises 10 pairs of borehole core samples. Table-15.1 shows that the difference in arithmetic mean,

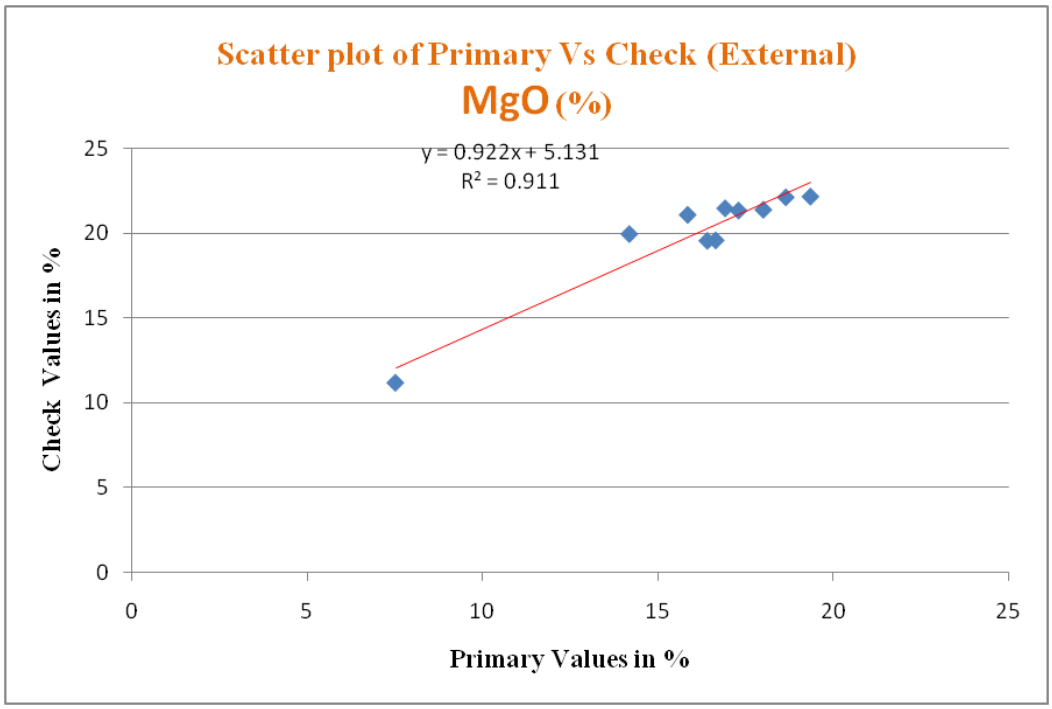
standard deviation, of primary and external check samples for CaO are not high. The value of R^2 given in scatter plot (Text Figure – 4.1) is 0.946, which is close to 1.00 and indicates a good correlation in primary and external check analysis.

15.5.4 The comparative studies of Primary Vs External check analysis of borehole core samples for MgO is given in Table-15.2 and scatter plots is represented as Text Figure- 4.2.

Table-15.2

Comparison of Primary vs. External Check of Dolomite samples for MgO

Comparison Index	MgO%	
	Primary	Check
No. of Sample Pairs	10	
Arithmetic Mean (%)	16.085	19.969
Standard Deviation	3.171	3.064
Std. Error of Mean	1.003	0.969
Variance	10.055	9.386
Mean of Deviation	-3.884	
Standard Deviation (Error)	0.944	
Correlation Coefficient	0.955	
Mean Absolute Error	3.884	
Mean Relative Random Error	24.147%	
Paired T Value	-13.015	
F-Test Value	1.071	



Text Figure-4.2: Scatter Plot of Primary Vs Check (External) Analysis of MgO

15.5.4.1 The data set for Primary Vs External check analysis comprises 10 pairs of borehole core samples. Table-15.2 shows that the difference in arithmetic mean, standard deviation, of primary and external check samples for MgO are not high. The value of R^2 given in scatter plot (Text Figure 4.2) is 0.911, which is close to 1.00 and indicates a good correlation in primary and external check analysis.

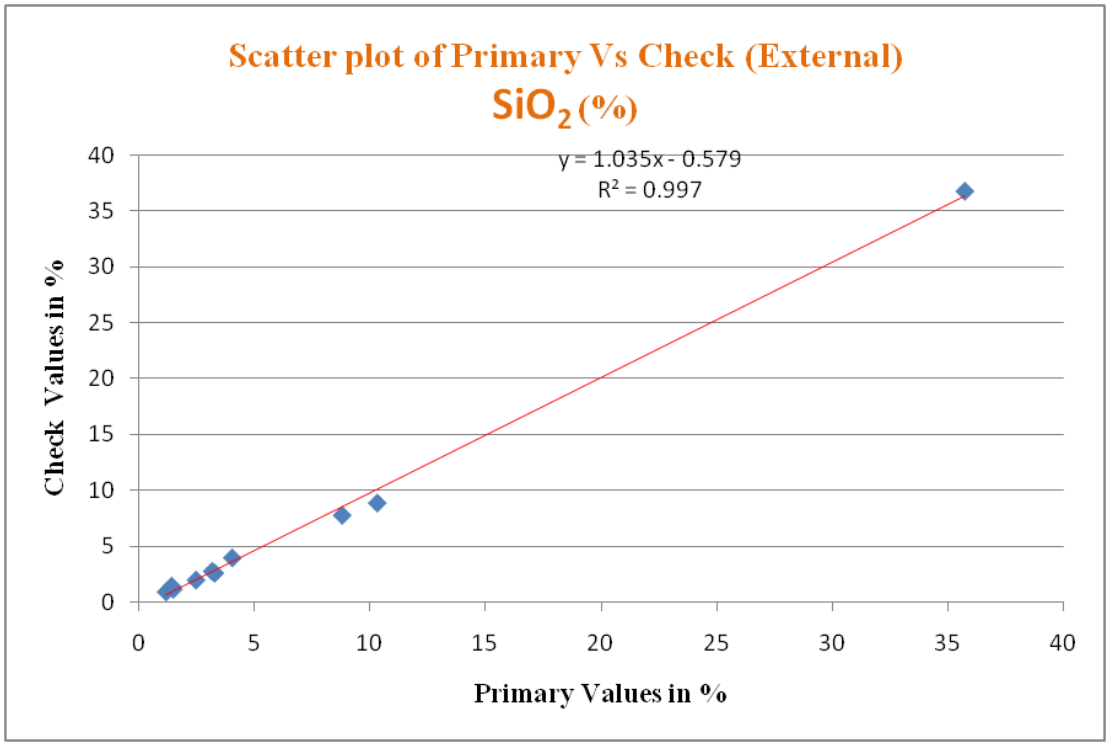
15.5.5 The comparative studies of Primary Vs External check analysis of borehole core samples for SiO_2 is given in Table-15.3 and scatter plots is represented as Text Figure- 4.3.

