Proposal for

Undertaking of Geo-chemical Analysis of Samples from Granite & Masonry Stone leases associated with Siwana Ring Complex (SRC) in Western Rajasthan for REE

Through NMEDT Funding

Indian Bureau of Mines, Indira Bhavan, Civil Lines,

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Content

1. INTRODUCTION

1.1 The Siwana Ring Complex (SRC) of Barmer district occupies an area of approximately 1100 Km² and has been extensively studied over the past several decades (Murthy 1962; Narayan Das et al. 1978; Pyne and Mukherji 1987; Bhushan 1984; Bhushan and Mohanty 1988; Jain et al. 1996; Maheshwari and Sial 2001; Bhushan and Chandrasekaran 2002; Mohanty and Bhushan 2004). The Siwana granites form an important component of the Malani Igneous Suite (MIS), which is characterised by an acid volcanoplutonic assemblage related to A-type, anorogenic magmatism under hot-crust conditions (Kochhar 1984; Bhushan and Chittora 1999). Compositionally, these granites range from peralkaline to mildly peraluminous, and certain phases have long been recognised to host locally anomalous concentrations of Nb, Y, Ta, Zr, Zn, Pb, Hf, U, Th, and rare earth elements (REE) (Das et al. 1978; Jain et al. 1996; Mohanty and Bhushan 2004).

1.2 Three distinct pulses of alkaline granitic magmatism have been proposed for the Siwana area (Bhushan and Somani 2019). The first phase comprises medium- to coarse-grained granites, followed by a second phase represented by voluminous coarse-grained to pegmatitic leucogranites. The third and most evolved phase consists of granite porphyry and microgranite dykes, accompanied by minor rhyolite and quartz veins. This phase is commonly associated with hydrothermal activity and significant enrichment of REE and related minerals. On the basis of mineralogical, geochemical, and magmatic characteristics, the peralkaline granites of Siwana have been compared with the Strange Lake REE deposit of Canada (Bhushan and Somani 2019; Kerr and Rafuse 2012).

1.3 Preliminary beneficiation studies on REE-mineralised microgranite from the Gudanal area (Rao et al. 2019) indicate that the Siwana granites possess favourable metallurgical characteristics in addition to significant REE grades. Physical beneficiation tests involving size classification, gravity separation, and magnetic separation have demonstrated enrichment of REE and Y, particularly in fine-grained fractions. These results suggest that a substantial proportion of REE may be recoverable through conventional mineral processing routes.

