Ref. No: MAPL/NMEDT/DPR/26-27/02 Date: 08.05.2026

To,
The Director & HOD
NMEDT
Ministry Of Mines
F-114, Shastri Bhavan
NEW-DELHI-110001

Subject: **Submission of Detailed Proposal for Preliminary Exploration (G3 Stage) for Mankhetra Limestone Block in Junagadh District, Gujarat State.**

Respected Sir,

We are pleased to submit the Detailed proposal for Preliminary Exploration (G3 Stage) for Mankhetra Limestone Block (8.903 Sq. Km.) in Junagadh District, Gujarat State.

The same was approved in the 94th TCC-I meeting. The project has thereafter received final approval in the 8th Project Sanctioning Committee (PSC) meeting.

We reaffirm our continued commitment to NMEDT and assure diligent and timely execution of the proposed exploration program.

Thanking You,

For Mining Associates Private Limited

MINING ASSOCIATES PVT. LTD. ASANSOL

Indranil Bhattacharjee
(GM - Projects)

MINERAL EXPLORATION PROJECT PROPOSAL

FOR

PRELIMINARY EXPLORATION (G3) FOR LIMESTONE IN MANKHETRA BLOCK NEAR THE VILLAGES MANKHETRA, SHEPA, HUSENABAD, KOTDA JUNA, DISTRICT- JUNAGADH, STATE - GUJARAT

(8.903 SQ. KM.)

UNDER NMEDT

(T.S. No. 41K/04)

Commodity-LIMESTONE

(Industrial Mineral**)**

(Date of Submission: 8th May, 2026)

Submitted by:

MINING ASSOCIATES PVT. LTD.
Plot no. 110, Main Dhemo,
Beside Railway Siding,
P.O. Sitarampur, Asansol,
Dist. Paschim Bardhaman,
WEST BENGAL- 713359.

To,

THE DIRECTOR AND HOD
National Mineral Exploration And Development Trust
Ministry Of Mines
NEW-DELHI-110001.

INDEX

LIST OF FIGURES

LIST OF ANNEXURES

LIST OF PLATES

SUMMARY OF THE BLOCK FOR G3 STAGE EXPLORATION

	Features	Details
	Block ID	Mankhetra Limestone Block
	Current Exploration Agency	Mining Associates Pvt. Ltd.
	Previous Exploration Agency	Commissioner of Geology and Mining (CGM), Gujarat and Geological Survey of India.
	Previous Geological Exploration Report	Based on CGM report: ➢ Geological report of southern part of Saurashtra covered under toposheet nos. 41G/5, G/10+6, 41K/4, G/15+11, 41L/5, L/9+10 (Based on interpretation of satellite imagery with limited field checks) (Field Season 1995-96 and 1996-97) by S. D. Kapse, Asstt. Geologist, Y.C. Patel, Asstt. Geologist (F.S. 1995-96) and S. D. Kapse, Asstt. Geologist (F.S. 1996-97). Based on GSI report: ➢ Investigation for BF and Chemical grade limestone in Sepa and Sheriyakhan area in Junagadh District, Gujarat (Progress report on field season 1998-99) by Des Raj, Geologist (Sr.), Gandhinagar, November-2000.
	Commodity	Limestone
	Mineral Belt	Saurashtra Limestone belt (hosted with Dwarka, Gaj and Miliolite Formations)
	Completion Period with entire Time Schedule to complete the project	10 Months with review after 3rd and 6th months.
	Objectives	1. Geological mapping in 1:4000 scale to delineate the surface outcrops/disposition, lithological contacts and lateral continuity of limestone bearing formations within the block. 2. To undertake systematic collection of bed Rock samples and their chemical analysis for assessment of grade, quality, and suitability of limestone. 3. To drill 14 boreholes (Grid: 800m*800m) in accordance with MEMC Rules, 2015 to establish subsurface continuity, thickness variation, depth persistence of limestone horizons, and to confirm the limestone–basement contact. 4. To evaluate grade variability of limestone, including CaO, SiO_2 and MgO contents, based on core and bedrock sampling. 5. To develop geological sections and a conceptual subsurface model of the limestone deposit. 6. To generate MEMC-2015 compliant G3 level geological resources (333 – Inferred category) for facilitating auction by the

<table>
<tr><td></td><td></td><td>Government of Gujarat.</td></tr>
<tr><td></td><td>Whether the work will be carried out by the proposed agency or through outsourcing and details thereof. Components to be outsourced and Name of the outsource agency</td><td>Drilling and Laboratory analysis works will be outsourced.</td></tr>
<tr><td></td><td>Name/Number of Geoscientists</td><td>One Geologist (1G) & Surveyor (1)</td></tr>
<tr><td></td><td>Expected Field days (Geology, Geophysics, Surveyor)</td><td>a. Geologist:90 Field Days+30 HQ Days
b. Surveyor:30 Days</td></tr>
<tr><td>1.</td><td>Location</td><td></td></tr>
<tr><td></td><td>Boundary Coordinates of Proposed Block</td><td>
<table>
<tr><th>Points</th><th>Latitude</th><th>Longitude</th></tr>
<tr><td>A</td><td>21°10'34.38"N</td><td>70° 9'33.63"E</td></tr>
<tr><td>B</td><td>21° 9'20.89"N</td><td>70°10'23.60"E</td></tr>
<tr><td>C</td><td>21° 8'22.81"N</td><td>70° 8'4.83"E</td></tr>
<tr><td>D</td><td>21° 9'0.34"N</td><td>70° 7'44.48"E</td></tr>
<tr><td>E</td><td>21° 9'11.32"N</td><td>70° 8'10.60"E</td></tr>
<tr><td>F</td><td>21° 9'45.13"N</td><td>70° 8'17.48"E</td></tr>
</table>
</td></tr>
<tr><td></td><td>Villages</td><td>Mankhetra, Shepa, Husenabad, Kotda Juna</td></tr>
<tr><td></td><td>Tehsil / Taluk</td><td>Mangrol</td></tr>
<tr><td></td><td>District</td><td>Junagadh</td></tr>
<tr><td></td><td>State</td><td>Gujarat</td></tr>
<tr><td>2.</td><td>Area(hectares/square kilometers)</td><td></td></tr>
<tr><td></td><td>Block Area</td><td>8.903 sq. km.</td></tr>
<tr><td></td><td>Forest Area</td><td>--</td></tr>
<tr><td></td><td>Government Land Area</td><td>--</td></tr>
<tr><td></td><td>Private Land Area</td><td>--</td></tr>
<tr><td>3.</td><td>Accessibility</td><td></td></tr>
<tr><td></td><td>Nearest Rail Head</td><td>Chorvad Railway Station ~ 12 km</td></tr>
<tr><td></td><td>Road</td><td>Keshod- Mangrol road passes through the block.</td></tr>
<tr><td></td><td>Airport</td><td>Keshod Airport ~35km</td></tr>
<tr><td>4.</td><td>Hydrography</td><td></td></tr>
<tr><td></td><td>Local Surface Drainage Pattern (Channels)</td><td>The drainage pattern is sub-dendritic to dendritic in nature</td></tr>
<tr><td></td><td>Rivers / Streams</td><td>Nali River flows in the vicinity of the block (SE from the block), while the block area itself is drained by minor seasonal nallahs with no perennial rivers/streams within the boundary.</td></tr>
<tr><td>5.</td><td>Climate</td><td></td></tr>
<tr><td></td><td>Mean Annual Rainfall</td><td>1190 mm</td></tr>
<tr><td></td><td>Temperatures (December)(Minimum)
Temperatures (June) (Maximum)</td><td>Minimum-12^0C
Maximum-43^0C</td></tr>
<tr><td>6.</td><td>Topography</td><td></td></tr>
<tr><td></td><td>Toposheet Number</td><td>41K/04</td></tr>
<tr><td></td><td>Morphology of the Area</td><td>The block area comprises gently undulating plain terrain with low relief, locally covered by soil and calcareous exposures, and minor seasonal drainage channels.</td></tr>
<tr><td>7.</td><td>Availability of baseline geosciences data</td><td></td></tr>
<tr><td></td><td>Geological Map (1:50K)</td><td>Attached (refer Plate No.-IV)</td></tr>
</table>

	Geochemical Map	Available
	Geophysical Map (Aerogeophysical, Ground geophysical, Regional as well as local scale GP maps)	Available
8.	Justification for taking up G3 stage mineral exploration	1. The Mankhetra Limestone Block, located in Junagadh District, Gujarat, forms part of the Saurashtra Limestone Belt represented by the Gaj and Dwarka formations, which are regionally known to host cement-grade limestone. Regional geological information and earlier investigations carried out by GSI and CGM, Gujarat indicate favourable geological conditions for the occurrence and lateral continuity of limestone in and around the proposed block. The presence of nearby limestone lease areas and large-scheme limestone blocks further substantiates the mineral potential of the region. 2. Investigations by CGM during Field Seasons 1995–97 reported the continuity of limestone horizons of the Gaj and Dwarka formations, along with lateritic development, and recommended the area for pre-detailed survey. 3. Subsequent studies by GSI during Field Seasons 1997-98 **recorded average chemical grades of about CaO ~49.36%** and MgO ~2.68% in the surrounding region and recommended systematic exploration of the Gaj, Dwarka, and Miliolitic limestone formations, establishing the area as geologically favourable for limestone mineralisation. 4. The limestone blocks of Junagadh District, including Mankhetra, were identified and invited for exploration by the Commissioner of Geology and Mining (CGM), Gujarat through NPEAs. Subsequently, CGM, Gujarat granted No Objection Certificate (NOC) to MAPL for carrying out exploration in the Mankhetra block under NMEDT, thereby enabling systematic exploration and facilitating future auction of the block. 5. Field visit was carried by MAPL in the proposed Mankhetra Block. **3 samples were collected (M1 to M3)** and were analysed by an **NABL**, accredited Laboratory. **Average CaO% in 3 samples is 50.66% CaO.** Considering the aerial extent of the block, proximity to operating limestone mines indicating geological continuity, and observed grade variability in nearby CGM studies, Preliminary G3 level exploration is technically justified. • The proposed G3 exploration will enable generation of **MEMC-2015 compliant** 333 (Inferred) limestone resources, facilitating **scientific evaluation & auction** of block by the Govt. of Gujarat.

DETAILED DESCRIPTION OF THE PROJECT

1. Block Summary

Physiography

The proposed Limestone Block is located in Mangrol Taluka of Junagadh District, Gujarat, forming part of the coastal Saurashtra region. The terrain is characterized by gently undulating plain topography with low relief, locally covered by soil and calcareous exposures, along with occasional low mounds developed over limestone-bearing formations. No perennial river flows within the block; however, minor seasonal nallahs drain the area during the monsoon, forming a sub-dendritic to dendritic drainage pattern controlled by gentle regional slope. The area generally remains dry for most of the year except during the monsoon season. The elevation within the block is low and uniform, representing typical coastal plain morphology of the Saurashtra limestone terrain, and is favourable for reconnaissance-level geological mapping and exploratory drilling. The elevation ranges from about 30 m to 65 m above mean sea level.

Geological Background of the area

Regional Geology

The Mankhetra Limestone Block is situated in the coastal Saurashtra region of Junagadh District, Gujarat, where Tertiary marine sedimentary formations overlie the Deccan Trap basaltic basement. A discontinuous horizon of Palaeocene laterite locally intervenes between the Deccan Trap and the overlying sedimentary sequence.

The Gaj Formation (Lower to Middle Miocene) comprises fossiliferous limestone interbedded with marl, calcareous clay and shale, representing an important limestone-bearing unit of the region. This formation is unconformably overlain by the Dwarka Formation (Upper Miocene to Pliocene), which consists predominantly of white to grey, cavernous and shelly limestone occurring as laterally persistent beds.

The Pleistocene Miliolite Formation occurs as discontinuous blanket and pocket-type calcareous deposits resting over the Tertiary formations, while Recent to sub-recent alluvium and soil occupy low-lying areas.

Thus, the Mankhetra area forms part of the Saurashtra Limestone Belt, where economically significant limestone mineralization is chiefly associated with the Gaj and Dwarka formations, with subordinate calcareous development in the overlying miliolitic deposits.

The general stratigraphic succession of the region is as follows:

Age	Formation/Unit	Lithology
Holocene (Recent–Sub-recent)	Alluvium / soil	Clay, sand, mud and superficial deposits
……Unconformity……		
Pleistocene	Miliolite Formation	Porous to compact miliolitic limestone with marl/clay
……Unconformity……		
Pliocene to Upper Miocene	Dwarka Formation	White to grey shelly limestone
……Unconformity……		
Lower to Middle Miocene	Gaj Formation	Fossiliferous limestone with marl and clay
……Unconformity……		
Palaeocene	Laterite	Laterite
Lower Eocene to Upper Cretaceous	Deccan Trap	Basalt

Geology of the Block

The Mankhetra Limestone Block is underlain mainly by calcareous sedimentary rocks of the Gaj and Dwarka formations, which rest unconformably over the Deccan Trap basalt.

The Gaj Formation, comprising fossiliferous limestone interbedded with marl and calcareous clay, forms the main limestone horizon within the block. The overlying Dwarka Formation is represented by white to grey shelly limestone occurring as thin but laterally persistent beds.

Miliolitic limestone occurs locally as discontinuous superficial deposits, and thin soil/alluvial cover is present in low-lying parts of the block.

The geology of this area includes Dwarka or Jhagadia, Gaj and Miliolite formations in which good quality of limestone is reported. The Milliolite limestone and Gaj formation unconformably overlies Deccan trap. The Dwarka formation is divisible into Lower and Upper members. Only Upper member of Dwarka formation is exposed in this area. This member mainly comprises of white to greyish white shell limestone (0.2m to 0.8m thick). Miliolitic limestone occurs as outlines in the form of blanket and pockets and consist of limestone with bands of marl and clay.

Stratigraphy observed during joint field visit by CGM-GMRDS's officials and MAPL's officials:

Alluvium

Porous Miliolitic Limestone

White to grey Limestone

Fossiliferous limestone with clay

Thickness of individual litho-units varies from place to place. The field photographs are given in **Annexure-I**.

During field work, 3 samples (M1-M3) were collected and analysed for 6 radicals from a NABL accredited laboratory. The Sample Location Map is given below in **Figure 1**.

Figure 1: Sample Location Map

Location details of samples collected by MAPL is given below:

Sample ID	Latitude	Longitude
M1	21° 9'28.26"N	70° 8'32.76"E
M2	21° 9'57.48"N	70° 9'15.72"E
M3	21° 9'4.38"N	70° 9'28.02"E

The average CaO% reported by the analysis of 3 collected samples is **50.66% CaO** (Cement Grade)**.** The chemical analysis results are given below and the Analysis Report is given in **Annexure-II**.

Sample ID	CaO%	MgO%
M1	50.75	0.60
M2	49.07	0.60
M3	52.15	0.81

Mineralization potential of Limestone

Regional investigations carried out by CGM and GSI in parts of Junagadh District and adjoining Saurashtra region have established the occurrence and lateral persistence of limestone within the Gaj and Dwarka formations through geological mapping, surface sampling, and chemical analysis. The limestone deposits are reported to be bedded in nature and suitable for cement-grade utilisation.

GSI studies have reported high-grade limestone within the Gaj Formation, with CaO around 41–50%, low MgO, and silica within permissible limits, confirming suitability for cement manufacture. The presence of existing limestone and bauxite mines in the surrounding region, together with favourable stratigraphic continuity of calcareous formations, indicates good mineral potential within the Mankhetra block, thereby justifying G3 stage exploration.

Scope for proposed exploration

Sr. No.	Nature of Work	Proposed Work
1	Detailed Mapping in1:12500 scale	8.903 sq. km
2	Bed Rock Samples	30
3	Bulk Density Determinations	2 no.
4	Sample Analysis (Bed rock samples)	30
5	Core Drilling	~375 m
6	Borehole Depth	~25 m
7	Drill Core Samples	340 No.
8	Category of Land	--
9	Geological Personnel	01 Nos. (Field) + 01 No. (HQ)
10	Period of Scheme	10 months

Recommendations by CGM, Gujarat:

CGM, Gujarat invited NPEA's for taking up exploration of certain blocks of limestone. MAPL had applied for 5 limestone blocks. Thereafter, CGM, Gujarat granted NOC to Mining Associates Pvt. Ltd. to take up G4/G3 level explorations in 4 blocks of Junagadh District under NMEDT to facilitate Auction of the blocks. NOC for Mankhetra Limestone Block (one of the 4 blocks) was granted to MAPL by CGM, Gujarat.

A joint field visit was also conducted by CGM-GMRDS's Officials and MAPL's Official in all 4 blocks including the proposed Mankhetra Limestone Block. DPR with Project cost and Timeline was approved in 94th TCC-I meeting. Finally, Project was approved in the 8th Project Sanctioning Committee (PSC) meeting.

Objectives:

- Geological mapping in 1:4000 scale to delineate the surface outcrops/disposition, lithological contacts and lateral continuity of limestone bearing formations within the block.

- To undertake systematic collection of Bed Rock samples and their chemical analysis for assessment of grade, quality, and suitability of limestone.

- To drill 14 boreholes @ (800*800) m grids in accordance with MEMC Rules, 2015 to establish subsurface continuity, thickness variation, depth persistence of limestone horizons, and to confirm the limestone–basement contact.

- To evaluate grade variability of limestone, including CaO, SiO_2 and MgO contents, based on core and bedrock sampling.

- To develop geological sections and a conceptual subsurface model of the limestone deposit.

- To generate MEMC-2015 and subsequent amendments compliant G3 level geological resources (333 – Inferred category) for facilitating auction by the Government of Gujarat.

2. Previous Work

- Regional geological investigation covering parts of southern Saurashtra including toposheet 41K/4 was carried out by CGM during FS 1995–96 and 1996–97 based on interpretation of satellite imagery supported by limited field checks. The study, carried out by S. D. Kapse and Y. C. Patel (FS 1995–96) and S. D. Kapse (FS 1996–97), established the presence of Tertiary limestone-bearing formations such as Gaj and Dwarka and indicated favourable limestone potential in the Mankhetra region. Pre-detailed survey was recommended in this report.

- GSI conducted investigation for BF- and chemical-grade limestone in the Sepa–Sheriyakhan area, Junagadh District during FS 1998–99, involving geological mapping, surface sampling and chemical analysis. The work was carried out by Des Raj, Geologist (Sr.), and reported the occurrence of cement-grade limestone within the Gaj Formation, with CaO around 41–50%, low MgO, and silica within permissible limits. GSI's report stated an average grade of CaO-49.36 % and MgO-2.68% in and around the area and recommended exploration of Gaj and Dwarka formations along with Miliolitic formation.

- The above investigations confirm the occurrence and grade suitability of limestone in the region, while no exploratory drilling has been reported in the Mankhetra area so far, indicating the need for Preliminary (G3) stage exploration. The area comprises of Limestone of Dwarka and Gaj Formations, which are reported to be of cement grade. Several leases for limestone mining occur in the vicinity of proposed block which is suggestive of high potentiality of the block.

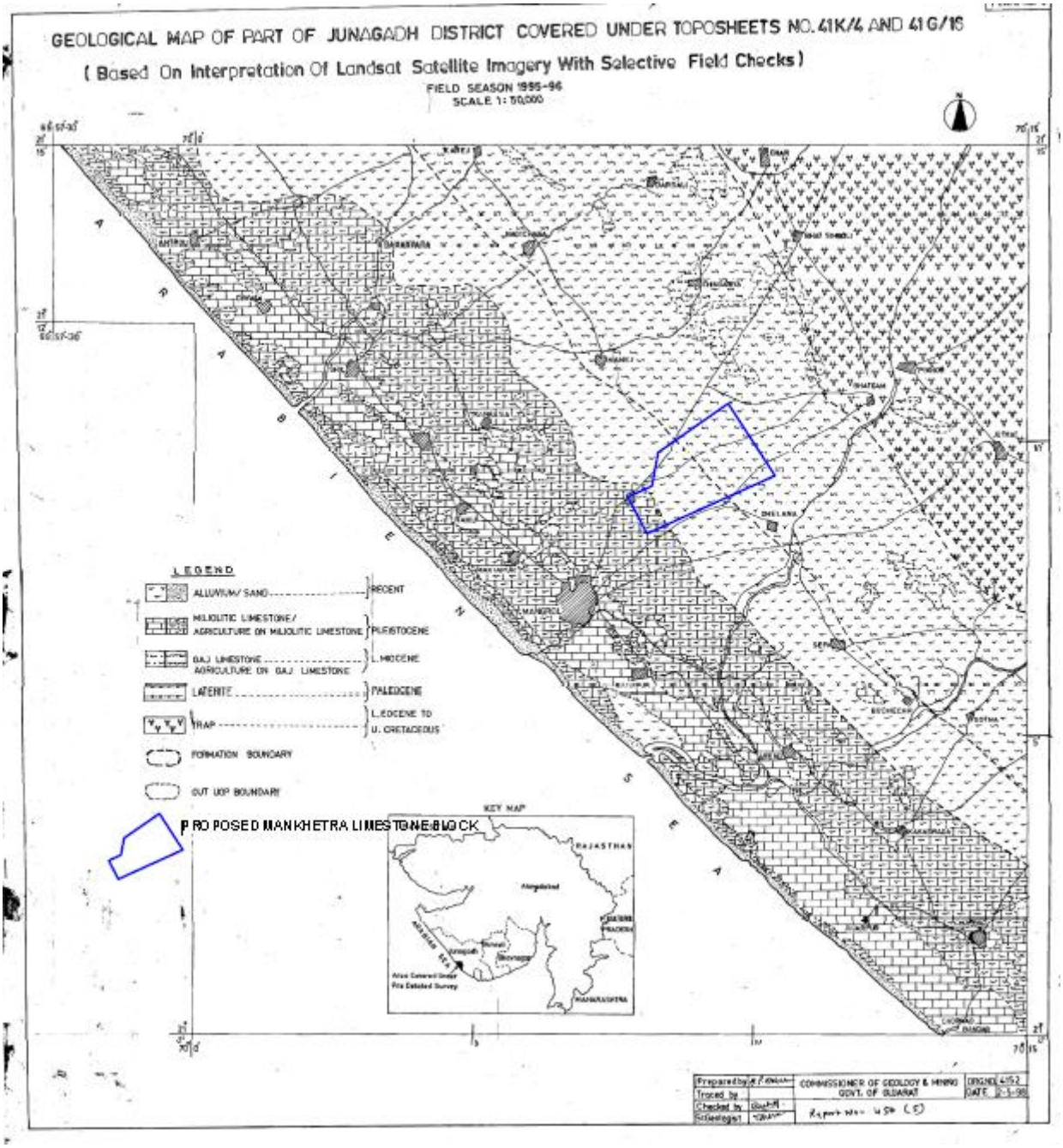


Figure 2: Proposed Mankhetra Block superimposed on geological map of CGM, Gujarat's Report.

3. Block description

Sr. No.	Block Corner Point	Latitude	Longitude
1.	A	21°10'34.38"N	70° 9'33.63"E
2.	B	21° 9'20.89"N	70°10'23.60"E
3.	C	21° 8'22.81"N	70° 8'4.83"E
4.	D	21° 9'0.34"N	70° 7'44.48"E
5.	E	21° 9'11.32"N	70° 8'10.60"E
6.	F	21° 9'45.13"N	70° 8'17.48"E

4. Proposed/ Planned Methodology

Detailed Geological Mapping

Geological mapping will be carried out on 1:4,000 scale over the entire 8.903 sq. km block area by systematic traverses using GPS, Brunton compass, and tape. Lithological contacts, structural

features, geomorphology, and surface manifestations of limestone observed during field mapping will be incorporated for preparation of the geological map and sections.

Topographic Survey

A topographic survey shall be undertaken with reference to the triangulation network established by the authorized agencies. Topographic surveys shall be carried out on a 1:4,000 scale and contours shall be generated with 2 m interval. All the surface features such as roads, pits, trenches, borehole collars, streams, village boundaries, etc. shall be brought up on to the map using Electronic Total Station/DGPS survey.

Coordinates and collar RLs of the proposed boreholes and Block boundary corner points shall be surveyed using DGPS.

