PROPOSAL FOR RECONNAISSANCE SURVEY (G-4) FOR REE AND ASSOCIATED MINERALIZATION IN GOL-BAGINDI-TILWARA AREA (82.50 SQ KM), SIWANA RING COMPLEX, DISTRICT-BALOTRA, RAJASTHAN

COMMODITY: REE AND ASSOCIATED MINERALS

BY

MINERAL EXPLORATION AND CONSULTANCY LIMITED

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SEMINARY HILLS

PLACE: NAGPUR

DATE: AUGUST, 2025

Summary of the Block for Reconnaissance Survey (G-4)

GENERAL INFORMATION ABOUT THE BLOCK

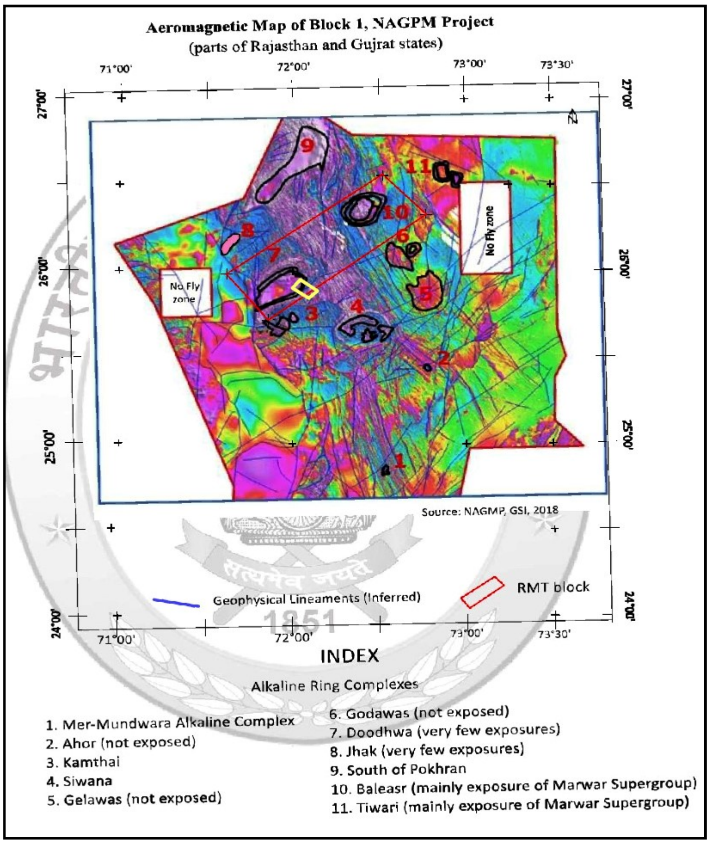
	Features	**Details**
	Block ID	
	Exploration Agency	Mineral Exploration and Consultancy Limited (MECL)
	Commodity	REE and associated minerals
	Mineral Belt	Siwana Ring Complex
	Completion Period with entire Time schedule to complete the project	10 Months
	Objectives	i. To carry out detail geological mapping on 1:12500 scale for distribution of REE mineral bearing formation. ii. To collect systematic bedrock and channel samples for analysis of 34 elements by IC-PMS which include REE to understand the distribution on primary source. iii. To carry out detail surface geophysical survey by gravity, magnetic and Gamma ray spectrometry method to understand the continuity and characteristics of rhyolite below the aeolian cover. iv. To carry out scout drilling of boreholes to establish subsurface occurrence of REEs.To establish the reconnaissance resource for REE bearing minerals as per UNFC norms & Minerals (Evidence of Mineral Contents) Rules- 2015.
	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	Work will be carried out by the proposed agency.
	Name/ Number of Geoscientists	Two nos. of Geoscientist (1 Field + 1 HQ)
	Expected Field days (Geology) Geological Party Days	Geologist Party Days: 100 Days (Field) Geologist Party Days: 30 Days (HQ)
1	**Location**	

	The coordinates of corner points of proposed Gol-Bagundi-Tilwara Area as follows:	

Points	Latitude	Longitude
A	25° 56' 44.18" N	072° 02' 51.62" E
B	25° 52' 48.59" N	072° 08' 47.4" E
C	25° 50' 16.54" N	072° 05' 46.49" E
D	25° 53' 48.17" N	072° 00' 4.18" E

	Villages	Gol, Bagundi, Tilwara
	Tehsil/ Taluk	
	District	Balotra
	State	Rajasthan
2.	**Area (hectares/ square kilometers)**	
	Block Area	82.50 sq km
	Forest Area	
	Government Land Area	Data Not Available
	Private Land Area	Data Not Available
3.	**Accessibility**	
	Nearest Rail Head	Nearest railway station is Tilwara Railway station of NW Railway which is present in the NE part of the study area.
	Road	The area is well connected with district HQ Balotra and Barmer by SH-25.
	Airport	Nearest airport is Jodhpur Airport located 121 km from study area.
4	**Hydrography**	
	Local Surface Drainage Pattern (Channels)	There are only perennial Nalas present inside the block.
	Rivers/ Streams	The drainage system of the proposed area is manifested by Luni River.
5	**Climate**	
	Mean Annual Rainfall	The highest amount of precipitation occurs during the monsoon season, which spans from July to September.
	Temperatures (December) (Minimum) Temperatures	During summer (March toJune), the maximum temperature generally varies between 46 and 51˚C. Night temperaturesdecrease considerably to 20–29˚ C. January is the coldest month. During winter (December toFebruary), minimum temperatures may fall to 0℃ at night.

	(June) (Maximum)	
6	**Topography**	
	Toposheet Number	Part of topo sheets 45C/01
	Physiography of the Area	The physiography of the study area is mainly manifested by the desert landscapes i.e. aeolian plain, sand dunes, interdunal depression. The height of dunes is varies from few m to 50 m. The study area exhibit scanty outcrops of igneous rocks of Malani Igneous Suite exhibited by isolated hillocks.
7	**Availability of baseline geosciences data**	
	Geological Map (1:50K/ 25K)	1:50000
	Geochemical Map	NGCM Data is available in NGDR
	Geophysical Map	NGPM & Aero-geophysical Data is available in NGDR
8.	**Justification for taking up Reconnaissance Survey / Regional Exploration**	1. Neoproterozoic Siwana Ring Complex (SRC), in western Rajasthan is a well-preserved collapsed caldera in the third largest felsic volcanism of Malani Igneous Suite, hosting multiple phases of magmatism comprising high silicic, low alumina and calcium, iron rich bimodal volcanic suite intruded by peralkaline granite ring dyke and younger microgranite, granophyre, felsites and aplites, rich in Y, Zr, Nb, LREE (La and Ce). It presents a diverse volcanogenic setting suitable for multi-metal mineralisation along the margins of caldera at the contact with acid volcanics and granites, and also strata-bound association with acid volcanic flows and Moat sediments within the caldera. Besides Siwana Ring Complex, there are many other favourable volcanic centres in Malani Igneous suite viz, Nakoda Ring Complex (north west of SRC), Sarnu-Dandali, Kamthai, Rama, Miniari-Pali, Tavidar, Doodhwa etc. The present proposed block lies in the Doodhwa Ring Complex.



2. The proposed area lies adjacent to Nakoda Ring Complex, bimodal volcanics with pyroclastic intercalations near Tilwara, Bagundi and Gol area following anomalous concentration of Ba (383 ppm) and Sc (14 ppm) near Gol; Na2O 8.31%, La 371 ppm, Ce-579 ppm Nd-705ppm, Pr-208ppm NE of Tilwara, warrants close sampling and close checking of geological attributes in the block.

3. The proposed G-4 block has been carved out from the RMT block (FS-2020-23), which is characterized by a volcanic phase represented by rhyolitic flows which is porphyritic in nature. The proposed block lays on top a buried ring structure as evident from the aero-magnetic anomaly map of the area. These rock types gave encouraging values in terms of REE and RM mineralization and were recommended to study the entire area in G-4 level to access the full mineral potential.

4. Petrographic and EPMA analyses confirmed the presence of several primary rare earth element (REE) minerals namely; Thorite (Silicates), Britholite (phosphate), Parisite (carbonate), Monazite (phosphate), Allanite (Silicates) etc in and around this area.

