Preliminary Exploration (G-3) for REE and associated minerals in SB-1 Block of the southern part of the Siwana ring Complex, Balotra District, Rajasthan

To

National Mineral Exploration and Development Trust
Ministry of Mines,
Room No. 325 & 326, Wing-F,
Udyog Bhawan, Rafi Ahmed Kidwai Marg, Rajpath Area,
Central Secretariat, New Delhi-110011

By

Geo Marine Solutions Pvt. Ltd.
15-17-909/9, Leslie Haven, 5th Cross,
Shivabagh, Mangalore-575005, Karnataka

February 2026

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Mangalore

FEB 2026

Summary of the Proposal Preliminary Exploration (G-3) for REE and associated minerals in SB-1 Block of the southern part of the Siwana ring Complex, Balotra District, Rajasthan

	Features	**Details**
	Block ID	SB-1
	Current Exploration Agency	Geo Marine Solutions Pvt. Ltd., Mangalore for Preliminary Mineral exploration G3 level
	Previous Exploration Agency	Geological Survey of India
	G4 stage Geological Report & G3 stage Exploration report	1. Barman, B.J and Neog, P. 2018. Reconniassance survey for Rare Earth Elements Mineralization in Siwana area, Barmer district, Rajasthan. GSI, Unpublished Report, FS 2017-18. 2. Bidwai, R., Srinavasan, S., Nanda, L.K., Banerjee, A., Bangroo, P.N., Rai, A.K. and Parihar, P.S., 2014. Anomalous silver concentration in volcano-plutonic rocks of Siwana Ring Complex, Barmer district, Western Rajasthan. Current science, Vol. 106, January 2014, pp.159-162. 3. Chittora, V.K. and Bhushan S.K., 1994. Flow-straigraphy, geochemistry and petrogenesis of Malani Igneous Suite arround Kankani, Siwana & Bhadrajan, Western Rajasthan. GSI, Unpublished Report, F.S. 1990-94. 4. Das, U.K., Gantait, A. and Panda, L., 2015. Investigation for REE and other rare metals in Siwana area, Barmer district, Rajasthan. GSI, Unpublished Report, F.S. 2014-15. 5. Dhar, S., Frei, R., Kramers, J.D., Nägler, T.F. and Kochhar, N. 1996. Sr, Pb and Nd isotope studies and their bearing on the petrogenesis of the Jalore and Siwana complexes, Rajasthan, India. Journal of the Geological Society of India 48, 151–160. 6. Dostal, J. 2017. Rare Earth Element Deposits of Alkaline Igneous Rocks. Resources, 6, 34.

doi:10.3390/resources6030034.

7. Kumar, S. and Sharma, R. 2020. Reconnaissance survey for Rare Earth Elements mineralization in and around Chhappan-ka-Pahar, Siwana Ring Complex (SRC), Siwana area, Barmer district, Rajasthan. GSI, Unpublished Report, FS 2018-19.
8. Lal, S. and Ghosh, I. 2023. Reconnaissance survey for Rare Earth Elements and associated mineralisation around Sainji ki beri-Meli area, northern part of Siwana Ring Complex, Siwana (SRC), Barmer district, Rajasthan (Stage: G4). GSI, Unpublished Report, FS 2021-22.
9. Pollard, P. J., 1995. Geology of rare metal deposits: an introduction and overview, Econ. Geology. 90, 489- 494. 4
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11. Rastogi S. K. and Mukherjee T., 2015. Specialized thematic mapping of the Malani Igneous Suite (MIS) around Siwana, Barmer district, Rajasthan. GSI, Unpublished Report, F.S. 2013-15.
12. Rathore, S.S., Venkatesan, T.R., Srivastava, R.K. 1999. Rb-Sr isotope dating of Neoproterozoic (Malani Group) magmatism from southwest Rajasthan, India: evidence 82 of younger pan African thermal event by 40Ar–39Ar studies. Gondwana Research 2, 271–281.
13. Singh, A.K. and Vallinayagam, G., 2009. Radioactive element distribution and rare-metal mineralization in anorogenic acid volcano-plutonic rocks of the Neoproterozoic Malani Felsic Province, Western Peninsular India. Jour. Geol. Soc. India, v.73, pp.837-853.
14. Torsvik T. H., Ashwal L. D., Tucker R. D. and Eide E. A. 2001. Neoproterozoic geochronology and

		palaeogeography of the Seychelles micro-continent: The India link; *Precamb. Res.* 110 47–59.
	Commodity	REE and associated minerals
	Mineral Belt	The study area forms a part of the Siwana Complex, which constitutes an integral component of the Malani Igneous Suite.
	Completion Period with entire Time schedule to complete the project	**Phase 1- 4 months ,** **PhaseII- 4 mohths** **Phase III-4 months** **Total: 12 months**
	Objectives	Preliminary Exploration (G-3) for REE and associated minerals in SB-1 block of the southern part of the Siwana ring Complex, Balotra District, Rajasthan
	Whether the work will be carried out by the proposed agency or through outsourcing and details thereof.	The NABET accredited exploration agency (Geo Marine Solutions Pvt Ltd., Mangalore) will be carrying out all the components of the proposed exploration. The chemical analysis will be done at NABL accredited lab.
	Name/Number of Geoscientists	2 geologists, 2 surveyors, 1 Geophysicist
	Expected Field Months (Geology)	Field work: 10 months

1.	**Location**	SB-1 block, south of Siwana ring complex, Balotra District.
		Boundary points / **Longitude** / **Latitude** A / 25°37'5.906"N / 72°20'1.046"E B / 25°37'5.615"N / 72°20'44.904"E C / 25°36'15.694"N / 72°20'55.017"E D / 25°36'15.222"N / 72°19'59.169"E
	Villages	Piploon, Nalgudha, Gura

	Tehsil/Taluk	Balotra
	District	Balotra
	State	Rajasthan
2.	**Area (hectares/square kilometers)**	
	Block Area	2.0 Sq.km
	Forest Area	Nil
	Government Land Area	1.4 sq km
	Private Land Area	0.6 sq km
3.	**Accessibility**	
	Nearest Rail Head	Balotra Jn Railway Station (40 km)
	Road	NH 754 A & NH 325
	Airport	Jodhpur Airport (140 km)
4.	**Hydrology**	
	Local Surface Drainage Pattern (Channels)	The drainage pattern in the area is dendritic.
	Rivers/Streams	Luni River
5.	**Climate**	
	Mean/Average Annual Rainfall	277 mm per annum
	Temperatures (December)(Minimum) Temperatures (June)(Maximum)	Balotra district is situated in Thar Desert and represents arid climatic conditions. The climate is characterized by low rainfall with 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. January is the coldest month. During winter (December to February), minimum temperatures may fall to 0℃ at night.
6.	**Topography**	
	Toposheet Number	Toposheet No. 45C/06

