

COMMODITY: RARE EARTH ELEMENTS (REE) AND ASSOCIATED MINERALS

**PROPOSAL FOR PRELIMINARY (G-3) EXPLORATION FOR REE AND
ASSOCIATED MINERALISATION IN THE INDRANA WEST BLOCK,
BALOTRA DISTRICT, RAJASTHAN**

**BY
GEOLOGICAL SURVEY OF INDIA
STATE UNIT: RAJASTHAN**

**PLACE: JAIPUR
DATE: JULY 2026**

Summary of the Block for G3 Level Exploration

GENERAL INFORMATION ABOUT THE BLOCK

Feature	Details
Block ID	INDRANA WEST BLOCK
Exploration Agency	Geological Survey of India, Western Region, State Unit: Rajasthan
Commodity	Rare Earth Elements (REE) and associated minerals
Mineral Belt / Geological Domain	Siwana Ring Complex, Malani Igneous Suite (Siwana Granite)
Block Area	1.25 sq. km
Completion Period	One year
Objectives	To establish subsurface continuity and estimate resource of REE and associated mineralisation.
Projected Outcome	Preliminary exploration data for resource appraisal and further advancement of the block.
Personnel	Two geoscientists
Expected Field Days	Officer-1: 100 days; Officer-2: 100 days; Supervisory Officer: 7 days
Toposheet / Degree Sheet	45C/6
District / State	Balotra (previously Barmer), Rajasthan

1. Location

Cardinal Points	Latitude (N)	Longitude (E)
A	25°38'50.29"	72°15'20.20"
B	25°38'59.74"	72°15'39.78"
C	25°39'43.60"	72°15'14.75"
D	25°39'52.48"	72°15'27.68"
E	25°40'2.80"	72°15'18.78"E
F	25°39'49.82"	72°15'0.19"
G	25°39'25.97"	72°14'58.93"
Tehsil / Taluk	Siwana	
District	Balotra	
State	Rajasthan	

2. Area

Block Area	1.25 sq. km
Forest Area	NIL
Government Land Area	Data not available
Private Land Area	Data not available

3. Accessibility

Nearest village	Indrana village, about 2.2 km NE of the block
Nearest town	Siwana town, about 14 km east of Indrana
District headquarters	Balotra
Nearest Rail head	Balotra
Nearest Airport	Jodhpur, about 100 km

4. Hydrography: Small seasonal streams.

5. Climate: Semi-arid to arid, with hot summers and a short monsoonal rainy season.

6. Topography: Rocky terrain controlled by rhyolitic and granitic hills of the Siwana Ring Complex, with intervening low-relief, sand-covered surfaces.

7. Availability of baseline geoscience data

Geological map	Large-scale geological mapping (1:12,500) and earlier G4 investigations by GSI in and around the block; GCM completed (FS 2018-19)
Geochemical data	Surface chemical data from rhyolites, felsic dykes, granites and channel samples in and around the block; NGCM
Geophysical data	Regional airborne spectrometric coverage; NGPM

8. Justification for taking up G3 level exploration

1. The block forms part of the Siwana Ring Complex of the Malani Igneous Suite, a recognised Neoproterozoic peralkaline igneous province and India's most significant known REE-HFSE province, whose evolved intrusive phases are strongly enriched in REE and rare metals.
2. Earlier G4 investigation (Kumar & Mishra, 2021) around the Indrana-Siwana area returned anomalous TREE+Y; of the samples falling within the proposed block (14 in number), TREE+Y ranges from 1,547 ppm to 5,491 ppm.
3. The contiguous Northwest of Indrana G3 block (FS 2025-26) has returned encouraging core assays (TREE+Y 3,028-12,860 ppm; Nb 279-1,412 ppm), reinforcing the case for advancing the proposed block to G3.

FOR PRELIMINARY (G-3) EXPLORATION FOR REE AND ASSOCIATED MINERALISATION IN THE INDRANA WEST BLOCK, BALOTRA DISTRICT, RAJASTHAN

1.1.0 INTRODUCTION

Rare Earth Elements are critical minerals of strategic importance because of their applications in clean energy technologies, high-performance magnets, advanced electronics, batteries, defence systems and a range of high-technology manufacturing sectors.

