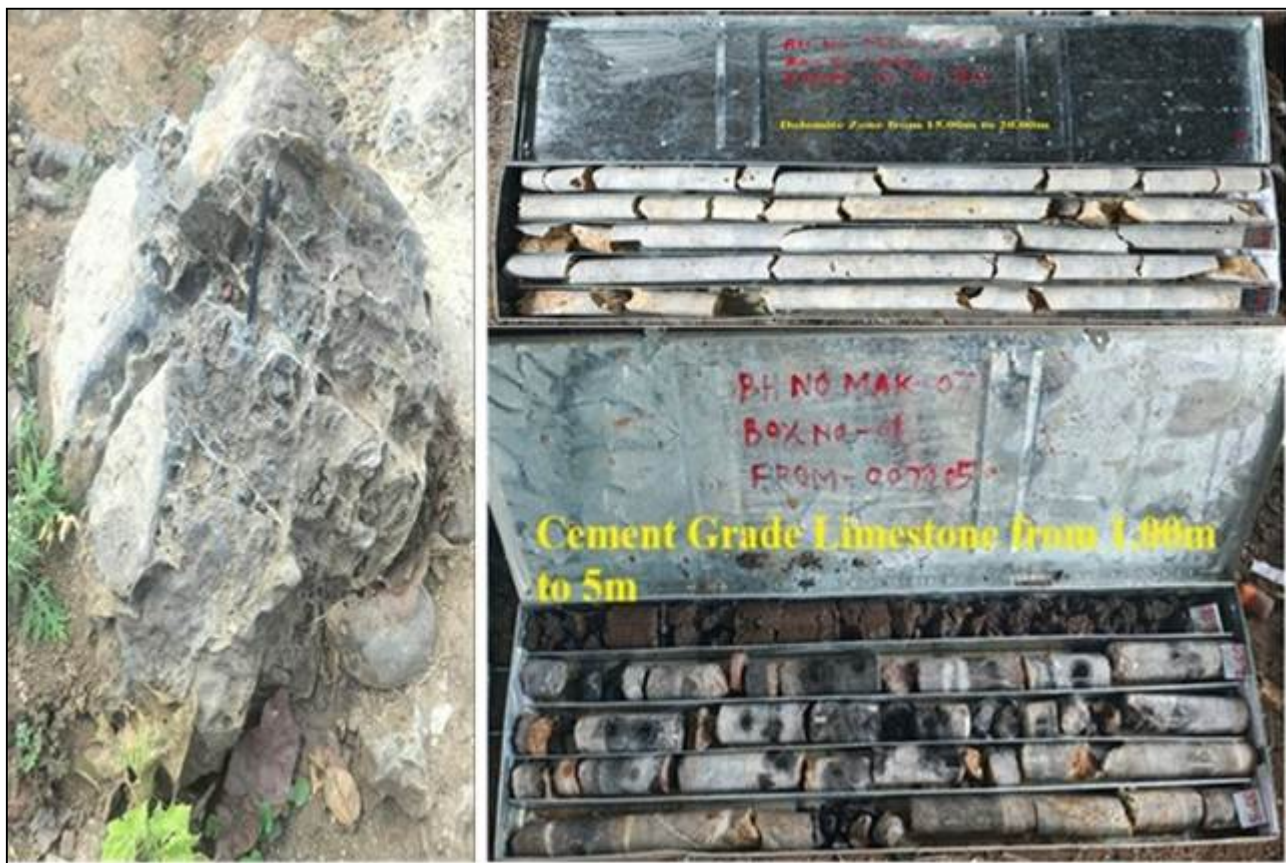


**GEOLOGICAL REPORT ON PRELIMINARY EXPLORATION (G3)
FOR LIMESTONE IN**

AKAPUR 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**

OCTOBER-2025

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

SALIENT FEATURES

1.	Name of the block	Akapur Block, Tahsil - Maregaon, District - Yavatmal, State - Maharashtra						
2.	Mineral	Limestone / Dolomite						
3.	Total Area	6.45 sq.km.						
4.	Area covered under present scheme	6.45 sq.km.						
5.	Period of Exploration	May 2025 to July 2025						
6.	Meterage drilled by MECL	Total 350.00 m						
7.	No. of Boreholes drilled by MECL	Total 07 Nos						
8.	Thickness of Different Grades of Limestone	Cement Grade Limestone - Thickness 14m, Beneficial Grade Limestone -Thickness 2m.						
9.	Cut-off grade	As per end use grade classification recommended by Indian Bureau of Mines (IBM).						
		Grade	CaO (Min.) %	MgO (Max.) %	SiO ₂ (Max.) %	Al ₂ O ₃ %	Fe ₂ O ₃ %	Insoluble Total (SiO ₂ + Al ₂ O ₃ + Fe ₂ O ₃)
		Cement Limestone	42	5	6	–	–	–
		Beneficial Limestone	38	12	6	–	–	–
		Beneficial Dolomite	30	20	6	--	--	--
10.	Resources	Cement Grade Limestone: 30.97 MT with an average grade 44.34% CaO, 6.65% MgO, 5.70% SiO ₂ Beneficial Grade Limestone: 4.42 MT* with an average grade 38% CaO, 11.13% MgO, 5.36% SiO ₂ Beneficial Grade Dolomite: 446.83 MT* with an average grade 31.81% CaO, 17.37% MgO, 4.69% SiO ₂ . Unclassified Dolomite: 361 MT* with an average grade 27.94% CaO, 13.76% MgO, 13.56% SiO ₂ . * MT – Million Tonnes						
11.	Grade	Cement Grade Limestone, Beneficial Grade Limestone, Beneficial Grade Dolomite & Unclassified Dolomite						
12.	UNFC Category	Inferred Category (333)						
13.	Report Submission	October 2025						

अकापुर ब्लॉक में चूना पत्थर हेतु प्रारंभिक गवेषण (जी3) पर भूवैज्ञानिक रिपोर्ट, जिला: यवतमाल, महाराष्ट्र

अध्याय 1

1.0.0 कार्यकारी सारांश

- 1.1.0 अकापुर का प्रस्ताव महाराष्ट्र राज्य सरकार द्वारा चिन्हित उन व्यपगत पट्टा क्षेत्रों के आधार पर किया गया है , जिन्हें मूल रूप से एमएमडीआर अधिनियम, 2015 की धारा 10ए(2)(बी) के तहत प्रदान किया गया था। हालाँकि, अधिनियम में 2021 के संशोधन के बाद, ऐसी सभी पूर्वक्षेपण लाइसेंस (पीएल) रिपोर्टों को अयोग्य घोषित कर दिया गया, जिससे नीलामी के माध्यम से आवंटन अनिवार्य हो गया। इसके अलावा, खनिज (खनिज सामग्री के साक्ष्य) नियम, 2015 के प्रावधानों के अनुसार खनिज साक्ष्य (जी4, जी3, आदि) के स्तर की पुष्टि के लिए इन पीएल रिपोर्टों का मूल्यांकन किया जाना आवश्यक है।
- 1.2.0 भूविज्ञान और खनन निदेशालय (डीजीएम), महाराष्ट्र सरकार ने पत्र संख्या टेक / 1848 / 2023 /260, दिनांक 23/01/2024 के तहत एमईसीएल से व्यपगत 10ए(2)(बी) खनन पट्टा क्षेत्रों में गवेषण करने का अनुरोध किया।
- 1.3.0 एमईसीएल महाराष्ट्र के यवतमाल जिले के मारेगांव तहसील के अकापुर गांव में और उसके आसपास गवेषण के जी3 स्तर पर 07 बोरहोल में 350 मीटर ड्रिलिंग से संबंधित गवेषण प्रस्ताव तैयार किया गया।
- 1.4.0 गवेषण प्रस्ताव (जी3) के लिए अकापुर ब्लॉक (6.45 वर्ग किमी) था प्रस्तुत और 26, 27 और 30 सितंबर, 2024 को आयोजित 69^{वीं} टीसीसी-1 बैठक में विचार-विमर्श किया गया । समिति ने 10ए(2)(बी) मामलों और एमईसीएल के माध्यम से इन पीएल क्षेत्रों के गवेषण के लिए महाराष्ट्र सरकार के अनुरोध पर ध्यान दिया। तदनुसार, 69^{वीं} टीसीसी-1 समिति अनुशंसित परियोजना प्रस्ताव का शीर्षक है "अकापुर ब्लॉक (6.45 वर्ग किमी.), यवतमाल जिला, महाराष्ट्र में चूना पत्थर के लिए प्रारंभिक गवेषण (जी3 स्तर)।"
- 1.5.0 69^{वीं} टीसीसी-1 की सिफारिश पर, 38^{वीं} कार्यकारी समिति (ईसी), एनएमईटी की 29 नवंबर, 2024 को हुई बैठक में पत्र संख्या एफ.सं. 23/520/2024-एनएमईटी/573, दिनांक 12 दिसंबर, 2024 के तहत 97.21 लाख रुपये की लागत वाली परियोजना को मंजूरी दी गई।
- 1.6.0 महाराष्ट्र के यवतमाल जिले में स्थित अकापुर ब्लॉक 6.45 वर्ग किमी में फैला है, जो देशांतर 78°50'57.22955"E से 78°53'04.22409"E और अक्षांश 20°08'22.66430"N से 20°09'33.58331"N तक घिरा है और मारेगांव तहसील के अकापुर, चिंचला , पंडारकवाड़ा , वडगांव , डोल डोंगरगांव और लाखापुर गांवों को शामिल करता है , जो टोपोशीट संख्या 55 एल/16 के अंतर्गत आते हैं।

- 1.7.0 एनएमईटी से अनुमोदन प्राप्त होने के बाद, एमईसीएल ने अकापुर ब्लॉक में जी3 स्तर का गवेषण किया है। एमईसीएल ने ड्रिलिंग 7 ऊर्ध्वाधर बोरहोल और 167 मुख्य नमूनों (साथ ही 17 बाह्य जांच नमूनों) का विश्लेषण जो जेनरेट हुई से कोर से ड्रिलिंग भूमिगत निरंतरता को रेखांकित करने और खनिज संसाधनों का आकलन करने के साथ 1:4000 पैमाने पर भूवैज्ञानिक मानचित्रण और स्थलाकृतिक सर्वेक्षण किया।
- 1.8.0 क्षेत्रीय रूप से महाराष्ट्र के यवतमाल जिले में दक्कन बेसाल्ट की प्रधानता के साथ-साथ गोंडवाना, लेमेटा और पेनगंगा बेड्स भी मौजूद हैं। इस क्षेत्र का चूना पत्थर संरचना पेनगंगा समूह के पुटनूर-मंगुर्दा संरचना से संबंधित है। इसमें उथले समुद्री से लेकर नदीय मूल के परतदार चूना पत्थर और शेल शामिल हैं। ये चट्टानें उत्तर-पश्चिम-दक्षिण-पूर्व की ओर एक क्षेत्रीय नतिलंब प्रदर्शित करती हैं, जिसमें दक्षिण-पश्चिम की ओर 5° से 10° तक का निम्न नति है।
- 1.9.0 अकापुर ब्लॉक क्षेत्र पुटनूर-मंगुर्दा संरचना का हिस्सा है, जो पेंगंगा समूह की एक कम ज्ञात लेकिन भूवैज्ञानिक रूप से दिलचस्प इकाई है। ये संरचनाएँ आमतौर पर प्रोटेरोज़ोइक अवसादी चट्टानों जैसे शेल, चूना पत्थर और डोलोमाइट से बनी हैं। इन बेड्स का नतिलंब N64° W-S64° E है और दक्षिण-पश्चिम की ओर नति 5° से 20° तक है।
- 1.10.0 इस ब्लॉक में, लगभग 7 ऊर्ध्वाधर बोरहोल ड्रिल किए गए, जिनकी कुल माप 350 मीटर थी। कुल 167 नमूनों का CaO, MgO, SiO₂, Fe₂O₃, Al₂O₃, SO₃, P₂O₅, के लिए विश्लेषण किया गया। K₂O, Na₂O और LOI. बाह्य जांच विश्लेषण के लिए 17 नमूने। 5 नमूनों का पेट्रोलॉजिकल और 2 नमूनों का थोक घनत्व के लिए अध्ययन किया गया।
- 1.11.0 सीमेंट ग्रेड चूना पत्थर, लाभकारी ग्रेड चूना पत्थर, लाभकारी ग्रेड डोलोमाइट और अवर्गीकृत डोलोमाइट के लिए एमईएमसी नियम 2015 (संशोधित 2021) के अनुसार भूवैज्ञानिक संसाधनों का अनुमान मुख्य विधि के रूप में बहुभुज विधि और चेक विधि के रूप में क्रॉस सेक्शनल द्वारा लगाया गया था, आईबीएम ग्रेड कट-ऑफ के वर्गीकरण के आधार पर, संसाधनों के आकलन के लिए 2.84 ग्राम/सीसी (कैलिपर विधि) के थोक घनत्व पर विचार किया गया था।
- 1.12.0 सीमेंट ग्रेड चूना पत्थर और लाभकारी ग्रेड चूना पत्थर बोरहोल संख्या MAK-07 में प्रतिच्छेदित किए गए, जिनकी मोटाई क्रमशः 14.00 मीटर और 2 मीटर है। लाभकारी ग्रेड डोलोमाइट को सभी बोरहोलों अर्थात MAK-01, 02, 03, 04, 05, 06, 07 में प्रतिच्छेदित किया गया, जिनकी संचयी मोटाई क्रमशः 43.00 मीटर, 9.50 मीटर, 5.00 मीटर, 39.00 मीटर, 4.00 मीटर, 22.00 मीटर और 29.00 मीटर है। अवर्गीकृत

डोलोमाइट बोरहोल संख्या MAK-01, 02, 03, 04, 05, 06, 07 में पाया गया, जिनकी संचयी मोटाई क्रमशः 4.00 मीटर, 29.30 मीटर, 41.50 मीटर, 10.00 मीटर, 41.80 मीटर, 26.00 मीटर और 4.00 मीटर है।

चूना पत्थर और डोलोमाइट के अनुमानित भूवैज्ञानिक सकल स्वस्थाने संसाधन इस प्रकार हैं:

क्रम सं.	संसाधनों का प्रकार	भूवैज्ञानिक सकल स्व-स्थाने संसाधन (एमटी*)	औसत गुणवत्ता		
			CaO %	MgO %	SiO ₂ %
1	सीमेंट ग्रेड चूना पत्थर	30.97	44.34	6.65	5.70
2	लाभकारी ग्रेड चूना पत्थर	4.42	38.00	11.13	5.36
3	लाभकारी ग्रेड डोलोमाइट	446.83	31.81	17.37	4.69
4	अवर्गीकृत डोलोमाइट	361.00	27.94	13.76	13.56

*एमटी - मिलियन टन

1.13.0 एमईसीएल द्वारा अकापुर ब्लॉक में किए गए प्रारंभिक गवेषण (जी3) से सीमेंट ग्रेड चूना पत्थर, लाभकारी ग्रेड चूना पत्थर, लाभकारी ग्रेड डोलोमाइट और अवर्गीकृत डोलोमाइट संसाधन प्राप्त हुए हैं, जिन्हें यूएनएफसी नामकरण के अनुसार 333 श्रेणी में रखा गया है। यह रिपोर्ट महाराष्ट्र सरकार को ब्लॉक की नीलामी में सहायता प्रदान करेगी।

**GEOLOGICAL REPORT ON PRELIMINARY EXPLORATION (G3) FOR
LIMESTONE IN AKAPUR BLOCK, DISTRICT: YAVATMAL,
MAHARASHTRA
CHAPTER-1**

1.0.0 EXECUTIVE SUMMARY

- 1.1.0 The Akapur has been proposed on the basis of lapsed lease areas identified by the State Government of Maharashtra, which were originally granted under Section 10A(2)(b) of the MMDR Act, 2015. However, following the 2021 amendment to the Act, all such Prospecting License (PL) reports were declared ineligible, mandating allocation through auction. Further, these PL reports are required to be evaluated to confirm the level of mineral evidence (G4, G3, etc.) as per the provisions of the Minerals (Evidence of Mineral Contents) Rules, 2015.
- 1.2.0 The Directorate of Geology and Mining (DGM), Government of Maharashtra requested MECL to take up the exploration in lapsed 10A(2)(b) mining lease areas vide letter no. Tech/1848/2023/260, Dated 23/01/2024.
- 1.3.0 MECL formulated exploration proposal involving 350m drilling in 07 boreholes at G3 level of exploration in and around Akapur village of Tehsil Maregaon, District: Yavatmal, Maharashtra.
- 1.4.0 Exploration Proposal (G3) for Akapur block (6.45 sq.km.) was submitted and deliberated in 69th TCC-1 meeting held on 26th, 27th and 30th September, 2024. Committee, noted 10A(2)(b) cases and request of Govt. of Maharashtra for exploration of these PL areas through MECL. Accordingly, 69th TCC-1 committee recommended the project proposal titled as “Preliminary Exploration (G3 Level) for Limestone in Akapur block (6.45 sq.km.), Yavatmal District, Maharashtra”.
- 1.5.0 On recommendation of 69th TCC-1, 38th Executive committee (EC), NMET meeting held on 29th Nov 2024, vide letter no F.No. 23/520/2024-NMET/573, Dated 12th December, 2024 approved the project with cost of INR 97.21 lakhs.
- 1.6.0 The Akapur Block, located in Yavatmal District of Maharashtra, spans 6.45 sq.km., is bounded by Longitude 78°50'57.22955"E to 78°53'04.22409"E and Latitude 20°08'22.66430"N to 20°09'33.58331"N and encompasses the villages of Akapur,

Chinchala, Pandarkawada, Wadgaon, Dol Dongargaon and Lakhapur in Tehsil Maregaon, falling within Toposheet No. 55 L/16.