	Morphology of the area	The area is characterized by arcuate ridges as well as isolated hillocks which are arranged in a semicircular fashion around Siwana. The ridges forming the northern half of the semicircle extend parallel to the strike of the rhyolite flows and show steep escarpments on their northern side and gentle slopes towards south. Sand dunes and sand sheet occur in the area occupying all intervening area among hills and ridges. Rainwater is the prime source of cultivation as there is no major flowing river. Luni river around study area is dry almost throughout the year.
7	**Availability of baseline geoscience data**	
	Geological Map (1:50K/25K)	The proposal is based on the published literature mentioned in the reference. Geological inputs pertaining to the area falling in 45C/06 are available and referred while preparing the write up.
	Geochemical Map	Geochemical inputs pertaining to the area falling in 45C/06 are available
	Geophysical Map (Aero-geophysical, Ground geophysical, Regional as well as local scale GP maps)	Geophysical inputs (Ground geophysical: - gravity & magnetic) pertaining to the area falling in 45C/06 are available.
8	**Justification for taking up G3 or G2 stage mineral exploration**	Preliminary sampling of the rhyolites and associated tuffs of Siwana Ring Complex, Balotra district, carried out by GSI during 2013-14, indicated anomalous REE values with ΣREE ranging from 1334 to 3319ppm ΣREE (Rastogi & Mukherjee, 2015). Bidwai *et al.*, 2014, reported the presence of high LREE, Zr, Nb, Th and U along with Ag in surface samples in the Siwana Ring Complex. Kumar and

		Sharma, 2020, carried out G-4 investigation and reported Σ REE+Y ranges in various lithiounits are i) Plagioclase rich granite (n=79) Σ REE+Y = 0.029%-0.70%. ii) K-feldspar rich granite (n=116) Σ REE+Y= 0.047%-0.66%. iii) Younger Intrusives (n=146) Σ REE+Y= 0.019%-2.66%. iv) Felsic volcanic (n=43) ΣREE+Y = 0.015%-0.96% and v) Enclave/Restite (n=19) ΣREE+Y = 0.022%-1.27%. LREE/HREE ratio indicates that LREE>>HREE in the area and LREE values ranges between 86.45ppm to 1.93%, however, HREE values ranges between 23.94ppm to 0.26%. LREE:HREE ratio in Siwana area is 4:1 approximately. Apart from REE, rare metals and some trace elements also indicate very encouraging results, Zr (0.1% to 1.1%), Nb (2.5ppm to 1039ppm), Ba (25ppm to 3948ppm), Zn (120ppm to 1258ppm), U (0.61ppm to 124ppm), Th (2ppm to 481ppm) and Hf (4.52ppm to 828.18ppm). Barman and Neogi (2018) mapped the peralkaline – peraluminous granite (A type) in the central part of Siwana ring Complex area extending from Mokalsar in the east to Siner in the west through. REE bearing carbonates (perisite) and phosphates (monazite) were identified in both plutonic and volcanic rock types. The granite recorded values ranging from 182.77 ppm to 8611.11 ppm and the average being 2006.95 ppm (count=84). The volcanics recorded values ranging from 142.3 ppm to 8502.50 ppm, average value being 2008.03 ppm (count=116). Sukleswar Ka Mandir (G3) block yields total REE upto 2901ppm in microgranite dyke, 2121 ppm in alkali feldspar granite and 2996ppm in andesite. In the proposed block SB-1, mostly the peralkaline to peraluminous granite is exposed.

		The Total REE values in 05 samples collected from granites in the proposed SB-01 block shows consistent value of REE varying from 1574.55 ppm to 1836.73 ppm. High-resolution aeromagnetic survey in Siwana Ring Complex was carried out by RSAS Division, GSI, Bangalore, during FS. 2017-18. Aeromagnetic maps help in delineating the regional continuity of magnetically susceptible lithounits of Siwana Ring Complex even under soil-covered terrain. Spectrometric maps of potassium and thorium further suggest that the proposed area possesses good potential for rare earth element (REE) mineralization in exposed area. Based on these chemical data and the Remote Sensing and Aerial Survey maps SB-1 block is recommended for G3 stage exploration. The SB-1 block is situated in the southern part of the toposheet no. 45C/06. The block lies about 7 km SW of Siwana town. Siwana is located 132km east of Barmer and 35 south east of Balotra.

DETAILED DESCRIPTION OF THE PROPOSAL

1. Block Summary:

a) Physiography

The geomorphology of the proposed block area is defined by moderately dissected hills with aeolian dune complex. Aeolian sand sheets are present in portions of the study area. The elevation in this block, ranges from 190m to 325m. Luni River form the drainage network in the region.