Peralkaline igneous complexes, carbonatites and feldspathoid-bearing rocks are the principal sources of REE minerals (with associated HFSE, U and Th) and are therefore favourable hosts for REE and rare-metal mineralisation. The Siwana Ring Complex of western Rajasthan is one such peralkaline province where earlier investigations have repeatedly indicated anomalous enrichment of REE and associated elements.

The proposed programme is designed to generate the geological, geochemical and drilling data required for preliminary resource appraisal of the Indrana West block and to guide subsequent exploration.

2.1.0 BACKGROUND INFORMATION

Regional Geology. The Siwana Ring Complex forms part of the Neoproterozoic Malani Igneous Suite (MIS), dated at ca. 771 +/- 2 Ma (Torsvik et al., 2001a) and ~745 Ma (Dhar et al., 1996; Rathore et al., 1999). Its magmatic evolution can be divided into three phases (Kumar & Sharma, 2020): a first phase of bimodal volcanism (acid flows dominant over basic flows); a second, plutonic phase of arfvedsonite-riebeckite-aegirine-bearing peralkaline Siwana Granite that intrudes the volcanics; and a third, later intrusive phase comprising rhyolite, microgranite, andesite and felsite dykes. All three phases host anomalous TREE+Y, with the third phase the most enriched. Peralkaline granites, volcanics and associated zoned pegmatoids are considered storehouses of REE and rare metals (Nb-Ta, Zr-Hf, Sn, W, Be) (Pollard, 1995), with mineralisation concentrated in the more evolved parts of the complex (Dostal, 2017).

Within the Western Indian Craton, basement rocks and the overlying Aravalli and Delhi Supergroups record repeated Palaeo- to Neoproterozoic magmatism. MIS magmatism comprises peralkaline (Siwana), metaluminous to mildly peralkaline (Jalore) and peraluminous (Tusham, Jhunjhunu) granites with a cogenetic carapace of acid volcanics, and is characterised by a volcano-plutonic ring structure and radial dykes (Singh & Vallinayagam, 2009). The proposal represents upgradation of a previously identified G4 target to G3 stage for systematic subsurface testing and is linked with the annual plan of GSI.

3.1.0 LOCATION AND ACCESSIBILITY

The Indrana West block lies in Balotra district (previously Barmer), Rajasthan, in toposheet no. 45C/06, within the Siwana Ring Complex. The block lies about 2.2 km from Indrana village, which in turn lies about 14 km west of Siwana town. The proposed block area is 1.25 sq. km. The nearest rail head and district headquarters is Balotra, and the nearest airport is Jodhpur (about 100 km).

4.1.0 PHYSIOGRAPHY, DRAINAGE AND CLIMATE

The block lies within the volcanic-plutonic terrain of the Siwana area, where local topography is controlled by rhyolitic and granitic hills with intervening low-relief, sand-covered surfaces. Drainage is mainly seasonal. The climate is semi-arid to arid, with hot summers and a short monsoonal rainy season.

5.1.0 PREVIOUS WORK

Preliminary sampling of rhyolites and associated tuffs of Bhimgoda Pahar and Koiliyasar-Ka-Pahar (GSI, 2013-14) returned anomalous TREE ranging from 1,334-2,692 ppm and 1,075-3,319 ppm respectively (Rastogi & Mukherjee, 2015). Bidwai et al. (2014) reported high LREE, Zr, Nb, Th, U and Ag in surface samples. Das et al. (2015) carried out G4 investigation in the Siwana eastern and central blocks.

Kumar and Sharma (2020) reported G4-stage TREE+Y ranges by lithounit: plagioclase-rich granite (0.029-0.70%, n=79), K-feldspar granite (0.047-0.66%, n=116), younger intrusives (0.019-2.66%, n=146), felsic volcanics (0.015-0.96%, n=43) and enclave/restite/soil (0.022-1.27%, n=19), with LREE:HREE ~4:1 and encouraging Zr, Nb, Ba, Zn, U, Th and Hf. Barman and Neog (2018) recorded granite values of 182.77-8,611.11 ppm (avg 2,006.95, n=84) and volcanic values of 142.3-8,502.50 ppm (avg 2,008.03, n=116) across the Siwana area.