- 1.7.0 After receipt of approval from NMET, The MECL has carried out G3 level exploration in Akapur Block. MECL carried out geological mapping and topographical survey on 1:4000 scale with drilling 7 vertical boreholes and analysing 167 core samples (plus 17 external check samples) generated from core drilling to delineate subsurface continuity and assess mineral resources.
- 1.8.0 Regionally Yavatmal district in Maharashtra has exposures dominated by Deccan basalts along with presence of Gondwana, Lameta and Penganga beds also present. The limestone formation of the area belongs to Putnur-Mangurda formation of Penganga Group. It is comprising laminated limestones and shales of shallow marine to fluvial origin. The rocks, exhibit a regional strike of NW - SE with low dips ranging from 5° to 10° towards the southwest.
- 1.9.0 The Akapur block area belongs to the Putnur-Mangurda formation lesser-known but geologically intriguing unit of the Penganga Group. These formations typically consist of Proterozoic sedimentary rocks like Shale, limestone and dolomite. The strike of the beds is N64°W – S64°E and dip varies from 5° to 20° towards southwest.
- 1.10.0 In this block, about 7 no. of vertical boreholes were drilled, with total meterage of 350m. A total of 167 no of samples analysed for CaO, MgO, SiO₂, Fe₂O₃, Al₂O₃, SO₃, P₂O₅, K₂O, Na₂O & LOI. 17 no. of samples for external check analysis. 5 no. of samples are studied for petrological and 2 no. of samples for bulk density.
- 1.11.0 Geological resources were estimated by polygonal method as principal method and cross sectional as check method as per MEMC Rules 2015 (Amended 2021) for Cement Grade Limestone, Beneficial Grade Limestone, Beneficial Grade Dolomite and Unclassified Dolomite based on classification of IBM grade cut-off, bulk density of 2.84 gm/cc (Caliper Method) was considered for estimation of resources.
- 1.12.0 Cement Grade Limestone and Beneficial Grade Limestone was intersected in the borehole no MAK-07, whose thickness are 14.00m and 2m respectively. Beneficial Grade Dolomite was intersected in the boreholes all the boreholes i.e. MAK-01, 02,

03, 04, 05, 06, 07 whose cumulative thickness are 43.00m, 9.50m, 5.00m, 39.00m, 4.00m, 22.00m and 29.00m respectively. Unclassified Dolomite was intersected in the boreholes no MAK-01, 02, 03, 04, 05, 06, 07 whose cumulative thickness are 4.00m, 29.30m, 41.50m, 10.00m, 41.80m, 26.00m and 4.00m respectively.

Estimated geological gross in-situ resources of limestone and dolomite are as follows:

Sl. No.	Type of Resources	Geological Gross in-situ Resources (MT*)	Average Quality		
			CaO %	MgO %	SiO ₂ %
1	Cement Grade Limestone	30.97	44.34	6.65	5.70
2	Beneficial Grade Limestone	4.42	38.00	11.13	5.36
3	Beneficial Grade Dolomite	446.83	31.81	17.37	4.69
4	Unclassified Dolomite	361.00	27.94	13.76	13.56

*MT – Million Tonnes

1.13.0 Preliminary exploration (G3) carried out by MECL in Akapur block established Cement Grade Limestone, Beneficial Grade Limestone, Beneficial Grade Dolomite and Unclassified Dolomite resources, which are placed under 333 category as per UNFC nomenclature. This report will facilitate state Govt. of Maharashtra for auction of the block.

CHAPTER – 2

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

2.1.0 INVESTIGATING AGENCY

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

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

1	Overall guidance	Shri Shrikant Sharma, HOD (Exploration)
2	Overall Planning, Co-ordination & Supervision	Shri Shrikant Sharma, HOD (Exploration) 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) Shri Manish Kumar Paswan, Geologist
	b) Survey	Shri Sanilam Guha, S.T.A (S&D)
	c) Drilling	Shri Niranjan Mardo, A D O
5	Sample Processing	Shri Ankush Haridas Wagh, Sr. Tech. (Sampling)
		Shri Pushpraj Tiwari, Tech. (Sampling)
6	Chemical Laboratory	Shri Shrikant Sharma, HOD (Exploration)
		Shri Rohit Sharma, Manager (Chemistry)
		Dr Deepti Rahangdale, Manager (Chemistry)
7	Petrographic Studies	Shri Sayantan Pal, Manager (Geology)
8	Documentation	Shri Naveen Kumar Pala, Sr. Manager (Geology)
		Shri Lakshmanarao Kaddala, Sr. Manager (Geology)
9	Non-Coal Geological Report Cell	Shri N C S Reddy, Sr. Console Operator
		Shri Uday Patil, Sr. Computer Operator

		Shri Ashok Kumar, Sr. Computer Operator
10	Hindi Translation	Shri Shreekant Rai, Sr. Hindi Translator

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 Akapur 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 02.05.2025 with the surveying and geological mapping on 1:4,000 scale over 6.45 sq.km. area with completion of all field operations on 31.08.2025. The analytical / laboratory studies were also carried out simultaneously at laboratories of MECL in Nagpur and other NABL accredited laboratories.

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

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

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

CHAPTER – 4

4.0.0 DETAILS OF THE AREA

4.1.0 LOCATION OF THE BLOCK

- 4.1.1 The Akapur Block, located in Yavatmal District of Maharashtra, spans 6.45 sq.km., is bounded by Longitude 78°50'57.23"E to 78°53'04.22"E and Latitude 20°08'22.66"N to 20°09'33.58"N and encompasses the villages of Akapur, Chinchala, Pandharkawada, Dol.Dongargaon and Lakhapur in Tehsil Maregaon falling within Toposheet No. 55L/16.
- 4.1.2 The block area is well connected to district headquarter Yavatmal, by all weather metalled road from the MH SH236 and MH SH 06 via Vadki and Karanji respectively.
- 4.1.3 The nearest railhead is Wani in Central Region which is about 20 km South East 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, Akapur Block,
Dist - Yavatmal, Maharashtra

UTM, ZONE-44, WGS-84			GEOGRAPHIC (LAT/LONG), WGS-84	
POINTS	EASTING	NORTHING	LONGITUDE	LATITUDE
A	275202.896	2230339.195	78°50'57.26011" E	20°09'26.16636" N
B	278796.958	2230521.203	78°53'00.90762" E	20°09'33.58331" N
C	278866.192	2228391.371	78°53'04.22409" E	20°08'24.37275" N
D	277551.238	2228355.593	78°52'18.97661" E	20°08'22.66430" N
E	275188.131	2229266.583	78°50'57.22955" E	20°08'51.29115" N

4.2.0 CADASTRAL DETAILS OF THE AREA WITH LAND USE

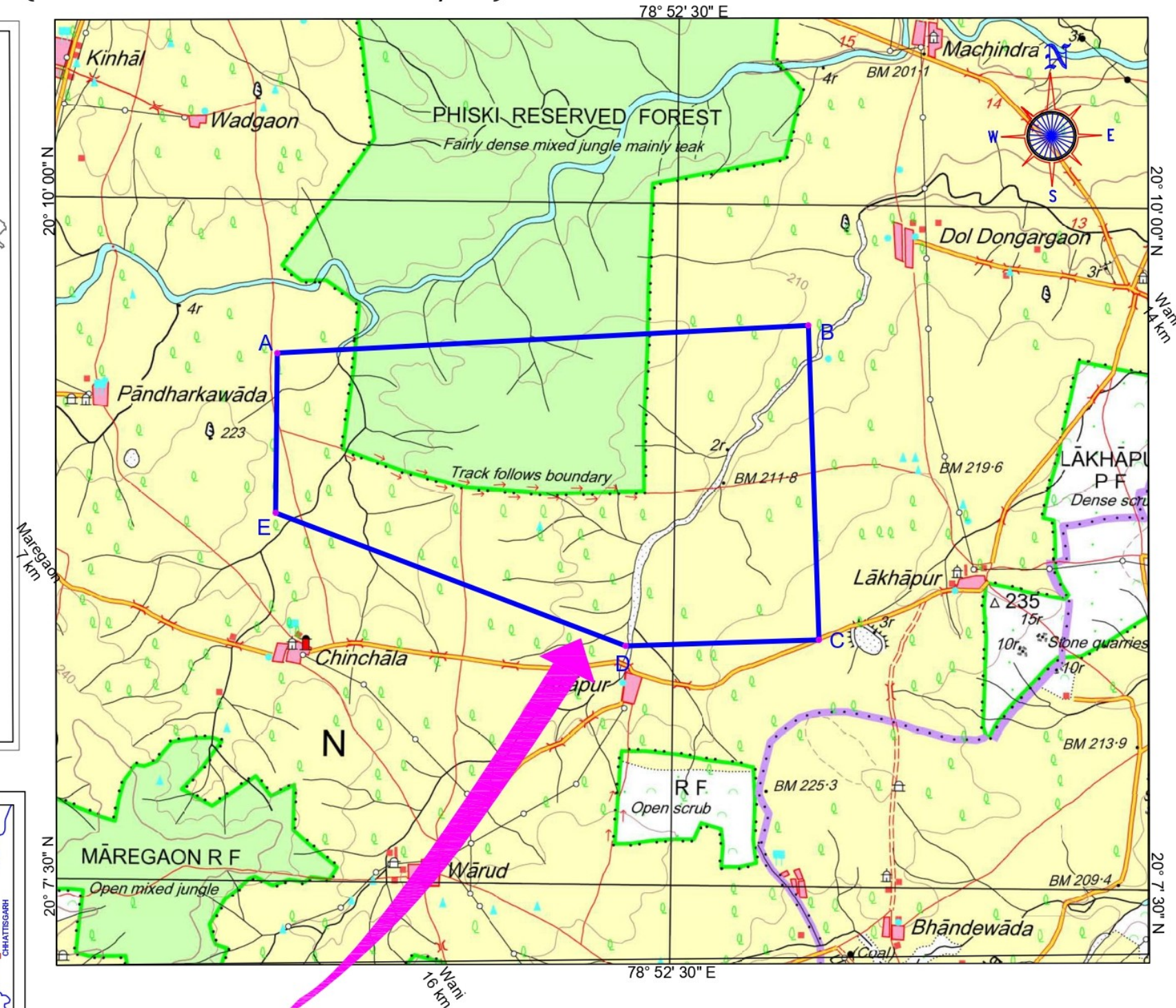
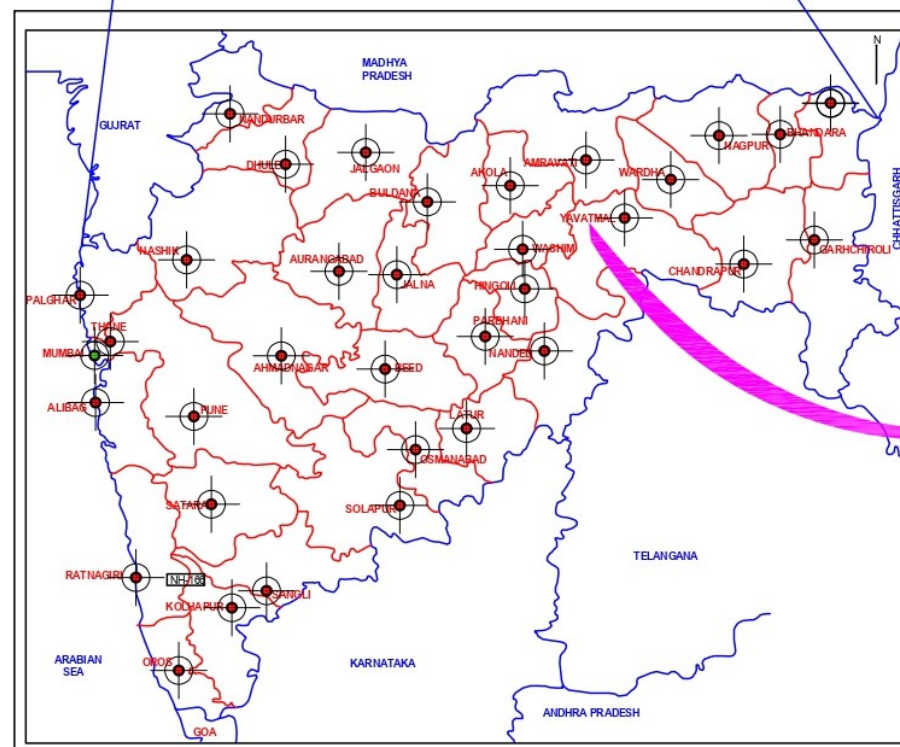
Cadastral details are not available for the study area, however indicative data collected from NGDR portal, which is being given below:

North central part of Akapur block area is covered with Phiski Reserve Forest, Maregaon Range, Pandharkawada Division, Yavatmal Circle and remaining area falls in Non-Forest Land (revenue and private land).

4.3.0 MINERAL(S) UNDER INVESTIGATION

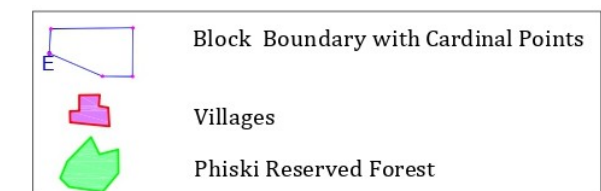
LIMESTONE / DOLOMITE.

LOCATION MAP OF AKAPUR BLOCK (PART OF TOPO SHEET 55 L/16), DISTRICT: YAVATMAL, MAHARASHTRA



Not to Scale

Cardinal point	Easting(m)	Northing(m)	Latitude	Longitude	Elevation(m)
A	275202.896	2230339.195	N20°09'26.16636"	E78°50'57.26011"	218.028
B	278796.958	2230521.203	N20°09'33.58331"	E78°53'00.90762"	208.863
C	278866.192	2228391.371	N20°08'24.37275"	E78°53'04.22409"	225.775
D	277551.238	2228355.593	N20°08'22.66430"	E78°52'18.97661"	215.710
E	275188.131	2229266.583	N20°08'51.29115"	E78°50'57.22955"	218.378



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 proposed block area is characterized by undulating terrain, comprising both hilly and flat regions, with gentle slopes towards the south, east, and west. The majority of the land within the block is used for agriculture. The average elevation ranges from 241 to 263 meters above mean sea level (MSL). The area exhibits a dendritic drainage pattern.

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

5.2.1 The block area is well connected to district headquarter Yavatmal, by all weather metalled road from the MH SH236 and MH SH 06 via Vadki and Karanji respectively.

5.2.2 The nearest railhead is Wani in Central Region which is about 20 km South East of the block. The nearest airport is Dr. Babasaheb Ambedkar International Airport, Nagpur (located about 170 km in northern direction of the block).