Table-15.3

Comparison of Primary vs. External Check of Dolomite samples for SiO_2

Comparison Index	SiO_2 %	
	Primary	Check
No. of Sample Pairs	10	
Arithmetic Mean (%)	7.177	6.85
Standard Deviation	9.959	10.322
Std. Error of Mean	3.149	3.264
Variance	99.181	106.551
Mean of Deviation	0.327	
Standard Deviation (Error)	0.633	
Correlation Coefficient	0.999	

Comparison Index	SiO_2 %	
	Primary	Check
Mean Absolute Error	0.559	
Mean Relative Random Error	7.789%	
Paired T Value	1.635	
F-Test Value	0.931	



Text Figure-4.3: Scatter Plot of Primary Vs Check (External) Analysis of SiO_2

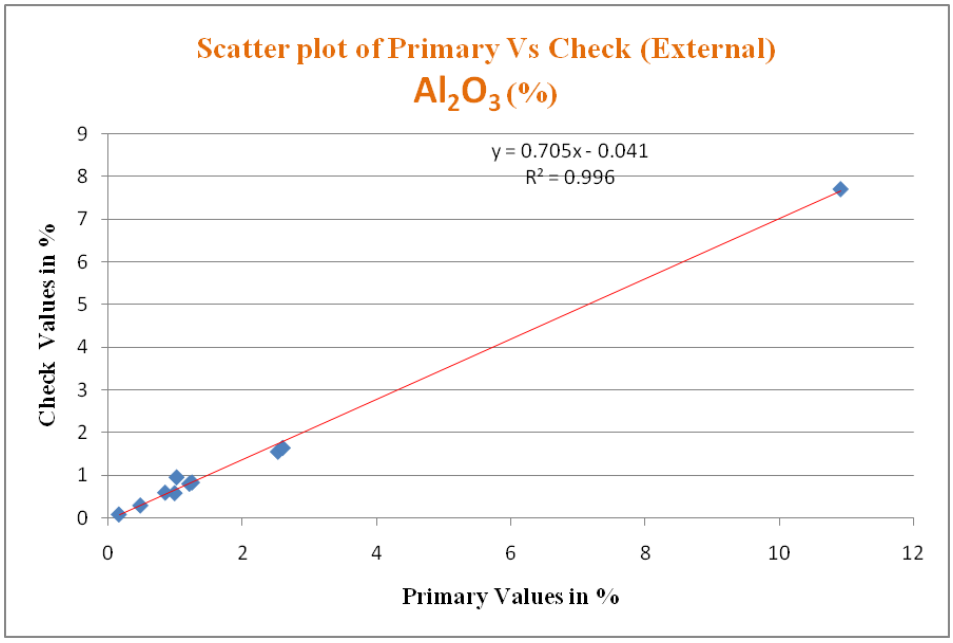
15.5.5.1 The data set for Primary Vs External check analysis comprises 10 pairs of borehole core samples. Table-15.3 shows that the difference in arithmetic mean, standard deviation, of primary and external check samples for SiO_2 are not high. The value of R^2 given in scatter plot (Text Figure 4.3) is 0.997, which is close to 1.00 and indicates a good correlation in primary and external check analysis.

15.5.6 The comparative studies of Primary Vs External check analysis of borehole core samples for Al_2O_3 is given in Table-15.4 and scatter plots is represented as Text Figure- 4.4.

Table-15.4

Comparison of Primary vs. External Check of Dolomite samples for Al_2O_3

Comparison Index	Al_2O_3%	
	Primary	Check
No. of Sample Pairs	10	
Arithmetic Mean (%)	2.2	1.511
Standard Deviation	2.997	2.118
Std. Error of Mean	0.948	0.67
Variance	8.981	4.486
Mean of Deviation	0.689	
Standard Deviation (Error)	0.890	
Correlation Coefficient	0.998	
Mean Absolute Error	0.689	
Mean Relative Random Error	31.318%	
Paired T Value	2.447	
F-Test Value	2.002	



