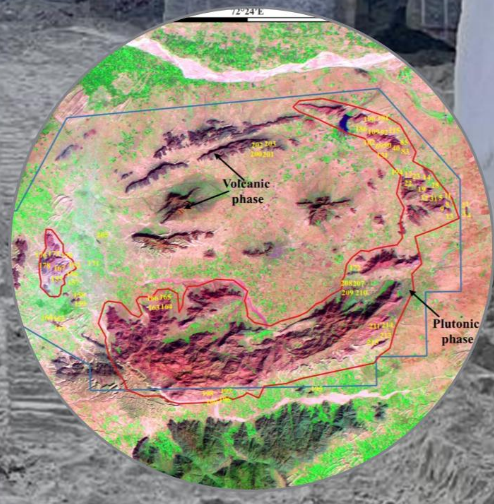
JULY 2026

GEOCHEMICAL ANALYSIS OF GRANITE & MASONRY STONE LEASE SAMPLES WITHIN THE SIWANA RING COMPLEX, RAJASTHAN

Under
National Mineral Exploration & Development Trust
Ministry of Mines
Government of India



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OM No.- F. No. 6/2/2015-NMET/996 dated 30.03.2026

Commodity: Rare Earth Elements

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CONTENTS

List of Acronyms

AAS: Atomic Absorption Spectroscopy
AMD: Atomic Minerals Directorate for Exploration and Research
A-type: Anorogenic-type Granite
EPMA: Electron Probe Micro-Analyzer
GSI: Geological Survey of India
HFSE: High Field Strength Elements
HREE: Heavy Rare Earth Elements
IBM: Indian Bureau of Mines
ICP-MS: Inductively Coupled Plasma–Mass Spectrometry
JNARDDC: Jawaharlal Nehru Aluminium Research Development and Design Centre
LCD: Liquid Crystal Display
LED: Light Emitting Diode
LOI: Loss on Ignition
LREE: Light Rare Earth Elements
MAD: Median Absolute Deviation
MECL: Mineral Exploration & Consultancy Limited
MIS: Malani Igneous Suite
MPD: Mineral Processing Division
MRI: Magnetic Resonance Imaging
NMEDT: National Mineral Exploration & Development Trust
PSC: Project Sanctioning Committee
PSC: Project Sanctioning Committee
QA/QC: Quality Assurance / Quality Control
REE: Rare Earth Element
SEM-EDS: Scanning Electron Microscopy–Energy Dispersive Spectroscopy
SRC: Siwana Ring Complex
TAS: Total Alkali Silica
TCC: Technical cum Cost Committee
TREE: Total Rare Earth Elements (La-Lu + Sc+ Y)
TREO: Total Rare Earth Elements Oxide
WD-XRF: Wavelength Dispersive X-Ray Fluorescence
WPG: Within-Plate Granite
XRD :X-Ray Diffraction

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EXECUTIVE SUMMARY

The present study titled **"Geochemical Analysis of Granite and Masonry Stone Lease Samples within the Siwana Ring Complex (SRC), Rajasthan"** was undertaken by Indian Bureau of Mines (IBM) with the support of the National Mineral Exploration & Development Trust (NMEDT). The objective of the study was to assess the Rare Earth Element (REE) and associated critical mineral potential of active granite and masonry stone quarry leases operating within the Siwana Ring Complex, Rajasthan. The study aimed to establish a geochemical database, identify REE-enriched zones, and evaluate the spatial distribution of REEs and other critical elements within the quarry leases.

The Siwana Ring Complex, located in Balotra District, Rajasthan, forms part of the Neoproterozoic Malani Igneous Suite, one of India's most prospective provinces for REE and high-field-strength element (HFSE) mineralization. Previous investigations by Geological Survey of India (GSI), Atomic Minerals Directorate for Exploration and Research (AMD), and several independent researchers have reported significant enrichment of REEs, Y, Nb, Zr, Hf, Th, and U in the peralkaline granites, rhyolites, felsic pyroclastics, and younger intrusive phases of the complex.

A total of 116 quarry leases comprising 97 granite leases and 19 masonry stone leases covering about 230.655-hectare area was covered under the study. Systematic geological mapping and geochemical sampling were carried out from quarry faces, benches, outcrops, and associated intrusive bodies. A total of 215 representative rock samples were collected and analysed, along with 21 check samples as part of the QA/QC programme. Major oxides and selected trace elements were analysed using WD-XRF, while REEs and critical trace elements were determined by ICP-MS following multi-acid digestion.

The study has revealed that granite quarry leases are predominantly associated with the plutonic alkali granite phase, whereas masonry stone leases are mainly developed over rhyolitic volcanic rocks.

Mineralogical investigations were carried out on four representative rock samples comprising rhyolite, granite, trachyte and pyroclastic rock from the Siwana Ring Complex using FE-SEM coupled with EDS. The analyses identified quartz, alkali feldspars, pyroxenes, amphiboles, iron oxide/hydroxide, zircon, sphene (titanite), apatite and several accessory minerals characteristics of evolved peralkaline igneous rocks.

The investigation confirmed the presence of several REE-bearing minerals, including monazite, allanite, cheralite and cerite, together with REE-enriched zircon, hedenbergite, aenigmatite, apatite and iron oxide/hydroxide. Zircon and sphene were also found to host significant concentrations of Zr, Nb, Th, Y and REEs.

Geochemically, both granite and masonry stone samples are characterized by high silica and alkali contents and display features of highly evolved ferroan, alkalic, metaluminous to weakly peraluminous A-type granitoids. Tectonic discrimination diagrams indicate a dominant Within-Plate Granite (WPG) affinity, suggesting emplacement in an extensional intraplate tectonic setting. The rocks exhibit pronounced enrichment in incompatible elements and HFSEs such as Zr, Hf, Nb, Ta, Y, Th, and U, accompanied by depletion of Ba and Sr due to extensive feldspar fractionation.

Significant REE enrichment was recorded throughout the study area. Total REE concentrations (TREE + Sc + Y) range from 360–6263 ppm in granite lease samples and 639–5558 ppm in masonry stone lease samples, with average concentrations of 2127 ppm and 2051 ppm, respectively. The REE distribution is strongly dominated by Light Rare Earth Elements (LREEs), and chondrite-normalized REE patterns exhibit pronounced LREE enrichment over Heavy Rare Earth Elements (HREEs), together with distinct negative europium anomalies, indicating advanced magmatic differentiation and extensive feldspar fractionation. The maximum concentration recorded during the present study corresponds to approximately 0.63 wt.% TREE+Y.

Descriptive statistical analysis of critical and rare metals indicates substantial enrichment of several high-field-strength elements (HFSEs) and associated critical elements within both granite and masonry stone lease samples. Relative to average crustal abundances, the samples exhibit marked enrichment in Zr, Hf, W, Be, Zn, Nb, Ta, Th, and Ga. Among the granite lease samples, the highest enrichment factors are observed for Zr, Hf, W, and Be, whereas the masonry stone lease samples show even greater enrichment relative to average crustal abundances.

Spatial distribution analysis of REEs and associated critical elements revealed distinct zones of enrichment across the Siwana Ring Complex. Among the granite quarry clusters, the Indrana–Nalgoda–Siner sector in the south-east records the highest average concentrations of TREE (0.25%), Y (697 ppm), HREE (408 ppm), Hf (121 ppm), Th (56 ppm), and Zr (0.53%), while the Deora–Fulan–Rakhi–Maili–Balu sector in the north west also exhibits significant enrichment, with average values of TREE (0.20%), Y (537 ppm), HREE (286 ppm), Hf (82 ppm), Th (54 ppm), and Zr (0.36%). The Mokalsar cluster is characterized by the highest average zirconium concentration (0.60%) in south. These enriched zones closely coincide with the REE-prospective areas previously delineated by GSI and AMD, highlighting their significance as favourable targets for future exploration.

The observed enrichment is corroborated by FE-SEM–EDS studies, which identified REE-bearing minerals including monazite, allanite, cheralite, cerite, zircon, apatite, and REE-bearing silicates such as hedenbergite and aenigmatite. These mineralogical observations, together with the A-type granitoid affinity and elevated concentrations of REEs, Y, Zr, Hf, Nb, Th, and U, confirm that the Siwana Ring Complex provides a favorable geological environment for REE–HFSE mineralization.

The REE concentrations obtained during the present investigation are comparable with those reported in earlier GSI and academic studies from the Siwana Ring Complex. The maximum TREE+Y concentration of approximately 0.63 wt.% falls within the range reported from REE prospects such as Mawri, Chhappan-ka-Pahar, Kalaur Ka Danta, Nal, and Phulan, thereby confirming the regional continuity and exploration potential of REE mineralization within the Siwana Ring Complex.

2

INTRODUCTION

2.1 Background

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

Minerals of the "rare earths" groups not containing Uranium and Thorium have been included in "Part-D, Critical and Strategic Minerals" of the First Schedule of the Mines and Minerals Development and Regulation Act, 1957. The REE's constitute a unique group of 17 chemically similar elements of the periodic table that possess immense strategic, technological, and economic significance. REE's includes elements in the lanthanide series, plus scandium and yttrium.

Though REEs occur in relatively small concentrations, their role in modern industrial and technological advancement is exceptionally important. These elements are indispensable for national security, clean energy transition, environmental sustainability, and the development of advanced manufacturing sectors. Neodymium (Nd), Praseodymium (Pr), and Dysprosium (Dy) are primarily used in high-strength permanent magnets for electric vehicles, wind turbines, and electronic devices; Lanthanum (La) is widely utilized in nickel–metal hydride (Ni–MH) batteries and petroleum refining; Cerium (Ce) is used in catalytic converters, glass polishing, and UV-resistant glass; Europium (Eu), Terbium (Tb), and Yttrium (Y) are important phosphors in LEDs, LCDs, and fluorescent lighting; Gadolinium (Gd) is used in magnetic resonance imaging (MRI) and medical applications; while Erbium (Er) and Ytterbium (Yb) find applications in lasers and optical communication systems.

The Siwana Ring Complex (SRC) located in western Rajasthan has emerged as a promising exploration target for Rare Earth Elements and associated critical minerals owing to the occurrence of peralkaline felsic rocks and associated younger intrusive phases. Several independent researchers, along with investigations carried out by GSI and AMD, have highlighted the promising prospect of REE mineralization in the SRC region.

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

In this context, as per the directions of Ministry of Mines, IBM has taken up a study to have a first-hand information on REE mineralization in the minor mineral leases granted in and around the SRC. A total of 116 quarry leases comprising 19 masonry stone leases and 97 granite stone leases spread across the SRC covering about 230.65 hectares were identified for the study. A systematic sampling programme in these quarry leases was taken up to evaluate the occurrence, distribution, and enrichment of REEs and associated critical minerals.

Accordingly, IBM submitted a project proposal to NMEDT for financial support to undertake geochemical analysis of samples collected from granite and masonry stone leases in the SRC, Rajasthan, for assessment of REE potential.

The proposal was presented before the 90th meeting of the Technical-cum-Cost Committee-I (TCC-I) of NMEDT held on 12th February, 2026, and was recommended by TCC-I for further consideration of Project Sanctioning Committee (PSC) of NMEDT.

The project titled "Undertaking Geochemical Analysis of Mine Samples of Siwana Ring Complex, Rajasthan" at a cost of ₹70.01 lakh (inclusive of taxes) was approved in the 6th meeting of the PSC held on 2nd March, 2026. The approval was conveyed to IBM on 30 March 2026, stipulating a timeline of three months (up to 10.06.2026) for submission of the final report (Annexure-I).

Due to the pending analysis of check samples and completion of mineralogical studies, IBM sought an extension of one month, for submission of the final report. The request was placed before the 97th TCC-I meeting of NMEDT on 26.05.2026. Subsequently, based on the recommendation of TCC-I, the PSC approved the extension of the project timeline up to 31.07.2026 (Annexure-II).

2.2 Types of Quarry Leases in Siwana Ring Complex

The quarry leases occurring within the SRC are predominantly associated with two minor mineral commodities, namely granite and masonry stone, reflecting the dual lithological character of the complex. ASTER imagery of the region Fig. 2.1 clearly indicates that the central part of the complex is largely occupied by the volcanic phase, whereas the peripheral ring-shaped zones are represented by plutonic granitic intrusions. This lithological distribution has a direct control on the type and location of quarry leases.

Granite quarry leases are mainly concentrated within the plutonic phase of the Siwana Ring Complex, where coarse-grained alkali granites exhibit favourable dimensional stone characteristics. These granites are hard, compact, massive, and display well-developed joint systems that facilitate extraction of large blocks suitable for decorative and dimensional stone applications. The majority of the active quarry leases in the SRC belong to this category.

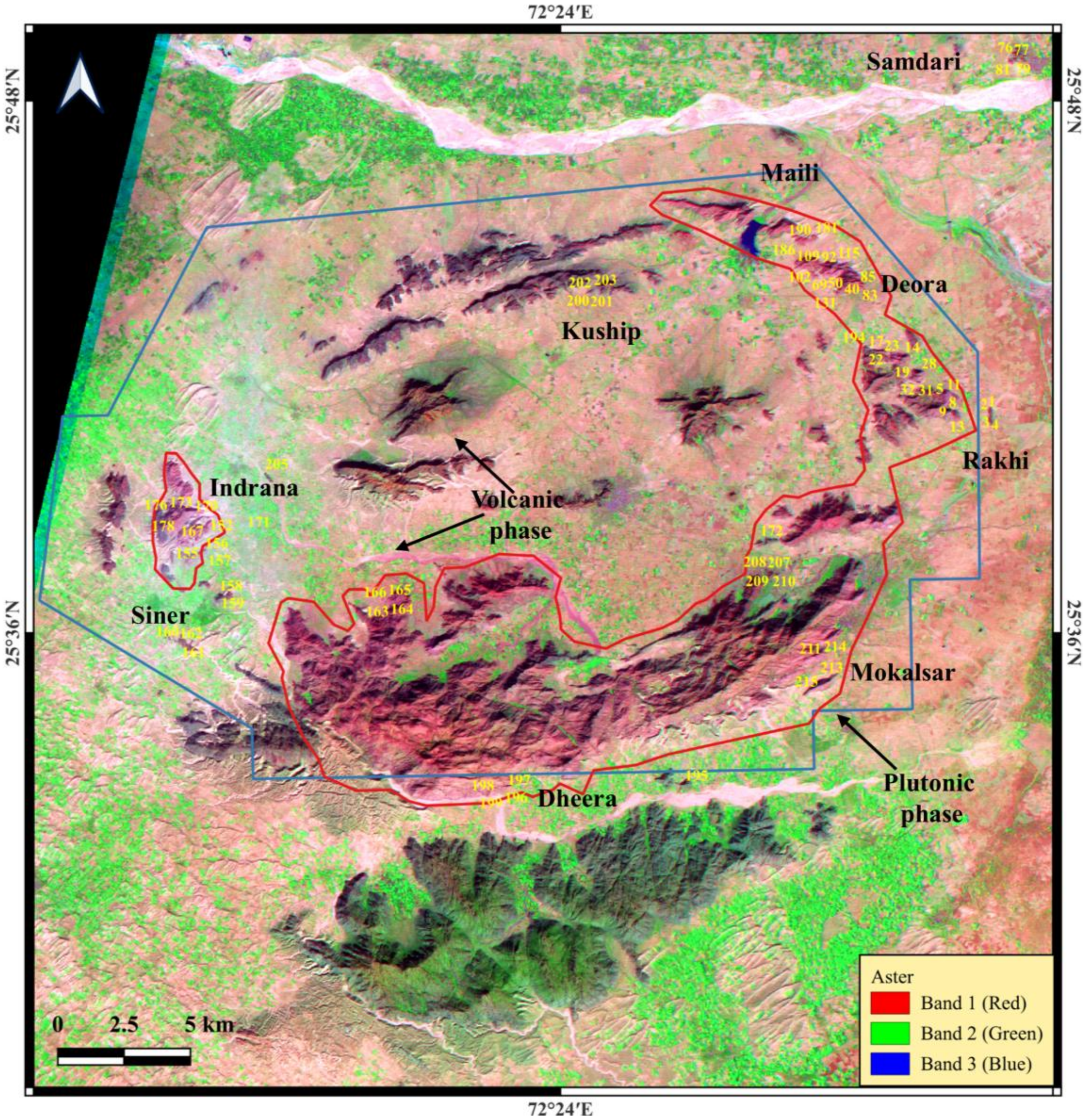

Figure 2.1. ASTER false-colour composite image (Band Ratio 9:3:1) showing lithological discrimination within the Siwana Ring Complex. The plutonic phase is represented by pinkish-brown tones, while the volcanic phase appears as dark green to black tones. The blue polygon delineates the jointly designated potential area identified by GSI and AMD for REE and associated mineralization.

Masonry stone quarry leases are generally associated with the volcanic phase, particularly rhyolitic rocks. Owing to their flow structures, variable texture, and comparatively lower blockability, these rocks are primarily exploited as masonry stone, building stone, road metal, and crusher aggregate. Such leases occur mainly in and around the volcanic exposures of the ring complex.

As per information furnished by the Directorate of Mines & Geology, Rajasthan, a total of 116 quarry leases occur within the Siwana Ring Complex area, comprising of 97 granite leases covering 206.750 ha and 19 masonry stone leases covering 23.905 ha, with a cumulative lease area of 230.655 ha. The spatial distribution of these leases broadly follows the geological framework of the complex, with granite leases concentrated along the plutonic ring and masonry stone leases associated with rhyolitic volcanic units.

2.3 Objectives of Investigations

The primary objective of the study was to evaluate the REE mineralisation potential of the active granite and masonry stone leases and to establish a reliable geochemical database. The study also aimed to identify zones enriched in REE and assess their spatial distribution within the study area.

2.4 Nature and Quantum of Work

The study involved collection of representative field samples from all the granite and masonry quarry leases granted in the SRC area followed by geochemical analysis of the samples for assessment of REE potential in the quarry leases. The work involved systematic collection and geochemical characterization of representative samples from mine faces, active quarry benches and outcrops to evaluate the occurrence, distribution, and enrichment behaviour of REEs within the granitic suite.

The scope of work includes field sampling, sample documentation, preparation of representative sub-samples, and outsourcing of laboratory analysis under NMEDT funding support.

Tentatively around 386 samples were proposed to be drawn from the identified 116 quarry leases. The analytical programme comprised of determination of major oxides, selected trace elements, and complete REE concentrations in the samples.

Against the tentatively proposed 386 samples including check samples for analysis the number of field samples collected were 215. The lesser number of field samples generated was owing to the very small size of the leases and was based on field level judgment made by the geologist involved in sampling on the basis of variation in geology and lithounits exposed in the quarries. Further 10% of the samples collected i.e. 21 samples were sent for check analysis. Thus, a total of 236 samples were analysed.

Major oxide and trace element analyses were proposed to be carried out to establish the geochemical characteristics and petrogenetic affinity of the granites and to understand the association and distribution patterns of REEs within different lithological phases. Complete REE analyses, including both light and heavy REEs, were proposed to be undertaken to evaluate total REE enrichment, fractionation trends, and spatial distribution patterns within the study area.

The outcome of the study is expected to facilitate the identification of REE-enriched zones and assess the potential for recovery of critical minerals associated with granitic and masonry stone mining leases in the Siwana Ring Complex.

Table 2.1: Summary of Work Proposed and Achieved during the Project Period

S.No.	**Target Sites**	**Proposed**		**Actual**	
		Mines	Samples	Mines	Samples
1	Masonry Stone Leases	19	57	19	215
2	Granite Stone Leases	96	294	96	
3	Check Samples (10%)		35		21
	Total	116	386	116	236

Table 2.2: List of Radicals/Elements analyzed

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, Zr, W, Sr, Ba, Cr, Ni, Cu, Zn, Ga, Pb
3	14 REE	La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Ho, Er, Dy, Tm, Yb, Lu

The collected samples were initially proposed to be analyzed externally through both Mineral Exploration and Consultancy Limited (MECL), Nagpur and the Jawaharlal Nehru Aluminium Research Development and Design Centre (JNARDDC), Nagpur to ensure timely completion of the analytical programme. However, JNARDDC expressed its inability to undertake the analysis within the stipulated timeframe due to an existing heavy sample workload and other laboratory commitments. Consequently, all primary samples collected during the study were submitted to MECL, Nagpur for geochemical analysis. In addition, a set of 21 check samples were submitted to the Mineral Processing Division (MPD), Indian Bureau of Mines (IBM) for quality assurance and verification of analytical results.

Besides, a few representative hand specimens were selected and analyzed for their mineralogical composition at the Mineral Processing Division (MPD) Laboratory of the Indian Bureau of Mines (IBM). The primary objective of the mineralogical investigation was to study the mineral assemblages, with particular emphasis on the identification and characterization of rare earth element (REE)-bearing minerals.

3

GEOLOGY OF THE STUDY AREA

Chapter: 03
GEOLOGY OF STUDY AREA

3.1 Regional Geological Set Up

The study area forms part of the Trans-Aravalli region of western Rajasthan and occurs west and southwest of the Aravalli mountain belt. Geologically, the area belongs to the Malani Igneous Suite (MIS), which represents one of the largest Neoproterozoic felsic magmatic provinces of India characterized by extensive acid volcanism and associated plutonic activity. Neoproterozoic igneous activity developed between 830 Ma and 680 Ma (Choudhary et al., 1984; Rathore et al., 1999).

The MIS unconformably overlies the Mesoproterozoic rocks of the Delhi Supergroup and is non-conformably overlain by the sedimentary succession of the Marwar Supergroup (Bhushan, 2000; Chittora and Bhushan, 1990–94).

Lithologically, the province comprises felsic volcanic rocks, granitoid plutons, ring complexes and extensive dyke swarms emplaced under predominantly anorogenic tectonic conditions.

Different tectono-magmatic models have been proposed for the origin of the MIS. Bhushan (2000) and Singh and Vallinayagam (2013) suggested that the magmas were generated by partial melting of the lower crust in a rift-related tectonic setting, whereas Eby and Kochhar (1990) related the magmatism to mantle plume activity. Li et al. (1999) and Torsvik et al. (2001) linked the MIS magmatism with the breakup of the Rodinia supercontinent and correlated it with a superplume event beneath South China. Another model proposed by Ashwal et al. (2002) and Tucker et al. (2001) associated the magmatism with tectonic processes related to subduction of the Mozambique Ocean between Seychelles–Madagascar and northwestern India.

Based on field relationship, mode and type of magmatism, texture and composition, MIS has been divided into three phases of magmatic activity (Kumar and Sharma, 2019). The first phase commenced with the eruption of basic flows, followed by voluminous outpouring of felsic lava flows and culminating in ash flow deposition. The second phase experienced intrusion of peraluminous, per-alkaline and meta-aluminous granitoids as plutons, ring dyke, bosses and plugs within the extrusive phase. The third phase represents the mafic and felsic dyke swarms and sills within the earlier two phases.

A generalized classification of the Malani Igneous Suite after Bhushan and Chandrasekaran (2002) is presented in Table 3.1.

Table 3.1: Generalized classification of Malani Igneous suite (after Bhushan and Chandrasekaran, 2002).

Super Group	Group	Formation	Mode of Magmatism	Lithology
Marwar Supergroup (Vendian 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 porphyry Trachyte porphyry andesite porphyry porphyritic/non-porphyritic dyke &boss and aplite veins.
	Granitoid plutonism	Malani granite, Siwana granite, Jalor granite	Intrusive phase-II	Hornblende granite riebeckite Aegirine granite biotite/ Hornblende granite
	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		

Despite differing views regarding tectonic origin, the MIS is widely recognized as an anorogenic A-type magmatic province enriched in incompatible trace elements and rare metals. The suite is generally devoid of major tectonic deformation and preserves several primary volcanic and plutonic features.

3.2 Geology of Siwana Ring Complex

The Siwana Ring Complex forms an important intrusive centre within the Malani Igneous Suite and occupies an area of approximately 750 km^2, extending nearly 30 km in the east-west direction and 25 km in the north-south direction. The geological map of the SRC showing the location of samples collected for the present study is provided in Figure 3.3.

Previous studies done in this region suggest that magmatic activity in the Siwana area occurred through three distinct pulses of alkaline granitic emplacement (Bhushan and Somani, 2019). The earliest phase is represented by medium- to coarse-grained granites, whereas the second phase comprises voluminous coarse-grained to pegmatitic leucogranites. The final and most evolved intrusive phase is represented by granite porphyry and microgranite dykes associated with minor rhyolite intrusions and quartz veins. This younger intrusive phase is closely associated with hydrothermal activity and carries significant concentrations of REE and associated rare metals.

The Peralkaline Siwana Granite intrudes the rhyolitic rocks of the area and forms a conspicuous ring-shaped intrusive pattern around Siwana. The characteristic circular geometry of the granitic intrusions and associated rhyolitic units led Murthy (1962) to formally establish the "Siwana Ring Structure." Later, Mukherjee and Roy (1981) interpreted the structure as a caldera-related feature associated with ring dyke emplacement. The volcanic flows within the complex commonly exhibit elliptical flow patterns gently dipping towards the centre of the structure.

The volcanic and plutonic rocks exposed in and around the Siwana area generally lack major deformational structures except for localized faults. Several primary volcanic structures including flow layering, vesicular and amygdaloidal textures, columnar joints and megaspherulitic structures have been reported from the felsic volcanic sequences. Flow lobes, joints and minor faults occur in both volcanic and plutonic units (Rastogi and Mukherjee, 2015).

No significant regional metamorphism has been documented from the Siwana area. However, several studies have emphasized the importance of late-magmatic and post-magmatic metasomatic processes in the evolution of the Siwana granites and associated REE enrichment (Strong, 1982; Baginski et al., 2016; Rong et al., 2016; Mondal et al., 2021). Kumar and Sharma (2020) reported various late-stage replacement textures including perthite coarsening due to albitization, development of chessboard perthite, deuteric alteration of alkali feldspar, pseudomorphic replacement by aegirine, formation of albite rims and crystallization of secondary zircon and apatite along grain boundaries and inclusions.

Primary inosilicate minerals such as aenigmatite, aegirine-augite and astrophyllite have undergone replacement by aegirine and arfvedsonite under the influence of alkaline hydrothermal fluids during late to post-magmatic stages (Kumar and Sharma, 2020). These metasomatic processes are considered important in mobilization and concentration of REE and associated HFSE mineralization within the Siwana Ring Complex.

Geochronological studies indicate that emplacement of Siwana Granite and Jalore Granite occurred during separate magmatic events within the MIS. Rathore et al. (1999) suggested emplacement ages of approximately 727±8 Ma for Jalore Granite and 693±8 Ma for Siwana Granite. However, Dhar et al. (1996) proposed that the Siwana Granite is mantle-derived and contemporaneous with the Jalore Granite, yielding an age of approximately 723±6 Ma.

Geological sequence of MIS established in Siwana area after Rastogi et al (2015) is presented in Table 3.2.

Table 3.2: Geological sequence of MIS established in Siwana area (after Rastogi et al., 2015)

<table>
<tr><th>Age</th><th colspan="2">Phase</th><th>Rock type</th></tr>
<tr><td rowspan="4">Late Proterozoic</td><td rowspan="2">Phase III Intrusive phase</td><td>Phase III b granite phase</td><td>Coarse grained grey porphyritic granite. (Granite-granodiorite - quartz monzonite)</td></tr>
<tr><td>Phase III a microgranite phase</td><td>Microgranite</td></tr>
<tr><td>Phase II Intrusive phase</td><td>Phase II dyke phase</td><td>Felsic and basic dykes (rhyolite rhyodacite- dacite-trachydacite with opalescent quartz and trachybasalt tephrite- basanite-basalt respectively).</td></tr>
<tr><td>Phase I Extrusive phase</td><td>Phase I extrusive flow phase</td><td>Flows of rhyolite/trachyte without opalescent quartz</td></tr>
</table>

3.3 REE Prospectivity of the Siwana Ring Complex: A Review

The Siwana Ring Complex is characterized by well-developed volcano-plutonic associations, anorogenic magmatic affinity and significant potential for rare earth and rare metal mineralization (Kochhar, 1992; Jain et al., 1996; Vallinayagam and Kochhar, 1998; Bhushan and Chittora, 1999; Kochhar, 2000; Vallinayagam, 2001; Vallinayagam, 2004; Singh and Vallinayagam, 2009).

Mineralogical characteristics, geochemical signatures and magmatic evolution trends of the Siwana peralkaline granites closely resemble those of the Strange Lake REE deposit of Canada, one of the world's important peralkaline-hosted REE deposits (Bhushan and Somani, 2019; Kerr and Rafuse, 2012). Geochemically, the granites range from peralkaline to mildly peraluminous compositions and are enriched in incompatible and high field strength elements such as Nb, Y, Ta, Zr, Zn, Pb, Hf, U, Th and REE (Narayan Das et al., 1978; Jain et al., 1996; Mohanty and Bhushan, 2004).

Several investigations carried out by GSI, AMD, private exploration agencies and independent researchers have demonstrated significant potential for REE-HFSE mineralization within the SRC.

Early investigations by Majumdar (1976–1978) indicated enrichment of Nb, La, Y and Zr within the Siwana suite, highlighting its metallogenic significance with respect to critical minerals. Subsequent studies by Das et al. (2015) suggested that the younger intrusive dykes emplaced along the periphery of the Siwana Ring Complex are comparatively more enriched in REE and associated rare metals than the earlier granitic phases. Barman and Neog (2019) also reported appreciable REE concentrations within different granitic phases of the SRC, whereas Kumar and Sharma (2020) observed relatively higher REE and rare metal enrichment in younger intrusive rocks compared to plagioclase-rich granites, K-rich granites and felsic volcanic rocks.

A specialized thematic mapping programme in the Siwana Ring Complex was undertaken by Rastogi and Mukherjee (2015) to evaluate the potential for rare earth elements and associated mineralization. Analytical results from 17 granite samples revealed ΣREE concentrations ranging from 657 ppm to 5,812 ppm, with an average value of 1,609 ppm. In addition, nine granite samples recorded an average niobium (Nb) concentration of 165 ppm. Geochemical analysis of five aplite/microgranite dyke samples showed ΣREE concentrations varying between 669 ppm and 3,210 ppm, averaging 1,784 ppm, while the average Nb concentration was 167 ppm.

Detailed geochemical investigations carried out by Das and Ghantait (2020) on REE-bearing felsite dykes from the Phulan area reported exceptionally high concentrations of REE and associated high field strength elements within the peralkaline felsic suite. The felsite dykes recorded concentrations up to 1.17% Ce, 0.6% La, 0.8% Y, 0.12% Dy, 1385 ppm Nb, 9944 ppm Zr, 571 ppm Th and 169.25 ppm U, indicating strong enrichment of both REE and HFSE.

Banerjee et al. (2021) reported significant REE-Nb mineralization associated with rhyolitic tuffs and felsic pyroclastic rocks from the Dantala and Buriwara areas of the SRC. The study established that the peralkaline felsic volcanic rocks of the Siwana Ring Complex constitute a highly prospective geological environment for REE-HFSE mineralization in India. Surface grab samples from Dantala recorded REE concentrations up to 0.629% ΣREE along with average values of 519 ppm Nb, 46 ppm U, 171 ppm Th and nearly 1% Zr, whereas samples from Buriwara yielded up to 0.37% ΣREE and 300 ppm Nb. The study further highlighted notable Heavy Rare Earth Element (HREE) enrichment, with Dy values averaging around 233 ppm, exceeding the cut-off values of some internationally known peralkaline rhyolite-hosted REE deposits such as the Foxtrot deposit of Canada.

Mundra et al. (2022) reported significant REE concentrations from peralkaline granites and microgranites of Nal, Ramaniya, Phulan and Bhatikhera areas, with composite core sample values reaching up to 0.60% REE. The reported LREE:HREE ratio ranging between 2.6:1 and 3:1 indicates significant HREE enrichment. The study also observed elevated Nb, Zr and Y concentrations within the microgranites, suggesting emplacement under within-plate peralkaline magmatic conditions favourable for HREE mineralization.

Singh et al. (2023) documented significant REE-Y-Nb-Zr enrichment associated with peralkaline microgranite dykes from Nal, Phulan and Bhatikhera areas. Average total REE concentrations of about 1.06% from Nal, 0.58% from Phulan and 0.55% from Bhatikhera were reported from grab and core samples. The microgranites exhibited relatively low LREE:HREE ratios ranging from 0.87:1 to 3.38:1 compared to the global average ratio of 13:1, thereby indicating notable HREE enrichment. Nb concentrations ranged from 370 ppm to 1175 ppm, while Zr concentrations reached up to 2.17%, reflecting strong enrichment of high field strength elements.

Kumar et al. (2024) carried out detailed investigations on granites, volcanic rocks and felsic dykes exposed in 17 quarry sections within the Siwana area and identified monazite, zircon and apatite as the principal REE-bearing mineral phases. Geochemical analyses of rock samples using ICP-MS recorded REE+Y concentrations ranging from 1061.22 ppm to 9088.62 ppm, with an average of 2361.89 ppm. The study also documented significant HREE enrichment along with Hf concentrations reaching up to 425.55 ppm. In addition, weathered soil horizons showed REE+Y values ranging from 223.39 ppm to 3175.75 ppm, with maximum enrichment observed in clay-rich ion adsorption horizons, indicating the possibility of secondary REE concentration in weathered profiles.

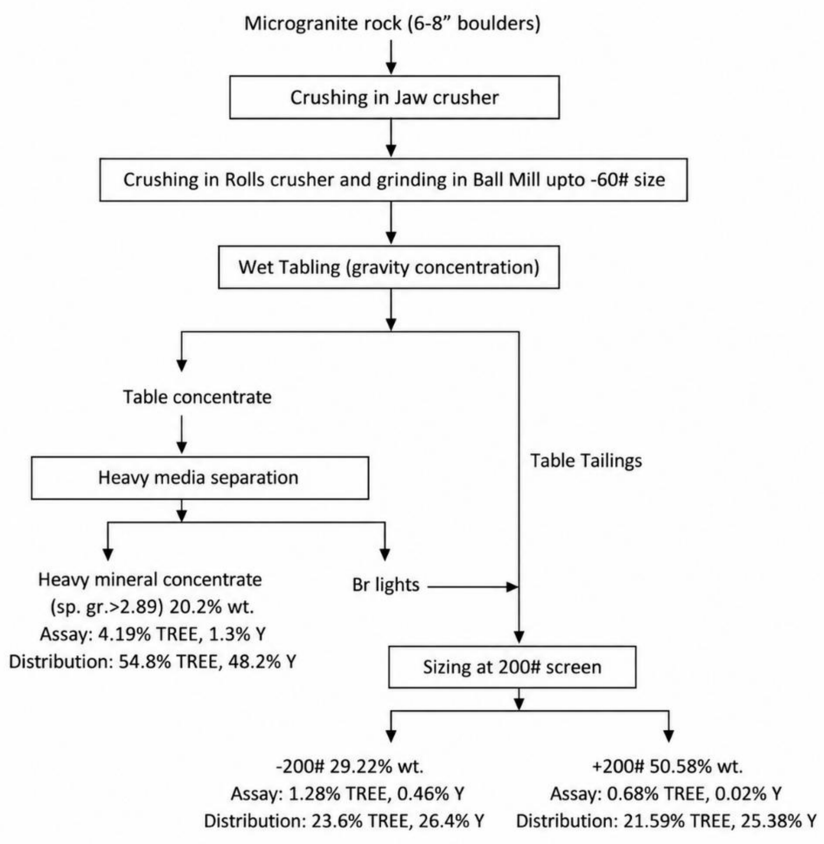

Figure 3.1: Flow sheet for beneficiation of REE from microgranite of Gudanal, Siwana Ring Complex (redrawn from Rao *et al.*, 2019; source: Singh, 2020).

A preliminary beneficiation study conducted on REE-mineralized microgranite from the Gudanal area by Rao et al. (2019) demonstrated encouraging metallurgical characteristics in addition to significant REE grades (Figure 3.1). Beneficiation tests involving size classification, gravity separation and magnetic separation showed appreciable enrichment of REE and Y, particularly within finer-grained fractions. The study suggested that a substantial proportion of REE values could potentially be recovered through conventional mineral processing techniques, thereby enhancing the economic significance of the Siwana REE mineralization.

3.4 Present Study

3.4.1 Location of the area

The present study focuses on active granite and masonry stone mine leases located in and around the Siwana Ring Complex to evaluate their potential for rare earth elements and other critical element mineralisation.

The mine leases investigated in the present study are located within the Siwana Ring Complex in Balotra District (formerly Barmer District), Rajasthan, and fall within Survey of India Toposheet No. 45C/06 and 45C/05. The study area extends between 25°32′22″N and 25°49′01″N latitude and 72°15′18″E and 72°34′15″E longitude, covering the principal granite and masonry stone quarry leases associated with the Siwana Ring Complex.

3.4.2 Accessibility

The study area is situated approximately 430 km south-west of Jaipur, the capital city of Rajasthan. The region is well connected to Jaipur through National Highways NH-58 and NH-162, along with State Highway SH-68.

The area is accessible through a network of metalled, semi-metalled, and gravel roads, facilitating easy access to the mine and quarry lease locations. The nearest railway station is Balotra Railway Station, located approximately 50 km from the lease areas, whereas the nearest airport is located at Jodhpur, about 150 km away. The distribution of the quarry leases and the location map of the investigated area are provided in Figure 3.2.

