Proposal for Limestone in Vayor Block, Kachchh District, Gujarat State for G3 Stage Mineral Exploration under NMET.

Commodity: Limestone

By

Commissioner of Geology and Mining
Gujarat

Place: Gandhinagar **Date: 16 January 2024**

Summary of the Block for G3 stage exploration

	Features	Details		
	Block ID	CGM/NMET/BP/2024/02		
	Current Exploration Agency	CGM, Gujarat		
	G4 stage Geological Report (Previous stage Geological Report)	GSI report no.:WRO-11626 & WRO-13796		
	Commodity	Limestone		
	Mineral Belt	Khari nadi Formation & Gaj Formation		
	Completion Period with entire Time schedule to complete the project	6 months		
	Objectives	To assess the mineral resource of Limestone mineral at G3 stage in the proposed study area.		
	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	The work will be carried out through outsourcing.		
	Name/ Number of Geoscientists	Geologist: 1 (Field) + 1(HQ)		
	Expected Field days (Geology, Geophysics, Surveyor)	45 days: Field Geologist 20 days: Surveyor		
1.	**Location**			
	Co-ordinates (Latitude, Longitude) of Block Boundary	**Block corner points**	**Latitude**	**Longitude**
		1	23° 24' 23.46"	68° 39' 37.41"
		2	23° 26' 23.91"	68° 40' 41.33"
		3	23° 25' 05.46"	68° 43' 18.25"
		4	23° 22' 53.19"	68° 41' 01.89"
	Villages	Vayor,Vagoth,Padhdhar, Ukir,Karamta		
	Tehsil/ Taluk	Lakhpat		
	District	Kachchh		
	State	Gujarat		
2.	**Area (hectares/ square kilometres)**			
	Block Area	2068 hectares		
	Forest Area	NA		
	Government Land Area	NA		
	Private Land Area	NA		
3.	**Accessibility**			
	Nearest Rail Head	Naliya railway station – 22.00 km		

	Road	Nearest road-NH 41
	Airport	Bhuj airport – 98 km
4.	**Hydrography**	
	Local Surface Drainage Pattern (Channels)	Sub-parallel
	Rivers/ Streams	In study area no major river is present. Small waterbody is present in the area.
5.	**Climate**	
	Mean Annual Rainfall	below 450 mm
	Temperatures (December) (Minimum) Temperatures (June) (Maximum)	Minimum – 7° C Maximum – 47° C
6.	**Topography**	
	Toposheet Number	41A11
	Morphology of the Area	The area is generally flat and maximum area is covered by agricultural and barren fields. The block area depicts plain with gentle slope towards coast(south-west). The elevation of the area ranges from 35m to 62m above mean sea level.
7	**Availability of baseline geoscience data**	Plate-1
	Geological Map	
	Geochemical Map	Not available
	Geophysical Map (Aerogeophysical, Ground geophysical, Regional as well as local scale GP maps)	Not available
8.	**Justification for taking up G3 stage mineral exploration**	• The block is proposed based on the geology of the area and sample collection during current year field season. • Several lease areas are also present in the north direction of the proposed block which testify the limestone prospectivity of this block. • GSI also mapped geological formation on the scale of 1:50000 and upon completing chemical analysis, the collected rock samples during current year field season revealed an average CaO content of 43.06%.

		• CGM officials found that the Geological data and Chemical analysis result of this area is very promising and recommended for the further Limestone studies. Thus, the block is suggested for G3 level of exploration. • In order to fillful the demand of Limestone Mineral in cement industries, our organization is planning for ML directly, which will expedite the auction process & as a result of which state will get more royalty income as well as industries will get profit.

Detailed description:

1. **Block Summary**

Physiography

The study area is located in the Lakhpat taluka, Kachchh district in the western region of Gujarat. The area under investigation is a western plain, these plains are mainly composed of recent alluvium, wind-blown sands covering the Tertiary strata. These plains gradually merge into mudflats of Rann of Kutch. The topography of the study area is mostly undulating. There is no major river in the area. The area is mostly drained by numerous streams and nallas which are seasonal in nature and mostly remain dry in summer.

Background Geology (Regional Geology & Geology of the Block).