Text Figure-4.4: Scatter Plot of Primary Vs Check (External) Analysis of Al_2O_3

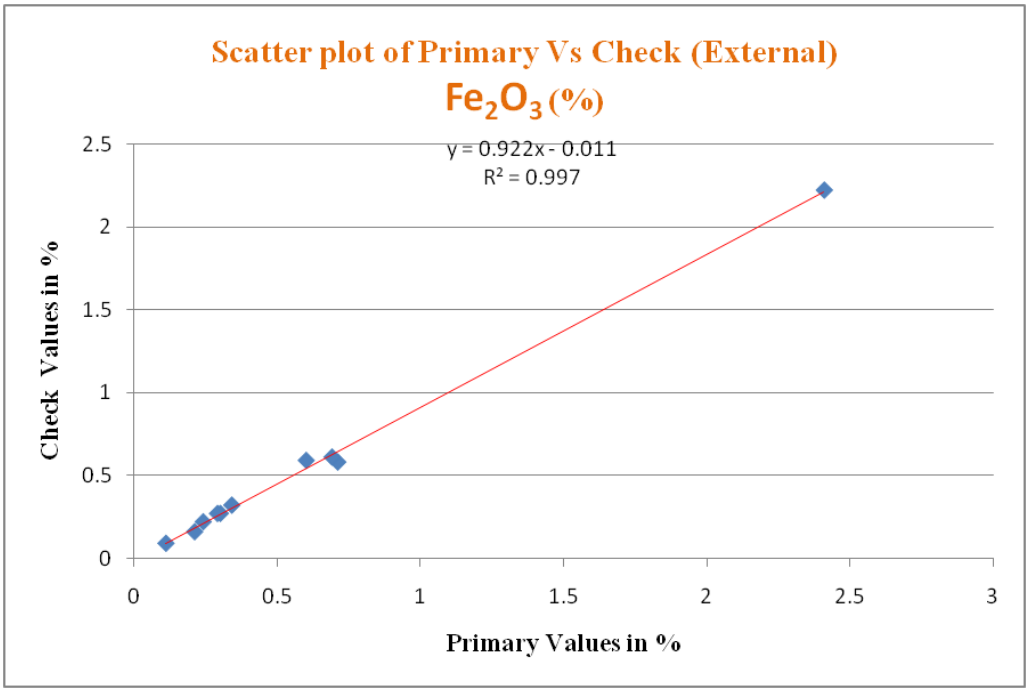
15.5.6.1 The data set for Primary Vs External check analysis comprises 10 pairs of borehole core samples. Table-15.4 shows that the difference in arithmetic mean, standard deviation, of primary and external check samples for Al_2O_3 are not high. The value of R^2 given in scatter plot (Text Figure 4.4) is 0.996, which is close to 1.00 and indicates a good correlation in primary and external check analysis.

15.5.7 The comparative studies of Primary Vs External check analysis of borehole core samples for Fe_2O_3 is given in Table-15.5 and scatter plots is represented as Text Figure- 4.5.

Table-15.5

Comparison of Primary vs. External Check of Dolomite samples for Fe_2O_3

Comparison Index	Fe_2O_3 %	
	Primary	Check
No. of Sample Pairs	10	
Arithmetic Mean (%)	0.59	0.533
Standard Deviation	0.638	0.589
Std. Error of Mean	0.202	0.186
Variance	0.407	0.347
Mean of Deviation	0.057	
Standard Deviation (Error)	0.057	
Correlation Coefficient	0.999	
Mean Absolute Error	0.057	
Mean Relative Random Error	9.66%	
Paired T Value	3.186	
F-Test Value	1.172	



Text Figure-4.5: Scatter Plot of Primary Vs Check (External) Analysis of Fe_2O_3

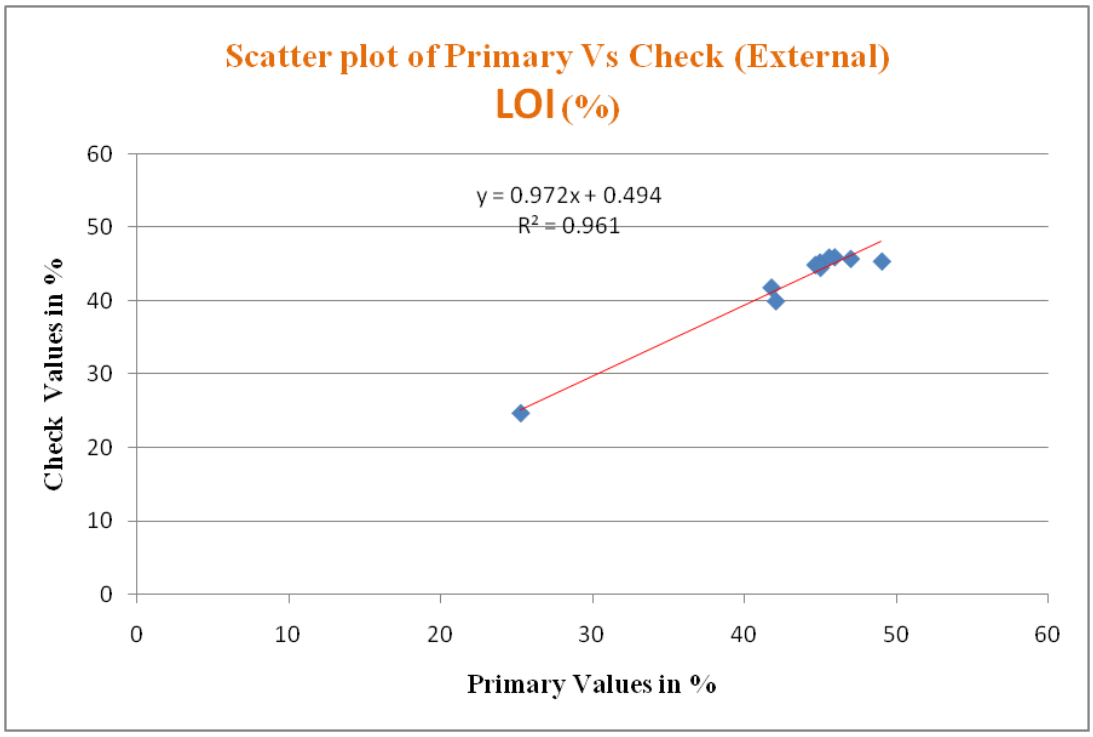
15.5.6.1 The data set for Primary Vs External check analysis comprises 10 pairs of borehole core samples. Table-15.5 shows that the difference in arithmetic mean, standard deviation, of primary and external check samples for Fe_2O_3 are not high. The value of R^2 given in scatter plot (Text Figure – 4.5) is 0.997, which is close to 1.00 and indicates a good correlation in primary and external check analysis.

15.5.7 The comparative studies of Primary Vs External check analysis of borehole core samples for LOI is given in Table-15.6 and scatter plots is represented as Text Figure- 4.6.

Table-15.6

Comparison of Primary vs. External Check of Dolomite samples for LOI

Comparison Index	LOI %	
	Primary	Check
No. of Sample Pairs	10	
Arithmetic Mean (%)	43.111	42.435
Standard Deviation	6.278	6.227
Std. Error of Mean	1.985	1.969
Variance	39.409	38.78
Mean of Deviation	0.676	
Standard Deviation (Error)	1.229	
Correlation Coefficient	0.981	
Mean Absolute Error	0.914	
Mean Relative Random Error	2.12%	
Paired T Value	1.739	
F-Test Value	1.016	



Text Figure-4.6: Scatter Plot of Primary Vs Check (External) Analysis of LOI

15.5.7.1 The data set for Primary Vs External check analysis comprises 10 pairs of borehole core samples. Table-15.6 shows that the difference in arithmetic mean, standard deviation, of primary and external check samples for LOI are not high. The value of R^2 given in scatter plot (Text Figure 4.6) is 0.961, which is close to 1.00 and indicates a good correlation in primary and external check analysis.