Drilling

To understand the subsurface lithological disposition and continuity of limestone horizons, 14 boreholes are proposed with 13 BH's having an average depth of ~25 m each and 1 stratigraphic BH upto 50m depth. The total cumulative drilling meterage will therefore be ~375 m within the proposed block. Borehole locations will be finalized based on geological mapping results. Borehole depths may vary depending on vertical extent of mineralization.

Core Logging and Sampling

Recovered cores will be preserved in standard core boxes and logged run-wise for lithology, colour, texture, structures, weathering characteristics, core recovery, and RQD where applicable. Representative core samples from limestone and associated lithologies will be collected following standard sampling procedures for laboratory studies.

After detailed core logging, the drill core will be split into two equal halves, of which one half will be preserved in the core box as reference. The other half will be pulverized to −200 mesh size and reduced by coning and quartering to obtain four representative parts (~250 g each).

Out of these, one part will be sent for chemical analysis, the second preserved at camp as duplicate, the third utilized for preparation of composite samples, and the fourth retained as check/sample for any specific future analysis.

Chemical Analysis

The collected surface and core samples i.e. 370 samples shall be analyzed by XRF for 6 radicals like CaO, MgO, Al_2O_3, SiO_2, Fe_2O_3 and LOI etc. 10% of the primary samples i.e. 37 samples shall be analyzed as check samples.

Geotechnical study

2 Nos. of Limestone samples will be collected for Bulk Density determination. Thin section will be prepared and complete petrographic studies will be carried out for 5 Nos. of samples.

Geological Report

All geological, drilling, sampling, and analytical data generated during G3 exploration will be compiled into a Final G3 Stage Geological Report in accordance with MEMC Rules, 2015 and its subsequent amendments and NMEDT guidelines, establishing the occurrence, quality, and preliminary extent of limestone mineralization and estimation of 333 (Inferred) Limestone Resources.

5. Nature and Quantum of the work

SI. No.	Components	Unit	Quantity
A	**Detailed Geological Mapping**		
1	In 1:4000 Scale	Sq. Km.	8.903
B	**Survey work**		
1	Demarcation of block boundary, Fixation of Borehole and determination of co-ordinates & Reduced Level (RL) of the borehole by DGPS (14 BH + 6 Block Boundary Points)	Per Point of observation	20
2	Topographic survey with 5m contouring (1:12500 Scale)	Sq. Km.	8.903
C	**Pitting**		
1	Pitting (1m length X 1m width X 3 m depth)	Cu.m.	0
D	**Drilling**		
1	Core Drilling (~25 m average depth-13 BH & 1 Stratigraphic BH-50m)	m	375 m
2	Borehole Pillaring (12"X12"X30")	Nos.	14
E	**Laboratory studies Chemical Analysis**		
1	Primary drill core samples for 6 radicals viz. CaO, MgO, Al_2O_3, SiO_2, Fe_2O_3, LOI (XRF)	Nos.	340
2	Pit Samples	Nos.	0
3	BRS samples	Nos.	30
4	External Check Samples from NABL Labs for 6 radicals viz CaO, MgO, Al_2O_3, SiO_2, Fe_2O_3, LOI (10% of total samples)	Nos.	37
	TOTAL NUMBER OF SAMPLES	Nos.	407
5	Sample preparation	Nos.	407
	Laboratory studies Physical analysis		
6	Preparation of standard thin section of rock	Nos.	5
7	Complete Petrographic Studies along with 5 no. of digital photographs	Nos.	5
8	Bulk Density determination	Nos.	2
F	**Preparation of Exploration Proposal**	Nos.	1
G	**Geological Report preparation (as per MEMC Amendment Rules, 2021/UNFC)**	Nos.	1

6. Proposed Exploratory Drilling Plan

The total area of the proposed block is 8.903 sq. km. The block is proposed to be explored by drilling 14 boreholes at (800*800) m grid spacing with a cumulative drilling meterage of ~375 m, 13 boreholes having an approximate vertical depth of ~25 m and 1 stratigraphic borehole upto 50m , in order to assess the subsurface disposition and continuity of bedded limestone deposits, in accordance with the MEMC Rules, 2015 guidelines and its subsequent amendments for G3 stage exploration.

Collar details of proposed scout boreholes (UTM Zone: 42Q):

BH ID	Easting	Northing	Collar RL (m)	Inclination	Depth (m)
PBH-1	618266	2340178	49	Vertical	25
PBH-2	618926	2340630	53	Vertical	25
PBH-3	619587	2341082	56	Vertical	25
PBH-4	620247	2341533	60	Vertical	25
PBH-5	618053	2339063	43	Vertical	25
PBH-6	618713	2339515	47	Vertical	50
PBH-7	619374	2339967	52	Vertical	25
PBH-8	620034	2340418	60	Vertical	25
PBH-9	620694	2340870	61	Vertical	25
PBH-10	617947	2338505	48	Vertical	25
PBH-11	619161	2338852	50	Vertical	25
PBH-12	619821	2339303	51	Vertical	25
PBH-13	620481	2339755	54	Vertical	25
PBH-14	621142	2340207	52	Vertical	25

Note: Proposed borehole coordinates and RLs' may change after detailed Geological mapping and collar survey using DGPS instrument. Borehole depth may also change based on actual depth of mineralization encountered in each borehole.

The proposed borehole locations are shown in **Plate–V**.

7.0 TIME SCHEDULE

S. No.	Item of Work	1	2	3		4	5	6		7	8	9	10
1	Camp Setting												
2	Geological Mapping & Sampling												
3	Survey Party days												
4	Pitting/Trenching												
5	Surface Drilling (1 rig)												
6	Geologist Man days (Field)				REVIEW				REVIEW				
7	Geologist Man days (HQ)												
8	Sampler Man days												
9	Camp Winding												
10	Chemical Analysis of Surface Samples												
11	Lab analysis of Drill Core Samples												
12	Processing of Analytical Data												
13	Report Writing												
14	Final Submission												
Note:	* Commencement of the project may be reckoned from the day exploration agency available with all necessary clearances												
	* Time loss on account of Forest Clearance, Monsoon, local law and order problems if any may be addition to the above timeline.												

Manpower Deployment Geologist party:

- **Geologist party:** 1 Geologist (Field) - 90 days + 1 Geologist (HQ) - 30 HQ days. Labour - 2 labours/Geologist (i.e. 90 days*2 labours = 180 days).
- **Sampler Party:** 1 Sampler – 60 Days and 4 Labours - (60x4) = 240 Days.
- **Survey Party:** 1 Surveyor – 30 Days and 4 Labours – (30x4) = 120 Days.
- **Drilling Party:** 1 Driller, 2 Assistant Driller, 1 Mechanic, 6 labours for Approx. 60 days

8.0 BREAK UP OF EXPENDITURE

SL. No.	Component	Cost in Rs.
A	Geological Mapping and Other Geological Works	24,87,445
B	Survey Work	8,61,720
C	Drilling	32,30,850
D	Laboratory Studies	17,30,900
E	Tendering Cost	41,250
F	Operational charges towards Technical Supervision of outsourced work	2,06,250
G	***Total A to F***	**85,58,415**
H	Preparation of Exploration Proposal	1,71,168
I	Geological Report Preparation	2,50,000
J	Peer Review	30,000
K	**Total Estimated Cost without GST**	**90,09,583**
L	Provision for GST@18%	**16,21,725**
M	**Total estimated cost with GST**	**10,631,308**
	or say Rs. in lakhs	**~106.31**

Preliminary Exploration (G3) for Limestone in Mankhetra Block, Junagadh District, Gujarat, Area 8.903 sq. km, Core Drilling: 375 m (After Review), No. of BH: 14 (1 stratigraphic BH upto 50 m + 13 BH upto 25m), Schedule timeline- 10 months, Review: After 3 & 6 Months							
S. No.	**Item of Work ***	**Unit ***	**Rates as per NMEDT SoC 2025-26**		**Estimated Cost of the Proposal**		**Remarks**
			SoC-Item No. *	**Rates as per SoC * (a)**	**Qty. (b)**	**Total Amount (Rs) (a*b)**	
A	**Geological Mapping Other Geological Work & Surveying**						
	Geological mapping with contouring, (1:4000 scale) & sampling	Sq. km.	**1.1**	18,300	**8.903**	1,62,925	
i	a. Charges for Geologist per day for **Field**	day	**1.2.1a**	14,500	**90**	13,05,000	
ii	b. Labours Charges; Base rate (2 labours/Geologist)	day	**5.8**	556	**180**	1,00,080	
iii	c. Charges for Geologist per day **(HQ)**	day	**1.2.1a**	10,500	**30**	3,15,000	
iv	d. Charges for one Sampler per day (1 Party-2 months i.e. 60 days)	one sampler per day	**1.2.1b**	7,850	**60**	4,71,000	
v	e. Labours (4 Nos- i.e. 60 days*4 = 240 days)	day	**5.8**	556	**240**	1,33,440	
	Sub Total-A					**24,87,445**	
B	**Survey work**						
a	Charges for one surveyor per day (topographic survey 1:4000 Scale)	day	**1.3.1**	10,500	**30**	3,15,000	
b	Labour (4 Nos.) per party	day	**5.7**	556	**120**	66,720	
c	Demarcation of lease boundary, Fixation of Borehole and determination of co-ordinates & Reduced Level (RL) of the boreholes by DGPS	Per Point of observation	**1.3.2**	24,000	**20**	4,80,000	(6BP+14BH)
	Sub Total-B					**8,61,720**	
D	**DRILLING (Outsource)**						(after review)
1	Core Drilling: 375m – (After Review), No. of BH: 14 nos. at	Per m	**2.2.1.1c**	5,500	**375**	20,62,500	

	800*800m grids						
2	Construction of concrete Pillar (12" *12" *30")	Per Borehole	**2.2.7**	2,000	**14**	28,000	
3	Borehole plugging by cement.	Per Borehole	**2.2.8**	10,000	**14**	1,40,000	Lumpsum
4	Land/Crop compensation	Per Borehole	**5.6**	30,000	**14**	4,20,000	As per actuals as certified by local authorities subject to a maximum of 30,000 per borehole
5	Drill Core preservation	Per m	**5.3**	1,590	**365**	5,80,350	
	Sub Total-D					**32,30,850**	
E	**Laboratory Studies**						
1	**Chemical Analysis**						
i	Analysis of Major Oxides by XRF	Nos.	**4.1.17a**	4,200	**370**	15,54,000	340 core samples + 30 BRS
	Analysis of Major Oxides by XRF (external check (10%))	Nos.	**4.1.17a**	4,200	**37**	1,55,400	
2	**Physical, Petrological & Mineralogical studies**						
i	Preparation of thin section	Nos.	**4.3.1**	500	**5**	2,500	
ii	Complete Petrographic report of rock sample along with digital photographs	Nos.	**4.3.4**	2800	**5**	14,000	
iv	Bulk Density	Nos.	**4.8.1**	2500	**2**	5,000	
	Sub Total-E					**17,30,900**	
	Total Outsourced					**20,62,500**	
	Tendering Cost		**5.9**			**41,250**	
	Technical Supervision Cost		**6**			**2,06,250**	
F	**TOTAL**					**85,58,415**	
G	**Preparation of Exploration Proposal**		**5.1**	2% of approved project cost or 5 lakh whichever is lower	**1**	1,71,168	

H	**Geological Report Preparation**	**5 Hard copies with a soft copy**	**5.2 (ii)**	Total cost exceeding 50 lakh but less than 150 lakh	**1**	2,50,000	
I	**Peer review**	Per review	**--**	As per EC decision	**--**	30,000	
L	**Total Estimated Cost without GST**					**90,09,583**	
M	**Provision for GST (18% of M)**					**16,21,725**	
N	**Total Estimated Cost with GST**					**1,06,31,308**	
				or Say Rs. In Lakhs		**~106.31**	

Note:	
1	**Strict adherence to the Ministry of Finance's and GFR guidelines is mandatory. Every transaction must adhere to GFR rule 21.**
2	**In case of delay/non- performance, the appropriate action will be taken by competent authority against delinquent agency as per prevailing govt. of India rules/guidelines on procurement.**
3	**If any part of the project is outsourced, the amount will be reimbursed as per the Paragraph 3 of NMEDT SoC and Item no. 6 of NMEDT SoC. In case of execution of the project by NEA on its own, a Certificate regarding non outsourcing of any component/project is required.**
4	**Necessary efforts should be made to minimize any adverse impact on the environment during exploration activities.**
5	**Any item of work not mentioned above shall be added as per SoC.**

Note:

A. Timelines

Total estimated time period for execution of G3 stage exploration in Mankhetra Limestone Block is 10 months with review after 3rd and 6th months. In case, local hindrances, weather, climate etc. results in delay the timeline will undergo changes accordingly.

B. Total estimated expenditure

Total estimated cost is **Rs. 1,06,31,308** including GST.

C. Terms of payment

M/s Mining Associates Pvt. Ltd. will raise the invoice for the quantum of work completed in accordance with the approval as per NMEDT.

9. Reference:

1. CGM Report: Geological report of southern part of Saurashtra covered under toposheet nos. 41G/5, G/10+6, 41K/4, G/15+11, 41L/5, L/9+10 (Based on interpretation of satellite imagery with limited field checks) (Field Season 1995-96 and 1996-97) by S. D. Kapse, Asstt. Geologist, Y.C. Patel, Asstt. Geologist (F.S. 1995-96) and S. D. Kapse, Asstt. Geologist (F.S. 1996-97).

2. GSI Report: Investigation for BF and Chemical grade limestone in Sepa and Sheriyakhan area in Junagadh District, Gujarat (Progress report on field season 1998-99) by Des Raj, Geologist (Sr.), Gandhinagar, November-2000.

3. 1:50,000 scale Geological Data obtained from Bhukosh portal (https://bhukosh.gsi.gov.in) of Geological Survey of India.

4. NGDR portal.

5. Revised Schedule of Charges – NMEDT.

ANNEXURE – I: Field Photographs

Limestone outcrops within the Mankhetra Block

Piled up Limestones

Limestone outcrops within the Mankhetra Block

Well showing extent of mineralization at depth

Limestone outcrops within the Mankhetra Block

Agricultural lands within the proposed block.

ANNEXURE – II: Analysis results of samples collected by MAPL

HORIZON ENVIRONMENT & MINERAL SOLUTION LLP

B/112, THE LANDMARK, OPP. KANSAR GARDEN RESTAURANT, KUDASAN, GANDHINAGAR – 382421

+91 99798 44388 HORIZONEMSLLP@GMAIL.COM WWW.HEMSLAB.COM

TC-13952

ULR No: - TC13952260000000106 Date: - 23/03/2026

TEST REPORT

(Mineral)

1	Name of Customer	:	**Mining Associates Pvt Ltd**
2	Customer Contact No.	:	+91 6289339388
3	Type of Sample	:	Limestone (As per Party's Letter)
4	Sample Identification	:	Labeled Samples of Lambora, Mankhetra & Santipura Blocks
5	Date of Receipt of Sample	:	17/03/2026, Sample submitter by customer
6	HEMS Job No.	:	HEMS0326M01 to HEMS0326M17
7	Name of work	:	Chemical Analysis of Limestone (IS 1760)
8	Sample Location	:	Junagadh, Gujarat
9	Date of Testing	:	17/03/2026 to 23/03/2026

Test Results:-

Sr. No.	HEMS ID.	Sample code	Test Parameter (%)					
			SiO_2	Fe_2O_3	Al_2O_3	CaO	MgO	LOI
1	HEMS0326M01	L1	0.51	0.80	0.25	53.56	0.81	43.91
2	HEMS0326M02	L2	1.34	*UDL (DL<2)	0.51	51.31	1.21	42.39
3	HEMS0326M03	L3	1.82	1.92	0.51	53.28	0.40	41.94
4	HEMS0326M04	L4	1.58	2.00	0.64	52.72	0.81	42.12
5	HEMS0326M05	L5	13.23	*UDL (DL<2)	*UDL (DL<2)	42.06	1.41	*BDL (DL>40)
6	HEMS0326M06	L6	13.08	*UDL (DL<2)	*UDL (DL<2)	41.78	1.81	*BDL (DL>40)
7	HEMS0326M07	M1	5.60	1.16	0.89	50.75	0.60	40.34
8	HEMS0326M08	M2	9.32	1.16	1.02	49.07	0.60	*BDL (DL>40)
9	HEMS0326M09	M3	0.70	*UDL (DL<2)	0.76	52.15	0.81	42.73
10	HEMS0326M10	SB1	4.87	*UDL (DL<2)	1.66	48.79	1.21	*BDL (DL>40)
11	HEMS0326M11	SB2	2.60	*UDL (DL<2)	1.15	52.15	0.40	40.95
12	HEMS0326M12	SB3	1.11	0.40	0.25	54.12	0.20	43.12
13	HEMS0326M13	SB4	1.56	0.32	0.51	53.56	0.20	43.27
14	HEMS0326M14	SB5	1.34	0.80	0.38	53.84	0.40	42.42
15	HEMS0326M15	SB6	1.71	0.60	0.51	53.84	0.40	42.07
16	HEMS0326M16	SA1	9.60	*UDL (DL<2)	*UDL (DL<2)	44.86	0.20	*BDL (DL>40)
17	HEMS0326M17	SA2	0.67	0.68	0.51	53.28	0.40	43.83

*BDL: Below Detection Limit, DL: Detection Limit, UDL:Upper Detection Limit

Tested By

Nikita Patel
Chemist

Authorized By

Kaushik Shukla
Quality Manager

Notes:

- The test results refer only to the samples received in the Laboratory.
- HEMS shall not in any way be involved in any action following the interpretation of test results.
- Any discrepancy in test results should be reported within 15 days.
- This report Is not to be reproduce wholly or in a part and cannot be used as evidence in court of law and shall not be used in advertising media without permission of HEMS in writing.
- The Sample will be destroyed after suitable retaining period, unless otherwise requested by party.
- Subject to Gandhinagar-GJ Jurisdiction only.

End of Report

ANNEXURE – III: CGM LEGACY REPORTS

R.N. 450

GEOLOGICAL REPORT OF SOLITHERN PART OF SAURASHTRA COVERED UNDER TOPOSHEET NOS. 41 G/5, G/10+6, 41 K/4, G/15+11, 41 L/5+1. L/9+10 (BASED ON INTERPRETATION OF SATELLITE IMAGERY WITH LIMITED FIELD CHECKS)(FIELD SEASON 1995-96 AND 1996-97)

By

S.D. KAPSE, ASSTT. GEOLOGIST

Y.C. PATEL, ASSTT. GEOLOGIST

(F.S. 1995-96)

AND

S.D. KAPSE, ASSTT. GEOLOGIST

(F.S. 1996-97)

OCTOBER 1997

COMMISSIONER OF GEOLOGY AND MINING

GOVERNMENT OF GUJARAT

GANDHINAGAR

CONTENTS

ABSTRACT

During the field seasons 1995-96 part of the Junagadh and Jamnagar districts of Saurashtra were taken up for geological mapping on 1:50,000 scales covering an area about 2580 sq. kms. by using Remote Sensing Techniques. The geological maps were prepared using False Colour Composit (F.C.C) OF "LANDSAT" and "SPOT" Satellite data. This aurveyed area falls under the Survey of India topographical map Nos. 41 G/5, 41 G/10 + 6, 41 G/15+11, 41 K/4, small part of 41 K/3, 41 L/5+1 and L/9+10.

The study of imagery revealed that the major part of the surveyed area is covered with trap rocks and miliolitic limestone. The granophyre which is regarded as magmatically differentiated product of basic igneous rock is noticed north of Ranavav. The miliolitic limestone is found throughout all along the coastal tract from kodinar to Miyani exposed intermittently. The other important rock types are Gaj shale and limestone, Dwarka limestone. Weathering of trap rocks has resulted in formation of ferruginous clay and laterites which are found in abundance from North of Miyani to Bhogat. The chalk deposits are noticed near Ranavav.

The other interesting feature of this area is presence of mud flats which are observed within the dissected parts of the coast. These dissected portions act as conduits for the deposition of silt and clay. The silt and clay are deposited in the low lying areas where many small seasonal streams collectively deposit their load during monsoon such areas became liable to flooding and water logging.

Generally along creeks faults are noticed. The marginal shifting of coast are observed at many places such as Madhavpur, Muldwarka, Miyani, Veraval and Porbandar.

During field investigations six samples were collected for Petrographic identifications and were studied at the Petrographic laboratory at Gandhinagar.

Economic minerals in the area are limestone, chalk, coterie, Granophyre & Trap.

INTRODUCTION

The Department has taken up Saurashtra coast for geological mapping using Remote Sensing Techniques since 1989. The coast from Chara to Bhogat has been mapped during the F.S. 1995-96 and 1996-97. These areas form the part of Junagadh and Jamnagar districts, which falls under Survey of India Toposheet Nos. 41 G/5, 41 G/10+6, 41 G/15+11, 41 K/4, small part of 41 K/3, 41 L/5+1 and L/9+10.

The geology of the area was interpreted with the help of Remote Sensing Techniques using "SPOT" and "LANDSAT" Satellite imagery and thus pre-field maps were prepared at the laboratory. To check accuracy of interpretation field checks were carried out. The necessary corrections were made based on field observations. By incorporating the field details, the maps were finalized. In all 2580 sq. kms. area was covered under geological mapping.

METHODOLOGY

The base maps were prepared by tracing the details like roads, nallas, villages from topographical maps of Survey of India. These maps were overlain on the False Colour Composit (F.C.C.) of Satellite Imagery and by using Remote Sensing Techniques the lithological boundaries of different litho units and other features were demarcated on the maps. Thus prefield maps were prepared and taken in the field for verification. Based on the field observations and evidences necessary corrections were incorporated and final geological maps were prepared.

LOCATION AND ACCESSIBILITY

The surveyed area form the Southern and South Western part of Saurashtra and fall in the districts of Junagadh and Jamnagar which are well connected by rail and road. The state coastal highway is passing through these districts. The Taluka places are also well connected

tract important ports such as Kodinar, Chorwad, Madhavpur, Veraval and Porbandar etc. are Present Porbandar and Keshod are important airports which fall under surveyed area.

PHYSIOGRAPHY

The area in general is flat to undulating. At places, mounds of trap and miliolitic dunes are seen. The area north of Porbandar exhibits rugged topography where hills attaining an elevation of 200 mts. are noticed.

The main rivers flowing through this area are Main, Raval, Machundri, Singoda, Meghal, Madhumati, Bhadar, Orat etc. Since central part of the Saurashtra peninsula forms upland many of these rivers originate in this region and flow radually and most the Arabian Sea. The streams and nallas are ephemeral in nature.

The area experiences hot tropical climate. During summer, i.e. from April to June the climates are very hot and uncomfortable, but nights are pleasant because of cool breeze from sea. The temperature rises up to 42°C during summer whereas in winter it is usually around 12°C. The average rainfall of the area is around 60 cm.

VEGETATION

The coastal area of Saurashtra is well cultivated. The black cotton soil of trap is very fertile and case crops like cotton are seen along the coast from Chorwad to Madhavpur. The hills in general are barren as at many places the trees are cut.

PREVIOUS WORK

In this area, the geological investigation has been carried out since last one century. Fedden (1884) gave a generalized account of the regional geology of the Kathiawar Peninsula with some details of unusual rock type like Felsite, diorite, rhyolite, Trachyte and

pitchstone etc. He regarded these extraordinary association of flow and dykes features to have resulted on account of great fissure eruptions.

The officers of Oil and Natural Gas Commission (ONGC) have carried out geological mapping of Saurashtra during 1957-64 with the emphasis on part of coastal tract of Saurashtra, where sedimentary rocks are exposed and hold prospects of containing oil and gas. Shri P.K. Shrivastava of ONGC compiled the information and worked out the stratigraphy of Saurashtra.

Number of workers from Geological Survey of India (GSI) carried out systematic geological mapping along the coast of Saurashtra. Besides preparing geological maps they worked out stratigraphic sequence and structural framework of this region. They also made detailed Petrographic studies based on which they deduced the nature of the eruption and its chronology. Recently, Commissioner of Geology and Mining (CGM) has also initiated systematic geological mapping of the coast to prepare comprehensive maps by using Remote Sensing Techniques. The mapping has brought about the stratigraphic sequence of Saurashtra area besides establishing chronology of basic igneous activity in the region.