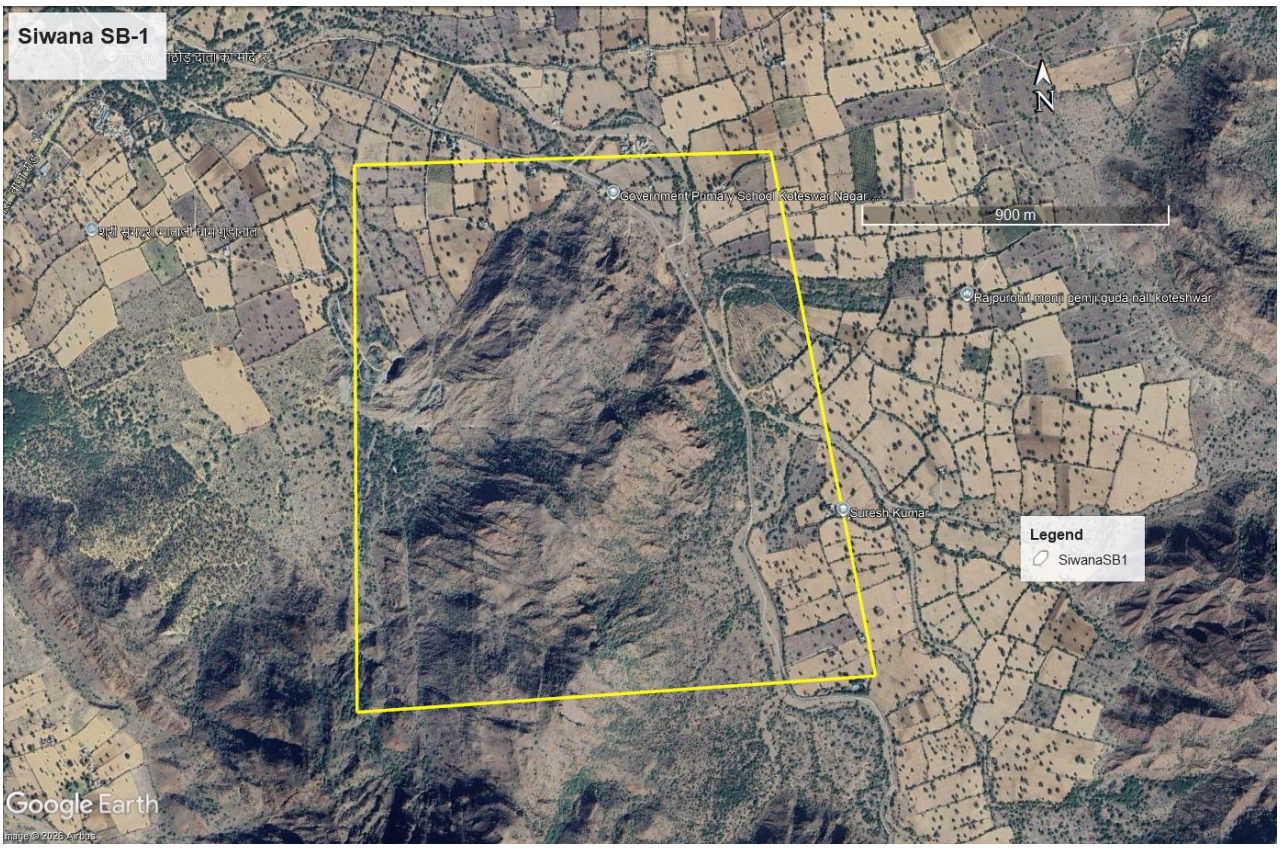

Fig 1: Proposed SB-1 block boundary on Google Earth Imagery

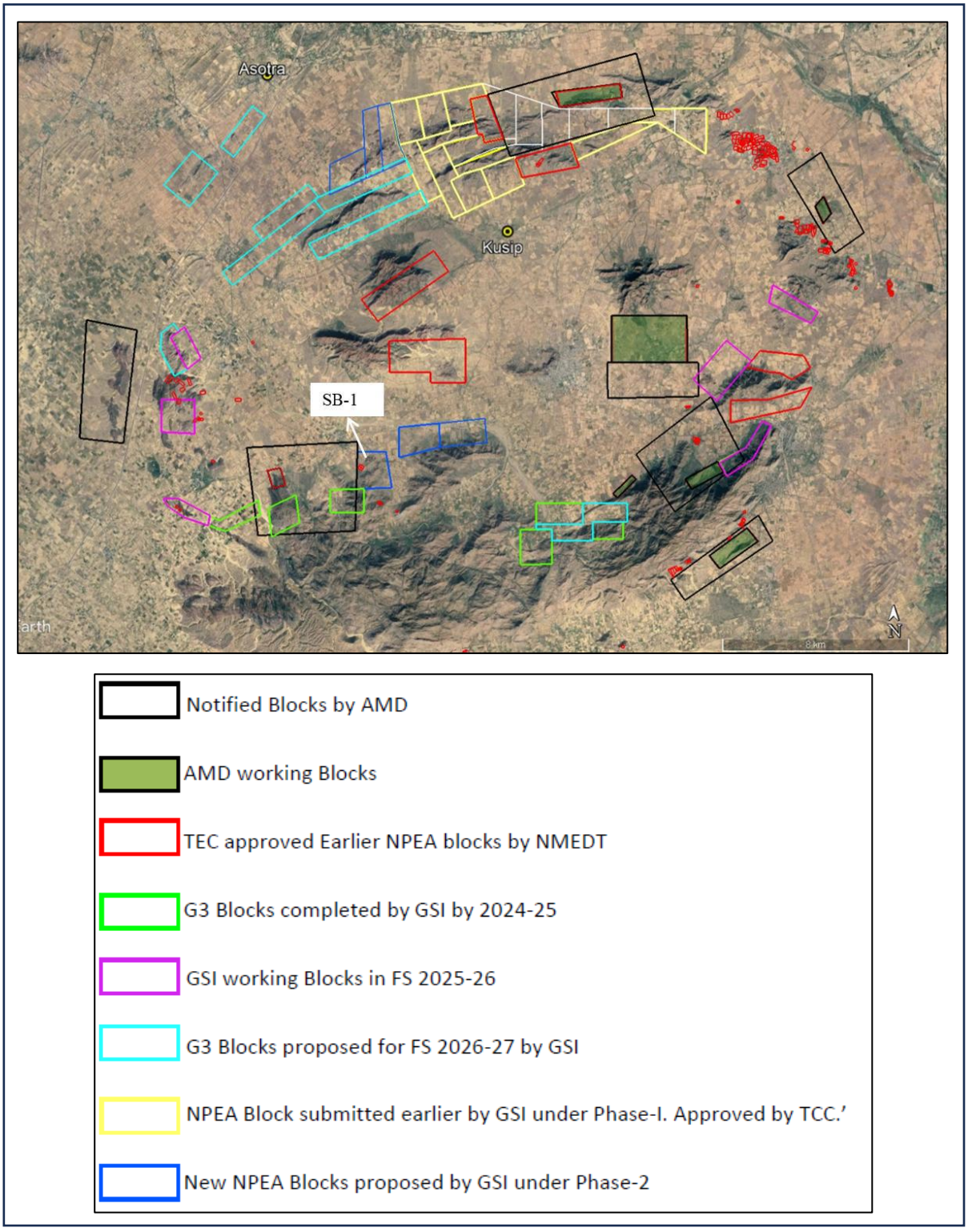

Fig 2: Proposed SB-1 block boundary along with GSI's carved blocks, NPEA Blocks and GSI proposed blocks on Google Earth Imagery