5. In the southern extension of the eastern limb of the buried ring structure (near Noser village) TREE value ranges from 1491 to 2316 PPM; as the same limb is continuing in the present proposed area, it

		might be equally potential for REE mineralization. In the western limb of the ring structure, TREE value ranges from 1029-1490 PPM. 6. Based on the analysis of regolith samples in the RMT block, elevated values of Nb, Hf, Zr was also noted. Nb values ranging from 51 to 68 ppm were clustered in locations, such as Bagundi-Patodi area. Zr value is in the range of 301-513 PPM in regolith sample; Nb value is in the range of 51-68 PPM in regolith sample; Hf value is in the range of 41-100 PPM in petrochemical sample; Y value is in the range of 200-300 PPM in petrochemical sample was found in and around Gol-Bagundi. 7. Based on the studies of the RMT block by GSI, Nawatala-Devigarg EL has also been curved out where aero-magnetic signatures is showing NW-SE (south-eastern part of the block) and N-S (in the central portion of the block) trending two high magnetic linears. Similar aeromagnetic responses have been also observed from the nearby Siwana Ring Complex, which is well known for its REE and RM potential. The NGPM Magnetic (TF) anomaly contour map is well corroborating with the aeromagnetic anomaly. The proposed EL Block lies over a gravity gradient in NGPM Bouguer Gravity anomaly map. In Siwana area gravity gradient zones are found potential for search of REE mineralisation. 8. The geophysical and geological signatures supporting the presence of Malani Volcanic suite (known for its REE & RM potentiality) below the soil cover. Hence, the area is proposed for REE and associated mineralization.

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1.1.0 INTRODUCTION

1.1.1 Development of renewable energy infrastructure requires critical raw materials, such as the rare earth elements (REEs, including scandium) and niobium, and is driving expansion and diversification in their supply chains. Although alternative sources are being explored, the majority of the world's resources of these elements are found in alkaline-silicate rocks and carbonatites. These magmatic systems also represent major sources of fluorine and phosphorus. Exploration models for critical raw materials are relatively less developed than those for major and precious metals, such as iron, copper, and gold, where most of the mineral exploration industry remainsfocused. The diversity of lithologic relationships and a complex nomenclature for many alkaline rock types represent further barriers to the exploration and exploitation of REE-high field strength element (HFSE) resources that will facilitate the green revolution.

1.1.2 Rare earth elements are characterized by high density, high melting point, high conductivity and high thermal conductance with distinctive electrical, metallurgical, catalytic, nuclear, magnetic and luminescent properties make them indispensable for a variety of emerging high end and critical technology applications which are relevant to India's energy security i.e., clean energy, defense, civilian application, environment and economic areas. REE demand is expected to continue its growth, especially for their use in low carbon technology. The ever-increasing demand for these REE necessitates a concerted effort to augment the resource position of our country.

1.1.3 The Rare earth elements (REE) are a collection of 17elements in the periodic table, namely scandium, yttrium and lanthanides (15 elements in the periodic table with atomic numbers 57 to 71 namely: lanthanum (La), cerium (Ce), praseodymium(Pr), neodymium (Nd), promethium (Pm), samarium (Sm), europium (Eu), gadolinium (Gd), terbium (Tb), dysprosium (Dy), holmium (Ho), erbium (Er), thulium (Tm), ytterbium (Yb) and lutetium (Lu). In spite of its low atomic weight Yttrium (atomic no. 39) has properties more similar to the heavy lanthanides and is included with this group. Scandium (atomic no. 21) is found in a number of minerals although it may also occur with other rare earth elements (REE).

1.1.4 Although these elements tend to occur together, the lanthanide elements are divided into two groups. The light rare earth elements (LREE) are those with atomic numbers 57 through 62(La, Ce, Pr, Nd, Pm, Sm) and the heavy rare earth elements (HREE) are those with atomicnumbers from 63 to 71 (Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb and Lu) and Y, Sc. However, because of their geochemicalproperties, rare earth elements are typically dispersed and not often found concentrated as rareearth minerals in economically exploitable ore deposits.

1.1.5 Generally, the light rare earth elements (LREE) are more abundant in the earth's crustand easily extracted than heavy rare earth elements (HREE). It was the very scarcity of these minerals (previously called "earths") that led to the term "rare earth". The first such mineral discovered was gadolinite, a compound of cerium, yttrium, iron, silicon and other elements.

This mineral was extracted from a mine in the village of Ytterby in Sweden; several of the rare earth elements bear names derived from this location.

1.1.6 In the other hand, critical minerals are those minerals that are essential for economic development and national security. The lack of availability of these minerals or concentration of extraction or processing in a few geographical locations may lead to supply chain vulnerabilities and even disruption of supplies. The future global economy will be underpinned by technologies that depend on minerals such as lithium, graphite, cobalt, titanium, and rare earth elements. These are essential for the advancement of many sectors, including high-tech electronics, telecommunications, transport, and defence. They are also vital to power the global transition to a low carbon emissions economy, and the renewable energy technologies that will be required to meet the 'Net Zero' commitments of an increasing number of countries around the world. Hence, it has become imperative to identify and develop value chains for the minerals which are critical to our country.

1.1.7 Considering important parameters such as resource/ reserve position in the country, production, import dependency, use for future technology/ clean energy, requirement of fertilizer minerals in an agrarian economy, the Committee has identified a set of 30 critical minerals. These are Antimony, Beryllium, Bismuth, Cobalt, Copper, Gallium, Germanium, Graphite, Hafnium, Indium, Lithium, Molybdenum, Niobium, Nickel, PGE, Phosphorous, Potash, REE, Rhenium, Silicon, Strontium, Tantalum, Tellurium, Tin, Titanium, Tungsten, Vanadium, Zirconium, Selenium and Cadmium. (Critical Minerals for India, Report of the Committee on Identification of Critical Minerals, Ministry of Mines, June 2023)

1.1.8 A study, conducted by the Council on Energy Environment and Water, identified 12 minerals out of 49 that were evaluated as **'**most critical**'** for India's manufacturing sector by Vision 2030 which makes more thrust for exploration in Strategic Mineral, Precious Metals, Platinum Group of Elements by Government of India.

1.2.0 BACKGROUND

1.2.1 Emphasis has been given to explore the more numbers of blocks for strategic and critical minerals in the different states of India by Govt of India. Keeping this in view, the present proposal Reconnaissance Survey (G-4) for REE and associated minerals is proposed in Gol-Bagundi-Tilwara area in Balotra district, Rajasthan.

1.3.0 LOCATION AND ACCESSIBILITY

1.3.1 The proposed area comprises of 82.50sq km area and lies in Balotra District (part of Toposheet No. 45C01), Rajasthan. The major villages falling in and around the proposed block are Gol, Bagundi and Tilwara.The area is well connected with district HQ Balotra and Barmer by N SH-25. The study area is well traversed with metalled, semi metalled and gravel road. Nearest railway station is Tilwara Railway station of NW Railway which is present in the NE part of the study area and nearest airport is Jodhpur Airport located 121 km from study area.

1.3.2 The location map of the proposed block is provided as Plate No- I. The detailed location of the boundary points are given in Table 1.

Table 1: Coordinates of Corner Points of Proposed Gol-Bagundi-Tilwara Area, Balotra District, Rajasthan

Points	Latitude	Longitude
A	25° 56' 44.18" N	072° 02' 51.62" E
B	25° 52' 48.59" N	072° 08' 47.4" E
C	25° 50' 16.54" N	072° 05' 46.49" E
D	25° 53' 48.17" N	072° 00' 4.18" E

1.4.0 PHYSIOGRAPHY, DRAINAGE AND CLIMATE

1.4.1 The study area forms a part of Thar Desert and displays aeolian sand and establisheddunes along with high hills with steep slope. The topography is mainly controlled by geological features such as rhyolitic and pyroclastic flow, major joint traversing the flows andaeolian activity in the area. The elevation observed in the area varies from 190 m in south east to 500 m in central part of the block.

1.4.2 Drainage pattern of the Dhiran area is dendritic control by lithology and joint pattern present in the area. Major stream around the area is Luni Wala River draining from north-west to north-east near Mubari, Mangi and Dhiran. The area is also drained by numerous 1st, 2nd and 3rd order stream joining into the major streams and its tributaries mentioned above

1.4.3 The climate of the area is arid with average rainfall 277mm per year and most of the rainfall is received during the monsoon (from July to October) and very rarely during winter as an effect of western disturbances. The climate is characterized by extremes of diurnal and annual ranges of temperatures, low humidity and high wind velocity. During summer (March to June), the maximum temperature generally varies between 46° and 51° C. Night temperatures decrease considerably to 20°–29° C. January is the coldest month. During winter (December to February), minimum temperatures may fall to 0° C at night. Occasional secondary western disturbances mostly crosses western, northern and eastern Rajasthan during the winter months, causing light rainfall and increased wind speeds which result in a wind-chill effect. The average annual temperature in Barmer district is 27.1 °C.