Kachchh, located in western Gujarat, is renowned for its intricate geological history. The stratigraphy of Kutch mainly comprises rocks ranging in age from middle Jurassics to Recent. Major part of the Kutch mainland is occupied by the Mesozoic sediments and Deccan Trap rocks. Tertiary sediments occupy the coastal strips of the mainland bordering Mesozoic sediments and Deccan traps. The study area falls in the western part of Kutch mainland where Tertiary sequence is developed and Tertiary rocks overlie unconformably the basaltic rocks belonging to Deccan traps. Lithologically, the proposed area comprises Gaj formation and Khari nadi formation's Limestone rock. limestone occurs as stratiform deposit and the Nummulitic limestone is associated with the alluvium, sand, clay, basalt, marl, and shale of the area.

The general stratigraphic succession of the region is as follows:

Age	**Formation**	**Lithology**
Holocene	Rann Formation	Rann clay and deposits
	Jantral Formation	Unstabilized sand sheet and sand dune deposit
Lower Pleistocene	Kothara Formation	Pebbly sandstone, conglomerate gravel and sand
Pliocene	Sandhan Formation	Micaceous sandstone, siltstone, conglomerate and calcareous clay with marl
Lower to Middle Miocene	Gaj Formation	Shale interbedded with fossiliferous limestone and marl
Upper Oligocene to Lower Miocene	Khari Nadi Formation	Variegated siltstone and gypseous claystone
Middle to Upper Oligocene	Maniyara Fort Formation	Calcareous and gypseous claystone/siltstone, clay, coral limestone and sandstone
Middle Eocene	Fulra Formation	Foraminiferal limestone, glauconitic shale and clay

Lower Eocene	Kakdi Nadi Formation		Gypseous, lignite- bearing shale, fossiliferous nodular limestone and clay, ferruginous shale and clay with intercalated marl
Palaeocene	Matanomadh Formation		Laterite, sandstone, conglomerate and bentonitic and kaolinitic clay
Upper Cretaceous to Eocene	Deccan Volcanics	Extrusive	Andesitic trachyte
		Intrusive	Olivine gabbro, basalt and dolerite dyke
		Extrusive	Basalt flows with intertrappean sediments
Cretaceous	Bhuj Formation		Glauconitic and burrowed sandstone, siltstone, shale, limestone, marl, conglomerate, ironstone and clay with marine and plant fossil
Upper Jurassic to Lower Cretaceous	Katrol Formation		Shale, fossiliferous sandstone, marl and conglomerate
Middle to Upper Jurassic	Chari Formation		Gypseous shale, siltstone and conglomerate with phosphatic nodule, oolitic limestone
Middle Jurassic	Pachchham Formation		Gypseous shale, siltstone, limestone, sandstone and conglomerate

The stratigraphic sequence of the proposed block area is as follows:

Lithounits	**Age**
Alluvium/surface soil	Recent to Holocene
Limestone	Tertiary
Marlite	Tertiary

Gaj Formation

The Gaj Formation unconformably rests on the palaeocene sediments. It consists of variegated clays, fossiliferous limestone, gypseous shale and bentonitic clays. These are mostly horizontal with a low dip towards south-southwest. The lowermost member is a variegated clay showing tinges of white, yellow, red and brown. The next succeeding member is a brownish to yellowish coloured hard and compact fossiliferous limestone carrying lamellibranches, gastropods and echinoderms. Shales are grey to dark grey in colour with small scattered flakes of gypsum. It carries thin intercalations of calcareous sandstone and argillaceous limestone. Discontinuous

lenses of bentonitic clays showing imperfect layering are found towards the top of this formation. The Gaj Formation belongs to the shallow water marine argillaceous facies.

Khari Nadi Formation

This formation consists of variegated to mottled silt stones, gray to khaki shales and clays, micaceous siltstones with intervening fossiliferous marlite bands, comman fossils being turritella and Variety of oysters. The lower contact of the formation is kept below the bluish grey claystone overlying the spiroclypcus limestone of Maniyara Fort Formation. Major part of this formation is poorly fossiliferous. Few lamellibranchs mostly oysters, gastropods like turritella and few echinoidsare commonly found in the marlite/limestone bands seen in this formation.

Soil and Alluvium

Major portion of the area is covered with soil or alluvium. This can be divided as the type formed due to weathering of limestone and the type formed due to deposition of clays brought by wind. The soil formed due to weathering of limestone is regur soil and wind deposit sediment is brownish color in nature.

Mineral potentiality based on geology, geophysics, ground geochemistry etc.

It was noted that the Khari Nadi Formation exposed as outcrops in the area of investigation. It is exposed on the surface in forms of low mounds of limestone.

Limestone rock of this area are horizontal to sub horizontal and may not have undergone any tight folding.