GEOLOGY

Mapping in the parts of coastal Saurashtra from Chara to Bhogat revealed that the Deccan Trap suite of rocks are the dominant and oldest rock unit exposed in the area. The post trappen Tertiary rocks occupying the margin of the trap rocks are noticed along the coast. The younger miliolitic limestones occur as continuous strip overlying Tertaries and traps. The exposures of miliolitic limestone are observed along the coast.

The general stratigraphic sequence as observed in the field is as follows.

Alluvium/ coastal sand/ Mud/ Salt waste Recent to Sub-recent

---------- Unconformity ----------

Miliolitic limestone	Pleistocene
---------- Unconformity ----------	
Dwarka limestone	Pliocene to upper Miocene
---------- Unconformity ----------	
Gaj limestone/ shale	Lower Miocane
---------- Unconformity ----------	
Laterite	Palaeocene
Basalt/ Granite (Granophyre)	Lower Eocene to Upper Cretaceous

Basalt

Basalt commonly known as Deccan Trap is the oldest rock type noticed in the area. This rock is the most prominantly exposed noticed in the area. This rock is the most prominantly exposed rock type in Saurashtra region covering almost its length and width.

The fine grained basaltic rocks which is seen extensively from Devalia to further NE of paneli, Suryavada area is of the black colour, hard and compact in nature. This rock is fresh and has a thin brown coloured weathering surface. The vesicular fillings are rare in this type of basalt. At few place the basalt is amygdaloidal type.

The trap which is exposed around Tukada - Miyani and its north is highly weathered which at many place changes to laterite. The laterite is reddish, brownish and brick red in colour, sometime it occurs as mound, comprising 3 to 4 meter. thickness. Number of old working for laterite is noticed in this area. The trap rocks are also seen to occur north of Prachi.

On Satellite Imagery grayish - blue tone and fine texture associated with basalt are typically observe. Further, dendritic drainage which is characteristic drainage pattern of basaltic area is also noticed in this region.

Granite (Granophyre)

The Barda hills 15 km north east of Porbandar essentially expose granophyre. Besides this, felsites and quartz felsites are reported by previous works. It is regarded that differentiation of original basaltic magma has given rise to a vide variety of rock types which are associated with these messes. These felsitic rocks are ash grey to pink colour, medium to coarse grained. Innumerable joints are present in these rocks. These joints are trending in NE-SE and NW-SE directions dipping in SE or NW at high angle or vertical. Along the joints leaching of iron is seen and this has imparted pink and red colour along the joints. In hand specimen feldspar, quartz and pyroxene can be identified. On Satellite imagery it is characterized by yellowish reddish tone and medium texture.

Laterite

Between Deccan Trap and overlying Gaj beds variegated hard laterite rocks are seen occurring in narrow zone. The sporadic exposures of laterite are seen SW of Palkhada, SW of Hathiani and in Visavadar villages. The high ground near Vadal comprises laterite. ON laterite sometime thin capping of dirty yellow coloured limestone is observed. On the imagery it shows either as greenish or brownish toned feature. From Harshadmata temple towards Lambha NNW-SSE trending linear hillocks also expose laterite. The laterite is also observed at Ashpura Talav and Asphapura Mandir. Here laterite is forming linear mounds and in the saddle portion Dwarka limestone is occuring. The thin laterite cover which is exposed around Babada is extending up to Bhakharla. It is spread over the agricultural fields having about 1 mt. thickness. Laterite rocks by virtue of their resistance to weathering and rich hues of red, brown, yellow stand out prominantly often forming colourful ridges.

Shales of Gaj Series

The shales and limestone forming this series are occurring along the southern and south-western margin of the Trap/Laterite. The Gaj rocks are resting unconformably over the trap rocks. They are deep yellow to dirty yellow in colour and highly fossiliferous. The

fossils of gastropods and Pelecypods are common. The Gaj limestone/ shale is seen exposed west of Bhetali through kodidra, Padwa, Mantore, Mantore, Bhedala north of Morej, Inej, Umba, Malondha etc Villages. Here width of gastropods and Pelecypods are common. The Gaj limestone/shale is seen exposed west of Bhetali through kodidra, Padwa, Mantore, Bhedala north of Morej, Inej, Umba, Malondha etc. villages. Here width of limestone is varying 2 to 3 km. The terrain exposing the Gaj limestone is monotonously flat, unlike that of rugged topography of miliolitic limestone. The Gaj shales are exposed north east of Bhogat roughly 2 km. Their continuity below the soil cover can be traced. The exposures of these rocks are seen up - to Navagam. The hillocks SE of Navagam are composed of Gaj shales, they are noticed up to Satapar.

Dwarka Limestone

The Dwarka rocks are exposed near Baroda Sagar dam. This limestone is of dirty yellow colour and highly fossiliferous. Due to weathering it has become boundary.

The Dwarks rocks are also exposed north west of Miyani, around are Asapura Talav and Ashpura Mandir. Here NNE-SSW trading hills are comprising Dwarka limestone and are forming capping over trap rocks. On the imagery it appears as light yellow to white coloured feature. Since its extent is meager, it is difficult to pick up on the imagery; therefore it is marked based on the field traverses.

Milliolitic limestone

The Milliolitic limestone overlies unconformably fossiliferous tertiary rocks and at places it is directly resting over trap. This rock is essentially composed of fossil milliolina (foraminifera) and cemented by calcareous metric. The colour of the rock varies from light buff grey when freshly broken; some time is pinkish or brownish in colour. The brownish tint is due to leaching of iron. The outcrops of miliolitic limestone are highly pitted and porous due to chemical weathering induced by circulating water.

The miliolitic limestone is exposed intermittently throughout the coast (plate No.2) i.e from Sutrapada in south east to Meghal river in the North west.

Number of small dune shaped exposures is seen in plenty spreaded over agricultural fields. The NE-SW trending dunes can be observed 7 to 8 KM. away from coast. Near Adri, sand dunes are observed over the miliolitic limestone. This limestone gives reddish tint due to leaching of iron.

Near Vadodara, in quarry section 4 Mts. thick Milliolitic limestone exposure is observed. The maximum thickness of limestone in Hiran river section near Savani village is about 13 mts. Here the limestone generally occupies valley portion and also along the river bank. The limestone which occurs as crescent shaped dune generally does not have much depth extension and its depth varies from 2 mt to 4 mt. below the ground. The thickness of limestone as observed in the well section around Ajak and Karej (Plate No. 3) is around 15 Mts. Further north from Nagichana the thickness of limestone decreases as observed in the well sections. The limestone is exposed throughout the coastal track of this sheet. The coast, except at Shil village is rocky showing cliff. But at Shil, the coast is sandy. After Mul Madhavpur (plate No.4) width of limestone band starts decreasing. In this area few out-crop are observed near kadhach and north of kodhach. Most of the northern part of kadhach is liable to flood hence showing thick pile of alluvium cover except at Sharma village where buff grey coloured fossiliferous weathered shale is observed. At Mocha, near Hanuman temple in the well section of Mollusca. Further west of Navibandar, the thickness of limestone observed in well section is about 8 mts.

Around Sirderali and Kantela villages (Plate No.1) soil cover is seen over the miliolitic limestone. The limestone is seen exposed sporadically from kantela to Sungetha, Vithalpur, Jamalpur, Mahabatpar, Khambha and Anida villages. Here thickness of the limestone is meargre as in the road cutting exposures of trap are seen. The stony waste as seen on the toposheet between Bhetali and Rampara are of miliolitic limestone. The road from Khengeri to Bhetali appears to be the boundary between Bhetali and Rampara are of miliolitic limestone. The road from Khengeri to Bhetali appears to be the boundary between

miliolitic limestone and trap. The village Bhetali is on trap. To the south and south west of Bhetali isolated mounds of miliolitic limestone are observed. These mounds attain high up to 2 to 2.5 mts. below this miliolitic, brown coloured unconsolidated calcareous and ferruginous clay material is seen. The saddle portions between these mounds are devoid of miliolitic limestone.

From Harshadmata to Virpur (Gangari) the isolated pocket of miliolitic limestone is seen (plate No.6). This limestone is of buff white colour and surrounded by laterite. On Satellite imagery the Milliolitic limestone exposures appears as whitish, bluish, brownish and even yellowish toned features with smooth texture. At places typical banding nature formed on account of sedimentation of miliolitic limestone could be observed on imagery between Veraval and Porbandar. At places, miliolitic limestone forming mounds could be seen. These mounds are formed as a result of deposition of miliolitic limestone sand on account of SW blowing winds. Thus these mound are Aeolian in origin. The characteristic parabolic and linear shaped dunes are observed on the imagery in support of this view.

In the Porbandar area (Plate No.5), the miliolitic limestone is seen around Pendavada, kantela, Degam, Rinawada, Simani, Lavadia, Bhakharla, Boricha, Dobalia talav, Kajavadari, Digvijaygad villages etc. and also all along the foot hills of Barda from Adityana to Ranavav. Here limestone is pinkish to cream in colour. Some times, it is buff colour. At Places, it is siliceous. It is thinly bedded forming almost horizontal bedded deposit. Numbers of working quarries are observed in this area. The thickness of limestone at Pandavada, Degam and Rinavada is about 4mt. but at the foot hills of Barda, near Adityana it is about 30 mts.

The Milliolitic limestone is seen continuous all along the Porbandar coast ie. from Bosa in south west up to Miyani in the north west. The coast of Porbandar is rocky. The limestone from Porbandar to Gosa is a long narrow strip which extends northwardly up to the muddy areas. In this lying muddy area thick alluvial cover is noticed and no outcrops are visible. The limestone (from Porbandar to Gosa) is mostly sandy and cemented by calcareous matrix forming ridges attain 3 to 5 mts. height.

STRUCTURE

In-genteral, the surveyed area is plain to undulating terrain and most of horizontal to gently dipping towards sea and do not possess much structural capacity. Few faults are marked based on the interpretation of Satellite imagery. These faults are trending ENE - WSW direction. They are easily identified on imagery because of straight alignment of rivers and shifting/ displacement of coast.

It is also observed that Saurashtra coast is almost straight and at few places it shows zigzag configuration which may be attributed to faulting. As these places form depression, in which mud is deposited. Hence mud flats are seen. The occurrences of these faults along southern coast where Milliolite limestone is exposed indicating prevalence of neo tectonic activity during pleistoane period.

ECONOMIC MINERALS

Limestone

The area under survey contains inexhaustible reserves of chemical and cement grade limestone. This limestone contains 85% to 92% of CaCO3. This limestone is seen throughout the southern coastal tract of Saurashtra mainly at Madhavpur, Varaval Porbandar areas etc. This limestone at places attains 3 to 12 mts. thickness and near foot hills of Barda it is 30 mts. thick. But, at places it forms cover or capping having upto 1 mt. thickness. The limestone from thin cover or capping having up to 1 mt. thickness. The limestone from these areas is supplied to M/s. Saurashtra Chemicals, M/s. siddhi Cement, M/s. Tata Chemicals. This limestone is also used in making lime and for dimensional stones in construction of building. Due to its soft nature, it can be cut into required size along the bedding planes.

At places, this limestone forms dune like structure spreaded over the agricultural fields.

Chalk

The chalk deposits are located around Adityana and Ranavav area near Porbandar. The chalk in Adityana occurs at shallow depth, i.e about one meter to 4 mts. It is quarried by open cast method. Many navigation units are located around Adityana and Ranavav. This chalk contains pebbles of cherty limestone and minute silica particles.

Laterite

The laterite deposits are seen to occur north of Miyani and around Virpur. It occurs in the form of outlier from Lambha to Bhogat and can be seen up to Jodhapur village in the north. It is also seen north of Babada up to Bhakharla in agricultural fields. Here thickness of laterite is 1 to 3 it. This laterite is used as additive in cement manufacturing industries.

Granophyre

It is used as construction material for construction of building and road.

Trap

The trap rocks area used as metal in construction of roads and also used in other constructions.

CONCLISION AND RECOMMENDATIONS

The Satellite imagery of the area is found extremely useful (i) for delineating geological boundaries of different litho units (ii) It is useful in delineating linear structures like faults/lineaments etc., as it provides synoptic view.

The study of the surveyed area revealed that limestone of Gaj and Dwarka formations are continuing to occur in adjacent sheets along-with laterite patches. So it is recommended to cover these areas under Pre-detailed survey.

REFERENCE

No.	Author	Year	Title
1	Banerjee A.C	1988	Report on systematic geological mapping in parts of T.S.No. 41 J/6 and 41 J/7 in Jamnagar district of Gujarat, January 1988.(Unpublished report of G.S.I)
2	Mukhopadhyay	1986	Report on geological mapping in part of T.S. No. 41 F/8, 41 G/5, 41 G/9 and G/13 Jamnagar and Junagadh district.(Unpublished report of GSI)
3	Patols B.P.	1974-75	Report on the occurrences of chalk around Adityan and Boricha, Ranavav talukas of Junagadh district. (Unpublished report of DGM).
4	Pathole B.P	1989-90 1990-91	Geological report of south eastern Part of Saurashtra. (Unpublished report of DGM).
5	Shah N.V	1966-67	Report on prospecting on bauxite deposits in some of the villages of Jamnagar district. (Unpublished report of DGM).
6	Rao U.D.G	1966-67	Report on limestone deposits in eastern part of Veraval Taluka.(Unpublished report of DGM)
7	Shrivastav P.K.	1963	Geology of Saurashtra. (Unpublished report of ONGC).

LIST OF LOCALITY

VILLAGE	LATITUDE	LONGITUDE
1. Adityana	21° 42' 45"	69° 41' 30"
2. Digvijaygadh	21° 40' 30"	69° 42' 30"
3. Kodinar	20° 47' 30"	70° 42' 10"
4. Mangrol	21° 07' 20"	70° 06' 50"
5. Miyani	21° 50' 20"	69° 23' 00"
6. Navibandar	21° 27' 00"	69° 47' 36"
7. Paneli	21° 53' 30"	69° 26' 30"
8. Porbandar	21° 38' 28"	69° 36' 00"
9. Pranchi	21° 35' 00"	70° 36' 30"
10. Ranavav	21° 40' 57"	69° 44' 45"
11. Savani	21° 57' 05"	70° 27' 20"
12. Veraval	21° 54' 18"	70° 00' 00"
13. Visavadar	21° 20' 30"	70° 45' 00"
14. Virpur	21° 53' 30"	69° 21' 30"

PLATES

Plate No. **Description**

1. Geological map of part of Junagadh and Amrali districts covered under T.S. No. 41 L/9 +10

2. Geological map of part of Junagadh district covered under T.S. No. 41 L/5 + 1.

3. Geological map of part of Junagadh district covered under T.S.No. 41 K/4 and 41 G/16

4. Geological map of part of Junagadh district covered under T.S. No. 41 G/15 + 11.

5. Geological map of part of Junagadh district covered under T.S. No. 41 G/10 +6

6. Geological map of part of Junagadh and Jamnagar districts covered under T.S. No 41 G/5 +1.

Sample No	**Petrographic Results**		**Rock/ Mineral identification**
	Megascopic study	**Microscopic study**	
1.	The rock is black in colour. It is fine to medium grained, crystalline granular, hard, massive and compact. At some place black to greenish black, medium sized	The thin section shows ophitic to sub ophitic to sub ophitic texture where the difference in sizes of feldspar (labradorite) and pyroxene (augite) + olivine is quite remarkable. It is mainly	Olivine dolerite

	minerals are observed, the cleaved surface of which are giving vitreous luster. Majority of the grains, as observed are fine in size with vitreous luster at cleaved surface. At some places, a few fine to medium sized grains of pale olive green colour are also noticed, where cleavages are not present. Looking to the colour and Megascopic studies, it is presumed that the rock is basic in nature and intrusive (hypabyssal) in character.	composed of labradorite and augite where labradorite is modality than augite. Olivine is also present in remarkable modality of approximately 15% Opaque present in the form of streaks with modality of almost 2% to 3% have generally occupied the interstitial spaces.	
2.	The rock is light coloured and bended in nature and bended in nature. It is fine grained and porous. Minute pores are observed throughout the sample surface. Coloured bands are almost 1 C.M. in thickness. The rock is compact, massive and considerably hard. It gives perfuse off when treated with dilute Hcl. Also it can be easily scratched by a pen knife.	Thin section shows fine grained equigranular clastic texture. Clasts are sub rounded to rounded. Cementing matrix is very fine grained and almost wholly constituted of carbonates (calcite) and partially by clayey matter. Clasts are also carbonate (calcite). At a few places clasts of free quartz, feldspars and ferruginous matter are also observed in negligible proportion.	Carbonate rock (Lime stone).

3.	The rock is golden yellow in colour, fine grained, hard, massive and compact with a few minute fossils. At places, fine to medium size calcite grains are observed in the mass. Fine sized black spots are present in the whole mass. It gives perfuse off when treated with dilute Hcl. Solution Cavities are present in the rock.	Thin section shows very fine grained non clastic texture composed almost entirely of carbonate (calcite) material. A few fossil fragments are also observed in thin section. Opaque are neglible modality.	Carbonate rock (Lime stone)
4.	The rock is fine grained light (pinkish white) in colour with numerous minute fossils. The other portion of the rock is conglomeratic types conglomeratic types consisting of rounded pebbles of ferruginous material, mega fossils and other rock fragments. Fossils and other rock fragments. Fossils are observed in one part i.e. in the younger part are settled along the bedding planes. Both the portions give perfuse off. When treated with dilute Hcl and both the	The thin sections shows bio-clastic texture mainly composed of carbonate (calcite), and fossil fragments. Negligible proportion of feldspar, quartz and ferruginous matter is present in the rock.	Fossiliferous (lime stone)

	partings are hard massive and compact.		
5.	The rock is fine grained fossiliferous and pinkish in colour. It is hard massive and compact. It gives perfuse of when treated with dilute Hcl.	Thin section shows fine grained bio-clastic texture mainly composed of fine grained carbonate (calcite) and some fossils. Accessory minerals are quartz, feldspar and ferruginous matter Cementing matrix is mainly of carbonate (calcite). Clasts are fine in size.	Fossiliferous lime stone)
6.	Polishing Report Sample is medium grained and the polished surface is black in colour. Polished surface is in spotted form (colors). Spotted colors are get-black, black and light black, uniformly scattered throughout the polished face. Jet black spots are nearly 15% in abundance and rest two colors are almost in equal proportion, but the general colour of the polished face is black. A few fine streaks of opaque are also observed, equally distributed throughout the polished face. Also a few blackish white colored spots find to medium size are observed on the polished face, which are randomly scattered. On the whole the sample has received a good polish but light black coloured spots are some what pitted in appearance.		Dolerite.

PLATE NO-1

GEOLOGICAL MAP OF PARTS OF AMRELI DISTRICT COVERED UNDER T.S. NO. 41 L/9+10

(Based on the Interpretation of IRS and Landsat Satellite imagery with Selective field checks)

Field Season 1995-96

N

SCALE 1:50000

70° 30' | 35' | 40' | 70° 45' | 21° 0'

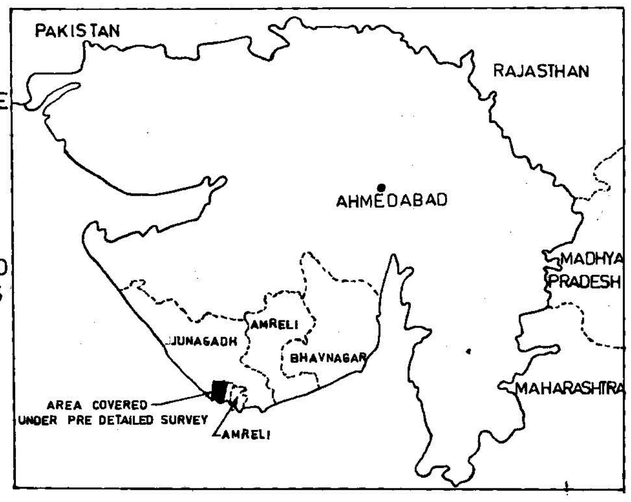
20° 45' | 70° 30' | 35' | 20° 42' 30" | 70° 40' | 70° 45'

GUNVANTPUR
KODIDARA
LUMBHA
ANIDA
JAWANTINES
BHETALI
KHANDHERI
VALADAR
KANKASA
PIKHOR
RAGPUR
PIPALWA
BHUVAWADA
SOMAT NADI
KATELA
GANGETHA
GIRDEVALI
SARASWATI RIVER
SORA
UMBRI
CHOGIYA
SIDDHI CEMENT
ANANDPUR
SINDHEJ
MORASA
MORDIYAR
NAWAGAM
PEDHWADA
W.RAILWAY TO KODINAR
VAWARI
DEWALPUR
VADNAGAR
PASNAWADA
MOTANA
VADODARA
SINGSAR
DUNDANA
RAKHEJ
KODINAR
SOMAT
DHAMLEJ
BARDA
SINGWADA RIVER
DEWALI
KADODARA
DAMLI
PANADAR
PIPLI
CHHARA
MUD
F
ARABIAN SEA

LEGEND

- ALLUVIUM/SAND/MUD ---------- RECENT
- MILIOLITIC LIMESTONE/AGRICULTURE ON MILIOLITIC LIMESTONE } PLEISTOCENE
- GAJ LIMESTONE & SHALE/AGRICULTURE ON MILIOLITIC LIMESTONE } L. MIOCENE
- TRAP } L.EOCENE TO U.CRETACEOUS
- FORMATION BOUNDARY
- FAULTS
- WATERBODY
- OUT CROP BOUNDARY

KEY MAP



PREPARED BY		COMMISSIONER OF GEOLOGY & MINING GOVT. OF GUJARAT	DRG. NO. 4140
TRACED BY			DATE 17-10-97
CHECKED BY			
SR. GEOLOGIST			

Report No - 450 (1)

PLATE NO-6

GEOLOGICAL MAP OF PARTS OF JUNAGADH AND JAMNAGAR DISTRICT COVERED UNDER T.S.NO.-41G/5+1

(Based on the Interpretatation of IRS and Landsat Satellite imagery with Selective field checks)

Field Season 1996-97

N

SCALE:-1:50,000

69° 10' 22° 0'

69° 15'

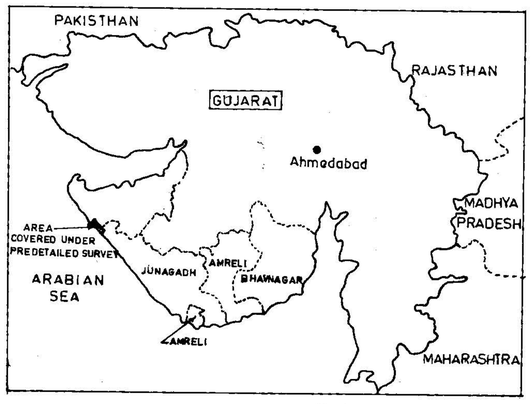
69° 30' 22° 0'

BHOGA
MALETA
PANDI
SATAPAR
SURYADA
NAVADRA
DEVLIA
SANOSRI
ACHLANA
RAVAL
LAMBA
VIRPUR
KAMAN NADI
CHANDRAWADA
GANDHAVI
MIYANI
VADALA
HATHIANI
RABANIWAD
PALKHADA
ARABIAN SEA
MUD
F

LEGEND

- SAND/MUD ---------- RECENT
- MILIOLITIC LIMESTONE / AGRICULTURE ON MILIOLITIC LIMESTONE } PLEISTOCENE
- DWARKA LIMESTONE ---------- PLIOCENE TO U.MIOCENE
- GAJ SHALE LIMESTONE / AGRICULTURE ON SHALE & LIMESTONE } L MIOCENE
- LATERITE ---------- PALEOCENE
- TRAP ---------- L.EOCENE TO U.CRETACEOUS
- FORMATION BOUNDARY
- FAULT
- WATERBODY

KEYMAP



21° 45' 69° 10'

21° 45' 69° 30'

PREPARED BY		COMMISSIONER OF GEOLOGY & MINING GOVT. OF GUJARAT	DRG.NO 4141
TRACED BY			DATE 24-11-97
CHECKED BY			
SR. GEOLOGIST		Report No - 450 (4)	