1.5.0 FLORA AND FAUNA

1.5.1 The study areas consist of various types of flora which includes mainly sparse shrubs in hilly areas and trees in low-lying and catchment area of river. Natural vegetation in the study area include Neem *(Azadirachta indica),* Peepal *(Ficus religiosa)*, semal*(Bombax ceiba),* Mango *(Mangifera indica),* tamarind *(Tamarindus indica)*, Palash (*Butea Monosperma*) Lemon *(Citrus limon)* are the tree species. Ber *(Ziziphus mauritiana),* Khejri *(Prosopis cineraria),* Thor *(Euphorbia royleana)*, Aak*(Calotropis gigantea),* Desi Babul(*Vachellia nilotica*), Kair (*Capparis decidua*), Dhok (*Anogeissus pendula*), Khair (*Acaciacatechu*) etc are commonly found herbs and shrubs species in the area.

A variety of fauna found here are Jungle Cat *(Felis chaus),* Jackal *(Canis aureus),* Indian Fox *(Vulpes bengalensis*), Common Langoor*(Semnopithecus),* Common Mongoose *(Herpestesedwardsii),* Indian Hare *(Lepus nigricollis),* nilgai *(Boselaphustragocamelus),* Peacock *(Pavo cristatus), Teetar (Francolinuspondicerianus), Bater (Coturnix coturnix),* wild boar (*Sus scrofa*) etc. Besides, various domestic animals such as cow, camel, buffalo, sheep and goats are also found in the area.

2.0.0 REGIONAL GEOLOGY

2.1.1 The Malani Igneous Suite comprises of Neoproterozoic plutonic and volcanic rocks. The suite covers an area of about 51,000 sq. km in parts of Jaisalmer, Jodhpur, Barmer, Churu, Pali, Sirohi and Jalor districts of Western Rajasthan and extends further in Sind province of Pakistan. Malani magmatism, the largest anorogenic acid volcanism in India showing little metamorphic effect, is associated with post-Erinpura granitic activity and pre- Marwar sedimentation and covers a span of 850-550Ma. Three phases of igneous activity have been identified viz. eruption of basic flows, followed by voluminous acid rhyolite flows culminating with ashflow deposits (first phase); intrusion of subjacent discordant granites as plutons, ring dykes, bosses and plugs (second phase) and the indiscriminate intrusion of mafic and felsic, coarse to fine-grained dykes swarms (third phase).

2.1.2 The mafic-felsic volcanic suite is intruded by post-tectonic, anorogenic Siwana and Jalor Granites during the second phase. The hornblende granite (Malani Granite) occurs as porphyry dykes in Barmer area. The third phase of igneous cycle experience intrusion of felsic and mafic dykes trending either NNW-SSE or NE-SW direction, the dolerite forming the predominant dyke phase. Five sub-phases in a dyke swarm near Sankra have been recorded commencing with felsic intrusions and culminating with the basic intrusions.

2.1.3 The area lies in the south-central part of the Great Indian Thar Desert and mostly covered by its sand dunes. The rock types exposed in the area belong to the Malani Igneous Suite occuring as isolated hillocks and comprise of volcanic, hypabyssal and plutonic equivalents of basic to acid magma represented respectively, by basalt, and rhyolite flows, pyroclastics, rhyolite-porphyry, dolerite dykes, and granites. The rock outcrops are highly scattered in the sandy area, thus making the correlation between different units and estimation of the total thickness of Malani rocks difficult. The Malani Igneous Suite of rocks are most extensive & are oldest in the area. The Malani volcanics occur towards the western side of tightly compressed Delhi-Aravalli Fold Belts. A possible sudden release of pressure, causing rifting may have triggered the eruption. NW-SE trending fissures and several calderas and cones were the possible mode of eruptions.

2.1.4 Generalized classification of Malani Igneous suite (after Bhushan and Chandrasekaran, 2002) is given in the Table no.2 below:

Table No 2

Generalized classification of Malani Igneous suite (after Bhushan and Chandrasekaran, 2002)

SuperGroup	Group	Formation	Mode of Magmatism	Lithology
Marwar Supergroup (Vindhyan to lower Cambrian)				Sandstone, shale, limestone and evaporates
..............Unconformity..............				
Malani Igneous Suite (Upper Proterozoic)	Dyke swarms	Basic dyke; Acid dykes, Trachyte porphyry, Andesite and Porphyry Dykes Aplite and Diorite plugs	Intrusive dyke Phase–III	Gabbro, dolerite, basalt, granite, rhyolite porphyryTrachyte, porphyry andesite, porphyry porphyritic/non-porphyritic Dyke & aplite veins.
	Granitoid plutonism	Malani granite, Siwana granite Jalorgranite	Intrusive phase-II	Hornblende granite, riebeckite Aegirine, granite biotite/ Hornblendegranite
	Bimodal volcanism	Rhyolite, Trachyte and Basalt flow	Extrusive phase-I	Rhyolite, dacite, trachyte and rhyodacite flows, Basalt and trachyandesite flows
..............Unconformity..............				
Pre Malani Basement (Middle to Lower Proterozoic)		Aravalli and Delhi Supergroup		

2.1.6 **Regional mineralization:** Siwana granites and Malani rhyolites are considered to be important sources of REE in the Siwana area. The peralkaline granite of Siwana Ring

Complex (SRC) is enriched with REE potential and the later intrusive dykes intruding the granite and rhyolite at the periphery of Siwana Ring Complex are even more enriched with REE (Das et al. 2015). Barman and Neog, (2019) also reported appreciable occurrences of REE in Siwana Granite. Notable occurrence of REE and RM mineralization in younger intrusive>plag-rich granite> K-rich granite> felsic volcanic were observed by Kumar and Sharma (2020). Majumdar (1976-1978) considered that the Siwana suite is definitely enriched in Nb, La, Y and Zr.

3.0.0 GEOLOGY OF THE BLOCK

3.1.0 The area is dominantly covered by aeolian sand and alluvium with sparse outcrops of Malani Igneous Suite forming isolated hillocks, concentrated mostly in the southern western part. Volcanic phase of MIS is present in this area (Neo-proterozoic). The rhyolites have been intruded by a series of dykes viz. rhyolite, phonolite, dolerite, granite porphyry and gabbro that mark the end of igneous activity in the area. These are followed by deposition of huge sand sheet masking the area. The fluvio-aeolian basin covered by the Quaternary sediments, displays various geomorphic units like older aggraded flood plain, obstacle dune, longitudinal dune, complex parabolic dune, transverse dune, buried channel, present day flood plain, channel bar etc.

The stratigraphy of study area is given in table below:

Table No. 3
Stratigraphy of area

Supergroup	Group	Formation	Lithology	Age
-	-	Thar Desert	Fine aeolian sand and silt with occassional kankar	Holocene
Malani Igneous Suite	Jodhpur Volcanics	Kalyana felsic volcanics	Tuff, Volcanic breccia, ash bed and agglomerate, Rhyolite flow	Neoproterozoic

3.2.0 DESCRIPTION OF THE ROCK TYPES

3.2.1 **Rhyolite Flow:** A lenticular, but discontinuous outcrops of red brown, less porphyritic or sometimes aphyric rhyolite is exposed near *Gol-Bagundi* area. The rhyolite is highly flow banded. Near *Bagundi* it is often cavernous, cavities filled with quartz, epidote, chalcedony, etc. The groundmass is devitrified. No quartz is visible by naked eye. The rhyolite is brown to greyish brown, and contains bands of finely bedded tuff which is directly in contact with the underlying weathered basalt as seen in a stream section. A continuation of the rhyolite can be traced further south-west of *Keetpala* with an intervening area covered under sand.

Under thin section Rhyolite flow (TS-1) of Kaliana felsic volcanic formation is a very fine grained rhyolite rock composed of alkali feldspar, quartz, plagioclase, and traces of biotite, titanite, apatite and opaque minerals. The rock is showing hypo crystalline to holocrystalline texture. Grain to grain contact is difficult to identifying as grain size is very small (GSI, 2020).

3.2.2 **Sand, soil and alluvium:** More than 98% of the total area mapped is covered by a thick deposit of wind-blown sand, soil and alluvium. Sand occurs in the form of longitudinal sand dunes or lose sandy plains. The western part of the area is characterised by closely spaced stabilised sand dunes while the rest of the area is plain. The average thickness of sand cover in the plain area as noticed in wells, is about 2-5 metres. The colour of soil varies according to the parent rock. Alluvium occurs as thin, narrow creeks along the Luni river. Salt lakes, as observed southeast of *Bagundi,* on drying leave behind a thick deposit of dark grey mud of salt waste locally known as *'Khara'*.

3.3.0 STRUCTURE

3.3.1 **Flow Layers:** Flow layers are defined in the non-porphyritic rock types due to alternate colour bands of various thicknesses (1 mm to10 mm) or due to difference in crystallinity. In the glassy varieties of green rhyolite, flow layers are very fine and consistent. These are well developed in rhyolites near *Gol*.