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

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 followed 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 calliper 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:** 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.	Avg. Length (cm)	Avg. Diameter (cm)	Avg. Radius (cm)	Volume (cm^3)	Weight (gm)	Density (gm/cc)
		A	B	C	($D=\pi C^2 A$)	E	(F=E/D)
1	HG-BD-01	15.92	4.66	2.33	271.38	771	2.84
2	HG-BD-02	16.54	4.70	2.35	286.96	816	2.84
Average Bulk Density							**2.84**

17.1.3 Average bulk density of dolomite calculated as 2.84 gm/cc. calculated value has been considered for estimation of resources. The details of Bulk density determination results are given in Annexure-VII.

Photo 10: Photographs of dolomite core samples showing determination of length, diameter and weight of sample number HG/BD/01 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 grade classification given by IBM in following categories for Dolomite (Annexure-XB)

i) SMS (LD) Grade- 30–36% CaO, 20-21% MgO, 0.4-1.8% SiO_2, 0.2-0.6% Al_2O_3 & 0.2- 0.4% Fe_2O_3

ii) SMS (O.H) Grade: 30-34% CaO, 15 - 21% MgO, 0.9 - 2.5% SiO_2 & 0.74 - 2.8% Acid Insoluble.

iii) Beneficial Grade: 29% CaO, 15% MgO, 6 %(max) SiO_2, 12% (max) Acid Insoluble.

Further Resource have been estimated and categorized as per UNFC and placed as Inferred Resources (333) categories by polygonal method (Annexure VIIA and VIIB). Resources (333) has been calculated by cross sectional method also (Annexure-VIIC and VIID).

19.2.0 EVALUATION OF MINERALISATION ZONES

19.2.1 A total of 102 primary samples were generated from 300 m of core drilling conducted across six exploratory boreholes. Out of these, five boreholes MHG-01, MHG-02, MHG-03, MHG-05 and MHG-06 intercepted dolomite of SMS (LD) and Beneficial grades. SMS (LD) grade dolomite intersected in the boreholes MHG-03 and MHG-05 with thickness of 50.00 m and 36.00 m respectively. Beneficial grade dolomite was encountered in boreholes MHG-01, MHG-02 and MHG-06 with cumulative thicknesses of 23.70 m, 6.00 m and 17.50 m respectively. Zone thickness greater than or equal to 2m were considered for resource estimation.

19.2.2 SMS (LD) Grade Dolomite was intercepted in exploratory boreholes MHG-03 and MHG-05. However, Beneficial grade dolomite intercepted in three boreholes i.e. MHG-01, 02 and 06 drilled by MECL in the block. The details are given below in Table no. 19.1 & 19.2 respectively.

Table 19.1
SMS (LD) grade of dolomite demarcated as per IBM grade classification for entire primary sample analysis of exploratory boreholes drilled in Hiwardhara-Ganeshpura Block, District: Yavatmal, Maharashtra

Bh. No	From (m)	To (m)	Thick. (m)	CaO %	MgO %	Al_2O_3 %	SiO_2 %	Fe_2O_3 %	SO_3 %	P_2O5 %	K_2O %	Na_2O %	LOI %	Grade
MHG-03	0.00	50.00	50.00	32.36	18.96	0.57	1.16	0.20	0.04	0.09	0.09	0.06	46.31	SMS (LD)
MHG-05	14.00	50.00	36.00	32.83	19.28	0.19	1.39	0.13	0.02	0.04	0.02	0.04	45.89	SMS (LD)

SMS (LD)- Steel Melting Shop (Linz-Donawitz)

Table 19.2
Beneficial grade of dolomite demarcated as per IBM grade classification for entire primary sample analysis of exploratory boreholes drilled in Hiwardhara-Ganeshpura Block, District: Yavatmal, Maharashtra

Bh.No.	From (m)	To (m)	Thick. (m)	CaO %	MgO %	Al_2O_3 %	SiO_2 %	Fe2O3 %	SO_3 %	P_2O_5 %	K_2O %	Na_2O %	LOI %	Grade
MHG-01	0.00	8.00	8.00	32.04	15.65	1.37	5.73	0.51	0.09	0.03	0.24	0.03	44.12	Beneficial
MHG-01	25.00	28.70	3.70	31.79	15.70	1.37	5.24	0.62	0.13	0.05	0.20	0.04	44.70	
MHG-01	38.00	50.00	12.00	31.90	16.42	1.42	4.98	0.42	0.14	0.02	0.21	0.03	44.28	
MHG-02	22.00	26.00	4.00	31.45	16.13	1.68	6.44	0.50	0.22	0.05	0.29	0.04	43.05	Beneficial
MHG-02	34.00	36.00	2.00	29.92	18.66	0.88	3.67	0.30	0.16	0.02	0.13	0.04	46.08	
MHG-06	0.50	4.00	3.50	30.57	16.88	1.43	6.68	0.52	0.05	0.04	0.22	0.03	43.43	Beneficial
MHG-06	36.00	50.00	14.00	30.31	17.71	1.47	5.81	0.39	0.33	0.03	0.22	0.03	43.53	

19.3.0 RESOURCES ESTIMATION METHODS

The dolomite body within the block area exhibits a gentle dip, striking in the east–west direction with dip angles ranging from 5° to 20° towards the south. To assess the subsurface disposition and estimate the dolomite resources, vertical boreholes were drilled down to a depth of 50 mRL. Resource estimation was carried out using both the Polygonal and Cross-sectional methods, as detailed in the subsequent sections.

19.4.0 ASSUMPTIONS FOR RESOURCE ESTIMATION

19.4.1 Resource was computed by "polygonal method" as principal method and to check the validation of resources "Cross-sectional method" was used. The estimation of overall grade and resource for the deposit inherently involves certain fundamental assumptions, which are elaborated upon in the subsequent paragraphs.