5.2.3 There is no major electrical line passing through the block

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

5.3.1 According to Census 2011, There are a total 2956 no. of people living in the villages, viz., Akapur, Chinchala, Pandharkawada, and Dol. Dongargaon which are falling in and around the part of explored block. Out of the total population, 1357 numbers are Male and 1308 numbers are female. Apart from adults, children below 6 years are about 291 in around the explored area

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 1681 number of people are working in agriculture as owner, co-owner and labourers, as the main occupation is agriculture.

Out of the total 2956 no of populations 135 number belongs to Scheduled Caste and 690 number belongs to Scheduled Tribe community.

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

5.5.1 No Archaeology and ASI site present inside the block.

No National Park, Wildlife Sanctuary falls inside the block.

No Eco Sensitive Zone inside the block.

No Monument falls inside the block.

No Archaeological sites present inside the block.

5.6.0 FOREST, SANCTUARIES, NATIONAL PARK AND WILD LIFE SANCTUARY

30 percentage of the block area falls in Phiski Reserve Forest towards north direction, Maregaon Range, Pandharkawada Division, Yavatmal Circle, Maharashtra.

5.7.0 FLORA AND FAUNA

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.

The local vegetation primarily comprises native species such as Shal, Babul, and various thorny bushes and shrubs. In addition to this natural vegetation, agricultural lands are also present, where predominantly single-season (kharif) crops are cultivated.

The wildlife in the area includes species such as tiger, foxes, pigs, wolves, monkeys, hares (*Lepus nigricollis*), and a variety of snakes, both venomous and non-venomous. Domesticated animals commonly found in the villages surrounding the block include oxen, buffaloes, cows, sheep, and goats.

Avian observed in the region consists of bird species like mynas, parrots, sparrows, cuckoos, and owls.

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

One seasonal nala is flowing in the area. The nala is flowing south westerly to north easterly. However, the easterly flowing drainages are merged into nala, which is ultimately merged with Wardha River in the east. The area has got dendritic pattern of drainage.

5.9.0 CLIMATE

- 5.9.1 The area experiences a tropical monsoon climate with three distinct seasons: summer, monsoon, and winter. Summers (March to May) are hot and dry, with temperatures reaching up to 45°C. The monsoon arrives in June/July and continues till September, bringing the majority of annual rainfall, which ranges from 85 cm to 110 cm, mostly during July and August. Winters (November to February) are mild, with minimum temperatures occasionally dropping below 15°C. The region has a moderately dry to wet climate overall. (Central Ground Water Board, 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 proposed block is primarily situated on plain terrain, with a minor elevation located in the north-central part of the area. The general slope of the land is towards the southwest (SW). Surface drainage is influenced by a seasonal nalla that flows in the same direction. The drainage pattern observed in the area is dendritic, indicating a natural and well-integrated network of water flow paths.
- 5.10.2 Most of the block area belongs to agriculture land. Yavatmal district is endowed with three major economic resources, viz. agricultural land, mineral deposits and forest products. The chief major forest produces are timber and firewood and the chief minor produce is Tembhurani leaves and Hirda. Jowar and Cotton are the main crops of the district, other important cash crops are groundnut, pulses (Tur Dal) and soyabean. The chief export articles of the district are cotton and teakwood giving highest revenue to the district. In the vicinity there are several coal mines of M/s Western Coal Fields Limited and Limestone / Dolomite mines are catering for cement plants located in Chandrapur and Yavatmal districts.

CHAPTER - 6

6.0.0 INFRASTRUCTURE

6.1.0 LOCAL INFRASTRUCTURE DETAILS

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

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

Facility	Location	Distance from the block (Appx.)
Police station	Maregaon	12 km
Bank facility	Maregaon	12 km
Hospital	Maregaon	12 km
Educational Institutes	Maregaon	12 km
High School	Akapur	1 km
Post Office	Akapur	1 km

6.1.2 The nearest railhead is Wani of Central Railways which is about 18 km south east of the block and nearest railway station is Wani, it is connected by a broad- gauge railway line. Specifically, it's part of the Wani-Adilabad broad gauge line, which links to Nagpur, Mumbai, and Chandrapur. The railway line serves as a crucial transportation route, including for transporting cement from a Birla/Adani group company's plant.

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

CHAPTER - 7

7.0.0 GEOLOGY OF THE AREA

7.1.0 REGIONAL GEOLOGY

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

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

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

Age	Supergroup	Group	Formation	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 Carboniferous to Early Permian			Talchir	Sandstone
Neoproterozoic	Penganga		Putnur-Mangurda	Limestone, laminated shale with limestone
			Takallapalli	
Archean to Palaeoproterozoic	Peninsular Gneissic Complex-II			Hornblende Biotite Gneiss

7.1.1 Alluvium

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

7.1.2 Basalt

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

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

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

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

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

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

7.1.3 Lameta Formation

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

7.1.4 Lower Gondwana

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

- **Kamthi Formation:** This unit belongs to the Late Permian age and is prominently exposed in the northern part of the block area, including around Mukutban. It typically comprises sandstones, shales, and occasional coal seams, deposited in a fluvial to deltaic environment. The sedimentary structures observed in the formation reflect high-energy river systems during its deposition.
- **Barakar Formation:** The Barakar Formation is characterized by coarse-grained sandstones interbedded with significant coal seams, making it economically important. The sandstones are typically dirty white to grey in colour and often show cross-bedding, indicating deposition in a braided stream environment.
- **Talchir Formation:** Representing the oldest unit of the Lower Gondwana Group, the Talchir Formation ranges from the Late Carboniferous to Early Permian. It is distinguished by glacially influenced deposits, including pebbly beds, olive green shale, gritty yellow sandstone, thinly bedded soft rocks, and a basal conglomerate (boulder bed). These lithologies reflect deposition in glacio-fluvial and glaciolacustrine environments, marking the onset of Gondwana sedimentation following extensive glaciation.

7.1.5 Penganga Group

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

cover, extending further south into Adilabad district, Telangana. Stratigraphically, it comprises a lower limestone member and an upper shaly member. The limestone dominates exposures in the western and southwestern stretches along the Penganga River, whereas the shale member is more prevalent in the eastern and southeastern areas, particularly along the Penganga and Khuni rivers.

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

Limestone/Dolomite exposed in Akapur block belongs to Putnur-Mangurda formation.

7.1.6 Peninsular Gneissic Complex–II (PGC-II)

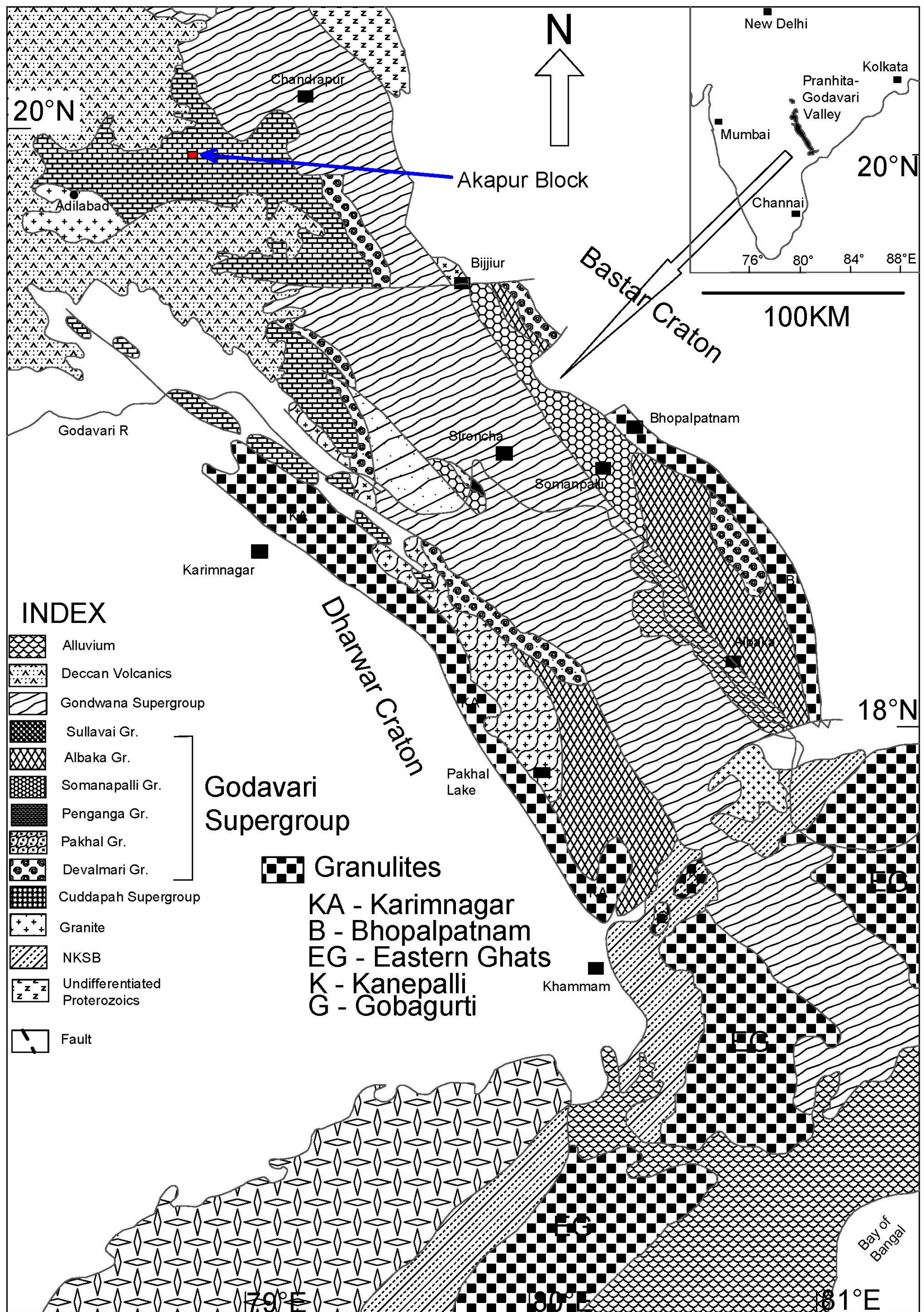
PGC-II represents some of the oldest crystalline basement rocks in the Indian subcontinent, dating back to the Archaean Eon (over 2.5 billion years ago). In the Yavatmal district, exposures of PGC-II are typically found in the eastern and southeastern parts, often forming the basement for younger sedimentary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

7.2.0 REGIONAL STRUCTURE

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

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

Generalised Geological Map of the Pranhita Godavari (PG) Valley showing Akapur Block (After Chaudhuri et al. 2012)



Source: GSI, SR, Hyderabad

Not to Scale

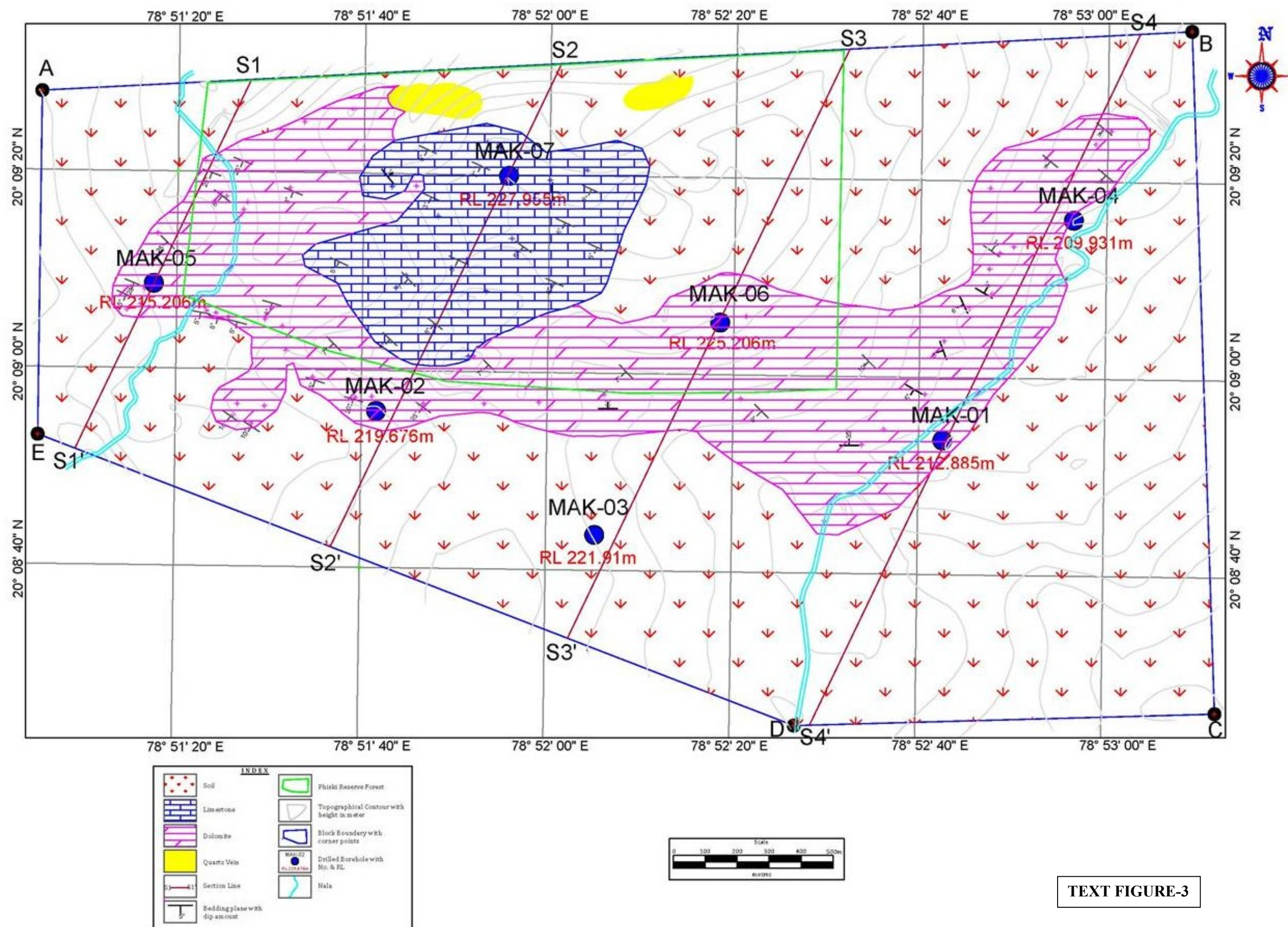
TEXT FIGURE-2

7.3.0 GEOLOGY OF THE BLOCK

7.3.1 The Akapur Block, covering an area of 6.45 sq.km., was geologically mapped by MECL on 1:4000 scale, accompanied by a topographical survey. The majority of the area is blanketed by soil and with exposures of limestone and dolomite, which belongs to Putnur-Mangurda formation.

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

TOPOGRAPHICAL & GEOLOGICAL MAP OF AKAPUR BLOCK (Over an extent of 6.45 sq.km)



TEXT FIGURE-3

Table-7.2
Generalized stratigraphy of Akapur 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	Quartz vein, Shale Limestone/Dolomite Conglomerate
			Takallapalli	
Archean to Palaeoproterozoic	Peninsular Gneissic Complex-II			Hornblende Biotite Gneiss

7.4.0 DESCRIPTION OF ROCK TYPES

The Litho-units of Akapur block area is described below.

7.4.1 SOIL

About 40 percent of the block area is covered by soil. Soil cover within the block area varies in thickness from 1m to 4m, colour is light grey to black. The thickness of the soil is not uniform in entire block. A maximum thickness of 4m is observed southern part and minimum thickness 1m in northern part of the block. Thickness of soil as intersected is maximum 4m in borehole no. MAK-02, 03 & 05 and minimum thickness 1m in the borehole no. MAK-04 & 07.

PUTNUR-MANGURDA FORMATION

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

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

7.4.2 SHALE

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

These shales were deposited in low-energy environments, such as lacustrine (lake) or deltaic settings, where fine sediments could settle undisturbed. Their laminated structure and organic content suggest anoxic conditions. Outcrops of Shale are not exposed in the surface area however; shale beds are intersected in 5 no. of borehole no. MAK-01, 02, 04, 05 & 07, whose thicknesses are 4m, 16m, 2m, 14m and 4m respectively.