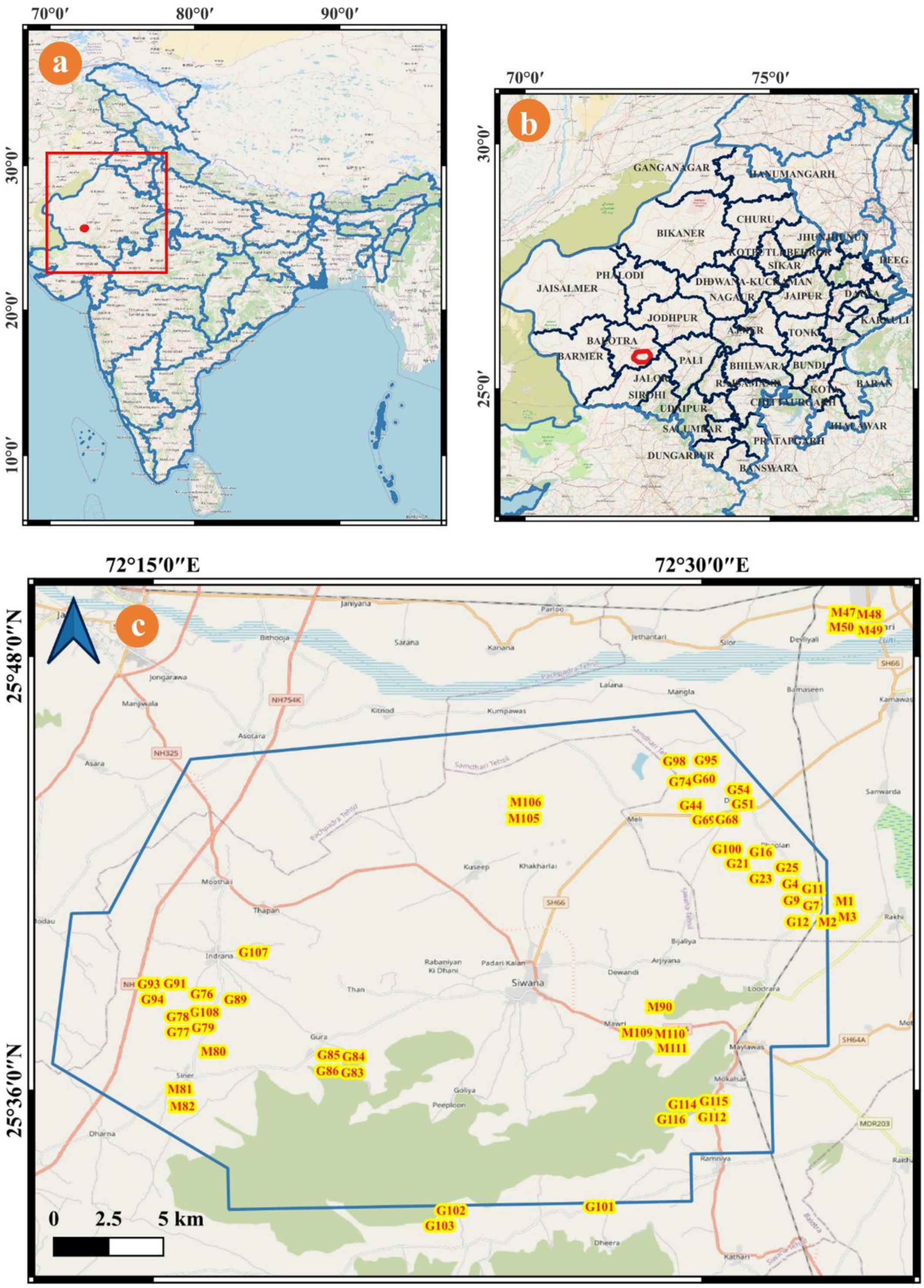

Figure 3.2: Distribution of quarry leases and location map of the study area.

The leases covered in the study are distributed across the villages of Rakhi, Balu, Fulan, Deora, Samdari, Maili, Indrana, Siner, Nalgoda, Mavdi, Dhira, Sela, Kuship, and Mokalsar. The details of the various quarry leases covered in the present study is provided at Annexure III.

3.4.3 Distribution of Granite and Masonry Stone Quarry Leases in the Siwana Ring Complex, Rajasthan

As can be seen in Geological map of the Siwna Ring Complex in Figure 3.3 (a) :(c), the granite and masonary stone quarry leases are distributed across the major lithological units of the complex and occur as distinct clusters corresponding to the spatial distribution of peralkaline granite and rhyolite exposures.

Based on their spatial distribution, granite quarry leases of the Siwana Ring Complex can be grouped into four clusters (A-D) (Figure 3.3b). The largest concentration occurs in Cluster (A) within the Deora–Fulan–Rakhi–Maili–Balu region, where 74 granite quarry leases are present. Cluster (B) includes 16 leases distributed across the Indrana, Nalgoda and Siner areas while Cluster (C) comprises 5 leases near Mokalsar village. Cluster (D) consists of 2 leases located near Sela village.

In contrast to the granite quarry leases, which are concentrated in a few large and well-defined clusters associated with extensive peralkaline granite bodies, the masonry stone quarry leases exhibit a relatively scattered and discontinuous distribution pattern. This dispersed occurrence is controlled by the localized exposures of rhyolite, porphyritic rhyolite and other volcanic rocks of the Malani Igneous Suite that are exploited as masonry stone. Consequently, masonry stone quarrying is restricted to isolated pockets across the Siwana Ring Complex, resulting in smaller and spatially separated quarry clusters. Cluster (E), located around Samdari village, comprises four masonry stone quarry leases. Cluster (F) occurs in the Rakhi area and contains three leases. Cluster (G) forms a smaller grouping in the Kuship area and includes three quarry leases. Cluster (H), situated near Mavdi village, comprises four leases, while Cluster (I) includes four leases distributed around the Siner and Indrana areas. In addition to these clusters, a solitary masonry stone quarry lease occurs near Dhira village. Overall, compared to the granite quarry leases, masonry stone quarry leases are fewer in number and exhibit a relatively dispersed distribution across different parts of the Siwana Ring Complex.

An important observation from Figure 3.3a is that, with the exception of four masonry stone quarry leases situated near Samdari village i.e., cluster E nearly all quarry leases are located within or immediately adjacent to the critical mineral prospective zone delineated jointly by GSI and AMD. This spatial link further highlights the significance of the quarrying areas for evaluating the potential of REE and associated critical mineral mineralization.

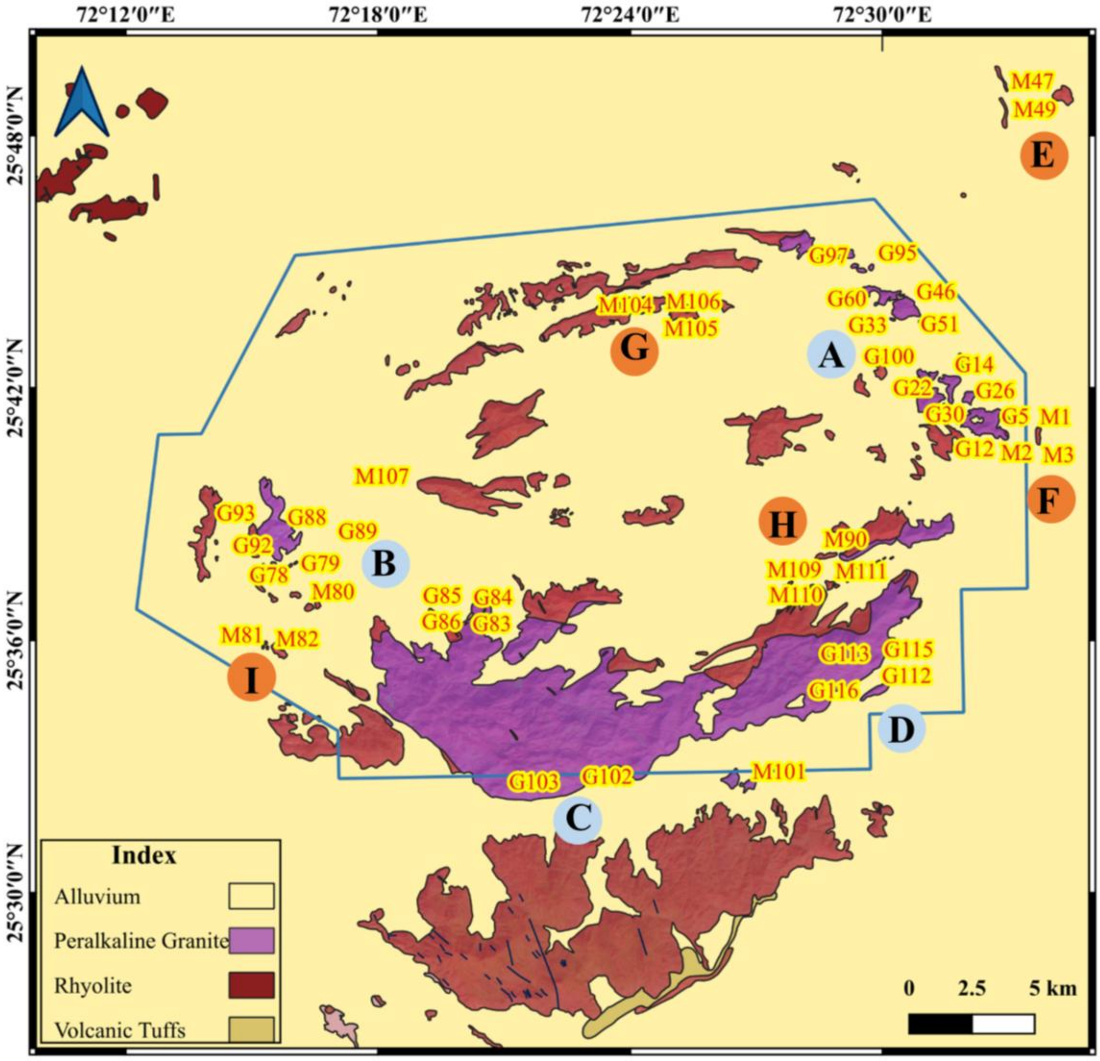

Figure 3.3a: Geological map of the Siwana Ring Complex (after GSI from NGDR portal) showing the locations of quarry leases covered during the study. The blue outline showing the jointly designated potential area by GSI and AMD for exploration of REE and associated mineralization in Siwana Ring Complex. The areas marked (a)–(d) and (e)–(i) denote clusters of granite and masonry stone quarries; enlarged views of these areas are presented in the subsequent figures.

3.4.4 Lithology encountered in quarry leases

Field investigations carried out in quarry leases associated with the Siwana Ring Complex revealed the occurrence of both volcanic and plutonic lithologies represented by rhyolite, porphyritic rhyolite, microgranite, and alkali granite. The quarries are

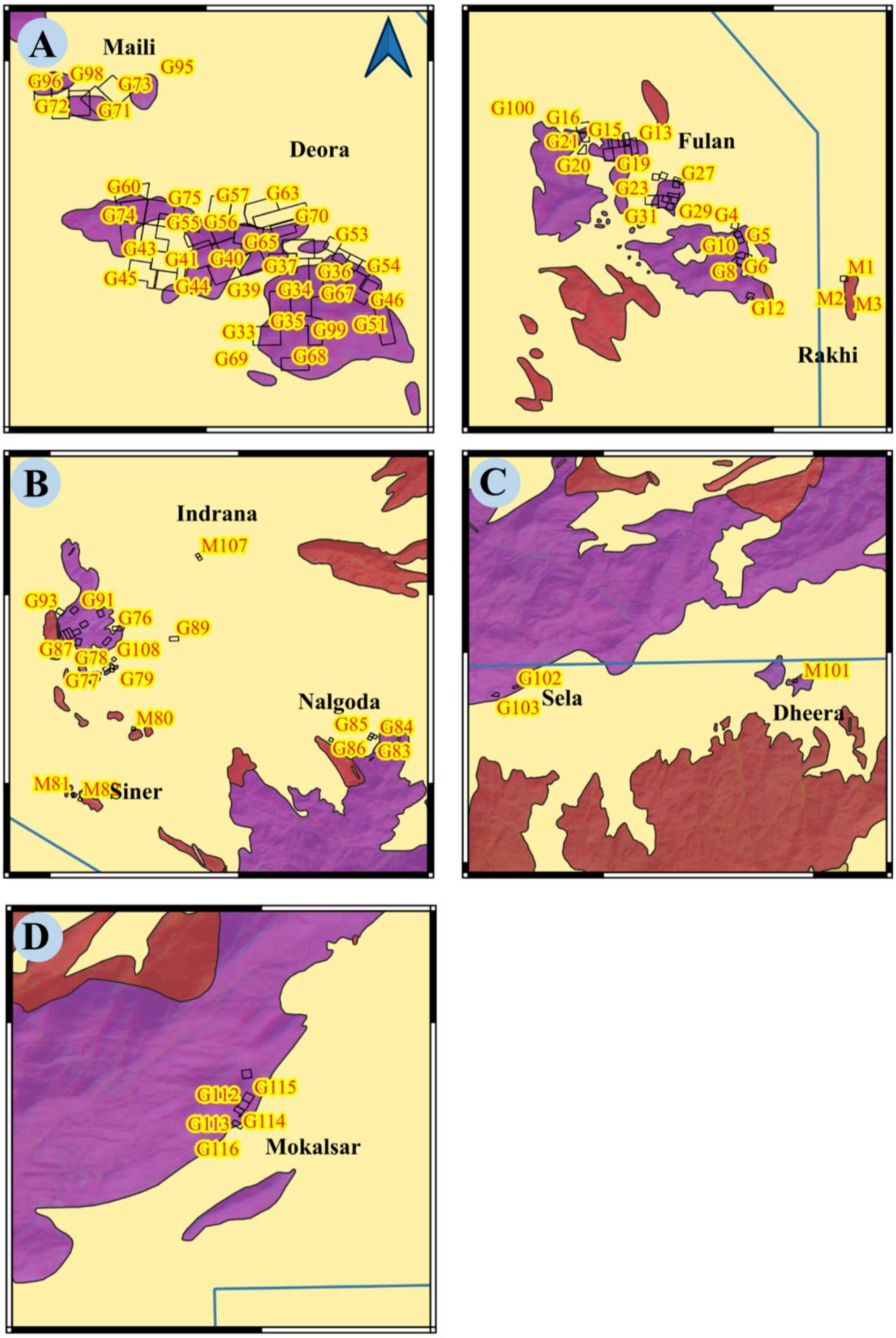

Figure 3.3b: Spatial distribution of granite quarry leases (A-D) within the Siwana Ring Complex. Granite leases are concentrated mainly in Deora, Fulan, Indrana, Maili, Mokalsar, Nalgoda and Sela villages.

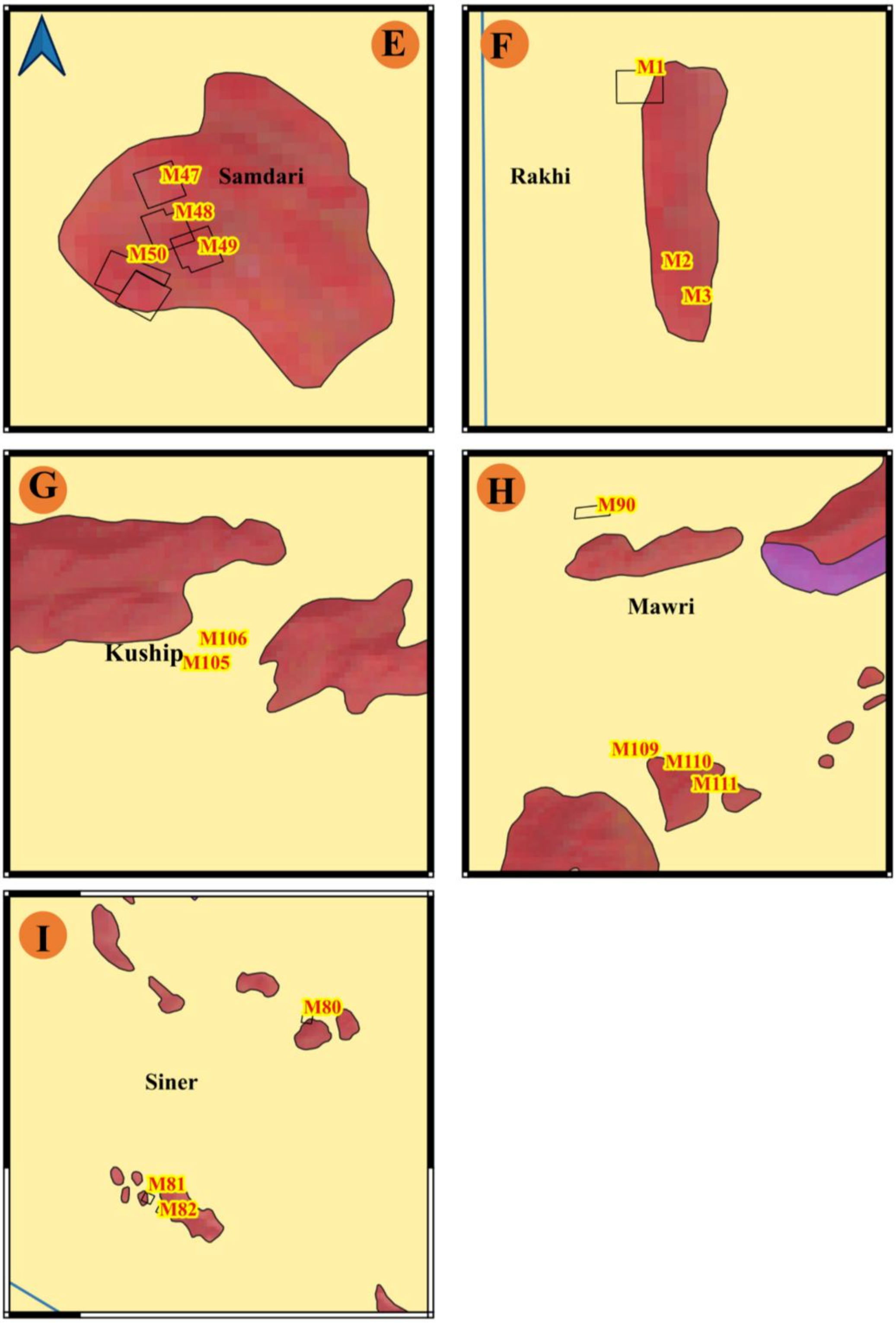

Figure 3.3c: Spatial distribution of masonry stone quarry leases (E_I) within the Siwana Ring Complex. Masonry stone leases are clustered in Samdari, Rakhi, Mavdi, Kuship and Siner villages.

predominantly occupied by Siwana Granite, felsic volcanic rocks, and associated minor dyke and veins intrusions.

3.4.4.1 Masonry Stone (Felsic volcanics)

The masonry stone quarry leases are mainly developed in the felsic volcanic rocks of the Siwana Ring Complex. These rocks are predominantly rhyolitic in composition and exhibit considerable textural variation (Figure 3.4). The rhyolites are generally grey to dark grey, fine-grained, compact, and locally display flow banding and porphyritic textures marked by feldspar phenocrysts embedded within a fine-grained groundmass. Both porphyritic and aphanitic varieties of rhyolite were observed during field studies. Mineralogically, the rhyolites comprise K-feldspar, quartz, mafic minerals, and devitrified glassy material. The rocks are highly fractured and jointed, resulting in angular blocks and boulders that are extensively utilized as masonry stone, road metal, and crusher aggregate.

3.4.4.2 Granite mines (Siwana Granites)

The Siwana Granite exposed in granite mines represents the plutonic phase of the Siwana Ring Complex and are predominantly pink to grey, leucocratic, medium- to very coarse-grained, holocrystalline, and massive in nature (Figure 3.5 – 3.6). They are composed chiefly of feldspar, quartz, and mafic minerals along with minor accessory phases. The feldspar assemblage includes orthoclase, albite, and oligoclase, while the mafic constituents are represented mainly by sodic amphiboles such as arfvedsonite and riebeckite and sodic pyroxenes such as aegirine. Zoning in feldspar crystals is commonly observed.

Texturally, the granite exhibits coarse- to very coarse-grained fabric with conspicuous accumulations of large feldspar crystals, imparting a locally porphyritic character. In several exposures, feldspar megacrysts are embedded within a medium-grained granitic matrix. Well-developed joints and fractures impart a distinct blockable character to the rock mass.

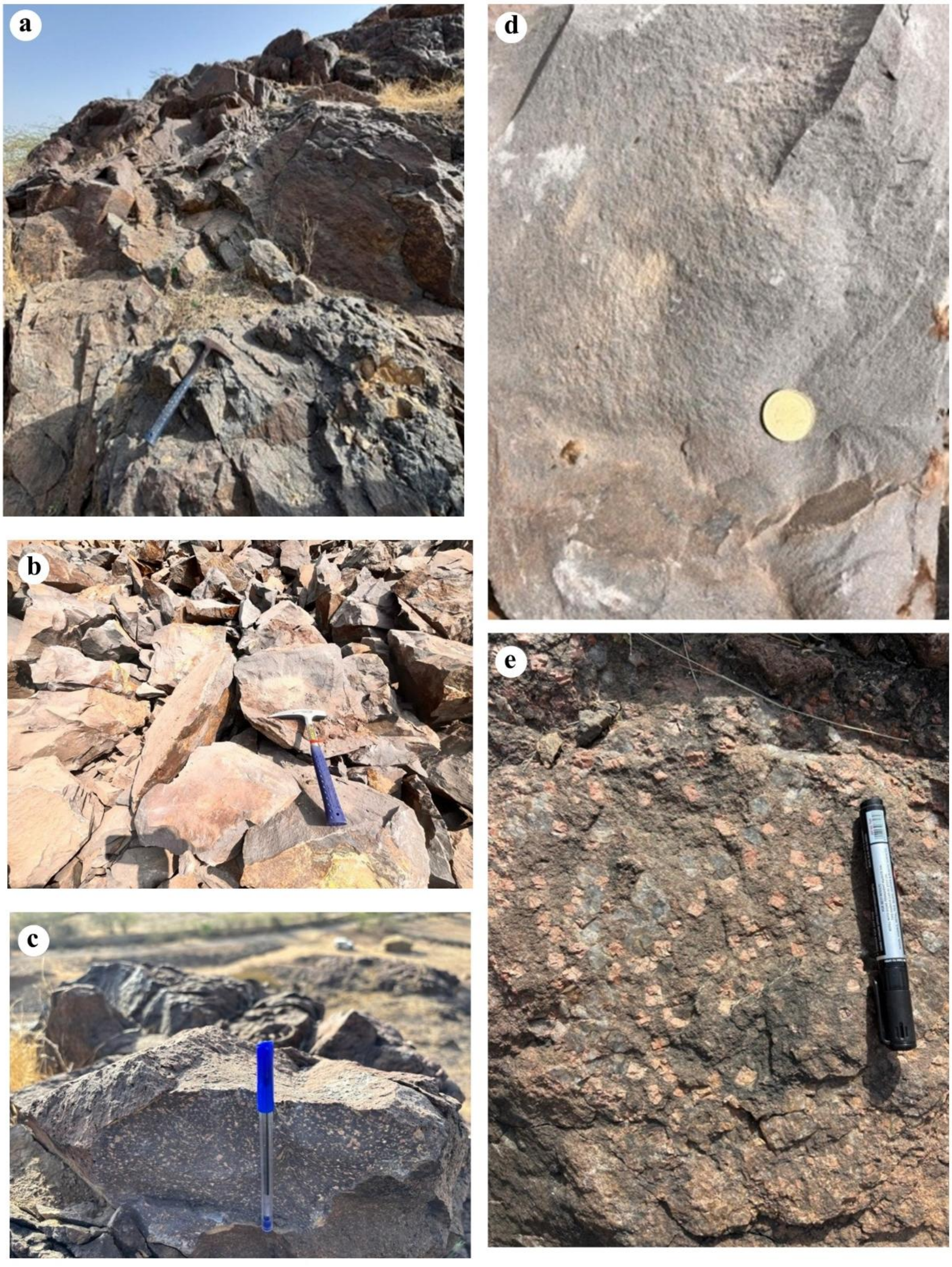

Figure 3.4. Masonry stone quarry leases within the Siwana Ring Complex: (a) fractured rhyolite outcrop exposed in Siner village (b) quarried rhyolite blocks used as masonry stone in Rakhi village; (c) porphyritic rhyolite with conspicuous feldspar phenocrysts in Siner village (d) fine-grained rhyolite displaying compact texture in Rakhi village and (e) porphyritic rhyolite exhibiting abundant K-feldspar phenocrysts in a felsic groundmass in Rakhi village.

Figure 3.5. Active granite quarry in the Siwana Ring Complex exhibiting massive, blockable granite for dimension stone extraction.

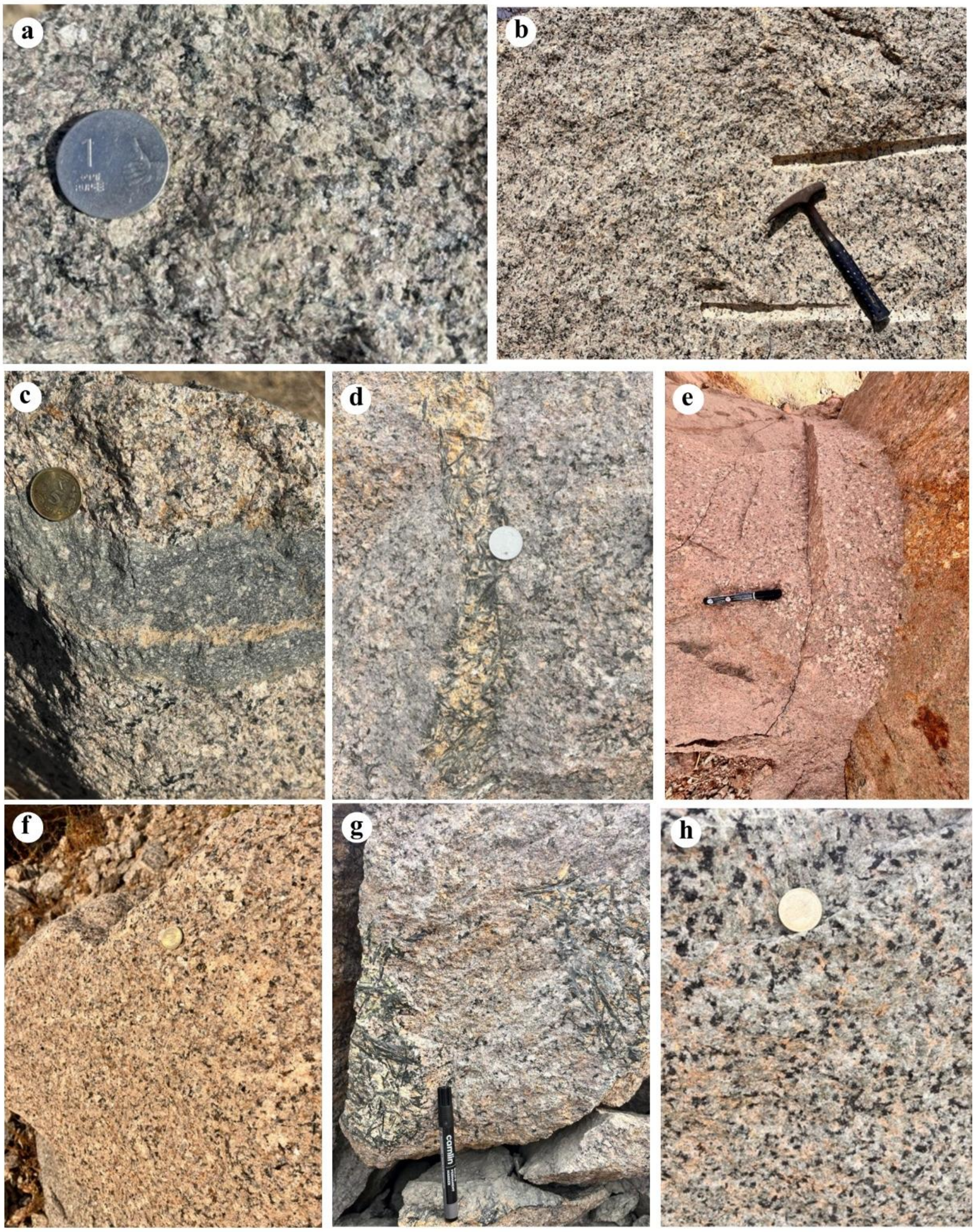

Figure 3.6. Representative field photographs of Siwana Granite exposed in granite quarry leases of the Siwana Ring Complex in Deora & Mokalsar village (a) (b) coarse-grained alkali granite comprising quartz, feldspar and mafic minerals (c) mafic-rich enclave within Siwana Granite near village Deora; (d) aegirine-rich mafic segregation band within granite exposed in Phulan; (e) pink porphyritic granite showing conspicuous feldspar megacrysts; (f) medium- to coarse-grained pink granite in Phulan village; (g) aegirine bearing coarse grained granite and (h) fresh, coarse-grained granite displaying a typical hypidiomorphic granular texture exposed in Phulan village.

4

GEOCHEMICAL SAMPLING METHODOLOGY & ANALYSIS

Chapter: 04 GEOCHEMICAL SAMPLING METHODOLOGY& ANALYSIS

4.1 Sampling for the present study

The sampling work from granite and masonry stone mines/leases of the Siwana Ring Complex, Rajasthan, was undertaken in a systematic and phased manner by the officers of Ajmer Regional Office of IBM. A total of 116 leases were covered under the study based on the list provided by the State Government of Rajasthan. The work was carried out in close coordination with the officers of the State government. All the lease areas were identified in the field by State Government officials, and accordingly, the sampling operations were meticulously planned and executed.

The sampling was conducted in two phases during the periods from 15.02.2026 to 21.02.2026 and from 05.03.2026 to 20.03.2026. The list of leases covered in the study is given at Annexure III.

4.2 Field Sampling Methodology

Chip and grab methods were adopted for collecting field samples depending upon field conditions and exposure characteristics. Samples were collected from exposed fresh rock faces after carefully removing the outer 2–3 cm weathered portion to avoid contamination. Approximately 2–3 kg of fresh rock material was collected for each sample to ensure adequate representation of all visible mineral phases. In the case of coarse-grained lithologies, up to 5 kg of material was collected to maintain sample homogeneity and representativeness.

In granite leases exploited as dimensional stone, chip samples were collected from fresh quarry faces ensuring coverage across lithological banding and visible mineralogical variations to obtain representative compositions. In masonry stone leases comprising rhyolite, chip samples were collected from distinct flow units covering variations in texture, grain size, and phenocryst distribution to capture compositional heterogeneity. Intrusive and dyke bodies encountered within the lease areas, such as microgranite, felsite, pegmatite, and mafic dykes, were sampled separately through representative chip sampling owing to their distinct geochemical characteristics.

As the lease areas were generally small, a maximum of three representative samples were collected from each lease depending upon lithological variability.

Separate samples were collected from distinct lithological units wherever they occurred as significant entities, including granite, biotite/hornblende granite, rhyolite, microgranite, felsite dykes, pegmatitic/aplitic veins, and structurally controlled zones such as joints, fractures, and alteration zones wherever they formed a significant portion of the lease area.

To confirm lithological characteristics, small fist-sized fresh rock samples were additionally collected from selected locations for petrographic studies and thin-section analysis. Each sampling location was recorded using GPS coordinates, and detailed field observations including lithology, texture, mineralogy, structural features, alteration, and quarry depth were systematically documented. Photographic records of each sampling site were also maintained, including both site-scale photographs and close-up images of the rock types to document grain size, textures, flow structures, and other relevant field characteristics.

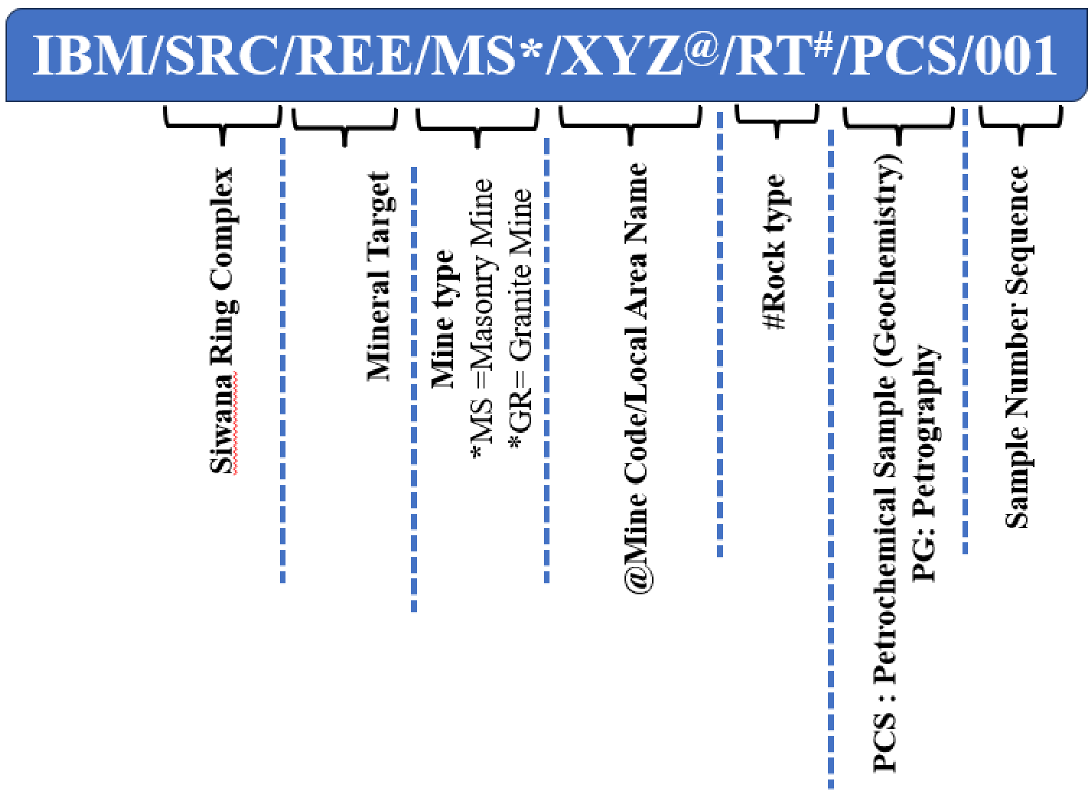

Figure. 4.1. Unique sample identification numbers to the collected samples where wherein standard abbreviations such as GB–Gabbro, DOL–Dolerite, BAS–Basalt, GR–Granite, RP–Rhyolite Porphyry, TP–Trachyte Porphyry, ANP–Andesite (Porphyritic), ANNP–Andesite (Non-porphyritic), APL–Aplite Veins, RH–Rhyolite, TR–Trachyte, and BD–Basic Dyke were used for representing different rock types.

The field samples collected from the mines were sent to the Regional Mineral Processing Laboratory (RMPL) of IBM at Ajmer, for sub sampling by size reduction to facilitate easy dispatch to different laboratory for further processing and analysis.

4.3 Geochemical Analysis

Major oxide and selected trace element analysis comprising Cu, Pb, Zn, Ni, Sr, and Ga were carried out using Wavelength Dispersive X-Ray Fluorescence (WD-XRF) techniques. Quantitative analysis of 14 REEs, namely La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, and Lu, along with trace elements such as U, Ta, Ge, Be, Hf, Sn, As, Rb, Th, Sc, Y, Zr, Nb, and W, was carried out using ICP-MS following multi-acid digestion (HF–HNO_3–$HClO_4$).

The entire analytical work for the collected 215 samples was carried out at the analytical laboratory of Mineral Exploration & Consultancy Limited, Nagpur. For this purpose, a Standard Operating Procedure (SOP) for geochemical analysis of mine samples and quality management, adopted from previous studies, was followed.

The complete analytical dataset for all analysed samples, including the selected check samples, is provided in Annexure IV, V and VI.

4.4 Check Analysis

In accordance with standard Quality Assurance and Quality Control (QA/QC) practices, check sample analyses were also undertaken at the Modern Mineral Processing Laboratory of Indian Bureau of Mines, Nagpur. About 10% of the primary samples, comprising 21 samples, were re-analysed as check samples for all radicals analysed to ensure the reliability, precision, and accuracy of the analytical results.

For check sample analysis, major oxides including Al_2O_3, SiO_2, Total Fe, TiO_2, CaO, MgO, Na_2O, K_2O, P_2O_5, BaO, Cr_2O_3, Total Mn, and Loss on Ignition (LOI) were determined using Wavelength Dispersive X-Ray Fluorescence (WD-XRF). Base metals such as Cu, Pb, Zn, and Ni were analysed by Atomic Absorption Spectroscopy (AAS). Rare earth elements (REEs), comprising La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, and Lu, along with Sc and Y, were determined using Inductively Coupled Plasma–Mass Spectrometry (ICP-MS). In addition, selected strategic and critical elements, namely Be, Ga, Ge, As, Zr, Sr, Nb, Sn, Hf, and Ta, were analysed by ICP-MS following appropriate sample digestion and preparation procedures.The analytical results of internal check samples have been compared with the corresponding analysis of primary samples and have been presented in Annexure IV, V and VI along with results of primary samples.

Comparison of primary and check sample analyses for ΣREE+Sc+Y, LREE, HREE, Y, Zr, and Hf reveals considerable scatter and weak correlation between the two datasets, with R^2 values ranging from 0.18 to 0.38 (Fig.4.2).

Most data points plot below the 1:1 reference line, suggesting that the check analyses generally yielded lower concentrations than the corresponding primary analyses. The divergence is more pronounced for Zr and Hf, whereas relatively better agreement is observed for LREE and Y. The observed variation may be attributed to sample heterogeneity, inter-laboratory analytical differences, and the uneven distribution of REE-bearing accessory minerals such as zircon, monazite, and xenotime within the host rocks.

Despite the variability between the primary and check analyses, both datasets consistently identify the same samples as being enriched in REEs and associated high-field-strength elements. The analytical results are therefore considered adequate for evaluating the relative distribution and enrichment trends of REEs and associated critical minerals within the study area.

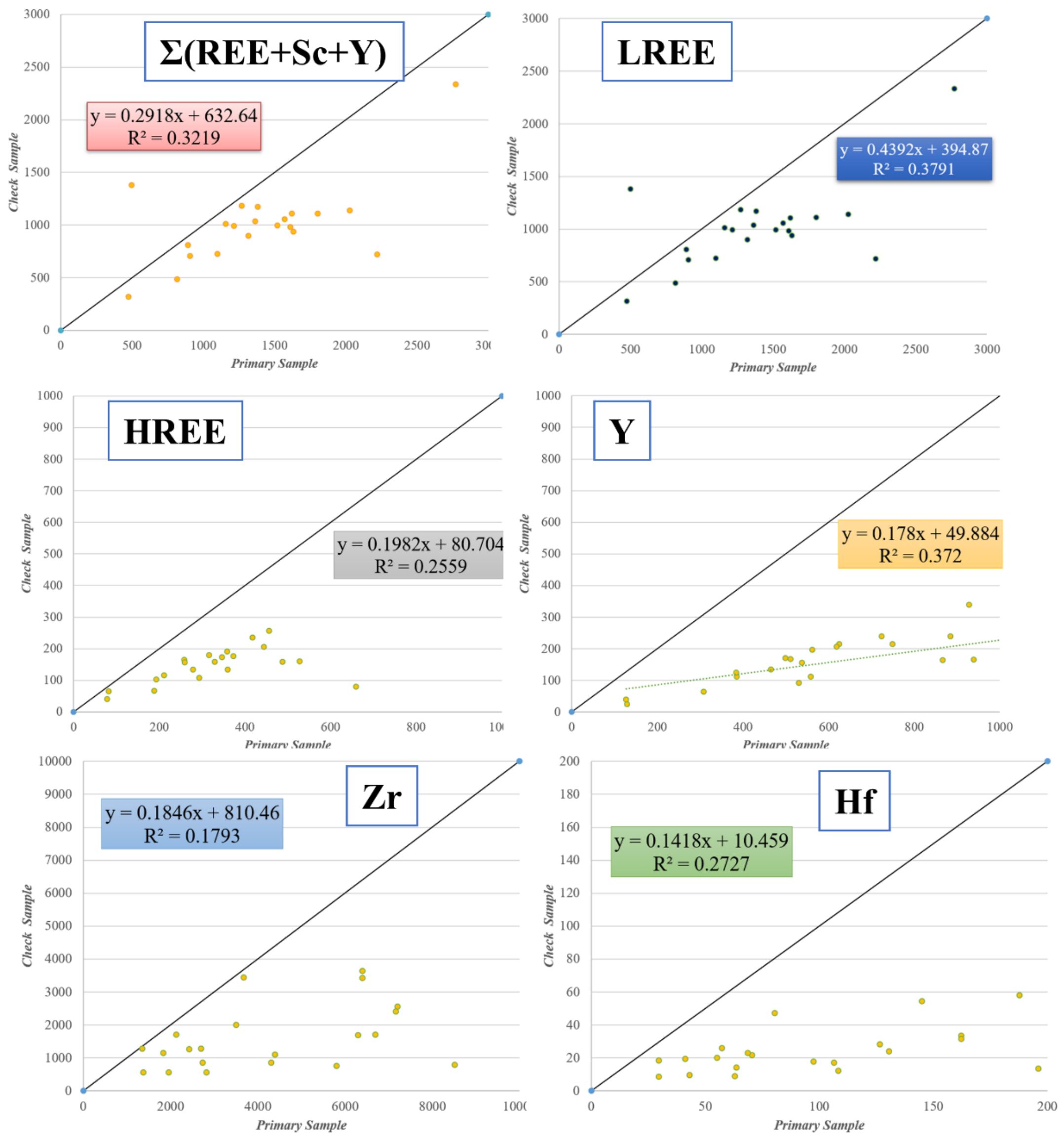

Figure 4.2. Scatter plot of Primary vs. Check Samples (values are in ppm).