PLATE NO. 4

GEOLOGICAL MAP OF PART OF JUNAGADH DISTRICT COVERED UNDER TOPOSHEETS NO. 41G/15+11

(Based on Interpretation of Landsat Satellite Imagery With Selective Field Checks)

Field Season 1995-96

SCALE:- 1 : 50 000

N

69° 44' 21° 30'

70° 0' 21° 30'

21° 25' 69° 45'

69° 44' 21° 15'

70° 0' 21° 15'

MUD

Bhadar River

Chikasa

Gorej

MUD

Olat River

Revadra

Mahiyadari

Kadeji

Anipur

Balej

Hatarpur

Ghed Bagasara

Kaddach

Ghodadar

Mander

Chigaria

Padva

Madhuvanti Nadi

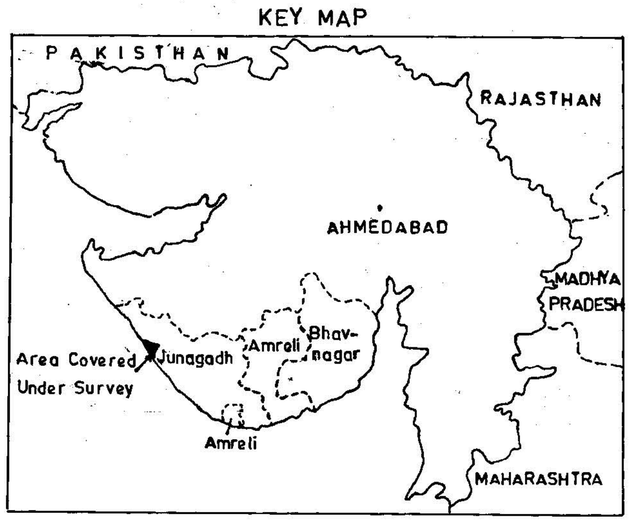
Madhavpur

A R A B I A N S E A

LEGEND

	SAND / ALLUVIUM / MUD	RECENT
	MILIOLITIC LIMESTONE AGRICULTURE ON MILIOLITIC LIMESTONE	PLEISTOCENE
	FORMATION BOUNDARY	
	OUT UOP BOUNDARY	
	WATER BODY	
	DAM	

KEY MAP



Prepared by	G.P.Mehta	COMMISSIONER OF GEOLOGY & MINING GOVT. OF GUJARAT	DRG. NO. 4149
Traced by			DATE 27-4-98
Checked by		Report No - 450 (6)	
Sr. Geologist			

PLATE NO. 2

GEOLOGICAL MAP OF PART OF JUNAGADH DISTRICT COVERED UNDER TOPOSHEET NO. 41 L/5 + 1

(Based on The Interpretation of Landsat Satellite Imagery With Selective Field Checks

FIELD SEASON 1995-96

SCALE:-1:50 000

N

21° 10'

70° 13-26"

70° 30'

Vadodara
Sidokar
Adri
Nawapara
Chhatrada
Dari
Dabhor
Umba
Malan
Inej
Ambliyala
Bherah
TO Talala
Devka Nadi
Tantivela
Govindpura
Hamla R.
Navadra
VERAVAL CITY
Talav
Meghpar
Ajotha
Saraswati R.
Harnasa
GHCL Plant
Sutrapada
ARABIAN SEA
BELT OF TRAP

LEGEND

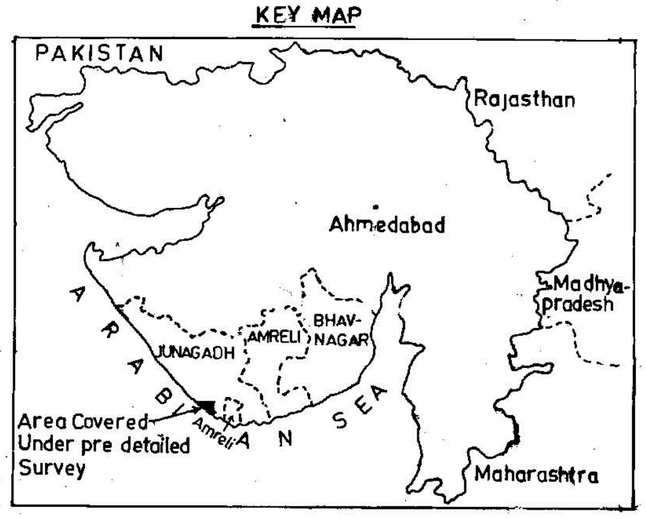
SAND / MUD	RECENT
MILIOLITIC LIMESTONE / MILIOLITIC LIMESTONE IN THE AGRICULTURAL AREA	PLEISTOCENE
GAJ SHALE / LIMESTONE GAJ IN AGRICULTURAL AREA	U. MIOCENE
TRAP	L. MIOCENE TO U. CRETACEOUS

FORMATION BOUNDARY

FAULT

OUT CROP BOUNDARY

KEY MAP



Prepared by		COMMISSIONER OF GEOLOGY & MINING GOVT. OF GUJARAT	DRG. NO.	4150
Traced by			DATE	1-5-98
Checked by				
Sr. Geologist				

Report No 450 (2)

20° 45'

70° 13-26"

70° 15'

70° 30'

20° 45'

PLATE NO. 5

GEOLOGICAL MAP OF PARTS OF JUNAGADH DISTRICT COVERED UNDER T.S.NO.41G 10+6

(Based on Landsat Satellite Imagery with limited field checks) F.S 1996-97

N

SCALE 1:50,000

69° 27' 69° 30' 69° 35' 69° 40' 69° 45'
21° 45' 21° 40' 21° 35' 21° 30'

SISLI
RATADI
BARDIA
SIMANI
BABDA
BAKHARLAI
LAVADIYA
RINAVADA
SHRINAGAR
PANDAVADAR
RESERVED FOREST
ADITYANA
RANTELA
DEGAM
BARVAN
DHALIYA NES
AMARDAD
KAJAVADARI
RANAVAV
KUCHHADI
KOLIKHADA
CREEK
SUKALA TALAV
DIGVIJAYGADH
SALT PLAN
KALATHANSA
KHAPAT
PIPLA
BOKHIRA
VANANA
CREEK
PORBANDAR
RANGHAVAV
BIRLASAGAR
BATANPAR
DARAR
LIMBADI
GOSA

A R A B I A N S E A

LEGEND

- ALLUVIUM/MUD/SAND ---------- RECENT/SUBRECENT
- MILIOLITIC LIMESTONE / AGRICULTURE ON MILIOLITIC LIMESTONE ---- PLEISTOCENE
- DWARKA LIMESTONE ---------- PLIOCENE TO U.MIOCENE
- LATRITE ---------- PALEOCENE
- GRANOPHYRE ---------- L.EOCENE TO U.CRETACEOUS

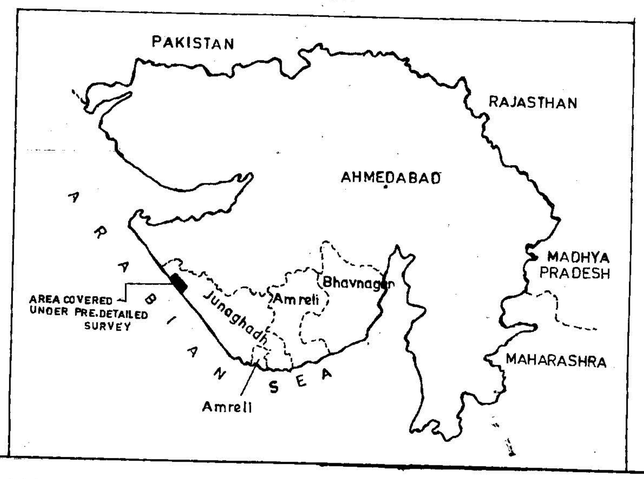
F — F FAULT

JOINT

OUT CROP AREA & FORMATION BOUNDARY

FORMATION BOUNDARY

KEY MAP



PREPARED BY		COMMISSIONER OF GEOLOGY & MINING GOVT. OF GUJARAT	DRG NO. 4151
TRACED BY			DATE 2-5-98
CHECKED BY		Report No. 45 (3)	
SR. GEOLOGIST			

PLATE NO 3

GEOLOGICAL MAP OF PART OF JUNAGADH DISTRICT COVERED UNDER TOPOSHEETS NO. 41K/4 AND 41G/16

(Based On Interpretation Of Landsat Satellite Imagery With Selective Field Checks)

FIELD SEASON 1995-96
SCALE 1: 50,000

N

69° 57'-30"
21° 15'
70° 0'
70° 15'
21° 15'
21° 12'
69° 57'-30"
21° 0'
70° 0'
10'
5'

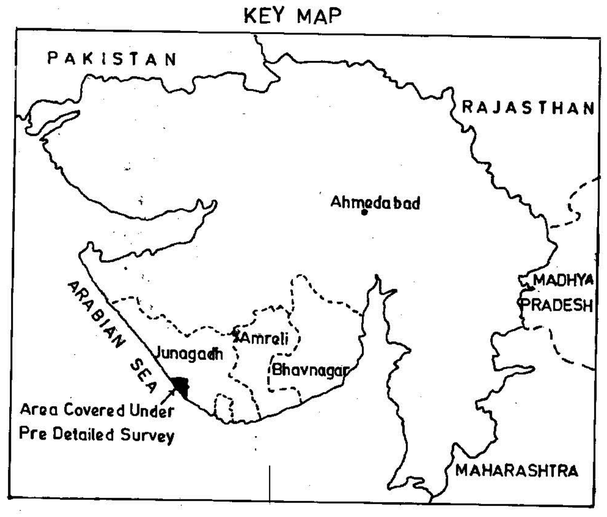
ARABIAN SEA

KAREJ
CHAR
DARSALI
ANTROLI
BAMANVARA
NAGICHANA
BHAT SIMROLI
CHINGARIYA
DIWASA
MANEJ
PIKHOR
BHATGAM
SHIL
KANKASAI
JUTHAT
RAHIJ
DHELANA
MAKTAPUR
MANGROL
SEPA
SHAHPUR
BUDHECHH
GOTNA
AREND
KAKASWADA
JUJARPUR
CHORWAD
CHORWAD BANDAR

LEGEND

ALLUVIUM/ SAND	RECENT
MILIOLITIC LIMESTONE/ AGRICULTURE ON MILIOLITIC LIMESTONE	PLEISTOCENE
GAJ LIMESTONE / AGRICULTURE ON GAJ LIMESTONE	L. MIOCENE
LATERITE	PALEOCENE
TRAP	L. EOCENE TO U. CRETACEOUS
FORMATION BOUNDARY	
OUT UOP BOUNDARY	

KEY MAP



Prepared by	G.P. Mehta	COMMISSIONER OF GEOLOGY & MINING GOVT. OF GUJARAT	DRG.NO. 4152
Traced by			DATE 2-5-98
Checked by		Report No- 450 (5)	
Sr.Geologist			

For Office use only

GOVERNMENT OF INDIA
GEOLOGICAL SURVEY OF INDIA
OPERATION GUJARAT

INVESTIGATION FOR BF AND CHEMICAL GRADE LIMESTONE IN SEPA AND SHERIYAKHAN AREA IN JUNAGADH DISTRICT, GUJARAT

(Progress Report for the Field *Sea*son 1998-99)

By

Des Raj
Geologist (Sr.),

Gandhinagar

November-2000

Investigation for BF and Chemical grade limestone in Sepa and Sheriyakhan area in Junagarh district, Gujarat
(Progress Report for the field season 1998-99)

By

Des Raj

Geologist (Sr.),

CONTENTS | **PAGE NO**

PLATES

I. Geological map of Sepa - Sheriyakhan area, Mangrol Taluka, Junagadh district (scale 1:10,000) D.O. No. GSI. Op. Gujarat 27/99

II. Map of Sepa - Sheriyakhan area, Taluka Mangrol, Junagadh district, showing zones of chemical grade-IV Limestone as per ISI specification. Scale 1:35 000

III. Map of Sepa - Sheriyakhan area, Taluka Mangrol, Junagadh district, showing zones of BF grade-I limestone as per ISI specification. Scale 1:35 000

IV. Map of Sepa - Sheriyakhan area, Taluka Mangrol, Junagadh district, showing zones of B F grade-II limestone as per ISI specification. Scale 1:35 000

V. Map of Sepa - Sheriyakhan area, Taluka Mangrol, Junagadh district, showing zones of BF grade limestone as per Tata sSteel and Mysore Iron Steel specification. Scale 1:4 0000

VI. Map of Sepa - Sheriyakhan area, Taluka Mangrol, Junagadh district, showing zones of BF grade limestone as per Hindustan Steel Rourkela Plant specification. Scale 1:40000

APPENDICES

I. Geochemical analysis of the Gaj, Dwarka and Miboiitc limestone of Sepa and Sheriyakhan area, Mangrol Taluka, Junagadh district, Gujarat (1998-1999), Scale I: 10 000

II. Limestone for chemical grade -IV as per ISI specification. Scale 1:35 000

III. Limestone for B F grade -1 as per ISI specification. Scale 1: 35 000

IV. Limestone for B F grade -II as per ISI specification Scale 1: 35 000

Investigation for BF and Chemical grade limestone in Sepa and Sheriyakhan area, Mangrol Talufca, Junagadh district, Gujarat
(Progress Report for the Field season 1998-99)

By

Des Raj Geologist (Sr.),

ABSTRACT

In pursuance of the Field Season Programme for 1998-99, an area of 20 sq. km. was mapped on 1:10,000 scale in parts of toposheet no, 4IK/4. 400 nos. of chip/groove samples were collected on grid pattern at 300m x 300m interval with help of tape and compass. The aim of this was to evaluate resource potentiality of the limestone belonging to Gaj and Dwarka Formations for B.F. and Chemical grade.

The oldest rock exposed in the area is basalt which is capped by laterite (Up. Cretaceous to Lr. Eocene). These are overlain by Gaj Formation (Lr. To Middle Miocene) which is successively overlain by Dwarka Formation (Middle Miocene to Up, Miocene) and the Miliolite Formation (Early Pleistocene) . The Gaj Formation is divisible into two units. Lower unit and Upper unit. Lower Gaj unit mainly comprises thick sequence of yellow marl /clay with thin intercalation thin band (0.4m. to lm.), where as Upper unit comprises of (0.5m to 7m) limestone intercalations with thin layer of marl and variegated clay. Dwarka Formation conformably overlies the Gaj Formation. The Dwarka Formation is also divisible into Lower and Upper members. Only Upper member of Dwarka Formation is exposed in mapped area. This member mainly comprises white to greyish white shell limestone (0.2m to 0.8m thick). At places, it is recrystallised and cavernous. Limestone in the entire 20 km^2 area is of cement grade having average thickness 2.30m. Average §7. Gravity 2.72 and reserves 125.12 million tonnes, CaO-49.36

%, MgO-2.68%, A. L- 3.45%, R&3-4.44%, LOI- 39.94%.

Reserve for chemical grade - IV and BF grade -I&I1 according to different specifications have also been calculated However, in view of extensive mining of Miliolite limestone being used by chemical as well as cement industries in the area, the reserve estimated may not be find consumers immediately.

जूनागढ़ जिले के मांगरोल तालुका के सेवा व झेरीयाखान क्षेत्रों में बी एफ व रसायनिक श्रेणी के लायमस्टोन का अन्वेषण पर प्रतिवेदन ।

फील्ड वर्ष 1998–99

प्रणेता
देस राज
भूवैज्ञानिक (वरिष्ठ)

सारांश

फील्ड सत्र 1998–99 कार्यक्रम के आधार पर 20,00 वर्ग कि मी क्षेत्र में 1:10,000 पैमाने पर विस्तृत भू–रसायनिक अन्वेषण किया गया । यह क्षेत्र टोपोसीट नम्बर 41 क/4 के मांगरोल तालुका, जूनागढ़ जिले में स्थित है । इस कार्य के दौरान् लायमस्टोन के 400 नमूने 300 मी × 300 मी० ग्रिड पेटर्न पर टेप–कम्पास की सहायता से एकत्रित किए गए । अन्वेषण का मुख्य उद्देश्य गज व द्वारका शिला फारमेशन में पाए जाने वाले लायमस्टोन के गुण–चारित्र, औद्योगिक श्रेणी एवं सम्पदा आंकलन का रहा है । क्षेत्र में पाई जाने वाली सबसे पुरानी शिला डीकन बेसाल्ट है जिसे ऊपर से लेटेराइट शिला द्वारा ढक लिया गया । डीकन बेसाल्ट के ऊपर क्रमशः गज, द्वारका व मिलियोलाइट फारमेशन की परतदार शिलाएं जमा हुई । गुण चरित्र के आधार पर गज फारमेशन का वर्गीकरण दो भागों में किया गया । पहला निम्न गज इकाई सामान्यतः काफी मोटी पट्टी है जिसमें पीले रंग की मार्ल/ खड़ी व लायमस्टोन की एक पतली पट्टिका है जो करीब 0.4 मी से 1 मी मोटी है । ऊपरी गज मेम्बर में मार्ल शिला चित्तकवरे रंग की खड़ी के साथ साथ मिलती है । व साथ में मिलने वाले लायमस्टोन शिला की मोटाई करीब 0.5 मी से 7.00 मीटर तक है । गज फारमेशन को द्वारका फोरमेशन की शिलाओं द्वारा ढंक लिया गया । द्वारका फारमेशन को भी दो इकाईयों में बांटा गया है । केवल ऊपरी शिला इकाई ही क्षेत्र में उपस्थित है इसमें पाए जाने वाले लायमस्टोन का ही अन्वेषण वर्तमान में किया गया है । यह लायमस्टोन सफेद व ग्रे सफेद व ग्रे सफेद रंग का है जिसकी मोटाई 0. 2 मीटर से 0.8 मी है । कहीं कहीं लायमस्टोन में द्वितीय–द्रव्य खनिजविधी से खड्डे आदि विकसित हो गए हैं । रसायनिक विश्लेषण यह दर्शाते हैं कि 20 वर्ग कि मी क्षेत्र में पाए जाने वाला लायमस्टोन सीमेन्ट ग्रेड है । जिसकी औसत मोटाई 2.30 मीटर है । व औसत घनत्व 2.72 व सीएओ=49.36% , एमजीओ= 2.68%, एआइ– 39.94% है एवं 125.12 मिलियन टन निक्षेप आंका गया है । कहीं कहीं पर रसायनिक श्रेणी 4 व बी एफ श्रेणी 1 व 2 के लायमस्टोन क्षेत्र में विद्यमान है । क्षेत्र में पाए जाने वाले सीमेन्ट व रसायनिक ग्रेड मिलियोलाइट का काफी मात्रा में खनन् हो रहा है जिसके कारण वर्तमान में दर्शाए गए लायमस्टोन निक्षेप का उपयोग औद्योगिक उद्देश्य के लिए निकट भविष्य में शायद सम्भव नहीं हो सकेगा ।

Investigation for BF and Chemical grade limestone in Sepa and Sheriyakhan area, Mangrol Talufca, Junagadh district, Gujarat
(Progress Report for the Field season 1998-99)

By

Des Raj Geologist (Sr.),

I. INTRODUCTION

In pursuance of Item No. MlP/WR/GUJ/003 of the Field Season Programme of Geological Survey of India, Operations: Gujarat, Western Region for the field season 1998-99, investigation for B.F. and chemical grade limestone was taken up. The aim was to evaluate resource potentiality of Gaj, Dwarka and Miliolite limestones. The area was selected on the basis of analytical results of chip and groove samples collected during Field Season 1996-97. An area of 20 sq km was mapped on 1:10,000 scale. A total of 400 chip samples were collected at 300m.x300m. grid between Sepa end Sheriyakhan villages in part of toposheet 41K/4 in Junagadh district, Gujarat. The area is bounded by latitudes 21 WOO": and 21°09'00" and longitudes 70^{0}15’00": and 70°14’00”.

Location and accessibility

The area, as already stated falls in the Survey of India toposheet 41 K/4 in Junagadh district, Gujarat. The area is well connected by State Highways and also by broad gauge railway line with Ahmedabad and Veraval. Important towns are Chorwad, Veraval, and Mangrol. Chorwad is a beach resort and Somnath temple at Veraval is an important pilgrim centre of historic importance.

Physiography and drainage

The area lies along coastal region of Saurashtra peninsula. Most of the area is flat and under cultivation, except in the northern part of the area, where small hillocks expose basaltic rocks capped by laterite. Langri Nadi and Noli river originate from the inner highland and meet the Arabian sea.

Climate

The area is characterised by semi- arid coastal climate. Rainfall is restricted to monsoon, which is erratic and occurs from June to August. The average rainfall is 629 mm. July is the rainiest month and 94% of annual rain fall is received during southwest monsoon season.

Flora and fauna

The common flora of the area includes coconut, mango, tamarid, acacia and mangrove. Among the faunas jackal, cats, bats, rabbits, black bucks, mongoose, blue bull and wild bear are present.

Previous work

Fedden (1884) in the memoir on "The Geology of Kathiawar Peninsula in Gujarat" described for the first time the general geology of the area and the post-trappean formations. He divided the Tertiary rocks of Saurashtra into Gaj of Miocene, Dwarka of Pliocene (?) and Quaternary rocks like Miliolitic limestone.

Mukul, et al (1979), Banerjee and Mukhopadhya (1985) and Gartiia, et al. (1990) carried out geological mapping in the area. Gaj, Dwarka and Miliolite rocks have been given Formation status. Miliolite and overlying semi-consolidated Chaya Formation have been included within Porbander Group by Mathur, et. al.

(1980). Miliolite Formation has been subdivided into Dhobhalia Talav and Aditiana Members.

Present work

On the basis of previous work including regional sampling carried out by Roychowdhury (F.S. 1997-98) blocks of Gaj and Dwarka limestones were demarcated for the purpose of finding its suitability for BF and chemical industry. Mapping and sampling was done using tape and compass method on 1:10,000 scale in between Sheriyakhan and Sepa villages. A total of 400 groove/chip samples were collected on 300m x 300 m grid, covering an area of 20 sq.km.

Acknowledgements

Author is thankful to Shri S.S. Kanwar, Dy. Director General for encouragement in carrying out the investigation and for providing necessary facilities. He is grateful to Shri B.L. Jangi, Dy. D. G. and Shri P. K. Yadav, Director, Proj: Industrial Minerals for their valuable guidance in the field as well as during preparation of this report.

II. GEOLOGY

Deccan Trap is the oldest rock exposed in the northern part of the mapped area and is capped -by Jaterite, now exposed along the contact of Deccan Trap/Tertiaries. Tertiary rocks were deposited in shallow marine to beach environment and are represented by the rocks of Gaj formation and the Dwarka formation (Lower Miocene to Pliocene). The rocks belonging to Porbander Group, Miliolite Formation (Pleistocene) are exposed -as detached outcrops in the mapped -area.

According to the present work lithostratigraphic succession of the area mapped is as given below:

RECENT				
EARLY PLEISTOCENE	PORBANDER GROUP	MILIOLITE FORMATION		White, dirty white to, light brownish, fine to medium grained calcarenite.
LOWER TO UPPER MIOCENE		DWARKA FORMATION	UPPER DWARKA MEMBER	White to greyish, white, medium grained, cavernous and shelly limestone
LOWER MIOCENE		GAJ FORMATION	UPPER GAJ UNIT	Fine grained, hard compact yellowish, highly fossiliferous limestone
			LOWER GAJ UNIT	Clay and variegated marl with thin intercalations of fine grained, yellowish to brownish fossiliferous limestone
CRETACEOUS TO LOWER EOCENE		LATERITE		Hard, compact and red Laterite
		BASALT		Dark grey, fine grained, hard, amygdular basalt.
BASE NOT EXPOSED				

Description of the rock types

Basalt

The basaltic rocks are exposed in the northern part of mapped area, which are largely covered with soil and alluvium. However, exposures along nala courses and well sections are encountered. The rock is fine grained, black, compact, massive, at places amygdular and porphyritic in nature. Upper part of basalt is highly weathered upto 1.5m and can be easily observed in nala courses and well sections.

Laterite

The laterite body is hard, compact and red occurring along the contact of basalt and Tertiary rocks. It mainly consists of iron ore oxides. It has sharp contact with the overlying Tertiary rocks.