7.4.3 LIMESTONE

The limestone outcrops are available on the surface near the borehole no. MAK-07 and two limestone beds are intersected in the borehole no. MAK-07 along with dolomite and thicknesses of limestone is 14m and 2m. Limestone is greyish-white in colour and fine grained, bedded, fractured, hard and massive. When tested with dilute hydrochloric acid, it shows medium to high effervescence, indicating a significant carbonate content.

The regional geological trends and borehole correlations suggest a strike ranging from N64°W–S64°E to with a gentle southwesterly dip of 5° – 20°. Subsurface data from boreholes MAK-07 confirm the presence of limestone along with dolomite.

Limestone intersected in the boreholes has analytical value ranging from 38.00% to 51.93% CaO, 2.73% to 9.47% MgO & 1.81% to 7.16% SiO₂.



Figure 1: Photograph showing cores of limestone zone from 1m to 5m in MAK-07

7.4.4 DOLOMITE

Outcrops of dolomite are observed in the mapped area are predominantly Dolomite. One outcrop of dimensions 15 x 7m is located in the eastern part of the block area. These dolomite beds exhibit the structural trend of N64°W – S64°E with a gentle dip angle ranging from 5° to 20° due Southwesterly. The dolomite is typically fine-to medium-grained, with a white to light grey colour and characterized by Mottling structure with highly jointed nature.

5 samples were collected from borehole cores MAK-03, MAK-04, MAK-05 & MAK-06), Thus a total 5 no of samples were sent to petrology lab of MECL for petrological studies and confirmed that samples are dolomite. Details are given below Table 7.3.

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

Sl.No.	Sample No.	BH No.	From (m)	To (m)	Rock type Identification
1	MK-PET-01	MAK-03	17.76	17.81	Dolostone (Dolomite)
2	MK-PET-02	MAK-03	49.02	49.07	Dolostone (Dolomite)
3	MK-PET-03	MAK-04	25.59	25.64	Dolostone (Dolomite)
4	MK-PET-04	MAK-05	20.82	20.87	Dolostone (Dolomite)
5	MK-PET-05	MAK-06	16.65	16.70	Dolostone (Dolomite)



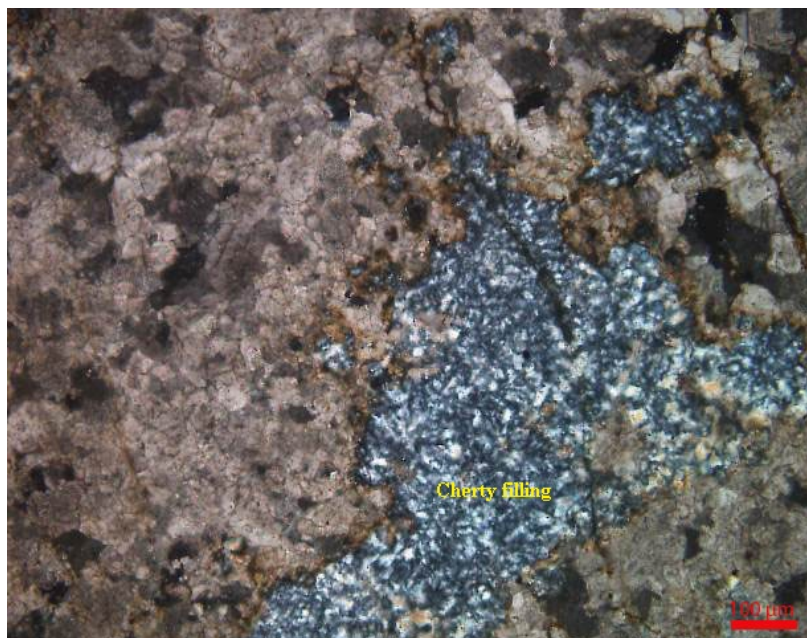
Figure 2: Photograph showing outcrop of dolomite in eastern part of the block area



Pmg – 1: Photomicrograph showing ferruginous filling along stylolitic cracks in dolomite as seen under crossed nicols.

Specimen No. : MK-PET-01

Magnification : 100X



Pmg – 2: Photomicrograph showing cherty fillings within dolostone as seen under crossed nicols. **Specimen No.: MK-PET-02 Magnification: 100X**



Pmg – 3: Photomicrograph showing calcite vein intrusion within dolostone as seen under crossed nicols. **Specimen No.: MK-PET-04 Magnification: 100X**

Dolomite was intersected in all the borehole MAK-01 to MAK-07 With interception of the maximum thickness of 48m in MAK-06 and minimum thickness of 30m in MAK-02 & MAK-05. The analytical values ranges from 30.25 to 37.22 % CaO, 6.44 to 18.91% MgO and 1.97 to 12.91% SiO₂.

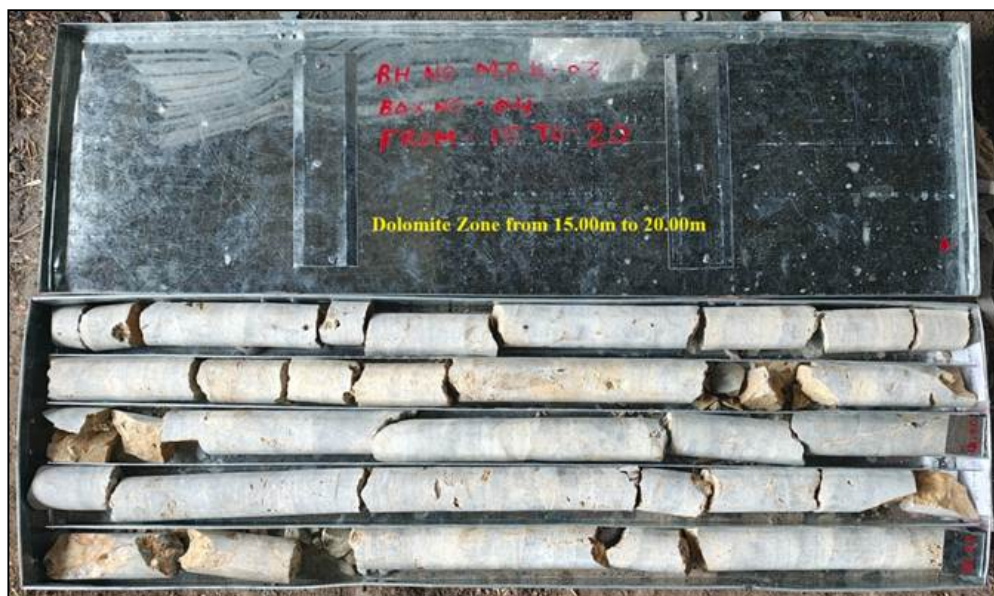


Figure 3: Photograph showing cores of dolomite zone from 15.00m to 20.00m in Bh. MAK-03



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

7.5.0 BLOCK STRUCTURE AND MINERALIZATION

7.5.1 The Dolomite beds block exhibit a consistent structural alignment with the associated units, maintaining a strike direction of N64°W-S64°E and dipping 5° to 20° towards south west direction. This uniformity in orientation suggests that lithology was subjected to the same tectonic regime, likely during a regional phase of gentle folding or tilting.

7.6.0 BEDDING AND DIP CHARACTERISTICS

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

7.6.2 The N64°W-S64°E strike aligns with regional structural trends observed in the surrounding sedimentary basins, possibly influenced by basement lineaments or paleostress orientations.

7.6.3 Fracturing and Jointing

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

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



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

7.6.4 Structural Controls on Mineralization

7.6.4.1 The alignment of limestone/ dolomite beds, along with the presence of an abandoned limestone/dolomite mine to the South of the block highlights the economic potential and geological persistence of these carbonate formations across the area.

7.6.5 Tectonic Implications

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

7.7.0 MINERALISATION IN THE BLOCK

7.7.1 The Akapur Block predominantly hosts dolomite mineralization with minor limestone development. Drilling data indicates that dolomite was consistently intersected in 7 boreholes (MAK-01 to MAK-07) with an average thickness of 39.50m, confirming its laterally persistent and regionally extensive nature.

Limestone horizons occur in borehole MAK-07 (14m), suggesting discontinuous and lensoidal development within the dolomite sequence. In the northern part of the block.

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

CHAPTER 8

8.0.0 PREVIOUS WORK

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

8.1.1 The earliest mention of limestone is by Jenkin (1833) and Voysey (1833) dealing with the geology and mineralogy of the Yavatmal area, Central provinces. The geology of the area was first studied by T.W.H. Hughes, in the year 1877 who mapped the limestone bands as Penganga beds in south of Yavatmal district as Vindhyan. B.N. Sinha mapped the toposheet no 55 L/16. 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 L/16 and 56 I/14 in field season 1984-85 and mapped the limestone bands as Penganga beds.

8.1.2 Ku Shailaja D. Dahule & Ku Varsha Prabhakar Thakre, Distt: Yavatmal was granted a prospecting Licence for Limestone over an area of 60.27 Ha. In the village Akapur, Tehsil- Maregaon, District Yavatmal, M.S. vide Govt. of Maharashtra order No. PLS- 1396/56511/ (7163)/ IND-9 dated 19.07.1997. 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 five pits and one trench has been undertaken for exploration in the said area. The analysis ranges of the samples are given below.

Constituents	Percentage%	
	From	To
CaO	46.52	50.69
MgO	2.66	3.43
SiO₂	2.20	4.30

The Lithologs of different pits undertaken during prospecting operations are as following:

Pit/Trench No.	Dimension in Mts.			Geological Formations in metre	
	Length (m)	Width (m)	Depth (m)		
I	2.80	2.40	2.60	1.80	Black cotton soil
				0.50	Sand
				0.30	Limestone
II	2.40	2.40	1.50	0.90	Black Cotton Soil
				0.60	Black limestone siliceous in nature
III	4.20	2.50	1.20	1.20	Black limestone exposed from the surface
IV	2.80	2.80	0.60	0.20	Soil
				0.40	Greyish white siliceous dolomite
V	4.00	2.00	0.60	0.60	Dolomitic limestone with calcareous and siliceous matter
Trench	30.00	1.00	0.75		Greyish black limestone in soil cover throughout the trench

The Statement of analysis which were found encouraging during the exploration work in the prospecting area is as following:

Statement of Analysis							
Sample Location	Constituents						
	SiO ₂	Fe ₂ O ₃	Al ₂ O ₃	CaO	MgO	P ₂ O ₅	LOI
Pit No. -II	4.3	0.92	1.96	46.52	2.85	0.05	40.77
Pit No. -III	3.67	0.9	2.17	49.2	3.16	0.05	41.5
Pit No. -IV	6.48	0.87	1.9	42.35	8.8	0.05	39.54
Surface Sample	3.89	0.96	1.55	48.72	3.43	0.05	40.37
Trench	2.2	0.93	2.07	50.69	2.66	0.05	41.9

8.1.3 Geologists from MECL has undertaken pre field visit in the proposed area for preparing exploration proposal. During the visit about 5 nos. of samples were collected and analyzed for 7 elements. The analysis of the samples are given below.

Sample No.	CaO%	MgO%	Al ₂ O ₃ %	SiO ₂ %	Fe ₂ O ₃ %	K ₂ O%	LOI%
YLS-01	33.9	14.2	1.3	5.3	0.5	0.3	44.0
YLS-02	34.5	9.0	2.8	10.3	1.4	0.6	40.9
YLS-03	40.8	6.8	1.9	6.2	1.3	0.4	42.1
YLS-04	35.8	12.6	0.8	5.7	0.4	0.2	44.1
YLS-05	38.7	9.2	1.0	7.8	0.4	0.2	42.4

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 INTRODUCTION

- 10.1.0 The Akapur block falls in Survey of India Toposheet No. 55 L/16. Akapur, Chinchala, Pandarkawada, Wadgaon, Dol Dongargaon and Lakhapur are villages in and around the block which belongs to Tehsil- Maregaon, District - Yavatmal, State - Maharashtra.
- 10.1.1 The Akapur has been proposed on the basis of lapsed lease areas identified by the State Government of Maharashtra, which were originally granted under Section 10A(2)(b) of the MMDR Act, 2015. However, following the 2021 amendment to the Act, all such Prospecting License (PL) reports were declared ineligible, mandating allocation through auction. Further, these PL reports are required to be evaluated to confirm the level of mineral evidence (G4, G3, etc.) as per the provisions of the Minerals (Evidence of Mineral Contents) Rules, 2015.
- 10.1.2 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.
- 10.1.3 MECL formulated exploration proposal involving 350m drilling in 07 boreholes at G3 level of exploration in and around Akapur & Chinchala villages of Tehsil- Maregaon, District - Yavatmal.
- 10.1.4 Exploration Proposal (G3) for Akapur block (6.45 sq.km.) was submitted and deliberated in 69th TCC-1 meeting held on 26th, 27th & 30th September, 2024. Committee, noted 10A(2)(b) cases and request of Govt of Maharashtra for exploration of these PL areas through MECL. Accordingly, 69th TCC-1 committee recommended (Annexure-VIII A) the project proposal titled as “Preliminary Exploration (G3 Level) for Limestone in Akapur block (6.45 sq.km.), Yavatmal District, Maharashtra”.
- 10.1.5 On recommendation of 69th TCC-1, 38th EC of NMET meeting held on 29th November 2024 approved this project with total cost of 97.21 lakhs. (Annexure-VIII B).

10.2.0 OBJECTIVES OF INVESTIGATION

- 10.2.1 The preliminary exploration was proposed with following objectives in Akapur block are as follows:

- (a) To carry out detailed Topographical Survey and Geological mapping on 1:4000 scale over an extent of 6.45 sq.km.
- (b) To delineate the strike and depth continuity of the limestone by drilling of vertical boreholes of 07 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 Akapur 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 Akapur Block

Sl. No.	Item of Work	Unit	Target	Achieved
1	Topographic Survey & Geological Mapping on 1:4000 scale (Ha)	sq.km.	6.45	6.45
2	Boundary and borehole demarcation with DGPS	Nos	12	12
3	Exploratory Drilling	m.	350.00 07 Bhs	350.00 07 Bhs
4	Laboratory Studies			
	i) Chemical Analysis; Primary samples for 10 radicals, CaO, MgO, SiO ₂ , Fe ₂ O ₃ , Al ₂ O ₃ , SO ₃ , P ₂ O ₅ , K ₂ O, Na ₂ O & LOI by XRF. (Borehole core samples)	Nos.	300	167
	ii) External Check (NABL) samples (10% of Primary samples) for analysis of for 10 radicals, CaO, MgO, SiO ₂ , Fe ₂ O ₃ , Al ₂ O ₃ , SO ₃ , P ₂ O ₅ , K ₂ O, Na ₂ O & LOI by XRF	Nos.	30	17
5	Physical Studies			
	b) Petrological Studies	Nos.	5	5
	b) Bulk Density Determinations	Nos.	2	2
6	Report Preparation (5 Hard copies with one soft copy)	Nos.	1	1
7	Preparation of Exploration Proposal (5 Hard copies with a soft copy)	Nos.	1	1

10.4.0 EXPLORATION ACTIVITIES TAKEN UP

- 10.4.1 Exploration activities viz., Geological Mapping, Topographical Survey on 1:4000 scale, exploratory drilling in 07 no of boreholes were carried out along with associated analytical works.
- 10.4.2 MECL commenced exploration activities on 02.05.2025 and completed with all field activities on 31.08.2025.
- 10.4.3 Geological mapping was carried out at 1:4,000 scale for the entire area of 6.45 sq.km. depicting the lithologs, 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 N64°W - S64°E with dip angle 5°- 20° due southwesterly. The readings recorded in the field were plotted in the geological map and submitted as (Plate III).
- 10.4.4 Topographical survey, exploratory drilling and borehole core sampling was carried out concurrently. The analytical / laboratory studies were carried out in laboratories of MECL and JNARDDC, Nagpur (NABL accredited laboratory).
- 10.4.5 Exploratory boreholes core was systematically logged as per geological characters i.e., grain size, rock type, structural, 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 Geologists from MECL has undertaken pre field visit in the proposed area for preparing exploration proposal, during the visit about 5 nos. of samples were collected and analyzed for 7 elements.
- 10.5.2 Total 167 numbers of primary core samples are generated from the drilled boreholes, which were analysed for 10 radicals i.e., CaO, MgO, SiO₂, Fe₂O₃, Al₂O₃, SO₃, P₂O₅, K₂O, Na₂O & LOI by XRF method and compiled as Annexure- IIIA.
- 10.5.3 10% samples of primary drill core samples, about 17 nos. samples were submitted to JNARDDC, Nagpur for external check analysis for 10 radicals i.e. CaO, MgO, SiO₂, Fe₂O₃, Al₂O₃, SO₃, P₂O₅, K₂O, Na₂O & LOI by XRF method. Analytical results of check samples are presented in Annexure-IIIB.