The limestone found is mostly dirty creamy white coloured and the rock is hard and compact. The texture of rock is mostly fine to medium grained at times ranging into coarse grade also. At some places current beddings are also observed. In this limestone deposit the thickness is variable due to its topography.

Scope for proposed exploration

1. Location:- Village: Vayor, Vagoth, Padhdhar, Ukir, Karamta, Tehsil: Lakhpat, District: Kachchh, State: Gujarat.
2. Quantum of work: The approximate core drilling work is 750 meters.
3. Rock formations to be drilled: Various types of soil, sub-soil, Limestone, clay, etc.
4. The boreholes shall be in depth range of approximately 25 m. However, this is indicative only and may vary as per actual geological conditions.
5. Type of Drilling: Core drilling by Hydraulic Drilling Rigs.
6. Borehole size: The holes shall be derived in NQ sizes.
7. The core recovery in all the formation should be at least 90% except in fault zone, weathered zone, soil, sand and structurally disturbed area

8. CGM will provide proposed borehole location plan of all the areas to be covered under exploration.
9. Sampling: There will be one mineral/rock sample for every 1-meter run. Each sample should be cut by core splitter. Each run shall be marked properly by plastic cards and the core boxes shall be numbered properly. Each sample shall be reduced to an approximate quantity by following the standard sampling procedures such as homogenizing, coning, quartering and pulverizing into 100/200 mesh and be prepared into two packets of 100-200 gm each. The final sample pockets shall be properly labelled with BH number, sample run.

Recommendations of G4 Stage Mineral Exploration Report.

G. Vijayasarathi, Geological Survey of India (Field season-1982-83) has done the geological mapping of the toposheet no. 41 A/10, 41 A/11 & 41 A/15. An area of about 430 sq Km was mapped on 1:50000 scale in the western part of Kutch district, mainly comprising of Tertiary rocks. In the geological map, limestone is depicted by the geologist.

G. Vijayasarathi & A.B. Sabale, Geological Survey of India (Field season-1983-84) has done the geological mapping of the toposheet no. 41A/10, 41A/11 & 41A/15.

Objectives of Exploration

- To know the continuity of the mineral body both along the strike and dip.
- To map the extent of the ore body.
- To ascertain the grade of Limestone deposit.
- Ore resource/reserve estimation in accordance with MEMC Rule-2015

2. Previous Work

Previous Exploration in proposed block area as well as adjoining area: All the sample (bed rock/trench/ groove/soil), borehole location should be plotted on the geological map and analytical data should be discussed briefly

Ultratech Cement mining lease is 1200 meters in north direction away from proposed block. These lease areas surrounding of the proposed block which testify the limestone prospectivity of this block.

Previously Geological survey of india conducted a geological mapping on 1:50000, revealing the geological potential for limestone in the area.

CGM officials has also carried out field in current year survey of the proposed area and taken grab samples 15 Nos and done the chemical analysis of that samples. So chemical analysis also suggests that good quality limestone present in the study area, it was recommended to more sampling of the area. Chemical analysis data is given as per Annexure-1.

3. Block description

Block corner points	Latitude	Longitude
1	23° 24’ 23.46”	68° 39’ 37.41”
2	23° 26’ 23.91”	68° 40’ 41.33”
3	23° 25’ 05.46”	68° 43' 18.25"
4	23° 22' 53.19"	68° 41' 01.89"

4. Planned Methodology

- The drilling for Limestone is to be carried out on the grid pattern of 800 x 800 meters as the deposit is of irregular habit, for G3 stage as per MEMC, 2015.
- The drilling will be carried out with the help of hydraulic drilling rigs.
- The depth for each borehole is set to be 25 meters or depending on the encountered mineralized zone.
- As it is bedded deposit so the drilling will be vertical.
- The Blocks boundary shall be surveyed by DGPS in WGS-84 datum for demarcation of block boundary/corner points.
- Boreholes will be fixed on the ground whose RL’s and co-ordinates of survey and exploration points will be determined.

