Proposal for Geological Prospecting (G4) for Vanadium and Titanium (Critical Minerals) in Magnetite bearing sand occurring in the beach/dune sands along the Saurashtra coast, from Dwarka to Gadhula, Gujarat under NMET.

(Basemetals/ Ferrous/ Non-Ferrous/ Industrial/ Strategic & Critical/ Precious metals etc.,)

By

Geo Marine Solutions Pvt Ltd.,

Mangalore

Place: Mangalore
Date: 17/10/2024

Summary of the Block for G4 stage prospecting

	Features	Details
	Block ID	Guj/Saurashtra/G4-1/2024
	Current Exploration Agency	(G4) Geo Marine Solutions Pvt Ltd., Mangalore
	Previous Exploration Agency	
	G4 stage Geological Report (Previous stage Geological Report)	No work has been carried out in this area
	Commodity	Vanadium and Titanium bearing Magnetite (Titanomagnetite)
	Mineral Belt	Saurashtra coast
	Completion Period with entire Time schedule to complete the project	14 months
	Objectives	To prospect for vanadiferous magnetite/titanomagnetite occurring in beach/dune sands for vanadium
	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	Except chemical analysis, entire work will be carried out by the proposing agency (Geo Marine Solutions Pvt Ltd)
	Name/ Number of Geoscientists	AC Dinesh, Guru Prasad
	Expected Field days (Geology, Geophysics, Surveyor)	No topographic and geophysical surveys are proposed. The proposed work includes collection of surface samples (1m bgl) and magnetite/titanomagnetite separation and analysis for vanadium, titanium and other trace metals.
1.	**Location**	From Dwarka to Gadhula along the Saurashtra coast
	Latitude Longitude	22.227922 N and 68.972436 E (Dwarka), 21.225375 N and 72.092050 E (Gadhula)
	Villages	
	Tehsil/ Taluk	
	Districts	Porbandar, Junagad, Gir Somanath, Amreli, Bhavnagar, Dwarka
	State	Gujarat
2.	**Area (hectares/ square kilometres)**	Since it is reconnaissance, the sampling will be carried out along the Saurashtra coast extending over of 400 km
	Block Area	About 40 sq.km (400kmx.1km)
	Forest Area	
	Government Land Area	
	Private Land Area	
3.	**Accessibility**	
	Nearest Rail Head	The area is along the Saurashtra coast and

	Road Airport	is well connected by roads and rail. Airport is at Rajkot, Jamnagar
4.	**Hydrography**	
	Local Surface Drainage Pattern (Channels) Rivers/ Streams	Drainage is scanty in the region. No major river exists. (Fig.2)
5.	**Climate**	Warm and humid
	Mean Annual Rainfall	477mm
	Temperatures (December) (Minimum) Temperatures (June) (Maximum)	16˚C to 41˚C min. and max.
6.	**Topography**	Undulating topography
	Toposheet Number	46C/4, 41O/16, 41O/12, 41P/9, 41P/5, 41P/1, 41P/2, 41L/14, 41L/13, 41L/10, 41L/9, 41L/5, 41L/1, 41K/4, 41G/16, 41G/15, 41G/11, 41G/10, 41G/6, 41G/5, 41G/1, 41F/4, 41B/16
	Morphology of the Area	Dune, beach, tidal flats, river mouths, estuaries, mangroves etc
7	**Availability of baseline geoscience data**	

	Geological Map (1:50K/ 25K)	**1:50,000 scale map available**
	Geochemical Map	**1:50,000 map available**
	Geophysical Map (Aero geophysical, Ground geophysical, Regional as well as local scale GP maps)	**Not needed**
8.	**Justification for taking up G4 mineral prospecting.**	1. Based on the GSI report titled " Reconnaissance survey for preliminary appraisal of Heavy Mineral in the coastal stretch from Daman to Dandi, Gujarat.", by Dinesh et al., in 2013. 2. Based on the report by Basheer Hijas.K., 2013 "A Preliminary Assessment of Heavy Minerals in Beach Sand along the Coast between Dumas, Surat District and Tithal, Valsad District, Gujarat" of Geological Survey of India. 3. Based on the research paper titled " The Occurrence of Vanadiferous Titanomagnetite in Offshore Sediments, Gulf of Khambhat, West

		Coast of India.", by Gopakumar et al., in 2022. 4. Based on the work that mentioned in IBM 2020, "As per AMD's communiqué to IBM (via letter dt. 26th July, 2018), 2.77 million tons of ilmenite and 0.02 million ton of rutile resources have been estimated between Moti Daman in the south and Ubhrat in the north about 70 km stretch along the coast of Gujarat (IBM, 2020)" All these works have been carried out in the eastern part of the proposed area. However, the provenance for magnetite/titanomagnetite ion the both areas is Deccan basalt (Figs.1 and 2).