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

CHAPTER - 11

11.0.0 LOCATION OF DATA POINTS

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

- 11.1.1 The entire survey work has been carried out with the help of DGPS (Make-Trimble DGPS, Model-R8S). With the help of DGPS, Co-ordinates of surface features i.e. roads, village boundaries, water bodies, base station and block co-ordinates i.e. 5 nos. of block boundary cardinal points with R.L. has been determined (Annexure IA) and topography along with geological map is presented (Plate-III). Contour interval in topographical map is kept at 2m. The topographical survey was done in PPK (Post Precision Kinematics) mode. Positional (horizontal) accuracy of the survey is 3mm while the elevation accuracy is 2.5mm in PPK mode.
- 11.1.2 DGPS survey was carried out for boreholes drilled by MECL (Annexure IB). The base station was utilized for the fixing of the boreholes on the ground level. The coordinates of base station is given in Table-11.1.

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

Point Name	UTM Zone-45North		Elevation (Meter)
	Easting (Meter)	Northing (Meter)	
A-1	276430.824	2229392.931	223.957

11.2.0 QUALITY AND ADEQUACY OF TOPOGRAPHIC CONTROL

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



Figure 6: Photograph showing Base Station of Akapur Block

CHAPTER - 12

12.0.0 SAMPLING TECHNIQUES

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

- 12.1.1 The present work has been formulated to undertake Preliminary Exploration (G3 stage) for limestone in the Akapur Block. Given that nearly 40% of the block is soil covered with scanty outcrops, exploration was largely dependent on subsurface core drilling to evaluate lithology and mineralization. A total of seven boreholes were drilled for 350 m cumulative depth, intersecting dolomite as the dominant litho unit with localized limestone horizons. In addition, five core samples were collected from boreholes for petrographical studies.
- 12.1.2 A total of 167 core samples were generated and 17 nos. external check samples are analysed for 10 radicals, CaO, MgO, SiO₂, Fe₂O₃, Al₂O₃, SO₃, P₂O₅, K₂O, Na₂O & LOI by XRF method. Further 2 no. of core samples were studied for bulk density.
- 12.1.3 Borehole core sampling work has been carried out in the presence of qualified geologist and sampling technician. Geologist marked the limestone/dolomite zones for sample preparation and under supervision of sampling technical sample was generated.

CHAPTER - 13

13.0.0 DRILLING TECHNIQUES AND DRILL SAMPLING EMPLOYED

13.1.0 DRILLING TYPES AND DETAILS

13.1.1 MECL has executed core drilling using RD 60 (MEC 347 & 353) coring drill rigs, A total 7 no. of vertical boreholes with a cumulative meterage of 350.00 were drilled. The details coordinates 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, Akapur Block

Sl. No.	Borehole No	Northing (m)	Easting (m)	Elevation (m)	Date of Commencement	Date of Closure	Total Depth (m)
1	MAK-01	278015.414	2229245.704	212.885	02.05.2025	13.05.2025	50.00
2	MAK-02	276245.719	2229338.058	219.676	03.05.2025	11.05.2025	50.00
3	MAK-03	276927.663	2228950.986	221.910	13.05.2025	17.05.2025	50.00
4	MAK-04	278426.912	2229931.706	209.931	15.05.2025	23.05.2025	50.00
5	MAK-05	275551.012	2229737.696	215.206	19.05.2025	24.05.2025	50.00
6	MAK-06	277321.344	2229613.809	225.206	25.05.2025	12.06.2025	50.00
7	MAK-07	276661.594	2230071.673	227.955	14.06.2025	26.06.2025	50.00
Total Drilling Meterage							350.00

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

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



Figure 7: Picture showing Conventional drill rig MEC- 347 (RD- 60) at drill site for Bh. MAK-06

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

- 13.2.1 The core samples have been recorded properly and the detailed borehole wise run wise lithologs and summarized lithologs for boreholes are given in Annexure-IIA and Annexure-IIB respectively. The run wise lithologs of drilled core as well as the cuttings from boreholes have helped in discerning the physical characters like colour, shape, size and nature of the mineralisation as well as texture, structural features and identification of different litho units.
- 13.2.2 The mineralised zones /length recorded during the geological core logging have been sampled for Limestone/Dolomite and analysed for 10 radicals. The primary samples had been marked in the mineralized zones intersected in the borehole based on visual inspection/lithology and in general the sample length has been kept as 2.00 m for all the boreholes. The details of analysis of primary core samples are given in Annexure-III A.

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

- 13.3.1 The entire core drilling has been done by NQ size diamond drill bit with single barrel wire line, wet core drilling method to optimize sample recovery. To stabilize the upper loose formation NW casing was set in each borehole ranging from 3.00m to 26.00m depending on lithological conditions. The polymer was used as drilling fluid to flush out the cuttings and stabilize the borehole wall. The drilling fluid also works as a coolant to avoid burning of drill bits. Core recovery

was consistently maintained in limestone/dolomite horizon, however in case of weathered, loose and fractured zone and in solution cavities, the core recovery was low. Whenever core recovery is less, the grade of the recovered portion has been extrapolated over the non-recovered section. However, all the precautions like modulated water pressure, proper liner, optimum head pressure and the hands of an expert drilling technician had been taken to maintain the quality of drilling.

13.4.0 ROCK QUALITY DESIGNATION STUDIES

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

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

$$\text{RQD}\% = (\text{Length (m) of core pieces} \geq 10 \text{ cm} / \text{Total length(m) core run}) \times 100$$

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

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

Table 13.2:
Classification Comparing RQD with qualitative rock quality

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

13.4.5 Total Core Recovery (TCR)

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

$$\text{Recovery} = [\text{Measurable core recovered length (m)}/\text{Drill run length (m)}] \times 100$$

13.4.6 The RQD conducted on all 7 no. of boreholes, which has been given in Table 13.3. The average of RQD is falls in “Very Poor” category as per D.U.Deere classification.

Table 13.3:
Borehole wise RQD as per Deere classification

Sl.No.	Borehole No.	Soil thickness	Thickness of litho	RQD Thickness	RQD %	Category
1	MAK-01	3	47	6.63	14.11	Very Poor
2	MAK-02	4	46	4.42	9.61	Very Poor
3	MAK-03	4	46	14.14	30.74	Very Poor
4	MAK-04	1	49	8.24	16.82	Very Poor
5	MAK-05	4	46	4.21	9.15	Very Poor
6	MAK-06	2	48	1.73	3.60	Very Poor
7	MAK-07	1	49	3.25	6.63	Very Poor

13.5.0 WHETHER THE RELATIONSHIP EXISTS BETWEEN SAMPLE RECOVERY AND GRADE

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

13.6.0 CORE LOGGING

13.6.1 The entire core recovered by drilling was logged systematically in detail describing 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 lithologs and summarized lithologs for boreholes are given in Annexure IIA and Annexure IIB respectively.

CHAPTER - 14

14.0.0 SUB SAMPLING TECHNIQUES AND SAMPLE PREPARATIONS

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

14.1.1 The core sampling has been carried out for entire mineralized limestone/dolomite zones/length intersected in the boreholes. Samples were marked and drawn from limestone/dolomite zones marked on the basis of visual basis. Then the core has been split into two equal halves by hydraulic core splitter in such a way that the core is uniformly split into two equal halves. The whole quantity of half portion of the sample as marked while logging is crushed to (-) 200 mesh size and about 500g representative sample of (-) 200 mesh was drawn by coning and quartering method of gradual size reduction with the help of crusher and pulveriser. Out of 500gm, 100gm each were drawn for Primary Chemical analysis of 10 radicals (CaO, MgO, Al₂O₃, SiO₂, Fe₂O₃, SO₃, P₂O₅, K₂O, Na₂O 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 167 nos. of primary samples, 17 nos. of external check samples for limestone/dolomite mineralization were prepared. 17 numbers of external check samples for same 10 radicals have been analysed at Jawaharlal Nehru Aluminium Research Development and Design Centre (JNARDDC) Nagpur (A NABL accredited Laboratory), the results along with comparison with primary core samples are placed in Annexure-IIIB. The details of analysis of primary core samples are given in Annexure- IIIA.

14.2.0 NATURE, QUALITY AND APPROPRIATENESS OF THE SAMPLE PREPARATION TECHNIQUE

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

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

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

14.3.0 QUALITY CONTROL PROCEDURES ADOPTED

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

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

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

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

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

CHAPTER - 15

15.0.0 QUALITY OF ASSAY DATA AND LABORATORY TESTS

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

15.1.1 The primary samples from limestone/dolomite mineralized zones have been analyzed for 10 radicals i.e. CaO, MgO, Al₂O₃, SiO₂, Fe₂O₃, SO₃, P₂O₅, K₂O, Na₂O and LOI by XRF method at Chemical Laboratory of MECL, Nagpur and External check samples for same 10 radicals have been analysed at Jawaharlal Nehru Aluminium Research Development and Design Centre, (JNARDDC) Nagpur (A NABL accredited Laboratory).

15.2.0 PRIMARY AND CHECK SAMPLE STUDIES OF BOREHOLE SAMPLES

15.2.1 A total of 17 samples as external check samples are submitted to Chemical Laboratory of Jawaharlal Nehru Aluminium Research Development and Design Centre, Nagpur for 10 radicals (CaO, MgO, Al₂O₃, SiO₂, Fe₂O₃, SO₃, P₂O₅, K₂O, Na₂O and LOI by XRF). Analytical results and comparison with primary samples are provided in the Annexure-IIIB.

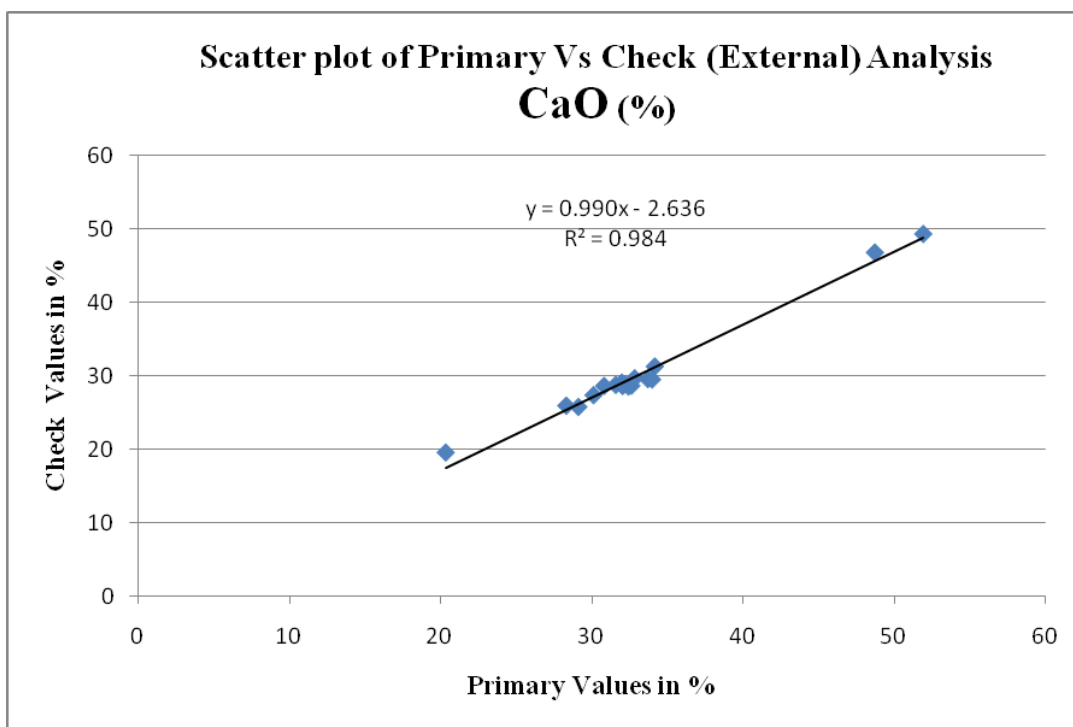
15.2.2 In order to assess the bias and inaccuracies in analytical determination as well as to check the repeatability of analysis, 07 borehole samples were analysed for external check analysis out of 167 primary samples for limestone/dolomite. The comparative studies for CaO external check samples are tabulated in Table-15.1 and scatter plot are represented as Text Figure-4.

15.2.3 The R² value = 0.984, which is very close to 1. This means that 98.4% of the variation in the check values can be explained by the primary values. It indicates a strong linear correlation between the two datasets. Since the slope is close to 1 and R² is high, the check samples are highly consistent with the primary values. The small deviation (slope slightly <1) suggests that the check values tend to be slightly lower than the primary values on average. This could indicate minor systematic differences between primary and check sample analyses, such as small lab measurement biases.

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

COMPARISON OF PRIMARY Vs EXTERNAL CHECK ANALYSIS

COMPARISON INDEX	Primary	CaO % Check
No. of Sample Pairs		17
Arithmetic Mean	33.359	30.392
Standard Deviation	6.949	6.936
Std. Error of Mean	1.685	1.682
Variance	48.294	48.11
Mean of Deviation		2.966
Standard Deviation (Error)		0.878
Correlation Coefficient		0.992
Mean Absolute Error		2.966
Mean Relative Random Error		8.893%
Paired T value		13.924
F - test value		1.004