5. Nature Quantum and Target

Components	G3
Aerial reconnaissance	NA
Geological Survey	NA
Scout drilling / Systematic drilling Only Systematic drilling	Refer below
Petrographic and mineragraphic studies	Bulk density/Specific Gravity studies
Synthesis of all available data	i) Integration of regional/ detailed geophysical, geological and geochemical data, if not done earlier. ii) Synthesis of all available data and Report writing

Borehole spacing (As per MEMC, 2015)

Type of deposit	**Bedded Stratiform and Tabular deposit of regular habit (Minerals to be identified)**	**Bedded stratiform and tabular deposits of irregular habit (Minerals to be identified)**	**Lenticular bodies occurring en echelon Lenses, pockets. (Different minerals)**
G3 Stage	800 m	Not applicable	Not applicable
	(Vertical depth of intersection of mineralised zone for different level boreholes should be specified, number of boreholes (first, second, third), borehole spacing, approximate length of different level of boreholes may also be specified)		

6. Exploratory Drilling

- The boreholes shall be in depth range of approximately 25 m. However, this is indicative only and may vary as per actual geological conditions.
- Type of Drilling: Core drilling by Hydraulic Drilling Rigs.
- Borehole size: The holes shall be derived in in NQ sizes.
- While drilling, wherever water table is encountered, depth of the water table should be recorded and to be mentioned in the driller logs.
- The core recovery in all the formation should be at least 90% except in fault zone, weathered zone, soil, sand and structurally disturbed area

7. Manpower deployment

Sl. No.	Activities	Unit	MONTHS					
			1	2	3	4	5	6
1	Camp Setting	Month						
2	Surface Drilling (3 rigs)	m.						
3	Survey Party days (1 Party)	day						
4	Geologist Party days in field (1 Party)	day						
5	Sampling Party days, Core Sampling (1 party)	day						
6	Laboratory Studies	Nos.						
7	Camp Winding	Month						
8	Geologist Party days in HQ (1 Party)	day						
9	Geological Report Writing with Peer Review	Month						

Note: 1. Commencement of project may be reckoned from the day the exploration acreage is available along with all statutory clearances.

2. Time loss on account of monsoon/agricultural activity/forest clearance/local law & order problem may be additional to above time line.

8. Break-up of expenditure

The cost has been estimated based on actual schedule of rates mandated in the circularOM No. 61/1/2018/NMET dated 31st March 2020 for NMET funded projects which is **Rs. 166.27 Lakhs.** The detailed cost sheet for G-3 exploration for Limestone in proposed Vayor Block is given below:

SL. NO.	Item	Estimated Cost (Rs.)
1	Drilling	**3981500**
2	Geology and Survey	**814000**
3	Laboratory	**8262375**
	Sub Total (1 to 3)	**13057875**
4	Exploration Report	**652894**
5	Proposal Preparation	**380000**
	Total	**14090769**
	GST 18%	2536339
	Grand Total (including GST)	**16627108**
	Say Rs. In Lakhs	**166.27**

9. References

- "Report on Geological mapping of the Tertiary rocks of Kachchh district, Gujarat" by G. Vijayasarathi & A.B. Sabale (1985), Ahmedabad, Geological Survey of India, Gujarat circle- western region.
- "Report on Geological mapping of the Tertiary rocks of Kachchh district, Gujarat" by G. Vijayasarathi (1984), Ahmedabad, Geological Survey of India, Gujarat circle-western region.
- Bhukosh (www.gsi.gov.in)
- Tertiary Stratigraphy of Kutch by S.K. Biswas (1992)

List of Annexures

Annexure-1: Chemical analysis data of collected samples
Annexure-2: Cost Estimation Sheet

List of Plates

Plate 1: Proposed block boundary over existing Geological map.
Plate 2: Proposed Borehole Location Map.
Plate 3: Proposed block boundary over topographic map.