Detailed description on the following titles to be made in the proposal.

1. **Block Summary:** The proposed coastal stretch is mainly covered by Miliolite limestone formation of Quaternary and Recent deposits. GSI has carried out exploration for ilmenite-titanomagnetite-magnetite in the eastern part of the proposed area that is from Dandi to Daman and reported encouraging results of ilmenite-titanomagnetite-magnetite in the beach/dune sands. GSI has also reported vanadium and titanium values which are worth for further exploration.

   Reconnaissance survey conducted along the Gujarat coast from Dandi to Daman found that beach and dune sediments consist mainly of carbonate-free sand. The survey collected 45 samples from various geomorphic units (foreshore, berm, and dune). The heavy mineral content in beach sediments varies in a wide range from 0.3 to 71.5%. Ilmenite and magnetite are the predominant heavy minerals found along the Gujarat coast, with rutile, sillimanite, and zircon in minor amounts. Beach sediments west of Dandi to Par River mouth show high ilmenite (37%) enrichment. Dune sediments from Dandi to Kanai Creek and a section near Surwada are also enriched in ilmenite (Ilmenite is concentrated more in 230 size fraction than in other size fractions) (Dinesh et al.,2013). Basheer (2013) from GSI reported 0.16 to 0.61% vanadium in magnetite-titanomagnetite-ilmenite suite of minerals.

   Since the provenance for ilmenite-titanomagnetite-magnetite in the area between Daman and Dandi and the proposed area are Deccan basalts, the coastal stretch of Saurashtra is worth prospecting.

   The proposed area is made into four sectors for better visibility of proposed sampling points. The four sectors are: 1. Gadhula to Dharabandar sectors 2. Dharabandar to Somanath sectors 3. Somanath to Odadar sectors 4. Odadar to Dwarka sectors are shown in Figures 5, 6, 7 and 8.

2. **Previous Work:** No work has been carried out in the proposed area for vanadium in magnetite-titanomagnetite-ilmenite

3. **Block description**

Block corner points / Cardinal Points	Latitude, Longitude A. 22.227922˚ N and 68.972436˚ E (Dwarka), Gujarat B. 21.225375˚ N and 72.092050˚ E (Gadhula), Gujarat (Note: since the proposed area is a coastal stretch of about 400km length having an approx. width of 50 to 200m.

4. **Planned Methodology**

   The proposed area between Dwarka in the northwest and Gadhula in the southeast are about 400km apart along the coast of Saurashtra. Work is planned to collect auger sampling up to 1m bgl (below ground level) at each location. The sample locations are being proposed at beach/dune at 1000m interval. A team of 2 geologists will exactly locate the sample point using DGPS. The samples collected will be packed and labelled and will be transported to the HQ of Geo marine Solutions at Mangalore.

5. **Nature and Quantum of work proposed:**

Sl. No.	Description of Work	Quantum (Sq Km/ Number)	Time required
1	Auger coring up to 1.0m BGL	363 nos	100 days
2	Grain size analysis	363 nos	90 days
3	Mineral Separation by gravity and magnetic methods	363 nos	150 days
4	Mineralogical Study under microscope	20 nos	20days
5	Geochemical analysis for Ti, V ,Fe, Cr, Cu and other elements using ICPMS (25% of total 363*3=1089)	273 nos	120 days
6	Check samples by ICPMS (5% of the total chemically analysed samples)	14 nos	
7	XRD	5 nos	10 days
9	Reporting	1	90 days

6. **Manpower deployment:** 2 Geologists will be deployed in the field and at HQ, 2 Geologists will be taken up sample processing, separation and analysis.