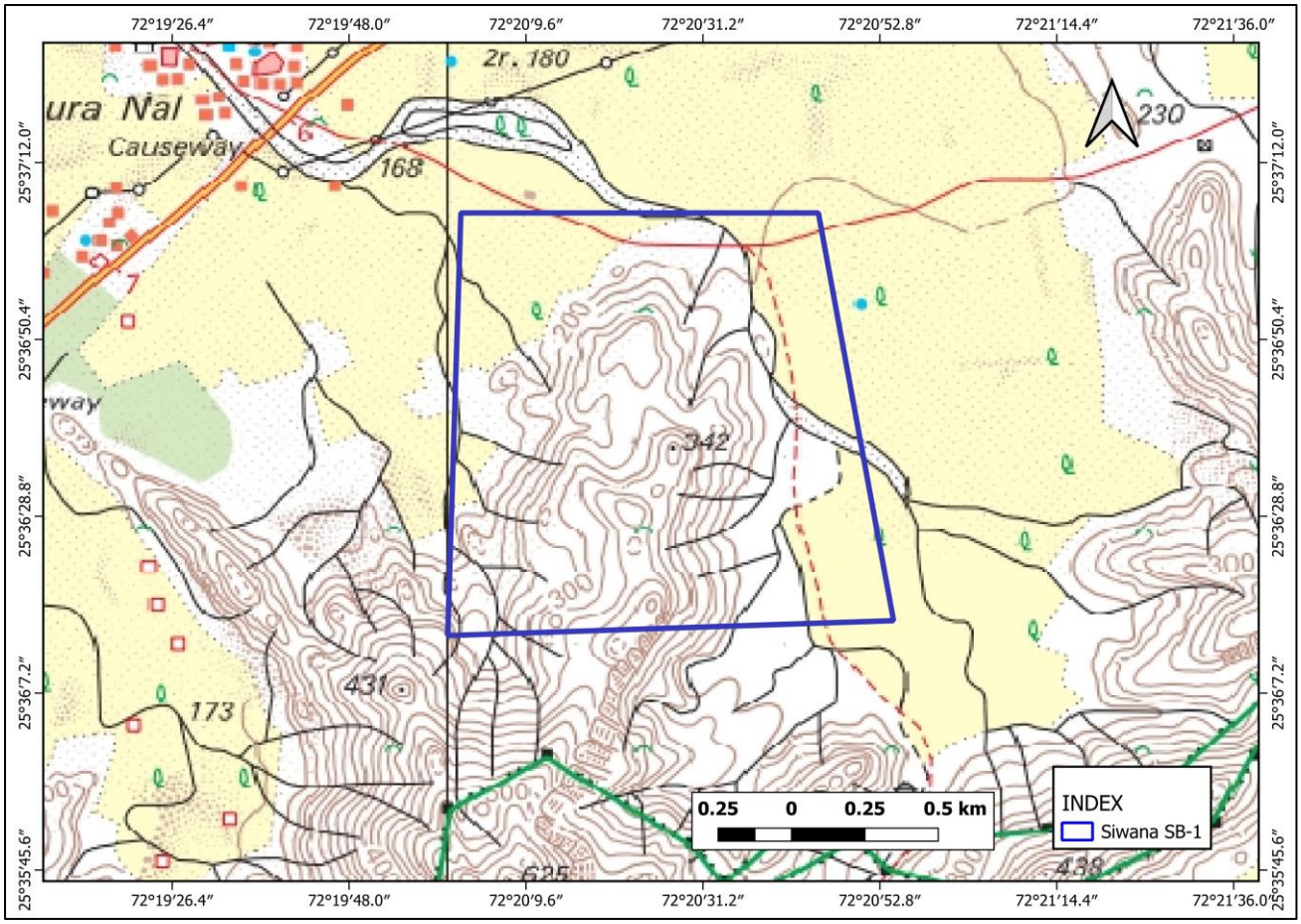

Fig 3. SB-1 block on SOI Toposheet No. 45C/06

b) Background Geology

The magmatic evolution of Siwana Ring Complex, part of Neoproterozoic Malani Igneous Suite (MIS); ca. 771±2 Ma (Torsvik *et al.* 2001), 745 Ma (Dhar *et al*., 1996; Rathore *et al*., 1999) can be divided into three phases (Kumar and Sharma, 2020). First phase is represented by bimodal volcanism of acid and basic flows (acid flows > basic flows). It is intruded by second, plutonic phase comprising arfvedsonite-reibeckite-aegirine bearing per-alkaline Siwana Granite. The third phase being later intrusive phase includes rhyolite, microgranite, andesite and felsite dykes. All these three phases host anomalous ΣREE+Y concentration and the third phase is more enriched (Kumar and Sharma, 2020). Peralkaline igneous rocks, carbonatites, feldspathoid bearing rocks are the main source of REE minerals (± HFSE, U & Th etc) and therefore are suitable host for targeting REE/RM mineralisation. Peralkaline granites, volcanics and associated zoned pegmatoids are considered to be storehouse of REE and rare metals (Nb–Ta, Zr–Hf, Sn, W, Be) (Pollard, 1995) and in layered intrusions, the mineralisation mostly appears in the more evolved parts of the complexes (Dostal, 2017).

Barman and Neogi (2018) mapped the peralkaline – peraluminous granite (A type) in the central part of Siwana ring Complex area extending from Mokalsar in the east to Siner in the west through Mawri, Gugrot, Piplun, Goliyan Bhairan and Kalur Ka Danta area. REE bearing carbonates (perisite) and phosphates (monazite) were identified in both plutonic and volcanic rock types. In addition to REE bearing mineral phases, haematite, ilmenite and zircon are also identified from both plutonic and volcanic phases. The granite recorded values ranging from 182.77 ppm to 8611.11 ppm and the

average being 2006.95 ppm (count=84). The volcanic recorded values ranging from 142.3 ppm to 8502.50 ppm, average value being 2008.03 ppm (count=116). Sukleswar Ka Mandir (G3) block yields tREE upto 2901ppm in microgranite dyke, 2121 ppm in alkali feldspar granite and 2996ppm in andesite.

In the proposed block SB-1, mostly the peralkaline to peraluminous granite is exposed. The Total REE values in 05 samples collected from granites in the proposed SB-01 block shows consistent value of REE varying from 1574.55 ppm to 1836.73 ppm. High-resolution aeromagnetic survey in Siwana area Siwana Ring Complex was carried out by RSAS Division, GSI, Bangalore, during FS. 2017-18. Aeromagnetic maps help in delineating the regional continuity of magnetically susceptible lithounits of Siwana Ring Complex even under soil-covered terrain. Spectrometric maps of potassium and thorium further suggest that the proposed area possesses good potential for rare earth element (REE) mineralization in exposed area.

Based on these chemical data and the Remote Sensing and Aerial Survey maps SB-1 block is recommended for G3 stage exploration. The SB-1 block is situated in the southern part of the toposheet no. 45C/06. The block lies about 7 km SW of Siwana town. Siwana is located 132km east of Barmer and 35 south east of Balotra.