Chemical analysis data **Annexure-1**

Sr.No.	Latitude	Longitude	SiO2 (%)	Al2O3 (%)	Fe2O3 (%)	TiO2 (%)	CaO (%)	MgO (%)	Na2O (%)	K2O (%)	P2O5 (%)	SO3 (%)	LOI	Total
1	23°24'02"	68°40'57"	6.1	2.07	10.83	0.18	43.99	0.59	0.07	0.26	0.17	0.09	34.76	99.11
2	23°23'59"	68°40'48"	6.3	1.1	9.35	0.1	47.03	0.51	0	0.19	0.28	0.12	34.03	99.01
3	23°23'52.8"	68°41'11.5"	16.71	3.69	9.19	0.38	41.44	0.74	0.12	0.53	0.13	0.07	26.29	99.29
4	23°23'51"	68°41'07"	12.1	3.35	19.02	0.27	35.72	0.87	0.1	0.45	0.37	0	26.82	99.07
5	23°23'53"	68°41'07"	20.58	2.42	9.73	0.3	41.5	0.57	0.11	0.34	0.12	0.07	23.44	99.18
6	23°24'04"	68°40'33"	13.57	4.45	2.44	0.16	41.51	1.15	0.06	0.19	0.08	0.02	36.25	99.88
7	23°23'52"	68°40'34"	9.5	2.15	9.16	0.18	43.3	0.66	0.09	0.22	0.4	0.1	33.37	99.13
8	23°23'50"	68°40'32"	6.95	1.9	8.23	0.17	46.12	0.49	0.08	0.21	0.35	0.09	34.52	99.11
9	23°24'00"	68°40'33"	4.58	1.24	2.16	0.06	50.89	0.62	0.06	0.08	0.03	0.02	40.51	100.23
10	23°24'30"	68°41'46"	14.56	3.54	6.4	0.38	43.27	0.55	0.11	0.57	0.05	0.07	29.89	99.39
11	23°24'31"	68°41'41"	11.43	1.99	2.22	0.1	45.91	0.68	0.05	0.1	0.07	0.02	36.68	99.26
12	23°24'55"	68°41'17"	7.87	3.24	6.5	0.19	34.26	7.42	0.12	0.42	0.05	0.12	39.37	99.56
13	23°24'55"	68°41'56"	11.19	3.36	11.37	0.31	40.57	0.74	0.1	0.48	0.13	0.07	31.18	99.5
14	23°24'4"	68°40'33"	9.84	5.05	3.53	0.32	42.84	0.67	0.12	0.61	0.06	0.05	36.67	99.76
15	23°25'13"	68°42'9"	5.41	2.26	2.34	0.19	47.65	1	0.13	0.2	0.04	0.09	40.49	99.8

Cost Estimate for Exploration of Limestone in Vayor Block, Kachchh Annexure-2											
SL. N0.	**Item of Work**	**Unit**	**Base**	**Financial Year (2023-24)**			**Financial Year (24-25)**			**Total**	
			Rate	**Esc.Rate**	**Qty.**	**Amount**	**Esc.Rate**	**Qty.**	**Amount**	**Qty**	**Amount**
			1.4.90	**(Rs)**		**(Rs)**					**(Rs)**
A	**DRILLING**										
1	Surface Drilling (3 Rigs)	m.		5242	750	3931500	0	0	0	750	**3931500**
2	Transportation	Km.		36	0	0	0	0	0	0	**0**
3	Accomodation	One time / Drill		50000	1	50000	0	0	0	1	**50000**
4	Camp Setting / Winding	Drill/ month		250000	0	0	0	0	0	0	**0**
5	Road Making (Hilly Terrain)	Km		0	0	0	0	0	0	0	**0**
	Sub Total A					**3981500**			**0**		**3981500**
B	**GEOLOGICAL WORK**										
1	Survey Party Days (1 party)	day		8300	20	166000	0	0	0	20	**166000**
2	Geologist Party days (1 party)	day		11000	45	495000	0	0	0	45	**495000**
3	Core Sampling Party days(1 party)	day		5100	30	153000	0	0	0	30	**153000**
	Sub-Total B					**814000**			**0**		**814000**
C	**LABORATORY STUDIES**										
a	**Chemical Analysis**										
1	Primary + Check Samples										
	i) for 6 radicals (CaO,MgO,Al_2O_3, SiO_2,Fe_2O_3 & LOI)	Nos		2841	750	2130750	2831	0	0	750	**2130750**
	ii) External Check Samples for 6 radicals (CaO,MgO,Al2O3, SiO2,Fe2O3 & LOI)	Nos		2841	75	213075	2831	0	0	75	**213075**

	iii) For additional 2 Radicals SO3 & P2O5	Nos		670	0	0	1067	0	0	0	**0**
2	Composite Samples										
	i) for 12 radicals (CaO, MgO, Al_2O_3, SiO_2, Fe_2O_3, SO_3, P_2O_5, Mn_2O_3, TiO_2, K_2O, Na_2O & LOI,)	Nos		4851	750	3638250	5304	0	0	750	**3638250**
b	**Physical Analysis**										
1	X-RD Studies on composite	Nos		4000	75	300000	6184	0	0	75	**300000**
2	Spectroscopic Studies	Nos		24360	75	1827000	6568	0	0	75	**1827000**
3	Preparation of thin section	Nos		2353	5	11765	588	0	0	5	**11765**
4	Petrographic Studies	Nos		4232	5	21160	1552	0	0	5	**21160**
5	Specific Gravity determination	Nos		1605	75	120375	206	0	0	75	**120375**
	Sub-Total C					**8262375**			**0**		**8262375**
	Total A+B+C					**13057875**			**0**		**13057875**
D	**EXPLORATION REPORT -**								**652893.75**		**652894**
E	**PROPOSAL PREPARATION -**					**380000**			**380000**		**380000**
	GRAND TOTAL A to D					**13057875**			**652893.75**		**14090769**
						Total				**Say 140.90 lakhs**	

Vayor Limestone Drilling Scheme - (VLDS), Kachchh District, Gujarat.