7. **Break-up of expenditure:** Cost table is attached

8. References:

1. Dinesh. A.C., Shareef. N.V., Durgaprasad. And Satyendra Baraik. (2013). Reconnaissance survey for preliminary appraisal of Heavy Mineral in the coastal strech from Daman to Dandi, Gujarat. Item No.067. GSI Report.

2. S. P. Prizomwala1 et.all. 2018. Late Pleistocene relative sea-level changes from Saurashtra, west coast of India, Current Science, VOL. 115, NO. 12, 25.

3. Basheer Hijas.K., 2013 “A Preliminary Assessment of Heavy Minerals in Beach Sand along the Coast between Dumas, Surat District and Tithal, Valsad District, Gujarat” of Geological Survey of India.

4. Gopakumar. B., L. G. Sarath, L. K. Soni, Sandeep Kumar, Sathish Gunasekharan, P.V. Anju, D. Aimdas and Sharika Mathew. (2022). The Occurrence of Vanadiferous Titanomagnetite in Offshore Sediments, Gulf of Khambhat, West Coast of India. Proc. Natl. Acad. Sci., India, https://doi.org/10.1007/s40010-022-00799-4.Maharashtra; Sect. A Phys. Sci. Indian Journal of Geosciences, vol 77, No.3, July-Sept 2023 pp 279-292.

5. IBM, 2020: Indian Minerals Yearbook 2020 (Part- III: Mineral Reviews): Ilmenite & Rutile.

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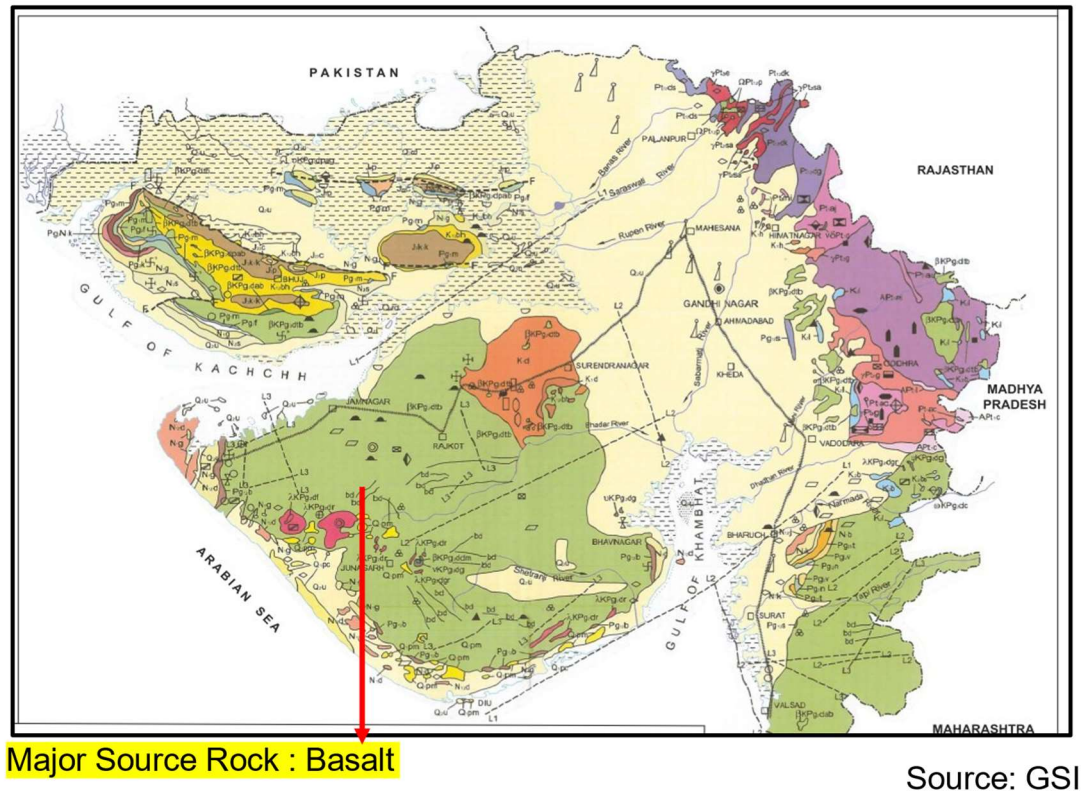