Gaj Formation

Deccan Trap is overlain by the rocks of Gaj Formation of Lower to Middle Miocene age, which was originally described by Fedden (1884) as Gaj bed. Gaj Formation occurs as scattered outcrops in north-eastern part of the mapped area. This formation unconformably overlies the laterite. Mapped area is flat and is mainly under cultivation. The thickness of Gaj limestone band is highly variable and often quite a thick band pinches abruptly. But, in general, thickness of Formation increases towards southwest.

The limestone generally contains very little free silica or is devoid of it. The Gaj beds are horizontal to sub-horizontal with low dip (upto 8°) to the south-west. The rocks of Gaj Formation have been subdivided on the basis of lithology into Lower and Upper Gaj Units. Lower Gaj Unit comprises of yellow to greenish grey marl and fossiliferous yellow clay intercalated with thin (0.2 - 0.8 m) bands of hard, compact, cryptocrystaliine limestone. The greenish grey clays, at places,

bear gypsum. Good sections of the above mentioned intercalated sequence can be seen in newly dug wells NW of Sheriyakhari arid SE of Lambora villages. The Upper Gaj limestone unit consists of hard, compact, crystalline limestone intercalated with thin (5-20 cm) layers of clay/marl. The limestone is mainly fine to medium grained, hard and deep yellow. Topmost part of limestone contains small grains of calcite. The thickness of this limestone unit is highly variable and often a quite thick band pinches out abruptly. An appreciated thickness of this unit (1-7m) is encountered north and northeast of Sepa in newly dug wells.

These limestones generally contain very little free silica or are almost devoid of it. The Gaj Formation is rich in marine megafossils and microfossils. Mega fossils include pelecypoda, gastropoda, cephalopoda, echinoidea, alcyonaia, decapoda and bryozoa. Earlier workers have assigned Lower Miocene age to Gaj Formation which at least is of Mid Miocene age, if not older as it contains fossils of Taberina, Malabarica and Lower to Middle Mocene foraminifera. Under thin section studies, (G/C/3-3782-84) Gaj limestone is very fine grained. However, at places crystallisation of coarse calcite is observed. Immature quartz is seen as accessory mineral. Opaque iron minerals are also present. In section (G/C/S 3777-79) Gaj shelly limestone is composed of fine to medium grained mass of shell fragments. Shell fragments are mostly crystallised to calcite. Few foraminifers and lepidocylina are seen, together with very few grains of quartz and opaque iron minerals.

Dwarka Formation

Dwarka Formation is equivalent to the Dwarka:bed of Fedden ^1884). This Formation conformably overlies the Gaj Formation. The age ranges from Middle Miocene to Pliocene. Dwarka Formation has been subdivided in to Lower, ^Middle and Upper Dwarka members by Jain and Aggarwal (1989-90). But Lower and Middle members are not exposed in the mapped area. Only Upper Dwarka member is well exposed around Sepa village and scattered outcrops occur in northeastern part of Sepa village. The limestone of Upper Dwarka member is

mainly composed of shell fragments of 0.1 to 7.0 cm size. It is often pitted due to the removal of shell fragments. The rocks are medium to coarse grained, mainly white to greyish white in colour with bedding thickness of 20-80 cm. The thickness increases towards south-west. In thin section (No.G/C/S-3780&82) limestone is mostly composed of rounded shell fragments of pelecypods with hollow cast and V cavities, test of foraminifers, bryozoans etc. and rounded grains of quartz (5-7%) with very fine-grained calcareous matter as cement. A very few grains of iron oxides are also noticed.

Miliolite Formation

A few isolated small patches of white to dirty white, fine to medium grained friable miliolitic limestone (with thickness 0.2 - 0.8m) are recorded in mapped area. The rock comprises microcrystalline calcite with rounded to sub-rounded quartz grains. The rock is devoid of mega fossils. A small patch of brownish, hard and compact limestone is noticed NW of Lambora village.

III. EXPLORATION FOR LIMESTONE

On the basis of previous work, good quality blocks of Gaj and Owarka limestone, where they are physically appeared to be suitable for B.F. and - chemical industry were demarcated. Mapping and sampling were carried out using tape and compass. Groove/chip limestone samples were collected, covering an area of_20 ^q. km. The thickness of limestone varies from 0.5 - 7 m (section measured in dug well NE of Sepa Village). The average thickness of limestone is 2 .25m. The grade of Lower Gaj and Upper Dwarka limestones is comparable to the Upper Gaj Limestone. The Upper Dwarka limestone which occurs as thin sheet over the UpperGaj limestone has been clubbed with the Gaj Limestone for reserve estimation.

Pitting and systematic groove sampling has been done for the Upper Dwarka limestone for finding out its depth continuation and far collection of samples for assessment of grade.

IV. ORE RESERVE ESTIMATION

The limestone exposures were geologically mapped using tape and compass method and sample locations were plotted. Area of the limestone has been calculated by graphical method for calculating reserves. The average thickness of limestone has been calculated by taking average of observed thickness of the exposed limestone in cliff, nala and dug well sections. Average thickness for chemical and B F grade limestone were taken from the observational points falling within such zones or nearest to the zones. The average specific gravity was determined using spring balance using. The details are given below-

Table I: Specific gravity of Upper Gaj limestone

Sl. No.	Specific gravity
1.	2.72
2.	2.78
3.	2.72
4.	2.66

Average specific gravity = 2.72

Table II: Specific gravity of Upper Dwarka limestone

Sl. No.	**Specific gravity**
1.	2.72
2.	2.66
3.	2.61
4.	2.66

5. 2.66

Average specific gravity = 2.66

Limestone in the entire 20 sq km area is of cement grade having average composition as CaO-49.36%, MgO - 2.68, A.I.-4.48%, R_2 O3 -3.45%, LOI - 39.94%. Total reserves estimated in indicated category are 125.12 million tonnes. The average thickness is 2.30m and average Sp. Gravity 2.69.

As per ISI specification out of 20sq.km. area, Isq.km. area comprising Gaj and Dwarka limestone is found suitable for chemical grade (Plate No-ll) Considering their average specific gravity as 2.70 and average thickness as 2.5m the indicated reserves are calculated as 6.75 million tonnes, having an average composition CaO - 51.63%, MgO -0.67%, Al 2.07%, R_20_3 - 2.52% and LOI 41.43%. As per ISI specification for B F _grade-l, only 2 sq. km. area of these limestones is suitable for BF grade-1 (Plate No. lll) Considering average thickness as 2.5m and specific gravity 2.70, indicated category reserves of BF. grade is 13.50 million tonnes with an average CaO 53.26%, MgO 0.89%, A I - 1.57%, R2O3 - 2.20% and LOI 41.72%. The limestone, which is mainly suitable for B F grade -II (Plate No-IV) as per ISI specification, is found to occupy 15 sq. km area and has an average thickness of 2.2m with 2.7 (rounded off) specific gravity. The calculated reserves are 91.12 million tonnes with average CaO 50.29%, MgO 2.19%, Al. 3.54%, R_2O3-3.20% and LOI 40.28%.

The table showing summary of data, area of the limestones of Gaj and Dwarka Formation, average thickness and reserves as per ISI specification of different grades is given below:

Table III

Grade	Area in sq. km.	Average thickness in Metres	Average Sp. gravity	Reserves in Million tonnes
Chemical Industry Grade IV	1.00	2.5	2.70	6.75
Flux. Grade I	2.00	2.5	2.70	13.50
Flux Grade II	15.00	2.25	2.70	91.12

The specifications of limestone used by Rourkela Steel Plant and Tata Iron & Steel Co. forB.F. are given below-

Table IV Specification for B.F. Grade

	Tata Iron & Steel Co.	Rourkela Steel Plant
CaO	47.5	44.5
$Si0_2$	5.3	10.0
R2O3	1.3	1.0
MgO	4.0	3.5

As per the specification of Tata Iron and Steel Co. 12 sq km area (Plate No.-V) of the Gaj and Dwarka limestones are suitable for the B.F. purpose. Considering average thickness as 2.25m, average specific gravity as 2.70 the reserve is calculated as 72.90 Million tonnes with average CaO - 48.75%, MgO - 2.80%, A.I. - 3.15%, R_20_3 1.09% and L.O.I. 40.33%.

According to the specification of Rourkela Steel Plant (Plate No- VI) 10 sq.km. area of the Gaj and Dwarka limestone is suitable for B.F. grade purposes. Considering average thickness as 2.40 M, average specific gravity as 2.70. The calculated reserves are 64.80 million tonnes with average CaO - 50.15%, MgO - 2.98%, A.I. 2.34%, R_20_3 3.94% and LO.I. 40.56%.

CONCLUSION AND RECOMMENDATIONS

Investigation for limestone was taken up in Sepa and Sheriyakhan areas in Junagadh district. Mapping and Sampling was done using tape and compass on 1:10,000 scale in toposheet no. 41 K/4 around Sepa and Sheriyakhan. 400 grove Ychip limestone samples were collected on 300m. x 300m. grid, covering an area of 20 sq km The oldest rocks exposed in the area are Deccan Traps: Rocks of the Gaj Formation of Lower to Middle Miocene age can be divided into two units, i. e. Lower Gaj and Upper Gaj on the basis of lithology. Lower Gaj limestone comprises of yellow, greenish grey marl and fossiliferous yellow clay intercalated with thin band (0.2m to 0 8m) of hard compact, fine grained limestone, whereas upper Gaj limestone (0.5m. to 8m thick) consists of hard, compact, yellow to buff coloured, crystalline limestone intercalated with thin layers (5 cm. to 20cm.) of clay. Gaj Formation is overlain by Upper Dwarka limestone (0.2m. to Im.thick) having shell fragments. Isolated outcrops of white to dirty white Miliolite limestone having 0.2m. to 1m. thickness overlies the above Formations These Formations are sub-horizontal (dip 5° 1o 7° southwesterly). The thickness of Gaj and Dwarka limestones increase towards southwest The limestone belonging to various Formations were sampled for assessing their grade. Ijmestone in the entire 20 sq km area is of cement grade having average composition as CaO-49.36 % MgO-2 68% A I.- 3.45%, $R_20$3-444%, LOI- 39.94% with average thickness of 2 30m average Sp Gravity 2.72 and reserves of 125.12 million tonnes of limestone. Reserves of limestone of indicated category as per different specifications are shown in the following tables:

Table V

CHEMICAL GRADE -IV, B F GRADE - I AND B F GRADE - II (ISI SPECIFICATION)

Grade	Area in sq.km.	Average thickness in Metre	Average Sp. gravity	Reserves in Million tonnes	Average composition in%	ISI Specification in%
Chemical Industry Grade -IV	1.00	2.5	270	6.75	CaO- 52.83 MgO- 0.67 A I- 2.07 R_2 Or 2.52 LOI- 41.43	CaO->50 MgO- <1 LOI- 41.43
B F Grade-1	2.00	2.5	270	13.50	CaO- 53.26 MgO- 0.89 Al- 1.57 R_2 Or 2.20 LOI- 41.72	CaO- >52 MgO- <2 AI-<2 LOI- 46
B F Grade- II	15.00	2.25		91.12	CaO- 50.29 MgO-2.19 Al- 3.54 R2O3- 3.20 LOI- 40.20	CaO- >42 MgO- =9 A I-=9 LOI- 46

Isolated outcrops of Miliollte limestone occur over Gaj and Dwarka Formations. Miiiolite limestone is used in chemical as well as in cement Industry in this area. It is of high grade (>50% CaO) with thickness 1m. to 1.5m without any over burden. It is also extensively used as building material. Though Gaj and Upper Dwarka limestones are high grade (46% to 63% CaO), presently there is no demand for Gaj and Dwarka limestones, as the local industries prefer Miiiolite, which is abundantly available in this area. Therefore, it is recommended that investigation of Gaj and Dwarka limestone is taken up on the demand of users only.

Name of the author(s)

1. Background of the investigation at whose instances or with what particular objective in view the investigation was undertaken	To identify the BF & chemical grade limestone with long extensive coastal belt of the territory limestone in the Saurashtra Peninsula
2. Whether the item of investigation was included in the approved programme for the year concerned. If so, particulars, such as item no. page reference etc. may be given	Yes. Item no. MIP/WR/GUJ/1998/003 F. S. 1998.99
3. Date of commencement of the investigation with month and year, and exact number of days spent by the officer(S) in the field in connection with the investigation	17th Dec, 1998
4. Brief comments by Director / supervisory officer of the conclusion and recommendation by the author (s) with suggestion for implementing the same	The results of the investigation are very encouraging in respect of BT and chemical grade of the limestone. However, in view of easy availability of the meliotite Lst. The present resources indentified may not be exploide immediately.
5. Please state specifically how the results of investigation were achieved compared with the objective for which it was under taken	All the objectives specified have been satisfactory achieved.

Place: Date:

Signature:
Name:
Designation

Project/ Divn.

Operation/ Region

INFORMATION SHEET FOR THE BIBLIOGRAPHY DATABASE IN UNPUBLISHED REPORTS

TITLE OF HELD	REOUIRED INFORMATION
TITL	INVESTIGATION FOR BF AND CHEMICAL GRAD LIMESTONE IN SEPA AND SHERIYAKHAN T JUNAGARD DISTRICT, GUJARAT
AUTH	DES RAJ
TDOC	Progress Report for FS 1998-1999
CONF	Classified
CORP	Western Region, Operation Gujarat
BENE	NA
DCNU	MIP/WR/GUJ/3
FSPR	1998-1999
MPRF	Toposheet no 4IK/4
ABST	An area of 20 sq. km. was mapped on 1:10.0 scale in parts of toposheet no. 4IK/4. 400 nos. of chip sample were collected on grid pattern at 300m x 300m interval with he of tape and compass. The oldest rock exposed in the area basalt which is capped by laterite. These are overlain by G Formation which is successively overlain by Dwarka Formatn and the Miliolite Formation. The Gaj Formation is divisible it. two units. Lower unit and Upper unit. Lower Gaj unit mail comprises thick sequence of

yellow marl /clay with th intercalation thin band (0.4m. to Im.), where as Upper u, comprises of (0.5m to 7m) limestone intercalations with th layer of marl and variegated clay. Dwarka Formati conformably overlies the Gaj Formation. The Dwarka Formati is also divisible into Txrwer and Upper members. Only Up member of Dwarka Formation is exposed in mapped area. Ti member mainly comprises white to greyish white shell limestc (0.2m to 0.8m thick). At places, it is recrystallised a cavernous. Limestone in the entire 20 km^2 area is of cemt grade having average grade of thickness 2.30m. Average . Gravity 2.72 and reserves 125.12 million tones.

CaO-49.36 MgO-2.68%, A. 1- 3.45%, $Rf)_3$-4.44%, I.OJ- 39.94%.

Reserve for chemical grade - IV and BF grade & 11 according to different specifications have also been calculated. However, in view of extensive mining of Miliolite limestone being used by chemical as wll as cement industries i, the area, the reserve estimated may not he find consumers

DPUB March'2001

Basic information to be incorporated/appended in the progress reports:

Number of days spent by geologists	75 mandays	
LSM 1:10,000:	20 Sq.km:	
Pitting/Trenching:	NumberNIL	Quantum:
Drilling:	Number: NIL	Quantum:
Number of samples:	l.Geochmical:	a) BRS:400
-	2.Petrological:	15
	3.Others:	NIL
Nature of Analysis	1. Mineralogical	NIL
	2. Chemical:	
	i) Spectrographic/Classical	
	ii) Wet Analyses	Radicals/Elements
		1. CaO, MgO,A l .,$R_2$03 and LOI.
	iv) Petrographic	NIL
	v) Ore microcopy	None

REFERENCE

Banerjee, A.C. and Mukhopadhya, A. 1985 Report on geological mapping in parts of toposheet nos.41K/12,41U9,L/13 & 41P/5 Junagadh and Amrell districts .Gujarat.

Choudhary.M.R. 1998 Prelimininary approriate of limestone on coastal area for selection of target for limestone suitable for S.M.S..B.F. and chemical grade.(Prog. Rep.F.S. 1997-98)

Fedden Francs 1854 Geology of Kathiawar Peninsula in Gujarat, G.SJ. Memoirs, Vol. 21.Part.-2.

Gartiia.S.S., Sbaima,V.P- andYadav.M.L. 1990 Quaternary geology and geomorphology of Mdhavpur, Veraval-Kodinar area.Junagadh district.Gujarat (Prog. Rep. F.S.1989-90).

Indian Standard 1978 ISI Specification for limestone for chemical Industry.l S:3204.

Indian Standard 1992 SI Specification of limestone for BF grade, 1 S:30304.

Jain,R.Land Aggarwal, R. K. 1990 Systematic geological mapping of Tertiary Rocks in parts of Jamnagar district Gujarat(Prog. Rep. F.S. 1989-90).

Mathur U.B. 1980 Marine Tertiary larger invertebrate Fauna of India. Geological Survey of India, Special Pub.no.11 .Vol.-ll.

Mukul, S.S. 1979 Report on the systematic geological mapping in parts of Junagadh, Rajkot and Jamnagar districts,(prog.Rep.1977-78).

Raj, D. Gandhi, P. and Prasad, J. 1997 Delineation of Cement and Chemical grade limestone in Okha Mandai Taluka, Jamnagar district, .(prog.Rep.F.S.1994-95).

Sinha, R.K. 1982 Industrial Minerals, Indian Bureau of Mines

APPENDIX -1

Chemical analysis of the Gaj limestone, Dwarka limestone -and Miliolite limestone of Sepa - Sheriyakhan area, Mangrol Taluka, Junagadh district, Gujarat.

SI. No.	Ref. No.	CaO%	MgO%	Al.%	R203%	LOI%
1	p-1	50.68	0.94	5.54	1.94	40.59
2	p-2	52.92	0.70	1.98	1.81	42.27
3	p-3	53.76	0.40	1.55	2.20	42.24
4	p-4	50.68	0.60	3.95	3.90	40.70
5	p-5	51.52	0.60	2.82	3.36	41.27
6	p-6	49.00	1.00	5.51	3.92	40.34
7	p-7	45.64	0.90	9.00	5.78	38.34
8	p-8	49.42	0.40	6.79	1.88	40.59
9	p-8B	45:63	2.40	13.08	2.04	36.54
10	p-9	49.00	1.60	5.58	5.48	38.35
11	EI-1	49.98	0.30	6.02	2.66	40.42
12	EI-2	51.94	0.50	2.78	2.29	41.77
13	EI-3	50.96	0.80	2.92	3.16	41.43
14	EI-4	50.12	1.00	3.33	3.87	41.16
15	EI-5	50.12	1.00	4.41	3.64	40.61
16	EI-6	53.65	1.06	1.45	1.97	40.70
17	EI-8B	47.60	4.80	5.42	1.61	40.25
18	EI-1A	52.20	0.80	2.62	2.92	41.24
19	EII-2B	49.54	4.20	2.66	2.45	40.94
20	EII-1	52.92	1.00	1.66	1.71	42.62
21	EII-2	49.98	0.70	4.73	3 00	40.78
22	EIl-3	39.20	2.61	20.00	3.65	32.85
23	EII-4	47.60	2.10	5.12	3.87	39.14
24	EII-5	47.60	4.10	2.86	2.77	40.65
25	EIII-6	41.30	5.50	7.00	7.65	38.25
26	EIII-1	41.30	5.00	14.01	2.92	36.48
27	EHI-2	49.70	3.22	1.69	2.50	42.87
28	EIII-3	46.20	7.41	1.66	3.92	40.64
29	EIII-4	50.40	2.87	3.45	3.02	40.40
30	EIII-5	50.40	2.04	2.64	3.07	41.00
31	EIII-5B	51.99	1.00	4.33	2.28	40.26
32	EIII-6	53.85	1.53	1.87	1.90	40.36
33	EIII-7	52.78	1.57	2.89	2.37	39.78
34	EIII-8	48.30	5.66	4.19	5.48	35.42
35	EIII-9	52.68	1.04	2.49	3.18	40.30
36	ElV-1	52.50	0.40	3.86	3.05	40.65
37	EIV-2	52.50	0.25	3.23	5.00	39.50
38	EIV-3	51.10	0.23	3.33	5.62	40.39
39	EIV-4	53.10	0.88	0.91	1.42	42.87
40	EIV-5	50.68	Tr	4.96	4.70	39.67
41	EIV-6	49.00	5.00	1.49	2.17	41.72
42	EIV-7	53.20	0.60	1.64	2.33	41.83
43	EV-1	51.52	0.20	5.10	2.38	40.51
44	EV-2	49.28	2.20	4.25	3.73	40.16
45	EV-3	50.12	1.40	4.53	3.13	40.43
46	EV-4	47.88	1.80	5.64	5.31	39.05
47	EV-5	52.36	0.40	3.54	1.92	41.36
48	EVI-3	50.68	1.00	3.50	2.98	41:60

49	EVI-2	51.24	0.80	4.00	2.31	39.67
50	EVI-3	50.68	1.40	3.49	3.33	40.74
51	EVI-4	50.40	3.00	2.61	0.87	42.86
52	EVI-5	49.00	1.90	4.57	3.55	40:65
53	EVII-1	46.20	0.60	12.27	3.00	37.50
54	EVII-2	54.04	0.20	1.57	1.51	42.32
55	EVII-3	52.92	0.20	3.12	2.48	41.06
56	EVII-4	49.56	0.20	5.85	3.85	40.20
57	EVII-5	53.48	0.60	1.56	1.37	42.12
58	EVII-6	53.20	0.40	2.51	1.49	41.94
59	EVIII-1	52.64	Trace	2.93	2.61	41.49
60	EVIII-2	53.48	Tr	2.06	2.17	41.76
61	EVIII-3	52.90	Tr	2.78	2.01	41.57
62	EVIII-4	52.64	0.20	2.58	2.76	41.36
63	EVIII-5	53.76	0.40	1.27	1.66	42.52
64	EVIII-6	50.68	0.60	6.08	1.97	40.16
65	EVIII-6B	50.80	4.50	3.61	3.54	37.34
66	EVIII-7	48.72	0.80	8.54	2.90	39.10
67	EVIII-8	51.80	0.40	4.08	2.40	40.98
68	EVIII-8B	48.51	4.77	4.05	4.54	37.07
69	WI-7	45.50	4.00	11.41	2.31	41.14
70	EIX-1	52.08	0.40	2.47	2 52	41.67
71	EIX-2	51.80	Tr	3.23	3.15	41.09
72	EIX-3	53.20	Tr	2.60	3.33	41.91
73	EIX-4	50.96	Tr	4.95	3.48	40.56
74	E1X-5	50.45	3.71	5.41	4.05	35.47
75	EIX-6	53.76	Tr	1.90	1.79	42.55
76	EIX-6B	51.80	1.60	1.60	2.38	42.09
77	EIX-7	51.24	0.60	4.24	2.41	40.64
78	EIX-8	52.92	1.40	1.46	.2.01	44.51
79	EIX-9	49.56	0.80	5.70	3.86	39.66
80	EIX-10	38.73	3.40	18.69	5.02	34,16
81	EIX-11	52.63	1.03	5.53	3.23	36.34
82	EX-1	49.70	0.60	5.90	3.65	40.70
83	EX-2	51.80	0.31	3.75	3.95	40.77
84	EX-3	47.37	2.80	4.34	3.85	40.11
85	EX-4	46.18	1.80	7.42	6.46	38.00
86	EX-5	47.37	1.20	7.99	5.57	37.85
87	EX-6	52.56	1.20	2.69	2.15	41.09
88	EX-8	46.70	2.00	2.19	4.21	40.49
89	EX-9	52.08	3.00	1.19	1.94	41.89
90	EX-10	52.36	2.20	1.19	1.62	41.84
91	EX-11	52.92	1.80	1.07	1.63	42.13
92	EX-12	53.20	1.40	1.03	1.64	42.41
93	EX-13	50.96	2.60	1.43	2.05	42.85
94	EX-14	49.28	4.00	2.18	1.76	42.26
95	EX-15	49.56	2.60	2.54	4.13	40.78
96	W-1	46.36	1.00	13.64	1.84	36.43
97	W-2	51.12	1.00	4.83	2.06	40.14
98	W-3	46.76	1.20	8.32	3.79	39.20
99	W-4	48.32	1.00	10.64	2.08	37.63
100	W-5	48.82	1.20	8.95	2.31	38.36
101	W-8	43.96	6.00	7.79	3.40	36.60
102	W-9	43.96	5.00	9.48	4.09	37.44