4.5 FE-SEM with EDS study

Four representative hand specimens of varying lithology were selected and analyzed for their mineralogical composition at the Mineral Processing Division (MPD) Laboratory of the Indian Bureau of Mines (IBM). The details of the samples are provided in the table 4.1 below.

Table 4.1 List of samples selected for FE-SEM–EDS analysis

S. No.	Sample ID	Lithology	Latitude	Longitude
1	IBM/SRC/REE/GR/(131/06)/RH/PS/05	Rhyolite	72°16'18.48"	72°16'18.48"
2	IBM/SRC/REE/GR/(232/02)/GR/PS/12	Granite	25°44'9.6"	72°30'10.8"
3	IBM/SRC/REE/GR/(78/22)/TR/PS/07	Trachyte	25°43'41.62"	72°24'39.15"
4	IBM/SRC/REE/GR/(412/05)/PC/PS/04	Pyroclastic	25°35'45.48"	72°15'27.86"

4.5.1 Sample preparations and methodology for FE-SEM

One small cut piece section was prepared from the as received lumpy sample and the same was carbon coated by employing a Quorum150T ESS putter Coating Unit for the FE-SEM & EDS study.

FE-SEM study was undertaken on a TESCANFE-SEM, model: MIRA/LMS G4 machine installed at the Mineralogy Laboratory, IBM, Nagpur. The FE-SEM study involved back scattered electron (BSE) imaging, qualitative elemental scanning and quantitative point analysis:

a) Back Scattered Electron (BSE) imaging:

BSE imaging was performed at very high magnifications to study particles of up to even 1 micron size. Phases of different chemical composition were discriminated by BSE imaging owing to the difference in their mean atomic number. An acceleration voltage of 20 keV, beam current of 300 pA, WD & Z – 15 mm, Scan Mode Resolution and a beam diameter of 1 micron were used.

b) Qualitative & Quantitative Elemental Scanning:

The studies were carried out by using APEX EDAX Software, Version 2.5.1 with an acceleration voltage of 20 keV, detector resolution 129 eV, WD & Z – 15 mm, beam current of 300 pA and beam diameter of 1 micron.

The minerals were identified based on the elemental composition of EDS data. The elemental composition of EDS data is approximate value. The name of below mentioned silicate minerals is nearer to the elemental composition of EDS data.

4.5.2 Mineralogy of the Representative Samples

4.5.2.1 IBM/SRC/REE/GR/(131/06)/RH/PS/05 (Rhyolite)

Megascopic Observation

The sample is dark grey in colour and exhibits a grey streak. It has a massive form with no distinct layering. Feldspar grains are embedded on certain parts of the lump. The grain size is variable and ranging from fine to coarse sized grains. The sample possesses a very high specific gravity.

Figure 4.3. Hand specimen of the rhyolite sample (Sample No. IBM/SRC/REE/GR/(131/06)/RH/PS/05) showing its dark grey colour, massive nature, and fine- to medium-grained texture.

FE-SEM Observations

Field Emission Scanning Electron Microscopic (FE-SEM) with EDS study conducted on a polished lump revealed that:

1. The sample consists of quartz, feldspar (albite), pyroxene [aegirine, hedenbergite), amphibole [arfvedsonite, riebeckite], iron oxide/hydroxide, aenigmatite galena, cheralite, zircon, sphalerite, rosasite, silver oxide, litharge, sphene and apatite.
2. The polished lump shows hematite occurs as needle shaped crystalline aggregates and subhedral to anhedral shaped grains embedded on the silicate groundmass. The hematite grains range in size from 10 to 320 microns. At very few places hematite and goethite grains carry minute inclusions of silicate minerals and the degree of

inclusion varies from grain to grain. Majority of microcrystalline hematite and goethite grains are intermixed/ intergrown with silicate minerals.

3. Cheralite occurs as extremely fine sized (1 to 2 micron) disseminated grains within silicate minerals (pyroxene) as inclusion. Compositionally, the cheralite grains contain La_2O_3 (17.8-23.9%), Ce_2O_3 (31.3-40.5%), Nd_2O_3 (9.4-11.3%) in the lattice.
4. Pyroxene (hedenbergite) occurs as fine to medium sized (4 to 80 microns) grain. Compositionally, almost all the hedenbergite grains contain La_2O_3 (5.8-7.7%), Ce_2O_3 (10.8-13.5%), Nd_2O_5 (3.8-4.4%), Sm_2O_3 (1.6%) in the lattice.
5. Amphibole (arfvedsonite) occurs as fine sized grain and compositionally, one grain contains ZrO_2 (2.1%) in the lattice.
6. Extremely fine sized litharge grains are noticed. It occurs as inclusion within iron oxide/hydroxide.
7. Rosasite (copper-zinc carbonate) occurs as extremely fine sized grains ranging in size from 1 to 3 microns. Most of the grains occur as interlocked with iron oxide /hydroxide.
8. Extremely fine sized galena grains occur as inclusion within sphalerite.
9. Very fine to medium sized sphalerite grains occur as inclusion in iron oxide/ hydroxide. Compositionally, few sphalerite grains contain 5.6% of Zr in the lattice.
10. Sphene occurs as inclusion within iron oxide/ hydroxide ranging in size from 20 to 30 microns. Compositionally, majority of the sphene grains contain Nb_2O_5 (1-2.3%) whereas few grains contain ZrO_2 (10%) in lattice.
11. At places, extremely fine sized zircon is present as inclusion in sphene.
12. Compositionally a few aenigmatite (Na-Fe-Ti silicate) grains contain La_2O_3 (4.4-6.8%), Ce_2O_3 (7.1-13.6%), Nd_2O_3 (3.8-4.4%) in the lattice and the size ranges from 8 to 40 microns.

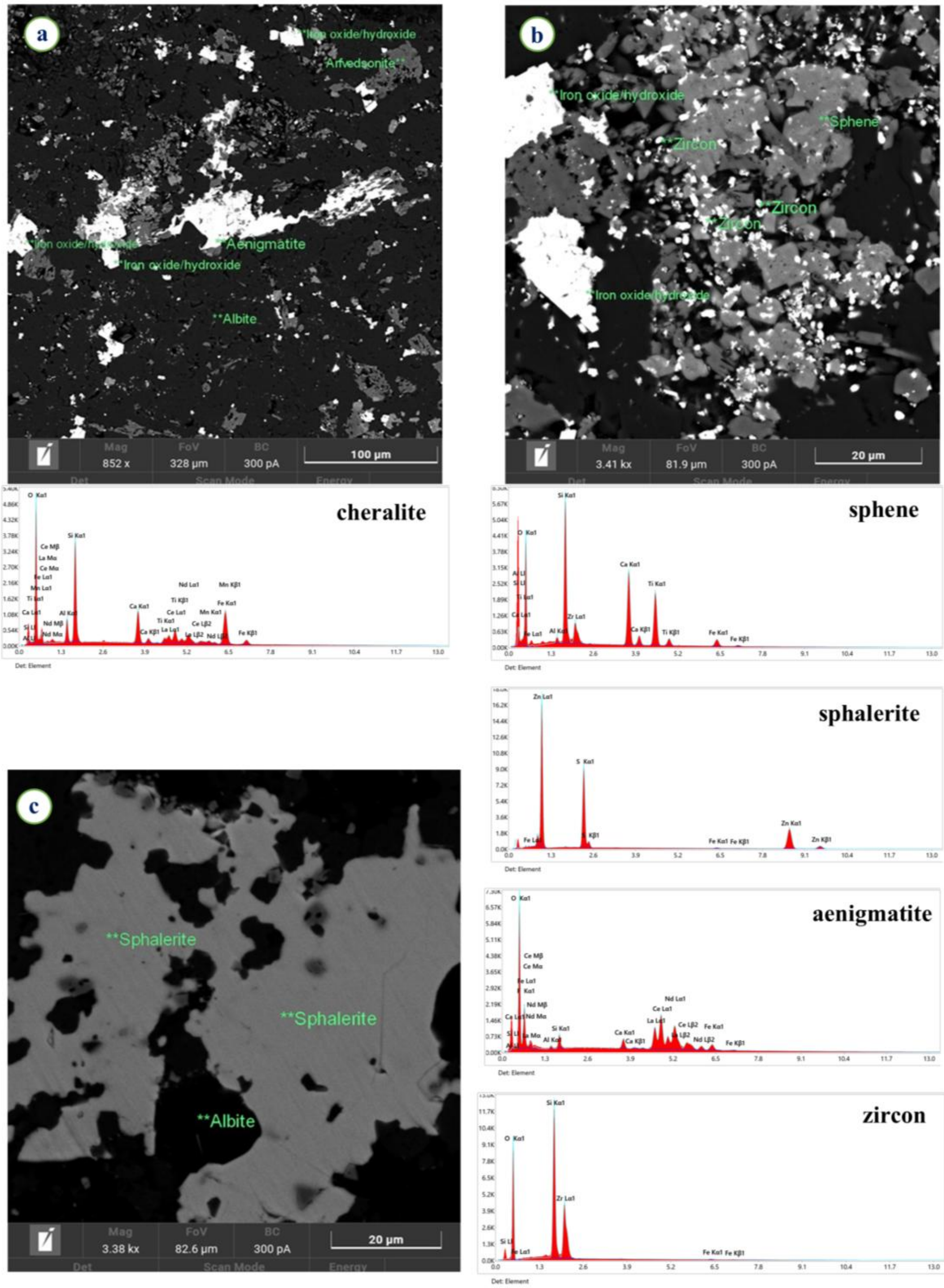

Figure 4.4. FE-SEM backscattered electron (BSE) images and corresponding EDS spectra of the rhyolite sample showing: (a) localized patches of very fine- to medium-grained iron oxide/hydroxide and aenigmatite embedded within the silicate groundmass; (b) occurrence of zircon and sphene (titanite) within the silicate groundmass; and (c) intergrowth of sphalerite with albite.

13. A very few augite grains (10 micron) are noticed which are interlocked with iron oxide /hydroxide. Compositionally, it contains La_2O_3 (8.2%), Ce_2O_3 (14.5%) in the lattice.

14. Apatite grains are present as inclusion in the silicate minerals.

4.5.2.2 IBM/SRC/REE/GR/(232/02)/GR/PS/12 (Granite)

Megascopic Observation

The rock is leucocratic in nature and exhibits a light grey colour. A porphyritic texture is prominently observed with conspicuous grains embedded within a fine-grained matrix at most locations of the lump. Intergranular texture is observed between quartz and feldspar minerals. Grey to green coloured grains are present and embedded throughout the sample. The specific gravity of the sample is very high.

Figure 4.5. Hand specimen of the representative granite sample (Sample No. IBM/SRC/REE/GR/(232/02)/GR/PS/12) showing its light grey colour, leucocratic nature, and porphyritic texture with conspicuous feldspar phenocrysts.

FE-SEM Observations

The below mentioned minerals are identified based on the elemental composition of EDS data. The elemental composition of EDS data is approximate value. The name of below mentioned silicate minerals is nearer to the elemental composition of EDS data.

Field Emission Scanning Electron Microscopic (FE-SEM) with EDS study conducted on a polished lump revealed that:

1. The sample consists of quartz, feldspar (orthoclase, albite, oligoclase, anorthoclase), pyroxene [aegirine, hedenbergite, hypersthene), iron oxide/hydroxide, aenigmatite, ferrosilite, galena, sphalerite, zircon, sphene, rutile, allanite, monazite and zincian chrysocolla.
2. The polished lump shows replacement of magnetite by hematite. The degree of replacement varies from grain to grain. Unaltered remnant of magnetite noticed within the groundmass of hematite. At very few places, magnetite grains carry exsolution lamellae of ilmenite are noticed. Hematite occurs in the form of anhedral to subhedral, platy, microcrystalline aggregates as well as acicular (needle like grains) shaped grains and ranging in size from 10 - 60 microns.
3. Allanite grains are present as inclusion in silicate minerals and the size ranges from 1 to 2 microns.
4. Monazite grains are present as inclusion in silicate (quartz) and the size ranges from 1 to 5 microns.
5. Zircon grains are present as inclusion in silicates and the size ranges from of 1 to 100 microns. Compositionally, the zircon grains contain Y_2O_3 (2.6-6.1%), TiO_2 (1 to 1.3%), Ce_2O_3 (0.3-3.3%), Nd_2O_3 (0.7-2.3%), Sm_2O_3 (4.5%) in the lattice.
6. Pyroxene (hedenbergite) grains are 25 to 250 microns in size. Compositionally, the grains contain La_2O_3 (7.3-8.0%), Ce_2O_3 (13.1-14.7%), and Nd_2O_3 (4.6%) in the lattice.
7. Sphalerite grains occur as inclusion in silicate minerals. The size of sphalerite grains range from 5 to 7 microns.
8. Sphene grains are present as inclusion in silicates (mostly potash feldspar). The size ranges from 25 to 30 microns. Compositionally, some of the sphene grains contain ZrO_2 (24.4%), AgO (3.5%), ThO_2 (18.5%) whereas a very few grains contain Nb_2O_5 (2.2 to 2.3%), ZrO_2 (1.4 to 1.8%) in the lattice.
9. Compositionally, ferrosilite occurs as fine to medium sized grains and the size ranges from 10 to 200 microns.

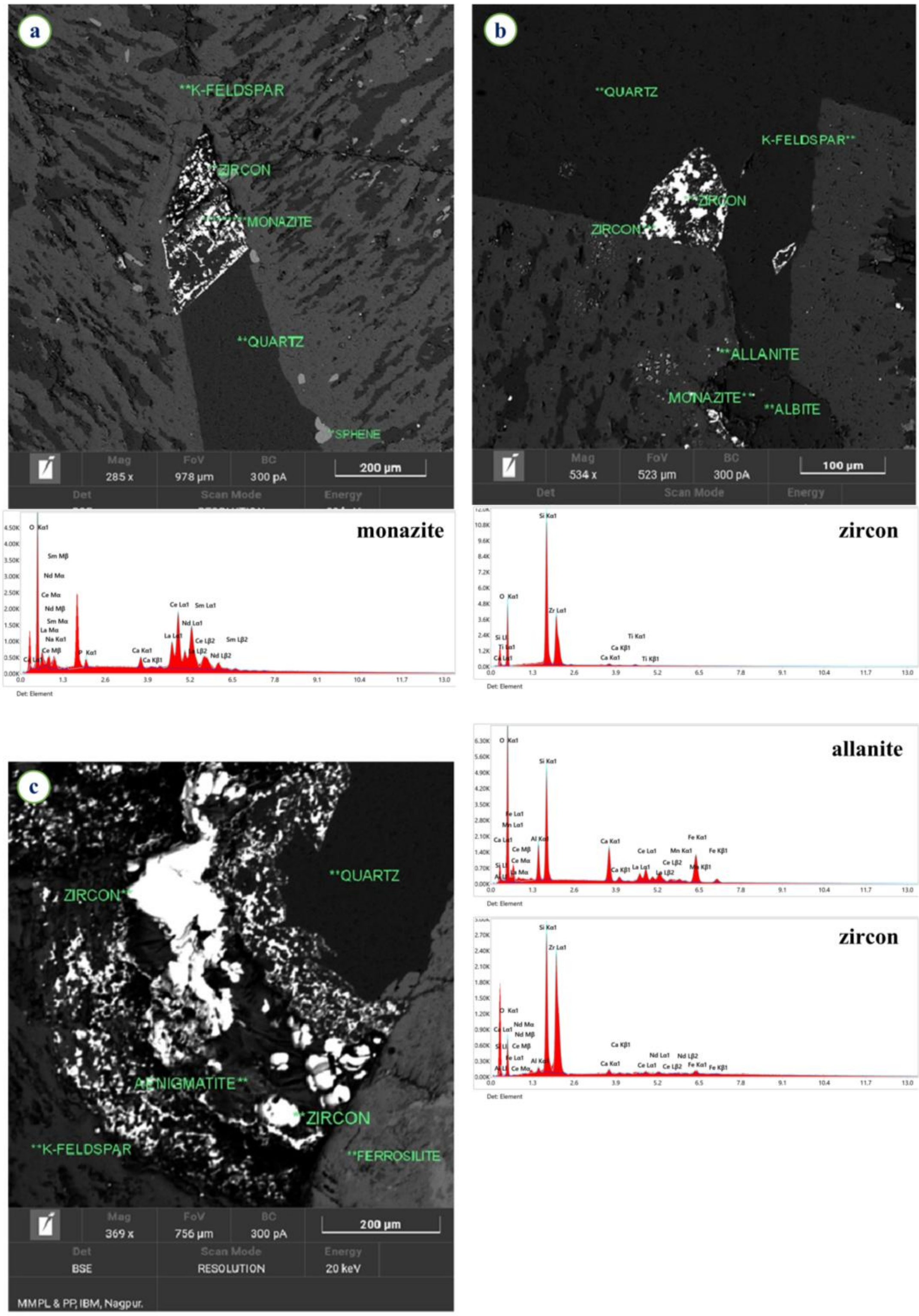

Figure 4.6. FE-SEM backscattered electron (BSE) images and corresponding EDS spectra of the representative granite sample showing: (a) intergrowth of monazite, zircon, and sphene (titanite) within silicate minerals (quartz and K-feldspar); (b) distribution of zircon, monazite, and allanite grains within quartz and feldspar; and (c) intricate intergrowth of zircon within silicate minerals, predominantly quartz, illustrating variable densities of zircon intergrowth from grain to grain.

4.5.2.3 IBM/SRC/REE/GR/(78/22)/TR/PS/07 (Trachyte)

Megascopic Observation

Figure 4.7. Hand specimen of the representative trachyte sample (Sample No. IBM/SRC/REE/GR/(78/22)/TR/PS/07) showing its dark grey colour, porphyritic texture, and pinkish alkali feldspar phenocrysts embedded within a fine-grained groundmass.

The sample was dark grey in colour and exhibits a grey streak. It has a massive form with no distinct layering. Feldspar grains are embedded on certain parts of the lump. The grain size is variable and ranging from fine to coarse sized grains. The sample possesses a very high specific gravity.

FE-SEM Observations

Field Emission Scanning Electron Microscopic (FE-SEM) with EDS study conducted on a polished lump revealed that:

1. The sample consists of quartz, K-feldspar, albite, iron oxide/hydroxide, sphene, zircon, gold, apatite, rutile, coronadite, ilmenite, zincian chrysocolla and arfvedsonite.
2. The polished lump shows hematite alters to /replaces by goethite. The size of hematite and goethite grains ranges from 10-240 microns. Goethite and hematite grains are embedded on the silicate groundmass. They also occur as patches, as bands and disseminated grains.
3. Compositionally, the Iron oxide/hydroxide grains contain TiO_2 (1-5.9%) whereas very few grains contain MnO (22.4%), PbO (12.2%), Ce_2O_3 (4.6%) in the lattice.
4. At places, very few extremely fine sized zircon grains are present as inclusion in silicate (quartz).

5. A very few K-feldspar grains compositionally contain ZrO_2 (6.4-23.1%) in the lattice.
6. Sphene grains are present as inclusion in silicate (quartz) and iron oxide/ hydroxide. Sphene grains range in size from 7 to 10 microns. Compositionally, a very few grains contain Nb_2O_5 (2.1%) in the lattice.
7. A gold grain is noticed which is ~ 25 micron in size. It is interlocked with silicate (quartz).
8. Apatite grains are present as inclusion in silicate (quartz). Apatite grains are 10 to 15 microns in size. Compositionally, it contains Ce_2O_3 (2.1%) in the lattice.
9. Compositionally, rutile grains contain Nb_2O_5 (2.1%) in the lattice. It is present as inclusion in silicate (quartz).
10. Compositionally zincian chrysocolla contains CuO (57.6%) and it is present as inclusion in silicate (quartz).

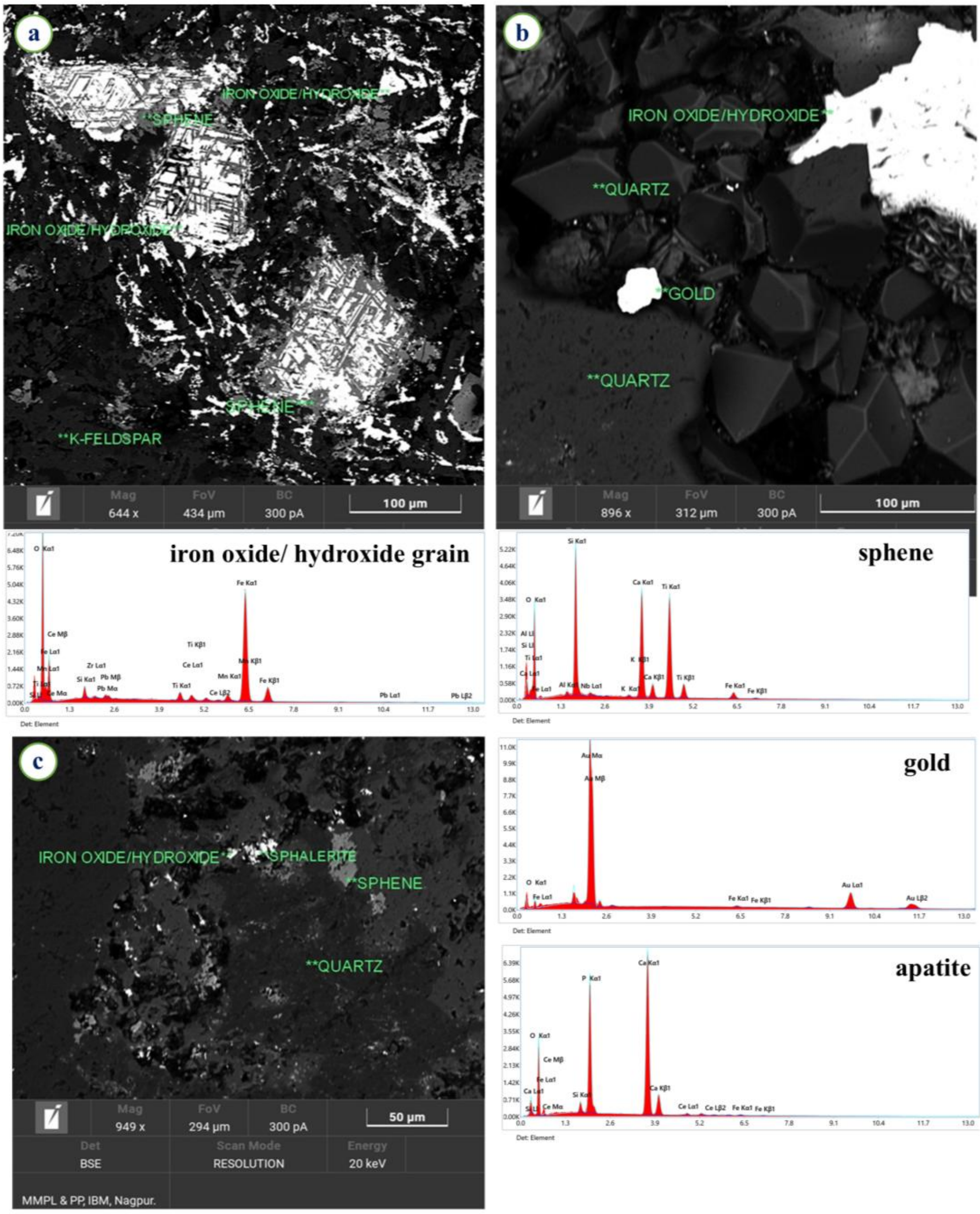

Figure 4.8. FE-SEM backscattered electron (BSE) images and corresponding EDS spectra of the representative trachyte sample showing: (a) intergrowth of iron oxide/hydroxide grains within sphene (titanite); (b) occurrence of a native gold grain (~20 µm) associated with silicate minerals; and (c) very fine-grained sphalerite and sphene (titanite) embedded within the silicate matrix.

4.5.2.4 IBM/SRC/REE/GR/(412/05)/PC/PS/04 (Pyroclastic)

<u>Megascopic Observation</u>

The sample is dark grey in colour and exhibits a grey streak. It shows alternate light and dark colour bands of 2 mm. At very few places, fine quartz grains are embedded on the sample. At some places, lapilli (>2mm) grains are observed. The sample possesses a very high specific gravity.

Figure 4.9. Hand specimen of the representative pyroclastic rock sample (Sample No. IBM/SRC/REE/GR/(412/05)/PC/PS/04) collected from the Siwana Ring Complex, Rajasthan, showing its dark grey to reddish-brown color, compact nature, and fine-grained pyroclastic texture with lithic fragments embedded within a fine-grained matrix.

<u>FE-SEM Observations</u>

Field Emission Scanning Electron Microscopic (FE-SEM) with EDS study conducted on a polished lump revealed that:

1. The sample consists of albite, K-feldspar, anorthoclase, quartz, iron oxide/hydroxide, zircon, cerite, arfvedsonite, sphene, ilmenite, allanite, coronadite, pyroxene (augite, hedenbergite), wollastonite and calcite.
2. The polished lump shows hematite is replaced by goethite. The hematite grains carry minute disseminated inclusions of silicate and vice versa which exhibits salt and pepper texture. The size of the magnetite and hematite grains ranges from 10 to 220 microns.
3. Iron oxide/ hydroxide occur as extremely fine to fine sized grain. Compositionally, few Iron oxide/ hydroxide grains contain La_2O_3 (4.5-5.9%), Ce_2O_3 (12.7-15.5%), Nd_2O_3 (7.1-12.0%) and Sm_2O_3 (10.2%) in the lattice.

4. A very few extremely fine sized cerite grains are present as inclusion in silicates (albite). Compositionally, it contains ZrO_2 (4.6%) in the lattice.
5. Compositionally, ilmenite grains contain ZrO_2 (22.7%) in the lattice and most of the grains are present as inclusion in silicates (feldspar).
6. Compositionally, sphene grains contain Nb_2O_5 (3.3%) in the lattice and is present as inclusion in silicates (quartz).
7. Compositionally, pyroxene (hedenbergite) grains contain La_2O_3 (22.6-24.2%), Ce_2O_3 (19.7-22.7%), Nd_2O_3 (16.9-18.8%) in the lattice.
8. Coronadite grains are present as inclusion in silicates (potash feldspar) and the size ranges 10 to 12 microns. Compositionally, coronadite grains contain PbO (26.4%) in the lattice.
9. Compositionally, a few zircon grains contain Ce_2O_3 (7.2-23.1%) in the lattice. Zircon grains are present as vein and as well as shows intergrowth texture on the silicate groundmass.
10. Allanite grains are noticed and are present as inclusion in silicates (quartz and K-feldspar). The size ranges from 2 to 50 microns.
11. Wollastonite grains are present as inclusion in silicates (feldspar) and the size is 1 to 2 micron.

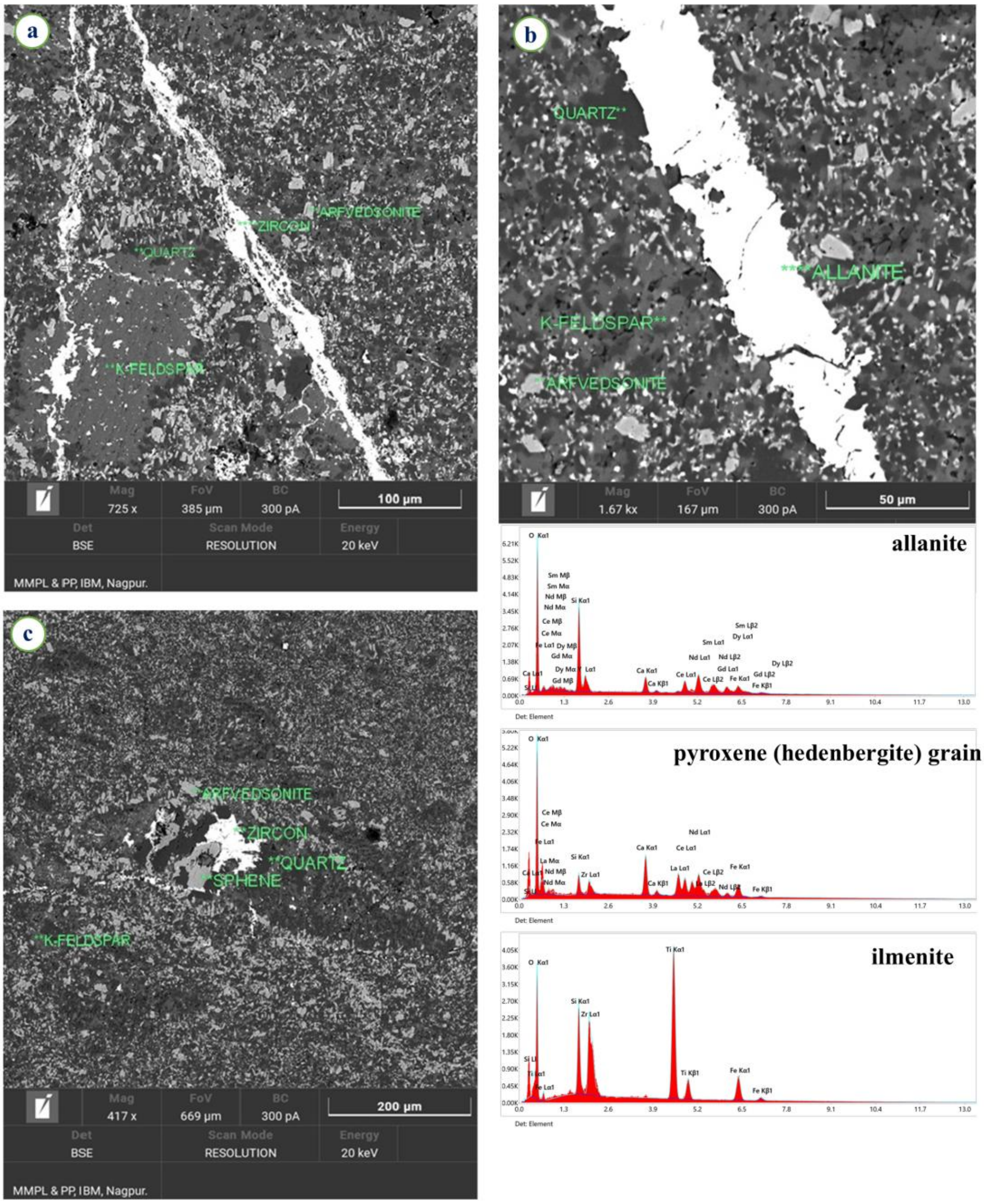

Figure 4.10. FE-SEM backscattered electron (BSE) images and corresponding EDS spectra of the representative pyroclastic rock sample showing: (a) a zircon vein traversing the silicate groundmass (quartz, K-feldspar, and arfvedsonite), along with the intergrowth of extremely fine- to medium-grained zircon within K-feldspar; (b) an elongated allanite grain occurring as a vein within the silicate groundmass (quartz, K-feldspar, and arfvedsonite); and (c) intergrowth of fine-grained zircon within the silicate groundmass, interlocked with sphene (titanite).

4.5.3 Summary of mineralogical studies of representative samples based on FE-SEM–EDS analysis

Table 4.1 below showing mineral assemblages identified by FE-SEM–EDS analysis in representative rock samples from the Siwana Ring Complex from the present study.

Table 4.2 Mineral assemblages identified by FE-SEM–EDS analysis from present study.

Sample	Rock Type	Major Mineral Assemblage	REE-bearing Minerals
IBM/SRC/REE/GR/(131/06)/RH/PS/05	Rhyolite	Quartz, albite, aegirine, hedenbergite, arfvedsonite, riebeckite, aenigmatite, iron oxide/hydroxide, zircon, sphene, apatite, sphalerite, galena, rosasite, litharge	**Cheralite**, REE-bearing hedenbergite, REE-bearing aenigmatite
IBM/SRC/REE/GR/(232/02)/GR/PS/12	Granite	Quartz, orthoclase/sanidine, albite, oligoclase, anorthoclase, aegirine, hedenbergite, hypersthene, ferrosilite, aenigmatite, zircon, sphene, rutile, iron oxide/hydroxide, sphalerite, galena	**Monazite**, **Allanite**, REE-bearing zircon, REE-bearing hedenbergite
IBM/SRC/REE/GR/(78/22)/TR/PS/07	Trachyte	Quartz, K-feldspar, albite, arfvedsonite, iron oxide/hydroxide, zircon, sphene, apatite, rutile, ilmenite, coronadite, gold, zincian chrysocolla	Ce-bearing apatite, Ce-bearing iron oxide/hydroxide
IBM/SRC/REE/GR/(412/05)/PC/PS/04	Pyroclastic Rock	Quartz, albite, K-feldspar, anorthoclase, arfvedsonite, hedenbergite, augite, zircon, sphene, allanite, cerite, ilmenite, coronadite, wollastonite, calcite, iron oxide/hydroxide	**Allanite**, **Cerite**, REE-bearing hedenbergite, REE-bearing zircon, REE-bearing iron oxide/hydroxide

5

GEOCHEMICAL RESULTS & DISCUSSION

Chapter:05 GEOCHEMICAL RESULTS & DISCUSSION

All samples considered in the present geochemical study were collected from fresh bedrock exposures from granite and masonry stone lease areas and are therefore considered representative of the primary geochemical characteristics of the host granitoids, with minimal influence of weathering or secondary alteration. The only exception is sample IBM/SRC/REE/GR/(589/02)/GR/PCS/171 from Shree Krishna Granite Mine (brown filled circle), which represents soil/alluvial cover material collected in the absence of exposed bedrock within the lease area. As this sample does not represent fresh granitoid lithology and may reflect the influence of surficial processes, it has been excluded from the bedrock dataset and is discussed separately. For interpretation purposes, the geochemical characteristics of the remaining samples are evaluated separately for granite and masonry stone leases to understand their compositional characteristics, magmatic evolution, REE behaviour, and associated critical mineral potential.

Before proceeding with the geochemical evaluation, it is essential to assess the degree of weathering to determine whether the observed major element and REE concentrations reflect primary magmatic characteristics or have been modified by secondary processes.

The Al_2O_3–(CaO+Na_2O)–K_2O (molar proportions) ternary diagram of Nesbitt and Young (1984, 1989) and the F–M–W diagram of Ohta and Arai (2007), shown in Fig. 5.1(a) and (b), respectively, indicate that both granite and masonry stone samples cluster close to the average granite composition and predominantly plot within the granite–rhyolite fields. The absence of significant displacement toward the weathering and alteration vectors suggests that the granitoids have undergone only limited chemical weathering and post-magmatic alteration. The tight clustering of samples further indicates the preservation of their primary feldspar-rich mineralogical composition and original magmatic geochemical signatures. Accordingly, the observed REE abundances and fractionation patterns are interpreted to be largely controlled by magmatic processes and accessory mineral assemblages rather than by secondary weathering or alteration.

Furthermore, bulk geochemical analyses show that, with the exception of a few samples, Loss on Ignition (LOI) values are generally low (<2 wt.% for most samples), indicating minimal weathering and alteration. This inference is consistent with the weathering indices discussed above. Therefore, the observed REE and critical element distributions are considered to primarily reflect magmatic processes and accessory mineral controls, with little influence from secondary enrichment associated with hydrothermal alteration or weathering.

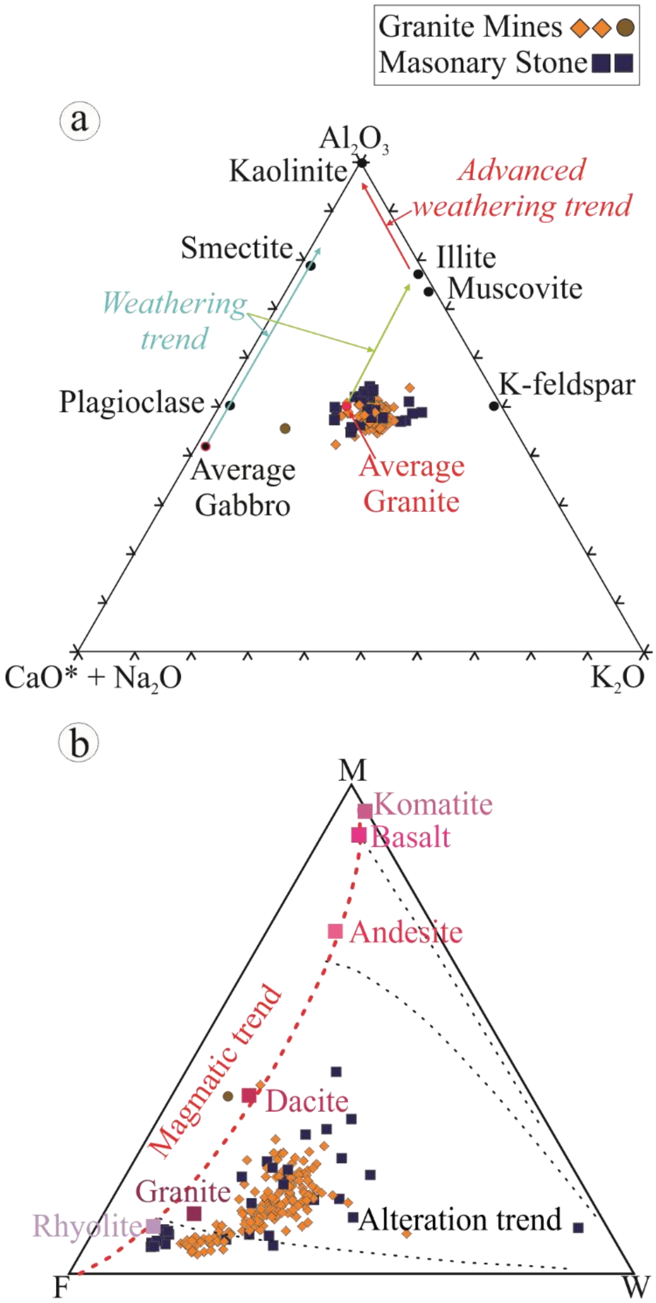

Fig. 5.1. Weathering trend diagrams (a) Al_2O_3-CaO+Na_2O-K_2O (molar prop) ternary diagram of Nesbitt and Young (1984,1989) and (b) F-M-W diagram of Ohta and Arai (2007) for chemical weathering in rocks.