Kumar and Mishra (2021) carried out G4-stage reconnaissance in the Indrana-Siwana area; analytical results of 300 BRS gave TREE+Y from 265.47 ppm to 8,984.74 ppm (mean 2,446 ppm), and of 44 analysed channel samples 476.25-8,582.98 ppm. Of the samples collected during that G4 exploration, fourteen fall within the presently proposed block, returning TREE+Y of 1,547 ppm to 5,491 ppm. During FS 2025-26 a G3-stage block (Northwest of Indrana) was drilled (7 first-level + 7 second-level boreholes); core samples returned so far give TREE+Y of 3,028-12,860 ppm and Nb of 279-1,412 ppm.

6.1.0 GEOLOGY OF THE AREA

Peralkaline igneous rocks and associated evolved units are well-known hosts for REE and HFSE mineralisation. In the Siwana area, all three magmatic phases carry anomalous TREE+Y, with the younger intrusive phase most enriched. The proposed Indrana West block is situated within this REE-fertile peralkaline igneous environment and is therefore suitable for systematic G3 exploration.

7.1.0 OBJECTIVES OF THE PROPOSED EXPLORATION PROGRAMME

1. To carry out detailed mapping on 1:2,000 scale and delineate REE and associated mineralised zones through bedrock and channel sampling.
2. To test the depth continuity, thickness and grade of mineralised zones through systematic drilling and borehole logging.
3. To generate adequate geological, geochemical and analytical data for preliminary resource appraisal of REE and associated mineralisation in the block.
4. To provide the basis for further stage advancement and focused exploration planning in the Indrana West block.

8.1.0 PROPOSED SCHEME OF EXPLORATION

The proposed G3 exploration programme comprises detailed geological mapping, surface sampling, systematic drilling, borehole geophysical logging, sample processing and laboratory studies. Detailed mapping on 1:2,000 scale will be carried out over 1.25 sq. km to delineate lithological boundaries, structures, mineralised zones and surface expressions of REE and associated mineralisation, together with the collection of bedrock and channel samples from favourable lithologies and mineralised exposures.

The depth continuity, grade and thickness of these zones will be checked by drilling around 11-12 first-level inclined boreholes of roughly 130 m depth at 200 m spacing, and about 7-8 second-level inclined boreholes of about 190 m each, for a total sanctioned drilling of 2,800 m. Geophysical Borehole logging (1,400 m), core sampling and laboratory analyses will support interpretation and preliminary resource appraisal. Selected samples will also be subjected to XRD and EPMA studies.

9.1.0 QUANTUM OF WORK

Item of Work	Unit	Proposed Quantum
Detailed geological mapping (1:2,000)	sq. km	1.25
Subsurface exploration: drilling	m	2800
Borehole geophysical logging	m	1400
Channel samples	nos.	150
PCS	nos.	10
Core samples (CS)	nos.	1000

PS	nos.	15
XRD	nos.	5
EPMA	nos.	5
Chemical analyses (incl. 100 check samples)	nos.	1260

10.1.0 COST

Summary of the Cost estimates (NMEDT-funded components costed on the Revised Schedule of Charges effective 15.12.2025, as modified on 10.02.2026). Detailed line-item computation is provided in the accompanying cost sheet.

Sl. No.	Item	Total Estimated Cost (Rs.)	Funding
1	Geology and Survey	0	
2	Drilling	2,80,00,000/-	NMEDT
3	Survey work	9,41,980/-	NMEDT
4	Laboratory studies	0	
5	Geologist at HQ	0	
	Sub Total (1 to 4)	2,89,46,620/-	NMEDT
6	Exploration Report Preparation	0	
7	Proposal Preparation	0	
8	Peer review charges	0	
	Sub Total (1 to 8)	2,89,41,980/-	NMEDT
9	GST 18%	52,09,556.4/-	NMEDT
	Total:	3,41,51,536.4/-	NMEDT
	Say Rs. In Lakh	341.52/-	NMEDT

PROPOSAL FOR Preliminary exploration for REE and associated mineralisation in Indrana West Block, Siwana Ring Complex, Balotra District, Rajasthan (Stage: G3)