3.3.2 **Vesicular and amygdaloidal structure:** Vesicles are common in the rhyolites. The vesicles are mostly spherical but sometimes they are irregular in shape. They also vary in size. These structures are well developed in red brown rhyolite near *Bagundi.* The vesicles are sometimes filled up with secondary minerals forming amygdules. The infilling minerals are secondary quartz, jasper, epidote, calcite and chalcedony etc. The vesicles are almond or of irregular shape show preferred orientation along the flow layers and varies in diameter from a few mm to 12 mm. The vesicular structure lies at the top of a flow.

4.0.0 PREVIOUS WORK

4.1.1 The rock exposures in the study area belong to the Malani Igneous Suite of rocks and rest of the area is represented by fine aeolian sands of Thar Desert. Blanford (1877) and Hacket (1881) were among the earliest workers to discuss the geology of the Malani volcanic suite. Blanford introduced the term 'Malani' to these volcanic rocks comprising porphyritic lavas and ash beds.

4.1.2 La Touche (1902) considered that the Malani flows comprise mostly rhyolites of highly acidic nature and concluded that the Siwana granite has intruded into the rhyolite which is an effusive phase of the granite. Coulson (1933) included these rocks into 'Malani System' and described Siwana as hornblende granite occurring in the interiors of the volcanic area along a more or less continuous ring.

4.1.3 Mukherjee (1958) considered the Siwana granite as coarse, porphyritic, hornblende granite without mica and thought that the erupted material occurs as a "doubly plunging syncline".Murthy, et. al. (1961) recognised the riebeckite aegirine rhyolites and granites in the Malani Igneous suite of rocks and suggested that crystallisation of riebeckite and aegirine took place under intrusive as well as extrusive conditions and formally established the "Siwana ring structure". Mukherjee and Pyne (1977) carried out first generation mapping (1:50,000) of the area and proposed two phases of igneous activity in the rhyolites and three phases in the Siwana granites. Gathania et. al., (1981-82) during the geological mapping the rock types mapped are in order of superposition: basalt, andesite, red brown rhyolitc, pyroclastics, green rhyolitc, dykes of porphyritic rhyolite and aegirine phonolite,granite, gabbro, dolerite and quartz veins(Fig.4.1). Gathania et. al., (1984) mapped small outcrops of red brown or greyish black porphyritic rhyolite in the north-western part of the area. Kochhar (1984) related the Malani magmatism to hot spot activity and cratonization process during the post-Delhi period.

4.1.4 Bhushan (1985) ruled out the presence of large-scale folding and faulting in the Malani volcanics. According to him the minor folds or faults present are related to the collapse structures, viscosity and drag of flows during non-orogenic Malani volcanic activity. Bhushan and Mohanty (1988) commented that the felsic magmatism culminated in the largescale outpouring of bimodal volcanics i.e. basalt & rhyolite and anorogenic granite. Srivastava (1988) suggested Malani rhyolite geochronologically to be contemporaneous with the Erinpura granite.

4.1.5 Chittora and Bhushan (1990) established volcano-stratigraphy of Siwana area comprising a total of 45 volcanic flows, where the older flows are generally dacite/rhyodacite to trachitic whereas the younger flows are either rhyolitic or trachytic in composition. They also suggested presence of three phases in Siwana magmatic activity: i) the basal per-alkaline (lower 24 flows), ii) middle meta-aluminous (top 21 flows), and iii) reappearance of peralkaline phase as intrusives (Siwana granite) at the end.

4.1.6 Bhushan and Chandrasekharan (2002) gave detailed account of geology and geochemistry of the tertiary alkaline complex (TAC) rocks.Sharma (2004) stated that the Malanis is characterized by bimodal volcanism with a dominant felsic component, followed by granitic plutonism and a terminal dyke phase.

4.1.7 Kumar et, al. (2014) stated that the rocks of Mewanagar area, part of Malani Igneous Suite (MIS) which is characterized by widespread acid volcanic rocks besides minor amounts of basic rocks in Barmer district. MIS is the largest A-type, anorogenic acid magmatism in the Western Peninsular India and owes its origin to hot spot tectonism. Mewanagar consists of extrusive rhyolite, trachyte, tuffs and basalts) and dyke phase (basalts and dolerite).

4.1.8 Jinger et, al. (2016) stated that the major rock unit of Malani Province is of rhyolites which are relatively more or less uniform in composition. Chemical analyses conducted by various workers in Malani Province suggest that the rhyolites are characterized by high silica content and are sub-alkaline in nature. There is a general consensus that the Malani Province represents Neoproterozoic volcanism and having an age of ~750 + 20 Ma. The origin of the Malani Province is considered as an event of anorogenic felsic volcanism.

4.1.9 Bhardwaj, (2019) reported alternating linear units of basaltic, andesitic and rhyolitic flows as well as E-W trending carbonatite and phonolite dykes in 40O/14. Six carbonatite dykes trending NE-SW to NW-SE exposed near Kamthai area assayed ΣREE values ranging from 0.06% to 16.5%. Foidite rock in Kamthai area assayed ΣREE ranging from 0.03% to 0.35%.

4.1.10 **Details of Geochemical Mapping:** The NGCM survey was carried out in toposheet no.45C/1 during the FS 2018-19. The chemical distribution of TREEs, as documented in the report by Suneeta and Savita (2020) reaches a maximum of 399ppm in the study area.The Kamthai REE prospect is present just southwest of the area, and the Siwana REE prospect lies to the south east of the study area.

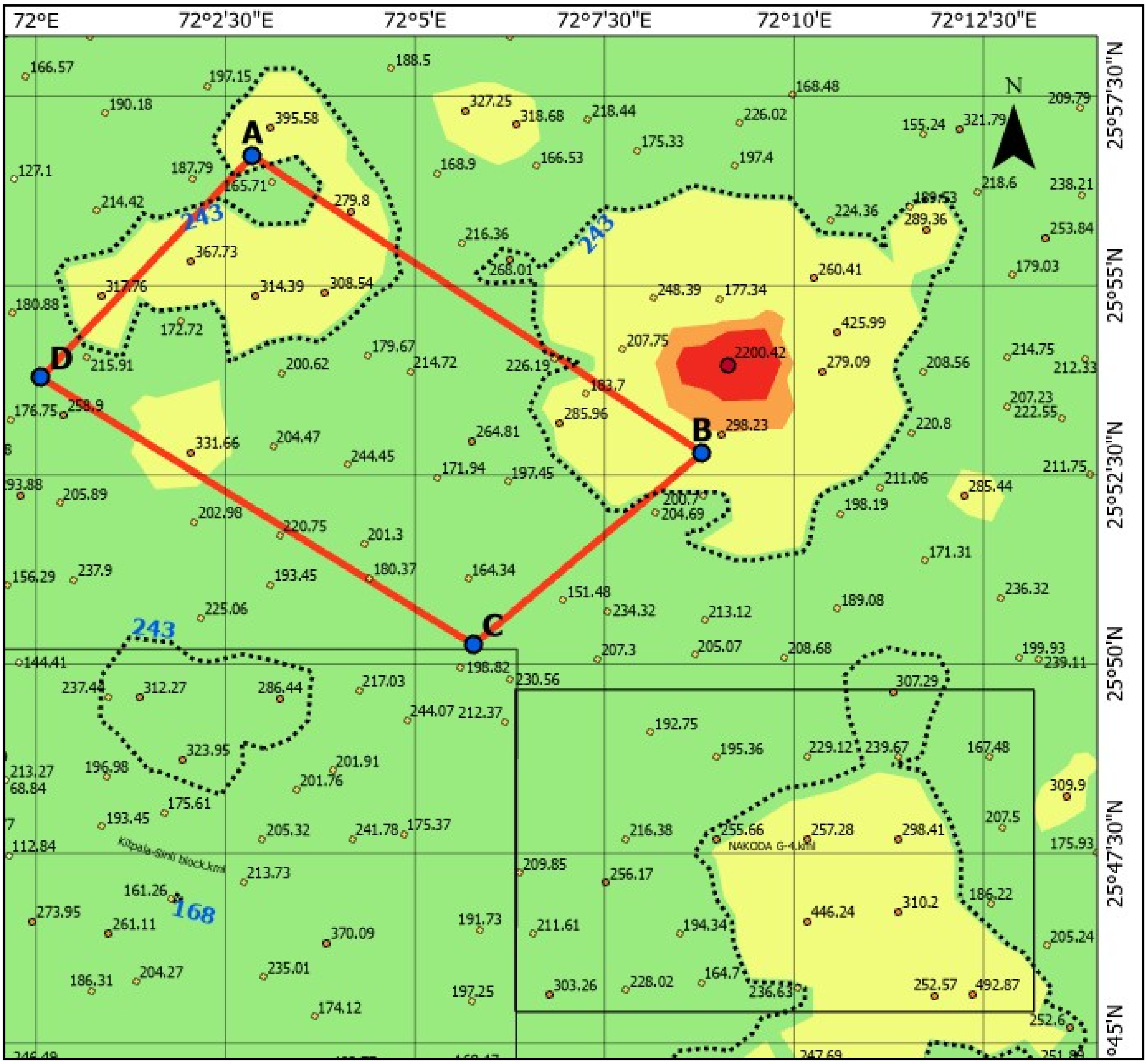


Fig: The element distribution map of TREE (ppm) from stream sediment samples (TS 45C01)

4.1.11 **Details of National Geophysical Mapping:** The NGPM surveys were conducted in the area falling within toposheet nos. 45C01, 45B03, 45B04, 45B07 and 45B08 included Gravity and Magnetic (Total Field) surveys in addition to Differential Global Positioning System (DGPS) surveys. The station density for the GM observations was one per 2.5 sq. km area (Rajan Kumar et al 2022).