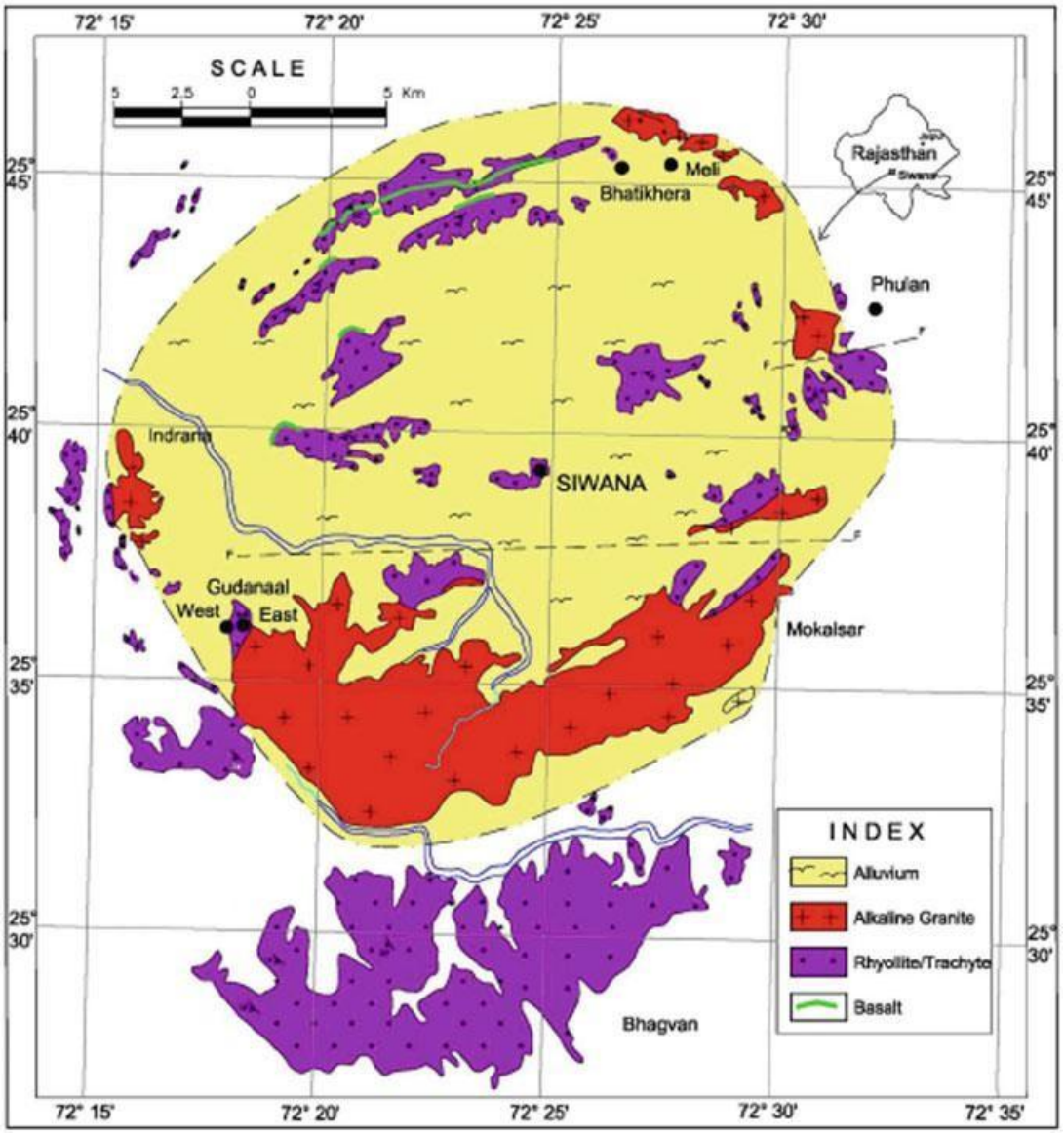

Figure 1.1. Geological map showing the Siwana Ring Structure, Barmer district, Rajasthan (after Bhushan and Somani 2019).

2. BACKGROUND

2.1 The Government of India has significantly enhanced its focus on the exploration, mining and production of critical and strategic minerals essential for national development and advanced technologies.

2.2 Rare earth elements (REEs) comprise only 17 elements of the periodic table, yet they are critically important for modern society. REEs are indispensable for national security, energy transition, environmental sustainability and economic development, with applications in a wide range of high-technology sectors including renewable energy, electronics, defence systems and electric vehicles.

2.3 India possesses an estimated 230–230.4 million tonnes of domestic REE resources; however, as of FY 2024–25, actual production remains limited to about 1.9–3.0 Kt, against an estimated demand of 4.3–4.8 Kt. This pronounced gap between demand and supply underscores the urgent need to identify and develop alternative indigenous sources.

2.4 In view of the limited availability of extractable REE resources in India and the growing demand for strategic and clean-energy sectors, the Siwana Ring Complex, Rajasthan, emerges as a promising geological target for future REE prospecting and evaluation.

2.5 In this context, a meeting was held under the chairmanship of the Additional Secretary (Mines) on 30th January 2026 at 04:00 PM to deliberate on the REE potential of the Siwana Ring Complex (SRC) in western Rajasthan along with senior officials from Ministry of Mines, State DGM Rajasthan, GSI, AMD and IBM.

2.6 During the deliberation, as stated by the State Directorate of Geology and Mining (DGM), a total of 117 mineral leases comprising 19 masonry stone leases and 98 granite stone leases are currently operational within the SRC area, collectively covering about 231 hectares. These leases are considered to have potential for REE mineralization.

2.7 Based on the deliberations held in the meeting, it was decided that the Indian Bureau of Mines (IBM) shall undertake systematic sampling and testing of the existing 117 leases for evaluation of REE potential

3. PROPOSAL

3.1 In this regard, the Indian Bureau of Mines (IBM) proposes to undertake a systematic programme of sampling and geochemical analysis of mine samples from Granite & Masonry Stone leases associated with Siwana Ring Complex (SRC) in Western Rajasthan for REE.