Fig.1: Geological Map of Gujarat

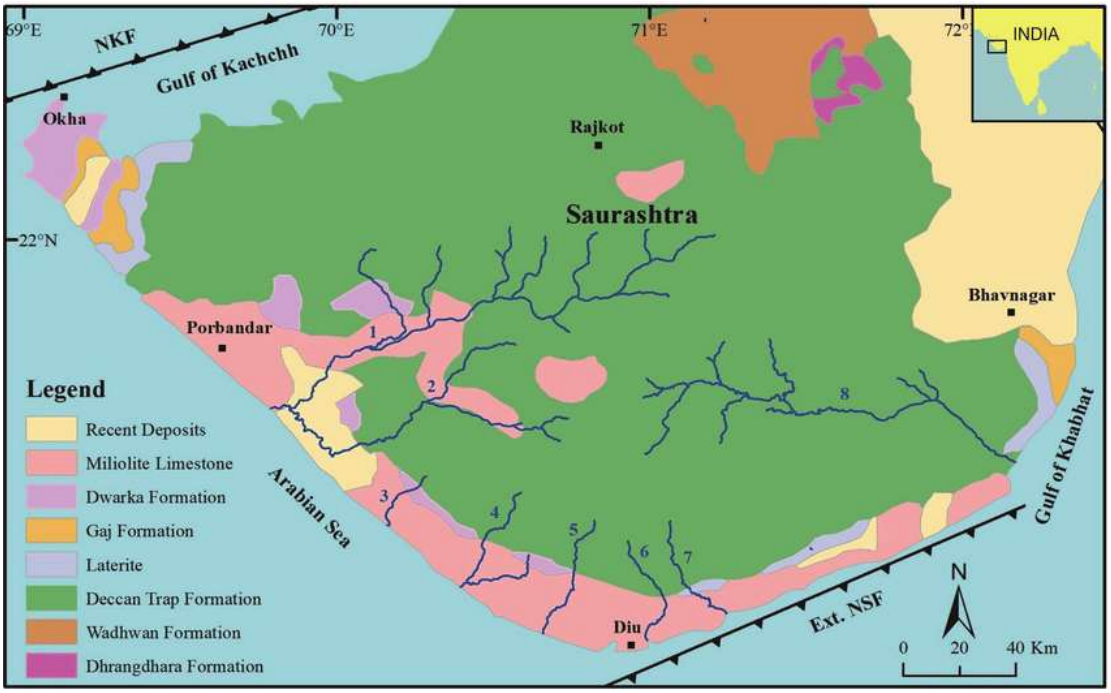

Fig.2: Drainage pattern of Saurashtra region
(Source: S. P. Prizomwala1 et.al. 2018.)

Fig.3: Google earth imagery showing 363 surface sample locations along Saurashtra coast.