5.1 Major Oxide Geochemistry

Granite Lease Samples

The granite lease samples are characterized by high SiO_2 contents, generally ranging from 58.01 to 71.60 wt.%, with the majority of samples containing between 65 and 69 wt.% SiO_2, indicating a predominantly felsic composition. Al_2O_3 contents vary from 8.43 to 12.95 wt.% and reflect the abundance of feldspar minerals within the granitoids. The samples exhibit moderate Fe_2O_3 concentrations, mostly between 7 and 11 wt.%, while TiO_2 contents remain low (<1 wt.%). The granitoids are enriched in alkali oxides, with Na_2O and K_2O generally ranging from 3.3–5.3 wt.% and 5.0–7.2 wt.%, respectively, indicating the dominance of feldspar-rich mineral assemblages and the evolved nature of the granitic magma. CaO and MgO concentrations are generally low, typically below 1 wt.%, suggesting limited contributions from mafic minerals and advanced magmatic differentiation. Overall, the major oxide composition suggests that the granite lease samples represent evolved, potassium-rich felsic granitoids.

Masonry Stone Lease Samples

The masonry stone lease samples display comparatively greater geochemical variability than the granite lease samples. SiO_2 contents range from 57.05 to 70.83 wt.%, indicating the presence of both highly evolved felsic varieties and comparatively less evolved granitoid phases. Al_2O_3 concentrations vary between 8.14 and 12.97 wt.%, reflecting variations in feldspar abundance and mineralogical composition. Fe_2O_3 contents show a wide range (3.73–15.63 wt.%), suggesting the occurrence of both low-Fe felsic granitoids and relatively Fe-rich lithological variants. The samples are generally enriched in alkali oxides, with combined Na_2O and K_2O contents commonly exceeding 8 wt.%, confirming their granitoid affinity. CaO and MgO concentrations remain low in most samples, although a few samples exhibit relatively elevated values, indicating localized variations in mineral composition. The observed geochemical variability indicates that the masonry stone leases encompass granitoids of differing compositions and degrees of magmatic evolution.

5.2 Geochemical Classification

In the Total Alkali Silica Diagram (Fig. 5.2a) of Le Bas et al., (1986) shows that the majority of the granite and masonry stone samples plot within the granite field, confirming their felsic character. A few samples extend towards the granodiorite and syenite fields, indicating minor compositional variation within the granitoid suite. Most samples occur above the alkaline-subalkaline boundary and exhibit elevated total alkali contents, suggesting an alkali-rich nature. The clustering of samples within the granite field indicates that the studied rocks predominantly represent evolved felsic granitoids derived from differentiated magmas.

On the R1–R2 diagram Multicationic classification plot (Fig. 5.2b) of De La Roche et al. (1980), the majority of the samples plot within the granite field, with a few samples extending into the granodiorite, quartz monzonite, and syenite fields. The clustering of most samples in the granite field corroborates the TAS classification and confirms the predominance of felsic granitoids within the study area. The limited spread towards adjacent fields reflects minor variations in mineralogical composition and degrees of magmatic differentiation. The overall distribution suggests that both granite and masonry stone leases are dominated by evolved granitoid lithologies which is favourable for the concentration of incompatible elements, including REEs and associated critical minerals, during magmatic differentiation.

5.3 Geochemical Characterizations

In the AFM diagram (Fig. 5.3a), Alkali ($A = Na_2O + K_2O$), total iron ($F = FeO_t$), and Magnesium ($M = MgO$) of Irvine and Baragar (1971) indicates that both granite and masonry stone samples predominantly follow the calc-alkaline trend and plot well away from the tholeiitic field. This suggests that the granitoids were derived from calc-alkaline magmatic suites, which are typically associated with continental crustal environments and evolved felsic magmatism. The close clustering of granite and masonry stone samples indicates a broadly similar magmatic affinity for both groups.

In the molar Na_2O: Al_2O_3: K_2O plot (Fig. 5.3b), the majority of the samples occupy the metaluminous to weakly peraluminous fields, with a tendency towards potassic compositions. Such characteristics indicate that the granitoids are rich in alkali feldspars and are typical of evolved granitic magmas.

(a)

(b)

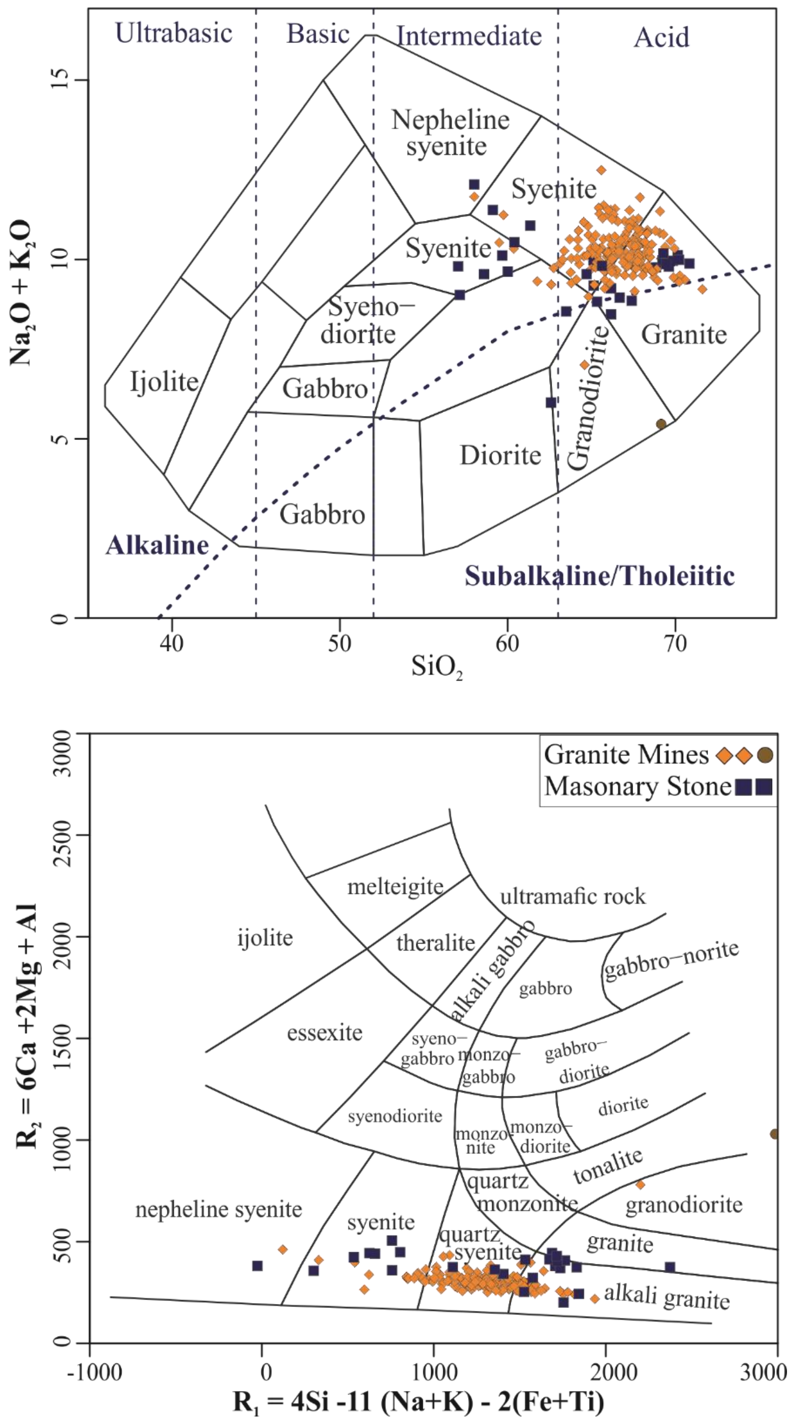

Fig. 5.2. Geo classification nomenclature diagram (a) Total Alkali Silica diagram of Le Bas et al. (1986), dividing line between alkaline and subalkaline series is that of Irvine & Baragar (1971) (b) Mult cationic classification plot of De La Roche et al. (1980).

The A/CNK vs A/NK plot of Shand (1943) (Fig. 5.3c), further confirms that most samples are metaluminous to weakly peraluminous in nature. Only a few samples approach the peraluminous field, while none display strongly peraluminous characteristics. The absence of strongly peraluminous compositions suggests limited contributions from highly aluminous crustal sources and indicates that the granitoids are dominated by feldspar-rich mineral assemblages.

In the K_2O - SiO_2 diagram (Fig. 5.3d) of Peccerillo & Taylor (1976) the majority of the samples plot within the high-K calc-alkaline and shoshonitic fields. Such high potassium enrichment is characteristic of evolved granitoids and reflects advanced magmatic differentiation.

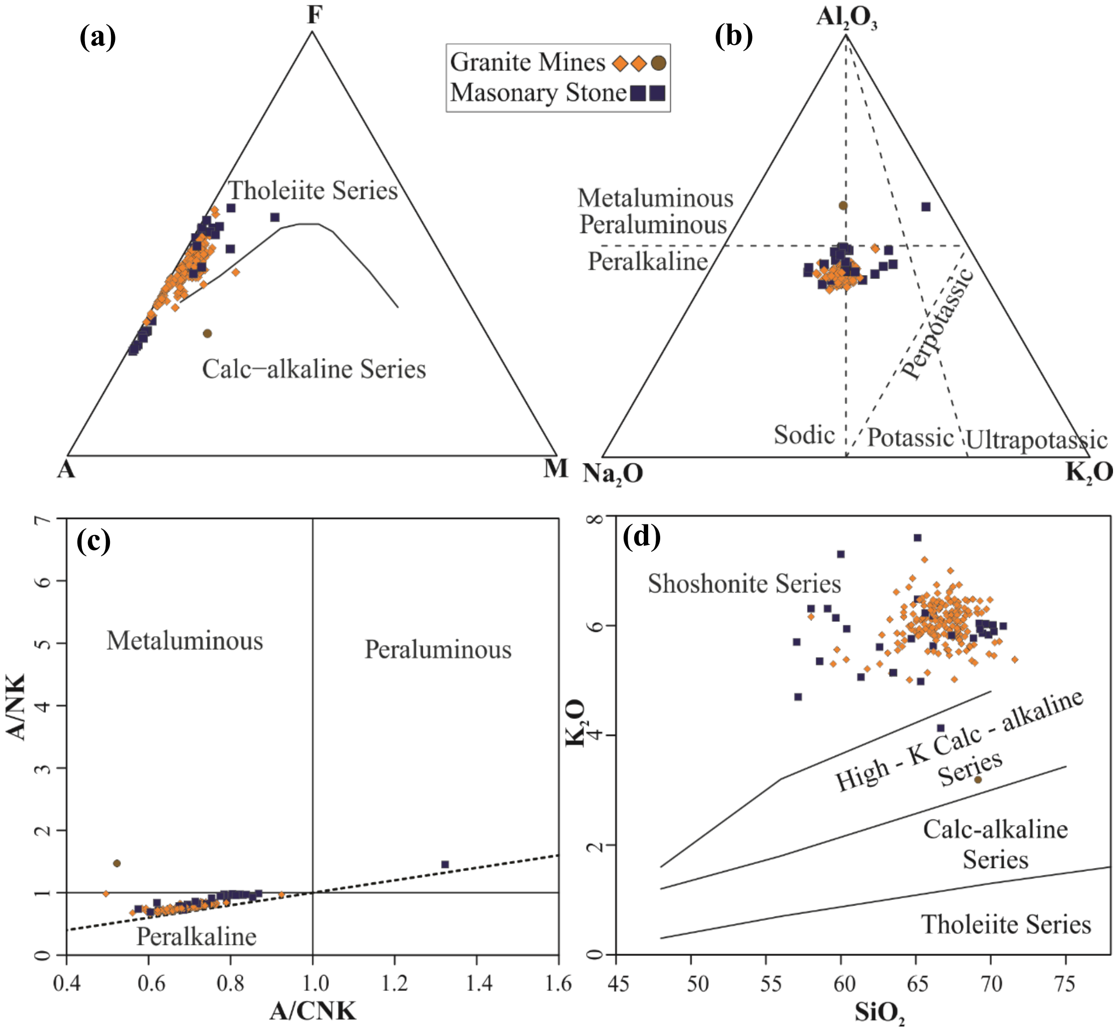

Fig. 5.3. Geochemical magma characterizations diagram (a) AFM plot that serves to discriminate between calc-alkaline and tholeiitic subalkaline series (Irvine & Baragar, 1971) (b) Molar Na_2O: Al_2O_3: K_2O plot (c) A/CNK - A/NK (Shand, 1943) (d) SiO_2 - K_2O (Peccerillo & Taylor 1976).

Further, the major element-based classification of granitoids in Fig. 5.4a-d proposed by Frost and Frost (2008) indicates that the studied granite and masonry stone samples are predominantly ferroan, alkalic, metaluminous, and silica-saturated in nature. The dominance of ferroan compositions suggests iron enrichment during magmatic differentiation and is characteristic of evolved felsic magmatic systems.

Similarly, the predominance of alkalic compositions reflects advanced fractional crystallization and the progressive enrichment of incompatible elements within the residual melt. The low alumina saturation indices indicate that the granitoids are largely metaluminous, while their silica-saturated character further confirms their evolved felsic affinity. Collectively, these geochemical characteristics are indicative of highly differentiated granitoids and are consistent with favourable conditions for the concentration of REEs and associated critical elements such as Y, Nb, Ta, Zr, Hf, Th, and U during the late stages of magmatic evolution.

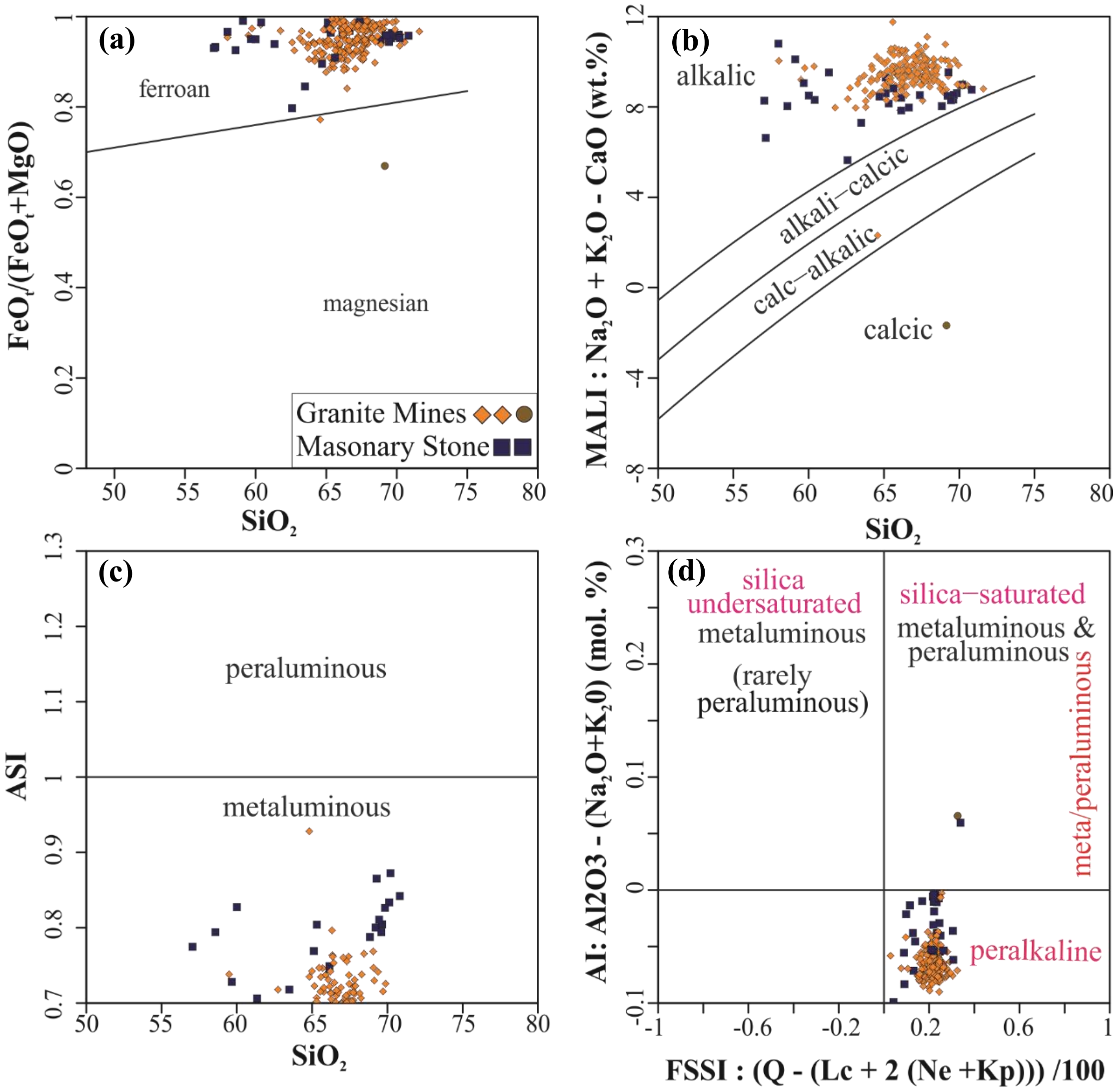

Fig. 5.4. Major-element based classification of granitoids (Frost & Frost 2008). Legends are same as in fig. 5.3.

5.4 Tectonic discriminations diagram

In Fig. 5.5, the tectonic setting of the studied samples was evaluated using the Rb–(Y+Nb), Nb–Y, Rb–(Ta+Yb), and Ta–Yb discrimination diagrams of Pearce et al.

(1984). The majority of both granite and masonry stone samples consistently plot within the Within-Plate Granite (WPG) field, with a few samples occurring near the boundary between the WPG and Ocean Ridge Granite (ORG) fields. This suggests that the granitoids were emplaced in an intraplate extensional tectonic environment. The enrichment of high-field-strength elements such as Nb, Ta, Y, Yb, Zr, and Hf, together with the predominance of WPG signatures, indicates highly evolved felsic magmas that underwent substantial fractional crystallization.

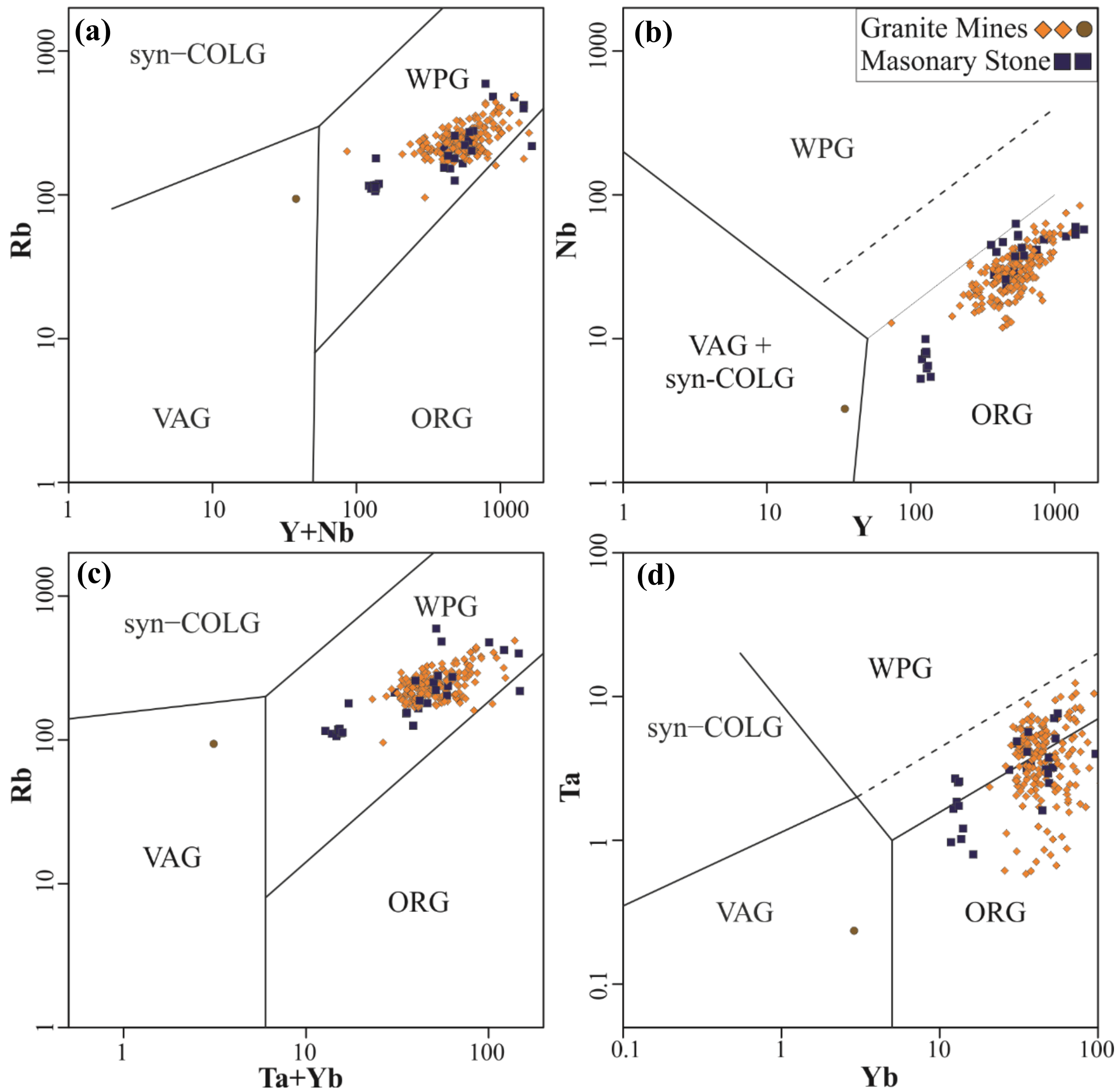

Fig. 5.5. Trace-element based geotectonic classification of granitoids by Pearce et al. (1984). Legends are same as in fig. 5.3.

Further, in the binary plots in Fig. 5.6 to distinguish A-type granitoid rocks after Whalen et al. (1987) based on 10000Ga/Al ratios and associated trace element parameters indicate that the majority of both granite and masonry stone samples plot within the A-type granite field. The samples exhibit elevated concentrations of Ga, Zr, Nb, Y, Ce, and Zn together with high FeO_t/MgO and $(Na_2O+K_2O)/CaO$ ratios, which are characteristic geochemical features of A-type granitoids.

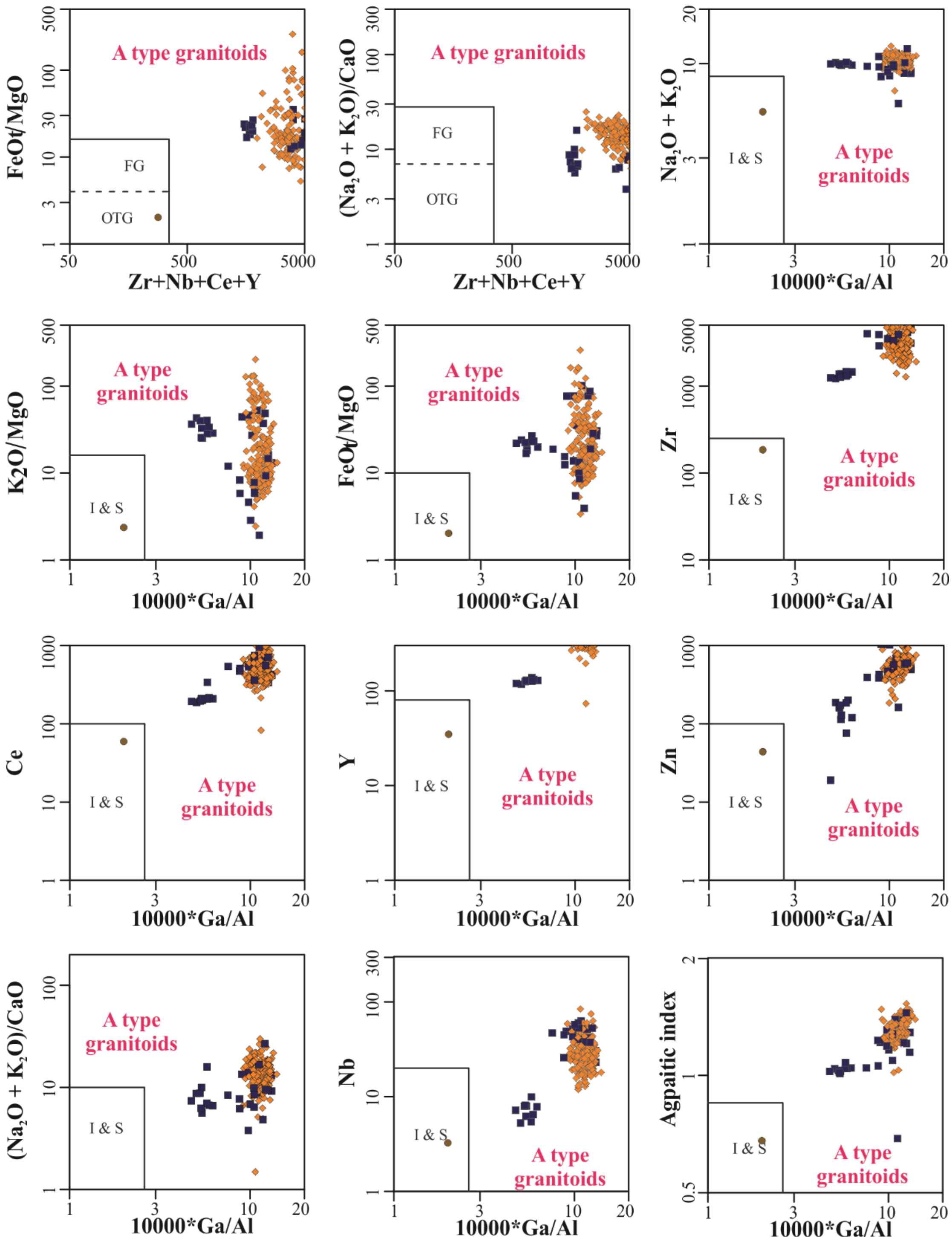

Fig. 5.6. Binary plots serving for distinction of A-type granitoid rocks after Whalen *et al.* (1987). Legends are same as in fig. 5.3.

5.5 REE element Geochemistry

Elements of the lanthanide series (La–Lu), together with scandium (Sc) and yttrium (Y), are collectively known as Rare Earth Elements (REEs). As per the IUPAC classification, REEs are broadly subdivided into Light Rare Earth Elements (LREEs), comprising Lanthanum (La), Cerium (Ce), Praseodymium (Pr), Neodymium (Nd), and Samarium (Sm), and Heavy Rare Earth Elements (HREEs), comprising Europium (Eu), Gadolinium (Gd), Terbium (Tb), Dysprosium (Dy), Holmium (Ho), Erbium (Er), Thulium (Tm), Ytterbium (Yb), and Lutetium (Lu). Yttrium (Y ~ HREEs) and scandium (Sc) are not rare earths; however, their physicochemical properties are very similar to those of rare earths, therefore they are included in this group. Moreover, promethium (Pm), one of the lanthanide elements, possesses a very short half-life and is therefore exceptionally rare in nature.

The descriptive statistics of the rare earth elements (REEs), including minimum, maximum, mean, median, standard deviation, and threshold values calculated using the Median + 2MAD approach, are presented in Table 5.1 and 5.2. The calculated threshold values (Median + 2MAD) delineate anomalous concentrations and help identify geochemically enriched samples. The descriptive statistics of REEs indicate significant enrichment of both light rare earth elements (LREEs) and heavy rare earth elements (HREEs) in the studied samples relative to average crustal abundances.

Granite lease samples exhibit TREE concentrations ranging from 360 to 6263 ppm, with an average value of 2127 ppm, whereas masonry stone lease samples contain TREE values ranging from 639 to 5558 ppm, averaging 2051 ppm. The REE distribution is dominated by LREEs.

Threshold values calculated using the Median + 2MAD approach indicate anomalous concentrations of REEs and associated elements within the granitoids. For granite lease samples, the TREE threshold is 2806 ppm, whereas for masonry stone lease samples it is 3625 ppm. Samples exceeding these thresholds may represent zones of enhanced REE concentration. The consistently high enrichment factors, elevated TREE contents, and strong concentration of both LREEs and HREEs collectively indicate that the studied samples possess significant REE fertility and favourable characteristics for associated critical mineral enrichment.

Compared to average crustal abundances, the granitoids show marked enrichment in nearly all REEs. Among the granite lease samples, enrichment factors range from 7 times for Eu to 36 times for Y and Tm, while Dy, Ho, Er, and Yb exhibit enrichment factors exceeding 30 times crustal values. Similarly, masonry stone lease samples display enrichment factors ranging from 11 times for Eu to 50 times for Y, with Dy, Ho, Er, Tm, and Yb showing enrichment of more than 35 times relative to average crustal abundances. The pronounced enrichment of Y together with elevated HREE concentrations suggests an important contribution from HREE-bearing accessory minerals such as xenotime and zircon.

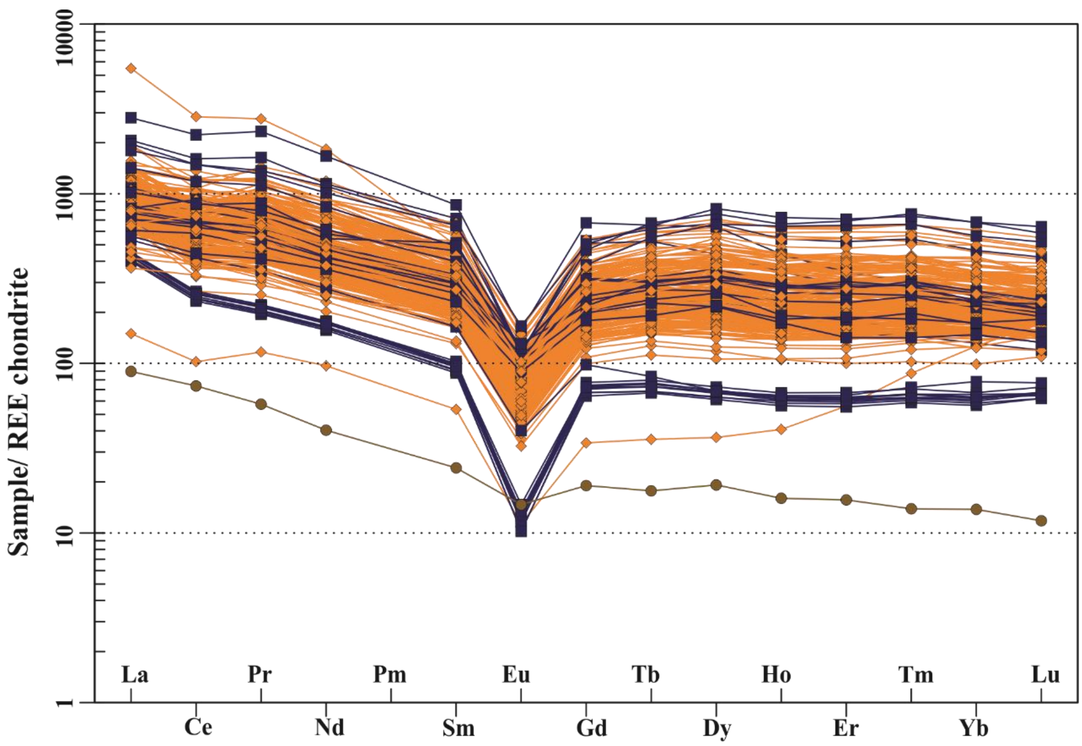

Fig. 5.7. REE chondrite normalized (Nakamura, 1974) showing LREE enrichment in Siwana quarry samples. Legends are same as in fig. 5.3.

Further the chondrite-normalized REE patterns (Figure 5.7) of the studied sample are characterized by strong enrichment of light rare earth elements (LREEs) relative to heavy rare earth elements (HREEs) and display broadly sub-parallel trends, indicating a common magmatic affinity and similar evolutionary history. The pronounced enrichment of La, Ce, Pr, Nd, and Sm reflect the incompatible behaviour of REEs during magmatic differentiation and their progressive concentration within the residual melt. A prominent negative Eu anomaly is observed in nearly all samples, indicating extensive feldspar fractionation, particularly the removal of plagioclase during crystallization. The HREE segment (Gd–Lu) exhibits relatively flat patterns with moderate enrichment, suggesting limited HREE fractionation. The overall REE patterns are characteristic of highly evolved, fractionated granitoids and support the interpretation that the studied rocks represent REE-enriched A-type granitic systems.

5.6 Other critical trace and rare elements

The descriptive statistics of critical and rare metals indicate substantial enrichment of several high-field-strength elements (HFSEs) and associated critical minerals within both granite and masonry stone lease samples as shown in table 5.3 and 5.4. Relative to average crustal abundances, the samples exhibit marked enrichment in Zr, Hf, W, Be, Zn, Nb, Ta, Th, and Ga. Among the granite lease samples, the highest enrichment factors are observed for Zr, Hf, W and Be whereas the masonry stone lease samples show even greater enrichment compared to average crustal values.

In granite mine samples, among the analysed elements, Zr exhibits the highest enrichment factor (24x), with concentrations ranging from 1,277 to 19,100 ppm and a mean value of 3,927 ppm. This is followed by Hf (20x), suggesting a strong association of high-field-strength elements (HFSEs) with the evolved granitic lithologies of the Siwana Ring Complex. Appreciable enrichment is also observed for Be (15x), Zn (11x), Th (8x), and Pb (6x).

In masonry stone quarry samples, Zr also exhibits the highest enrichment factor (43x), with concentrations ranging from 1,222 to 16,400 ppm and a mean value of 4,671 ppm. This is followed by Hf (32x) and W (24x). Appreciable enrichment is also observed for Be (21x) and Zn (14x).

The mean concentrations of Th are higher than its average crustal abundance in both granite and masonry stone quarry samples, suggesting the presence of accessory minerals capable of hosting thorium and other associated critical elements.

The threshold values, calculated using the Median + 2MAD method, identify anomalous concentrations. Several samples exceed these thresholds, indicating localized zones of enrichment that demands further mineralogical and geochemical investigation.

Table 5.1 Descriptive statistics and Threshold of Rare earth elements of Granite mines sample (values are in ppm)

Rare Earth elements		**La**	**Ce**	**Pr**	**Nd**	**Sm**	**Eu**	**Gd**	**Tb**	**Dy**	**Ho**	**Er**	**Tm**	**Yb**	**Lu**	**Sc**	**Y**	**TREE**	**LREE**	**HREE**
Crustal abundance		31	63	7	27	5	1	4	1	4	1	2	0	2	0	14	21	183	63	15
Outcrop sample	Range	46-1700	83-2300	14-337	58-1100	10-131	1-12	9-139	2-30	12-228	3-46	12-134	3-21	21-127	4-18	0-13	73-1500	360-6263	212-5534	73-750
	Mean	302	525	82	295	59	5	61	13	90	18	52	8	49	7	3	557	2127	1262	305
	MAD	59	102	22	60	13	1	13	3	22	4	12	2	10	1	1	122	414	243	67
	Median	285	486	78	260	55	5	57	12	81	17	47	7	44	7	3	520	1978	1175	279
	Threshold	403	689	122	380	80	7	84	18	124	25	72	11	63	9	5	765	2806	1660	412
	Enrichment	**13**	**11**	**17**	**14**	**17**	**7**	**21**	**25**	**32**	**31**	**31**	**36**	**32**	**29**	**0**	**36**	**15**	**26**	**27**
Soil Sample Conc.		28	59	7	24	5	1	5	1	6	1	3	0	3	0	7	35	186	123	21

Crustal abundance values are after Roberta L. Rudnick and Sally Gao (2003).

Table 5.2 Descriptive statistics and Threshold of Rare earth elements of Masonary Stone quarry (values are in ppm)

Rare Earth elements	**La**	**Ce**	**Pr**	**Nd**	**Sm**	**Eu**	**Gd**	**Tb**	**Dy**	**Ho**	**Er**	**Tm**	**Yb**	**Lu**	**Sc**	**Y**	**TREE**	**LREE**	**HREE**
Crustal abundance	31	63	7	27	5	1	4	1	4	1	2	0	2	0	14	21	183	63	15
Range	124-869	188-1800	24-284	94-1000	17-168	1-12	17-175	3-32	20-263	4-52	12-149	2-25	12-142	2-21	1-13	117-1600	639-5558	447-4120	72-824
Mean	272	551	77	286	59	6	61	13	90	17	49	8	44	6	4	509	2051	1245	293
MAD	88	241	35	121	30	2	31	7	51	10	25	4	19	2	1	306	967	512	161
Median	228	451	64	232	50	6	54	11	74	14	40	6	36	5	4	446	1691	1015	251
Threshold	403	933	134	474	110	11	116	26	177	33	89	14	74	10	6	1058	3625	2039	574
Enrichment	**13**	**15**	**19**	**18**	**23**	**11**	**29**	**37**	**45**	**40**	**39**	**45**	**37**	**32**	**0**	**50**	**19**	**16**	**27**

Crustal abundance values are after Roberta L. Rudnick and Sally Gao (2003).