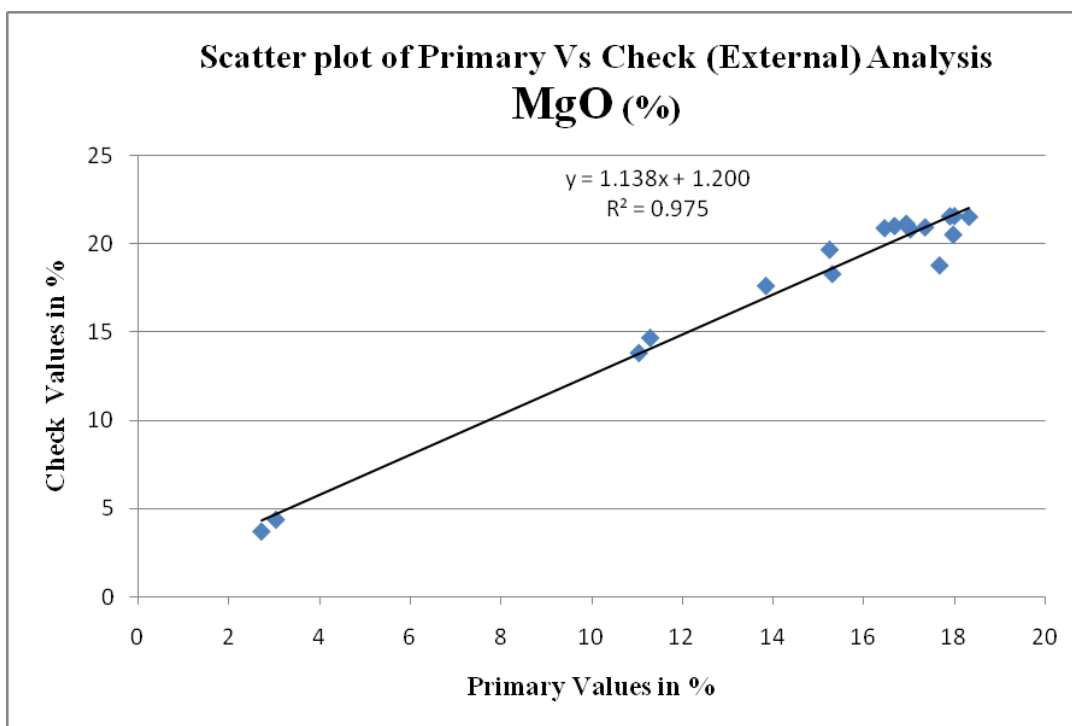


Text Figure-4: Scatter Plot of Primary and External Check Samples for CaO%

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

COMPARISON OF PRIMARY Vs. EXTERNAL CHECK ANALYSIS

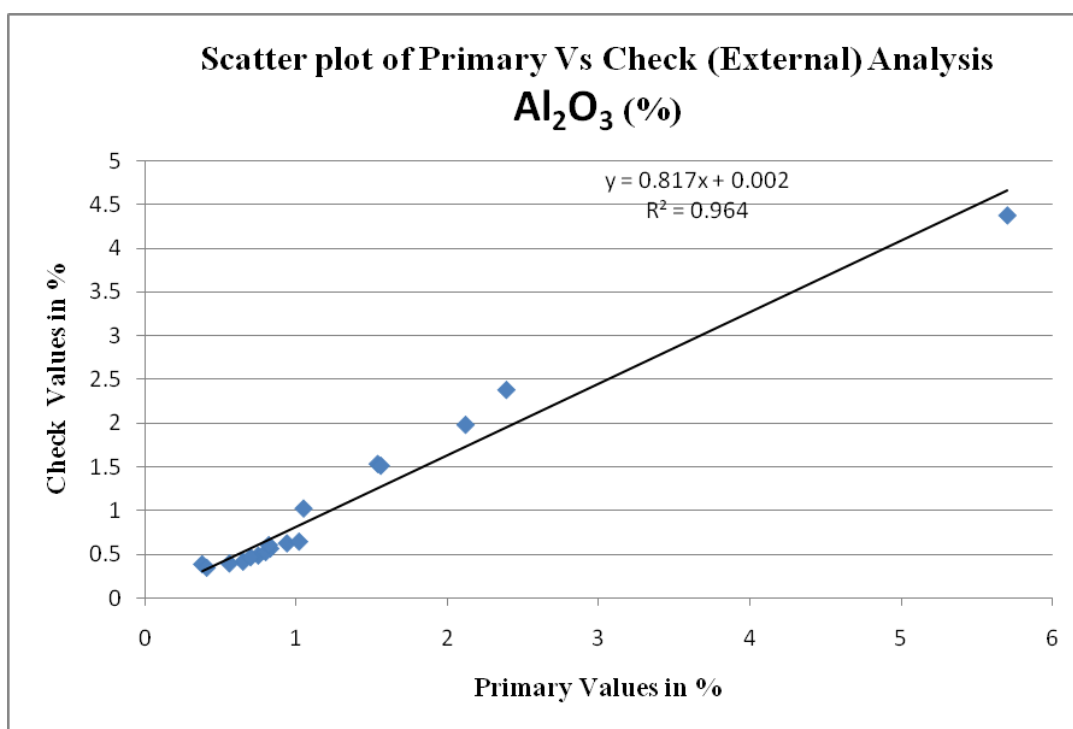
COMPARISON INDEX	Primary	MgO % Check
No. of Sample Pairs		17
Arithmetic Mean	14.512	17.722
Standard Deviation	4.743	5.469
Std. Error of Mean	1.15	1.326
Variance	22.5	29.907
Mean of Deviation		-3.21
Standard Deviation (Error)		1.085
Correlation Coefficient		0.987
Mean Absolute Error		3.21
Mean Relative Random Error		22.116%
Paired T value		-12.197
F - test value		0.752



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

Table-15.3
Comparison of Primary vs. External Check samples for Al₂O₃ in
Akapur (G3) Block, District Yavatmal, Maharashtra
 COMPARISON OF PRIMARY Vs. EXTERNAL CHECK ANALYSIS

COMPARISON INDEX	Primary	Al ₂ O ₃ Check
No. of Sample Pairs		17
Arithmetic Mean	1.307	1.071
Standard Deviation	1.227	1.021
Std. Error of Mean	0.298	0.248
Variance	1.505	1.042
Mean of Deviation		0.236
Standard Deviation (Error)		0.295
Correlation Coefficient		0.982
Mean Absolute Error		0.236
Mean Relative Random Error		18.092%
Paired T value		3.301
F - test value		1.445

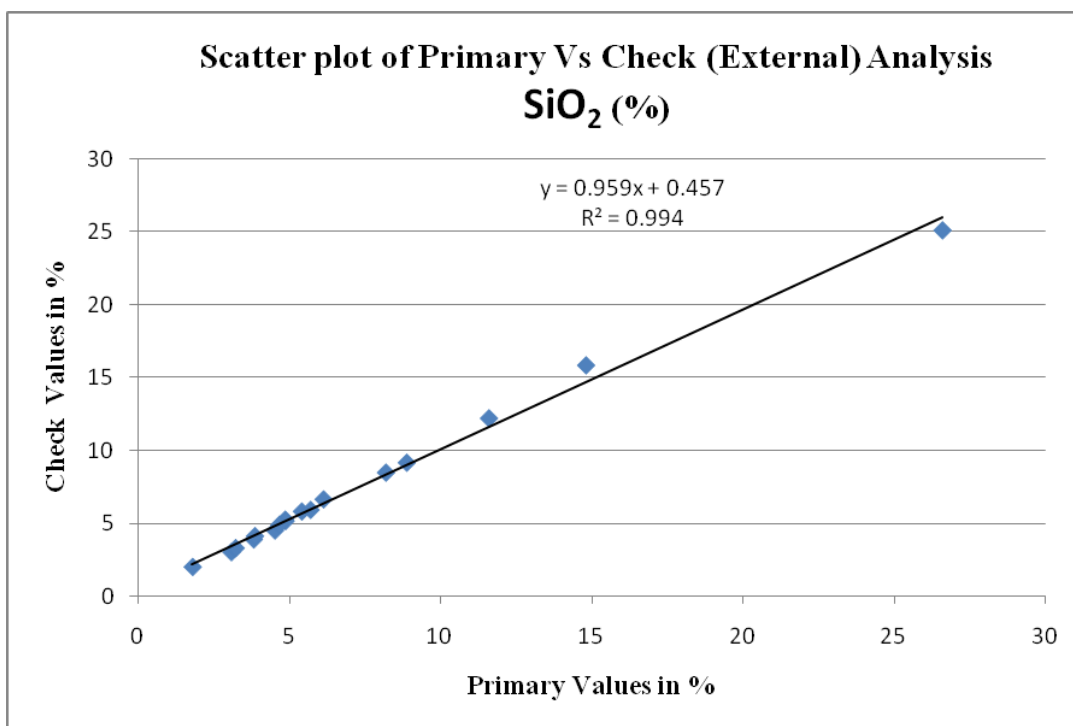


Text Figure-6: Scatter Plot of Primary and External Check Samples for Al₂O₃%

Table-15.4
Comparison of Primary vs. External Check samples for SiO₂ in
Akapur (G3) Block, District Yavatmal, Maharashtra

COMPARISON OF PRIMARY Vs. EXTERNAL CHECK ANALYSIS

COMPARISON INDEX	Primary	SiO ₂ % Check
No. of Sample Pairs	17	
Arithmetic Mean	7.188	7.353
Standard Deviation	5.806	5.587
Std. Error of Mean	1.408	1.355
Variance	33.71	31.209
Mean of Deviation		-0.165
Standard Deviation (Error)		0.487
Correlation Coefficient		0.997
Mean Absolute Error		0.358
Mean Relative Random Error		4.984%
Paired T value		-1.398
F - test value		1.08

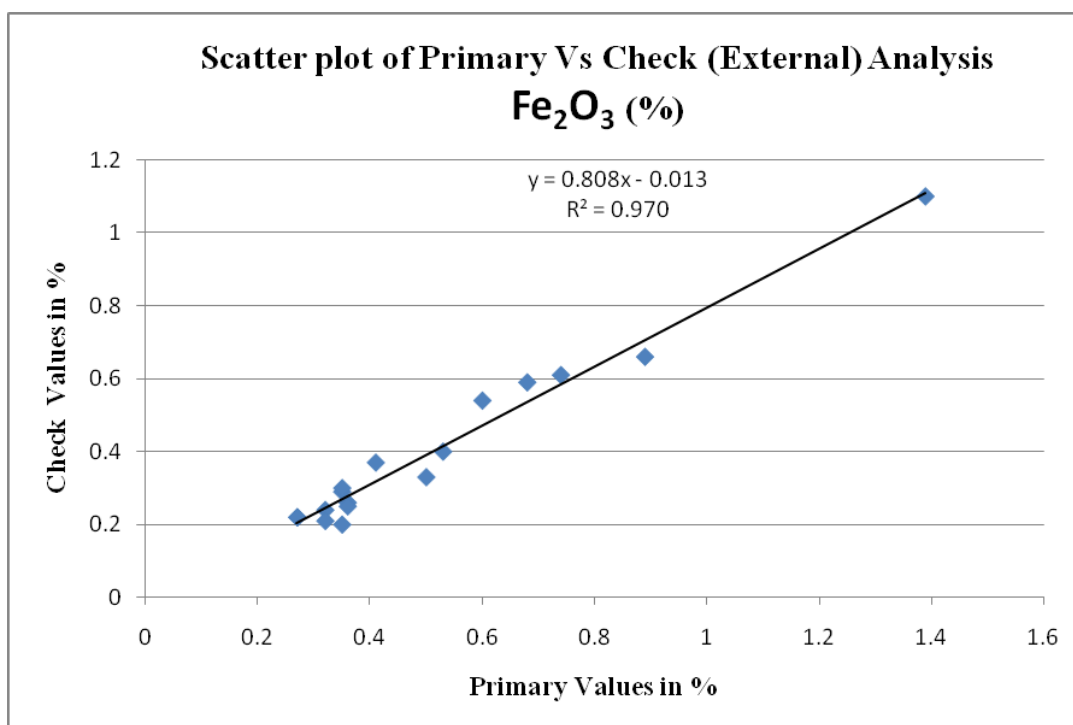


Text Figure-7: Scatter Plot of Primary and External Check Samples for SiO₂%

Table-15.5
Comparison of Primary vs. External Check samples for Fe₂O₃ in
Akapur (G3) Block, District Yavatmal, Maharashtra

COMPARISON OF PRIMARY Vs. EXTERNAL CHECK ANALYSIS

COMPARISON INDEX	Fe ₂ O ₃ %	
	Primary	Check
No. of Sample Pairs	17	
Arithmetic Mean	0.511	0.399
Standard Deviation	0.28	0.229
Std. Error of Mean	0.068	0.056
Variance	0.078	0.053
Mean of Deviation	0.112	
Standard Deviation (Error)	0.066	
Correlation Coefficient	0.985	
Mean Absolute Error	0.112	
Mean Relative Random Error	21.864%	
Paired T value	6.945	
F - test value	1.486	



Text Figure-8: Scatter Plot of Primary and External Check Samples for Fe₂O₃%

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

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

SOP for Chemical analysis carried out by XRF pellet method.

(a) Sample Particle Size: The Sample is ground to a particle size $<75\mu\text{m}$, but $<50\mu\text{m}$ is ideal.

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

(c) Instrumentation procedure

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



Figure 8: Picture Photograph of WD- XRF instrument (Rigaku, Japan) at Chemical Lab, MECL, Nagpur.

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

Procedure:

1. Weigh 1 gm of dry sample in silica or platinum crucible.

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

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

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

1. XRF (Model- Axiosm Ax, Make-Panalytical).
2. CRM used- NCSDC-16006.
3. Procedure for Preparation of Pellets by Hydraulic Press:
4. For XRF measurement a sample must be homogenized, pulverized to -200 mesh and pressed into pellet.
5. Weigh accurately 5 gm of sample and used 10 gm of boric acid as a binder.
6. Press the sample at a pressure of around 20-22 tons on a hydraulic press (Pallet Making Machine) with a diameter of 40 mm.
7. Calibrate the XRF equipment using known standards for elements present in limestone (Calcium, MAKnesium etc.).
8. Ensure the instrument is set up correctly according to standard guidelines
9. Place the prepared pellet into the sample holder.
10. Ensure the sample cup is positioned correctly in the instrument for carrying out analysis.
11. Start the XRF analysis using software and initiate the analysis process automatically.
12. Allow the XRF instrument to scan the sample. It will emit X-rays onto the sample, causing the atoms to emit fluorescence.
13. Record the results in a report, including elemental concentrations and any relevant information about the analysis conditions.
14. Intermediate check also performed using bead with inbuilt software.

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

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

15.5.0 NATURE OF QUALITY CONTROL PROCEDURES ADOPTED

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

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

15.5.3 A total 17 nos. of External Check samples have been sent to JNARDDC, Nagpur to analyse 10 radicals i.e. CaO, MgO, Al₂O₃, SiO₂, Fe₂O₃, SO₃, P₂O₅, K₂O, Na₂O and LOI analysis.

15.5.4 In order to assess the bias and inaccuracies in analytical determination as well as to check the repeatability of analysis, 17 borehole samples were analysed for external check analysis out of 167 primary samples.

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

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

15.6.2 Sample collection – under supervision of qualified geologist

Type of sample collection	Supervision
Bedrock/Soil/Stream	Qualified Geologist
Pitting Sample	N/A
Drill Core Sample Marking	Qualified Geologist

Sample processing. Packing, labelling	Sample Technician
Analysis	Assistant Manager Chemical
Sampling unit/Chemical Lab	Manager Chemical Lab

CHAPTER - 16

16.0.0 MOISTURE

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

CHAPTER - 17

17.0.0 BULK DENSITY

17.1.0 BULK DENSITY ANALYSIS DETAILS

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

- a. **Applicability:** This method shall be applicable in hard litho units, where regular solid cylindrical drill cores are obtained during the course of drilling. The drill core samples to be used for the study should be of NQ or larger diameter.
- b. **Sample Preparation:** Take a full cylindrical drill core sample of minimum fifteen (15) centimeters - length with both ends trimmed smoothly at right angle to the core axis using a mechanical core cutter to form a regular cylinder.
- c. **Procedure:** Measure the length of the sample, at-least at four locations along its axis by suitably rotating the sample. Measure the diameter of the sample using a Caliper scale, at least at four locations, preferably at regular interval. Weigh the air-dried sample in a platform balance.
- d. **Calculation:** Take mean average of all the readings for length and diameter. Divide the average mean value of diameter by two to arrive at the radius of the sample. The volume of a core sample is obtained by using formulae: $V = \pi r^2 h$ (where V = volume, r = radius and h = height or length of the cylindrical core). The bulk density of the sample is determined by using the formula: $B.D = M/V$ where $B. D$ = bulk density, M = mass (weight) of the sample and V = volume of the sample.

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

Sl.No.	Sample No.	Bulk Density (gm/cc)
1	MK-BD-01	2.84
2	MK-BD-02	2.84
Average Bulk Density		2.84

17.1.0 Average bulk density of limestone/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-VI.



Figure 9: Photographs showing procedure of determination of length, diameter and weight of sample number MK-BD-02 for bulk density calculation

CHAPTER – 18

18.0.0 BENEFICIATION STUDIES

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

CHAPTER – 19

19.0.0 RESOURCE ESTIMATION TECHNIQUE

19.1.0 GENERAL

- 19.1.1 Estimation of geological resources is the scientific and technical process of determining the quantity, quality and economic value. Following data was considered for resource estimation (1) Geological mapping (2) Exploratory drilling (3) Core logging (4) Chemical analysis and collating geological data of adjacent areas.
- 19.1.2 Grades and resources were categorized based on end-use grade classification given by IBM threshold in following categories for Limestone and Dolomite are presented in Annexure-XA & XB.

Table 19.1

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

Grade	CaO	MgO	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	Insoluble Total (SiO ₂ + Al ₂ O ₃ + Fe ₂ O ₃)
	%	%	%	%	%	
Cement Grade Limestone	42 (Min)	5 (max)	6 (max)	-	-	-
Beneficial Limestone	34 (Min)	12 (max)	18 (max)	-	-	-
Beneficial Dolomite	30 (min)	20 (max)	6 (max)	-	-	-

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

19.2.0 EVALUATION OF MINERALISATION ZONES

- 19.2.1 The evaluation of mineralization zones in the Akapur has been carried out on the basis of core drilling, systematic sampling and subsequent laboratory analysis. The lithological units intersected in the boreholes confirm the presence of limestone and dolomite horizons with significant mineralisation potential. Core recovery exceeding 90% in most boreholes has ensured reliability of the dataset. It is noted that Cement Grade Limestone & Beneficial Grade Limestone are interbedded within dolomite as lensoid whose thickness are 14.00m and 2.00m in MAK-07. Limestone is confined to the North central part of the explored area.
- 19.2.2 A total 167 samples were generated from 350m of drilling of 7 no. of exploratory boreholes, out of which one borehole i.e. MAK-07 have intersected Cement grade limestone (thickness 14m) and Beneficial Grade Limestone

(thickness 2m) interbedded within dolomite,

19.2.3 Cement Grade Limestone was intersected in exploratory borehole MAK-07 drilled by MECL in the block. The details are given below in Table no 19.2.