STRATIGRAPHY

Table 1: Geology of the area (Trans-Aravalli Region) (After Bhushan, 2000)

Group/supergroup	**Age**	**Rock Types**
Marwar Supergroup (Jodhpur Group)	Vendian to Lower Cambrian	Maroon and golden sandstone, siltstone, and shale
…..….....Unconformity……...……		
Pokharan Boulder Bed	Vendian	Scattered boulders and pebbles of glacial origin
…..….....Unconformity……...……		
Malani Igneous Suite (MIS)	Non-Proterozoic	Bimodal Volcanics, granites and dyke swarm
…..….....Unconformity……...……		
Delhi Supergroup (basement)	Meso-Neo-Proterozoic	Abu and Erinpura granite: Metasediments of Sirohi and Pali area. Unspecified gneisses of Balewa-harsani area: (Archean Supercrustals?)

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

Based on the previous exploration data by the GSI's G4 and G3 investigations, the felsic rocks, the plutonic per-alkaline Siwana Granite and the third phase being later intrusive phase viz. rhyolite, microgranite, andesite and felsite dykes as well as the younger intrusive in the southern periphery of SRC have been established to have mineralization potential for REE and RM.

d) Scope for proposed exploration

- The area is mainly constituted of linear ridges of predominantly acidic flows interlayered with basic flows with micro granite andesite and felsite dykes
- The rhyolite country rock (felsic flows) are later intruded by both felsic and basic dykes, which show arcuate and radial pattern with respect to ring structure.
- The Siwana Ring Complex consist of three magmatic phases which are Bimodal volcanism (acid > basic flows), Plutonic phase (Siwana granite: arfvedsonite-aegirine bearing peralkaline) and Late intrusives (rhyolite, microgranite, felsite, etc.).
- High concentration of rare metals such as Nb, Ta, Zr, Hf, Sn, W, Be, etc are reported (Pollard, 1995; Dostal, 2017) in this area.
- Specialized Thematic Mapping (2013-15) conducted by GSI, recommended mapping and detailed exploration in outer periphery of SRC for REE. In northern part of SRC, ∑Y+REE ranges from 513 ppm to 3700 ppm.
- GSI (Das et al, 2015) carried out G-4 stage investigation for REE-RM in central and eastern parts of SRC and indicated highly anomalous values of REE and RM with felsic dyke channel samples analyzed Σ REE+Y 0.17% to 3.49%, averaging 1.38%.
- The younger intrusives and felsic volcanics shows elevated REE+Y content and values of the rhyolites and associated tuffs of Bhimgoda Pahar and Koiliyasar-Ka-Pahar of Siwana Ring Complex show anomalous REE ranging from 1334 to 2692 ppm and 1075 to 3319 ppm (Rastogi & Mukherjee, 2015)
- As per the conclusions of Regional Mineral Targeting (RMT) (2023-24), all the phases of SRC are having high concentrations of HREE and Yttrium (Y).

e) Recommendations of G4 Stage Mineral Exploration Report

Das, Gantait and Panda, (2015) has carried out an Investigation for REE and other rare metals in Siwana area, Barmer district, Rajasthan and reported the occurrence of REE mineralization in felsites dykes of Siwana Eastern block in Phulan area. The Siwana Central block is represented by bimodal volcanism

of rhylolite and basalt. The samples were collected from rhyolite and tuff in Bhimgoda ka pahar, Koiliyasar ka pahar, Indrana and Guranal area. In Bhimgoda ka pahar area analytical results of rhyolite indicate ΣREE+Y ranging from 215.86 to 4938.30 ppm and tuff yielded ΣREE+Y ranging from 129.92 to 3793.72 ppm. In Koiliyasar ka pahar, analytical results of rhyolite indicate ΣREE+Y ranging from 231.24 to 4295.33 ppm and tuff yielded ΣREE+Y ranging from 309.66 to 9103.41 ppm and samples collected from rhyolite located near Indrana and Guranal village indicate ΣREE+Y ranging from 1076.69 to 3908.11 ppm. They suggested that the peralkaline granite of Siwana Ring Complex (SRC) is enriched with REE and the later intrusive dykes intruding the granite and rhyolite at the periphery of Siwana Ring Complex are even more enriched with REE potential.

Barman and Neogi (2018) mapped the peralkaline – peraluminous granite (A type) in the central part of Siwana ring Complex area extending from Mokalsar in the east to Siner in the west through Mawri, Gugrot, Piplun, Goliyan Bhairan and Kalur Ka Danta area. REE bearing carbonates (perisite) and phosphates (monazite) were identified in both plutonic and volcanic rock types. In addition to REE bearing mineral phases, haematite, ilmenite and zircon are also identified from both plutonic and volcanic phases. The granite recorded values ranging from 182.77 ppm to 8611.11 ppm and the average being 2006.95 ppm (count=84). The volcanic recorded values ranging from 142.3 ppm to 8502.50 ppm, average value being 2008.03 ppm (count=116). Sukleswar Ka Mandir (G3) block yields tREE upto 2901ppm in microgranite dyke, 2121 ppm in alkali feldspar granite and 2996ppm in andesite.

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Therefore, it needs further exploration with the help of geophysical and geochemical surveys and drilling to establish the REE/RM rich zones for further explorations at G-3 level.

f) Objectives

- Topographical survey (1: 2000 Scale)
- Geological mapping (1: 2000 Scale)
- Core drilling
- Borehole geophysical logging
- Geophysical survey ground magnetic
- Microscopic and petrological studies
- Geological report preparation and resource estimation.