Item of Work			Unit	SoC-Item - SI No. NME DT	Rates as per NMEDT SoC 2025 (w.e.f. 15.12.2025, incl. 10.02.2026 modification)	Rates of GSI for NMEDT work		Estimated Cost		Remarks	
								Qty.	Total Amount (Rs)		
B. SURVEY WORK											
9	a	Demarcation of block boundary, fixation of boreholes and determination of co-ordinates and reduced level (RL) of the boreholes by DGPS (including charges of labourers deployed for the work) - use of CORS Network system for all DGPS is compulsory	Per Point of observation	1.3.2		24000		-	25	600000	7 block-boundary points + 18 BH points = 25.
9	b	Charges of one qualified surveyor with Total Station for topographical survey in different RF and surface contouring, fixation of borehole and determination of co-ordinates and RL of boreholes with total station etc. (a) one surveyor per day (without labour) (up to 4 labourers per surveyor)	one surveyor per day	1.3.1		10500		-	20	210000	
9	c	Labour Charges for Survey work	Per day	As per Govt rates		556			80	44480	As per CLC / respective State Govt rates, whichever is higher

											(SoC 5.8, as modified 10.02.2026).
9	d	Drone Topographic Survey	per sq.km	7b		70000		-	1.25	87500	
Total Cost B (in case of outsourcing)										941980	
D. DRILLING - OUTSOURCED											
18. b		Drilling in Hard rock / Strata: HQ size borehole up to 400m depth and NQ beyond 400m; rate decreases 20% if NQ before 400m	m	2.2.1.1 d		10000	-	-	2800	28000000	Peralkaline granite / rhyolite of the Siwana Ring Complex = HARD ROCK per SoC. All boreholes < 400m -> HQ size, no NQ reduction.
19	DRILLING RELATED EXPENDITURE HEADS	Borehole Deviation Survey by Multishot survey tool (interval 6m; azimuth and inclination to be recorded)	per shot	2.2.5		330	-	-	0	0	
20		Land / Crop Compensation (in case the BH falls in agricultural land)	per BH	5.6		30000	-	-	0	0	
21		Construction of concrete Pillar (12"x12"x30")	per borehole	2.2.7		2000	-	-	0	0	
22		Borehole plugging with cement	per borehole	2.2.8		10000	-	-	0	0	
23		Miscellaneous Charges (Transportation of Drilling	Lumpsum	2.2.9		NOT INCLUDED	-	-	0	0	

		Rig, Drill Camp accommodati on, camp setting & winding, approach road)									
24		Drill Core Preservation - one complete BH plus mineralised cores of all BHs preserved in GI core boxes and transported to notified core repository	per m	X (5.2)		1590	-	-	0	0	
Total Cost D - outsourced										28000000	
Total (Drilling + Survey)										28941980	
GST 18%										5209556.4	
TOTAL (including 18% GST)										34151536.4	
Say Rs. in Lakh										341.52	

11.1.0 TIME SCHEDULE

The work programme is proposed for FS 2026-27. Mapping, surface sampling, drilling, logging, core sampling and associated geological and laboratory work are completed within about 10 months, with report writing over 4 months (2 months overlapping laboratory analysis); total duration 12 months from commencement. Field studies run from April 2026 to January 2027, with the draft report by 30 April 2027 and circulation by 30 June 2027.

Activities	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR
Surface sampling												
Geological Mapping (1:2,000)												
Drone topographic Survey												
Laboratory studies												
Core drilling												
Geophysical borehole logging												
Core sampling												
Report writing / Peer review												

*Time loss on account of monsoon / agricultural activity / forest clearance / local law & order problems will be in addition to the above time line.