Table 19.2
Cement Grade Limestone demarcated as per IBM threshold for entire primary sample analysis of exploratory boreholes drilled in Akapur Block, District: Yavatmal, Maharashtra

BH. No.	From (m)	To (m)	Thickness (m)	CaO %	MgO %	Al ₂ O ₃ %	SiO ₂ %	Fe ₂ O ₃ %	GRADE
MAK-07	1.00	15.00	14.00	44.34	6.65	1.25	5.70	0.55	CEMENT GRADE LIMESTONE

19.2.4 Beneficial Grade Limestone was intersected in exploratory borehole MAK-07 drilled by MECL in the block. The details are given below in Table no 19.3.

Table 19.3
Beneficial Grade Limestone demarcated as per IBM threshold for entire primary sample analysis of exploratory boreholes drilled in Akapur Block, District: Yavatmal, Maharashtra

BH. No.	From (m)	To (m)	Thickness (m)	CaO %	MgO %	Al ₂ O ₃ %	SiO ₂ %	Fe ₂ O ₃ %	GRADE
MAK-07	25.00	27.00	2.00	38.00	11.13	1.36	5.36	0.42	BENEFICIAL GRADE LIMESTONE

19.2.5 Beneficial Grade Dolomite intersected in all the boreholes MAK- 01 to MAK-07 with cumulative thickness are 43m, 9.50m, 5m, 13m, 4m, 22m and 29m respectively. The details are given below in Table No. 19.4.

Table 19.4
Beneficial Grade Dolomite demarcated as per IBM threshold for entire primary sample analysis of exploratory boreholes drilled in Akapur Block, District: Yavatmal, Maharashtra

BH. No.	From (m)	To (m)	Thickness (m)	CaO %	MgO %	Al ₂ O ₃ %	SiO ₂ %	Fe ₂ O ₃ %	GRADE
MAK-01	3.00	15.00	12.00	31.55	17.97	0.85	4.11	0.38	BENEFICIAL GRADE DOLOMITE
MAK-01	19.00	50.00	31.00	31.53	18.42	0.78	3.63	0.42	
MAK-02	3.50	9.00	5.50	33.62	13.78	1.46	8.11	0.72	
MAK-02	25.00	29.00	4.00	32.58	17.54	0.96	3.85	0.29	
MAK-03	37.00	39.00	2.00	31.46	16.39	1.28	5.26	0.64	
MAK-03	47.00	50.00	3.00	32.10	16.46	0.99	5.83	0.37	

BH. No.	From (m)	To (m)	Thickness (m)	CaO %	MgO %	Al ₂ O ₃ %	SiO ₂ %	Fe ₂ O ₃ %	GRADE
MAK-04	1.00	17.00	16.00	32.31	16.75	1.05	4.58	0.37	BENEFICIAL GRADE DOLOMITE
MAK-04	21.00	35.00	14.00	31.72	17.46	0.74	5.14	0.30	
MAK-04	41.00	50.00	9.00	30.58	17.64	1.25	5.33	0.37	
MAK-05	11.00	15.00	4.00	31.57	17.96	0.83	4.15	0.35	
MAK-06	18.00	26.00	8.00	33.93	16.07	0.67	4.41	0.33	
MAK-06	28.00	36.00	8.00	32.38	16.61	0.85	5.65	0.36	
MAK-06	44.00	50.00	6.00	32.02	16.63	0.83	5.62	0.37	
MAK-07	15.00	17.00	2.00	33.34	17.57	0.61	2.55	0.49	
MAK-07	21.00	25.00	4.00	33.61	16.91	0.68	3.14	0.39	
MAK-07	27.00	50.00	23.00	31.01	16.33	1.47	6.65	0.53	

19.2.6 Unclassified Dolomite was intersected in exploratory boreholes MAK-01 to 07 drilled by MECL in the block. The details are given below in Table no 19.5.

Table 19.5

Unclassified Dolomite demarcated as per IBM threshold for entire primary sample analysis of exploratory boreholes drilled in Akapur Block, District: Yavatmal, Maharashtra

BH. No.	From (m)	To (m)	Thickness (m)	CaO %	MgO %	Al ₂ O ₃ %	SiO ₂ %	Fe ₂ O ₃ %	GRADE
MAK-01	15.00	19.00	4.00	18.39	9.67	6.44	31.10	1.88	UNCLASSIFIED DOLOMITE
MAK-02	9.00	25.00	16.00	29.43	15.25	1.41	13.66	0.59	
MAK-02	29.00	42.30	13.30	25.71	12.53	4.83	16.80	1.42	
MAK-03	3.50	37.00	33.50	29.95	14.13	2.18	10.45	0.77	
MAK-03	39.00	47.00	8.00	29.94	15.23	2.18	8.72	0.71	
MAK-04	17.00	21.00	4.00	30.56	16.81	0.95	8.23	0.37	
MAK-04	35.00	41.00	6.00	26.63	14.08	3.26	13.03	0.86	
MAK-05	4.20	11.00	6.80	28.15	15.39	1.84	12.12	0.55	
MAK-05	15.00	50.00	35.00	24.90	12.32	4.75	18.01	1.30	
MAK-06	2.00	18.00	16.00	30.91	13.92	1.88	10.38	0.62	
MAK-06	26.00	28.00	2.00	32.45	16.68	0.81	5.14	0.35	
MAK-06	36.00	44.00	8.00	31.05	15.45	1.71	8.15	0.68	
MAK-07	17.00	21.00	4.00	22.42	10.05	6.24	22.46	1.47	

19.3.0 RESOURCES ESTIMATION METHODS

Limestone and Dolomite occurs as a gently dipping body in the block area, strike in direction of N64°W – S64°E and dip varies from 5° to 20° towards southwest, all the boreholes were drilled vertically to estimate dolomite resources upto a vertical depth of 50mRL. Limestone and Dolomite resources were estimated by Polygonal method and validated with cross sectional method (check method).

19.4.0 ASSUMPTIONS FOR RESOURCE ESTIMATION

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

19.4.2 For Limestone resource, Cement Grade and Beneficial Grade Limestone are taken consideration.

19.4.3 For Dolomite resource, Beneficial grade dolomite and unclassified dolomite are taken consideration.

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

19.4.5 The average bulk density of dolomite has been taken as 2.84 gm/cc as determined by Caliper’s method from 2 core samples in MECL Laboratory, Nagpur. This value is taken for computation of resources for Limestone and Dolomite.

19.5.0 PARAMETERS OF RESOURCE ESTIMATION

19.5.1 CUT-OFF GRADE

Resources estimated for Cement Grade Limestone, Beneficial Grade Limestone, Beneficial Grade Dolomite and Unclassified dolomite intersected are calculated as per IBM threshold grade classification as given in Table no 19.1

19.5.2 BULK DENSITY

A total of 2 nos. of limestone/dolomite core samples from MECL boreholes were subjected to bulk density determination by **Caliper Method** in Petrology laboratory, MECL, Nagpur. The average bulk density of these 2 samples has been determined as 2.84 gm/cc and the same have been considered for estimation of resources. The results of bulk density determination are presented in Annexure-VI. The procedure of determining the bulk density discussed in Chapter 17.

19.5.3 OVER BURDEN/SOIL

Overburden varies from 1.00m to 4.00m in thickness in all the boreholes. The average thickness of the overburden in the block is around 4.00m.

Minimum (m)	Maximum (m)
1.00 (MAK-04 & MAK-07)	4.00 (MAK-02 & MAK-05)

19.6.0 METHODOLOGY

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

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

The main objective of this method is to demarcate the area of influence of the dolomite intersected by a particular borehole. The influence area has been obtained by constructing polygons by drawing perpendicular bisector of triangles, rectangles that connect the adjoining boreholes. The area of the influence of zones has been ascertained by Auto-Cad software. The area of non-development of respective zones is shown on the geological plan. The height of polygons is the cumulative thickness of limestone/dolomite horizon/bands encountered by the corresponding borehole. The entire limestone/dolomite body in block is divided into 7 number of polygons. The grade wise borehole wise resource estimation by Polygonal method for possible Cement Grade Limestone, Beneficial Grade Limestone, Beneficial Grade Dolomite and Unclassified Dolomite of this block are calculated. The grade assigned to the polygon blocks is same as the weighted average grade of the corresponding boreholes. The area of non- development of particular grade in borehole has been deducted.

The formula of resource estimation is as follows:

$$R = P_A \times Th \times \text{Bulk Density}$$

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

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

19.7.2 The weighted average grades for 10 radicals i.e. CaO, MgO, SiO₂, Al₂O₃, Fe₂O₃, SO₃, P₂O₅, K₂O, Na₂O & LOI has been calculated. Thus, average grade of the block is calculated for Cement Grade Limestone, Beneficial Grade Limestone, Beneficial Grade Dolomite and Unclassified Dolomite.

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

19.8.1 Resources has estimated with cross sectional method (check method) for Cement Grade Limestone, Beneficial Grade Limestone, Beneficial Grade

Dolomite and Unclassified Dolomite, the resources are presented in Annexures – VIIE, VIIF, VIIG, VIIH.

A total 7 no. of boreholes which are falling in 4 parallel cross section lines S1-S1', S2-S2', S3-S3' and S4-S4' in Akapur Block, have been drawn along N 26°E/ S 26°W direction, which is marked on Plate No. III.

- 19.8.2 The limestone intersected in one borehole (MAK-07) and Dolomite intersected in all 7 no. of boreholes (MAK-01 to MAK-07). Efforts were made to pass these sections through drilled borehole locations wherever possible. The boreholes which have not fallen on section lines are projected on to the nearest section line. Since the beds are generally low dip of 5° to 20° due SW direction and boreholes drilled are all vertical hence true thickness will be the same as thickness intersected in the exploratory boreholes. Geological cross sections are generated by GDM software. Cross sectional area on each section has been measured with the help of Auto CAD map 2025 software and recorded systematically. Strike influence between two section lines and boreholes has been taken up-to half way distance. However, the influence is up to block boundary has been taken in section S4-S4' and S1-S1' up to 400m in 333 category. Each of these areas has been multiplied with sectional influence / strike influence of the section lines to give volume. The volume is then multiplied with average bulk density, to estimate geological gross in-situ resources.

$$R = S_v (X) T (X) \text{ Avg Bulk Density}$$

Where in,

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

- 19.8.3 Resources are estimated by cross sectional method (check method) and borehole wise resources presented as Annexures- VIIE, VIIF, VIIG, VIIH.

CHAPTER - 20

20.0.0 REPORTING OF RESOURCES

20.1.0 RESOURCE ESTIMATION

20.1.1 Resources are estimated by polygon method.

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

Block	Polygon No.	Borehole No.	Polygonal Area
			(m ²)
AKAPUR	P4	MAK-01	1461279.277
	P2	MAK-02	693046.7043
	P3	MAK-03	760911.3575
	P5	MAK-04	998722.5629
	P1	MAK-05	896002.0503
	P6	MAK-06	863190.0826
	P7	MAK-07	778881.7989

20.1.3 A total 30.97 MT of Cement Grade Limestone resources estimated by polygonal method with an average grade of 44.34 % CaO, 6.65% MgO and 5.70% SiO₂. The Polygon-wise, grade wise, borehole-wise resource estimation by Polygonal method for Cement Grade Limestone are given in Table number 20.2. (Annexure – VIIA).

20.1.4 A total 4.42 MT of Beneficial Grade Limestone resources estimated by polygonal method with an average grade of 38.00 % CaO, 11.13% MgO and 5.36% SiO₂. The Polygon-wise, grade wise, borehole-wise resource estimation by Polygonal method for Beneficial Grade Limestone are given in Table number 20.3. (Annexure – VIIB).

20.1.5 A total 446.83 MT of Beneficial Grade Dolomite resources estimated by polygonal method with an average grade of 31.81 % CaO, 17.37% MgO and 4.69% SiO₂. The Polygon-wise, grade wise, borehole-wise resource estimation by Polygonal method for Beneficial Grade Dolomite are given in Table number 20.4. (Annexure – VIIC).

20.1.6 A total 360.99 MT of Unclassified Dolomite resources estimated by polygonal

method with an average grade of 27.94 % CaO, 13.76% MgO and 13.56% SiO₂. The Polygon-wise, grade wise, borehole-wise resource estimation by Polygonal method for Unclassified Dolomite are given in Table number 20.5. (Annexure – VIID).

20.2.0 RELIABILITY OF RESOURCE

Geological resources estimated for Cement Grade Limestone, Beneficial Grade Limestone, Beneficial Grade Dolomite and Unclassified Dolomite classification by the polygonal method and cross-sectional methods were compared to ascertain the confidence level of estimation by relative difference method. The relative difference in Geological Resources by two methods comes to 1.70%. As per the industrial requirements the relative difference for geological resource falls in the category of “Excellent”. Comparison of resources with both the methods i.e. Polygonal Method (Principal Method) and Cross-Sectional Method (Check Method) is presented at Table number 20.1.

Table 20.1

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

Sl.No.	Category of Resources	Polygonal Method (MT)	Cross Sectional Method (MT)	Relative Difference %
1	Cement Grade Limestone	30.97	30.49	1.56
2	Beneficial Grade Limestone	4.42	4.33	2.06
3	Beneficial Grade Dolomite	446.83	455.43	1.91
4	Unclassified Dolomite	361.00	356.52	1.25

Table 20.2
Polygon wise, Borehole wise Resources (333) estimated for Cement Grade Limestone by Polygonal Method for Akapur 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)	Geological Gross in-situ Resources (tonnes)	Average Quality									
								CaO %	MgO %	Al ₂ O ₃ %	SiO ₂ %	Fe ₂ O ₃ %	SO ₃ %	P ₂ O ₅ %	K ₂ O %	Na ₂ O %	LOI %
P7	MAK-07	778881.80	1.00	15.00	14.00	10904345.20	30968340.37	44.34	6.65	1.25	5.70	0.55	0.05	0.02	0.24	0.02	40.94
Total Geological Gross in-situ Resources of Cement Grade Limestone in Tonnes							30968340.37										
Total Geological Gross in-situ Resources of Cement Grade Limestone in Million Tonnes							30.97	44.34	6.65	1.25	5.70	0.55	0.05	0.02	0.24	0.02	40.94

Table 20.3
Polygon wise, Borehole wise Resources (333) estimated for Beneficial Grade Limestone by Polygonal Method for Akapur 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)	Geological Gross in-situ Resources (tonnes)	Average Quality									
								CaO %	MgO %	Al ₂ O ₃ %	SiO ₂ %	Fe ₂ O ₃ %	SO ₃ %	P ₂ O ₅ %	K ₂ O %	Na ₂ O %	LOI %
P7	MAK-07	778881.80	25.00	27.00	2.00	1557763.60	4424048.624	38.00	11.13	1.36	5.36	0.42	0.09	0.02	0.28	0.02	43.10
Total Geological Gross in-situ Resources of Beneficial Grade Limestone in Tonnes							4424048.62										
Total Geological Gross in-situ Resources of Beneficial Grade Limestone in Million Tonnes (MT)							4.42	38.00	11.13	1.36	5.36	0.42	0.09	0.02	0.28	0.02	43.10

Table 20.4
Polygon wise, Borehole wise Resources (333) estimated for Beneficial Grade Dolomite by Polygonal Method for Akapur Block,
Dist. Yavatmal, Maharashtra