2. Previous work

a) Previous Geological Report (G4 Stage)

- Regional mineral targeting for rare earth elements and rare metals in Siwana Ring Complex, Malani Igneous Suite, Siwana-Mokalsar area, Barmer district, Rajasthan (2023-24)
- Report on Specialized Thematic Mapping of Malani Igneous Suite (MIS) around Siwana, Barmer district, Rajasthan by Saurabh Kumar Rastogi & Tanmay Mukherjee, GSI (2013-15)
- Report on "Reconnaissance survey for Rare Earth Elements mineralization in and around Chhappan-ka-Pahar, Siwana Ring Complex (SRC), Siwana area, Barmer district, Rajasthan (G4)" by Dr Suresh Kumar & Rohit Sharma, GSI (2018-19)
- Investigation for REE and other RM in Siwana area, Barmer district, by U.K Das, A. Gandait, L. Panda, F.S-2014-15, GSI
- Barman, B.J and Neog, P. 2018. Reconniassance survey for Rare Earth Elements Mineralization in Siwana area, Barmer district, Rajasthan. GSI, Unpublished Report, FS 2017-18.
- Chittora, V.K. and Bhushan S.K., 1994. Flow-straigraphy, geochemistry and petrogenesis of Malani Igneous Suite arround Kankani, Siwana & Bhadrajan, Western Rajasthan. GSI, Unpublished Report, F.S. 1990-94.
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- Lal, S. and Ghosh, I. 2023. Reconnaissance survey for Rare Earth Elements and

associated mineralisation around Sainji ki beri-Meli area, northern part of Siwana Ring Complex, Siwana (SRC), Barmer district, Rajasthan (Stage: G4). GSI, Unpublished Report, FS 2021-22.

b) Previous exploration in adjoining area (Regional area)

- **RMT (2023-25)**: - This project under RMT in the Siwana Ring Complex was taken up as a two-year programme to decipher the subsurface geology of covered areas, to know lithological control on RE-RM mineralization in the covered areas and to delineate areas for their exploration. The project extended in FS: 2024-25 to carry out drilling in the block and achieve other left out targets. The REE pattern of both plutonic and volcanic rocks shows that these are enriched in LREE with a flat HREE pattern. The TREE+Y content in BW chip samples of volcanic rocks ranges from 79.3-5324.5ppm and Nb+Ta values from 0.7-387.9ppm. The TREE+Y content in BW chip samples of plutonic rocks ranges from 140.3-4455.3ppm and Nb+Ta values from 2.3-347.9ppm. The TREE+Y content outcrop samples of volcanic rocks ranges from 112.6-5596.5ppm and Nb+Ta values from 7.8-457.5ppm. The TREE+Y content in outcrop samples of plutonic rocks ranges from 211.3-3747.3 ppm.
- **STM-GSI (2013-15): -** This work was carried out in and around Siwana area, to work out the petrogenesis and tectonic evolution of Malani Igneous Suite in Siwana Ring Complex (SRC) and to assess mineral potential. Out of 247 samples analyzed from Siwana Ring Complex, REE enrichment is reflected in 207 samples represented by rhyolite, aplite, microgranite, tuffs and alkali granite and Y+ΣREE values range from 502 ppm to 0.86%. Y+ΣREE > 0.2% is reflected in 58 samples. The anomalous values of Y+ΣREE are reflected from alkali granite, felsic dykes, tuffs and flows.
- **G4-GSI (2018-19): -** The major objective of this study was, to evaluate the potentiality of Rare Earth Elements in the study area. Out of 403 samples analysed, Σ REE+Y ranges between 2.2%-2.6% in 3 samples, 1.0%-1.8% in 9 samples, 0.50 to 0.98% in 36 samples, 0.10% to 0.49% in 258 samples and <0.1% in rest of the samples. Apart from REE, rare metals and some trace elements also indicate very encouraging results, Zr (0.1% to 1.1%), Nb (2.5ppm to 1039ppm), Ba (25ppm to 3948ppm), Zn (120ppm to 1258ppm), U (0.61ppm to 124ppm), Th (2ppm to 481ppm) and Hf (4.52ppm to 828.18ppm).
- **G4-GSI (2014-15)**: - In this G4 level project, the study area is divided into two

blocks; Siwana Eastern block and Siwana Central block. The analytical results reveal significant concentrations of rare earth elements (REE) and other valuable elements. In the Eastern block, granite, rhyolite, and felsite samples showed ΣREE+Y ranges of 1366-7532 ppm, 935-4660 ppm, and 5939-21937 ppm, respectively. Felsite dykes had ΣREE+Y content of 0.17-3.49% (avg. 1.38%) and notable amounts of U, Th, Nb, Zr, Hf, and W. In the Central block, rhyolite and tuff samples from Bhimgoda ka pahar and Koiliyasar ka pahar also showed significant ΣREE+Y concentrations, ranging from 215.86 to 9103.41 ppm.

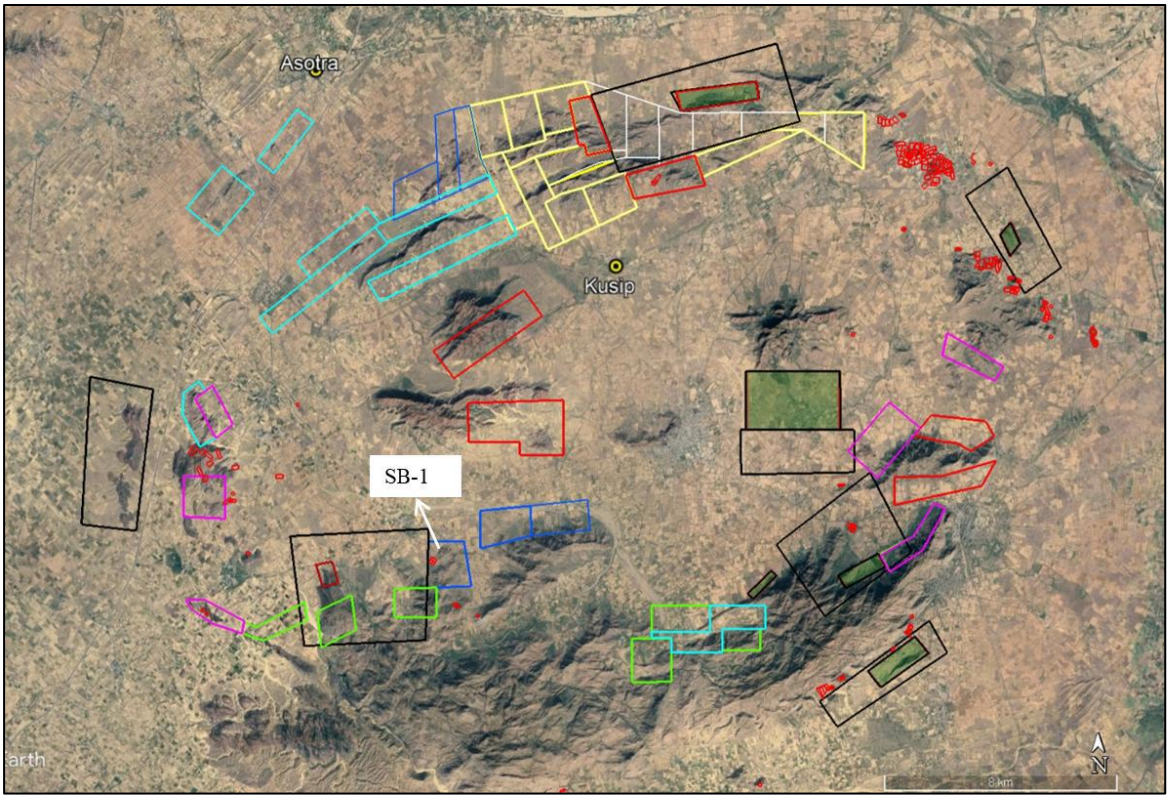

Fig 4: Previous exploration blocks and currently ongoing blocks in adjoining area of SB-1 Block, demarcated on google earth