3.2 As per information provided by the State Directorate of Geology and Mining (DGM), Rajasthan, the Siwana Ring Complex hosts 117 mining comprising 19 masonry stone leases and 98 granite stone leases. These mining leases shall form the basis for selection of mines for the present study.

3.3 The study will involve collection of representative samples exclusively from active mining lease areas. Sampling shall include mine faces, and stockpiled material such as mineral or block stacks. Fine-grained residues generated during cutting or processing.

3.4 All samples shall be collected by officers of IBM following established sampling protocols to ensure representativeness and data quality.

3.5 The total number of samples proposed to be collected and analysed is estimated to be around 386 samples, including check samples. The geochemical analysis will be carried out for major oxides and few trace elements i.e., Nb, Sc, Y, Ta, Zr, Hf, Nb, Ta, U, Th etc. and rare earth elements (REE).

3.6 The completion timeline for the study is 3 months starting from 1st of March, 2026. To ensure timely execution of the project, all samples were proposed to be collected by 15th of April, 2026. Analysis of all the samples including data compilation, is proposed to be completed by 15th of May, 2026, followed by final report preparation and submission by 31st of May 2026.

3.7 IBM has its own in-house facilities for analytical testing at Mineral Processing Division (MPD). The major objective of IBM Mineral processing division is to undertake beneficiations studies of exploration and mine samples. As the laboratories of IBM are overburdened with huge number of beneficiations projects, and current Limestone and Iron Mine samples analysis project it may not be possible to take up the analysis of the samples generated during the present study.

3.8 In view of this, it is proposed to engage services of other organizations under the Ministry of Mines to take up the chemical analysis of the mine samples through NMEDT funding.

3.9 Hence, the total **386** (approx.) samples generated including check samples, will be analysed at the outsourced laboratories i.e., Jawaharlal Nehru Aluminium Research Development and Design Centre (JNARDDC), Nagpur and Mineral Exploration and Consultancy Limited (MECL), Nagpur.

3.10 The proposal is limited to the outsourcing of samples for sub-sampling and geochemical analysis. The proposal does not include the cost of sample collection by the officers of IBM.

4. TARGET SITES FOR SAMPLING & NO. OF SAMPLES TO BE GENERATED

S. No.	Target Sites (Mine faces, and stockpiled material, fine-grained residues)	No. of Mines	No. of Samples to be generated
1	Masonry Stone Leases	**19**	**57**
2	Granite Stone Leases	**98**	**294**
3	**Total**	**117**	**351**
4	**Check Samples (10%)**		**35**
5	**Total Samples (Proposed to be outsourced (required financial assistance)**		**386**

5. PARAMETER FOR ANALYSIS

5.1 The parameter for analysis for the present study shall include determination of major oxides, selected trace elements, and rare earth elements (REE) in representative granite samples from the Siwana Ring Complex.

5.2 Major oxide and trace elements will be undertaken to establish the geochemical characterisation of the granites to understand the association and pattern of REE associated, while complete REE analysis will be carried out to evaluate total REE enrichment and distribution patterns.

S.No.	Parameters	Radicals/Elements
1	Major Oxides	SiO_2, Al_2O_3, Fe_2O_3(T), MnO, MgO, CaO, Na_2O, K_2O, TiO_2, P_2O_5, BaO, LOI
2	Trace Elements	U, Ta, Ge, Be, Hf, Sn, As, Rb, Th; Sc, Y, Nb, Ta, Zr, W
3	14 REE	La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Ho, Er, Dy, Tm, Yb, Lu

6. QUANTUM OF WORK

6.1 Under the proposed study, IBM will undertake geochemical characterization of mine samples from Granite and Dimensional stone mines associated with Siwana Ring Complex, Rajasthan to assess the occurrence, distribution, and enrichment behavior of Rare earth elements in the mine. The study will focus on identifying potential enrichment in mine face, outcrops, fine rejects etc.

6.2 A total of 386 number of samples shall be outsourced to the above-mentioned agencies for sub sampling and detailed geochemical analysis on a nomination basis under NMEDT funding.