Bouguer gravity anomaly contour map is characterized by wide-ranging gravity variations, as we can see gravity 'high' in western portion and central part of Toposheet No. 45C/01. The shallow anomalies aligned approximately NW-SE direction and Gravity high recorded near Rikarlai, Jasol and Nimbli in southwestern portion of Toposheet No. 45C/01

The magnetic (T.F.) anomaly map is presented (Fig.4.4) with a contour interval of 50 nT. The general trend of magnetic contour is in NNE-SSW direction, which is in corroboration with alignment of the Bouguer gravity anomaly map. High dominant anomaly recorded near Rikarlai, Jasol and Nimbli villages in southwestern portion (Toposheet No. 45C/01) is due to intrusive/ extrusive body (Basalt/ Rhyolite & Tuffs).

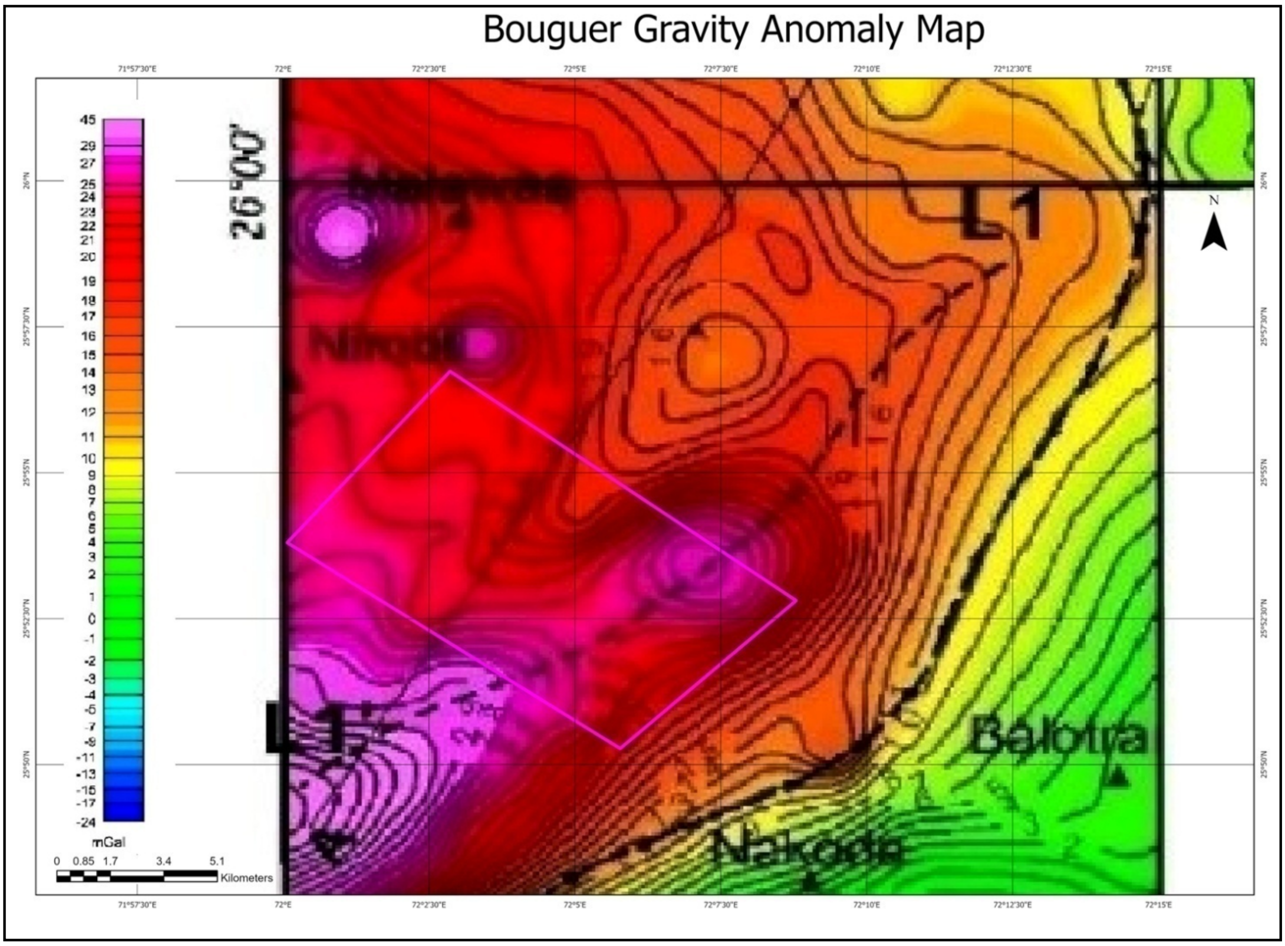


Fig: Analytical signal map of Bouger gravity anomaly map (NGPM) inToposheet No-45C/01 showing current G4 Block

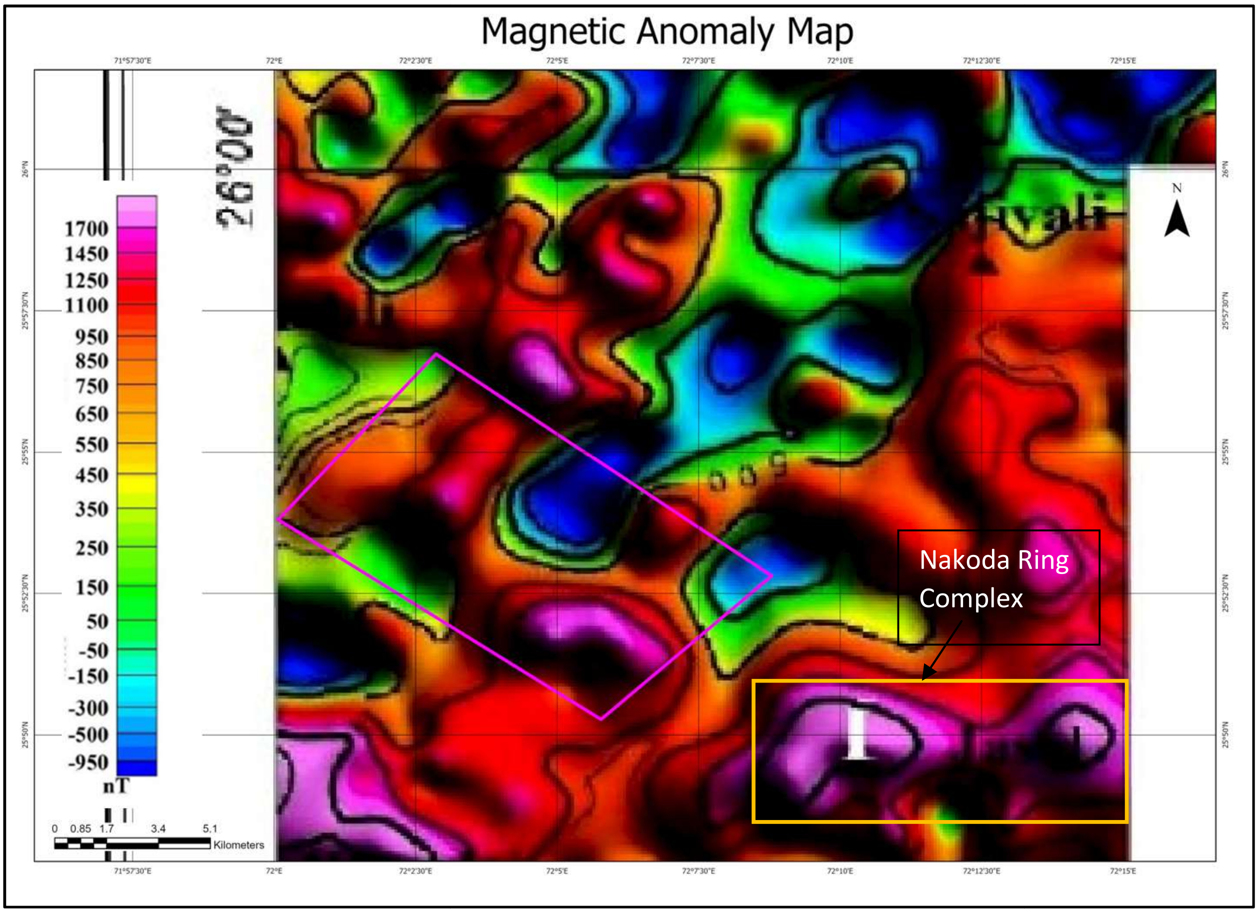


Fig: Magnetic (TF) anomaly map (NGPM) in part of Toposheet No- 45C/01 showing Current G4 Block