103	W-10	50.71	1.57	6.30	3.49	37.88
104	W-12	40.60	5.50	12.17	4.96	36.34
105	W-13	44.00	9.20	2.74	3.45	40.25
106	W-15	44.50	9.40	1.63	3.10	40.89
107	W-16	51.10	2.00	2.60	3.79	40.46
108	W-17	54.60	1.00	2.19	2.40	40.01
109	6T	45.50	3.50	8.79	2.85	38.38
110	7T	45.50	4.00	8.63	3.03	38.39
111	W-18	46.90	1.00	5.66	6.79	38.71
112	WI-1	45.50	4.00	7.85	3.17	38.86
113	39.94	38.50	3.50	21.44	4.37	32.15
114	WI-3	46.90	4.50	6.95	1.98	39.61
115	WI-4	47.00	1.00	11.60	2.85	37.52
116	WI-5	52.64	0.40	3.03	2.25	41.84
117	WI-6	44.10	3.00	8.00	6.93	37.84
118	WI-1B	46.20	4.00	4.42	7.41	38.29
119	WI-2B	48.30	1.50	4.68	7.19	37.97
120	WI-3B	45.50	2.50	7.55	6.52	35.57
121	WI-4B	41.02	1.00	15.69	6.77	41.49
122	WI-5B	52.64	Tr	2.56	3.06	36.16
123	WI-6B	54.04	0.60	1.56	1.86	39.14
124	WI-7B	45.08	0.80	13.71	4.25	41.28
125	WI-8B	36.40	4.20	15.42	10.45	33.53
126	WII-1	48.56	2.20	6.89	3.56	38.41
127	WII-2	52.11	2.00	1.45	1.74	42.55
128	WII-3	42.56	2.80	14.92	4.31	35.36
129	WII-5	50.62	0.80	5.40	3.06	39.74
130	WII-1B	46.90	3.00	6.93	3.74	38.02
131	WII-2B	49.54	4.20	2.66	2.45	40.94
132	WII-3B	53.20	0.80	1.38	2.29	41.91
133	WII-4B	22.68	0.80	33.36	19.74	23.31
134	WII-6B	51.00	2.00	2.10	3.20	41.55
135	WII-7B	53.64	Tr	1.46	2.20	42.15
136	WIII-1	52.64	1.20	2.52	1.62	41.62
137	WIII-2	52.92	0.80	1.59	2.53	41.81
138	WIII-3	53.64	0.80	1.46	2.20	42.15
139	WIII-4	52.48	2.40	1.39	1.91	41.61
140	wIII-5	47.32	2.80	5.72	4.41	39.33
141	WIII-6	51.24	3.40	1.67	2.53	41.15
142	WIII-7B	45.96	4.40	6.09	4.00	39.42
143	WIII-8B	47.88	4.80	2.25	2.49	42.04
144	WIII-9B	40.00	3.50	2.81	3.00	39.23
145	WIV-1	37.10	4.50	9.80	12.14	34.93
146	WIV-3	53.48	0.40	2.60	1.69	41.50
147	WIV-1 B	52.50	3.50	1.54	1.58	40.54
148	WIV-2B	49.24	4.72	3.15	4.54	38.13
149	WIV-3B	47.90	3.00	5.43	3.68	38.34
150	W1V-4B	51.80	3.00	2.08	2.26	39.54
151	WIV-5B	45.86	7.50	1.53	3.12	40.72
152	WIV-6B	49.30	2-00	4.00	4.64	38.85
153	WIV-7B	46.20	7.20	1.39	2.98	41.82
154	WIV-8B	48.14	4.32	4.44	4.11	37.96
155	WIV-9B	50.71	4.72	3.26	2.81	37.62
156	WIV-10B	52.16	1.86	2.73	2.03	39.51

157	WV-1	49.84	3.00	4.90	2.23	42.29
158	WV-2	46.20	5.00	3.96	2.68	41.85
159	WV-3	45.36	6.20	2.46	3.51	42.25
160	WV-4	40.40	7.80	5.70	5.67	40.11
161	WV-5	52.87	1.04	1.84	2.74	40.30
162	WV-1B	47.60	4.50	2.63	4.74	40.54
163	WV-2B	50.80	4.50	3.61	3.45	37.34
164	WV-4B	51.41	1.04	3.61	3.39	39.26
165	WV-5B	53.20	0.40	1.93	3.14	41.65
166	WV-6B	46.70	3.00	1.54	2.55	42.21
167	WV-7B	49.00	3.50	2.22	2.51	41.22
168	WV-9B	51.80	1.50	1.72	2 08	42.45
169	WVI-1	50.60	1.20	5.53	2.24	39.76
170	WVI-2	50.28	1.60	5.53	2.71	39.44
171	WVI-3	48.00	1.80	5.97	5.11	38.45
172	WVI-4	53.65	1.06	1.45	1.97	40.70
173	WVI-5	37.80	6.50	10.37	8.61	36.83
174	WVI-8	46.90	7.00	1.56	3.12	41.27
175	WVI-9	52.64	0.80	2.30	2.40	41.48
176	WVI-13	50.00	1.20	5.35	2.35	4.80
177	WVI-14	46.20	6.50	2.95	3.18	41.41
178	WV1-15	51.46	0.80	2.99	3.34	41.13
179	WVI-16	50.74	0.80	4.18	3.48	40.58
180	WVI-17	53.50	0.60	1.78	1.66	42.06
181	WV1I-1B	39.20	2.50	10.57	12.72	33.37
182	WVII-2B	53.14	2.60	3.06	2.45	38.50
183	WVII-3B	45.43	2.75	3.71	10.52	36.08
184	WV1I-4B	52.17	2.14	2.21	2.56	39 52
185	WVII-5B	53.20	0.40	1.93	3.14	41.65
186	WVI-6B	52.92	Tr	2.29	2.55	41.76
187	WVII-7B	50.80	1.00	3.27	3.00	41.00
188	WVII-8B	47.60	4.00	2.00	3.65	41.49
189	WV1I-9B	38.50	5.50	9.52	9.22	36.87
190	WVII-10B	44.80	3.50	7.74	5.13	38.26
191	WVII-11B	47.60	5.00	1.72	2.23	42.77
192	WVII-12B	52.56	0.40	1.95	3.15	41.58
193	WII-13B	49.70	5.00	1.69	2.31	41.46
194	WII-14B	50.71	4.20	2.20	3.83	38.60
195	WII-21	52.50	2.50	1.50	2.43	41.16
196	WIX-B	50.00	1.80	5.25	23.18	39.77
197	DLS-1	51.12	1.80	3.14	3.51	40.28
198	DLS-2	51.84	2.40	2.83	2.37	40.38
199	DLS-3	53.20	0.40	1.78	3.38	40.74
200	DLS-4	53.76	Tr	1.62	2.70	42.01
201	DLS-5	52.92	0.40	2.13	2.57	41.55
202	DLS-6	48.16	1.00	6.52	3.80	39.53
203	DLS-7	48.17	0.40	10.70	2.16	38.16
204	DLS-8	52.42	3.21	1.73	1.89	39.71
205	DLS-9	52.00	1.60	3.03	2.84	40.24
206	DLS-10	52.92	1.20	1.65	2.64	41.16
207	DLS-11	52.08	3.00	1.83	1.75	40.99
208	1	48.50	4.80	3.42	2.34	40.73
209	2	51.70	4.20	0.96	1.71	41.41
210	3	46.57	6.40	3.83	3.39	39.70

211	4	50.10	5-00	3.19	1.10	40.23
212	5	53.76	Tr	1.75	2.98	41.37
213	6	49.84	1.20	4.86	4.79	39.27
214	7	48.72	1.20	5.43	5.11	39.23
215	8	53.48	0.40	2.17	2.46	41.14
216	9	51.80	0.80	3.50	3.64	40.27
217	10	52.90	0.80	2.56	2.71	40.74
218	11	52.64	0.80	3.65	2.91	40.00
219	12	52.92	0.80	2.43	2.20	41.12
220	13	50.96	1.60	3.19	3.30	40.43
221	14	48.44	2.20	4.72	4.71	39.69
222	15	51.72	2.00	1.59	3.47	40.92
223	16	53.48	1.60	1.72	1.92	41.33
224	17	52.64	1.20	2.50	1.96	41.31
225	18	47.60	7.00	1.84	2.34	41.08
226	19	51.52	2.00	3.10	2.16	40.91
227	20	49.70	1.50	4 09	4.91	40.55
228	21	50.40	2.00	3.00	2.86	41.05
229	22	43.40	9.00	4.00	4.14	40.23
230	23	50.40	2.00	2.29	2.08	42.23
231	24	37.80	9.50	9.22	2.56	39.47
232	25	50.40	2.00	5.00	2.20	40.33
233	26	48.30	2.50	7.00	3.00	39.17
234	27	39.90	1.50	20.19	3.29	34.34
235	28	48.20	4.50	3.22	1.87	41.29
236	29	49.00	4.50	2.22	2.14	41.62
237	30	47.60	3.00	6.81	2.41	39.07
238	31	48.30	3.50	3.45	2.70	40.89
239	32	51.10	1.00	1.83	2.73	41.67
240	33	45.50	3.00	7.61	3.00	39.56
241	34	45.50	2.00	6.60	3.87	40.75
242	35	53.20	1.00	1.44	2.15	41.50
243	36	51.80	2.50	1.46	2.28	41.59
244	37	49.70	1.50	2.08	4.87	40.82
245	38	49.00	3.50	3.04	3.45	41.00
246	39	52.50	2.00	2.86	3.60	39.60
247	40	53.90	0.50	1.58	2.17	41.70
248	41	51.10	1.50	3.50	3.44	40.27
249	42	53.20	0.50	1.62	2.47	41.77
250	43	51.10	3.00	2.07	2.24	41.68
251	44	50.10	3.00	5.17	2.19	39.65
252	45	45.50	4.50	5.06	6.00	38.86
253	46	51.10	2.00	2.12	2.38	41.34
254	47	50.40	3.00	2.13	3.00	41.19
255	48	49.00	1.50	4.52	4.47	39.99
256	49	51.80	1.00	1.61	3.03	41.14
257	50	52.64	1.00	1.77	3.83	41.38
258	51	51.52	Trace	4.43	3.48	40.33
259	52	53.80	Tr	1.92	2.52	41.45
260	53	49.00	Tr	6.10	5.56	39.08
261	54	49.56	Tr	5.98	5.45	38.45
262	55	52.64	Tr	2.78	2.81	41.35
263	56	44.24	Tr	10.03	8.78	36.60
264	57	52.08	Tr	2.92	2.71	41.89

265	58	53.66	Tr	2.20	2.93	41.08
266	59	52.64	Tr	1.54	4.16	41.35
267	60	52.64	Tr	4.25	1.30	41.36
268	61	50.12	Tr	5.23	4.40	39.76
269	62	51.59	0.40	2.91	3.19	41.06
270	63	51.94	0 80	3.05	3.20	40.74
271	64	50.40	2.60	4.00	3.26	39.59
272	65	50.68	3.00	2.88	4.13	38.93
273	66	52.92	3.30	1.08	2.11	40.27
274	67	52.00	4.40	1.78	2.11	40.27
275	68	51.68	4.70	1.64	2.37	40.34
276	69	49.84	2.70	4.82	2.90	39.46
277	70	48.72	4.00	3.68	4.10	39.27
278	71	50.12	5.20	1.12	2.32	40.88
279	72	48.16	7.20	1.43	1.95	40.88
280	73	38.64	7.20	10.79	8.04	36.04
281	74	43.12	9.50	5.28	2.59	39.01
282	75	43.96	10.00	4.22	2.47	38.98
283	76	41.60	9.50	9.00	2.34	38.28
284	77	42.70	8.50	8.36	2.63	37.58
285	78	50.00	7.10	1.29	1.64	40.59
286	79	47.64	8.30	1.66	1.70	40.27
287	0.8	51.10	2.00	2.42	2.75	40.99
288	81	50.40	4.00	2.43	2.01	40.60
289	82	52.50	2.50	1.26	2.69	40.16
290	83	49.00	3.00	2.50	4.30	41.12
291	84	49.00	4.00	1.34	3.46	41.45
292	85	SS	I	M	I	NG
293	86	44.10	4.30	4.06	6.64	39.90
294	87	46.20	4.50	2.82	6.38	40.33
295	88	46.90	2.50	4.57	6.06	39.90
296	89	49.00	2.50	4.06	5.46	39.01
297	90	50.40	1.00	2.53	4.10	41.35
298	91	44.10	7.00	1.83	3.68	41.93
299	92	46.90	5.50	3.17	2.15	41.35
300	93	50.40	5.00	1.97	3.16	39.39
301	94	51.10	1.50	1.75	3.47	42.05
302	95	52.50	1.50	1.45	3.87	40.87
303	96	51.80	2.00	1.46	3.87	40.61
304	97	51.80	1.80	2.72	2.80	40.51
305	98	51.24	2.00	3.34	3.53	40.72
306	99	51.24	2.00	2.64	3.53	40.46
307	100	51.52	3.50	1.77	2.06	40.82
308	101	49.28	5.40	1.43	2.55	40.94
309	102	48.16	5.50	1.43	3.08	41.51
310	103	44.32	5.00	5.04	6.33	38.85
311	104	43.00	5.00	12.23	2.88	36.72
312	105	46.36	5.64	4.02	2.25	40.60
313	106	49.71	3.50	2.89	3.06	39.61
314	107	52.50	2.10	2.10	9.08	39.78
	AVERAGE	49.21	2.68	4.44	3.46	39.83

APPENDIX-II

LIMESTONE SAMPLES FOR CHEMICAL GRADE AS PER AS ISI SPECIFICATION

SI. No.	Ref. No	CaO%	MgO%	Al%	R203%	LOI%
1	P-2	52.92	0.70	1.98	1.98	42.27
2	P-3	53.76	0.40	1.55	2.20	42.24
3	P-5	51.52	0.60	2.82	3.36	41.27
4	EI-2	51.94	0.50	2.78	2.29	41.77
5	EI-3	50.96	0.80	2.92	3.16	41.43
6	EI-6	53.65	1.06	1.45	1.97	40.70
7	EI-1A	52.20	0.80	2.62	2.92	41.24
8	EI-1A	52.20	0 80	2.62	2.92	41.24
9	EIII-9	52.68	1.04	2.49	3.18	40.30
10	EIV-4	53.10	0.88	0.91	1.42	42.87
11	EIV-7	53.20	0.60	1.64	2.33	41.83
12	EVII-2	54.04	0 20	1.57	1.51	42.32
13	EVII-5	53.48	0.60	1.56	1.37	42.12
14	EVII-6	53.20	0.40	2.51	1.49	41.94
15	EVIII-4	52.64	0.20	2.58	2.76	41.36
16	EVIII-5	53 76	0 40	1.27	1.66	42.52
17	EIX-1	52.08	0.40	2.47	2.52	41.67
18	W-17	54.60	1.00	2.19	2.40	40.01
19	WI-5	52.64	0.40	3.03	2.25	41.84
20	WI-6B	54.04	0.60	1.56	1.86	39.14
21	WII-3B	53.20	0.80	1.38	2.29	41.91
22	WIII-2	52.92	0.80	1.59	2.53	41.81
23	WIII-3	53.64	0.80	1.46	2.20	42.15
24	WIV-3	53.48	0.40	2.60	1.69	41.50
25	WV-5	52 87	1.04	1.84	2.74	40.30
26	WV-5B	53.20	0.40	1.93	3.14	41.65
27	WVI-4	53.65	1.06	1.45	1.97	40.70
28	WVI-9	52.64	0.80	2.30	2.40	41.48
29	WVI-15	51.46	0.80	2.99	3.34	41.13
30	WVI-17	53.50	0.60	1.78	1.66	42.06
31	WV1I-5B	53.20	0.40	1.93	3.14	41.65
32	WVII-12B	52.56	0.40	1.95	3.15	41.58
33	DLS-3	53.20	0.40	1.78	3.38	40.74
34	DLS-5	52.92	0.40	2.13	2.57	41.55
35	8	53.48	0.40	2.17	2.46	41.14
36	10	52.90	0.80	2.56	2.71	40.74
37	12	52.92	0.80	2.43	2.20	41.12
38	32	51.10	1.00	1.83	2.73	41.67
39	35	53.20	1.00	1.44	2.15	41.50
40	40	53.90	0.50	1.58	2.17	41.70
41	42	53.20	0.50	1.62	2.47	41.77
42	49	51.80	1.00	1.61	3.03	41.14
43	50	52.64	1.00	1.77	3.83	41.38
44	62	51 59	0.40	2.91	3.19	41.06
45	63	51.94	0.80	3.05	3.20	40.74
46	90	50 40	1 00	2.53	4.10	41.35
	Average	52.83	0.67	2.07	2.52	41.43

APPENDIX-III

LIMESTONE SAMPLES FOR FLUX GRADE-I AS PER IS SPECIFICATION

SI. No.	Ref. No.	CaO%	MgO%	A.l.%	R2O3%	LOI%
1	P-2	52.92	0.70	1.98	1.81	42.27
2	P-3	53.76	0.40	1.55	2.20	42.24
3	EI-6	53.65	1.06	1.45	1.97	40.70
4	EII-1	52.92	1.00	1.66	1.71	42.62
5	EIII-6	53.85	1.53	1.87	1.90	40.36
6	EIV-4	53.10	0.88	0.91	1.42	42.87
7	EIV-7	53.20	0.60	1.64	2.33	41.83
8	EVII-2	54.04	0.20	1.57	1.51	42.32
9	EVII-5	53.48	0.60	1.56	1.37	42.12
10	EVIII-5	53.76	0.40	1.27	1.66	42.52
11	EIX-8	52.92	1.40	1.46	2.01	44.51
12	EX-11	52.92	1.80	1.07	1.63	42.13
13	EX-12	53.20	1.40	1.03	1.64	42.41
14	WI-6B	54.04	0.60	1.56	1.86	39.14
15	WII-2	52.11	2.00	1.45	1.74	42.55
16	WII-3B	53.20	0.80	1.38	2.29	41.91
17	WII-2	52.92	0.80	1.59	2.53	41.81
18	WIII-3	53.64	0.80	1.46	2.20	42.15
19	WV-5	52.87	1.04	1.84	2.74	40.30
20	WV-5B	53.20	0.40	1.93	3.14	41.65
21	WVI-4	53.65	1.06	1.45	1.97	40.70
22	WVI-17	53.50	0.60	1.78	1.66	42.06
23	WVII-5B	53.20	0.40	1.93	3.14	41.65
24	WVII-12B	52.56	0.40	1.95	3.15	41.58
25	DLS-3	53.20	0.40	1.78	3.38	40.74
26	DLS-10	52.92	1.20	1.65	2.64	41.16
27	16	53.48	1.60	1.72	1.92	41.33
28	35	53.20	1.00	1.44	2.15	41.50
29	40	53.90	0.50	1.58	2.17	41.70
30	42	53.20	0.50	1.62	2.47	41.77
31	95	52.50	1.50	1.45	3.87	40.87
	Average	53.26	0.89	1.57	2.20	41.72

APPENDIX-IV

LIMESTONE SAMPLES FOR FLUX GRADE-II AS PER ISI SPECIFICATION

SI. No.	Ref. No.	CaO%	MgO%	A.l.%	R2O3%	LOI%
1	P-1	50.68	0.94	5.54	1.94	40.59
2	P-2	52.92	0.70	1.98	1.81	42.27
3	P-3	53.76	0.40	1.55	2.20	42.24
4	P-4	50.68	0.60	3.95	3.90	40.70
5	P-5	51.52	0.60	2.82	3.36	41.27
6	P-6	49.00	1.00	5.51	3.92	40.34
7	P-7	45.64	0.90	9.00	5.78	38.34
8	p-8	49.42	0.40	6.79	1.88	40.59
9	P-9	49.00	1.60	5.58	5.48	38.35
10	EI-1	49.98	0.30	6.02	2.66	40.42
11	EI-2	51.94	0.50	2.78	2.29	41.77
12	EI-3	50.96	0.80	2.92	3.16	41.43
13	EI-4	50.12	1.00	3.33	3.87	41.16
14	EI-5	50.12	1.00	4.41	3.64	40.61
15	EI-6	53.65	1.06	1.45	1.97	40.70
16	EI-8B	47.60	4.80	5.42	1.61	40.25
17	EI-1A	52.20	0.80	2.62	2.92	41.24
18	EII-2B	49.54	4.20	2.66	2.45	40.94
19	EII-1	52.92	1.00	1.66	1.71	42.62
20	EII-2	49.98	0.70	4.73	3.00	40.78
21	EII-4	47.60	2.10	5.12	3.87	39.14
22	EII-5	47.60	4.10	2.86	2.77	40.65
23	EIII-2	49.70	3.22	1.69	2.50	42.87
24	EIII-3	46.20	7.41	1.66	3.92	40.64
25	EIII-4	50.40	2.87	3.45	3.02	40.40
26	EIII-5	50.40	2.04	2.64	3.07	41.00
27	EIII-5B	51.99	1.00	4.33	2.28	40.26
28	ElII-6	53.85	1.53	1.87	1.90	40.36
29	EIII-7	52.78	1.57	2.89	2.37	39.78
30	EIII-8	48.30	5.66	4.19	5.48	35.42
31	EIII-9	52.68	1.04	2.49	3.18	40.30
32	EIV-1	52.50	0.40	3.86	3.05	40.65
33	EIV-2	52.50	0.25	3.23	5.00	39.50
34	EIV-3	51.10	0.23	3.33	5.62	40.39
35	EIV-4	53.10	0.88	0.91	1.42	42.87
36	EIV-6	49.00	5.00	1.49	2.17	41.72
37	EIV-7	53.20	0.60	1.64	2.33	41.83
38	EV-1	51.52	0.20	5.10	2.38	40.51
39	EV-2	49.28	2.20	4.25	3.73	40.16 .
40	EV-3	50.12	1.40	4.53	3.13	40.43
41	EV-4	47.88	1.80	5.64	5.31	39.05
42	EV-5	52.36	0.40	3.54	1.92	41.36
43	EVI-1	50.68	1.00	3.50	2.98	41.60
44	EVI-2	51.24	0.80	4.00	2.31	39.67
45	EVI-3	50.68	1.40	3.49	3.33	40.74
46	EVI-4	50.40	3.00	2.61	0.87	42.86
47	EVI-5	49.00	1.90	4.57	3.55	40.65
48	EVII-2	54.04	0.20	1.57	1.51	42.32
49	EVII-3	52.92	0.20	3.12	2.48	41.06
50	EVII-4	49.56	0.20	5.85	3.85	40.20
51	EVII-5	53.48	0.60	1.56	1.37	42.12
52	EVII-6	53.20	0.40	2.51	1.49	41.94