19.4.2 For the assessment of dolomite resources, chemical thresholds of >29% CaO, >15% MgO, and <6% SiO_2 were applied. Within the block area two distinct grades of dolomite—namely SMS (LD) grade and Beneficial grade—were considered for resource classification.

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 2.84 gm/cc as determined by Calliper's method from 2 core samples in MECL Laboratory, Nagpur. This value is taken for computation of resources for Dolomite SMS (LD) and Beneficial Grades.

19.5.0 PARAMETERS OF RESOURCE ESTIMATION

19.5.1 CLASSIFICATION OF GRADE

Resources estimated for Dolomite grades intercepted are calculated as per IBM classification given in Table no 19.3.

Table No. 19.3

Dolomite grade classification as per IBM, 2018

Grade	CaO %	MgO %	SiO_2 %	Al_2O_3 %	Fe_2O_3 %	Acid Insoluble %
*SMS (LD)	30-36	20-21	0.4-1.8	0.2-0.6	0.2-0.4	-
**SMS (OH)	30-34	15-21	0.9-2.5	-	-	0.74-2.8
Beneficial	29	15	6 (max)	-	-	12 (max)

*SMS (LD)- Steel Melting Shop (Linz-Donawitz)
**SMS (OH)- Steel Melting Shop (Open Hearth)

19.5.2 BULK DENSITY

A total of two nos. of dolomite core samples from MECL boreholes were subjected to bulk density determination by Calliper Method in Petrology laboratory, MECL, Nagpur. The average bulk density of these two samples has been determined as

2.84 gm/cc and the same have been considered for estimation of resources. The results of bulk density determination are calculated in Annexure-VI. The procedure of determining the bulk density already discussed in Chapter 17.

19.6.0 METHODOLOGY

The resources of dolomite have been estimated by polygonal method as principal method and cross-sectional method as check method. The methodology adopted, keeping the above assumptions in view for resource estimation are described further.

19.6.1 METHODOLOGY ADOPTED IN POLYGONAL METHOD OF RESOURCE ESTIMATION (PRINCIPAL METHOD)

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 resource plan. The height of polygons is the cumulative thickness of dolomite horizon/bands encountered by the corresponding borehole. The entire dolomite body in block is divided into number of polygons. The grade wise borehole wise resource estimation by Polygon method for possible Dolomite i.e. SMS (LD) & Beneficial Dolomite grades 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:

$$\mathbf{R = P_A \ X \ Th \ X \ Bulk \ Density}$$

Where, P_A = Area of Polygon
R= Resource/ Tonnage
Th= Thickness of Dolomite

19.6.2 METHODOLOGY ADOPTED IN CROSS-SECTION METHOD OF RESOURCE ESTIMATION (CHECK METHOD)

Two numbers of parallel cross section lines S1-S1' and S2-S2' are drawn along N 6°W-S6°E and N13ºW-S13ºW directions respectively at more or less 800m interval throughout the block which is marked on Plate No. III. 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. During geological mapping, it was determined that the general strike of the beds is east–west, with a predominantly flat attitude and variable dips ranging from 5° to 20° towards the south. Since all boreholes were drilled vertically, cross-sections were constructed perpendicular to the strike direction. Geological cross sections are generated by GDM software. Cross sectional area on each section has been measured with the help of Auto CAD map 2018 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, wherever it was necessary. 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 in-situ gross resources.

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

Where

R = Resources / Tonnage

Sv = Sectional area of dolomite

T = Influence between successive section lines

19.6.2 The resources are estimated grade wise, borehole wise and presented as Annexures-VIIC and VIID.

19.6.3 The weighted average grades for 10 radicals i.e. CaO, MgO, SiO_2, Al_2O_3, Fe_2O_3, SO_3, P_2O_5, K_2O, Na_2O, LOI have been calculated. Thus, average grade of the block is calculated for SMS (LD) and Beneficial grades of dolomite.

CHAPTER - 20

20.0.0 REPORTING OF RESOURCES

20.1.0 RESOURCE ESTIMATION POLYGON METHOD

20.1.1 The Resource of dolomite have been estimated grade wise, borehole wise and polygon wise in polygon method (principal method) while in cross sectional method (check method) resource of dolomite has been estimated for different intersected zones/grade wise, cross section wise as per specifications and basic assumptions enumerated earlier. Earlier in the report, both Gross and Net (In-situ) Geological Inferred Resources were presented. However, in accordance with the recommendation of the 79th TCC-I (NMET), only the Gross (In-situ) Geological Inferred Resources are now reported in the Geological Report.

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 (Plate V).

Block	Polygon No	Borehole No	Polygonal Area (m^2)
HIWARDHARA -GANESHPURA	P1	MHG-01	527659.95
	P3	MHG-02	985810.09
	P6	MHG-03	918336.124
	P4	MHG-04	1052484.3699
	P5	MHG-05	1157506.116
	P2	MHG-06	848036.8653

20.1.3 248.75 MT of SMS (LD) grade dolomite gross (in-situ) geological inferred resources (333) estimated by polygon method with an average grade of 32.58%CaO, 19.12%MgO, 0.39% Al_2O_3, 1.27% SiO_2, 0.17% Fe_2O_3, 46.11% LOI. The Polygon-wise, grade wise, borehole-wise resource estimation by Polygon method for SMS (LD) Grade dolomite are given in Table number 20.1 (Annexure – VII A).

20.1.4 94.46 MT of Beneficial grade dolomite gross (in-situ) geological inferred resources (333) estimated by polygon method with an average grade of 31.06% CaO, 16.88% MgO, 1.43% Al_2O_3, 5.63%SiO_2, 0.44% Fe_2O_3, 43.90% LOI. The Polygon-wise, grade wise, borehole-wise resource estimation by Polygon method for Beneficial Grade Dolomite are given in Table number 20.2 (Annexure – VII B).