7. TIME SCHEDULE AND COST ESTIMATES

7.1 The proposed geochemical characterization programme is structured such that all major activities including sample collection from mines, packaging and dispatch, laboratory processing comprising sample preparation and geochemical analysis, data compilation, and final report preparation will be completed within a period of three months starting from 1st of March, 2026.

7.2 The final report is proposed to submit by 31st of May, 2026.

Timelines for sampling and analysis (3 months)				
S.No.	**Activities**	**March**	**April**	**May**
1	Collection of Samples from Mines			
2	Sub-Sampling and Geochemical Analysis of the samples collected			
3	Data Compilation & Final Report Preparations			

6.3 As the sample preparation charges per sample is not available in the Schedule of Charges (SoC) of NMET, the same is proposed to be worked out as per the formula given below.

Sample Preparation Charges per sample =

$$\frac{\text{Sampler party day charges* (1 sampler / Day) +Charges of Engaging Labour** (4Nos./Day)}}{\text{8 Nos. of Sample Per Day}}$$

*As per SoC of NMET

**As per rates prescribed by Central Labour Commission rates or respective State Govt. whichever is higher

6.4 The cost of the project involving outside agencies for analysis has been estimated based on actual schedule of rates mandated in the circular OM No. 6/2/2015-NMET/588 dated 4/12/2025 for NMET funded Projects. The total estimated cost is **INR 70.67 Lakhs**. The summary of cost estimates for this programme is given below.

Summary of Cost Estimates		
Sl. No.	**Item**	**Total Estimated Cost (Rs.)**
1	Geologist man-days sampling and Sample preparations	**5,36,625**
2	Laboratory studies	**54,52,636**
3	Sub Total (1 to 2)	59,89,261
4	GST 18%	10,78,066.92
	Total:	**70,67,327.56**
	Round off	**70,67,328**
	Say Rs. In Lakh	**70.67 Lakh**

Enclosure: Detailed Cost Sheet

Appendix: Detailed Cost Sheet

ESTIMATED COST for Undertaking Chemical Analysis of Mine Samples							
Sl. No.	**Item of Work**	**Unit**	**Rates as per NMET SoC December, 2025**		**Total Cost of the Project**		**Remarks**
			SoC- Item- S. No.	**Rates as per SoC**	**Qty./days**	**Total Amount (Rs)**	
1.0	**Sample Processing**						
1.1	Sampling man days for Sample processing work - Charges of one sampler per day (without Labour)	day	1.2.1b	7,850	48	3,76,800	386 (total samples)/8 (no. of samples processed each day) = 48.25 days*
1.2	4 labours/sampler (832.42 per day/labour) for sampling work	day	5.8	832.42	192	1,59,825	Charges of Unskilled workers (NMET 5.8 & 02(01)/2017-MWA dated 21.02.2025)
Sub-Total 1						**5,36,625**	
2.0	**Laboratory Studies**						
2.1	Major Oxides (WD XRF) - (oxides + Traces-24 elements)	per sample	4.17a	**4,200**	386	16,21,200	
2.3	Analysis of one rock sample for quantitative analysis of 14 REE elements + 9 trace elements (U, Ta, Ge, Be, Hf, Sn, As, Rb, Th) by ICP-MS (sequential technique)	per sample	4.1.15	**7,400**	386	28,56,400	
2.4	For each additional trace elements by ICP-MS	per sample	4.1.17b	**2,526**	386	9,75,036	421 * 6 additional elements (Sc, Y, Zr, Nb, Ta, W) = 2526 per sample

Sub-Total 2		**54,52,636**	
Total Estimated Cost without GST		**59,89,261**	
Provision for GST (18%)	**CGST (@ 9%)**	**5,39,033.46**	GST will be reimburse as per actual and as per notified prescribed rate
	SGST (@9%)	**5,39,033.46**	
	IGST	**_**	
Total GST (CGST+SGST+IGST)		**10,78,066.92**	
Gross Value		**59,89,261**	
Tax Value		**10,78,066.92**	
Final Amount (Gross Value + Tax Value)		**70,67,327.56**	
Round off		**70,67,328**	
Amount in words	**Rupees Seventy Lakh Sixty-Seven Thousand Three Hundred Twenty-Eight Only**		