Table 5.3 Descriptive statistics and Threshold of other critical and rare metals of Granite mines sample (values are in ppm)

		Zn	Ga	Pb	Be	Ge	Rb	Sn	Hf	Ta	Th	U	Nb	Ta	W	Zr
Crustal abundance		**67**	**18**	**17**	**2**	**1**	**84**	**2**	**5**	**1**	**11**	**3**	**12**	**1**	**2**	**193**
Outcrop sample	Range	185-1010	41-77	11-319	10-52	2-12	96-490	0-8	27-482	1-12	3-152	1-19	12-84	1-12	1-164	1277-19100
	Mean	580	61	75	25	4	246	1	88	4	53	6	31	4	44	3927
	MAD	79	3	19	4	1	32	0	17	1	16	1	7	1	11	792
	Median	579	61	69	24	4	235	1	70	4	50	5	27	4	13	3110
	Thresh old	737	67	106	32	6	299	1	104	7	81	8	40	7	36	4694
	Enrich ment	**11**	**4**	**6**	**15**	**4**	**4**	**1**	**20**	**8**	**8**	**3**	**3**	**8**	**19**	**24**
Soil Sample Conc.		44	11	32	3	1	94	0	4	0	7	1	3	0	92	185

Table 5.4 Descriptive statistics and Threshold of other critical and raretals of Masonary Stone quarry (values are in ppm)

	Zn	Ga	Pb	Be	Ge	Rb	Sn	Hf	Ta	Th	U	Nb	Ta	W	Zr
Crustal abundance	**67**	**18**	**17**	**2**	**1**	**84**	**2**	**5**	**1**	**11**	**3**	**12**	**1**	**2**	**193**
Range	19_1053	32_75	8_148	2-73	2-10	106-594	0-4	27-333	1-8	12-77	1-17	5-63	1-8	4-223	1222-16400
Mean	448	51	50	20	4	223	2	100	3	30	5	31	3	44	4671
MAD	235	13	20	14	2	67	1	47	1	4	1	18	1	12	2325
Median	458	53	37	17	4	184	1	77	3	21	3	34	3	20	3700
Threshold	928	79	77	45	7	319	4	170	6	30	5	70	6	45	8350
Enrichment	**14**	**4**	**5**	**21**	**5**	**4**	**2**	**32**	**7**	**3**	**2**	**6**	**7**	**24**	**43**

Crustal abundance values are after Roberta L. Rudnick and Sally Gao (2003).

The primitive mantle-normalized multi-element patterns of the granite and masonry stone samples (Fig. 5.8) are characterized by pronounced enrichment of incompatible elements, including Rb, Th, U, K, REEs, Y, Zr, and Hf, relative to primitive mantle values. The overall patterns exhibit broadly parallel trends, indicating a common magmatic affinity and similar evolutionary history for the studied sample. Distinct negative anomalies of Ba and Sr are observed in nearly all samples, reflecting extensive feldspar fractionation during magmatic differentiation. The pronounced depletion of Sr, together with the negative Eu anomalies observed in the REE patterns, indicates significant plagioclase fractionation, whereas the negative Ba anomaly suggests the fractionation of K-feldspar. Most samples also display negative Ti anomalies, indicating the removal of Ti-bearing phases such as ilmenite, titanite, and Fe-Ti oxides during crystallization. Elevated concentrations of REEs, Y, Zr, and Hf further demonstrate enrichment of incompatible and high-field-strength elements within the residual melt.

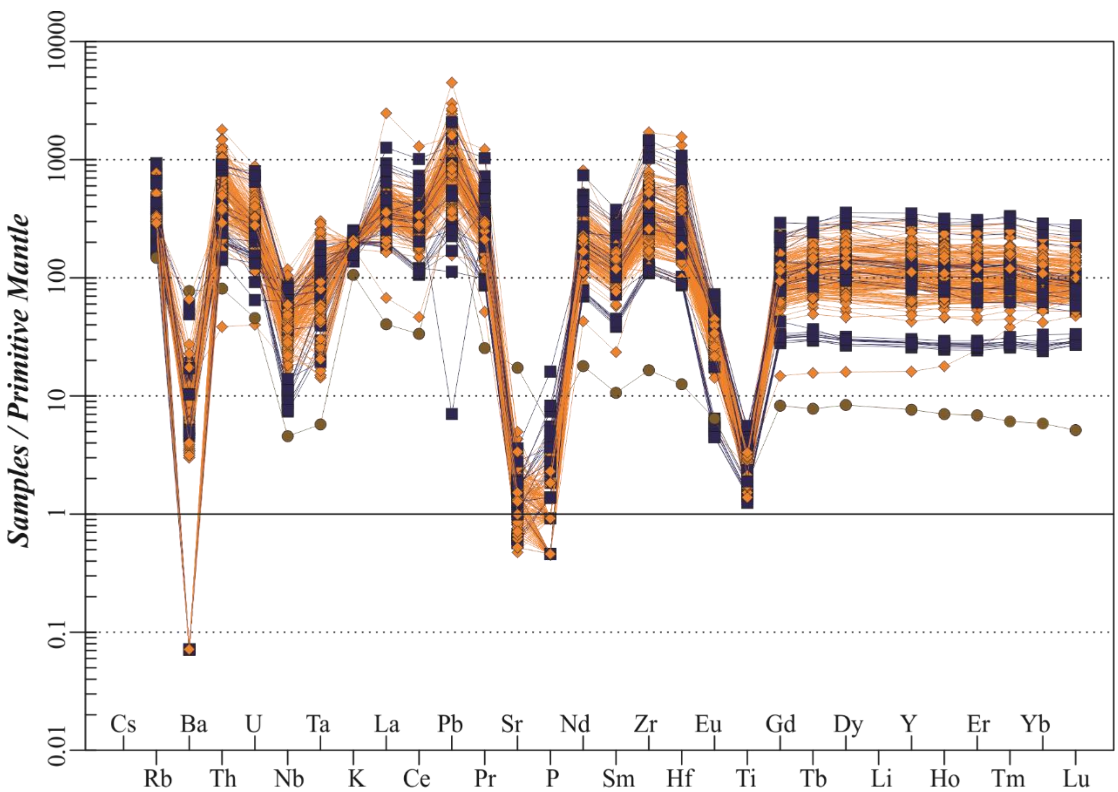

Fig. 5.8. Primitive mantle normalized diagram (after McDonough and Sun, 1995). Legends are same as in fig. 5.3.

Collectively, these geochemical characteristics are typical of highly evolved, fractionated A-type granitoids and indicate favourable conditions for the concentration of REEs and associated critical elements during the late stages of magmatic evolution.

5.7 Discussion

Peralkaline felsic rocks like Siwana granites, have been recognized as important hosts for REEs and associated rare metals. These granitoids as evident from the present studies are developed in continental anorogenic settings associated with extensional tectonics and rifting (Bailey, 1964) corresponding to A-type granites (Collins et al., 1982) and Within-Plate Granites (WPG) of Pearce et al. (1984). The studied granitoids exhibit many of the geochemical characteristics commonly associated with evolved granite suites, including enrichment of REEs, Y, Zr, Hf, Nb, Ta, Th, U, W, and Ga, together with pronounced depletion of Ba and Sr resulting from extensive feldspar fractionation. Similar enrichments of Zr, Hf, Nb, Ta, Y, Th, and U have been reported from peralkaline granites worldwide (Harris and Marriner, 1980; Dostal, 2016).

The chondrite-normalized REE patterns are characterized by pronounced LREE enrichment and distinct negative Eu anomalies, reflecting advanced magmatic differentiation and feldspar fractionation. Enrichment of middle and heavy REEs, particularly Sm, Gd, Tb, Dy, and Y, is a characteristic feature of evolved alkaline to peralkaline granitoids (Bowden and Whitley, 1974). The alkali-rich nature of such magmas enhances the solubility and mobility of REEs and high-field-strength elements (HFSEs) through increased volatile activity within the melt (Kogarko, 1990; Gysi and Williams-Jones, 2013), thereby promoting their concentration during the late stages of magmatic evolution.

The enrichment of REEs and associated critical elements within the studied samples is likely controlled by REE bearing minerals such as monazite, allanite, apatite, and zircon, which act as the principal repositories of REEs, Y, Th, U, Zr, and Hf in evolved felsic magmatic systems. The elevated concentrations of these elements, together with the A-type and within-plate affinities of the granitoids, indicate favourable conditions for REE-HFSE mineralization and highlight the potential of the Siwana granites.

5.7.1. Previous investigations in Siwana Ring Complex for REE

The REE concentrations obtained during the present investigation are broadly consistent with those reported from previous studies carried out within the Siwana Ring Complex (Table 5.5). Earlier investigations by GSI and various researchers have documented significant REE enrichment in granites, rhyolites, felsic pyroclastics, and microgranite dykes, with reported concentrations ranging from a few hundred ppm to more than 1 wt.% REE. The present study yielded TREE+Sc+Y values ranging from 360 to 6263 ppm, corresponding to a maximum grade of approximately 0.63 wt.% TREE+Y. These values fall within the range reported from Mawri, Chhappan-ka-Pahar, Kalaur Ka Danta, and other REE-bearing prospects of the Siwana Ring Complex.

Table 5.5. Summary of REE Concentrations Reported from Previous investigations in the Siwana Ring Complex

S. No.	Study	Reported REE Concentration
1	Final Report on Preliminary Exploration for REE and Associated Mineralization in SE of Mawri, Barmer, Rajasthan (G3), GSI, 2024	1121.76–7168.49 ppm (TREE+Y)
2	Preliminary Exploration for REE and Associated Mineralization in Southeast of Gugrot, Barmer District, Rajasthan (G3), GSI, 2024	164 ppm–0.15% (TREE+Y)
3	Final Report on Reconnaissance Survey for REE and Associated Mineralization around Indrana–Siwana Area, Central Part of SRC (G4), GSI, 2022	Up to 0.15% (TREE+Y)
4	Reconnaissance Survey for REE Mineralization in and around Chhappan-ka-Pahar, SRC, Barmer District, Rajasthan (G4), GSI, 2020	196 ppm–0.65% (TREE+Y)
5	Preliminary Exploration for REE and Associated Mineralization in Kalaur Ka Danta, Barmer District, Rajasthan (G3), GSI, 2024	511 ppm–1.00% (TREE+Y)
6	Kumar et al. (2024): REE and Y enrichment in peralkaline felsic rocks of the Siwana region	1061.22–9088.62 ppm (TREE+Y)
7	Banerjee et al. (2021) : REE and Nb mineralization in felsic pyroclastics of SRC	Up to 0.629% REE
8	Singh et al. (2023): REE-Y-Nb-Zr mineralization associated with microgranite dykes	Average REE: 1.06% (Nal), 0.58% (Phulan), 0.55% (Bhatikhera)
9	**Present Sampling Study of Granite & Masonary Stone Leases in Siwana Ring Complex by Indian Bureau of Mines (2026)**	360–6263 ppm (TREE+Sc+Y); TREE+Y; Average ≈ 0.21% TREE+Y

5.7.2. Spatial distribution map of TREE and other critical elements within Siwana Ring Complex

As the present study covers nearly the entire exposed extent of the Siwana Ring Complex through a network of granite and masonry stone quarry clusters , spatial distribution maps were prepared for the most significant and promising elements, particularly TREE+Y, LREE, HREE, Y, Zr, Hf, and Th (Figures 5.9–5.15) to evaluate the spatial variations in elemental concentrations across the complex and to identify zones of relative enrichment. The cluster-wise average concentrations superimposed on the maps provide an overview of regional geochemical trends, while the proportional bubble sizes facilitate visualization of localized enrichment patterns.

The granite quarry leases exhibit significant spatial variation in TREE+Y and associated critical element concentrations across the identified clusters. Cluster (A), encompassing the Deora–Fulan–Rakhi–Maili–Balu region and representing the largest concentration of granite quarries, records an average TREE concentration of 2,073 ppm and Y concentration of 533 ppm. Cluster (B), located in the Indrana–Nalgoda–Siner area, shows the highest average TREE concentration (2,537 ppm) and Y content (697 ppm), accompanied by elevated HREE (408 ppm), LREE (1,429 ppm), Th (56 ppm), Hf (121 ppm), and Zr (5,341 ppm) concentrations. Cluster (C) in the Mokalsar area records intermediate TREE concentrations (2,268 ppm) but exhibits the highest average Zr content (6,000 ppm) among the granite clusters. In contrast, Cluster (D) near Sela village shows comparatively lower concentrations of TREE (1,507 ppm), Y (433 ppm), Th (18 ppm), Hf (75 ppm), and Zr (3,875 ppm).

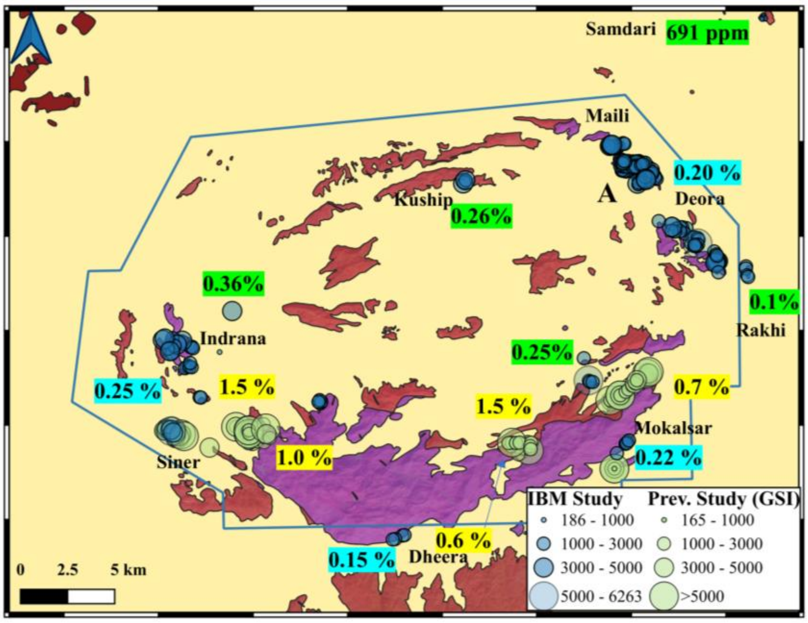

Figure 5.9. Spatial distribution of TREE+Y concentrations within the Siwana Ring Complex, showing a comparison between the present IBM study and previous GSI investigations (see Table 6.1). Bubble sizes are proportional to TREE+Y concentrations (ppm). The values shown in blue and green represent the average TREE+Y contents of the granite and masonry stone quarry clusters, respectively, as delineated in Figure 3.3. The yellow values indicate the maximum TREE+Y contents (%) reported from previous GSI investigations. Legend same as in Figure 3.3.

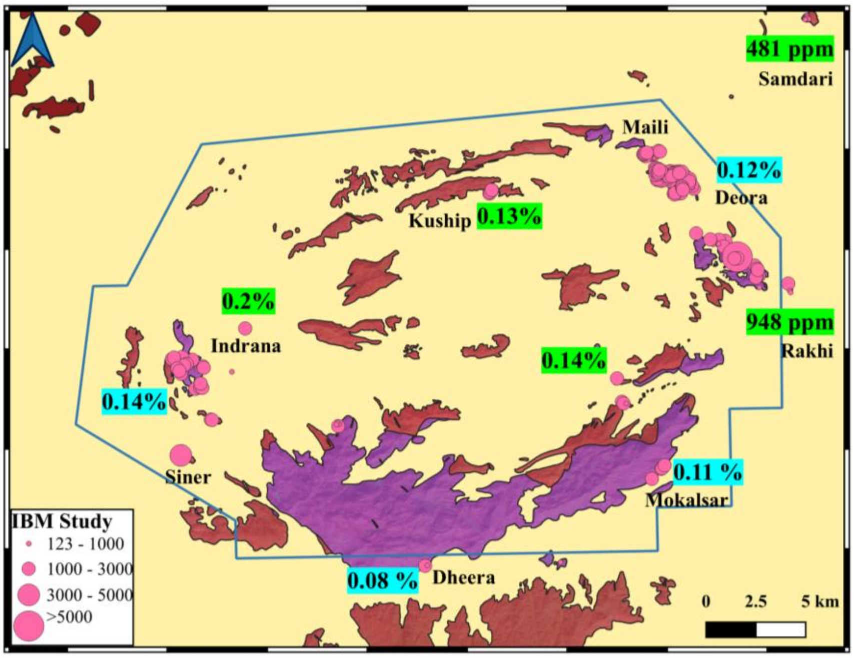

Figure 5.10. Spatial distribution of LREE concentrations within the Siwana Ring Complex. Bubble sizes are proportional to LREE concentrations (ppm). The values shown in blue and green represent the average LREE contents of the granite and masonry stone quarry clusters, respectively, as delineated in Figure 3.3. Legend same as in Figure 3.3.

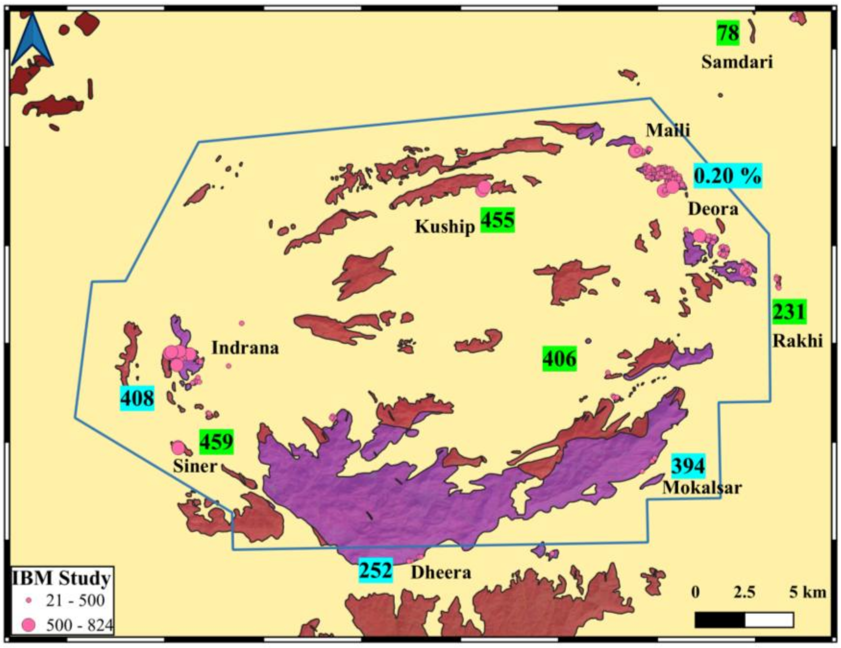

Figure 5.11. Spatial distribution of HREE concentrations within the Siwana Ring Complex. Bubble sizes are proportional to HREE concentrations (ppm). The values shown in blue and green represent the average HREE contents of the granite and masonry stone quarry clusters, respectively, as delineated in Figure 3.3. Legend same as in Figure 3.3.

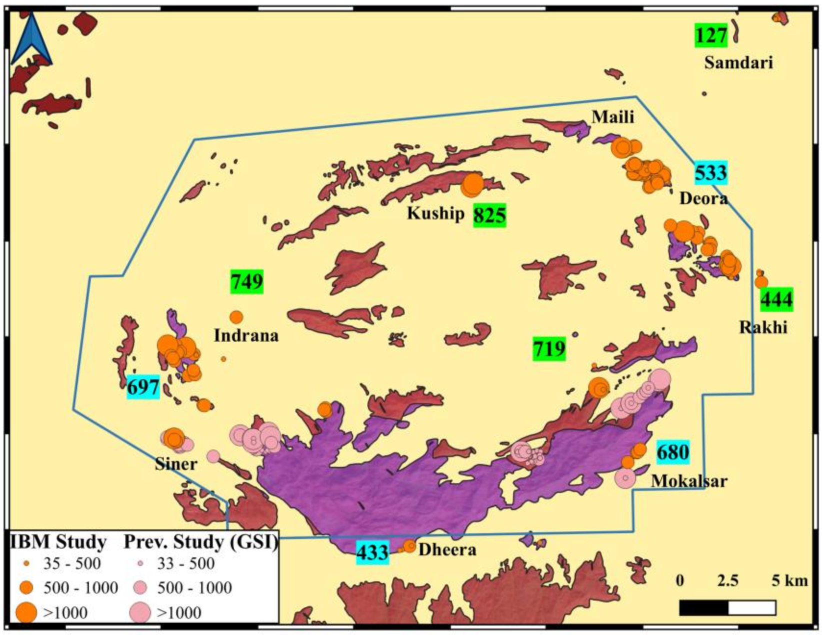

Figure 5.12. Spatial distribution of Y concentrations within the Siwana Ring Complex, showing a comparison between the present IBM study and previous GSI investigations (see Table 6.1). Bubble sizes are proportional to Y concentrations (ppm). The values shown in blue and green represent the average Y contents of the granite and masonry stone quarry clusters, respectively, as delineated in Figure 3.3. The yellow values indicate the maximum Y contents (ppm) reported from previous GSI investigations. Legend same as in Figure 3.3.

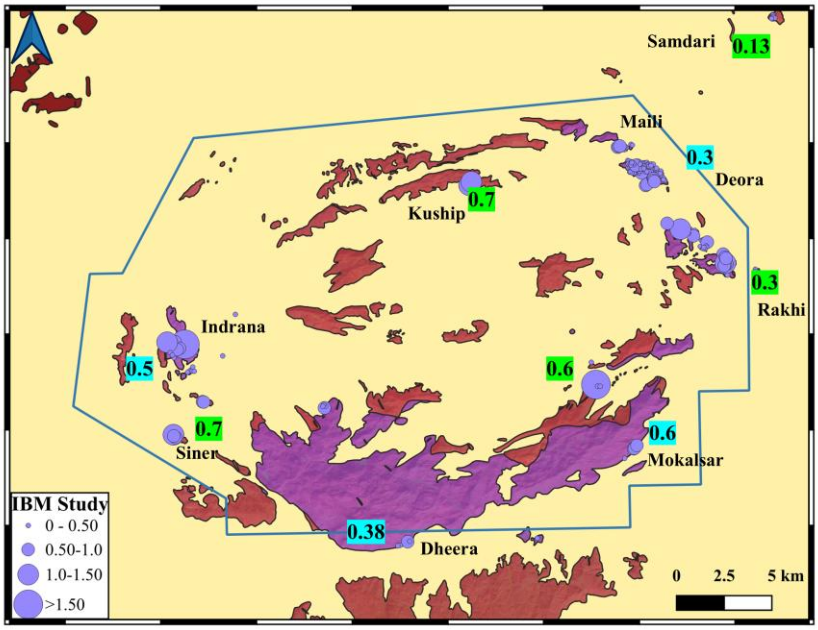

Figure 5.13. Spatial distribution of Zr concentrations within the Siwana Ring Complex. Bubble sizes are proportional to Zr concentrations (%). The values shown in blue and green represent the average Zr contents of the granite and masonry stone quarry clusters, respectively, as delineated in Figure 3.3. Legend same as in Figure 3.3.

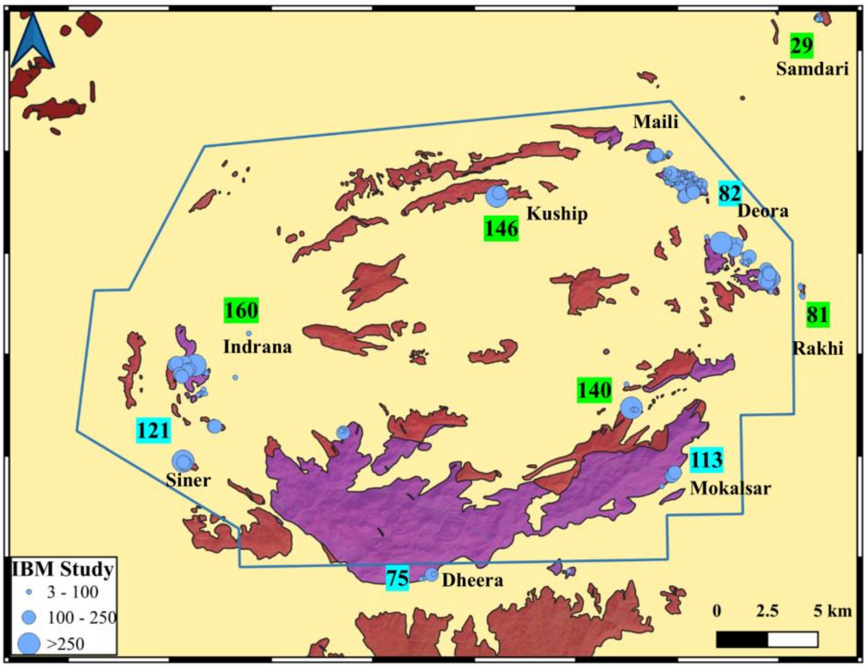

Figure 5.14. Spatial distribution of Hf concentrations within the Siwana Ring Complex. Bubble sizes are proportional to Hf concentrations (ppm). The values shown in blue and green represent the average Hf contents of the granite and masonry stone quarry clusters, respectively, as delineated in Figure 3.3. Legend same as in Figure 3.3.

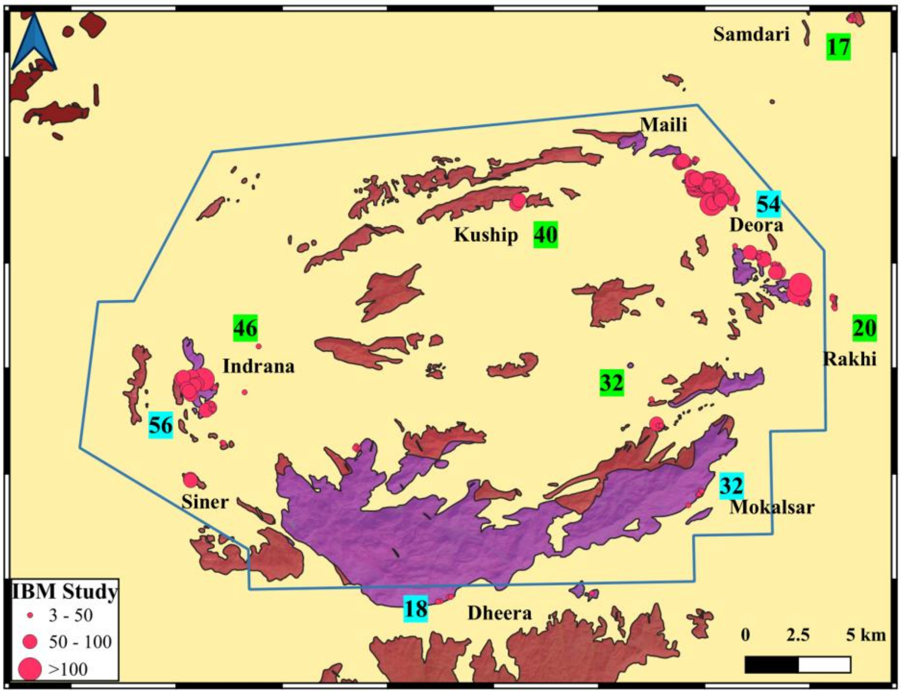

Figure 5.15. Spatial distribution of Th concentrations within the Siwana Ring Complex. Bubble sizes are proportional to Th concentrations (ppm). The values shown in blue and green represent the average Th contents of the granite and masonry stone quarry clusters, respectively, as delineated in Figure 3.3. Legend same as in Figure 3.3.

The masonry stone quarry leases on the other hand exhibit considerable variation in TREE+Y and associated critical element concentrations across the identified clusters. Cluster (E) around Samdari village records the lowest average concentrations, with TREE and Y values of 691 ppm and 127 ppm, respectively. In contrast, Clusters (G), (H), and (I) display substantially higher concentrations of REEs and associated critical elements. Cluster (G), located in the Indrana–Siner area, records the highest average TREE concentration (3,647 ppm) along with elevated HREE (459 ppm), LREE (2,436 ppm), Th (46 ppm), Hf (160 ppm), and Zr (7,116 ppm) contents. Clusters (H) and (I) also show significant enrichment, with average TREE concentrations of 2,615 ppm and 2,572 ppm, respectively. Cluster (F) in the Rakhi area exhibits intermediate concentrations, with an average TREE content of 1,628 ppm.

All these identified granite and masonry stone quarry clusters merit further investigation. However, the Deora–Fulan–Rakhi–Maili–Balu, Indrana–Siner, Kuship, and Mavdi areas may be prioritized for detailed exploration owing to their relatively higher concentrations of TREE, Y, HREE, Th, Hf, and Zr.

5.7.3. Comparison of the Siwana Ring Complex with Other Peralkaline Igneous Complexes worldwide

Further, comparison with selected advanced REE exploration projects hosted by peralkaline igneous rocks worldwide (Table 5.6) indicates that the highest-grade sample obtained during the present investigation contains approximately 0.69 wt.% TREO, which is comparable to the grades reported from several internationally significant REE deposits such as Norra Kärr (0.59% TREO), Bokan Mountain (0.61% TREO), Strange Lake Granite (0.87% TREO), and Dubbo (0.89% TREO). Although the present study is based on reconnaissance-scale quarry sampling and no mineral resource estimation has been undertaken, the observed grades demonstrate that the Siwana Ring Complex possesses REE enrichment comparable to that observed in several globally recognized peralkaline REE-bearing systems. These results, together with the widespread occurrence of REE-enriched granites, rhyolites, and micrograniti intrusive phases, highlight the potential of the Siwana Ring Complex for further detailed exploration and resource evaluation.

Table 5.6. Tonnage and Ore Grade of Selected Advanced REE Exploration Projects Related to Peralkaline Igneous Rocks in various complexes (from Dostal, 2017)

Deposit	TREO Reserves (Mt)	TREO (%)
Thor Lake (Nechalacho), Northwest Territories, Canada		
Basal	1.799	1.43
Upper	2.353	1.32
Ilimaussaq Complex, Greenland		
Kvanefjeld	6.547	1.06
Sørensen	2.667	1.10
Zone 3	1.106	1.16
Kipawa (Zeus), Quebec, Canada	0.107	0.40
Norra Kärr, Sweden	0.343	0.59
Strange Lake, Quebec/Labrador, Canada		
Enriched Granite	0.288	1.44
Granite	4.118	0.87
Bokan, Alaska, United States	0.030	0.61
Two Tom, Labrador, Canada	0.480	1.18
Dubbo, Australia	0.651	0.89

Hastings/Brockman, Australia	0.076	0.21
Present Sampling Study of Granite & Masonary Stone Leases in Siwana Ring Complex by Indian Bureau of Mines (2026)	Not Established	0.69 % (Max. sample TREO)

Although the highest grades reported from mineralized microgranite dykes and localized REE prospects are greater than those observed in the present study, the widespread occurrence of elevated REE concentrations across active granite and masonry stone quarry leases demonstrates that REE enrichment is not restricted to isolated occurrences but is a regional characteristic of the Siwana Ring Complex.

BOX: 5.1

TREE + Y = TREO +Y2O3 (element-to-oxide stoichiometric conversion)

Sample: IBM/SRC/REE/GR/(219/91)/GR/PCS/29

Element	Conc. (ppm)	Oxide form	Conversion factor	Oxide equivalent (ppm)
La	1700.00	La_2O_3	1.17	1993.76
Ce	2300.00	CeO_2	1.23	2825.32
Pr	337.35	Pr_6O_{11}	1.21	407.59
Nd	1100.00	Nd_2O_3	1.17	1283.04
Sm	96.40	Sm_2O_3	1.16	111.78
Eu	8.05	Eu_2O_3	1.16	9.32
Gd	72.33	Gd_2O_3	1.15	83.37
Tb	11.31	Tb_4O_7	1.18	13.31
Dy	67.57	Dy_2O_3	1.15	77.54
Ho	13.62	Ho_2O_3	1.15	15.61
Er	39.33	Er_2O_3	1.14	44.97
Tm	5.87	Tm_2O_3	1.14	6.70
Yb	35.14	Yb_2O_3	1.14	40.01
Lu	4.94	Lu_2O_3	1.14	5.62
TREE	5791.91	TREO		6917.94
Y	467.56	Y_2O_3	1.27	593.75
Sc	3.24	Sc_2O_3	1.53	4.96
TREO		6917.94 ppm	**TREO+Y_2O_3**	7511.69 ppm
		0.69 %		**0.75 %**

For conversion: Individual rare earth element concentrations were converted to their corresponding stoichiometric oxide equivalents using element-to-oxide conversion factors (https://www.jcu.edu.au/advanced-analytical-centre/resources/element-to-stoichiometric-oxide-conversion-factors).

6

CONCLUSION & RECOMMENDATION

Chapter: 06
CONCLUSION & RECOMMENDATIONS

6.1 KEY CONCLUSION

The present investigation represents the first systematic geochemical assessment of active granite and masonry stone quarry leases within the Siwana Ring Complex in Western Rajasthan, with the objective of evaluating their Rare Earth Element (REE) and associated critical mineral potential.

Based on field investigations, geochemical analyses, and interpretation of the analytical data, the following conclusions are drawn:

1. A total of 236 representative rock samples (including 21 check samples) were collected and analysed from 116 active quarry leases comprising 97 granite leases and 19 masonry stone leases distributed across the Siwana Ring Complex (SRC), Rajasthan.
2. Field investigations indicate that the quarry leases are developed within both the plutonic (Siwana Granite) and volcanic (rhyolite and related felsic volcanic rocks) phases of the SRC.
3. The FE-SEM–EDS study confirms that the Siwana Ring Complex hosts a mineral assemblage typical of highly evolved peralkaline igneous rocks enriched in rare earth elements and associated high-field-strength elements. The occurrence of monazite, allanite, cheralite and cerite, together with REE-bearing zircon, hedenbergite, aenigmatite and apatite, demonstrates that REEs are hosted by both accessory minerals and major silicate phases.
4. The widespread occurrence of zircon and sphene enriched in Zr, Nb, Th, Y and REEs, together with the presence of REE-bearing pyroxenes and amphiboles, indicates favourable conditions for REE–HFSE mineralization within the Siwana Ring Complex.
5. Weathering assessment using geochemical indices and low loss on Ignition values demonstrates that most samples represent fresh bedrock, and the observed REE and critical element enrichment is primarily controlled by magmatic processes rather than secondary weathering or alteration.
6. Major element and trace element geochemistry indicate that the studied rocks are predominantly high-K calc-alkaline to shoshonitic, ferroan, alkalic, metaluminous to weakly peraluminous A-type granitoids.

7. Tectonic discrimination diagrams shows that the majority of samples falls within the Within-Plate Granite (WPG) field, indicating emplacement in an extensional intraplate setting associated with anorogenic magmatism.
8. Chondrite-normalized REE patterns exhibit pronounced LREE enrichment and strong negative Eu anomalies, reflecting extensive feldspar fractionation and advanced magmatic differentiation.
9. The granitoids exhibit significant enrichment of REEs and associated critical elements. Total REE concentrations (REE + Sc + Y) range from 360–6263 ppm in granite leases and 639–5558 ppm in masonry stone leases, with average concentrations exceeding 2000 ppm in both groups.
10. Besides REEs, the samples show notable enrichment of Y, Zr, Hf, Nb, Ta, Th, U, W, and Ga, indicating the presence of a broader REE-HFSE metallogenic system within the SRC.
11. Granite quarry leases can be grouped into four major clusters (A–D), with Cluster A (Deora–Fulan–Rakhi–Maili–Balu) representing the largest concentration of leases, followed by smaller clusters in the Indrana–Nalgoda–Siner, Mokalsar, and Sela areas. In contrast, masonry stone quarry leases occur in five relatively small clusters (E–I) distributed around Samdari, Rakhi, Kuship, Mavdi, and Siner–Indrana, along with a solitary quarry near Dhira.
12. The cluster-wise ranking based on mean TREE (REE + Sc + Y) concentrations (table 6.1) indicates that, among the granite mine clusters, Cluster B (Indrana–Nalgoda–Siner) records the highest mean TREE concentration of 2,537 ppm, followed by Cluster C (Mokalsar) at 2,268 ppm and Cluster A (Deora–Fulan–Rakhi–Maili–Balu) at 2,073 ppm.

    Among the masonry stone quarry clusters, Cluster I (Siner–Indrana) exhibits the highest mean TREE concentration of 3,647 ppm, followed by Clusters G (Kuship) and H (Mavdi), with mean values of 2,615 ppm and 2,572 ppm, respectively.
13. Further, Spatial analysis indicates that the Deora–Fulan–Rakhi–Maili–Balu, Indrana–Siner, Kuship, and Mavdi village clusters are relatively more enriched in TREE, Y, HREE, Zr, Hf, and Th and therefore constitute priority targets for future exploration.
14. The study confirms that REE enrichment in the Siwana Ring Complex as also evident by previously known mineralized dykes and localized prospects is a

regional-scale phenomenon extending across active granite and masonry stone quarry leases.

Table 6.1. Ranking of granite and masonry stone quarry clusters based on mean TREE concentrations in the Siwana Ring Complex.

Rank	Cluster (Village)	Location within SRC	TREE	LREE	HREE
			Mean values in ppm		
Granite Mines					
1	**B** (Indrana, Nalgoda and Siner (16))	Eastern Part	**2537**	1429	408
2	**C** (Mokalsar (5))	South Eastern part	**2268**	1191	394
3	**A** (Deora–Fulan–Rakhi–Maili–Balu (74))	North Eastern Part	**2073**	1249	286
4	**D** (Sela (2))	South	**1507**	819	252
Masonry Stone					
1	**I** (Siner and Indrana (4))	South Eastern	**3647**	2436	459
2	**G** (Kuship (3))	North	**2615**	1330	455
3	**H** (Mavdi (4))	South west	**2572**	1440	406
4	**F** (Rakhi (3))	West	**1628**	948	231
5	**E** (Samdari (4))	North West (outside of SRC)	**691**	481	78

15. The maximum TREO grade obtained during the present investigation (~0.69 wt.% TREO) is comparable to grades reported from several globally recognized peralkaline REE-bearing systems, highlighting the exploration significance of the Siwana Ring Complex.

Overall, the Siwana Ring Complex, Rajasthan represents a highly prospective geological domain for REE and associated critical mineral exploration in India.

6.2 Recommendations

Based on the geological, geochemical, and comparative evaluation undertaken during the present investigation, the following recommendations are proposed:

1. Detailed mineralogical investigations involving petrography, XRD, SEM-EDS, EPMA, and automated mineralogical studies may be undertaken to identify the principal REE-bearing phases and their mode of occurrence.
2. Beneficiation and metallurgical studies may be initiated on representative high-grade samples to assess the recovery potential of REEs and associated critical elements such as Y, Nb, Ta, Zr, Hf, Th, and U.
3. Based on the ranking of the identified quarry clusters, the Indrana–Nalgoda–Siner clusters (Clusters B and I) and the Deora–Fulan–Rakhi–Maili–Balu clusters (Clusters A and F) have emerged as the most promising zones for REEs and associated HFSEs and may be prioritized for further detailed exploration and assessment.
4. Alternatively, the identified promising clusters may be considered for delineation as potential blocks for auction under the Exploration Licence (EL) regime.
5. Based on the studies conducted to assess the potential for REEs and HFSEs in the study area, the Centre may take an appropriate decision regarding the continuation of mining operations or termination of the mineral concessions in respect of the identified quarries, in accordance with the applicable statutory provisions and following due process of law.

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ANNEXURES

Annexure I Office Memorandum: Approval for "Undertaking geochemical analysis of Mine Samples of Siwana Ring Complex, Rajasthan"

Government of India
Ministry of Mines
National Mineral Exploration and Development Trust

File No. 6/2/2015-NMET/ 996 **New Delhi, 30.03.2026**

OFFICE MEMORANDUM

Subject: Approval for "Undertaking Geo-chemical Analysis of mine samples of Siwana Ring Complex by IBM through NMEDT fund."