c) **Previous Exploration details in the proposed block area:** Das, Gantait and Panda, (2015) has carried out an Investigation for REE and other rare metals in Siwana area, Barmer district, Rajasthan and reported the occurrence of REE mineralization in felsites dykes of Siwana Eastern block in Phulan area. The Siwana Central block is represented by bimodal volcanism of rhylolite and basalt. The samples were collected from rhyolite and tuff in Bhimgoda ka pahar, Koiliyasar ka pahar, Indrana and Guranal area. In Bhimgoda ka pahar area analytical results of rhyolite indicate ΣREE+Y ranging from 215.86 to 4938.30 ppm and tuff yielded ΣREE+Y ranging from 129.92 to 3793.72 ppm. In Koiliyasar ka pahar, analytical results of rhyolite indicate ΣREE+Y ranging from 231.24 to 4295.33 ppm and tuff yielded ΣREE+Y ranging from 309.66 to 9103.41 ppm and samples collected from rhyolite located near Indrana and Guranal village indicate ΣREE+Y ranging from 1076.69 to 3908.11 ppm. They suggested that the peralkaline granite of Siwana Ring Complex (SRC) is enriched with REE and the later intrusive dykes intruding the granite and rhyolite at the periphery of Siwana Ring Complex are even more enriched with REE potential.

Barman and Neog, 2018 mapped the peralkaline – peraluminous granite (A type) in the central part of Siwana ring Complex area extending from Mokalsar in the east to Siner in the west through Mawri, Gugrot, Piplun, Goliyan Bhairan and Kalur Ka Danta area. REE bearing carbonates (perisite) and phosphates (monazite) were identified in both plutonic and volcanic rock types. In addition to REE bearing mineral phases, haematite, ilmenite and zircon are also identified from both plutonic and volcanic phases. The granite recorded values ranging from 182.77 ppm to 8611.11 ppm and the average being 2006.95 ppm (count=84). The volcanic recorded values ranging from 142.3 ppm to 8502.50 ppm, average value being 2008.03 ppm (count=116). Sukleswar Ka Mandir (G3) block yields tREE upto 2901ppm in microgranite dyke, 2121 ppm in alkali feldspar granite and 2996ppm in andesite.

3. Block description

Corner points	Latitude (°N)	Longitude (°E)
A	25°37'5.906"N	72°20'1.046"E
B	25°37'5.615"N	72°20'44.904"E
C	25°36'15.694"N	72°20'55.017"E
D	25°36'15.222"N	72°19'59.169"E

4. Planned methodology

- **Topographical survey & Geological mapping**: - Reference points will be established within the mapping area by level transferring of SoI (Survey of India) benchmark point or through SOI CORS network based TBM establishment. The total area of 2.0 sq km will be mapped on 1:2000 scale using DGPS survey method to bring out different geological and geomorphological units. All the mapped units will be linked (geo-referenced) to the toposheet (45C/06) pertaining to the area.
- **Core drilling for Sub surface mineral content**: The core drilling will be carried out

initially in 5 bore holes upto 125 m and further , if results are encouraging, in remaining 19 bore holes upto 125 m will be carried out. A total of 24 boreholes drilled up to 125 m or at 200 by 400m grid pattern covering the entire block.

- **Borehole Geophysical Logging**: Spectral Gamma logging (in borehole) for locating and delineation of potential mineral zones during the course of mineral exploration
- **Ground magnetic survey**: 250 station of ground magnetic survey is proposed to be undertaken in G3 exploration