FIGURES

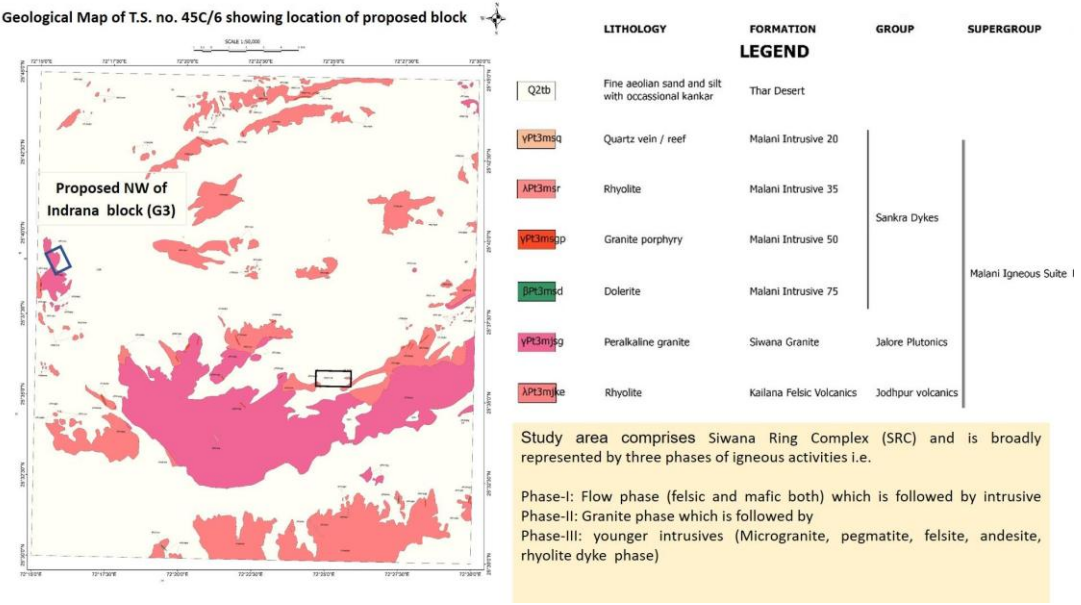
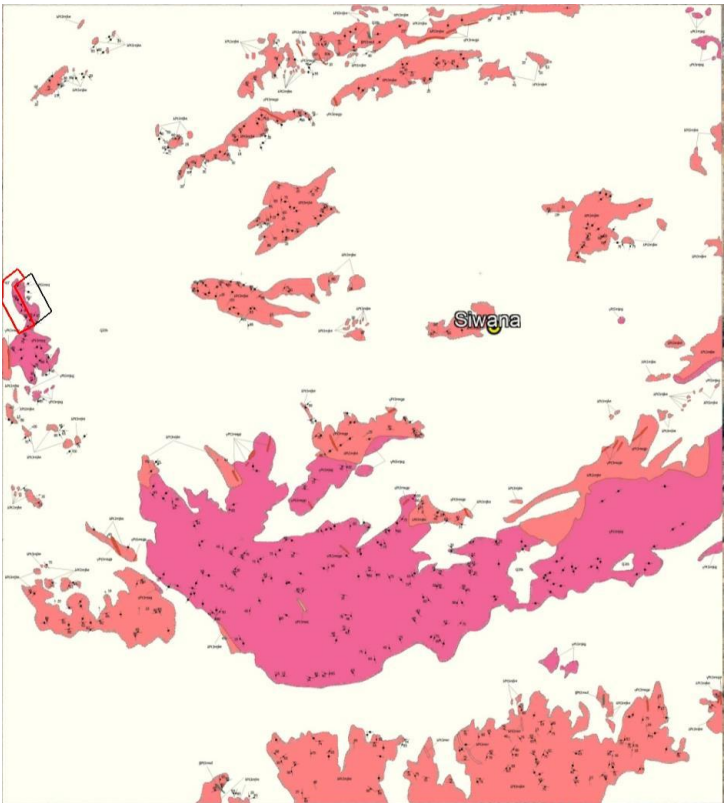


Fig. 1: Proposed Indrana West block (red) on the 50K geological map of toposheet 45C/6, with the Northwest of Indrana G3 block (black) running in FS 2025-26.



Index to the lithology (Malani Igneous Suite).