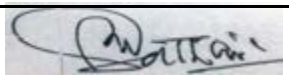
53	EVIII-4	52.64	0.20	2.58	2.76	41.36
54	EVHI-5	53.76	0.40	1.27	1.66	42.52
55	EVIII-6	50.68	0.60	6.08	1.97	40.16
56	EVIII-6B	50.80	4.50	3.61	3.54	37.34
57	EVIII-7	48.72	0.80	8.54	2.90	39.10
58	EVIII-8	51.80	0.40	4.08	2.40	40.98
59	EVIII-8B	48.51	4.77	4.05	4.54	37.07
60	EIX-1	52.08	0.40	2.47	2.52	41.67
61	EIX-5	50.45	3.71	5.41	4.05	35.44
62	EIX-6B	51.80	1.60	1.80	2.38	42.09
63	EIX-7	51.24	0.60	4.24	2.41	40.64
64	EIX-8	52.92	1.40	1.46	2.01	44.51
65	EIX-9	49.56	0.80	5.70	3.86	39.66
66	EIX-11	52.63	1.03	5.53	3.23	36.34
67	EX-1	49.70	0.60	5.90	3.65	40.70
68	EX-2	51.80	0.31	3.75	3.95	40.77
69	EX-3	47.37	2.80	4.34	3.85	40.11
70	EX-4	46.18	1.80	7.42	6.46	38.00
71	EX-5	47.37	1.20	7.99	5.57	37.85
72	EX-6	52.56	1.20	2.69	2.15	41.09
73	EX-8	46.70	2.00	2.19	4.21	40.49
74	EX-9	52.08	3.00	1.19	1.94	41.89
75	EX-10	52.36	2.20	1.19	1.62	41.84
76	EX-11	52.92	1.80	1.07	1.63	42.13
77	EX-12	53.20	1.40	1.03	1.64	42.41
78	EX-13	50.96	2.60	0.07	2.05	42.85
79	EX-14	49.28	4.00	2.18	1.76	42.26
80	EX-15	49.56	2.60	2.54	4.13	40.78
81	W-2	51.12	1.00	4.83	2.06	40.14
82	W-3	46.76	1.20	8.32	3.79	39.20
83	W-5	48.82	1.20	8.95	2.31	38.36
84	W-8	43.96	6.00	7.79	3.40	38.60
85	W-10	50.71	1.57	6.30	3.49	37.88
86	W-16	51.10	2.00	2.60	3.79	40.46
87	W-17	54.60	1.00	2.19	2.40	40.01
88	6T	45.50	3.50	8.79	2.85	38.38
89	7T	45.50	4.00	8.63	3.03	38.39
90	W-18	46.90	1.00	5.66	6.79	38.71
91	WI-1	45.50	4.00	7.85	3.17	38.86
92	WI-3	46.90	4.50	6.95	1.98	39.61
93	WI-5	52.64	0.40	3.03	2.25	41.84
94	WI-6	44.10	3.00	8.00	6.93	37.84
95	WI-1B	46.20	4.00	4.42	7.41	38.29
96	WI-2B	46.30	1.50	4.68	7.19	37.97
97	WI-3B	45.50	2.50	7.55	6.52	35.57
98	WI-6B	54.04	0.60	1.56	1.86	39.14
99	WII-1	48.56	2.20	6.89	3.56	38.41
100	WII-2	52.11	2.00	1.45	1.74	42.55
101	WII-5	50.62	0.80	5.40	3.06	39.74
102	WII-1 B	46.90	3.00	6.93	3.74	38.02
103	WII-2B	49.54	4.20	2.66	2.45	40.94
104	WII-3B	53.20	0.80	1.38	2.29	41.91
105	WII-6B	51.00	2.00	2.10	3.20	41.55
106	WIII-1	52.64	1.20	2.52	1.62	41.62
107	WIII-2	52.92	0.80	1.59	2.53	41.81
108	WIII-3	53.64	0.80	1.46	2.20	42.15

109	WIII-4	52.48	2.40	1.39	1.91	41.61
110	WIII-5	47.32	2.80	5.72	4.41	39.33
111	WIII-6	51.24	3.40	1.67	2.53	41.15
112	WIII-7	45.96	4.40	6.09	4.00	39.42
113	WIII-8	47.88	4.80	2.25	2.49	42.04
114	WIII-9	49.00	3.50	2.81	3.00	39.23
115	WIV-3	53.48	0.40	2.60	1.69	41.50
116	WIV-1B	52.50	3.50	1.54	1.58	40.54
117	WIV-2B	49.24	4.72	3.15	4.54	38.13
118	WIV-3B	47.90	3.00	5.43	3.68	38.34
119	WIV-4B	51.80	3.00	2.08	2.26	39.54
120	WIV-5B	45.86	7.50	1.53	3.12	40.72
121	WIV-6B	49.30	2.00	4.00	4.64	38.85
122	WIV-7B	46.20	7.20	1.39	2.98	41.82
123	WIV-8B	48.14	4.32	4.44	4.11	37.96
124	WIV-9B	50.71	4.72	3.26	2.81	37.62
125	WIV-10B	52.16	1.86	2.73	2.03	39.51
126	WV-1	49.84	3.00	4.90	2.23	42.29
127	WV-2	46.20	5.00	3.96	2.68	41.85
128	VW-3	45.36	6.20	2.46	3.51	42.25
129	WV-5	52.87	1.04	1.84	2.74	40.30
130	WV-6	47.60	4.50	2.63	4.74	40.54
131	WV-2B	50.80	4.50	3.61	3.45	37.34
132	WV-4B	51.41	1.04	3.61	3.39	39.26
133	WV-5B	53.20	0.40	1.93	3.14	41.65
134	WV-6B	46.70	3.00	1.54	2.55	42.21
135	WV-7B	49.00	3.50	2.22	2.51	41.22
136	WV-9B	51.80	1.50	1.72	2.08	42.45
137	WVI-1	50.60	1.20	5.53	2.24	39.76
138	WVI-2	50.28	1.60	5.53	2.71	39.44
139	WVI-3	48.00	1.80	5.97	5.11	38.45
140	WVI-4	53.65	1.06	1.45	1.97	40.70
141	WVI-8	46.90	7.00	1.56	3.12	41.27
142	WVI-9	52.64	0.80	2.30	2.40	41.48
143	WVI-13	50.00	1.20	5.35	2.35	4.80
144	WVI-14	46.20	6.50	2.95	3.18	41.41
145	WVI-15	51.46	0.80	2.99	3.34	41.13
146	WVI-16	50.74	0.80	4.18	3.48	40.58
147	WVI-17	53.50	0.60	1.78	1.66	42.06
148	WVII-2B	53.14	2.60	3.06	2.45	38.50
149	WVII-3B	45.43	2.75	3.71	10.52	36.08
150	WVII-4B	52.17	2.14	2.21	2.56	39.52
151	WVII-5B	53.20	0.40	1.93	3.14	41.65
152	WVII-7B	50.80	1.00	3.27	3.00	41.00
153	WVII-8B	47.60	4.00	2.00	3.65	41.49
154	WVII-10B	44.80	3.50	7.74	5.13	38.26
155	WVII-11B	47.60	5.00	1.72	2.23	42.77
156	WVII-12B	52.56	0.40	1.95	3.15	41.58
157	WVII-13B	49.70	5.00	1.69	2.31	41.46
158	WVII-14B	50.71	4.20	2.20	3.83	38.60
159	WIX-21	52.50	2.50	1.50	2.43	41.16

160	ll-B	50.00	1.80	5.25	23.18	39.77
161	DLS-1	51.12	1.80	3.14	3.51	40.28
162	DLS-2	51.84	2.40	2.83	2.37	40.38
163	DLS-3	53.20	0.40	1.78	3.38	40.74
164	DLS-5	52.92	0.40	2.13	2.57	41.55
165	DLS-6	48.16	1.00	6.52	3.80	39.53
166	DLS-8	52.42	3.21	1.73	1.89	39.71
167	DLS-9	52.00	1.60	3.03	2.84	40.24
168	DLS-10	52.92	1.20	1.65	2.64	41.16
169	DLS-11	52.08	3.00	1.83	1.75	40.99
170	1	48.50	4.80	3.42	2.34	40.73
171	2	51.70	4.20	0.96	1.71	41.41
172	3	46.57	6.40	3.83	3.39	39.70
173	4	50.10	5.00	3.19	1.10	40.23
174	6	49.84	1.20	4.86	4.79	39.27
175	7	48.72	1.20	5.43	5.11	.39.23
176	8	53.48	0.40	2.17	2.46	41.14
177	9	51.80	0.80	3.50	3.64	40.27
178	10	52.90	0.80	2.56	2.71	40.74
179	11	52.64	0.80	3.65	2.91	40.00
180	12	52.92	0.80	2.43	2.20	41.12
181	13	50.96	1.60	3.19	3.30	40.43
182	14	48.44	2.20	4.72	4.71	39.69
183	15	51.72	2.00	1.59	3.47	40.92
184	16	53.48	1.60	1.72	1.92	41.33
185	17	52.64	1.20	2.50	1.96	41.31
186	18	47.60	7.00	1.84	2.34	41.08
187	19	51.52	2.00	3.10	2.16	40.91
188	20	49.70	1.50	4.09	4.91	40.55
189	21	50.40	2.00	3.00	2.86	41.05
190	22	43.40	9.00	4.00	4.14	40.23
191	23	50.40	2.00	2.29	2.08	42.23
192	25	50.40	2.00	5.00	2.20	40.33
193	26	48.30	2.50	7.00	3.00	39.17
194	28	48.20	4.50	3.22	1.87	41.29
195	29	49.00	4.50	2.22	2.14	41.62
196	30	47.60	3.00	6.81	2.41	39.07
197	31	48.30	3.50	3.45.	2.70	40.89
198	32	51.10	1.00	1.83	2.73	41.67
199	33	45.50	3.00	7.61	3.00	39.56
200	34	45.50	2.00	6.60	3.87	40.75
201	35	53.20	1.00	1.44	2.15	41.50
202	36	51.80	2.50	1.46	2.28	41.59
203	37	49.70	1.50	2.08	4.87	40.82
204	38	49.00	3.50	3.04	3.45	41.00
205	39	52.50	2.00	2.86	3.60	39.60
206	40	53.90	0.50	1.58	2.17	41.70
207	41	51.10	1.50	3.50	3.44	40.27
208	42	53.20	0.50	1.62	2.47	41.77
209	43	51.10	3.00	2.07	2.24	41.68
210	44	50.10	3.00	5.17	2.19	39.65
211	45	45.50	4.50	5.06	6.00	38.86
212	46	51.10	2.00	2.12	2.38	41.34
213	47	50.40	3.00	2.13	3.00	41.19
214	48	49.00	1.50	4.52	4.47	39.99
215	49	51.80	1.00	1.61	3.03	41.14

216	62	51.59	0.40	2.91	3.19	41.06
217	63	51.94	0.80	3.05	3.20	40.74
218	64	50.40	2.60	4.00	3.26	39.59
219	65	50.68	3.00	2.88	4.13	38.93
220	66	52.92	3.30	1.08	2.11	40.27
221	67	52.00	4.40	1.78	2.11	40.27
222	68	51.68	4.70	1.64	2.37	40.34
223	69	49.84	2.70	4.82	2.90	39.46
224	70	48.72	4.00	3.68	4.10	39.27
225	71	50.12	5.20	1.12	2.32	40.88
226	72	48.16	7.20	1.43	1.95	40.88
227	77	42.70	8.50	8.36	2.63	37.58
228	78	50.00	7.10	1.29	1.64	40.59
229	79	47.64	8.30	1.66	1.70	40.27
230	80	51.10	2.00	2.42	2.75	40.99
231	81	50.40	4.00	2.43	2.01	40.60
232	82	52.50	2.50	1.26	2.69	40.16
233	83	49.00	3.00	2.50	4.30	41.12
234	84	49.00	4.00	1.34	3.46	41.45
235	86	44.10	4.50	4.06	6.64	39.90
236	87	46.20	4.50	2.82	6.38	40.33
237	88	46.90	2.50	4.57	6.06	39.90
238	89	49.00	2.50	4.06	5.46	39.01
239	90	50.40	1.00	2.53	4.10	41.35
240	91	44.10	7.00	1.83	3.68	41.93
241	92	46.90	5.50	3.17	2.15	41.35
242	93	50.40	5.00	1.97	3.16	39.39
243	94	51.10	1.50	1.75	3.47	42.05
244	95	52.50	1.50	1.45	3.87	40.87
245	96	51.80	2.00	1.46	3.87	40.61
246	97	51.80	1.80	2.72	2.80	40.51
247	98	51.24	2.00	3.34	3.53	40.72
248	99	51.24	2.00	2.64	3.53	40.46
249	100	51.52	3.50	1.77	2.06	40.82
250	101	49.28	5.40	1.43	2.55	40.94
251	102	48.16	5.50	1.43	3.08	41.51
252	103	44.32	5.00	5.04	6.33	38.85
253	106	49.71	3.50	2.89	3.06	39.61
254	107	52.50	2.10	2.10	9.08	39.78
	Average	50.14	2.45	3.40	3.24	40.27

FIVE POINT PERFORMA

Name of the author(s)	
1. Background of the investigation at whose instances or with what particular objective in view the investigation was undertaken	To identify the BF & chemical grade limestone with long extensive coastal belt of the territory limestone in the Saurashtra Peninsula
2. Whether the item of investigation was included in the approved programme for the year concerned. If so, particulars, such as item no. page reference etc. may be given	Yes. Item no. MIP/WR/ GUJ/1998/003 F. S. 1998.99
3. Date of commencement of the investigation with month and year, and exact number of days spent by the officer(S) in the field in connection with the investigation	17th Dec, 1998
4. Brief comments by Director / supervisory officer of the conclusion and recommendation by the author (s) with suggestion for implementing the same	The results of the investigation are very encouraging in respect of BT and chemical grade of the limestone. However, in view of easy availability of the meliotite Lst. The present resources indentified may not be exploide immediately.
5. Please state specifically how the results of investigation were achieved compared with the objective for which it was under taken	All the objectives specified have been satisfactory achieved.
Place: Date:	Signature:  Name: R.C. Gothamia Designation: Director Project/ Divn. Proj.Eco.Geol. Operation/ Region

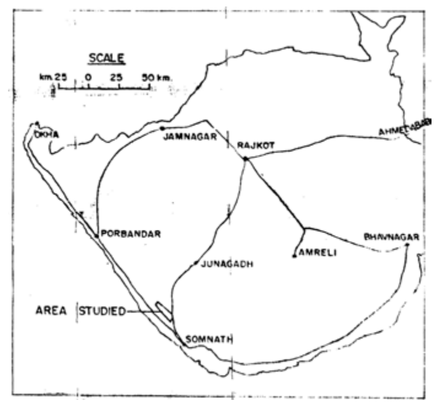
GEOLOGICAL SURVEY OF INDIA

GEOLOGICAL MAP OF SEPA - SHERIYA KHAN AREA MANGROL TALUKA, JUNAGADH DISTRICT, GUJARAT

(Part of Toposheet no. 41k/4)

0 200 400 600 Metre

N



INDEX

RECENT	Recent		Alluvium
EARLY PLESTOCENE	Miliolite Limestone		Wiite to dirty white, light brownish, fine to medium grained calcarenite
LOWER TO UPPER MIOCENE	Upper Dwarka		White to greyish, white, Medium grained, Cavernous and Shelly limestone
LOWER MIOCENE	Upper Gaj		Fine grained, hard compact, yellowish, highly fossiliferous limestone
	Lower Gaj		Fine grained, yellowish to brownish fossiliferous thin limestone,intercalated with clay and variegated marl
LOWER EOCENE TO CRETACEOUS	Deccan trap		Laterite
			Basalt
			Inferred contact
			Contact Observed
		6	Bedding
			Joints
			Road
			Location of sample; on surface, dugwell

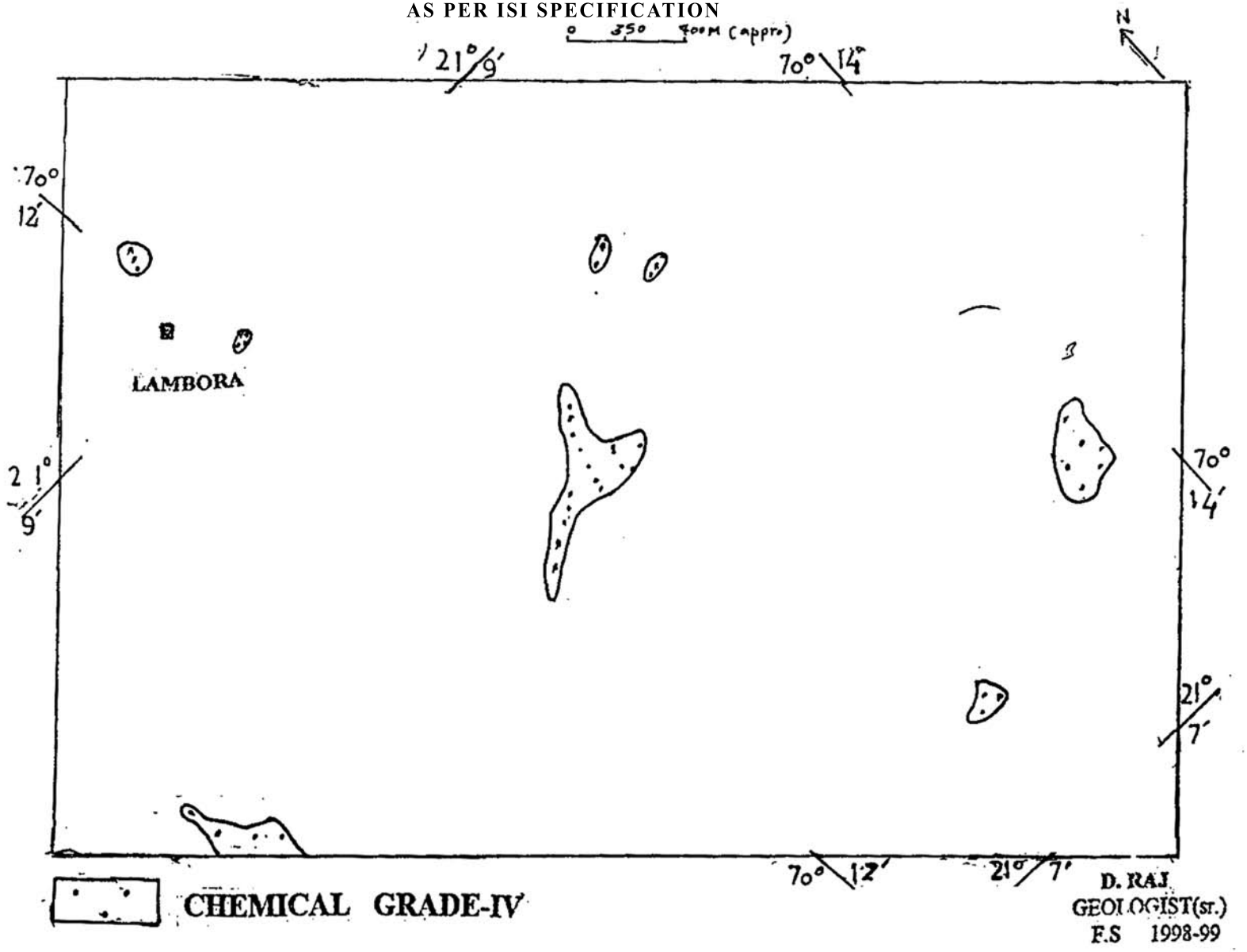
G.S.I. O.P. GUJ. D.O. NO. 27/99

Des Raj Geologist (Sr.)
F.S. 1998-99

GEOLOGICAL SURVEY OF INDIA

MAP OF SEPA-SHERIYAKHAN AREA, TALUKA MANGROL, JUNAGADH DISTRICT, SHOWING ZONES OF CHEMICAL GRADE-IV LIMESTONE AS PER ISI SPECIFICATION

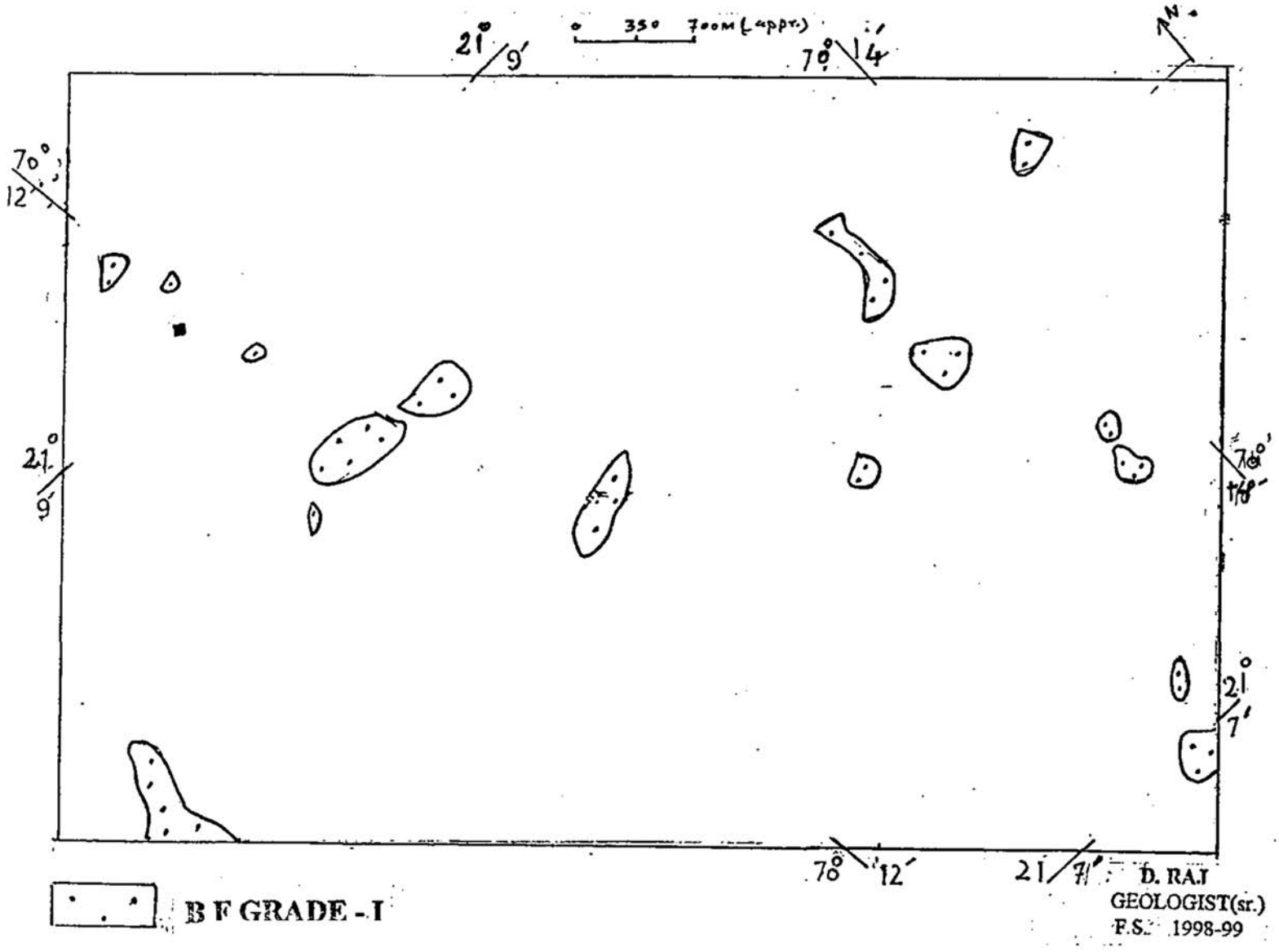
PL-II



GEOLOGICAL SURVEY OF INDIA

MAP OF SEPA-SHERIYAKHAN AREA, TALUKA MANGROL, JUNAGADH DISTRICT, SHOWING ZONES OF BF GRADE-I LIMESTONE AS PER ISI SPECIFICATION