On the recommendation of 90th Technical-cum-Cost Committee-I (TCC-I), the Project Sanctioning Committee at its 6th meeting held on 02.03.2026 has approved the proposal of IBM as mentioned below :

Name of Project	Duration (in months)	Amount (inclusive of taxes)
Undertaking Geo-chemical Analysis of mine samples of Siwana Ring Complex by IBM through NMEDT fund	03 months (by 10.06.2026)	₹70,01,303/- *(inclusive of all taxes)*

(Rupees Seventy lakh one thousand three hundred three only)

2. The approval is for the above project for geochemical analysis as per the rates mentioned in the cost sheet (annexure-A).
3. There is timeline of three months from the date of circulation of Minutes of 6th PSC's Meeting i.e. 11.03.2026 for carrying out the project work and submission of report.

4. And also that,

a) representative sampling from mine faces, stockpiles and processing residues will be carried out following NMEDT SoC protocols, with uniform methodology, parameters and evaluation criteria across all blocks, aligned with the approach earlier adopted for SRC block allocation.

b) all samples will be collected by IBM officers following established protocols to ensure representativeness and data quality

[Geetika Sharma]
Director (Projects) & HoD, NMEDT

To

The Controller General, Indian Bureau of Mines, Nagpur.

Copy for Information:

Dr. S. Ravi, Chairman, TCC-1 NMET and Dy. D.G & HoD, GSI Training Institute, Bandlaguda, Hyderabad-500068.

Annexure II Office Memorandum for Timeline extension approval by NMEDT

F. No.- 117/1/2025-NMET/265
Government of India
Ministry of Mines
National Mineral Exploration and Development Trust
***

9th Floor, Jeevan Prakash Building,
25, K.G. Marg, New Delhi.
Date: 12.06.2026

Office Memorandum

Subject: Approval of timeline extension of ongoing projects sanctioned to exploration agencies from NMEDT-reg

On the recommendation of Technical-cum-Cost Committees (TCCs), the Project Sanctioning Committee (PSC) of NMEDT at its 9th meeting held on 03.06.2026 approved the extension of timeline for following ongoing projects:

Sl. No.	Block/Project	Agency	Scheduled date of completion	Required timeline (up to)	Remarks
26	Undertaking geochemical analysis of mine samples of Siwana Ring Complex, Rajasthan by IBM through NMEDT fund.	IBM	29.06.26	31.07.2026	For completion of project & submission of GR

राजीव कुमार
12/6/2

(Rajiv Kumar)
Joint Director (Admn. & Legal)
For Director (Project) & HoD

To,

1. The Dy. Director General, PSS, GSI, CHQ, 27 J. L. Nehru Road, Kolkata-700016
2. The General Manager (Exploration), Mineral Exploration and Consultancy Limited (MECL), Dr. Babasaheb Ambedkar Bhawan, Seminary Hills, Nagpur
3. The Director, DGM Bihar, 1st Floor, Udyog Bhawan, East Gandhi Maidan, Patna
4. The Director, DGM Arunachal Pradesh, Chandranagar, Papum Pare, along NH-52A (Itanagar Road) in Itanagar, Arunachal Pradesh
5. The Director, DMG Telangana 2nd Floor, B.R.K.R. Bhavan, Government Offices Complex, Tank Bund Road, Saifabad, Hyderabad
6. The Director, DGM Mizoram, Luangmual, Aizawl, Mizoram
7. The Madhya Pradesh State Mining Corporation Ltd. Block 'A', 2nd Floor, Paryawas Bhawan Jail Road, Arera Hills, Bhopal
8. The Director, DMR Meghalaya, Risa Colony, Shillong, Meghalaya
9. The Director, DGM Nagaland, Near Deputy Commissioner (DC) Office, Dimapur

Annexure III: List of Mines covered during Present study and Sample Location Details

Toposheet No. **45C/06 & part of 45C/05** District: **Balotra**, State: **Rajasthan**

Mine No.	M L number	Lessee Name (Tehsil, Village)	Mineral as per ML	Area (Ha)	Sample ID	Samples Descriptions	Latitude (D-M-S)	Longitude (D-M-S)
1	354/2005	Ghanshyam Singh Sekhawat (Samdari, Rakhi)	Micro Granite	1	IBM/SRC/REE/MS/(354/05)/RH/PCS/01	Micro granite	25°41'2.15"	72°33'38.43"
			Micro Granite	1	IBM/SRC/REE/MS/(354/05)/RH/PCS/02	Micro granite	25°40'58.06"	72°33'38.15"
2	32/2021	M/s Shree Nagnechi Stone Crush (Samdari, Rakhi)	Micro Granite	1.14	IBM/SRC/REE/MS/(32/01)/RH/PCS/03	Micro granite	25°40'45.11"	72°33'40.76"
3	33/2021	Narpat Singh (Samdari, Rakhi)	Micro Granite	1.39	IBM/SRC/REE/MS/(33/01)/RH/PCS/04	Micro granite	25°40'42.04"	72°33'42.52"
4	73/2009	Narpatsingh (Samdari, Rakhi)	Granitoids	1	IBM/SRC/REE/GR/(73/09)/GR/PCS/05	Coarse grain granite	25°41'30.59"	72°32'37.92"
5	264/1991	Mahendar Chodhry (Samdari, Rakhi)	Granitoids	1	IBM/SRC/REE/GR/(264/91)/GR/PCS/06	Coarse grain granite	25°41'19.76"	72°32'43.58"
6	16/1994	Uijwal Garnite Pvt Ltd (Samdari, Rakhi)	Granitoids	1.21	IBM/SRC/REE/GR/(16/94)/GR/PCS/07	Coarse grain granite	25°41'13.66"	72°32'42.05"
7	62/1993	Uijwal Garnite Pvt Ltd (Samdari, Rakhi)	Granitoids	1	IBM/SRC/REE/GR/(62/93)/GR/PCS/08	Coarse grain granite	25°41'12"	72°32'45"
8	107/1988	Narsegaram (Samdari, Rakhi)	Granitoids	1	IBM/SRC/REE/GR/(107/88)/GR/PCS/09	Coarse grain granite	25°41'11"	72°32'42"
9	08/95	Narsegaram (Samdari, Rakhi)	Masonary	1	IBM/SRC/REE/GR/(08/95)/GR/PCS/10	Coarse grain granite	25°41'09"	72°32'40"
10	205/2009	Shantnu Punia (Samdari, Rakhi)	Granitoids	1	IBM/SRC/REE/GR/(205/09)/GR/PCS/11	Coarse grain granite	25°41'25"	72°32'42"
11	136/2009	Shantnu Punia (Samdari, Rakhi)	Granitoids	1	IBM/SRC/REE/GR/(136/09)/GR/PCS/12	Coarse grain granite	25°41'22.5"	72°32'43.3"

Mine No.	M L number	Lessee Name (Tehsil, Village)	Mineral as per ML	Area (Ha)	Sample ID	Samples Descriptions	Latitude (D-M-S)	Longitude (D-M-S)
12	266/1991	Pelican Grani Marmo Pvt.Ltd. (Siwana, Balu)	Granitoids	1	IBM/SRC/REE/GR/(266/91)/GR/PCS/13	Coarse grain granite	25°40'51"	72°32'46"
13	427/2002	Jalam Singh (Samdari, Fulan)	Granitoids	3	IBM/SRC/REE/GR/(427/02)/GR/PCS/14	Coarse grain granite	25°42'15.14"	72°31'44.94"
14	272/1993	Fateh Granite Ltd (Samdari, Fulan)	Granitoids	2	IBM/SRC/REE/GR/(272/93)/GR/PCS/15	Coarse grain granite	25°42'16.83"	72°31'36.93"
15	271/1993	Fateh Granites Ltd (Samdari, Fulan)	Granitoids	2	IBM/SRC/REE/GR/(271/93)/GR/PCS/16	Coarse grain granite	25°42'16.94"	72°31'33.34"
16	240/2002	Fateh Granite Ltd (Samdari, Fulan)	Granitoids	3	IBM/SRC/REE/GR/(240/02)/GR/PCS/17	Coarse grain granite	25°42'23.58"	72°31'17.29"
17	241/2002	Fateh Granite Ltd (Samdari, Fulan)	Granitoids	3	IBM/SRC/REE/GR/(241/02)/GR/PCS/18	Coarse grain granite	25°42'14.4"	72°31'26.4"
18	31/2006	Praveen Modi (Samdari, Fulan)	Granitoids	3	IBM/SRC/REE/GR/(31/06)/GR/PCS/19	Coarse grain granite	25°42'05"	72°31'42"
19	231/2002	Fateh Granite Ltd (Samdari, Fulan)	Granitoids	3	IBM/SRC/REE/GR/(231/02)/GR/PCS/20	Coarse grain granite	25°42'9.5"	72°31'32.8"
20	Oct-18	Chetan Ram (Samdari, Fulan)	Granitoids	1.4	IBM/SRC/REE/GR/(10/18)/GR/PCS/21	Coarse grain granite	25°42'8.61"	72°31'22.93"
21	510/2002	Pavan Putra Stones (Samdari, Fulan)	Granitoids	1.28	IBM/SRC/REE/GR/(510/02)/GR/PCS/22	Coarse grain granite	25°42'10.32"	72°31'17.02"
22	511/2002	Champa Lal (Samdari, Fulan)	Granitoids	1.88	IBM/SRC/REE/GR/(511/02)/GR/PCS/23	Coarse grain granite	25°42'17.61"	72°31'17.53"
23	616/2002	Mahaveer Prasad (Samdari, Fulan)	Granitoids	3	IBM/SRC/REE/GR/(616/02)/GR/PCS/24	Coarse grain granite	25°41'45.05"	72°31'54.71"
24	322/1991	Vinod Chodhry (Samdari, Fulan)	Granitoids	1	IBM/SRC/REE/GR/(322/91)/GR/PCS/25	Coarse grain granite	25°41'56.39"	72°31'56.90"
25	71/1990	Mohit Agarwal (Samdari, Fulan)	Granitoids	1	IBM/SRC/REE/GR/(71/90)/GR/PCS/26	Coarse grain granite	25°41'57.76"	72°32'0.38"

Mine No.	M L number	Lessee Name (Tehsil, Village)	Mineral as per ML	Area (Ha)	Sample ID	Samples Descriptions	Latitude (D-M-S)	Longitude (D-M-S)
26	86/1991	Vishnu Garg (Samdari, Fulan)	Granitoids	1	IBM/SRC/REE/GR/(86/91)/GR/PCS/27	Coarse grain granite	25°41'56.26"	72°32'06.45"
27	30/2007	Rakesh Gupta (Samdari, Fulan)	Granitoids	1	IBM/SRC/REE/GR/(30/07)/GR/PCS/28	Coarse grain granite	25°41'53.10"	72°32'08.03"
28	219/1991	Adarsh Stone (Samdari, Fulan)	Granitoids	1	IBM/SRC/REE/GR/(219/91)/GR/PCS/29	Coarse grain granite	25°41'46.09"	72°32'06.25"
29	220/1991	Adarsh Stone (Samdari, Fulan)	Granitoids	1	IBM/SRC/REE/GR/(220/91)/GR/PCS/30	Coarse grain granite	25°41'43.64"	72°32'06.62"
30	222/1991	Sourabh Modi (Samdari, Fulan)	Granitoids	1	IBM/SRC/REE/GR/(222/91)/GR/PCS/31	Coarse grain granite	25°41'40.34"	72°32'03.62"
31	66/2006	Sunny Modi (Samdari, Fulan)	Granitoids	3	IBM/SRC/REE/GR/(66/06)/GR/PCS/32	Coarse grain granite	25°41'41.08"	72°31'59.84"
32	228/1991	Parth Modi (Samdari, Fulan)	Granitoids	1	IBM/SRC/REE/GR/(228/91)/GR/PCS/33	Coarse grain granite	25°41'43.24"	72°32'01.36"
33	302/2002	Narendra Kumar Jain (Samdari, Deora)	Granite	3	IBM/SRC/REE/GR/(302/02)/GR/PCS/34	Granite	25°43'47"	72°30'14"
			Granite	3	IBM/SRC/REE/GR/(302/02)/GR/PCS/35	Granite	25°43'48.2"	72°30'17.2"
			Granite	3	IBM/SRC/REE/GR/(302/02)/GR/PCS/36	Granite	25°43'50.0"	72°30'15.2"
34	146/2003	Sheveta Modi (Samdari, Deora)	Granite	3	IBM/SRC/REE/GR/(146/03)/GR/PCS/37	Granite	25°43'58"	72°30'17.6"
			Granite	3	IBM/SRC/REE/GR/(146/03)/GR/PCS/38	Granite	25°43'58.4"	72°30'19.3"
			Granite	3	IBM/SRC/REE/GR/(146/03)/GR/PCS/39	Granite	25°43'55.0"	72°30'19.2"
35	584/2002	Harsh Agarwal (Samdari, Deora)	Granite	3	IBM/SRC/REE/GR/(584/02)/GR/PCS/40	Granite	25°43'57.3"	72°30'23.8"

Mine No.	M L number	Lessee Name (Tehsil, Village)	Mineral as per ML	Area (Ha)	Sample ID	Samples Descriptions	Latitude (D-M-S)	Longitude (D-M-S)
			Granite	3	IBM/SRC/REE/GR/(584/02)/GR/PCS/41	Granite	25°43'55.0"	72°30'23.7"
			Granite	3	IBM/SRC/REE/GR/(584/02)/GR/PCS/42	Granite	25°43'55.2"	72°30'26.5"
36	27/2006	Mahesh Kumar (Samdari, Deora)	Granite	3	IBM/SRC/REE/GR/(27/06)/GR/PCS/43	Granite	25°44'8.0"	72°30'27.9"
			Granite	3	IBM/SRC/REE/GR/(27/06)/GR/PCS/44	Granite	25°44'4.01"	72°30'28.6"
			Granite	3	IBM/SRC/REE/GR/(27/06)/GR/PCS/45	Granite	25°44'0.81"	72°30'29.5"
37	99/2004	Bhagwati Devi (Samdari, Deora)	Granite	3	IBM/SRC/REE/GR/(99/04)/GR/PCS/46	Granite	25°44'12.3"	72°30'26.7"
			Granite	3	IBM/SRC/REE/GR/(99/04)/GR/PCS/47	Granite	25°44'12.6"	72°30'22.9"
			Granite	3	IBM/SRC/REE/GR/(99/04)/GR/PCS/48	Granite	25°44'9.43"	72°30'24.8"
38	448/2002	Narendra Kumar (Samdari, Deora)	Granite	3	IBM/SRC/REE/GR/(448/02)/GR/PCS/49	Granite	25°44'8.5"	72°30'22.5"
			Granite	3	IBM/SRC/REE/GR/(448/02)/GR/PCS/50	Granite	25°44'5.67"	72°30'22.2"
			Granite	3	IBM/SRC/REE/GR/(448/02)/GR/PCS/51	Granite	25°44'5.77"	72°30'18.2"
39	233/2002	Fateh Granite Ltd (Samdari, Deora)	Granite	3	IBM/SRC/REE/GR/(233/02)/GR/PCS/52	Granite	25°44'5.5"	72°30'7.1"
			Granite	3	IBM/SRC/REE/GR/(233/02)/GR/PCS/53	Granite	25°44'5.68"	72°30'2.57"
			Granite	3	IBM/SRC/REE/GR/(233/02)/GR/PCS/54	Granite	25°44'3.18"	72°30'4.44"

Mine No.	M L number	Lessee Name (Tehsil, Village)	Mineral as per ML	Area (Ha)	Sample ID	Samples Descriptions	Latitude (D-M-S)	Longitude (D-M-S)
40	232/2002	Fateh Granite Ltd (Samdari, Deora)	Granite	3	IBM/SRC/REE/GR/(232/02)/GR/PCS/55	Granite	25°44'6.0"	72°30'10.8"
			Granite	3	IBM/SRC/REE/GR/(232/02)/GR/PCS/56	Granite	25°44'9.6"	72°30'10.8"
			Granite	3	IBM/SRC/REE/GR/(232/02)/GR/PCS/57	Granite	25°44'6.0"	72°30'14.4"
41	295/2002	Bheru Singh Balawat (Samdari, Deora)	Granite	3	IBM/SRC/REE/GR/(295/02)/GR/PCS/58	Granite	25°44'3.2"	72°29'59.3"
			Granite	3	IBM/SRC/REE/GR/(295/02)/GR/PCS/59	Granite	25°44'4.74"	72°29'54.4"
			Granite	3	IBM/SRC/REE/GR/(295/02)/GR/PCS/60	Granite	25°44'5.77"	72°29'55.9"
42	234/2002	Fateh Granite Ltd (Samdari, Deora)	Granite	3	IBM/SRC/REE/GR/(234/02)/GR/PCS/61	Granite	25°44'8.95"	72°29'57.02"
			Granite	3	IBM/SRC/REE/GR/(234/02)/GR/PCS/62	Granite	25°44'9.9"	72°30'0.33"
			Granite	3	IBM/SRC/REE/GR/(234/02)/GR/PCS/63	Granite	25°44'6.53"	72°30'0.43"
43	221/2004	Monu Rathore (Samdari, Deora)	Granite	3	IBM/SRC/REE/GR/(221/04)/GR/PCS/64	Granite	25°44'5.97"	72°29'51.82"
			Granite	3	IBM/SRC/REE/GR/(221/04)/GR/PCS/65	Granite	25°44'9.34"	72°29'51.29"
			Granite	3	IBM/SRC/REE/GR/(221/04)/GR/PCS/66	Granite	25°44'08.61"	72°29'48.31"
44	176/2006	Aditya Singh (Samdari, Deora)	Granite	3	IBM/SRC/REE/GR/(176/06)/GR/PCS/67	Granite	25°44'4.2"	72°29'51"
			Granite	3	IBM/SRC/REE/GR/(176/06)/GR/PCS/68	Granite	25°44'4.13"	72°29'48.3"

Mine No.	M L number	Lessee Name (Tehsil, Village)	Mineral as per ML	Area (Ha)	Sample ID	Samples Descriptions	Latitude (D-M-S)	Longitude (D-M-S)
			Granite	3	IBM/SRC/REE/GR/(176/06)/GR/PCS/69	Granite	25°44'3.06"	72°29'50.4"
45	122/2007	Sarla Exports Pvt Ltd (Samdari, Deora)	Granite	3	IBM/SRC/REE/GR/(122/07)/GR/PCS/70	Granite	25°44'4.9"	72°29'41.9"
			Granite	3	IBM/SRC/REE/GR/(122/07)/GR/PCS/71	Granite	25°44'3.86"	72°29'46.3"
			Granite	3	IBM/SRC/REE/GR/(122/07)/GR/PCS/72	Granite	25°44'6.22"	72°29'43.3"
46	420/1992	Veervikarmaditya Singh (Samdari, Deora)	Granite	1	IBM/SRC/REE/GR/(420/92)/GR/PCS/73	Granite	25°44'0.69"	72°30'41.62"
47	95/2007	Govind Ram (Samdari, Samdari)	Masonary	1	IBM/SRC/REE/MS/(95/07)/RH/PCS/74	Rhyolite	25°49'0.95"	72°34'11.8"
			Masonary	1	IBM/SRC/REE/MS/(95/07)/RH/PCS/75	Rhyolite	25°49'0.95"	72°34'11.8"
			Masonary	1	IBM/SRC/REE/MS/(95/07)/RH/PCS/76	Rhyolite	25°49'0.95"	72°34'11.8"
48	227/1997	Chandra Shekhar (Samdari, Samdari)	Masonary	1	IBM/SRC/REE/MS/(227/97)/RH/PCS/77	Rhyolite	25°48'57.71"	72°34'12.94"
			Masonary	1	IBM/SRC/REE/MS/(227/97)/RH/PCS/78	Rhyolite	25°48'57.71"	72°34'12.94"
49	3037/1995	Hukam Singh (Samdari, Samdari)	Masonary	1	IBM/SRC/REE/MS/(3037/95)/RH/PCS/79	Rhyolite	25°48'54.71"	72°34'15.12"
			Masonary	1	IBM/SRC/REE/MS/(3037/95)/RH/PCS/80	Rhyolite	25°48'54.71"	72°34'15.12"
50	145/2003	Shanti Devi (Samdari, Samdari)	Masonary	1	IBM/SRC/REE/MS/(145/03)/RH/PCS/81	Rhyolite	25°48'54.0"	72°34'8.9"
			Masonary	1	IBM/SRC/REE/MS/(145/03)/RH/PCS/82	Rhyolite	25°48'54.0"	72°34'8.9"

Mine No.	M L number	Lessee Name (Tehsil, Village)	Mineral as per ML	Area (Ha)	Sample ID	Samples Descriptions	Latitude (D-M-S)	Longitude (D-M-S)
51	389/2005	Krishna Stone (Samdari, Deora)	Granite	3	IBM/SRC/REE/GR/(389/05)/GR/PCS/83	Granite	25°43'48.91"	72°30'48.14"
			Granite	3	IBM/SRC/REE/GR/(389/05)/GR/PCS/84	Granite	25°43'54.3"	72°30'45.12"
			Granite	3	IBM/SRC/REE/GR/(389/05)/GR/PCS/85	Granite	25°43'50.78"	72°30'45.48"
52	64/1990	Stone Gallery (Samdari, Deora)	Granite	1	IBM/SRC/REE/GR/(64/90)/GR/PCS/86	Granite	25°44'9.29"	72°30'33.9"
53	66/1990	Stone Gallery (Samdari, Deora)	Granite	1	IBM/SRC/REE/GR/(66/90)/GR/PCS/87	Granite	25°44'12.31"	72°30'32.53"
54	68/1990	Stone Gallery (Samdari, Deora)	Granite	1	IBM/SRC/REE/GR/(68/90)/GR/PCS/88	Granite	25°44'6.82"	72°30'40.74"
55	47/2005	Kailash Singh (Samdari, Deora)	Granite	2.64	IBM/SRC/REE/GR/(47/05)/GR/PCS/89	Granite	25°44'15.3"	72°29'56.3"
			Granite	2.64	IBM/SRC/REE/GR/(47/05)/GR/PCS/90	Granite	25°44'13.0"	72°29'55.2"
			Granite	2.64	IBM/SRC/REE/GR/(47/05)/GR/PCS/91	Granite	25°44'14.08"	72°29'59.64"
56	148/2007	Devendra Singh (Samdari, Deora)	Granite	2.48	IBM/SRC/REE/GR/(148/07)/GR/PCS/92	Granite	25°44'17.4"	72°30'3.33"
			Granite	2.48	IBM/SRC/REE/GR/(148/07)/GR/PCS/93	Granite	25°44'14.0"	72°30'3.08"
			Granite	2.48	IBM/SRC/REE/GR/(148/07)/GR/PCS/94	Granite	25°44'15.6"	72°30'5.97"
57	149/2007	Nagnachi Minrals (Samdari, Deora)	Granite	3	IBM/SRC/REE/GR/(149/07)/GR/PCS/95	Granite	25°44'22.55"	72°30'9.15"
			Granite	3	IBM/SRC/REE/GR/(149/07)/GR/PCS/96	Granite	25°44'20.7"	72°30'8.21"

Mine No.	M L number	Lessee Name (Tehsil, Village)	Mineral as per ML	Area (Ha)	Sample ID	Samples Descriptions	Latitude (D-M-S)	Longitude (D-M-S)
			Granite	3	IBM/SRC/REE/GR/(149/07)/GR/PCS/97	Granite	25°44'18.5"	72°30'9.81"
58	221/2003	Pola Ram (Samdari, Deora)	Granite	3	IBM/SRC/REE/GR/(221/03)/GR/PCS/98	Granite	25°44'15.6"	72°29'46.36"
			Granite	3	IBM/SRC/REE/GR/(221/03)/GR/PCS/99	Granite	25°44'13.6"	72°29'44.6"
			Granite	3	IBM/SRC/REE/GR/(221/03)/GR/PCS/100	Granite	25°44'12.4"	72°29'45.9"
59	217/2004	Inani Infraprojects Pld (Samdari, Deora)	Granite	3	IBM/SRC/REE/GR/(217/04)/GR/PCS/101	Granite	25°44'16.76"	72°29'41.09"
			Granite	3	IBM/SRC/REE/GR/(217/04)/GR/PCS/102	Granite	25°44'13.6"	72°29'39.1"
			Granite	3	IBM/SRC/REE/GR/(217/04)/GR/PCS/103	Granite	25°44'15.2"	72°29'42.6"
60	265/2004	Stonez Hub Llp (Samdari, Deora)	Granite	3	IBM/SRC/REE/GR/(265/04)/GR/PCS/104	Granite	25°44'24.74"	72°29'44.13"
			Granite	3	IBM/SRC/REE/GR/(265/04)/GR/PCS/105	Granite	25°44'26.81"	72°29'38.33"
			Granite	3	IBM/SRC/REE/GR/(265/04)/GR/PCS/106	Granite	25°44'25.2"	72°29'40.71"
61	308/2002	Nagneshi Karpa Minerals (Samdari, Deora)	Granite	3	IBM/SRC/REE/GR/(308/02)/GR/PCS/107	Granite	25°44'17.76"	72°29'56.33"
			Granite	3	IBM/SRC/REE/GR/(308/02)/GR/PCS/108	Granite	25°44'17.6"	72°29'53.2"
			Granite	3	IBM/SRC/REE/GR/(308/02)/GR/PCS/109	Granite	25°44'18.9"	72°29'50.6"
62	615/2002	Jalam Singh (Samdari, Deora)	Granitoids	3	IBM/SRC/REE/GR/(615/02)/GR/PCS/110	Granite	25°44'22.36"	72°30'3.43"

Mine No.	M L number	Lessee Name (Tehsil, Village)	Mineral as per ML	Area (Ha)	Sample ID	Samples Descriptions	Latitude (D-M-S)	Longitude (D-M-S)
			Granitoids	3	IBM/SRC/REE/GR/(615/02)/GR/PCS/111	Granite	25°44'20.54"	72°30'6.32"
			Granitoids	3	IBM/SRC/REE/GR/(615/02)/GR/PCS/112	Granite	25°44'19.54"	72°30'1.88"
63	54/2004	Vikarm Poonia (Samdari, Deora)	Granite	3	IBM/SRC/REE/GR/(54/04)/GR/PCS/113	Granite	25°44'19.02"	72°30'11.99"
			Granite	3	IBM/SRC/REE/GR/(54/04)/GR/PCS/114	Granite	25°44'21.9"	72°30'11.6"
			Granite	3	IBM/SRC/REE/GR/(54/04)/GR/PCS/115	Granite	25°44'23.0"	72°30'14.6"
64	266/1992	Uijwal Garnite Pvt Ltd (Samdari, Deora)	Granite	4	IBM/SRC/REE/GR/(266/92)/GR/PCS/116	Granite	25°44'19.91"	72°30'16.52"
			Granite	4	IBM/SRC/REE/GR/(266/92)/GR/PCS/117	Granite	25°44'20.1"	72°30'22.5"
			Granite	4	IBM/SRC/REE/GR/(266/92)/GR/PCS/118	Granite	25°44'17.9"	72°30'15.0"
65	87/2005	Shree Krishan Poonia (Samdari, Deora)	Granite	3	IBM/SRC/REE/GR/(87/05)/GR/PCS/119	Granite	25°44'16.17"	72°30'11.71"
			Granite	3	IBM/SRC/REE/GR/(87/05)/GR/PCS/120	Granite	25°44'15.67"	72°30'8.88"
			Granite	3	IBM/SRC/REE/GR/(87/05)/GR/PCS/121	Granite	25°44'15.67"	72°30'8.88"
66	306/2003	Ram Kumar Poonia (Samdari, Deora)	Granite	2.21	IBM/SRC/REE/GR/(306/03)/GR/PCS/122	Granite	25°44'13.2"	72°30'6.83"
			Granite	2.21	IBM/SRC/REE/GR/(306/03)/GR/PCS/123	Granite	25°44'10.93"	72°30'3.82"
			Granite	2.21	IBM/SRC/REE/GR/(306/03)/GR/PCS/124	Granite	25°44'11.75"	72°30'8.6"

Mine No.	M L number	Lessee Name (Tehsil, Village)	Mineral as per ML	Area (Ha)	Sample ID	Samples Descriptions	Latitude (D-M-S)	Longitude (D-M-S)
67	232/2004	Veervikarmaditya Singh (Samdari, Deora)	Granite	3	IBM/SRC/REE/GR/(232/04)/GR/PCS/125	Granite	25°44'2.4"	72°30'36.0"
			Granite	3	IBM/SRC/REE/GR/(232/04)/GR/PCS/126	Granite	25°43'58.8"	72°30'39.6"
			Granite	3	IBM/SRC/REE/GR/(232/04)/GR/PCS/127	Granite	25°44'2.4"	72°30'39.6"
68	307/2002	Jayantilal (Samdari, Deora)	Granite	2	IBM/SRC/REE/GR/(307/02)/GR/PCS/128	Granite	25°43'40.8"	72°30'21.6"
			Granite	2	IBM/SRC/REE/GR/(307/02)/GR/PCS/129	Granite	25°43'40.8"	72°30'25.2"
69	256/02	Nilkanth rock minerals ltd (Samdari, Deora)	Granite	3	IBM/SRC/REE/GR/(256/02)/GR/PCS/130	Granite	25°43'40.01"	72°30'11.97"
			Granite	3	IBM/SRC/REE/GR/(256/02)/GR/PCS/131	Granite	25°43'38.65"	72°30'13.74"
			Granite	3	IBM/SRC/REE/GR/(256/02)/GR/PCS/132	Granite	25°43'41.63"	72°30'14.62"
70	100/2004	Shri Ram Grani Marmo Pvt. Ltd (Samdari, Deora)	Granite	2.35	IBM/SRC/REE/GR/(100/04)/GR/PCS/133	Granite	25°44'19.79"	72°30'26.58"
			Granite	2.35	IBM/SRC/REE/GR/(100/04)/GR/PCS/134	Granite	25°44'15.78"	72°30'18.64"
			Granite	2.35	IBM/SRC/REE/GR/(100/04)/GR/PCS/135	Granite	25°44'17.07"	72°30'22.04"
71	219/2004	Akshay Mining (Samdari, Deora)	Granite	3	IBM/SRC/REE/GR/(219/04)/GR/PCS/136	Granite	25°44'49.82"	72°29'30.99"
			Granite	3	IBM/SRC/REE/GR/(219/04)/GR/PCS/137	Granite	25°44'51.8"	72°29'32.52"
			Granite	3	IBM/SRC/REE/GR/(219/04)/GR/PCS/138	Granite	25°44'47.28"	72°29'32.74"

Mine No.	M L number	Lessee Name (Tehsil, Village)	Mineral as per ML	Area (Ha)	Sample ID	Samples Descriptions	Latitude (D-M-S)	Longitude (D-M-S)
72	263/2004	Ms Marwar Hills (Samdari, Maili)	Granite	3	IBM/SRC/REE/GR/(263/04)/GR/PCS/139	Granite	25°44'46.92"	72°29'25.53"
			Granite	3	IBM/SRC/REE/GR/(263/04)/GR/PCS/140	Granite	25°44'47.34"	72°29'28.35"
			Granite	3	IBM/SRC/REE/GR/(263/04)/GR/PCS/141	Granite	25°44'50.93"	72°29'25.33"
73	213/2004	Satya Narayan Singh (Samdari, Deora)	Granite	3	IBM/SRC/REE/GR/(213/04)/GR/PCS/142	Granite	25°44'51.26"	72°29'36.22"
			Granite	3	IBM/SRC/REE/GR/(213/04)/GR/PCS/143	Granite	25°44'52.83"	72°29'34.19"
74	218/2004	Stonez Hub Llp (Samdari, Deora)	Granite	3	IBM/SRC/REE/GR/(218/04)/GR/PCS/144	Granite	25°44'22.27"	72°29'43.19"
			Granite	3	IBM/SRC/REE/GR/(218/04)/GR/PCS/145	Granite	25°44'20.48"	72°29'39.45"
			Granite	3	IBM/SRC/REE/GR/(218/04)/GR/PCS/146	Granite	25°44'19.91"	72°29'42.83"
75	207/2003	Shri Sai Minerals (Samdari, Deora)	Granite	3	IBM/SRC/REE/GR/(207/03)/GR/PCS/147	Granite	25°44'21.87"	72°29'49.08"
			Granite	3	IBM/SRC/REE/GR/(207/03)/GR/PCS/148	Granite	25°44'18.3"	72°29'44.6"
			Granite	3	IBM/SRC/REE/GR/(207/03)/GR/PCS/149	Granite	25°44'23.0"	72°29'46.1"
76	365/2005	Prahlad Singh (Siwana, Indrana)	Granite	3	IBM/SRC/REE/GR/(365/05)/GR/PCS/150	Granite	25°38'28.09"	72°16'01.26"
			Granite	3	IBM/SRC/REE/GR/(365/05)/GR/PCS/151	Granite	25°38'28.78"	72°16'4.12"
			Granite	3	IBM/SRC/REE/GR/(365/05)/GR/PCS/152	Granite	25°38'26.22"	72°16'5.62"

Mine No.	M L number	Lessee Name (Tehsil, Village)	Mineral as per ML	Area (Ha)	Sample ID	Samples Descriptions	Latitude (D-M-S)	Longitude (D-M-S)
77	94/2003	M/S Siner Stones (Siwana, Siner)	Granite	3	IBM/SRC/REE/GR/(94/03)/GR/PCS/153	Granite	25°37'52.63"	72°15'56.92"
			Granite	3	IBM/SRC/REE/GR/(94/03)/GR/PCS/154	Granite	25°37'50.46"	72°15'54.02"
			Granite	3	IBM/SRC/REE/GR/(94/03)/GR/PCS/155	Granite	25°37'48.24"	72°15'50.52"
78	57/1999	Pelican Grani Marmo Pvt.Ltd. (Siwana, Siner)	Granite	1	IBM/SRC/REE/GR/(57/99)/GR/PCS/156	Granite	25°37'50.42"	72°15'59.24"
79	368/1991	Rajshree Bafna (Siwana, Siner)	Granite	1	IBM/SRC/REE/GR/(368/91)/GR/PCS/157	Granite	25°37'50.01"	72°16'03.10"
80	131/2006	Vikram Singh (Siwana, Siner)	Masonary	1	IBM/SRC/REE/MS/(131/06)/RH/PCS/158	Rhyolite	25°36'52.77"	72°16'18.48"
			Masonary	1	IBM/SRC/REE/MS/(131/06)/RH/PCS/159	Rhyolite	25°36'52.16"	72°16'20.74"
81	411/2005	Sumer Singh (Siwana, Siner)	Masonary	1	IBM/SRC/REE/MS/(411/2005)/MG/PCS/160	Micro granite	25°35'50.58"	72°15'23.89"
			Masonary	1	IBM/SRC/REE/MS/(411/2005)/MG/PCS/162	Micro granite	25°35'48.27"	72°15'24.47"
82	412/2005	Bhanwar Singh (Siwana, Siner)	Masonary	1	IBM/SRC/REE/MS/(412/2005)/RH/PCS/161	Rhyolite	25°35'45.48"	72°15'27.86"
83	53/1999	Ashok Gupta (Siwana, Nalgoda)	Granite	1	IBM/SRC/REE/GR/(53/1999)/GR/PCS/163	Granite	25°36'41.06"	72°20'7.93"
84	54/1999	Ashok Gupta (Siwana, Nalgoda)	Granite	1	IBM/SRC/REE/GR/(54/99)/GR/PCS/164	Granite	25°36'44.39"	72°20'9.99"
85	55/1999	Anjani Granites (Siwana, Nalgoda)	Granite	1	IBM/SRC/REE/GR/(55/1999)/GR/PCS/165	Granite	25°36'47.24"	72°20'06.7"
86	56/1999	Anjani Granites (Siwana, Nalgoda)	Granite	1	IBM/SRC/REE/GR/(56/1999)/GR/PCS/166	Granite	25°36'44.00"	72°20'4.69"

Mine No.	M L number	Lessee Name (Tehsil, Village)	Mineral as per ML	Area (Ha)	Sample ID	Samples Descriptions	Latitude (D-M-S)	Longitude (D-M-S)
87	196/2006	Madan Kunwar (Siwana, Indrana)	Granite	3	IBM/SRC/REE/GR/(196/06)/GR/PCS/167	Granite	25°38'18.01"	72°15'25.98"
			Granite	3	IBM/SRC/REE/GR/(196/06)/GR/PCS/168	Granite	25°38'15.32"	72°15'24.88"
88	05/14	Jitendra Verma (Siwana, Indrana)	Granite	2.51	IBM/SRC/REE/GR/(05/14)/GR/PCS/169	Granite	25°38'39.03"	72°15'44.46"
			Granite	2.51	IBM/SRC/REE/GR/(05/14)/GR/PCS/170	Granite	25°38'40.65"	72°15'45.15"
89	589/2002	Shree Krishna Granite (Siwana, Indrana)	Granite	3	IBM/SRC/REE/GR/(589/02)/GR/PCS/171 (Soil Sample)	Soil Sample	25°38'18.93"	72°16'56.44"
90	24/2018	Jalam Singh (Siwana, Mavdi)	Masonary	1	IBM/SRC/REE/MS/(24/18)/RH/PCS/172	Rhyolite	25°38'7.06"	72°28'29.88"
91	228/2006	M/S Sun Links Mintech Pvt Ltd (Siwana, Indrana)	Granite	3	IBM/SRC/REE/GR/(228/06)/GR/PCS/173	Granite	25°38'45.46"	72°15'26.65"
92	68/2007	Matishwari Interprises (Siwana, Indrana)	Granite	3	IBM/SRC/REE/GR/(68/07)/GR/PCS/174	Granite	25°38'33.14"	72°15'35.15"
			Granite	3	IBM/SRC/REE/GR/(68/2007)/GR/PCS/175	Granite	25°38'30.80"	72°15'30.65"
93	592/2002	Sanjeev Choudhry (Siwana, Indrana)	Granite	3	IBM/SRC/REE/GR/(592/02)/GR/PCS/176	Granite	25°38'42.08"	72°15'08.46"
			Granite	3	IBM/SRC/REE/GR/(592/02)/GR/PCS/177	Granite	25°38'44.63"	72°15'11.95"
94	192/2006	Naveen Mathur (Siwana, Indrana)	Granite	3	IBM/SRC/REE/GR/(192/06)/GR/PCS/178	Granite	25°38'25.06"	72°15'17.98"
			Granite	3	IBM/SRC/REE/GR/(192/06)/GR/PCS/179	Granite	25°38'20.56"	72°15'21.79"
95	28/2018	Mitha Lal (Samdari, Deora)	Granite	1.7	IBM/SRC/REE/GR/(28/18)/GR/PCS/180	Granite	25°44'56.13"	72°29'45.55"