Table 20.1

Polygon wise, Grade wise, Borehole wise Resources (333) estimated for SMS (LD) Grade Dolomite by Polygonal Method for Hiwardhara- Ganeshpura block, Dist. Yavatmal, Maharashtra

Bulk Density:2.84 gm/cc

Polygon No.	BH No.	Polygonal Area (m^2)	From (m)	To (m)	Thick (m)	Volume (m^3)	Gross Geological Resources (tonnes)	Average Quality									
								CaO %	MgO%	Al_2O_3%	SiO_2%	Fe_2O_3%	SO_3 %	P_2O_5%	K_2O%	Na_2O%	LOI %
P6	MHG-03	918336.12	0.00	50.00	50.00	45916806.20	130403729.61	32.36	18.96	0.57	1.16	0.20	0.04	0.09	0.09	0.06	46.31
P5	MHG-05	1157506.12	14.00	50.00	36.00	41670220.18	118343425.30	32.83	19.28	0.19	1.39	0.13	0.02	0.04	0.02	0.04	45.89
Total Gross (In-situ) Geological Resources of SMS (LD) grade Dolomite in Tonnes							**248747154.91**	**32.58**	**19.12**	**0.39**	**1.27**	**0.17**	**0.03**	**0.07**	**0.06**	**0.05**	**46.11**
Total Gross (In-situ) Geological Resources of SMS (LD) grade Dolomite in Mil. Tonnes							**248.75**										

Table 20.2

Polygon wise, Grade wise, Borehole wise Resources (333) estimated for Beneficial Grade Dolomite by Polygonal Method for Hiwardhara-Ganeshpura block, Dist. Yavatmal, Maharashtra

Bulk Density:2.84 gm/cc

Polygon No.	BH No.	Polygonal Area (m^2)	From (m)	To (m)	Thick (m)	Volume (m^3)	Gross Geological Resources (tonnes)	Average Quality									
								CaO%	MgO%	Al_2O_3%	SiO_2%	Fe_2O_3%	SO_3%	P_2O_5%	K_2O%	Na_2O%	LOI %
P1	MHG-01	527659.95	0.00	8.00	8.00	4221279.58	11988434.02	32.04	15.65	1.37	5.73	0.51	0.09	0.03	0.24	0.03	44.12
P1	MHG-01	527659.95	25.00	28.70	3.70	1952341.81	5544650.73	31.79	15.70	1.37	5.24	0.62	0.13	0.05	0.20	0.04	44.70
P1	MHG-01	527659.95	38.00	50.00	12.00	6331919.38	17982651.03	31.90	16.42	1.42	4.98	0.42	0.14	0.02	0.21	0.03	44.28
P3	MHG-02	985810.09	22.00	26.00	4.00	3943240.34	11198802.57	31.45	16.13	1.68	6.44	0.50	0.22	0.05	0.29	0.04	43.05
P3	MHG-02	985810.09	34.00	36.00	2.00	1971620.17	5599401.29	29.92	18.66	0.88	3.67	0.30	0.16	0.02	0.13	0.04	46.08
P2	MHG-06	848036.87	0.50	4.00	3.50	2968129.03	8429486.44	30.57	16.88	1.43	6.68	0.52	0.05	0.04	0.22	0.03	43.43
P2	MHG-06	848036.87	36.00	50.00	14.00	11872516.11	33717945.76	30.31	17.71	1.47	5.81	0.39	0.33	0.03	0.22	0.03	43.53
Total Gross (In-situ) Geological Resources of Beneficial grade Dolomite in Tonnes							**94461371.84**	**31.06**	**16.88**	**1.43**	**5.63**	**0.44**	**0.20**	**0.03**	**0.22**	**0.03**	**43.90**
Total Gross (In-situ) Geological Resources of Beneficial grade Dolomite in Mil. Tonnes							**94.46**										

20.2.0 RESOURCE ESTIMATION CROSS SECTIONAL METHOD

20.2.1 227.20MT of SMS (LD) Grade dolomite gross (in-situ) geological inferred resources (333) estimated by cross section method with an average grade of 32.57% CaO, 19.10% MgO, 0.40% Al_2O_3,1.26% SiO_2, 0.17% Fe_2O_3, 46.12% LOI. The section wise, grade wise, borehole wise resource estimation by Cross sectional method (Plate-VI) for SMS (LD) Grade dolomite are given in Table number 20.3 (Annexure – VII C).

20.2.2 95.32MT of Beneficial Grade dolomite gross (in-situ) geological inferred resources (333) estimated by cross section method with an average grade of 31.03% CaO, 16.96% MgO, 1.44% Al_2O_3,5.55% SiO_2, 0.43% Fe_2O_3, 43.90% LOI. The section wise, grade wise, borehole wise resource estimation by Cross sectional method (Plate-VI) for Beneficial Grade dolomite are given in Table number 20.4 (Annexure – VII D).

Table 20.3

Section wise, Grade wise, Borehole wise Resources (333) estimated for SMS (LD) Grade Dolomite by Cross sectional Method for Hiwardhara-Ganeshpura block, Dist. Yavatmal, Maharashtra

Bulk Density: 2.84 gm/cc

SECTION	BOREHOLE No.	SECTIONAL AREA (m^2)	STRIKE INFLUENCE (m)	VOLUME (m^3)	GROSS GEOLOGICAL RESOURCE (TONNES)	AVERAGE QUALITY						GRADE
						CaO %	MgO %	Al_2O_3 %	SiO_2 %	Fe_2O_3 %	LOI%	
S2-S2'	MHG-03	33895.75	1317.03	44641668.77	126782339.30	32.36	18.96	0.57	1.16	0.20	46.31	SMS (LD)
S2-S2'	MHG-05	32167.07	1099.19	35357575.23	100415513.64	32.83	19.28	0.19	1.39	0.13	45.89	SMS (LD)
Total Gross (In-situ) Geological Resource SMS (LD) Grade Dolomite in Tonnes					**227197852.94**	**32.57**	**19.10**	**0.40**	**1.26**	**0.17**	**46.12**	**SMS (LD)**
Total Gross (In-situ) Geological Resource SMS (LD) Grade Dolomite in Mil. Tonnes					**227.20**							

Table 20.4

Section wise, Grade wise, Borehole wise Resources (333) estimated for Beneficial Grade Dolomite by Cross sectional Method for Hiwardhara-Ganeshpura block, Dist. Yavatmal, Maharashtra