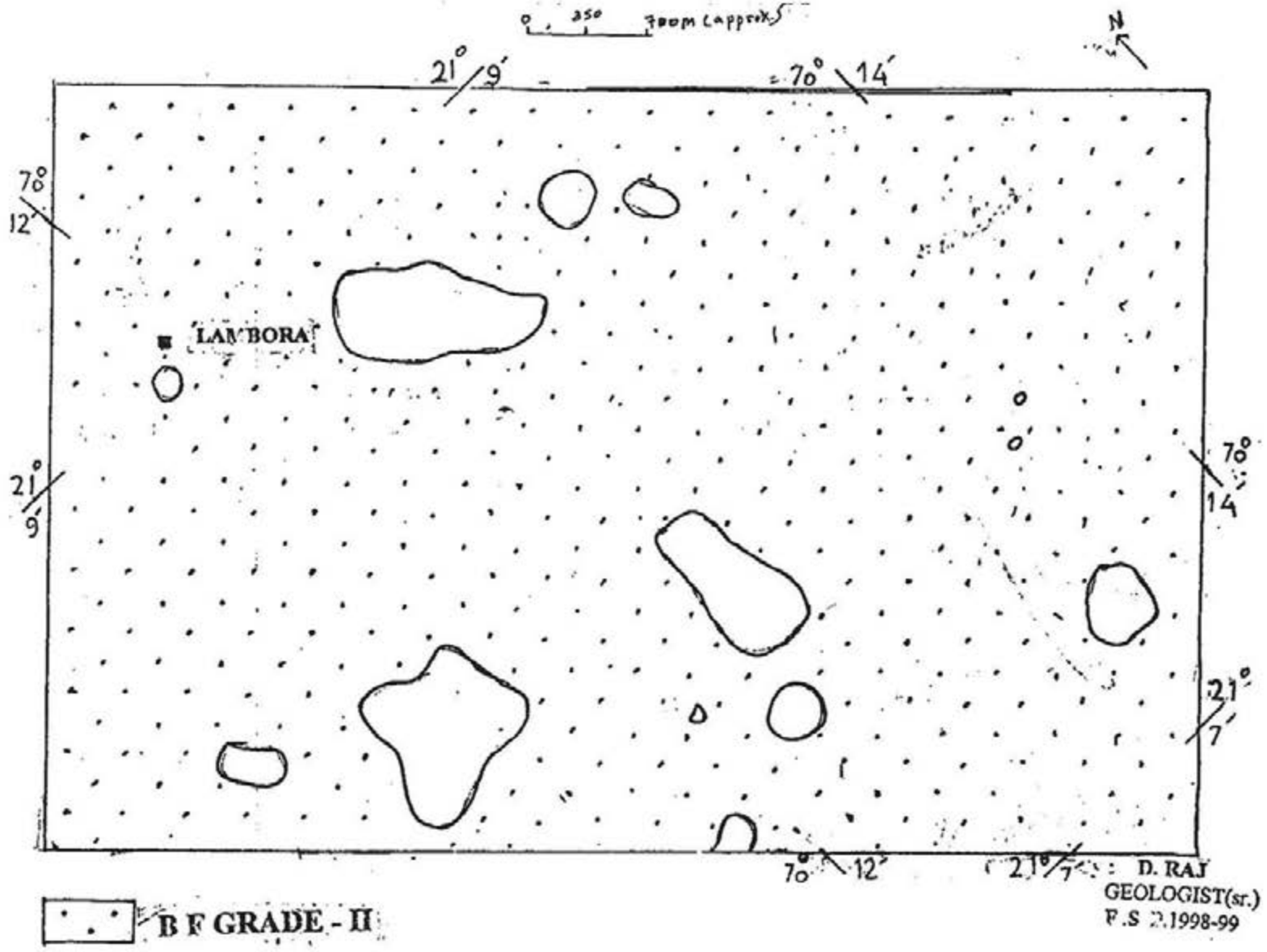
PL-III



GEOLOGICAL SURVEY OF INDIA

MAP OF SEPA-SHERIYAKHAN AREA, TALUKA MANGROL, JUNAGADH DISTRICT, SHOWING ZONES OF BF GRADE-II LIMESTONE AS PER ISI SPECIFICATION

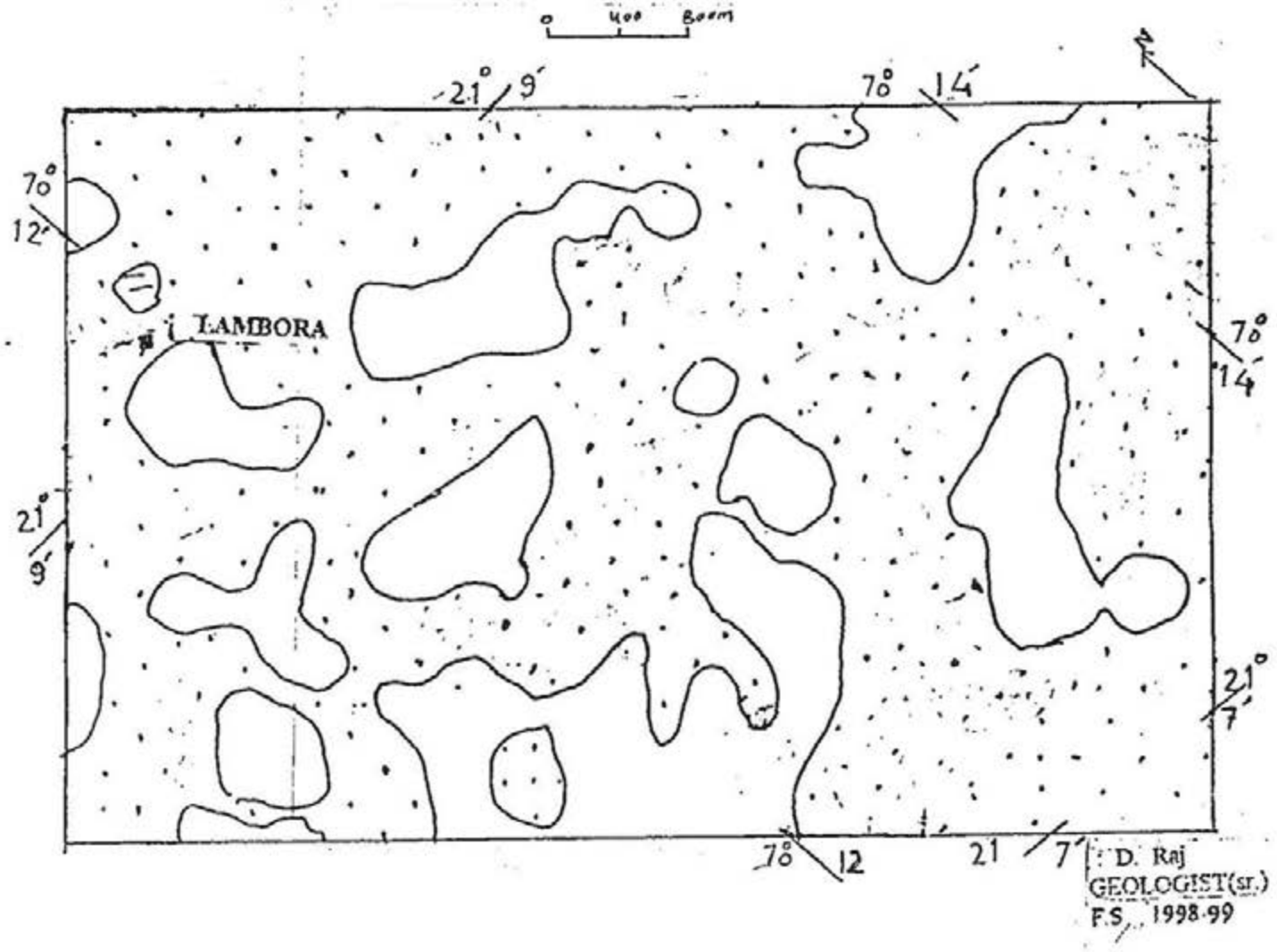
PL - IV



PL- V

GEOLOGICAL SURVEY OF INDIA

MAP OF SEPA - SHERIYAKHAN AREA, TALUKA MANGROL, JUNAGADH DISTRICT, SHOWING ZONES OF B F GRADE LIMESTONE AS PER TATA STEEL SPECIFICATION



MAP OF SEPA-SHERIYAKHAN AREA, TALUKA MANGROL, JUNAGADH DISTRICT, SHOWING ZONES OF BF GRADE LIMESTONE AS PER HINDUSTAN STEEL ROURKELA PLANT SPECIFICATION.

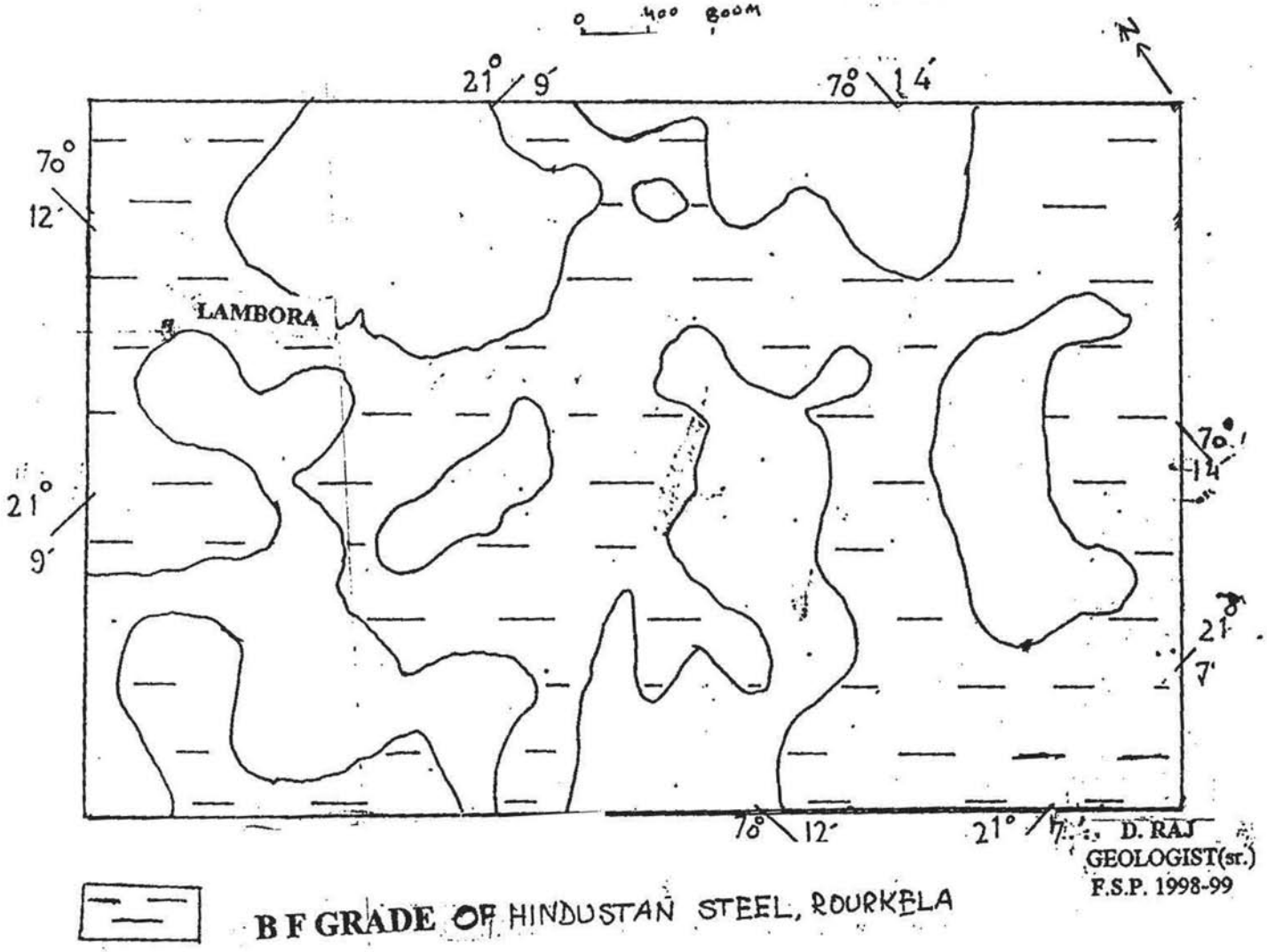
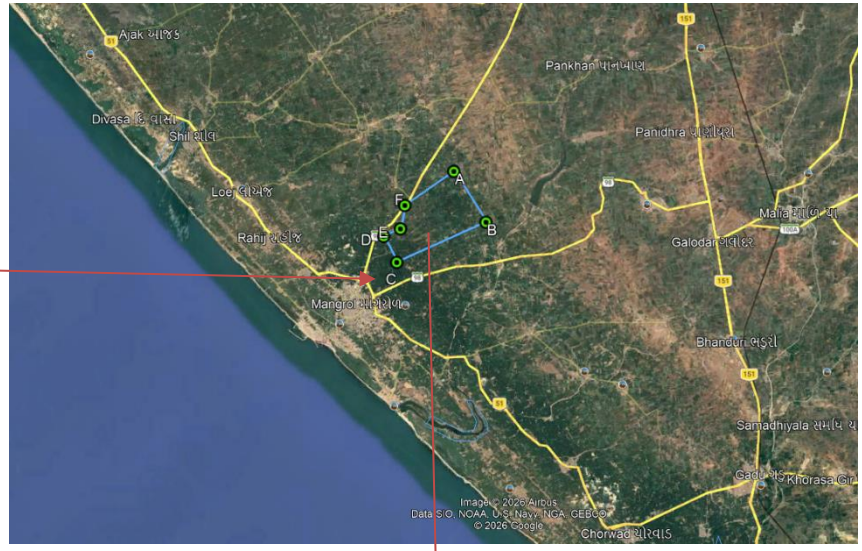


PLATE – I: Location Map

Gujarat

Junagadh



Proposed Mankhetra Block

PLATE – II: Satellite Image Map of Mankhetra Block

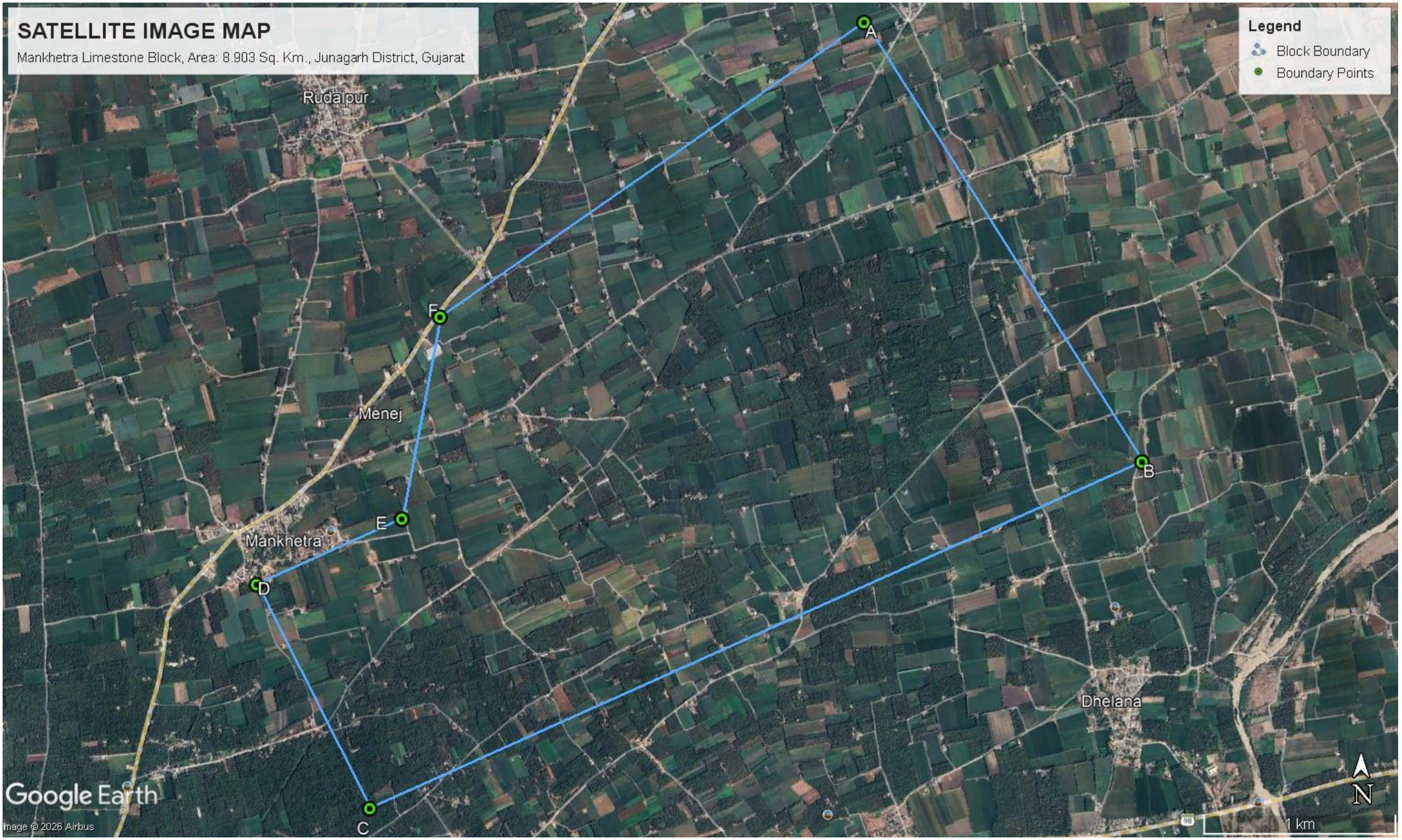


PLATE – III: Proposed Mankhetra Block Superimposed on Toposheet No. 41K/04

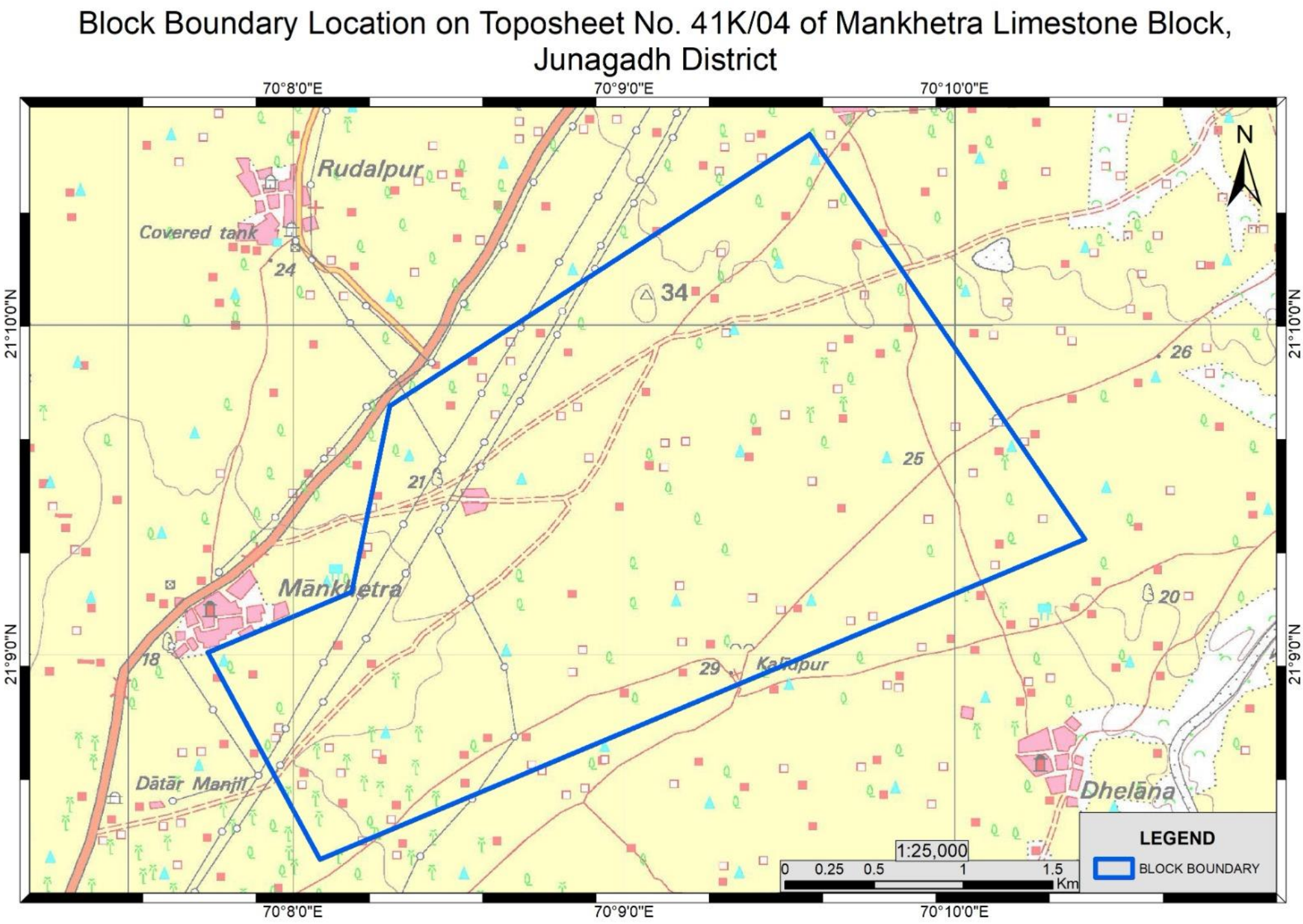


PLATE – IV: Proposed Mankhetra Block Superimposed on Geological Map

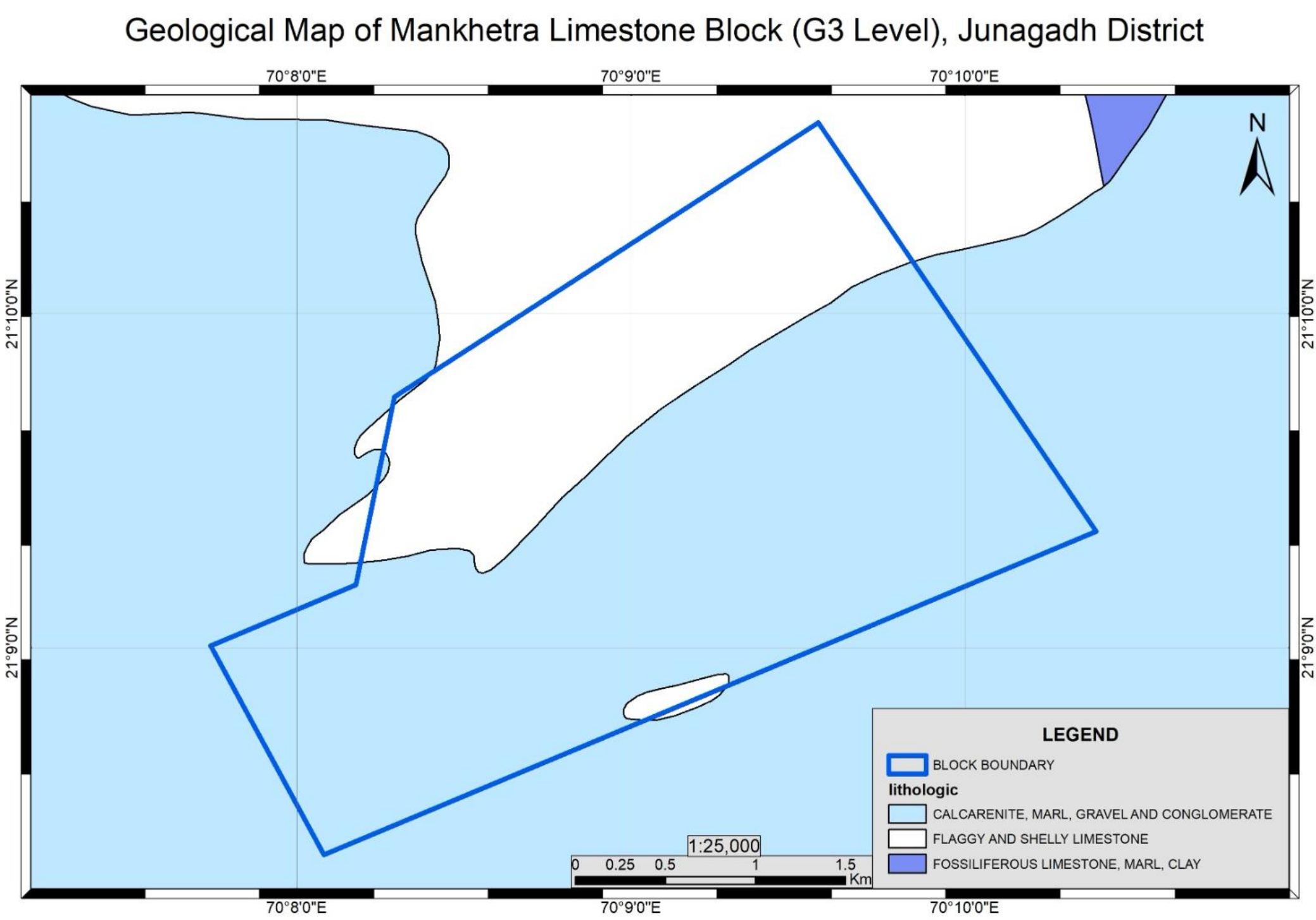


PLATE – V: Proposed Boreholes Plan