Mine No.	M L number	Lessee Name (Tehsil, Village)	Mineral as per ML	Area (Ha)	Sample ID	Samples Descriptions	Latitude (D-M-S)	Longitude (D-M-S)
			Granite	1.7	IBM/SRC/REE/GR/(28/18)/GR/PCS/181	Granite	25°44'57.13"	72°29'44.40"
			Granite	1.7	IBM/SRC/REE/GR/(28/18)/GR/PCS/182	Granite	25°44'55.81"	72°29'47.14"
96	264/2004	Alka Stone Jalore (Siwana, Maili)	Granite	3	IBM/SRC/REE/GR/(264/06)/GR/PCS/183	Granite	25°44'51.99"	72°29'23.57"
			Granite	3	IBM/SRC/REE/GR/(264/04)/GR/PCS/184	Granite	25°44'49.09"	72°29'22.63"
			Granite	3	IBM/SRC/REE/GR/(264/04)/GR/PCS/185	Granite	25°44'47.36"	72°29'21.31"
97	262/2004	Manglam Shubham Granite Pv (Siwana, Maili)	Granite	3	IBM/SRC/REE/GR/(262/02)/GR/PCS/186	Granite	25°44'50.45"	72°29'17.51"
			Granite	3	IBM/SRC/REE/GR/(262/04)/GR/PCS/187	Granite	25°44'51.97"	72°29'17.57"
			Granite	3	IBM/SRC/REE/GR/(262/04)/GR/PCS/188	Granite	25°44'51.96"	72°29'19.41"
98	24/2006	Chima Impex (Siwana, Maili)	Granite	1.14	IBM/SRC/REE/GR/(24/06)/GR/PCS/189	Granite	25°44'53.90"	72°29'21.01"
			Granite	1.14	IBM/SRC/REE/GR/(24/06)/GR/PCS/190	Granite	25°44'54.00"	72°29'23.68"
99	61/2006	Oda Industries Pvt.Ltd (Siwana, Deora)	Granite	1	IBM/SRC/REE/GR/(61/06)/GR/PCS/191	Granite	25°43'52.87"	72°30'26.68"
			Granite	2	IBM/SRC/REE/GR/(61/06)/GR/PCS/192	Granite	25°43'49.66"	72°30'27.55"
			Granite	3	IBM/SRC/REE/GR/(61/06)/GR/PCS/193	Granite	25°43'47.15"	72°30'28.47"
100	29/2022	Virdha Ram (Siwana, Fulan)	Granitoids	1.08	IBM/SRC/REE/GR/(29/22)/GR/PCS/194	Granite	25°42'28.48"	72°30'52.40"

Mine No.	M L number	Lessee Name (Tehsil, Village)	Mineral as per ML	Area (Ha)	Sample ID	Samples Descriptions	Latitude (D-M-S)	Longitude (D-M-S)
101	286/2007	Jitendra Kunwar (Siwana, Dhira)	Masonary	1	IBM/SRC/REE/MS/(286/07)/RH/PCS/195	Rhyolite	25°32'35.76"	72°26'48.23"
102	474/1996	Dhuda Ram (Siwana, Sela)	Granite	1.17	IBM/SRC/REE/GR/(474/96)/GR/PCS/196	Granite	25°32'29.20"	72°22'44.42"
			Granite	1.17	IBM/SRC/REE/GR/(474/96)/GR/PCS/197	Granite	25°32'30.0"	72°22'48.33"
103	331/1996	Chakarawatisingh (Siwana, Sela)	Granite	1.25	IBM/SRC/REE/GR/(331/96)/GR/PCS/198	Granite	25°32'22.41"	72°22'30.50"
			Granite	1.25	IBM/SRC/REE/GR/(331/96)/GR/PCS/199	Granite	25°32'21.54"	72°22'25.92"
104	Plot No 78/2022	Bharat Singh (Siwana, Kuship)	Masonary	1.01	IBM/SRC/REE/MS/(78/22)/RH/PCS/200	Masonary stone	25°43'41.62"	72°24'39.15"
			Masonary	1.01	IBM/SRC/REE/MS/(78/22)/GR/PCS/201	Masonary stone	25°43'40.39"	72°24'39.99"
105	Plot No 77/2022	Bharat Singh (Siwana, Kuship)	Masonary	1.01	IBM/SRC/REE/MS/(77/22)/RH/PCS/202	Masonary stone	25°43'42.58"	72°24'41.93"
106	38/2021	Bhim Singh (Siwana, Kuship)	Masonary	2.7201	IBM/SRC/REE/MS/(38/21)/RH/PCS/203	Masonary stone	25°43'46.35"	72°24'44.96"
			Masonary	2.7201	IBM/SRC/REE/MS/(38/21)/RH/PCS/204	Porphyritic Rhyolite	25°43'46.64"	72°24'44.22"
107	236/2006	Mahendra Singh (Siwana, Indrana)	Masonary	1	IBM/SRC/REE/MS/(236/06)/RH/PCS/205	Rhyolite	25°39'37.14"	72°17'20.35"
108	255/1991	Kishor Kumar (Siwana, Indrana)	Granite	1	IBM/SRC/REE/GR/(255/91)/GR/PCS/206	Granite	25°37'58.00"	72°16'0.15"
109	Plot No 113	Pooja Dewasi (Siwana, Mavdi)	Masonary	1.4851	IBM/SRC/REE/MS/(PN113)/RH/PCS/207	Porphyritic Rhyolite	25°37'24.12"	72°28'39.58"
			Masonary	1.4851	IBM/SRC/REE/MS/(PN113)/RH/PCS/208	Greenish Rhyolite	25°37'24.92"	72°28'38.60"

Mine No.	M L number	Lessee Name (Tehsil, Village)	Mineral as per ML	Area (Ha)	Sample ID	Samples Descriptions	Latitude (D-M-S)	Longitude (D-M-S)
110	Plot No 112	S Ganpat Singh Bhayal and Co (Siwana, Mavdi)	Masonary	1.7489	IBM/SRC/REE/MS/(PN112)/RH/PCS/209	Porphyritic Rhyolite	25°37'21.96"	72°28'41.69"
111	Plot No 111	Ram Niwas Acharya (Siwana, Mavdi)	Masonary	2.401	IBM/SRC/REE/MS/(PN111)/RH/PCS/210	Masonary stone	25°37'21.83"	72°28'46.58"
112	30/1985	Anita Ranawat (Siwana, Mokalsar)	Granite	1	IBM/SRC/REE/GR/(30/85)/GR/PCS/211	Granite	25°35'27.41"	72°29'52.94"
113	17/1994	Abhay Singh (Siwana, Mokalsar)	Granite	0.72	IBM/SRC/REE/GR/(17/94)/GR/PCS/212	Granite	25°35'24.13"	72°29'49.33"
114	17/1995	Vimal Chand (Siwana, Mokalsar)	Granite	0.68	IBM/SRC/REE/GR/(17/95)/GR/PCS/213	Granite	25°35'25.13"	72°29'51.19"
115	18/1995	Vimal Chand (Siwana, Mokalsar)	Granite	1	IBM/SRC/REE/GR/(18/95)/GR/PCS/214	Granite	25°35'30.40"	72°29'55.58"
116	3062/1995	Annsingh (Siwana, Mokalsar)	Granite	1.05	IBM/SRC/REE/GR/(3062/95)/GR/PCS/215	Granite	25°35'06.09"	72°29'32.70"

Annexure IV: Analytical Results: Major elements oxide

S.N.	Sample ID	SiO_2	Al_2O_3	Fe_2O_3	TiO_2	CaO	MgO	MnO	Na_2O	K_2O	P_2O_5	LOI	Sum
		in % by WD-XRF											
1	IBM/SRC/REE/MS/(354/05)/RH/PCS/01	66.66	9.61	10.84	0.75	0.97	0.32	0.18	4.81	4.13	0.04	1.04	99.35
2	IBM/SRC/REE/MS/(354/05)/RH/PCS/02	65.32	10.22	11.39	0.77	0.67	0.38	0.18	3.84	4.98	0.09	1.46	99.29
3	IBM/SRC/REE/MS/(32/01)/RH/PCS/03	65.11	10.19	10.97	0.76	0.69	0.28	0.16	2.38	7.60	0.06	1.09	99.31
4	IBM/SRC/REE/MS/(33/01)/RH/PCS/04	66.15	9.90	10.68	0.71	0.79	0.35	0.19	3.56	5.63	0.07	1.30	99.34
5	IBM/SRC/REE/GR/(73/09)/GR/PCS/05	67.78	11.24	7.08	0.49	0.47	0.06	0.14	4.82	6.32	0.02	0.50	98.91
6	IBM/SRC/REE/GR/(264/91)/GR/PCS/06	67.53	11.05	7.58	0.50	0.62	0.09	0.16	4.53	6.42	0.02	0.51	99.02
	IBM/SRC/REE/GR/ (264/91)/GR/PCS/06_CK	71.42	10.49	3.66	0.43	0.57	0.03	0.07	4.86	4.92	0.02	0.46	
7	IBM/SRC/REE/GR/(16/94)/GR/PCS/07	67.02	10.85	7.59	0.50	0.87	0.09	0.18	4.73	5.96	0.02	0.64	98.45
8	IBM/SRC/REE/GR/(62/93)/GR/PCS/08	67.91	10.86	7.11	0.44	0.74	0.09	0.17	4.58	6.24	0.02	0.57	98.73
9	IBM/SRC/REE/GR/(107/88)/GR/PCS/09	68.33	10.23	7.45	0.49	0.74	0.11	0.15	4.56	6.26	0.02	0.64	98.99
10	IBM/SRC/REE/GR/(08/95)/GR/PCS/10	68.31	10.85	6.90	0.41	0.85	0.09	0.15	4.56	6.18	0.02	0.59	98.90
11	IBM/SRC/REE/GR/(205/09)/GR/PCS/11	67.24	11.38	7.48	0.44	0.78	0.08	0.13	4.87	6.16	0.02	0.49	99.08
12	IBM/SRC/REE/GR/(136/09)/GR/PCS/12	66.98	11.27	7.51	0.42	0.83	0.09	0.15	4.70	6.37	0.02	0.60	98.94
13	IBM/SRC/REE/GR/(266/91)/GR/PCS/13	69.06	11.78	5.98	0.41	0.67	0.15	0.10	4.50	6.24	0.02	0.62	99.52
14	IBM/SRC/REE/GR/(427/02)/GR/PCS/14	64.99	10.82	9.48	0.60	1.05	1.20	0.21	3.86	5.88	0.02	1.17	99.29
15	IBM/SRC/REE/GR/(272/93)/GR/PCS/15	65.70	11.39	8.62	0.57	0.77	0.54	0.24	4.43	6.14	0.03	0.95	99.36
16	IBM/SRC/REE/GR/(271/93)/GR/PCS/16	66.92	11.22	8.17	0.50	1.01	0.18	0.21	4.42	6.06	0.04	0.58	99.32
17	IBM/SRC/REE/GR/(240/02)/GR/PCS/17	65.90	10.66	9.52	0.67	0.69	0.61	0.25	4.16	5.92	0.02	0.81	99.20
18	IBM/SRC/REE/GR/(241/02)/GR/PCS/18	69.13	11.10	6.14	0.35	1.25	0.08	0.13	3.80	6.22	0.02	1.24	99.46
	IBM/SRC/REE/GR/ (241/02)/GR/PCS/18_CK	71.57	10.71	3.69	0.32	0.91	0.03	0.07	3.79	4.91	0.02	1.15	
19	IBM/SRC/REE/GR/(31/06)/GR/PCS/19	66.35	10.17	9.48	0.60	0.44	0.90	0.13	3.72	5.96	0.02	1.20	98.97
20	IBM/SRC/REE/GR/(231/02)/GR/PCS/20	66.48	10.43	8.27	0.52	1.05	1.41	0.24	3.78	5.81	0.03	1.36	99.38
	IBM/SRC/REE/GR/(231/02)/GR/PCS/20R	66.53	10.41	8.28	0.52	1.06	1.41	0.24	3.80	5.81	0.03	1.34	99.43
	GBW-07103 (Observed Value)	72.31	13.47	2.17	0.30	1.56	0.43	0.06	3.14	5.02	0.10	0.71	99.27
	GBW-07103 (Certified Value)	72.83	13.40	2.14	0.29	1.55	0.42	0.06	3.13	5.01	0.09	0.70	99.62

S.N.	Sample ID	SiO_2	Al_2O_3	Fe_2O_3	TiO_2	CaO	MgO	MnO	Na_2O	K_2O	P_2O_5	LOI	Sum
		in % by WD-XRF											
21	IBM/SRC/REE/GR/(10/18)/GR/PCS/21	66.32	11.14	8.73	0.59	0.47	0.32	0.31	4.14	5.95	0.05	1.35	99.38
22	IBM/SRC/REE/GR/(510/02)/GR/PCS/22	67.42	11.29	7.46	0.46	0.58	0.68	0.21	4.28	6.26	0.02	0.86	99.52
23	IBM/SRC/REE/GR/(511/02)/GR/PCS/23	61.76	8.47	14.38	0.63	1.42	0.42	0.36	4.18	5.21	0.02	1.27	98.13
24	IBM/SRC/REE/GR/(616/02)/GR/PCS/24	66.44	11.76	7.12	0.42	0.60	0.84	0.11	4.52	6.59	0.02	0.93	99.34
25	IBM/SRC/REE/GR/(322/91)/GR/PCS/25	67.01	10.34	8.91	0.57	0.64	0.50	0.16	4.35	6.23	0.01	0.62	99.34
26	IBM/SRC/REE/GR/(71/90)/GR/PCS/26	69.38	10.73	6.82	0.40	0.55	0.35	0.15	4.12	6.23	0.02	0.74	99.48
27	IBM/SRC/REE/GR/(86/91)/GR/PCS/27	67.74	10.62	8.62	0.50	0.52	0.03	0.17	4.64	6.06	0.02	0.36	99.28
28	IBM/SRC/REE/GR/(30/07)/GR/PCS/28	67.96	9.93	8.20	0.51	0.99	0.06	0.16	4.39	6.07	0.02	0.67	98.96
	IBM/SRC/REE/GR/ (30/07)/GR/PCS/28_CK	70.83	9.61	4.63	0.44	0.81	0.01	0.09	4.69	4.77	0.02	0.65	
29	IBM/SRC/REE/GR/(219/91)/GR/PCS/29	64.58	8.65	7.71	0.28	4.75	2.05	0.50	2.05	5.01	0.02	3.21	98.80
30	IBM/SRC/REE/GR/(220/91)/GR/PCS/30	68.45	10.40	7.61	0.41	0.38	0.78	0.11	3.61	6.45	0.01	0.82	99.03
31	IBM/SRC/REE/GR/(222/91)/GR/PCS/31	67.12	10.40	8.41	0.52	0.71	0.48	0.14	4.27	6.50	0.02	0.76	99.34
32	IBM/SRC/REE/GR/(66/06)/GR/PCS/32	67.82	10.74	7.66	0.49	0.62	0.60	0.15	4.06	6.43	0.03	0.78	99.38
	IBM/SRC/REE/GR/ (66/06)/GR/PCS/32_CK	71.67	10.36	3.24	0.44	0.57	0.35	0.06	4.76	4.97	0.03	0.67	
33	IBM/SRC/REE/GR/(228/91)/GR/PCS/33	66.08	9.99	8.87	0.58	1.49	0.83	0.19	3.45	5.89	0.02	1.85	99.23
34	IBM/SRC/REE/GR/(302/02)/GR/PCS/34	65.45	10.29	8.97	0.55	1.02	0.87	0.16	4.19	6.10	0.02	1.36	98.98
35	IBM/SRC/REE/GR/(302/02)/GR/PCS/35	65.31	10.39	9.35	0.55	0.85	1.08	0.14	4.01	6.10	0.02	1.14	98.93
	IBM/SRC/REE/GR/ (302/02)/GR/PCS/35_CK	69.66	9.55	4.73	0.47	0.65	0.5	0.07	4.81	4.9	0.02	1.24	
36	IBM/SRC/REE/GR/(302/02)/GR/PCS/36	67.59	9.78	8.64	0.47	0.67	0.83	0.11	3.92	5.81	0.02	1.27	99.11
37	IBM/SRC/REE/GR/(146/03)/GR/PCS/37	66.25	9.34	10.09	0.51	1.16	0.30	0.25	4.29	5.80	0.03	1.14	99.16
38	IBM/SRC/REE/GR/(146/03)/GR/PCS/38	66.18	9.66	10.24	0.49	1.05	0.43	0.25	4.29	5.53	0.02	1.00	99.15
39	IBM/SRC/REE/GR/(146/03)/GR/PCS/39	60.36	10.05	16.19	0.54	0.50	0.27	0.34	4.92	5.38	0.01	0.66	99.21
40	IBM/SRC/REE/GR/(584/02)/GR/PCS/40	66.50	9.12	11.29	0.43	0.78	0.36	0.19	4.20	5.49	0.02	0.84	99.23
41	IBM/SRC/REE/GR/(584/02)/GR/PCS/41	67.25	9.48	10.01	0.43	0.63	0.42	0.21	4.10	5.91	0.02	0.70	99.18
42	IBM/SRC/REE/GR/(584/02)/GR/PCS/42	67.23	8.72	11.17	0.46	0.62	0.29	0.21	4.50	5.46	0.02	0.68	99.34
43	IBM/SRC/REE/GR/(27/06)/GR/PCS/43	66.64	9.99	9.02	0.50	0.99	0.30	0.28	3.98	6.36	0.02	0.81	98.90
44	IBM/SRC/REE/GR/(27/06)/GR/PCS/44	68.73	8.72	10.14	0.47	0.68	0.21	0.21	4.14	5.36	0.02	0.73	99.41

S.N.	Sample ID	SiO_2	Al_2O_3	Fe_2O_3	TiO_2	CaO	MgO	MnO	Na_2O	K_2O	P_2O_5	LOI	Sum
		in % by WD-XRF											
45	IBM/SRC/REE/GR/(27/06)/GR/PCS/45	67.57	8.55	11.03	0.50	0.83	0.30	0.22	4.09	5.02	0.02	1.03	99.18
46	IBM/SRC/REE/GR/(99/04)/GR/PCS/46	68.94	8.95	9.47	0.50	0.75	0.29	0.20	4.09	5.32	0.02	0.75	99.27
47	IBM/SRC/REE/GR/(99/04)/GR/PCS/47	68.13	9.91	8.25	0.50	0.78	0.36	0.18	4.14	5.96	0.02	1.05	99.29
	IBM/SRC/REE/GR/ (99/01)/GR/PCS/47_CK	71.84	9.23	4.27	0.32	0.67	0.17	0.08	4.83	4.76	0.02	0.56	
48	IBM/SRC/REE/GR/(99/04)/GR/PCS/48	64.78	9.95	9.49	0.55	1.45	0.50	0.32	4.07	6.86	0.02	1.20	99.18
49	IBM/SRC/REE/GR/(448/02)/GR/PCS/49	66.65	9.84	9.79	0.47	0.64	0.52	0.22	4.15	6.10	0.01	0.66	99.06
50	IBM/SRC/REE/GR/(448/02)/GR/PCS/50	67.80	9.17	9.25	0.49	0.69	0.48	0.21	4.17	5.96	0.01	1.03	99.26
51	IBM/SRC/REE/GR/(448/02)/GR/PCS/51	67.81	9.20	9.59	0.50	0.64	0.46	0.22	4.13	5.92	0.01	0.71	99.19
52	IBM/SRC/REE/GR/(233/02)/GR/PCS/52	67.58	9.33	9.30	0.45	0.88	0.62	0.14	3.76	6.14	0.01	0.98	99.19
53	IBM/SRC/REE/GR/(233/02)/GR/PCS/53	67.45	9.83	9.19	0.46	0.57	0.70	0.13	3.55	5.99	0.01	1.41	99.29
	IBM/SRC/REE/GR/(233/02)/GR/PCS/53R	67.56	9.75	9.14	0.48	0.55	0.69	0.13	3.49	6.06	0.01	1.46	99.32
	GBW-07103 (Observed Value)	72.91	13.45	2.19	0.28	1.60	0.45	0.06	3.10	4.97	0.10	0.71	99.82
	GBW-07103 (Certified Value)	72.83	13.40	2.14	0.29	1.55	0.42	0.06	3.13	5.01	0.09	0.70	99.62
54	IBM/SRC/REE/GR/(233/02)/GR/PCS/54	65.78	9.92	10.27	0.48	0.73	0.85	0.14	3.74	5.93	0.01	1.31	99.14
55	IBM/SRC/REE/GR/(232/02)/GR/PCS/55	66.24	10.39	9.08	0.44	0.70	1.02	0.12	3.90	6.37	0.01	0.87	99.15
56	IBM/SRC/REE/GR/(232/02)/GR/PCS/56	66.25	10.24	9.14	0.47	0.65	1.11	0.12	3.81	6.41	0.01	1.03	99.26
57	IBM/SRC/REE/GR/(232/02)/GR/PCS/57	65.55	10.23	9.59	0.45	0.52	1.10	0.13	3.95	6.36	0.01	1.23	99.13
58	IBM/SRC/REE/GR/(295/02)/GR/PCS/58	70.56	8.44	8.69	0.37	0.49	0.47	0.13	3.72	5.71	0.01	0.60	99.19
59	IBM/SRC/REE/GR/(295/02)/GR/PCS/59	70.26	8.77	8.67	0.35	0.51	0.32	0.12	3.86	5.69	0.01	0.71	99.28
60	IBM/SRC/REE/GR/(295/02)/GR/PCS/60	66.38	10.10	9.69	0.41	0.59	0.70	0.13	4.19	6.14	0.01	0.89	99.22
61	IBM/SRC/REE/GR/(234/02)/GR/PCS/61	68.04	9.25	9.20	0.38	0.67	0.42	0.13	3.89	5.67	0.02	1.45	99.11
	IBM/SRC/REE/GR/ (234/02)/GR/PCS/61_CK	72.32	8.61	4.34	0.27	0.59	0.27	0.05	4.78	4.57	0.03	0.84	
62	IBM/SRC/REE/GR/(234/02)/GR/PCS/62	68.59	8.80	9.61	0.41	0.54	0.44	0.15	4.04	5.63	0.01	0.98	99.19
63	IBM/SRC/REE/GR/(234/02)/GR/PCS/63	68.27	9.22	9.47	0.42	0.60	0.42	0.16	3.94	5.80	0.01	0.81	99.12
64	IBM/SRC/REE/GR/(221/04)/GR/PCS/64	68.24	9.64	8.73	0.51	0.56	0.26	0.17	4.06	6.32	0.01	0.79	99.28
65	IBM/SRC/REE/GR/(221/04)/GR/PCS/65	66.65	10.25	8.77	0.53	0.89	0.54	0.20	4.13	6.12	0.01	1.16	99.24
66	IBM/SRC/REE/GR/(221/04)/GR/PCS/66	67.07	10.90	7.49	0.69	0.60	0.88	0.14	4.00	6.18	0.01	1.68	99.65

S.N.	Sample ID	SiO_2	Al_2O_3	Fe_2O_3	TiO_2	CaO	MgO	MnO	Na_2O	K_2O	P_2O_5	LOI	Sum
		in % by WD-XRF											
67	IBM/SRC/REE/GR/(176/06)/GR/PCS/67	69.28	9.64	8.09	0.40	0.56	0.42	0.20	4.01	5.91	0.01	0.77	99.30
68	IBM/SRC/REE/GR/(176/06)/GR/PCS/68	67.60	9.99	8.72	0.53	0.63	0.38	0.19	4.30	6.21	0.01	0.77	99.33
	IBM/SRC/REE/GR/ (176/06)/GR/PCS/68_CK	71.31	9.41	4.5	0.43	0.54	0.16	0.08	4.83	4.74	0.02	0.76	
69	IBM/SRC/REE/GR/(176/06)/GR/PCS/69	67.61	9.74	8.69	0.46	0.83	0.47	0.19	4.12	6.10	0.01	0.72	98.95
70	IBM/SRC/REE/GR/(122/07)/GR/PCS/70	65.93	9.56	10.09	0.50	0.79	0.61	0.22	4.18	5.99	0.02	1.11	98.99
71	IBM/SRC/REE/GR/(122/07)/GR/PCS/71	66.10	9.94	10.08	0.49	0.64	0.30	0.22	4.41	5.84	0.01	1.06	99.08
72	IBM/SRC/REE/GR/(122/07)/GR/PCS/72	66.85	9.67	9.44	0.51	0.71	0.50	0.24	4.06	6.01	0.01	0.93	98.93
73	IBM/SRC/REE/GR/(420/92)/GR/PCS/73	66.04	9.94	9.66	0.51	0.71	0.23	0.21	4.49	6.11	0.01	1.10	99.02
	IBM/SRC/REE/GR/(420/92)/GR/PCS/73R	66.11	9.91	9.61	0.49	0.72	0.24	0.19	4.44	6.15	0.01	1.14	99.01
	GBW-07103 (Observed Value)	72.89	13.42	2.18	0.30	1.58	0.43	0.06	3.17	5.05	0.09	0.71	99.88
	GBW-07103 (Certified Value)	72.83	13.40	2.14	0.29	1.55	0.42	0.06	3.13	5.01	0.09	0.70	99.62
74	IBM/SRC/REE/MS/(95/07)/RH/PCS/74	70.13	12.76	3.73	0.32	1.16	0.14	0.07	4.11	6.01	0.03	1.19	99.65
75	IBM/SRC/REE/MS/(95/07)/RH/PCS/75	69.84	12.80	3.91	0.32	1.35	0.16	0.08	4.13	5.83	0.03	1.18	99.62
76	IBM/SRC/REE/MS/(95/07)/RH/PCS/76	70.21	12.97	4.01	0.33	1.00	0.18	0.08	4.10	5.89	0.03	0.93	99.74
	IBM/SRC/REE/MS/ (95/07)/RH/PCS/76_CK	72.49	12.49	2.31	0.28	0.76	0.13	0.04	3.79	4.73	0.03	0.83	
77	IBM/SRC/REE/MS/(227/97)/RH/PCS/77	68.84	12.55	4.65	0.34	1.74	0.23	0.11	4.01	5.77	0.03	1.47	99.75
	IBM/SRC/REE/MS/ (227/97)/RH/PCS/77_CK	70.23	12.14	2.27	0.43	1.16	0.18	0.04	5.5	4.53	0.03	1.28	
78	IBM/SRC/REE/MS/(227/97)/RH/PCS/78	69.60	12.19	4.63	0.32	1.48	0.21	0.10	3.78	6.02	0.03	1.30	99.65
79	IBM/SRC/REE/MS/(3037/95)/RH/PCS/79	69.22	12.49	4.65	0.39	1.49	0.18	0.10	3.94	6.04	0.05	1.20	99.76
80	IBM/SRC/REE/MS/(3037/95)/RH/PCS/80	69.65	12.46	4.44	0.33	1.42	0.15	0.10	3.92	6.03	0.03	1.24	99.76
81	IBM/SRC/REE/MS/(145/03)/RH/PCS/81	70.83	12.53	3.74	0.31	1.13	0.15	0.08	3.90	5.99	0.03	1.06	99.75
82	IBM/SRC/REE/MS/(145/03)/RH/PCS/82	69.45	12.72	4.30	0.38	1.58	0.23	0.10	4.01	5.86	0.05	1.09	99.77
83	IBM/SRC/REE/GR/(389/05)/GR/PCS/83	67.47	9.99	9.12	0.55	0.65	0.64	0.24	4.19	5.78	0.01	0.67	99.33
84	IBM/SRC/REE/GR/(389/05)/GR/PCS/84	66.25	10.02	9.93	0.50	0.69	0.44	0.25	4.44	5.85	0.02	0.45	98.84
85	IBM/SRC/REE/GR/(389/05)/GR/PCS/85	68.25	10.30	8.30	0.48	0.66	0.38	0.21	4.22	5.99	0.02	0.50	99.31
86	IBM/SRC/REE/GR/(64/90)/GR/PCS/86	68.37	9.09	9.86	0.54	0.63	0.28	0.21	4.28	5.54	0.02	0.42	99.24
87	IBM/SRC/REE/GR/(66/90)/GR/PCS/87	67.92	9.96	8.88	0.52	0.72	0.20	0.18	4.28	5.84	0.03	0.59	99.10

S.N.	Sample ID	SiO_2	Al_2O_3	Fe_2O_3	TiO_2	CaO	MgO	MnO	Na_2O	K_2O	P_2O_5	LOI	Sum
		in % by WD-XRF											
88	IBM/SRC/REE/GR/(68/90)/GR/PCS/88	68.58	9.82	8.23	0.52	0.67	0.14	0.16	4.21	6.21	0.02	0.65	99.21
	IBM/SRC/REE/GR/ (68/90)/GR/PCS/88_CK	71.6	9.39	4.4	0.46	0.61	0.07	0.08	4.59	4.88	0.02	0.68	
89	IBM/SRC/REE/GR/(47/05)/GR/PCS/89	67.79	9.49	9.05	0.51	0.66	0.44	0.21	4.17	6.20	0.01	0.56	99.08
90	IBM/SRC/REE/GR/(47/05)/GR/PCS/90	67.34	10.06	8.96	0.50	0.75	0.43	0.23	4.21	6.19	0.01	0.51	99.21
91	IBM/SRC/REE/GR/(47/05)/GR/PCS/91	67.94	9.22	9.60	0.53	0.65	0.56	0.25	4.05	5.75	0.02	0.55	99.11
92	IBM/SRC/REE/GR/(148/07)/GR/PCS/92	65.58	9.73	10.29	0.54	0.81	0.62	0.29	4.31	6.02	0.01	0.63	98.83
93	IBM/SRC/REE/GR/(148/07)/GR/PCS/93	64.94	9.24	11.28	0.61	0.87	0.69	0.31	4.40	5.90	0.01	0.74	99.00
	IBM/SRC/REE/GR/(148/07)/GR/PCS/93R	65.02	9.20	11.30	0.59	0.88	0.71	0.31	4.34	5.96	0.01	0.71	99.04
	GBW-07103 (Observed Value)	72.79	13.43	2.17	0.30	1.56	0.42	0.06	3.14	5.05	0.09	0.71	99.72
	GBW-07103 (Certified Value)	72.83	13.40	2.14	0.29	1.55	0.42	0.06	3.13	5.01	0.09	0.70	99.62
94	IBM/SRC/REE/GR/(148/07)/GR/PCS/94	65.97	9.20	11.01	0.50	0.73	0.64	0.28	4.26	5.86	0.01	0.63	99.09
95	IBM/SRC/REE/GR/(149/07)/GR/PCS/95	65.46	10.04	9.91	0.53	0.63	1.04	0.14	3.82	6.44	0.01	1.03	99.05
96	IBM/SRC/REE/GR/(149/07)/GR/PCS/96	65.23	9.77	10.74	0.57	0.87	0.96	0.17	3.88	5.90	0.01	0.94	99.03
97	IBM/SRC/REE/GR/(149/07)/GR/PCS/97	66.54	9.99	9.28	0.53	0.63	0.90	0.14	3.73	6.45	0.01	0.87	99.06
98	IBM/SRC/REE/GR/(221/03)/GR/PCS/98	67.72	9.10	9.77	0.46	0.80	0.31	0.21	4.09	5.82	0.01	0.74	99.05
99	IBM/SRC/REE/GR/(221/03)/GR/PCS/99	67.29	9.72	9.55	0.48	0.66	0.43	0.23	4.04	6.10	0.01	0.63	99.13
100	IBM/SRC/REE/GR/(221/03)/GR/PCS/100	67.06	9.74	9.88	0.47	0.69	0.50	0.24	4.24	5.56	0.01	0.73	99.13
101	IBM/SRC/REE/GR/(217/04)/GR/PCS/101	64.54	9.62	10.67	0.54	0.88	0.78	0.36	4.10	5.99	0.01	0.90	98.39
102	IBM/SRC/REE/GR/(217/04)/GR/PCS/102	64.26	9.49	10.57	0.56	1.26	0.97	0.39	4.14	5.73	0.02	1.16	98.55
103	IBM/SRC/REE/GR/(217/04)/GR/PCS/103	65.03	9.83	9.74	0.56	1.20	0.62	0.31	4.08	6.08	0.01	1.07	98.53
104	IBM/SRC/REE/GR/(265/04)/GR/PCS/104	63.37	10.64	11.23	0.67	1.00	0.60	0.29	5.11	5.13	0.06	1.07	99.15
105	IBM/SRC/REE/GR/(265/04)/GR/PCS/105	67.86	10.07	9.09	0.52	0.54	0.22	0.15	4.37	5.52	0.01	0.90	99.26
106	IBM/SRC/REE/GR/(265/04)/GR/PCS/106	69.88	9.76	7.93	0.50	0.51	0.21	0.14	4.02	5.48	0.01	0.93	99.38
107	IBM/SRC/REE/GR/(308/02)/GR/PCS/107	63.79	9.94	10.69	0.66	2.04	0.41	0.34	4.35	5.68	0.03	1.11	99.05
108	IBM/SRC/REE/GR/(308/02)/GR/PCS/108	63.12	9.91	11.27	0.86	1.93	0.51	0.36	4.39	5.50	0.03	1.04	98.93
109	IBM/SRC/REE/GR/(308/02)/GR/PCS/109	68.88	9.41	8.50	0.53	0.74	0.51	0.23	4.08	5.65	0.02	0.59	99.14
110	IBM/SRC/REE/GR/(615/02)/GR/PCS/110	68.62	9.34	9.55	0.48	0.57	0.39	0.23	4.06	5.61	0.01	0.50	99.36

S.N.	Sample ID	SiO_2	Al_2O_3	Fe_2O_3	TiO_2	CaO	MgO	MnO	Na_2O	K_2O	P_2O_5	LOI	Sum
		in % by WD-XRF											
	IBM/SRC/REE/GR/ (615/02)/GR/PCS/110_CK	71.62	8.84	4.97	0.43	0.57	0.21	0.11	4.58	4.49	0.02	0.53	96.37
111	IBM/SRC/REE/GR/(615/02)/GR/PCS/111	67.18	9.41	10.28	0.52	0.64	0.49	0.26	4.31	5.55	0.01	0.56	99.21
112	IBM/SRC/REE/GR/(615/02)/GR/PCS/112	66.35	9.33	10.73	0.56	0.71	0.54	0.28	4.33	5.73	0.01	0.60	99.15
113	IBM/SRC/REE/GR/(54/04)/GR/PCS/113	67.70	9.57	9.51	0.49	0.55	0.79	0.16	4.02	5.86	0.02	0.50	99.17
	IBM/SRC/REE/GR/(54/04)/GR/PCS/113R	67.78	9.62	9.46	0.50	0.57	0.81	0.14	3.96	5.92	0.02	0.48	99.26
	GBW-07103 (Observed Value)	72.76	13.36	2.17	0.27	1.59	0.44	0.06	3.10	5.05	0.10	0.68	99.58
	GBW-07103 (Certified Value)	72.83	13.40	2.14	0.29	1.55	0.42	0.06	3.13	5.01	0.09	0.70	99.62
114	IBM/SRC/REE/GR/(54/04)/GR/PCS/114	70.21	9.11	8.82	0.42	0.43	0.55	0.14	3.92	5.45	0.01	0.34	99.41
115	IBM/SRC/REE/GR/(54/04)/GR/PCS/115	66.97	9.47	10.17	0.55	0.57	0.81	0.17	3.91	5.65	0.02	0.52	98.80
116	IBM/SRC/REE/GR/(266/92)/GR/PCS/116	67.23	10.04	9.18	0.49	0.60	0.69	0.17	3.98	6.09	0.01	0.55	99.03
117	IBM/SRC/REE/GR/(266/92)/GR/PCS/117	67.66	10.05	8.64	0.55	0.52	0.53	0.21	4.21	6.25	0.01	0.42	99.06
118	IBM/SRC/REE/GR/(266/92)/GR/PCS/118	66.55	9.60	9.81	0.59	0.57	0.63	0.25	4.12	6.29	0.01	0.50	98.92
119	IBM/SRC/REE/GR/(87/05)/GR/PCS/119	66.62	10.21	9.07	0.58	0.60	0.67	0.24	4.12	6.06	0.02	0.61	98.78
120	IBM/SRC/REE/GR/(87/05)/GR/PCS/120	66.28	10.18	9.19	0.56	0.60	0.71	0.24	4.09	6.16	0.02	0.68	98.73
121	IBM/SRC/REE/GR/(87/05)/GR/PCS/121	67.14	9.72	9.31	0.58	0.60	0.67	0.24	4.00	5.81	0.02	0.66	98.74
122	IBM/SRC/REE/GR/(306/03)/GR/PCS/122	65.92	9.88	9.70	0.53	0.59	0.85	0.18	4.28	5.90	0.01	0.89	98.73
123	IBM/SRC/REE/GR/(306/03)/GR/PCS/123	64.72	9.97	10.37	0.55	0.70	0.97	0.19	4.19	5.93	0.01	1.07	98.67
124	IBM/SRC/REE/GR/(306/03)/GR/PCS/124	67.65	9.62	9.30	0.51	0.54	0.86	0.16	3.89	5.86	0.01	0.78	99.17
125	IBM/SRC/REE/GR/(320/04)/GR/PCS/125	67.90	9.71	9.24	0.47	0.59	0.27	0.18	4.22	5.74	0.01	0.81	99.13
126	IBM/SRC/REE/GR/(320/04)/GR/PCS/126	67.75	10.15	8.68	0.48	0.57	0.49	0.18	4.19	6.19	0.02	0.45	99.16
127	IBM/SRC/REE/GR/(320/04)/GR/PCS/127	65.23	10.10	10.35	0.60	0.74	0.53	0.23	4.40	5.94	0.02	0.62	98.76
128	IBM/SRC/REE/GR/(307/02)/GR/PCS/128	66.37	11.31	7.89	0.53	0.61	0.64	0.26	4.21	6.43	0.06	1.06	99.37
129	IBM/SRC/REE/GR/(307/02)/GR/PCS/129	64.82	11.15	9.26	0.67	0.63	0.74	0.27	4.47	6.21	0.02	0.81	99.04
130	IBM/SRC/REE/GR/(258/06)/GR/PCS/130	66.10	8.88	10.53	0.33	0.70	0.79	0.24	3.97	5.96	0.03	0.91	98.44
131	IBM/SRC/REE/GR/(258/06)/GR/PCS/131	67.31	11.62	7.02	0.44	0.62	0.20	0.17	4.48	6.43	0.03	0.94	99.26
132	IBM/SRC/REE/GR/(258/06)/GR/PCS/132	67.78	9.16	9.83	0.36	0.55	0.28	0.17	4.07	6.09	0.03	0.61	98.94
133	IBM/SRC/REE/GR/(100/04)/GR/PCS/133	67.79	9.33	9.75	0.55	0.55	0.53	0.21	4.16	5.91	0.01	0.49	99.27