Bulk Density: 2.84 gm/cc

SECTION	BOREHOLE No.	SECTIONAL AREA (m^2)	STRIKE INFLUENCE (m)	VOLUME (m^3)	GROSS GEOLOGICAL RESOURCE (TONNES)	AVERAGE QUALITY						GRADE
						CaO %	MgO %	Al_2O_3 %	SiO_2 %	Fe_2O_3 %	LOI%	
S1-S1'	MHG-01	4866.61	577.10	2808496.63	7976130.42	32.04	15.65	1.37	5.73	0.51	44.12	Beneficial
S1-S1'	MHG-01	3466.27	577.10	2000367.87	5681044.74	31.79	15.70	1.37	5.24	0.62	44.70	Beneficial
S1-S1'	MHG-01	12003.43	577.10	6927125.23	19673035.65	31.90	16.42	1.42	4.98	0.42	44.28	Beneficial
S1-S1'	MHG-02	3342.01	1639.53	5479316.23	15561258.09	31.45	16.13	1.68	6.44	0.50	43.05	Beneficial
S1-S1'	MHG-02	1411.47	1639.53	2314143.27	6572166.89	29.92	18.66	0.88	3.67	0.30	46.08	Beneficial
S1-S1'	MHG-06	11374.06	1233.73	14032550.98	39852444.79	30.31	17.71	1.47	5.81	0.39	43.53	Beneficial
Total Gross (In-situ) Geological Resource Beneficial Grade Dolomite in Tonnes					**95316080.58**	**31.03**	**16.96**	**1.44**	**5.55**	**0.43**	**43.90**	**Beneficial**
Total Gross (In-situ) Geological Resource Beneficial Grade Dolomite in Mil. Tonnes					**95.32**							

20.3.0 COMPUTATION OF AVERAGE GRADE

All calculations for grade estimation are made by weighted average method. Since the sample interval was maintained 2.00 m interval with the exception of minor variations or structural implications, the weighted average method of calculation is made by the following formula.

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

Where `V' = Volume of Dolomite in individual borehole

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

20.4.0 RELIABILITY OF RESOURCE

The Combined Gross (in-situ) Geological resources estimated for SMS (LD) and Beneficial 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 Gross (in-situ) Geological Resources by two methods comes to 6.22%. However, the relative difference in grades for CaO, MgO, Al_2O_3, SiO_2, Fe_2O_3 and LOI is 0.15%, 0.16%, 4.81%, 2.38%, 1.43%, 0.08% respectively. In accordance with industry standards, the relative variation in combined gross geological resources and grades is classified as 'very good'. The comparison of resource with average quality grades is given in the Table 20.5.

Table No. 20.5

Comparison of Combined Gross (in-situ) Geological Resources (333) estimated by Polygonal and Cross-sectional method for SMS (LD) and Beneficial Grade Dolomite

Method of estimation	Combined Gross Geological Resources (mT)	Relative Difference %	Average Quality						Relative Difference %					
			CaO %	MgO %	Al_2O_3 %	SiO_2 %	Fe_2O_3 %	LOI%						
Polygonal method	343.21	6.22	32.16	18.50	0.67	2.47	0.24	45.50	0.15	0.16	4.81	2.38	1.43	0.08
Cross sectional method	322.51		32.11	18.47	0.71	2.53	0.25	45.47						

CHAPTER – 21

21.0.0 SUMMARY AND RECOMMENDATION

21.1.0 SUMMARY

21.1.1 The Hiwardhara-Ganeshpura Block over an area of 5.72 sq.km, is bounded by Latitude N19°49'00.76239" to N19°51'35.52964" and Longitude E78°51'34.40085" to E78°53'18.53141" which falls in Toposheet No.56 I/13. Hiwardhara-Ganeshpura block encompasses Ganeshpur, Mukutban, Khadaki, Kosara, Hiwardhara and Nerad villages of Tehsil - Zari-Jamni and Wani, District - Yavatmal, State – Maharashtra.

21.1.2 Hiwardhara-Ganeshpura 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/1848/2023/3938, dated 22/12/2023.

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

21.1.5 On recommendation of 70th TCC, 37th Executive committee (EC), NMET meeting held on 29th Nov 2024 approved the project with cost of INR 93.84 lakhs.

21.1.6 MECL carried out exploration with objective to establish sub surface continuity of limestone/dolomite by drilling six numbers 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 Regionally Yavatmal district in Maharashtra has exposures dominated by Deccan basalts, with other Formations like Gondwana, Lameta and Penganga beds also present. The limestone/dolomite Formation of the area belongs to Putnur-Mangurda Formation. It is comprising of laminated limestone/dolomite and shale of shallow marine to fluvial origin, generally exhibiting a regional strike of NW-SE with low dips ranging from 5° to 10° towards the northeast.

21.1.8 Exposures mapped in the block belong to the Putnur-Mangurda Formation lesser-known but geologically intriguing unit of the Penganga Group. The majority of the area is blanketed by soil with exposures of occasional sandstone of Kampti/Barakar/Talchir Formation of Gondwana Supergroup and shale and dolomite representing Putnur-Mangurda Formation of Penganga Supergroup. Younger intrusive of Dolerite dykes mapped in the east-central part of block area. These Formations typically consist of Neoproterozoic sedimentary rocks. 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 dolomite beds is E-W and dip varies from 5° to 20° towards south. Generalized local stratigraphic succession of explored block (after GSI) is given in Table-21.1.

Table-21.1
Generalized stratigraphy of Hiwardhara-Ganeshpura block, Dist: Yavatmal, Maharashtra.

Age	Supergroup	Group	Formation	Lithology
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

21.1.10 A total of 102 nos. of primary samples are generated in six nos of boreholes drilled in Hiwardhara-Ganeshpura block which were analysed 10 radicals.

21.1.11 Resources estimated for Dolomite grades intercepted are calculated as per IBM classification given in Table below.