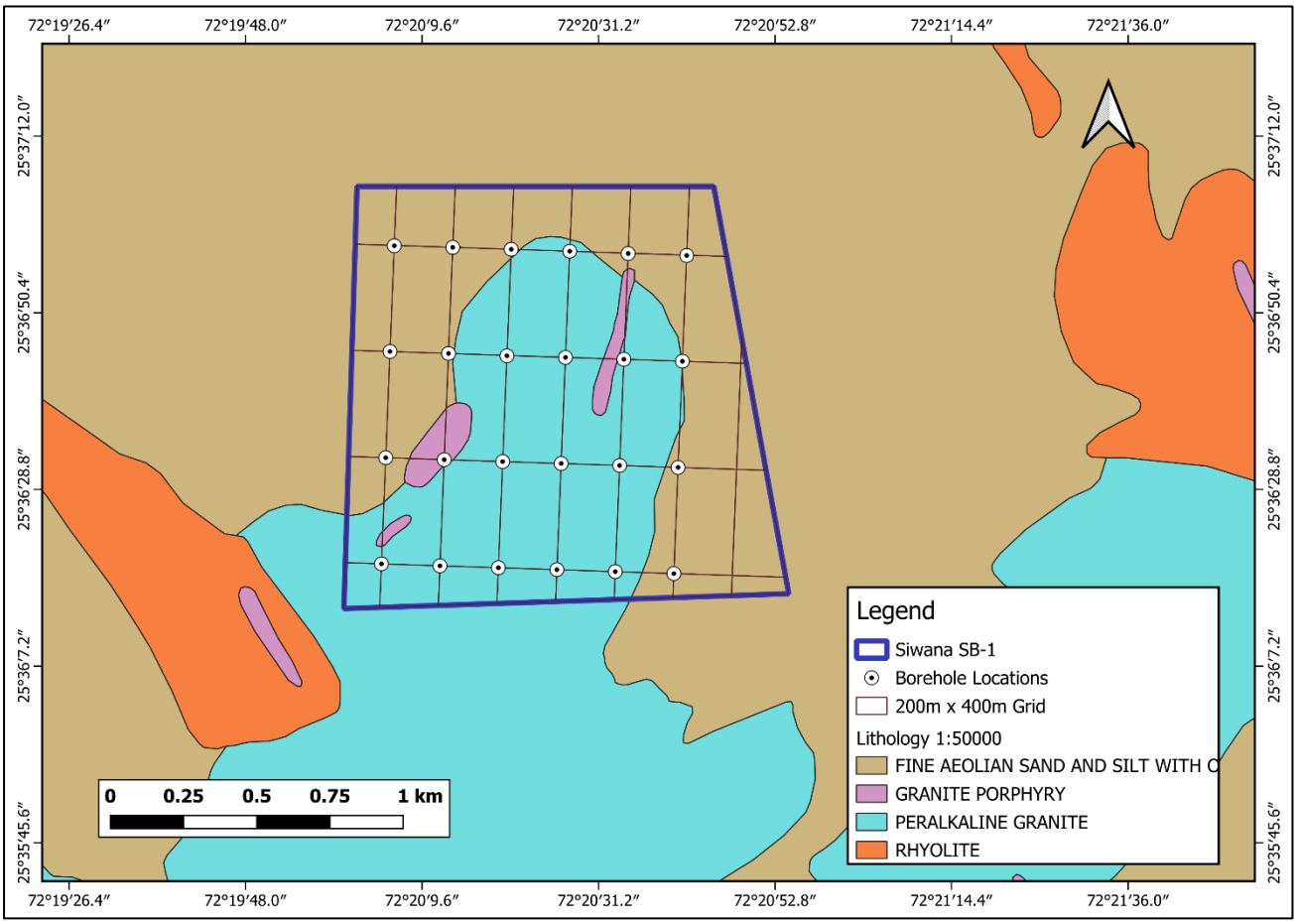

Fig 5: Proposed Borehole locations in 200 by 400 m grid in 1: 50,000 scale geological map

5. Nature Quantum and Target

Sl. No.	Description of Work	Unit	Time required
1	Interpretation of ground and air borne geophysical database, characterize the GP signals with rock types and host lithology by overlay analysis	-	30 days
2	Geological Mapping (1:2000 Scale) (GM/DM)	2.0 sq km	90 days
3	Topographical survey (1:2000 Scale)	2.0 sq km	90 days

4	Core Drilling	3000 m	
5	a) Drill core samples	800 Nos	
6	b) Bed rock/Trench sampling	100 Nos	
	Laboratory studies		
7	XRF	50 Nos	
8	XRF (check sample)	5 Nos	
9	ICPMS (250 from Drill core & 100 from BRS)	350 Nos	
10	ICPMS(check sample)	35 nos	
11	XRD	10 nos	
12	Preparation of polished thin section	10 nos	
13	Complete petrographic/ore microscopy/ mineragraphic report of rock samples and five digital photo micrograph	10 nos	
14	EPMA	10 hours	
	Geophysical investigation (Phase II)		
15	Magnetic survey	250 stations	
16	Report preparation (5 hard copies with a soft copy)	5 Nos	
17	Preparation of exploration proposal	5 Nos	

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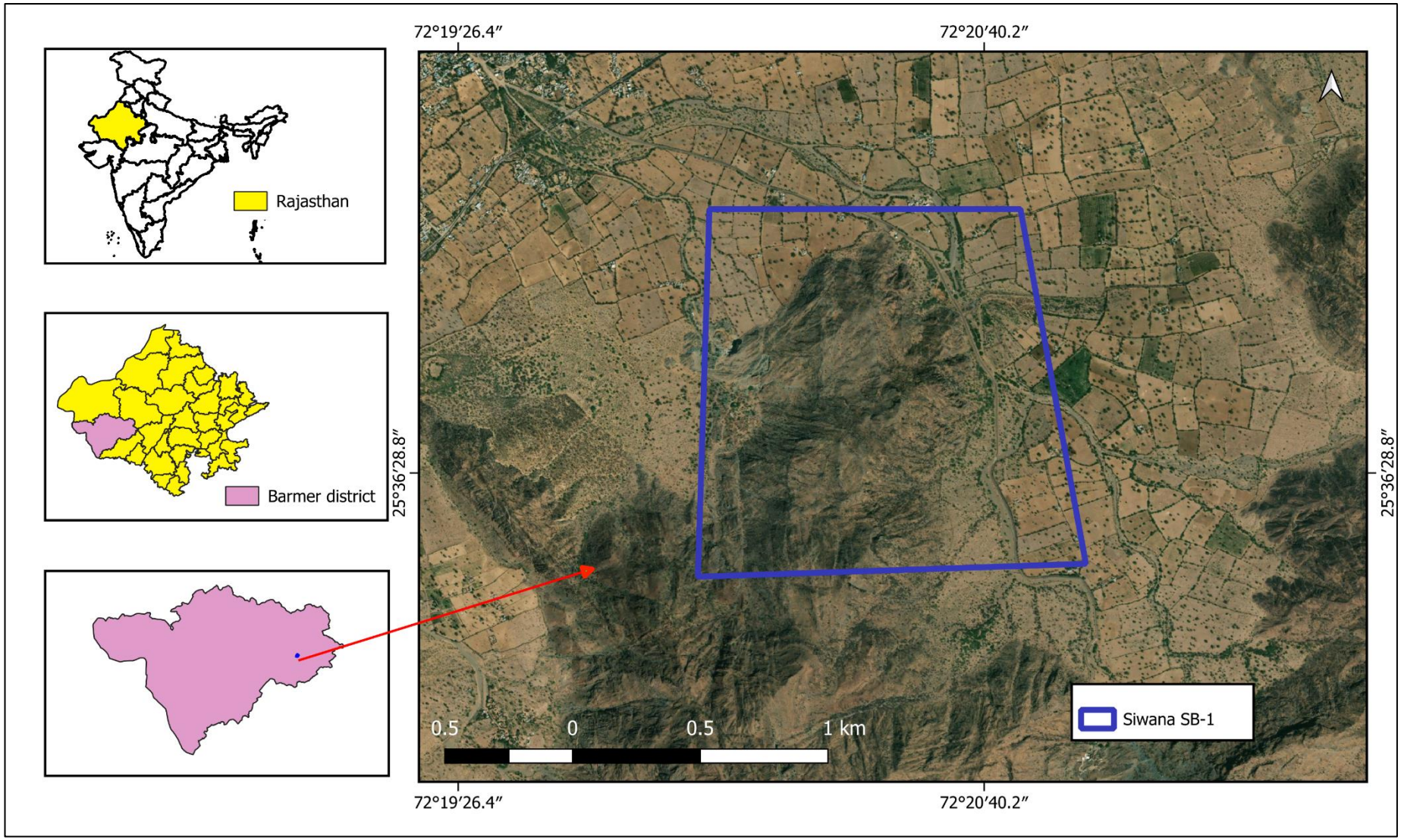

Fig 6: Location map of the proposed SB-1 block