4.1.12 **Details of National Aero-geophysical Mapping:** The aeromagnetic map from the NAGMP indicates the presence of a prominent linear high running east-west for approximately 11 kilometers within the specified area. Multiple parallel magnetic highs are observed towards the northern & southern part of this linear high, with a trend in a NNW-SSE direction. However, these NNW-SSE lineaments appear to end when they meet the E-W lineament and do not continue further. The NAGMP report suggests that this high, along with other intrusions, bears similarities to the Sarnu-Dandali alkaline complex based on their magnetic signatures. Natural gamma ray energy derived from radioactive isotopes of potassium, thorium, and uranium was detected in NAGMP, producing maps and images indicating the apparent surface concentration of these elements. The potassium concentration over the exposed areas exhibited a higher concentration compared to the surrounding areas, attributed to the presence of rhyolites rich in potassium. The thorium spectrometric map displayed higher concentrations over the rhyolite exposures in the area, suggesting potential for thorium enrichment in those areas. Similarly, the uranium concentration in the area also exhibited higher values, in alignment with the potassium and thorium concentrations. These anomalies were found to complement each other in the rhyolite-exposed areas.

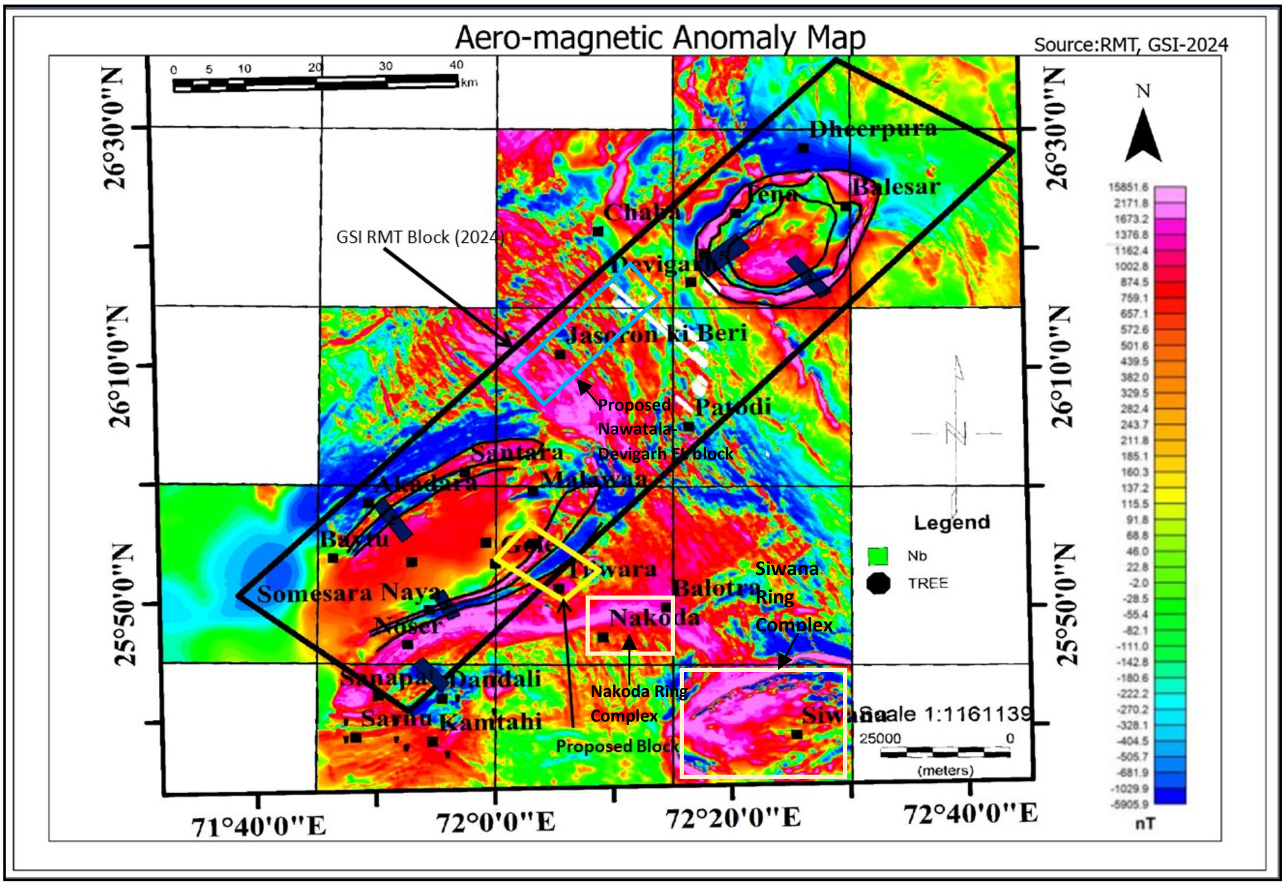


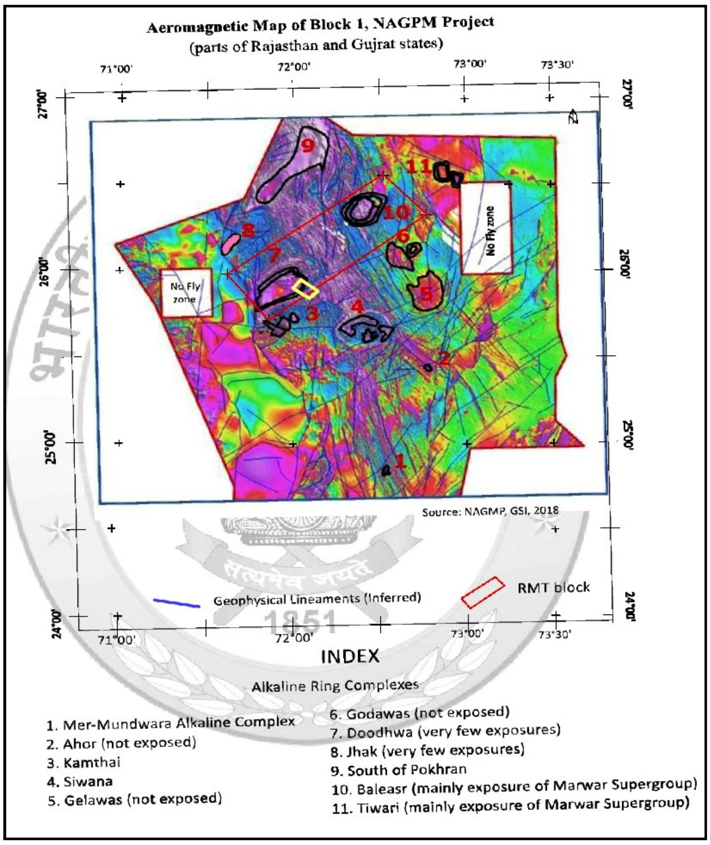
Fig: Aero-magnetic anomaly map

4.1.13 Regional Mineral Targeting (RMT) was carried out during FS 2020 to 2023. The rocks exposed in the study area exhibit a range of composition, including rhyolite, dacite, andesite, basalt, phonolite and trachyte. The basic and intermediate rocks in the study area are classified as meta-aluminous, indicating an M-type origin. Conversely, the acidic rocks display per-alkaline to per-aluminous characteristics, suggesting an I to S-type origin. The acidic rocks are calc-alkaline in nature, while the basic magmatic rocks exhibit tholeiitic affinity. The REE patterns of the Group I acidic rocks and the rocks of Siwana area follow a similar pattern, but differ in terms of LREE and HREE enrichment. This difference is believed to be a result of varying degrees of partial melting from the same source. The REE patterns of the basic and alkaline rocks do not match with the acidic/intermediate rocks, indicating that they originate from two distinct sources. The tectonic description diagram suggests that the acidic and basic rocks belong to the anorogenic or within plate type. The petrological study of the Group I acid volcanic rocks reveal wide variation in textures, from aphanitic to porphyritic. These rocks are primarily composed of glass and phenocrysts of K-feldspar, quartz, hornblende and biotite. Accessory minerals such as allanite, zircon, and apatite are present, while sericite, muscovite, and epidote occur as secondary minerals. Opaque minerals, specifically hematite and magnetite are abundant in the acidic rocks of the study area. NAGMP, reported ring type (northern part) and elliptical type (southern part) residual magnetic anomalies in the area which are interpreted as buried ring structures. Existence of walls of the crater of a volcano containing highly magnetic materials of circular lava flow itself may be attributed for this anomaly. Overall, the magnetic anomalies suggest the presence of volcanic structures and possibly shallow linear magnetized bodies or dykes within the surveyed area. The analysis of various rock groups gathered from the research site revealed that acidic rocks exhibit higher fertility for REE and RM mineralization when compared to alkaline and basic rock groups. Results of regolith samples reveal elevated value of total REE, Nb, and Zr. It is worth noting that Noser area exhibits TREE values exceeding 1000 ppm, while the highest Zr value of 1026 ppm was detected east of Balesar in Jodhpur district, Rajasthan. Nb values ranging from 51 to 68 ppm were concentrated in various locations, including Akadara village, Bagundi-Patodi area, Tena-Shergarh, and Balesar-Dheerpura area. Furthermore, elevated Nb values were also identified in the south-eastern corner around Noser and Dandali village. The Sajiyali area, which is part of Pachpadra Lake, yielded highest Li value of 124 ppm. Various elements in the area have displayed anomalous analytical values in the petrochemical samples. For example, the Zr concentration ranges from 115-7433 ppm, with an average of 1089 ppm, while the Hf concentration varies from 3.50-190.65 ppm. Additionally, the Nb concentration ranges from 6-605 ppm, and the Y concentration varies from 12.84-904.85 ppm. The concentration of TREE ranges from 80-2143 ppm. The elevated values of TREE and RM, indicating the potential for rare earth elements and rare metals in the Tena-Shergarh and Balesar to Dheerpura area of the northern buried ring structure of the RMT block, as well as the Khatu to Chiriya area in the southern buried ring structure. These elevated values highlight the need for further exploration in these areas, specifically through G4 stage exploration. The borehole RJRMTM-02, drilled near Khatu in the southern buried ring structure, represents a significant exploration effort to assess mineral potential. Located on the western fringe of the ring structure, this borehole has yielded promising results, with the first reporting of anomalous mineralization showcasing maximum values of ΣREE+ Y at 2137 ppm, ΣREE at 1598 ppm, Nb at 88 ppm, Hf at 64 ppm, and Sn at 42 ppm. Part core sampling from various zones of borehole RJRMTM-02 reveal the presence of four zones with a cumulative thickness of 13.65 m. These zones exhibit average values of ΣREE+ Y at 1036 ppm, 1411 ppm, 1109 ppm, and 1110 ppm, respectively, along with notable concentrations of Nb and Hf.