Bulk Density: 2.84 gm/cc

Polygon No.	BH No.	From (m)	To (m)	Thick. (m)	Polygonal Area (m ²)	Volume (m ³)	Geological Gross in-situ Resources (tonnes)	Average Quality									
								CaO %	MgO %	Al ₂ O ₃ %	SiO ₂ %	Fe ₂ O ₃ %	SO ₃ %	P ₂ O ₅ %	K ₂ O %	Na ₂ O %	LOI %
P4	MAK-01	3.00	15.00	12.00	1461279.28	17535351.36	49800397.86	31.55	17.97	0.85	4.11	0.38	0.06	0.03	0.17	0.04	44.59
P4	MAK-01	19.00	50.00	31.00	1461279.28	45299657.68	128651027.8	31.53	18.42	0.78	3.63	0.42	0.06	0.03	0.16	0.04	44.68
P2	MAK-02	3.50	9.00	5.50	693046.70	3811756.85	10825389.45	33.62	13.78	1.46	8.11	0.72	0.05	0.03	0.21	0.04	41.39
P2	MAK-02	25.00	29.00	4.00	693046.70	2772186.80	7873010.512	32.58	17.54	0.96	3.85	0.29	0.06	0.02	0.19	0.04	44.24
P3	MAK-03	37.00	39.00	2.00	760911.36	1521822.72	4321976.525	31.46	16.39	1.28	5.26	0.64	0.07	0.03	0.26	0.04	44.39
P3	MAK-03	47.00	50.00	3.00	760911.36	2282734.08	6482964.787	32.10	16.46	0.99	5.83	0.37	0.07	0.03	0.21	0.03	43.65
P5	MAK-04	1.00	17.00	16.00	998722.56	15979560.96	45381953.13	32.31	16.75	1.05	4.58	0.37	0.07	0.02	0.20	0.03	44.37
P5	MAK-04	21.00	35.00	14.00	998722.56	13982115.84	39709208.99	31.72	17.46	0.74	5.14	0.30	0.06	0.03	0.14	0.04	44.11
P5	MAK-04	41.00	50.00	9.00	998722.56	8988503.04	25527348.63	30.58	17.64	1.25	5.33	0.37	0.06	0.04	0.25	0.04	44.13
P1	MAK-05	11.00	15.00	4.00	896002.05	3584008.20	10178583.29	31.57	17.96	0.83	4.15	0.35	0.07	0.01	0.17	0.02	44.64
P6	MAK-06	18.00	26.00	8.00	863190.08	6905520.64	19611678.62	33.93	16.07	0.67	4.41	0.33	0.04	0.02	0.14	0.05	44.10
P6	MAK-06	28.00	36.00	8.00	863190.08	6905520.64	19611678.62	32.38	16.61	0.85	5.65	0.36	0.05	0.02	0.18	0.05	43.62
P6	MAK-06	44.00	50.00	6.00	863190.08	5179140.48	14708758.96	32.02	16.63	0.83	5.62	0.37	0.05	0.02	0.18	0.04	44.01
P7	MAK-07	15.00	17.00	2.00	778881.80	1557763.60	4424048.624	33.34	17.57	0.61	2.55	0.49	0.05	0.02	0.11	0.04	44.85
P7	MAK-07	21.00	25.00	4.00	778881.80	3115527.20	8848097.248	33.61	16.91	0.68	3.14	0.39	0.06	0.03	0.15	0.04	44.74
P7	MAK-07	27.00	50.00	23.00	778881.80	17914281.40	50876559.18	31.01	16.33	1.47	6.65	0.53	0.09	0.03	0.31	0.04	43.28
Total Geological Gross in-situ Resources of Beneficial Grade Dolomite in Tonnes							446832682.23	31.81	17.37	0.94	4.69	0.41	0.06	0.03	0.19	0.04	44.20
Total Geological Gross in-situ Resources of Beneficial Grade Dolomite in Million Tonnes (MT)							446.83										

Table 20.5
Polygon wise, Borehole wise Resources (333) estimated for Unclassified Dolomite by Polygonal Method for Akapur 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)	Geological Gross in-situ Resources (tonnes)	Average Quality									
								CaO %	MgO %	Al ₂ O ₃ %	SiO ₂ %	Fe ₂ O ₃ %	SO ₃ %	P ₂ O ₅ %	K ₂ O %	Na ₂ O %	LOI %
P4	MAK-01	556290.50	15.00	19.00	4.00	2225162.00	6319460.08	18.39	9.67	6.44	31.10	1.88	0.05	0.18	1.51	0.06	30.29
P2	MAK-02	693046.70	9.00	25.00	16.00	11088747.20	31492042.05	29.43	15.25	1.41	13.66	0.59	0.05	0.02	0.22	0.03	39.10
P2	MAK-02	693046.70	29.00	42.30	13.30	9217521.11	26177759.95	25.71	12.53	4.83	16.80	1.42	0.27	0.05	1.19	0.04	36.86
P3	MAK-03	760911.36	3.50	37.00	33.50	25490530.56	72393106.79	29.95	14.13	2.18	10.45	0.77	0.05	0.05	0.41	0.03	41.75
P3	MAK-03	760911.36	39.00	47.00	8.00	6087290.88	17287906.1	29.94	15.23	2.18	8.72	0.71	0.07	0.10	0.44	0.04	42.33
P5	MAK-04	998722.56	17.00	21.00	4.00	3994890.24	11345488.28	30.56	16.81	0.95	8.23	0.37	0.13	0.05	0.20	0.03	42.42
P5	MAK-04	998722.56	35.00	41.00	6.00	5992335.36	17018232.42	26.63	14.08	3.26	13.03	0.86	0.08	0.07	0.67	0.05	41.02
P1	MAK-05	896002.05	4.20	11.00	6.80	6092813.94	17303591.59	28.15	15.39	1.84	12.12	0.55	0.06	0.02	0.36	0.03	41.22
P1	MAK-05	896002.05	15.00	50.00	35.00	31360071.75	89062603.77	24.90	12.32	4.75	18.01	1.30	0.15	0.05	1.04	0.04	37.11
P6	MAK-06	863190.08	2.00	18.00	16.00	13811041.28	39223357.24	30.91	13.92	1.88	10.38	0.62	0.05	0.03	0.39	0.03	41.58
P6	MAK-06	863190.08	26.00	28.00	2.00	1726380.16	4902919.654	32.45	16.68	0.81	5.14	0.35	0.05	0.02	0.17	0.06	44.02
P6	MAK-06	863190.08	36.00	44.00	8.00	6905520.64	19611678.62	31.05	15.45	1.71	8.15	0.68	0.08	0.03	0.35	0.05	42.18
P7	MAK-07	778881.80	17.00	21.00	4.00	3115527.20	8848097.248	22.42	10.05	6.24	22.46	1.47	0.04	0.09	1.35	0.05	35.16
Total Geological Gross in-situ Resources of Unclassified Dolomite in Tonnes							360986243.79	27.94	13.76	3.03	13.56	0.92	0.10	0.05	0.64	0.04	39.68
Total Geological Gross in-situ Resources of Unclassified Dolomite in Million Tonnes (MT)							360.99										

20.3.0 COMPUTATION OF AVERAGE GRADE

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

$$\text{Weighted average grade} = \frac{V_1XG_1 + V_2XG_2 + V_3XG_3 + \dots + V_nXG_n}{V_1 + V_2 + V_3 + \dots + V_n}$$

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

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

CHAPTER – 21

21.0.0 SUMMARY AND RECOMMENDATIONS

21.1.0 SUMMARY

- 21.1.1 Akapur block over an area of 6.45 sq.km., is bounded by Longitude 78°50'57.22955"E to 78°53'04.22409"E and Latitude 20°08'22.66430"N to 20°09'33.58331"N located in Toposheet No.55 L/16 in Akapur, Chinchala, Pandarkawada, Wadgaon, Dol Dongargaon and Lakhapur villages of Tehsil - Maregaon, District - Yavatmal, State – Maharashtra.
- 21.1.2 Akapur block is proposed on the basis of lapsed lease areas by State Government of Maharashtra which was granted as per section 10A(2)(b) of the MMDR Act-15. In Year 2021 amendment to MMDR Act with a stipulation stated that all such PL reports stand ineligible and to conduct auction and PL Reports required to be evaluated to confirm mineral contents (G4, G3 etc. stages of exploration) as per the stipulations under Minerals (Evidence of Mineral Contents) Rules, 2015.
- 21.1.3 The Directorate of Geology and Mining (DGM), Government of Maharashtra, requested MECL to take up the exploration in lapsed 10A(2)(b) lease mining lease areas vide letter no. Tech/1848/2023/260, dated 23-01-2024.
- 21.1.4 Exploration Proposal (G3) was submitted and discussed in 69th TCC-1 meeting held on 27th, 28th & 30th September, 2024 and committee recommended the project proposal titled as “Preliminary Exploration (G3 Level) for Limestone in Akapur Block, Yavatmal District, Maharashtra”.
- 21.1.5 On recommendation of 69th TCC-1, 38th Executive committee (EC), NMET meeting held on 29th November, 2024 approved the project with cost of INR 97.21 lakhs.
- 21.1.6 MECL carried out exploration with objective to establish sub surface continuity of limestone / dolomite by drilling 7 no. of exploratory boreholes and to estimate geological resource under (333) category under UNFC nomenclature as per MEMC rules, 2015 (Amended upto 2021).
- 21.1.7 Yavatmal district is situated in central part of Maharashtra. Yavatmal district in Maharashtra has exposures dominated by Deccan basalts with other formations like Gondwana, Lameta and Penganga beds also present. The limestone formation of the area belongs to Putnur-Mangurda formation.

- 21.1.8 Exposures mapped in the block belong to the Putnur-Mangurda formation lesser-known but geologically intriguing unit of the Penganga Group. These formations typically consist of Proterozoic to Lower Palaeozoic sedimentary rocks, including Shale, Limestone, Dolomite. The Putnur–Mangurda sequence likely represents shallow marine to fluvial depositional environments, and its exposures may be found in structurally controlled inliers or along river sections, particularly in areas like Mangurda village in Yavatmal district.
- 21.1.9 The strike of the limestone / dolomite beds is N64°W-S64°E and dip varies from 5° to 20° towards southwesterly.
- 21.1.10 A total of 167 nos. of samples are generated in 7 no. of boreholes drilled in Akapur block, which were analysed 10 radicals.
- 21.1.11 Limestone and Dolomite zones are demarcated based on End use classification of IBM.
- 21.1.12 A total of 2 nos. of limestone /dolomite core samples from drilled boreholes were subjected to bulk density determination by **Caliper Method**. The average bulk density of these 2 samples has been determined as 2.84 gm/cc and the same have been considered for estimation of resources.
- 21.1.13 Average soil cover in the block is 2.60m.
- 21.1.14 Geological Gross In-situ resources were estimated by polygonal method.
- 21.1.15 A total **30.97 MT of Cement Grade Limestone** resources was estimated with an average grade of 44.34% CaO, 6.65% MgO, 5.70% SiO₂ and **4.42 MT Beneficial Grade Limestone** was estimated with an average grade of 38.00% CaO, 11.13% MgO, 5.36% SiO₂.
- 21.1.16 Combined **Cement Grade Limestone and Beneficial Grade Limestone** resources are **35.39 MT of geological resources** with average grade of 43.50% CaO, 7.21% MgO, 5.66% SiO₂.
- 21.1.17 A total of **446.83 MT Beneficial Grade Dolomite** resources was estimated with an average grade of 31.81% CaO, 17.37% MgO, 4.69% SiO₂ and **360.99 MT of Unclassified Dolomite** was estimated with an average grade of 27.94% CaO, 13.76% MgO, 13.56% SiO₂.
- 21.1.18 Combined **Beneficial Grade Dolomite and Unclassified Dolomite** resources are **807.82 MT of geological resources** with average grade of 30.08% CaO, 15.80% MgO, 8.65% SiO₂.

21.2.0 RECOMMENDATIONS

- 21.2.1 MECL has carried out Preliminary exploration (G3) over 6.45 sq.km. of Akapur block and established resources of Cement Grade Limestone, Beneficial Grade Limestone, Beneficial Grade Dolomite and Unclassified Dolomite as per MEMC rules 2015 (Amended 2021).
- 21.2.2 Estimated resources are considered under 333 category as per UNFC nomenclature. This report will facilitate state Government of Maharashtra to auction the block for mining lease.

CHAPTER - 22

22.0.0 LIST OF PLATES

- 22.1.0 Location Map of Akapur Block, District: Yavatmal, Maharashtra in Not to Scale (Plate-I).
- 22.2.0 Regional Geological Map of Akapur Block, District: Yavatmal, Maharashtra Not to Scale (Plate-II).
- 22.3.0 Topographical and Geological Map of Akapur Block, District: Yavatmal, Maharashtra in 1:4000 scale (Plate-III).
- 22.4.0 Graphical lithologs of all the boreholes showing Limestone and Dolomite with all other lithologies on 1:1000 scale (Plate-IV).
- 22.5.0 Polygonal map with area of polygon and thickness of intersected zones of all Grade of Limestone and Dolomite on 1:4000 scale (Plate-V).
- 22.6.0 Geological Cross Sections along section lines S1-S1', S2-S2', S3-S3' and S4-S4' along N 26° E -S26°W direction with quality data on 1:2000 scale (Plate-VI).

CHAPTER - 23

23.0.0 ANNEXURES / ENCLOSURES TO THE REPORT

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

CHAPTER - 24

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

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

1. CEMENT INDUSTRY SPECIFICATION

Table 24.1
Cement Industry Specification for Limestone

CaO	:	44% (min.) to 46%
46%		
MgO	:	3.50% (max.)
Silica	:	16% (max.)
Al ₂ O ₃	:	2 (max.)
Fe ₂ O ₃	:	2% (max.)
SO ₃	:	1.75% (max.)

$$\text{Lime Saturation Factor (LSF)} = \frac{\text{CaO}}{2.8 (\text{SiO}_2) + 1.2 (\text{Al}_2\text{O}_3) + 0.65 (\text{Fe}_2\text{O}_3)}$$

(ideal to be at 0.66 to 1.02)

$$\text{Silica Modules} = \frac{\text{SiO}_2}{\text{Al}_2\text{O}_3 + \text{Fe}_2\text{O}_3} = \text{ideal at (1.2 to 4.0)}$$

$$\text{Iron Modules} = \frac{\text{SiO}_2 + \text{Al}_2\text{O}_3 + \text{Fe}_2\text{O}_3}{\text{Fe}_2\text{O}_3} = \text{ideal at (1.7 to 2.4)}$$

$$\text{Hydraulic Modules} = \frac{\text{Al}_2\text{O}_3}{\text{Fe}_2\text{O}_3} = \text{ideal at (0.65 (min.))}$$

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 ₂ O 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 ₂ O 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 ₂ O ₃ (Max.)	0.25	0.15	-	-
Mn ₂ O 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 ₂ O ₃ + Fe ₂ O ₃ (Max.)	0.50	-	-	1.5
SiO ₂ + Al ₂ O ₃ + Fe ₂ O ₃ (Max.)	-	-	3.0	-

5. FERTILIZER INDUSTRY SPECIFICATION

CaCO₃+ MgCO₃: 85% (Min)

SiO₂ : 5% (Max.)

6. GLASS INDUSTRY SPECIFICATION

CaCO₃ : 94.5 %

CaCO₃+ MgCO₃ : 97.5 %

Fe₂O₃ : 0.20 % (Max.)

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

CaO : 53.0 %

SiO₂ : 2.5 %

Fe₂O₃ : 0.10 %

CaO + MgO : 54.50 %

7. FOUNDRY INDUSTRY SPECIFICATION

BIS Specifications (IS: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 ₂ O ₃ (Al ₂ O ₃ + Fe ₂ O 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 (IS: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 ₂ O ₃	2% (Max.)				0.25	0.15	-	-
Mn ₂ O 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 ₂ O ₃ + Fe ₂ O ₃	2%				0.50	-	-	1.5
SiO ₂ + Al ₂ O ₃ + Fe ₂ O ₃	--	11.5% (Max.)			-	-	3.0	-
Acid Insoluble			6.5% (Max.)					

**CERTIFICATE FROM THE QUALIFIED PERSON WITH NAME, DATE AND
SIGNATURE**

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

NAME: **SHRIKANT SHARMA**

DESIGNATION: **HOD (EXPLORATION)**

DATE:

ABBREVIATIONS USED

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

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. District website “yavatmal.gov.in”
10. www.census2011.co.in
11. www.censusindia.co.in
12. <https://villageinfo.in/maharashtra/yavatmal/Maregaon>