N

0 0.5 1 2 KM

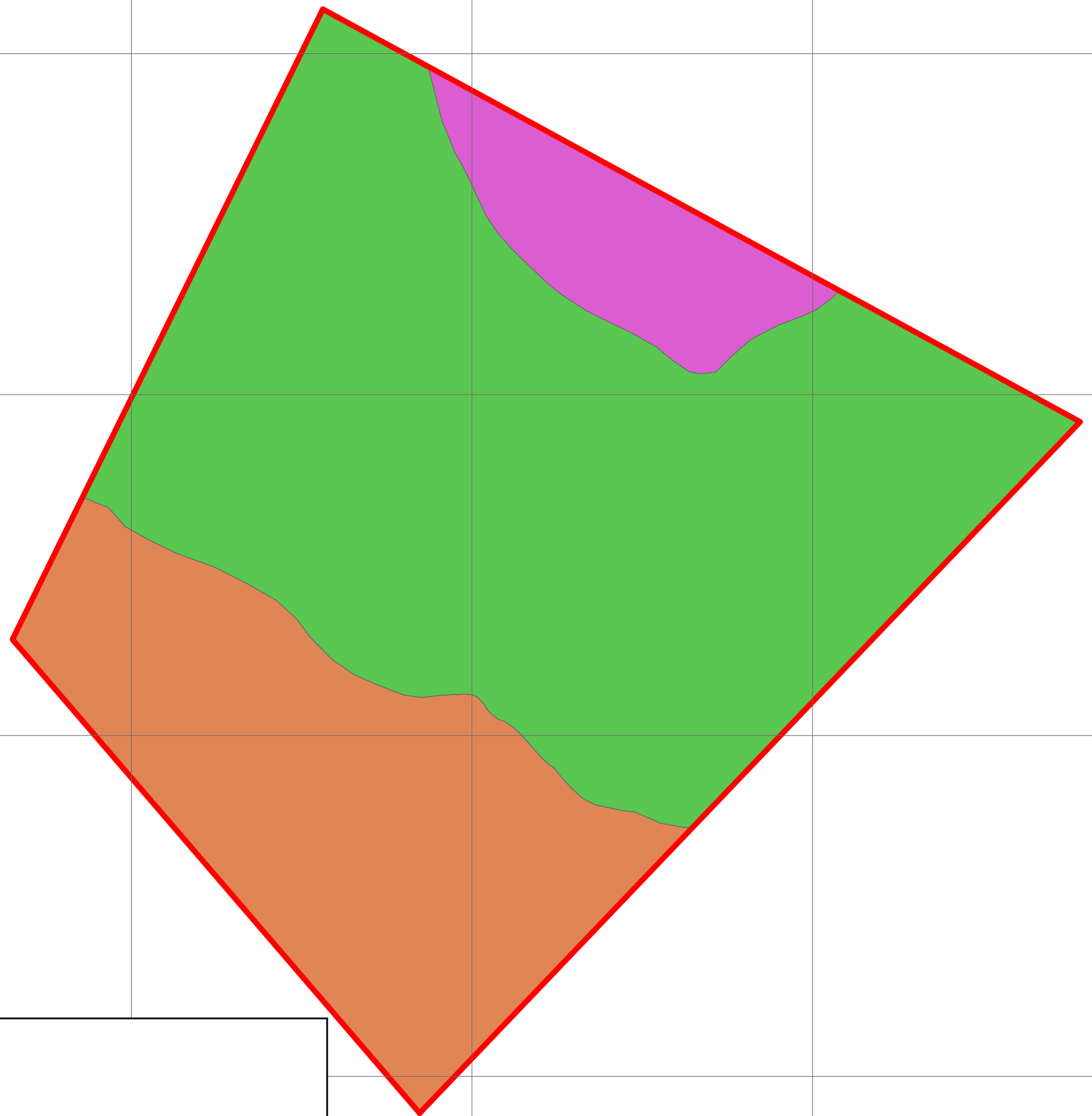
1:30,000

464000 466000 468000 470000 472000 474000

2592000 2590000 2588000 2586000

23°26'40"N 23°25'50"N 23°25'0"N 23°24'10"N 23°23'20"N 23°22'30"N

68°38'20"E 68°39'10"E 68°40'0"E 68°40'50"E 68°41'40"E 68°42'30"E 68°43'20"E 68°44'10"E



Legend

VLDS Block Boundary

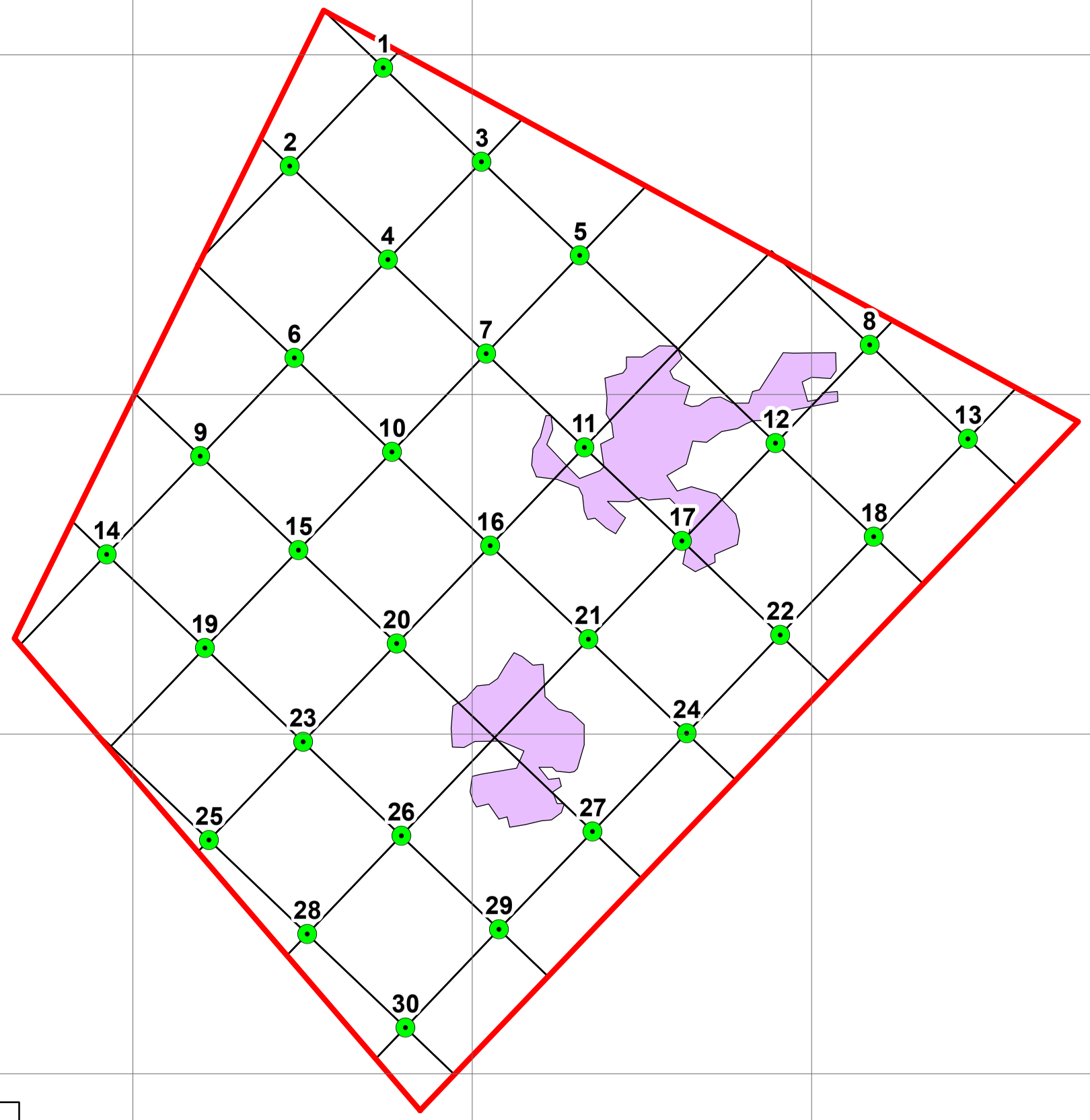
Geology

- Guj Formation shale interbedded with Fossiliferous Limestone and marl
- Maniyara Fort Formation Calcureous and gypseous claystone/siltsone, clay, coral limestone and sandstone
- Khari nadi Formation Variegated siltstone and gypsous claystone

PLATE - 1

GEOLOGICAL PLAN

Vayor Limestone Drilling Scheme - (VLDS), Kachchh District, Gujarat.