4.1.14 Singh and Kudupudiduring FS 2023-24 carried out large scale mapping in an area of 100 sq km in the Nakoda of Barmer District, Rajasthan in the parts of Survey of India Toposheet number 45C/01, with the primary objective of investigating the presence of RareEarth Elements (REE) and rare metal mineralization. The rocks of Nakoda Ring Complex (NRC) are exposed as semicircular to curvilinear outcrops surrounded by thick blanket of sand and sand dunes with Luni river at northern flank.The study area primarily consists of volcanic rocks of Kailana felsic volcanics from the Jodhpur Group, which belong to the Malani Igneous Suite, located in the central and southwestern portions of the study area surrounded by aeolian sand and silt belonging to the Thar Desert.The predominant lithology observed in the study area is rhyolite with textural variations from place to place, forming the surface country rock. Variations in the rhyolite were identified based on characteristics such as porphyries, color, phenocryst to matrix ratio, etc. Several basalt/dolerite dykes have intruded the rhyolite in a NW-SE direction. Basalt flows underlie the rhyolite flows. The rhyolite and basalt flows show sharp contact between them. Within the rhyolite outcrops, patches of pyroclastic breccias, hydrothermal breccias and thick sequence of pyroclastic materials were mapped. The highest concentrations of TREE + Y are observed in rhyolites at 3833 ppm, followed by lapilli tuffs at 2503 ppm, pyroclastic breccias/agglomerate at 1995 ppm, rhyolites with ferrous veins at 1898ppm and hydrothermal breccias at 1595ppm. The Zr content reaches its maximum in rhyolites at 3765 ppm, with lapilli tuff closely following at 3747 ppm. Nd concentrations are highest in lapilli tuff, recorded at 442 ppm, while rhyolites exhibit a concentration of 391 ppm. The highest concentration of Sn is found in hydrothermal breccias/lapilli at 46 ppm; Nb is most prevalent in rhyolites, with a concentration of 200 ppm, followed by hydrothermal breccias/lapilli at 122 ppm. Total of 36 samples out of 151 from the BRS & channel indicate values of TREE+Y exceeding 1000 ppm. Furthermore, 18 samples show concentrations greater than 1500 ppm of TREE+Y, and 5 samples show values exceeding 2000 ppm of TREE+Y.

5.0.0 MINERAL POTENTIALITY & JUSTIFICATION

5.1.0 Neoproterozoic Siwana Ring Complex (SRC), in western Rajasthan is a well-preserved collapsed caldera in the third largest felsic volcanism of Malani Igneous Suite, hosting multiple phases of magmatism comprising high silicic, low alumina and calcium, iron rich bimodal volcanic suite intruded by peralkaline granite ring dyke and younger microgranite, granophyre, felsites and aplites, rich in Y, Zr, Nb, LREE (La and Ce). It presents a diverse volcanogenic setting suitable for multi-metal mineralisation along the margins of caldera at the contact with acid volcanics and granites, and also strata-bound association with acid volcanic flows and Moat sediments within the caldera. Besides Siwana Ring Complex, there are many other favourable volcanic centres in Malani Igneous suite viz, Nakoda Ring Complex (north west of SRC), Sarnu-Dandali, Kamthai, Rama, Miniari-Pali, Tavidar, Doodhwa etc. The present proposed block lies in the Doodhwa Ring Complex.



5.2.0 The proposed area lies adjacent to Nakoda Ring Complex, bimodal volcanics with pyroclastic intercalations near Tilwara, Bagundi and Gol area following anomalous concentration of Ba (383 ppm) and Sc (14 ppm) near Gol; Na2O 8.31%, La 371 ppm, Ce-579 ppm Nd-705ppm, Pr-208ppm NE of Tilwara, warrants close sampling and close checking of geological attributes in the block.

5.3.0 The proposed G-4 block has been carved out from the RMT block (FS-2020-23), which is characterized by a volcanic phase represented by rhyolitic flows which is porphyritic in nature. The proposed block lays on top a buried ring structure as evident from the aero-magnetic anomaly map of the area. These rock types gave encouraging values in terms of REE and RM mineralization and were recommended to study the entire area in G-4 level to access the full mineral potential.

5.4.0 Petrographic and EPMA analyses confirmed the presence of several primary rare earth element (REE) minerals namely; Thorite (Silicates), Britholite (phosphate), Parisite (carbonate), Monazite (phosphate), Allanite (Silicates) etc in and around this area.

5.5.0 In the southern extension of the eastern limb of the buried ring structure (near Noser village) TREE value ranges from 1491 to 2316 PPM; as the same limb is continuing in the present proposed area, it might be equally potential for REE mineralization. In the western limb of the ring structure, TREE value ranges from 1029-1490 PPM.

5.6.0 Based on the analysis of regolith samples in the RMT block, elevated values of Nb, Hf, Zr was also noted. Nb values ranging from 51 to 68 ppm were clustered in locations, such as Bagundi-Patodi area. Zr value is in the range of 301-513 PPM in regolith sample; Nb value is in the range of 51-68 PPM in regolith sample; Hf value is in the range of 41-100 PPM in petrochemical sample; Y value is in the range of 200-300 PPM in petrochemical sample was found in and around Gol-Bagundi.