Dolomite grade classification as per IBM, 2018

Grade	CaO %	MgO %	SiO_2 %	Al_2O_3 %	Fe_2O_3 %	Acid Insoluble %
*SMS (LD)	30-36	20-21	0.4-1.8	0.2-0.6	0.2-0.4	-
**SMS (OH)	30-34	15-21	0.9-2.5	-	-	0.74-2.8
Beneficial	29	15	6 (max)	-	-	12 (max)

*SMS (LD)- Steel Melting Shop (Linz-Donawitz)
**SMS (OH)- Steel Melting Shop (Open Hearth)

21.1.12 A total of two nos. of dolomite core samples from drilled boreholes were subjected to bulk density determination by Calliper Method. The average bulk density of these two samples has been determined as 2.84 gm/cc and the same have been considered for estimation of resources.

21.1.13 Average soil cover in the block is 6.00m.

21.1.14 Geological resources were estimated by Polygonal method as principal method and Cross-sectional method as check method, on checking the reliability the difference in Resources by two methods comes to 6.22%.

21.1.15 SMS (LD) grade dolomite was intercepted in the borehole no MHG-03 and MHG-05, whose thickness is 50.00m and 36.00m respectively. However, Beneficial grade dolomite was intercepted in boreholes no MHG-01, MHG-02 and MHG-06 with cumulative thickness 23.70m, 6.00m and 17.50 m respectively.

21.1.16 248.75 MT of SMS (LD) grade dolomite gross (in-situ) inferred geological resources estimated with an average grade of 32.58%CaO, 19.12%MgO, 0.39% Al_2O_3, 1.27% SiO_2, 0.17% Fe_2O_3, 46.11% LOI and 94.46 MT of Beneficial grade dolomite gross (in-situ) inferred geological resources estimated with an average grade of 31.06% CaO, 16.88% MgO, 1.43% Al_2O_3, 5.63%SiO_2, 0.44% Fe_2O_3, 43.90% LOI.

21.1.17 Combined SMS (LD) and Blendable Dolomite grade gross (in-situ) geological inferred resources are 343.21MT with average grade of 32.16% CaO, 18.50% MgO,0.67% Al_2O_3, 2.47% SiO_2,45.50% LOI.

21.2.0 RECOMMENDATION

21.2.1 MECL has carried out Preliminary exploration (G3) over 5.72 sq.km of Hiwardhara-Ganeshpura block and established resources of SMS (LD) and Beneficial grade dolomite as per MEMC rules 2015 (Amended 2021).

21.2.2 Estimated resources are considered as 333 categories as per UNFC nomenclature. This report will support the Government of Maharashtra in facilitating the auction of the block for mining licence.

CHAPTER - 22

22.0.0 LIST OF PLATES

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

22.2.0 Generalised Geological map of the Pranhita Godavari (PG) valleys showing Hiwardhara-Ganeshpura Block (After Chaudhuri et al. 2012), Not to scale (Plate-II).

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

22.4.0 Graphic Lithologs of Boreholes drilled by MECL in Hiwardhara-Ganeshpura Block, District: Yavatmal, Maharashtra in 1:500 scale (Plate-IV).

22.5.0 Polygon Map for SMS (LD) and Beneficial Grades of dolomite in Hiwardhara-Ganeshpura block, Dist Yavatmal, Maharashtra in 1:4000 scale (Plate-V).

22.6.0 Geological Cross Sections along section line S1-S1' & S2-S2', N-S dip direction with quality data in Hiwardhara-Ganeshpura block, Dist Yavatmal, Maharashtra. in 1:2000 scale (Plate-VI).

CHAPTER - 23

23.0.0 ANNEXURE / ENCLOSURES TO THE REPORT

23.1.0 The report includes all the relevant annexure and 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
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 - Preliminary exploration (G3 level) for limestone in Hiwardhara-Ganeshpura 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: 31.07.2025

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 Enterprises
5	NMET	National Mineral Exploration Trust
6	TCC	Technical cum Cost Committee
7	EC	Executive Committee
8	DGM, Maharashtra	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 Tonne
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	R.F.	Reserve Forest
32	XRF	X-ray Fluorescence
33	ML	Mining Lease
34	CRM	Certified Reference Material
35	CL	Composite License
36	SMS (LD)	Steel Melting Shop (Linz-Donawitz)
37	SMS (OH)	Steel Melting Shop (Open Hearth)
38	MT	Million Tonnes

REFERENCES

1. District Resources Map, Yavatmal District, Maharashtra, Second Edition 2020 by Geological Survey of India.
2. "Report on the investigation of the limestone deposits in Wun taluka of Yeotmal district" by A.K.R. HEMMADY, Geological Survey of India, Field Season 1946-47.
3. Geology of The Penganga Group Adilabad Taluk, Adilabad District, Andhra Pradesh By T. Sambasivasarma**,** Geological Survey of India, Field Season 1973-74.
4. Agarwal R.K.V Subbarao 1986; Geology of parts of Yavatmal and Chandrapur district, Maharashtra, Geological Survey of India.
5. Aparajit, N.M., Ahmad S.A. K.C, 2020; Report on General Exploration for establishing Limestone deposit in Jevra-Tulshi Area (STAGE-G2) Ta: Korpana, Dist: Chandrapur, Maharashtra, Directorate of Geology and Mining, Maharashtra unpublished report.
6. Chaudhuri, A.K., Deb, G.K., Deb, S.P., Sarkar, S., 2012, "The Palaeozoic and Tectonic Evolution of the Pranhita- Godavari valley, Central India: A stratigraphic perspective", American Journal of Science, Vol. 312, pp. 766-815.
7. Guntiwar V.S., Samji R.N. 1986, Report on prospecting for limestone in Jawra-Tulsi area, Tah Rajura, Chandrapur District Maharashtra, Directorate of Geology and Mining, Maharashtra
8. Mukhopadhyay Joydip, Chaudhuri Asru K., 2003, "Stratigraphy of the Chanda limestone of the Proterozoic Penganga Group, Adilabad, Andhra Pradesh: New light on Depositional setting and Paleogeography", Journal Geological Society of India, Vol.62, Sept 2003, pp. 356-358.
9. Aquifer Mapping and Management of Ground Water Resources: Yavatmal District, Maharashtra (AAP 2021-2022).
10. District website "yavatmal.gov.in"