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23°26'40"N 23°25'50"N 23°25'0"N 23°24'10"N 23°23'20"N 23°22'30"N

68°38'20"E 68°39'10"E 68°40'0"E 68°40'50"E 68°41'40"E 68°42'30"E 68°43'20"E 68°44'10"E

Legend

- VLDS Borehole
- VLDS Block Boundary
- Village

Proposed Area :- 2068 Ha.
Proposed BH :- 30
Proposed Meterage :- 750 m

PLATE - 2

BOREHOLE PLAN

Vayor Limestone Drilling Scheme - (VLDS), Kachchh District, Gujarat.

464000 466000 468000 470000 472000 474000

2592000 2590000 2588000 2586000

23°26'40"N 23°25'50"N 23°25'0"N 23°24'10"N 23°23'20"N 23°22'30"N

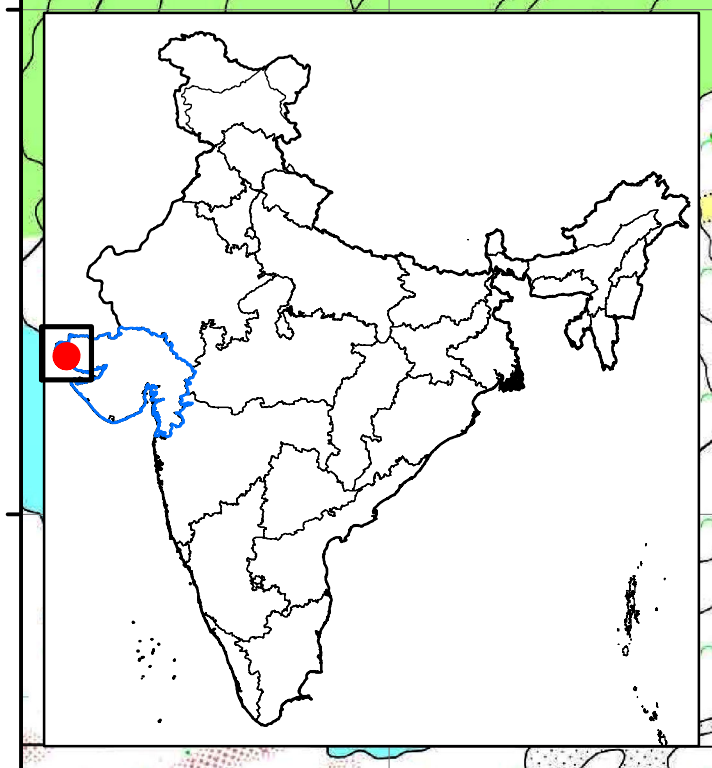
68°38'20"E 68°39'10"E 68°40'0"E 68°40'50"E 68°41'40"E 68°42'30"E 68°43'20"E 68°44'10"E

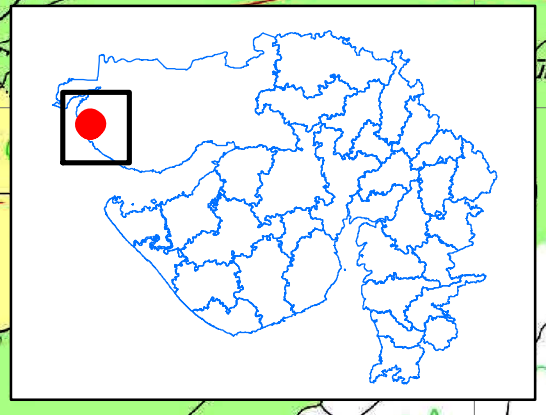
N

0 0.5 1 2 KM

1:30,000

Pakho
Covered tank
Rākhdi Nadi
Dense mixed jungle mainly babūl
Causeway
Lākhāpar
Sāpdev
Dense mixed jungle mainly babūl
Sluice
Canal
Siphon
Covered tank
Barkhān Canal
Siphon
Bhoa
Causeway
Padhanwādi
(Jethmalpar)
Covered tank
Siphon
Sluice
Open scrub
Vāyor
Siphon
Sluice
Open scrub
Covered tank
Wāgoth
Covered tank
Ukīr
Open scrub
Open scrub
Karamta
Covered tank





Legend

VLDS Block Boundary

PLATE - 3

TOPOSHEET PLAN