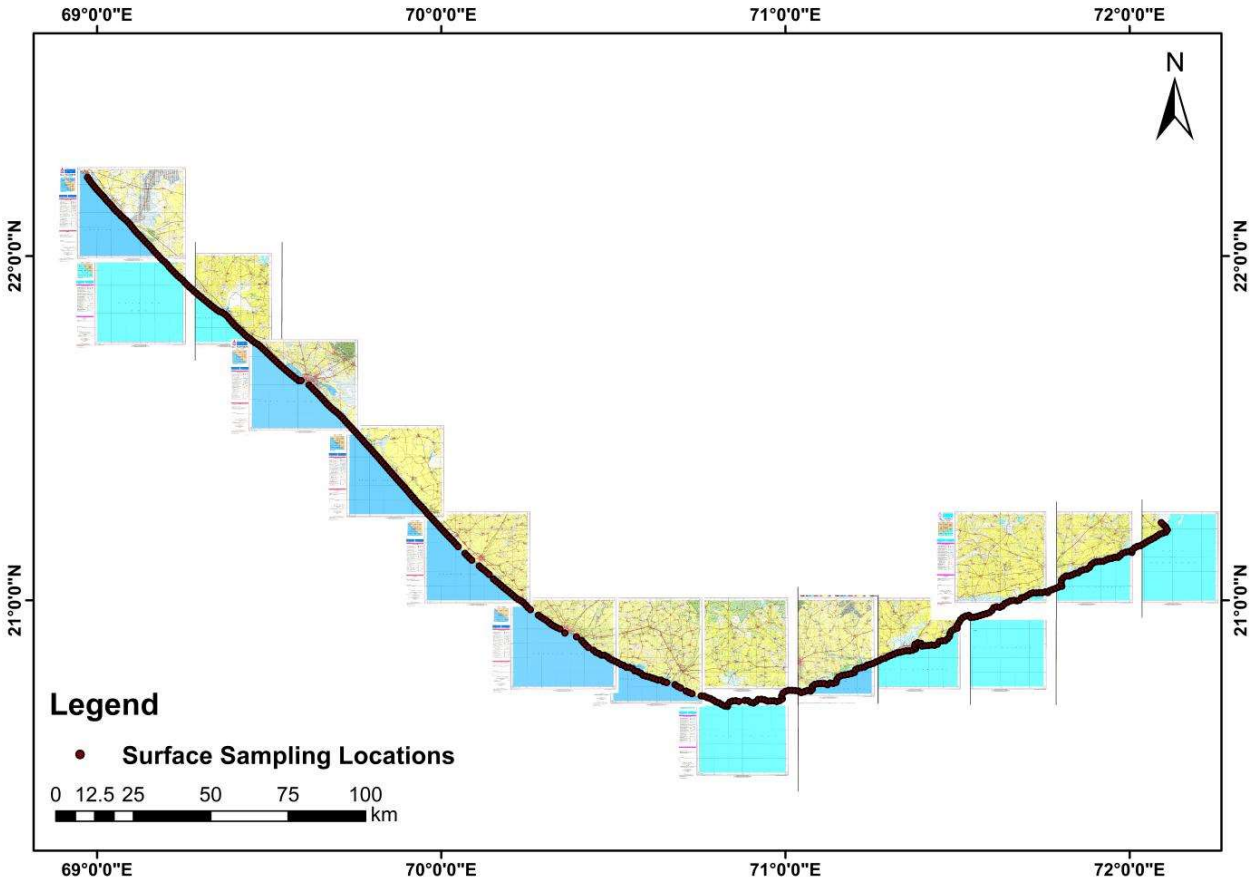

Fig.4: Surface sample locations falling in 22 toposheets.