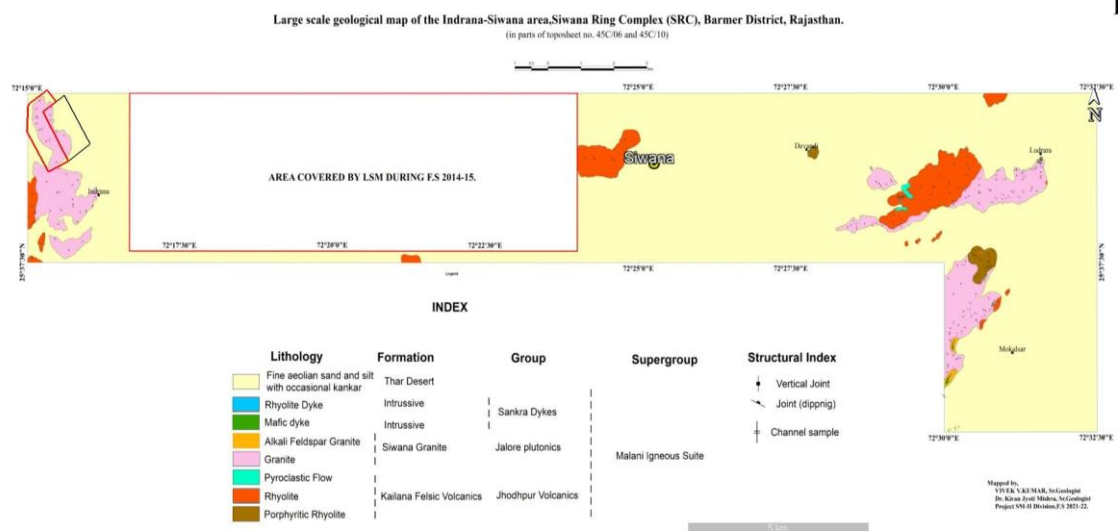


Fig. 2: Proposed block (red) on the large-scale geological map of the Indrana-Siwana area (parts of toposheets 45C/06 and 45C/10), with the NW of Indrana G3 block (black).



Fig. 3: TREE+Y concentration of G4 samples falling within the proposed block (red), on Google image, with the NW of Indrana G3 block (black).

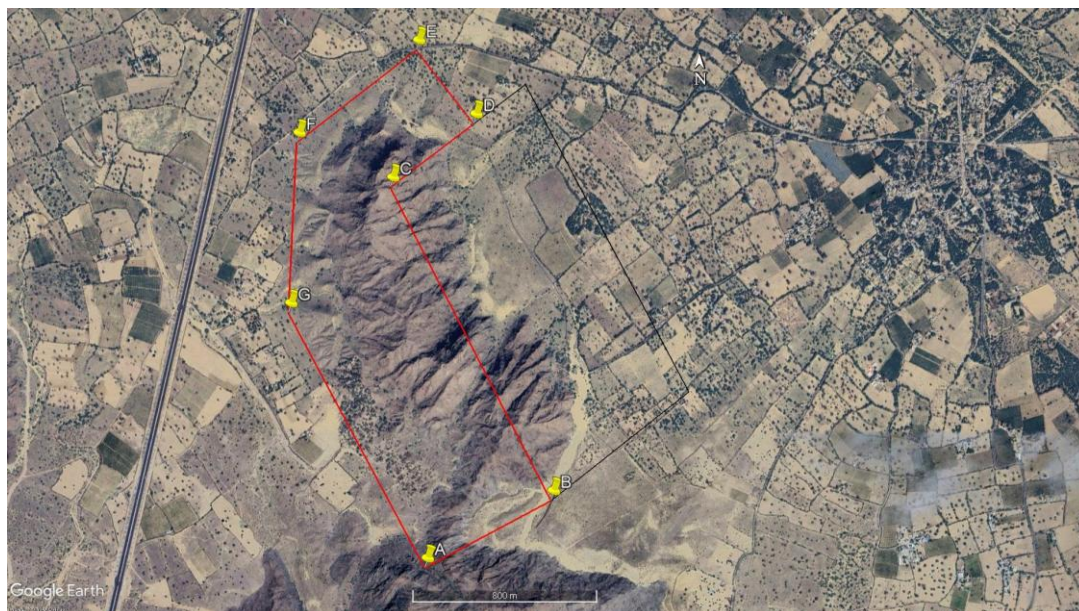


Fig. 4: Proposed Indrana West block with cardinal points A-G on Google image, with the NW of Indrana G3 block (black).

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