5.7.0 Based on the studies of the RMT block by GSI, Nawatala-Devigarg EL has also been curved out where aero-magnetic signatures is showing NW-SE (south-eastern part of the block) and N-S (in the central portion of the block) trending two high magnetic linears. Similar aeromagnetic responses have been also observed from the nearby Siwana Ring Complex, which is well known for its REE and RM potential. The NGPM Magnetic (TF) anomaly contour map is well corroborating with the aeromagnetic anomaly. The proposed EL Block lies over a gravity gradient in NGPM Bouguer Gravity anomaly map. In Siwana area gravity gradient zones are found potential for search of REE mineralisation.

5.8.0 The geophysical and geological signatures supporting the presence of Malani Volcanic suite (known for its REE & RM potentiality) below the soil cover. Hence, the area is proposed REE and associated mineralization.

6.0.0 PLANNED METHODOLOGY

Based on the evaluation of geological data available, the present exploration program has been formulated to fulfill the following objectives:

i. To carry out detail geological mapping on 1:12500 scale for distribution of REE mineral bearing formation.
ii. To collect systematic bedrock and channel samples for analysis of 34 elements by IC-PMS which include REE to understand the distribution on primary source.
iii. To carry out detail surface geophysical survey by gravity, magnetic and Gamma ray spectrometry method to understand the continuity and characteristics of rhyolite below the aeolian cover.
iv. To carry out scout drilling of boreholes to establish subsurface occurrence of REEs.
v. To establish the reconnaissance resource for REE bearing minerals as per UNFC norms & Minerals (Evidence of Mineral Contents) Rules- 2015.

The details of different activities to be carried out are presented in subsequent paragraphs.

6.1.0 GEOLOGICAL MAPPING

6.1.1 Geological mapping will be carried out in the entire 82.50sq.km area on 1:12500 scale. Rock types, their contact, structural features will be mapped. Surface manifestations of the mineralization (REE) available along with their surface disposition will be marked on map.

6.2.0 GEOCHEMICAL SAMPLING

6.2.1 **Bed Rock Sampling:** 30 nos. of bedrock samples will be collected systematically in grid pattern during mapping from the various lithounits present in the area, to understand the distribution of REE in granite, rhyolite and mafic dykes.

6.2.2 **Channel Samples:** Channels to be cut on the surface outcrop across the rhyolite. Hence a provision of 20 Channel samples has been kept for the above mentioned purpose.

6.3.0 EXPLORATORY DRILLING

6.3.1 Scout drilling will be carried out in accordance with the amended MEMC rule after mapping of all the dykes, joints and major fracture systems. A provision of 500 m of core drilling has been kept in the exploration scheme which will be finalized after geological mapping.

6.3.2 **Borehole Samples:** Core sampling is carried out after detailed core logging of the borehole. Since the REE & RM mineralization cannot be distinguished easily by naked eye or petrographic studies, sampling can be done on the basis of the mineralized zones established on surface by channel sampling. The sample interval is kept at 1m. However, to avoid mixing of samples of different lithologies, variable lengths samples may be collected near to the litho contacts. Hence a provision of 250 Nos of borehole core samples have been kept in the quantum.

6.4.0 Chemical Analysis

6.4.1 All the 320 nos of samples including bedrock samples (50 Nos), channel samples (20 Nos) and borehole core samples (250 Nos) will be subjected to chemical analysis of Sc, Y, La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Hf, Ta, Rb, Zr, Ge, Sr, Sn, W, V, Be, Ga, Nb, Mo, Pb, Li, Cs, U & Th through ICPMS at MECL's chemical laboratory facility Nagpur.

6.4.2 15 Nos of samples will be subjected to whole rock analysis through XRF.

6.4.3 10% of primary samples, i.e., 32 nos will be analysed at NABL accredited laboratory as external check sample and will be analysed for Sc, Y, La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Hf, Ta, Rb, Zr, Ge, Sr, Sn, W, V, Be, Ga, Nb, Mo, Pb, Li, Cs, U & Th through ICPMS.

6.5.0 PETROLOGICAL STUDIES:

6.5.1 During the course of Geological mapping, drilling and sampling 10 nos. of samples from outcrops and borehole core samples of various litho units will be collected for Petrographic Studies.

6.6.0 XRD STUDY

6.6.1 To know the different mineral phases which can possibly host REE, 10 samples will be studied by XRD method. The samples for XRD will be selected from the samples which will analyze higher values of REE in bedrock, channel and core samples.

6.7.0 EPMA Study

6.7.1 EPMA study on different REE and silicate phases will be carried out in few silicate samples.

6.8.0 GEOPHYSICAL SURVEY

6.8.1 As the area is mostly under alluvial sand cover, Gravity, Magnetic and Gamma ray spectrometry is proposed in order to delineate the sub-surface geology of the area.

Details of the particular, Quantum and the targets are tabulated in **Table No.-4.**

Table No-4
Envisaged Quantum of proposed work

Sl. No.	Item of Work	Unit	Target
1	**Large Scale Geological Mapping** (on 1:12500 Scale)	Sq km	82.50
2	**Surface Geochemical Sampling**		
i	Bedrock samples	Nos	30
ii	Channel Samples	Nos	20

Sl. No.	Item of Work	Unit	Target
3	**Core Drilling**		
i	Scout Drilling	m	500
iii	Borehole Core Sampling	Nos	250
4	**Laboratory Studies**(34 elemental analysis by ICPMS Sc, Y, La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Hf, Ta, Rb, Zr, Ge, Sr, Sn, W, V, Be, Ga, Nb, Mo, Pb, Li, Cs, U & Th		
	i)Primary Samples	Nos	300
	ii) External Check Samples	Nos	30
	iii) Whole rock samples for Major oxides by XRF	Nos	15
5	**Petrological Samples**	Nos	10
6	**XRD Mineral phase analysis**	Nos	10
7	**EPMA studies**	Hrs	10
8	**Geophysical Survey**		
i	Gravity Survey- Magnetic Survey	stations	4500
ii	Gamma ray spectrometry	stations	4500
9	**Report Preparation (5 Hard copies with a soft copy)**	Nos.	1
10	**Preparation of Exploration Proposal (5 Hard copies with a soft copy)**	Nos.	1

7.0.0 BREAK-UP OF EXPENDITURE

7.0.1 Tentative Cost has been estimated based on Schedule of Charges (SoC) of projects funded by National Mineral Exploration Trust (NMET) w.e.f. 01/04/2020. The total estimated cost is **Rs. 520.78 Lakhs.** The summary of cost estimates for Reconnaissance Survey (G-4) is given in **Table No. - 5.** The detailed cost sheet is given as Annexure-I.

Table No. 5

Summary of cost estimates for Gol-Bagundi-Tilwara Area, District- Balotra, Rajasthan

Sl. No.	Item	Total Estimated Cost (Rs.)
1	Geological Mapping (LSM), Other Geological Work	26,42,860
2	Geophysical Survey	2,90,70,000
3	Drilling	69,84,772
4	Laboratory Studies	29,06,090
	Sub Total (1 to 4)	**4,16,03,722**

Sl. No.	Item	Total Estimated Cost (Rs.)
5	Exploration Report Preparation	20,00,000
6	Proposal Preparation	5,00,000
7	Peer review charges	30,000
8	**Sub Total (1 to 7)**	**4,41,33,722**
9	GST 18%	79,44,070
10	**Total:**	**5,20,77,792**

8.0.0 TIMELINE

8.0.1 The entire project is planned tentatively for 10 months. Initially, geological mapping, geophysical survey and surface bedrock sampling shall be carried out followed by scout drilling provided positive results are obtained in the first phase of sampling.

Table No. 6

Tentative Time schedule / Action plan

Estimated timeline for Reconnaissance Survey (G-4) for REE & associated mineralization in Gol-Bagundi-Tilwara Area, District- Balotra, Rajasthan [Block area- 82.50 sq. km; Schedule timeline- 10 months]

S. No.	Particulars	Months/ Days	1	2	3	4	5		6	7	8	9	10
1	Camp Setting	months	■					**Review**					
2	Geological Mapping & sampling	months	■	■	■	■	■						
3	Geophysical Survey	months			■	■	■						
4	Scout Drilling	m							■	■			
5	Geologist days	days	■	■	■	■	■		■	■	■		
6	Geophysicist Days	days			■	■	■		■	■	■		
8	Sampling days	days			■	■	■		■	■	■		
9	Camp winding	months										■	
10	Laboratory Studies	months				■	■		■	■	■	■	
11	Geologist days, HQ	days										■	■
12	Geophysicist days, HQ	days										■	■
13	Report Writing with Peer Review	months										■	■

List of Plates: 1. Location Map of the Block

2. Regional Geological Map

3. Block Geological Map

4. LREE anomaly Map

5. HREE anomaly Map

6. TREE anomaly Map

7. Gravity anomaly Map

8. Magnetic anomaly Map

9. Aero-magnetic anomaly Map

List of Annexure: 1. Detailed cost sheet