Fig.5: Gadhula to Dharabandar Sector over Google earth imagery

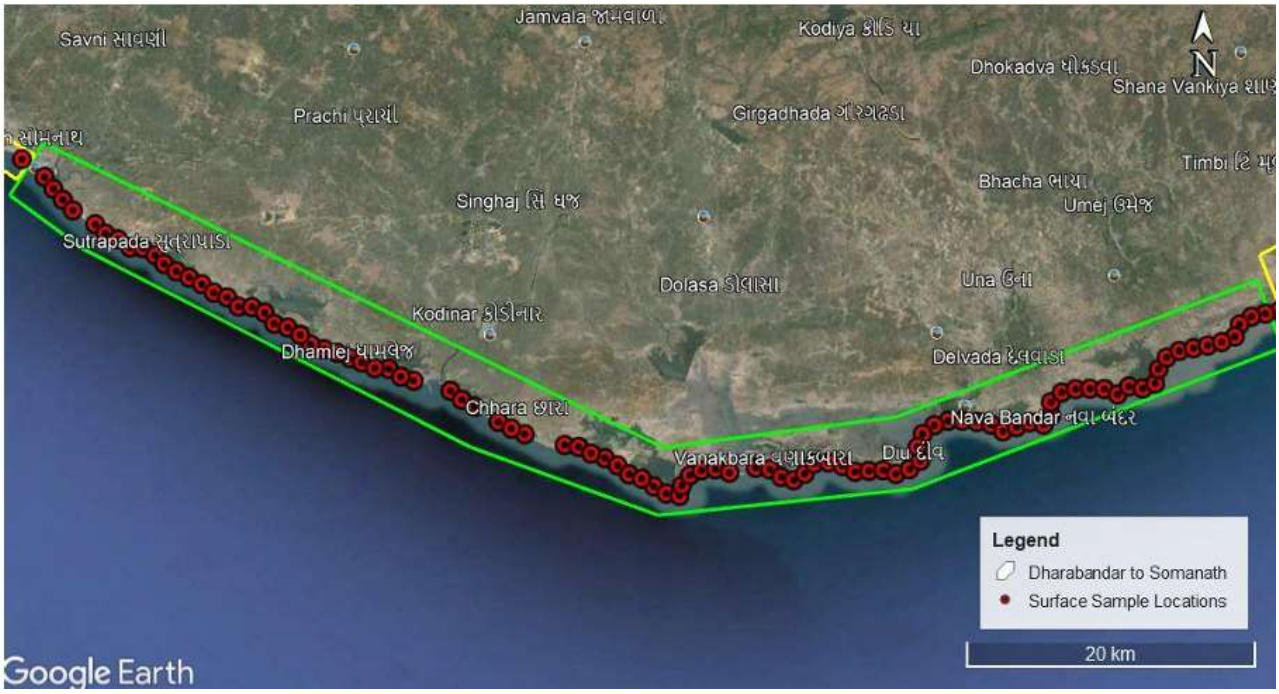

Fig.6: Dharabandar to Somanath Sector over Google earth imagery

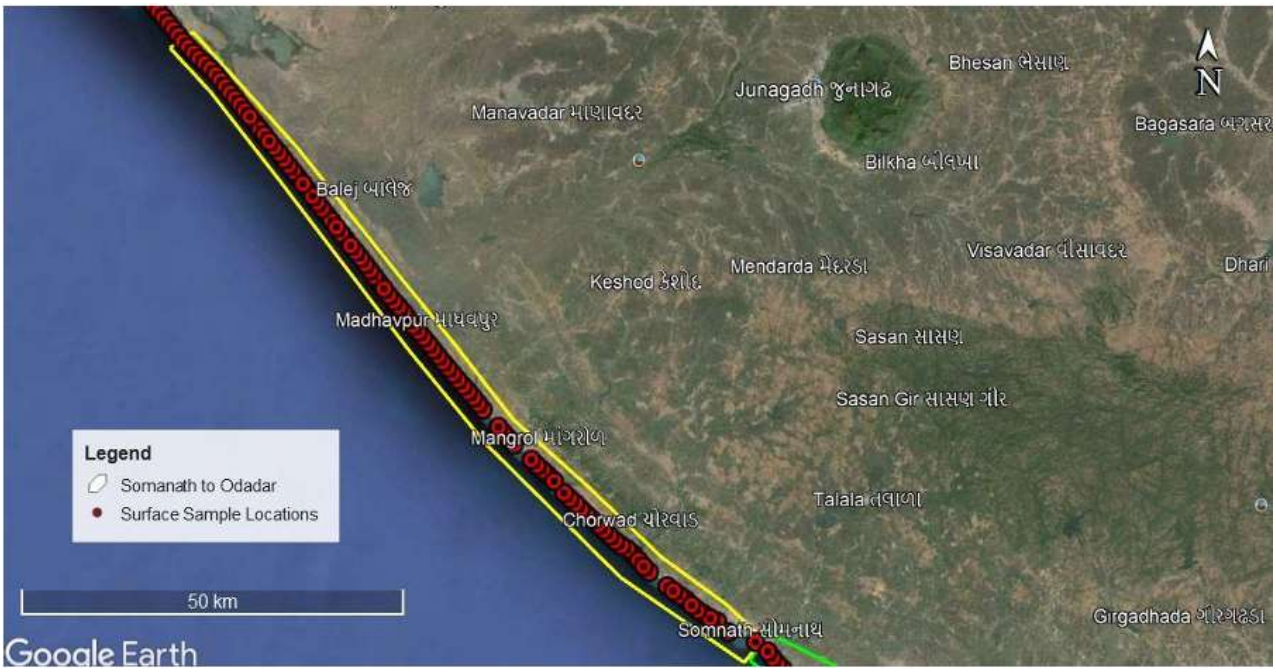

Fig.7: Somanath to Odadar Sector over Google earth imagery

Fig.8: Odadar to Dwarka Sector over Google earth imagery.