S.N.	Sample ID	SiO_2	Al_2O_3	Fe_2O_3	TiO_2	CaO	MgO	MnO	Na_2O	K_2O	P_2O_5	LOI	Sum
		in % by WD-XRF											
	IBM/SRC/REE/GR/(100/04)/GR/PCS/133R	67.86	9.30	9.78	0.51	0.56	0.55	0.21	4.11	5.86	0.01	0.46	99.21
	GBW-07103 (Observed Value)	72.78	13.35	2.19	0.31	1.58	0.40	0.05	3.09	5.07	0.09	0.73	99.64
	GBW-07103 (Certified Value)	72.83	13.40	2.14	0.29	1.55	0.42	0.06	3.13	5.01	0.09	0.70	99.62
134	IBM/SRC/REE/GR/(100/04)/GR/PCS/134	71.60	8.43	8.73	0.43	0.37	0.27	0.15	3.79	5.38	0.01	0.42	99.58
135	IBM/SRC/REE/GR/(100/04)/GR/PCS/135	59.49	12.11	12.79	1.08	1.27	0.50	0.31	5.17	5.30	0.06	1.19	99.27
	IBM/SRC/REE/GR/ (100/04)/GR/PCS/135_CK	62.88	11.38	6.95	0.98	1.26	0.49	0.17	5.42	4.63	0.08	1.29	
136	IBM/SRC/REE/GR/(219/04)/GR/PCS/136	63.79	9.80	11.06	0.75	1.08	1.04	0.18	3.79	5.55	0.03	1.70	98.78
137	IBM/SRC/REE/GR/(219/04)/GR/PCS/137	62.59	9.66	11.89	0.72	0.95	0.65	0.29	4.00	5.30	0.03	2.84	98.91
138	IBM/SRC/REE/GR/(219/04)/GR/PCS/138	64.70	9.57	10.68	0.53	0.98	0.87	0.21	3.60	6.01	0.02	1.68	98.87
139	IBM/SRC/REE/GR/(263/04)/GR/PCS/139	65.78	9.83	10.51	0.56	0.82	1.01	0.18	4.05	5.14	0.03	1.50	99.42
140	IBM/SRC/REE/GR/(263/04)/GR/PCS/140	65.30	10.12	9.70	0.58	0.80	0.58	0.16	4.08	5.84	0.03	1.61	98.79
141	IBM/SRC/REE/GR/(263/04)/GR/PCS/141	66.88	9.98	9.08	0.59	0.85	0.77	0.18	4.07	5.85	0.03	0.93	99.19
142	IBM/SRC/REE/GR/(213/04)/GR/PCS/142	62.74	10.32	10.96	0.58	0.92	0.80	0.16	3.93	5.83	0.03	2.46	98.73
143	IBM/SRC/REE/GR/(213/04)/GR/PCS/143	63.75	9.77	11.31	0.62	0.92	0.67	0.18	3.78	5.86	0.02	1.77	98.65
144	IBM/SRC/REE/GR/(218/04)/GR/PCS/144	65.05	10.02	10.56	0.57	0.65	0.54	0.29	4.44	6.12	0.02	0.86	99.11
145	IBM/SRC/REE/GR/(218/04)/GR/PCS/145	64.19	9.50	10.16	0.65	1.07	1.00	0.41	4.15	6.16	0.01	1.41	98.71
	IBM/SRC/REE/GR/ (218/04)/GR/PCS/145_CK	68.75	9.52	5.01	0.53	0.89	0.5	0.18	5.04	4.83	0.02	0.94	
146	IBM/SRC/REE/GR/(218/04)/GR/PCS/146	64.53	10.34	9.78	0.59	0.82	0.51	0.32	4.34	6.70	0.03	1.10	99.04
147	IBM/SRC/REE/GR/(207/03)/GR/PCS/147	64.09	9.38	11.21	0.60	0.95	0.61	0.33	3.82	5.62	0.02	2.23	98.87
148	IBM/SRC/REE/GR/(207/03)/GR/PCS/148	68.49	9.62	8.26	0.49	0.64	0.44	0.18	3.80	6.27	0.02	0.91	99.10
149	IBM/SRC/REE/GR/(207/03)/GR/PCS/149	65.79	9.10	10.94	0.57	0.85	0.51	0.24	3.90	5.53	0.02	1.67	99.13
150	IBM/SRC/REE/GR/(365/05)/GR/PCS/150	68.80	10.29	7.04	0.47	0.71	0.10	0.13	4.32	6.48	0.02	0.79	99.15
151	IBM/SRC/REE/GR/(365/05)/GR/PCS/151	69.28	10.05	7.18	0.44	0.66	0.08	0.12	4.25	6.45	0.01	0.52	99.05
152	IBM/SRC/REE/GR/(365/05)/GR/PCS/152	69.94	9.84	7.26	0.48	0.46	0.07	0.09	3.84	6.47	0.01	0.77	99.22
153	IBM/SRC/REE/GR/(94/03)/GR/PCS/153	67.87	10.44	7.77	0.50	0.68	0.09	0.15	4.41	6.36	0.02	0.70	98.99
154	IBM/SRC/REE/GR/(94/03)/GR/PCS/154	68.17	10.70	7.15	0.47	0.68	0.14	0.13	4.38	6.11	0.02	0.96	98.93
155	IBM/SRC/REE/GR/(94/03)/GR/PCS/155	66.39	10.64	8.12	0.51	0.94	0.10	0.14	4.67	6.74	0.03	0.81	99.09

S.N.	Sample ID	SiO_2	Al_2O_3	Fe_2O_3	TiO_2	CaO	MgO	MnO	Na_2O	K_2O	P_2O_5	LOI	Sum
		in % by WD-XRF											
	IBM/SRC/REE/GR/ (94/03)/GR/PCS/155_CK	69.77	11	3.92	0.38	0.7	0.09	0.06	5.37	4.92	0.04	0.73	
	IBM/SRC/REE/GR/(94/03)/GR/PCS/155R	66.31	10.67	8.14	0.49	0.95	0.10	0.16	4.71	6.70	0.03	0.85	99.11
	GBW-07103 (Observed Value)	72.90	13.44	2.18	0.29	1.58	0.40	0.06	3.11	5.03	0.10	0.70	99.79
	GBW-07103 (Certified Value)	72.83	13.40	2.14	0.29	1.55	0.42	0.06	3.13	5.01	0.09	0.70	99.62
156	IBM/SRC/REE/GR/(57/99)/GR/PCS/156	67.26	11.42	7.11	0.44	0.65	0.08	0.15	4.74	6.63	0.03	0.85	99.35
157	IBM/SRC/REE/GR/(368/91)/GR/PCS/157	69.71	10.41	6.86	0.42	0.46	0.08	0.12	4.22	6.30	0.02	0.55	99.15
158	IBM/SRC/REE/MS/(131/06)/RH/PCS/158	60.39	10.26	13.69	0.83	2.17	0.16	0.26	4.54	5.94	0.08	0.78	99.10
159	IBM/SRC/REE/MS/(131/06)/RH/PCS/159	59.11	10.92	13.50	0.91	1.28	0.12	0.35	5.07	6.31	0.08	1.22	98.86
	IBM/SRC/REE/MS/ (131/06)/RH/PCS/159_CK	63.11	11.31	6.73	0.76	1.07	0.1	0.18	5.65	5.17	0.08	1.29	
160	IBM/SRC/REE/MS/(411/05)/RH/PCS/160	65.12	8.88	11.97	0.29	0.67	0.14	0.25	2.79	6.48	0.01	1.04	97.64
161	IBM/SRC/REE/MS/(412/05)/RH/PCS/161	67.38	8.14	11.58	0.27	0.33	0.12	0.15	3.03	5.82	0.01	0.94	97.76
	IBM/SRC/REE/MS/ (412/05)/RH/PCS/161_CK	69.38	7.72	5.44	0.22	0.36	0.14	0.07	6.57	4.79	0.01	0.84	
162	IBM/SRC/REE/MS/(411/05)/RH/PCS/162	66.15	8.61	11.91	0.27	0.63	0.14	0.14	2.29	6.18	0.02	1.30	97.63
163	IBM/SRC/REE/GR/(53/99)/GR/PCS/163	66.00	10.82	9.03	0.59	0.92	0.05	0.21	4.85	6.40	0.04	0.45	99.36
164	IBM/SRC/REE/GR/(54/99)/GR/PCS/164	65.72	11.16	8.91	0.61	0.90	0.05	0.22	4.96	6.55	0.04	0.37	99.48
165	IBM/SRC/REE/GR/(55/99)/GR/PCS/165	66.15	11.18	8.22	0.58	0.90	0.05	0.18	4.91	6.47	0.04	0.60	99.28
166	IBM/SRC/REE/GR/(56/99)/GR/PCS/166	65.42	11.12	9.03	0.64	1.00	0.05	0.21	4.94	6.50	0.04	0.50	99.45
167	IBM/SRC/REE/GR/(196/06)/GR/PCS/167	67.47	11.30	6.81	0.46	0.63	0.13	0.13	4.40	6.71	0.03	1.03	99.11
168	IBM/SRC/REE/GR/(196/06)/GR/PCS/168	67.30	10.72	7.35	0.47	0.64	0.12	0.17	4.03	7.00	0.03	0.93	98.76
169	IBM/SRC/REE/GR/(05/14)/GR/PCS/169	68.30	11.08	6.73	0.43	0.60	0.16	0.10	4.25	6.47	0.03	0.93	99.09
170	IBM/SRC/REE/GR/(05/14)/GR/PCS/170	63.26	9.32	12.27	0.66	0.98	0.37	0.24	3.89	6.11	0.02	1.16	98.27
171	IBM/SRC/REE/GR/(589/02)/SS/PCS/171	69.15	10.45	3.04	0.40	7.08	1.35	0.06	2.22	3.19	0.12	2.73	99.79
172	IBM/SRC/REE/MS/(24/18)/RH/PCS/172	61.34	12.32	10.46	0.74	1.42	0.61	0.23	5.88	5.06	0.12	1.32	99.50
173	IBM/SRC/REE/GR/(228/06)/GR/PCS/173	65.16	9.97	9.43	0.84	1.01	0.46	0.14	3.49	5.81	0.03	2.43	98.77
174	IBM/SRC/REE/GR/(68/07)/GR/PCS/174	66.24	9.51	10.27	0.61	0.73	0.21	0.12	3.85	6.17	0.02	1.17	98.90
175	IBM/SRC/REE/GR/(68/07)/GR/PCS/175	66.09	10.26	9.46	0.67	0.84	0.25	0.12	3.54	6.22	0.02	1.61	99.06
	IBM/SRC/REE/GR/(68/07)/GR/PCS/175R	66.16	10.28	9.42	0.66	0.82	0.25	0.11	3.50	6.27	0.02	1.65	99.14

S.N.	Sample ID	SiO_2	Al_2O_3	Fe_2O_3	TiO_2	CaO	MgO	MnO	Na_2O	K_2O	P_2O_5	LOI	Sum
		in % by WD-XRF											
	GBW-07103 (Observed Value)	72.75	13.43	2.17	0.28	1.57	0.43	0.06	3.16	5.04	0.09	0.68	99.66
	GBW-07103 (Certified Value)	72.83	13.40	2.14	0.29	1.55	0.42	0.06	3.13	5.01	0.09	0.70	99.62
176	IBM/SRC/REE/GR/(592/02)/GR/PCS/176	65.46	9.95	9.87	0.68	0.85	0.29	0.11	3.82	6.14	0.03	1.41	98.61
177	IBM/SRC/REE/GR/(592/02)/GR/PCS/177	66.18	9.86	8.93	0.69	1.00	0.33	0.20	3.85	5.86	0.04	1.50	98.45
178	IBM/SRC/REE/GR/(192/06)/GR/PCS/178	66.18	10.76	8.32	0.68	0.81	0.20	0.17	4.06	6.35	0.05	1.38	98.95
179	IBM/SRC/REE/GR/(192/06)/GR/PCS/179	66.74	10.74	7.85	0.52	0.77	0.16	0.12	4.13	6.41	0.04	1.16	98.65
180	IBM/SRC/REE/GR/(28/18)/GR/PCS/180	64.13	10.27	11.23	0.63	0.91	0.62	0.23	4.18	5.85	0.04	1.12	99.21
181	IBM/SRC/REE/GR/(28/18)/GR/PCS/181	59.74	11.83	12.26	0.99	1.52	0.30	0.31	5.68	5.56	0.07	0.72	98.99
182	IBM/SRC/REE/GR/(28/18)/GR/PCS/182	58.01	12.90	11.69	0.98	1.71	0.51	0.32	5.59	6.16	0.08	1.20	99.15
183	IBM/SRC/REE/GR/(264/04)/GR/PCS/183	64.18	9.95	11.11	0.70	0.73	0.65	0.23	4.31	6.24	0.03	0.58	98.71
184	IBM/SRC/REE/GR/(264/04)/GR/PCS/184	66.62	10.30	9.01	0.60	0.63	0.45	0.19	3.90	6.33	0.02	1.12	99.16
185	IBM/SRC/REE/GR/(264/04)/GR/PCS/185	67.74	9.67	9.44	0.47	0.59	0.46	0.16	4.00	5.95	0.02	0.75	99.25
186	IBM/SRC/REE/GR/(262/04)/GR/PCS/186	68.45	9.48	9.40	0.33	0.62	0.18	0.12	4.33	5.89	0.03	0.44	99.27
187	IBM/SRC/REE/GR/(262/04)/GR/PCS/187	67.23	9.95	9.65	0.30	0.50	0.18	0.15	4.28	6.60	0.02	0.30	99.15
	IBM/SRC/REE/GR/ (264/04)/GR/PCS/187_CK	70.74	9.63	4.99	0.24	0.48	0.08	0.07	4.99	5.07	0.02	0.24	
188	IBM/SRC/REE/GR/(262/04)/GR/PCS/188	67.58	9.51	9.39	0.37	0.56	0.26	0.22	3.89	6.48	0.02	0.52	98.80
189	IBM/SRC/REE/GR/(24/06)/GR/PCS/189	64.22	10.47	9.68	0.63	1.13	0.76	0.19	4.46	6.34	0.10	0.84	98.82
190	IBM/SRC/REE/GR/(24/06)/GR/PCS/190	65.24	9.39	11.41	0.38	0.64	0.28	0.13	4.21	6.47	0.01	0.69	98.86
	IBM/SRC/REE/GR/ (24/06)/GR/PCS/190_CK	69.61	9.13	5.27	0.32	0.58	0.14	0.06	5.18	5.18	0.02	0.63	
191	IBM/SRC/REE/GR/(61/06)/GR/PCS/191	66.20	9.11	10.51	0.54	0.58	0.82	0.14	3.38	6.27	0.03	1.16	98.73
192	IBM/SRC/REE/GR/(61/06)/GR/PCS/192	65.95	9.73	9.75	0.52	0.61	0.73	0.14	3.84	6.36	0.03	1.01	98.67
193	IBM/SRC/REE/GR/(61/06)/GR/PCS/193	63.69	9.82	10.63	0.62	1.17	0.71	0.27	3.95	6.61	0.02	1.19	98.68
	IBM/SRC/REE/GR/ (61/06)/GR/PCS/193_CK	67.48	9.87	5.48	0.52	0.96	0.4	0.13	4.7	5.29	0.03	1	
194	IBM/SRC/REE/GR/(29/22)/GR/PCS/194	64.82	10.81	10.64	0.76	0.30	0.29	0.36	2.58	6.38	0.02	2.29	99.25
195	IBM/SRC/REE/MS/(286/07)/RH/PCS/195	69.28	12.43	5.37	0.48	0.64	0.21	0.10	4.24	5.93	0.08	0.91	99.65
	IBM/SRC/REE/MS/(286/07)/RH/PCS/195R	69.20	12.40	5.41	0.49	0.62	0.22	0.10	4.27	5.97	0.09	0.87	99.64
	GBW-07103 (Observed Value)	72.78	13.44	2.11	0.32	1.52	0.40	0.05	3.10	4.99	0.08	0.71	99.50

S.N.	Sample ID	SiO_2	Al_2O_3	Fe_2O_3	TiO_2	CaO	MgO	MnO	Na_2O	K_2O	P_2O_5	LOI	Sum
		in % by WD-XRF											
	GBW-07103 (Certified Value)	72.83	13.40	2.14	0.29	1.55	0.42	0.06	3.13	5.01	0.09	0.70	99.62
196	IBM/SRC/REE/GR/(474/96)/GR/PCS/196	65.47	12.19	8.20	0.66	0.70	0.12	0.21	5.37	5.90	0.07	0.48	99.38
197	IBM/SRC/REE/GR/(474/96)/GR/PCS/197	65.58	12.95	6.86	0.45	0.73	0.11	0.16	5.29	7.20	0.08	0.23	99.64
198	IBM/SRC/REE/GR/(331/96)/GR/PCS/198	69.08	11.93	5.83	0.49	0.57	0.07	0.13	5.03	6.31	0.07	0.16	99.67
199	IBM/SRC/REE/GR/(331/96)/GR/PCS/199	67.88	11.93	6.61	0.54	0.63	0.06	0.14	4.99	6.74	0.06	0.12	99.72
200	IBM/SRC/REE/MS/(78/22)/RH/PCS/200	59.67	10.86	13.88	0.96	1.06	0.66	0.31	3.97	6.14	0.08	1.55	99.13
201	IBM/SRC/REE/MS/(78/22)/GR/PCS/201	65.62	9.89	8.86	0.51	1.00	0.80	0.27	3.59	6.23	0.06	2.02	98.85
202	IBM/SRC/REE/MS/(77/22)/RH/PCS/202	60.00	11.28	12.75	0.90	1.15	0.61	0.11	2.36	7.30	0.10	2.49	99.05
203	IBM/SRC/REE/MS/(38/21)/RH/PCS/203	58.58	12.07	12.69	0.92	1.55	0.92	0.19	4.24	5.35	0.16	2.71	99.39
204	IBM/SRC/REE/MS/(38/21)/RH/PCS/204	64.70	9.84	9.42	0.51	1.13	0.99	0.22	3.83	5.76	0.11	2.13	98.64
205	IBM/SRC/REE/MS/(236/06)/RH/PCS/205	62.58	9.77	12.71	0.90	0.36	2.91	0.14	0.40	5.61	0.06	3.40	98.84
206	IBM/SRC/REE/GR/(255/91)/GR/PCS/206	67.73	11.06	7.15	0.46	0.73	0.14	0.14	4.47	6.38	0.04	0.90	99.18
207	IBM/SRC/REE/MS/(PN113)/RH/PCS/207	58.00	11.29	13.61	0.83	1.29	0.43	0.35	5.78	6.31	0.05	1.23	99.18
	IBM/SRC/REE/MS/ (PN113)/RH/PCS/207_CK	60.74	11.02	6.96	0.76	1.23	0.29	0.18	7.84	5.35	0.07	1.15	
208	IBM/SRC/REE/MS/(PN113)/RH/PCS/208	63.49	9.60	10.94	0.41	1.25	1.80	0.21	3.41	5.14	0.03	2.17	98.45
209	IBM/SRC/REE/MS/(PN112)/RH/PCS/209	57.15	10.24	15.63	1.14	2.38	1.02	0.46	4.31	4.70	0.35	1.98	99.37
210	IBM/SRC/REE/MS/(PN111)/RH/PCS/210	57.05	11.84	14.05	1.21	1.53	0.95	0.32	4.11	5.70	0.18	2.62	99.56
211	IBM/SRC/REE/GR/(30/85)/GR/PCS/211	66.56	10.96	8.51	0.71	0.89	0.23	0.22	5.06	6.00	0.04	0.21	99.39
212	IBM/SRC/REE/GR/(17/94)/GR/PCS/212	66.30	11.30	8.34	0.62	0.88	0.16	0.22	5.17	6.09	0.05	0.27	99.40
213	IBM/SRC/REE/GR/(17/95)/GR/PCS/213	65.65	11.10	8.61	0.65	0.86	0.63	0.23	5.21	5.94	0.04	0.42	99.34
214	IBM/SRC/REE/GR/(18/95)/GR/PCS/214	65.99	11.40	8.54	0.67	0.85	0.11	0.22	5.10	6.28	0.04	0.25	99.45
215	IBM/SRC/REE/GR/(3062/95)/GR/PCS/215	66.22	11.91	8.09	0.72	0.62	0.07	0.16	5.30	5.82	0.04	0.59	99.53
	IBM/SRC/REE/GR/(3062/95)/GR/PCS/215R	66.28	11.89	8.12	0.70	0.61	0.08	0.14	5.34	5.79	0.04	0.57	99.56
	GBW-07103 (Observed Value)	72.93	13.36	2.16	0.30	1.58	0.40	0.07	3.14	4.98	0.08	0.69	99.69
	GBW-07103 (Certified Value)	72.83	13.40	2.14	0.29	1.55	0.42	0.06	3.13	5.01	0.09	0.70	99.62

CK: Check Sample; R : Repeat Sample

Annexure V: Analytical Results: Selected Trace elements

S. No.	Sample Id	Be	Ge	As	Rb	Sn	Th	U	Zr (%)	Hf	Nb	Ta	W	Sr	Ba	Cr	Ni	Cu	Zn	Ga	Pb
		in ppm by ICP-MS												in ppm by WD-XRF							
1	IBM/SRC/REE/MS/(354/05)/RH/PCS/01	22.87	4.08	53.55	125.63	0.62	23.05	4.27	0.44	93.41	23.08	3.17	92.56	29	<1	54	14	4	494	67	37
2	IBM/SRC/REE/MS/(354/05)/RH/PCS/02	19.06	4.12	34.95	152.58	0.54	17.49	2.90	0.31	66.23	30.68	4.70	9.48	33	<1	68	15	6	512	71	54
3	IBM/SRC/REE/MS/(32/01)/RH/PCS/03	15.53	3.95	32.97	213.64	0.52	19.81	3.04	0.32	75.14	27.90	3.09	8.61	30	<1	76	15	5	492	55	40
4	IBM/SRC/REE/MS/(33/01)/RH/PCS/04	19.55	3.90	51.46	165.57	0.53	22.20	3.47	0.42	90.68	29.37	3.42	7.08	33	<1	82	12	5	516	66	54
5	IBM/SRC/REE/GR/(73/09)/GR/PCS/05	38.40	4.73	50.62	292.44	0.96	24.32	7.14	0.83	196.66	39.46	8.31	9.40	30	<1	99	14	6	500	59	116
6	IBM/SRC/REE/GR/(264/91)/GR/PCS/06	41.93	4.89	52.36	281.69	1.04	92.39	11.83	0.85	196.16	50.71	6.99	3.54	39	24	134	15	<1	724	65	145
	IBM/SRC/REE/GR/(264/91)/GR/PCS/06_CK	3.96	3.09	3.81		4.44			783.50	13.37 ppm	48.92	1.78		14.58			35	18	539	10.16	231
7	IBM/SRC/REE/GR/(16/94)/GR/PCS/07	52.38	7.29	50.24	269.80	1.38	152.48	18.43	1.34	410.26	84.17	11.83	4.27	69	82	144	14	<1	753	62	173
8	IBM/SRC/REE/GR/(62/93)/GR/PCS/08	45.32	5.45	54.58	291.25	1.03	98.53	12.67	0.85	202.95	53.36	8.03	9.56	41	23	97	4	5	637	57	133
9	IBM/SRC/REE/GR/(107/88)/GR/PCS/09	45.32	5.11	43.96	270.79	1.11	98.83	12.31	0.83	190.44	46.67	5.27	6.39	49	25	108	14	2	637	64	116
10	IBM/SRC/REE/GR/(08/95)/GR/PCS/10	42.85	5.34	43.48	269.33	0.87	126.91	12.70	0.75	177.41	49.16	5.06	7.52	58	25	116	13	3	664	58	88
11	IBM/SRC/REE/GR/(205/09)/GR/PCS/11	42.14	4.34	54.08	294.34	1.01	90.09	10.96	0.60	139.20	47.65	6.12	2.75	43	24	92	12	3	632	64	116

S. No.	Sample Id	Be	Ge	As	Rb	Sn	Th	U	Zr (%)	Hf	Nb	Ta	W	Sr	Ba	Cr	Ni	Cu	Zn	Ga	Pb
		in ppm by ICP-MS												in ppm by WD-XRF							
12	IBM/SRC/REE/GR/(136/09)/GR/PCS/12	38.40	4.31	33.27	269.75	0.97	103.70	11.27	0.59	142.85	42.11	4.81	2.28	43	<1	119	15	3	598	63	111
13	IBM/SRC/REE/GR/(266/91)/GR/PCS/13	22.59	3.31	33.72	211.49	0.54	28.09	4.88	0.22	53.55	28.86	4.03	5.09	31	<1	104	14	5	363	60	68
14	IBM/SRC/REE/GR/(427/02)/GR/PCS/14	25.69	3.71	53.61	175.88	0.63	28.17	5.28	0.49	109.08	42.59	4.86	5.72	19	<1	85	12	4	512	62	54
15	IBM/SRC/REE/GR/(272/93)/GR/PCS/15	21.67	3.24	25.35	174.12	0.50	22.24	3.70	0.37	85.09	30.29	4.12	7.40	18	<1	106	13	5	483	59	60
16	IBM/SRC/REE/GR/(271/93)/GR/PCS/16	22.52	3.80	40.65	172.73	0.52	27.90	4.56	0.47	105.48	35.28	4.74	7.98	43	27	138	15	6	440	59	63
17	IBM/SRC/REE/GR/(240/02)/GR/PCS/17	21.46	3.50	46.70	189.60	0.57	25.17	4.15	0.33	74.92	24.22	3.30	6.81	16	<1	123	13	<1	478	57	61
18	IBM/SRC/REE/GR/(241/02)/GR/PCS/18	19.84	2.83	47.12	168.53	0.44	23.28	3.92	0.44	92.94	26.10	3.05	3.08	14	58	160	14	7	236	61	21
	IBM/SRC/REE/GR/(241/02)/GR/PCS/18_CK	11.25	13.30	10.17		14.70			754.72 ppm	12.05	54.48	2.86		58.36			31	18	205	53.97	<100
19	IBM/SRC/REE/GR/(31/06)/GR/PCS/19	38.83	5.05	34.77	238.72	0.80	84.05	9.77	0.50	114.77	48.15	7.81	5.18	13	<1	120	12	3	823	58	50
20	IBM/SRC/REE/GR/(231/02)/GR/PCS/20	21.11	3.16	30.00	171.42	0.52	26.43	4.74	0.38	84.33	28.27	3.21	3.81	19	<1	151	14	5	367	58	30
	IBM/SRC/REE/GR/(231/02)/GR/PCS/20R	19.69	3.04	28.31	165.56	0.48	25.12	4.54	0.36	79.29	26.91	2.95	3.48	20	<1	149	13	5	362	60	28
	NCSDC-73022 (Observed Value)	2.59	1.69	278.85	130.09	6.19	17.20	3.82	260.40	13.10	10.97	1.43	14.63	109	347	4	2	3	29	20	30
	NCSDC-73022 (Certified Value)	2.40	1.74	304.00	130.00	6.70	14.00	3.70	241.00	7.40	6.40	1.23	15.50	106	343	3.6	2.3	3.2	28	19	31

S. No.	Sample Id	Be	Ge	As	Rb	Sn	Th	U	Zr (%)	Hf	Nb	Ta	W	Sr	Ba	Cr	Ni	Cu	Zn	Ga	Pb
		in ppm by ICP-MS												in ppm by WD-XRF							
21	IBM/SRC/REE/GR/(10/18)/GR/PCS/21	16.16	3.25	36.05	175.78	0.64	24.97	3.80	0.32	77.21	23.45	2.45	101.32	41	71	60	13	2	409	61	38
22	IBM/SRC/REE/GR/(510/02)/GR/PCS/22	20.75	3.04	36.39	173.78	0.45	21.87	3.56	0.30	69.36	19.19	2.31	98.69	15	29	52	12	4	395	58	24
23	IBM/SRC/REE/GR/(511/02)/GR/PCS/23	31.77	6.12	43.96	178.04	0.94	77.15	14.39	1.28	272.26	58.85	10.49	80.28	48	34	48	10	2	890	41	184
24	IBM/SRC/REE/GR/(616/02)/GR/PCS/24	27.39	3.80	24.88	220.26	0.68	31.38	5.35	0.37	88.49	25.36	2.81	79.17	13	<1	59	10	4	487	62	44
25	IBM/SRC/REE/GR/(322/91)/GR/PCS/25	26.61	3.84	40.05	203.51	0.76	31.85	5.53	0.37	88.28	26.15	3.46	14.48	15	<1	136	15	<1	565	66	68
26	IBM/SRC/REE/GR/(71/90)/GR/PCS/26	20.82	3.10	21.69	194.14	0.49	25.70	4.27	0.30	65.87	24.02	2.39	5.55	18	<1	155	13	5	393	54	54
27	IBM/SRC/REE/GR/(86/91)/GR/PCS/27	29.01	3.96	30.91	219.40	0.62	32.33	4.82	0.29	71.89	23.29	2.67	4.12	27	<1	116	14	3	499	60	70
28	IBM/SRC/REE/GR/(30/07)/GR/PCS/28	25.69	4.23	46.53	205.46	0.71	32.37	7.58	0.72	162.24	37.49	4.72	9.44	44	<1	124	12	3	566	60	82
	IBM/SRC/REE/GR/(30/07)/GR/PCS/28_CK	10.31	10.00	8.58		1.90			2404.78 ppm	31.55	72.04	4.05		11.18			39	20	432	36.38	147
29	IBM/SRC/REE/GR/(219/91)/GR/PCS/29	18.07	12.00	25.08	184.05	0.54	21.23	4.51	0.32	68.69	13.79	2.02	105.90	91	<1	62	14	4	322	49	111
30	IBM/SRC/REE/GR/(220/91)/GR/PCS/30	37.13	4.79	35.95	242.81	0.78	76.49	8.59	0.40	88.16	36.26	3.75	164.48	15	<1	71	13	7	550	62	51
31	IBM/SRC/REE/GR/(222/91)/GR/PCS/31	19.69	3.16	40.84	203.52	0.62	25.68	4.38	0.29	65.34	31.34	4.06	12.59	23	<1	120	12	4	421	66	42
32	IBM/SRC/REE/GR/(66/00)/GR/PCS/32	19.76	3.46	39.27	208.72	0.60	28.78	4.41	0.28	62.91	29.00	3.26	10.96	16	<1	136	10	5	410	59	36

S. No.	Sample Id	Be	Ge	As	Rb	Sn	Th	U	Zr (%)	Hf	Nb	Ta	W	Sr	Ba	Cr	Ni	Cu	Zn	Ga	Pb
		in ppm by ICP-MS												in ppm by WD-XRF							
	IBM/SRC/REE/GR/(66/06)/GR/PCS/32_CK	14.18	12.44	9.21		12.83			555.68 ppm	8.89	81.72	2.87		2.4			24	15	273	56.37	<100
33	IBM/SRC/REE/GR/(228/91)/GR/PCS/33	30.00	5.52	36.01	210.74	0.62	54.03	6.69	0.39	81.10	36.58	5.08	6.06	25	42	127	13	7	366	62	27
34	IBM/SRC/REE/GR/(302/02)/GR/PCS/34	30.00	5.87	26.96	218.88	0.73	72.17	6.81	0.42	102.74	34.64	4.56	6.03	23	<1	111	16	5	638	57	90
35	IBM/SRC/REE/GR/(302/02)/GR/PCS/35	32.61	5.29	29.48	222.88	0.84	66.76	6.71	0.43	106.53	39.16	6.25	7.69	23	<1	94	16	<1	712	60	101
	IBM/SRC/REE/GR/(302/02)/GR/PCS/35_CK	20.29	20.04	15.11		18.50			854.26 ppm	17.14	153.31	8.95		78.46			36	42	472	67.63	165
36	IBM/SRC/REE/GR/(302/02)/GR/PCS/36	31.62	4.61	24.43	215.04	0.75	61.02	6.07	0.42	102.45	35.17	4.61	5.85	17	<1	106	6	<1	578	54	80
37	IBM/SRC/REE/GR/(146/03)/GR/PCS/37	26.82	3.64	20.32	208.70	0.68	47.96	4.74	0.35	78.61	31.54	3.51	73.96	29	24	101	17	2	583	56	97
38	IBM/SRC/REE/GR/(146/03)/GR/PCS/38	27.95	3.76	34.18	193.07	0.70	53.63	5.88	0.48	109.56	37.32	3.86	75.98	30	<1	92	13	<1	604	55	67
39	IBM/SRC/REE/GR/(146/03)/GR/PCS/39	13.76	2.30	30.12	200.75	0.27	3.27	0.84	0.20	54.86	12.84	1.12	35.64	15	88	41	18	<1	648	61	28
40	IBM/SRC/REE/GR/(584/02)/GR/PCS/40	23.51	3.39	26.34	189.36	0.62	48.30	4.12	0.27	59.72	20.12	2.72	62.68	24	43	81	10	<1	572	59	55
41	IBM/SRC/REE/GR/(584/02)/GR/PCS/41	27.88	3.32	25.79	202.90	0.68	51.17	4.15	0.20	47.43	19.58	2.05	49.15	27	<1	91	14	<1	578	64	74
42	IBM/SRC/REE/GR/(584/02)/GR/PCS/42	20.54	3.11	33.44	193.17	0.62	51.85	4.17	0.20	44.76	20.17	2.62	63.88	20	<1	79	13	<1	518	58	44
43	IBM/SRC/REE/GR/(27/06)/GR/PCS/43	27.74	4.22	38.97	213.53	0.76	51.15	5.68	0.39	88.46	37.64	6.21	10.26	35	<1	123	14	<1	598	58	90

S. No.	Sample Id	Be	Ge	As	Rb	Sn	Th	U	Zr (%)	Hf	Nb	Ta	W	Sr	Ba	Cr	Ni	Cu	Zn	Ga	Pb
		in ppm by ICP-MS												in ppm by WD-XRF							
44	IBM/SRC/REE/GR/(27/06)/GR/PCS/44	23.65	3.20	35.41	188.83	0.62	35.93	3.51	0.23	53.75	21.94	2.75	4.01	20	<1	145	13	4	549	54	50
45	IBM/SRC/REE/GR/(27/06)/GR/PCS/45	21.39	3.50	28.00	168.25	0.65	42.21	4.22	0.30	67.36	30.47	4.63	8.91	31	<1	72	18	<1	611	55	70
46	IBM/SRC/REE/GR/(99/04)/GR/PCS/46	21.46	3.15	37.53	171.07	0.65	33.40	4.33	0.27	63.72	32.00	4.31	15.85	20	<1	75	13	4	495	56	60
47	IBM/SRC/REE/GR/(99/04)/GR/PCS/47	23.15	3.15	38.77	193.05	0.65	26.74	4.08	0.27	63.67	32.91	4.40	5.83	21	21	129	15	6	443	62	55
	IBM/SRC/REE/GR/(99/01)/GR/PCS/47_CK	19.47	18.05	11.37		16.28			850.34 ppm	14.28	133.69	6.65		13.44			28	13	319	73.91	143
48	IBM/SRC/REE/GR/(99/04)/GR/PCS/48	20.47	3.36	28.66	219.88	0.68	28.56	4.51	0.33	78.97	30.31	4.57	5.63	25	69	124	18	6	578	68	61
49	IBM/SRC/REE/GR/(448/02)/GR/PCS/49	24.49	3.19	45.52	211.89	0.67	42.86	5.13	0.27	64.41	33.69	4.26	4.22	17	<1	118	11	<1	580	64	56
50	IBM/SRC/REE/GR/(448/02)/GR/PCS/50	27.32	3.43	39.92	219.11	0.71	47.97	4.32	0.23	57.80	32.15	4.15	4.46	15	<1	135	13	2	573	63	69
51	IBM/SRC/REE/GR/(448/02)/GR/PCS/51	22.88	4.11	61.97	259.82	1.02	36.23	5.20	0.30	70.17	28.76	5.22	7.65	14	<1	128	13	<1	548	59	57
52	IBM/SRC/REE/GR/(233/02)/GR/PCS/52	20.09	3.93	48.53	250.74	0.75	34.52	4.24	0.25	53.82	21.89	3.91	5.61	19	<1	137	13	<1	543	60	36
53	IBM/SRC/REE/GR/(233/02)/GR/PCS/53	19.81	3.84	53.92	246.02	0.82	40.20	4.00	0.21	49.17	15.20	2.20	61.17	22	<1	71	12	<1	490	59	71
	IBM/SRC/REE/GR/(233/02)/GR/PCS/53 R	20.04	3.72	51.42	241.66	0.76	34.81	3.75	0.20	46.87	14.20	2.11	63.75	21	<1	74	12	<1	497	57	73
	NCSDC-73022 (Observed Value)	2.62	1.83	304.27	129.76	6.72	13.69	3.68	220.19	6.68	5.32	1.19	14.65	110	357	4	3	3	30	18	30

S. No.	Sample Id	Be	Ge	As	Rb	Sn	Th	U	Zr (%)	Hf	Nb	Ta	W	Sr	Ba	Cr	Ni	Cu	Zn	Ga	Pb
		in ppm by ICP-MS												in ppm by WD-XRF							
	NCSDC-73022 (Certified Value)	2.40	1.74	304.00	130.00	6.70	14.00	3.70	241.00	7.40	6.40	1.23	15.50	106	343	3.6	2.3	3.2	28	19	31
54	IBM/SRC/REE/GR/(233/02)/GR/PCS/54	21.27	4.47	65.82	226.49	0.78	50.23	6.74	0.51	107.10	22.14	4.02	108.54	27	<1	66	7	<1	554	66	70
55	IBM/SRC/REE/GR/(232/02)/GR/PCS/55	21.43	3.41	46.45	250.33	0.74	43.85	5.50	0.32	71.15	13.78	2.77	114.05	15	<1	53	13	<1	615	64	77
56	IBM/SRC/REE/GR/(232/02)/GR/PCS/56	21.38	3.58	49.75	250.19	0.76	38.15	5.01	0.29	65.82	18.99	4.01	154.61	14	<1	69	14	5	657	59	57
57	IBM/SRC/REE/GR/(232/02)/GR/PCS/57	18.92	3.42	55.09	252.34	0.74	49.07	5.97	0.36	79.36	12.47	1.89	84.62	13	<1	51	10	3	617	57	76
58	IBM/SRC/REE/GR/(295/02)/GR/PCS/58	21.49	3.76	63.32	233.60	0.73	56.25	5.48	0.31	68.21	27.05	6.38	6.49	23	<1	172	15	4	583	59	64
59	IBM/SRC/REE/GR/(295/02)/GR/PCS/59	23.05	3.42	46.90	245.45	0.70	56.93	4.27	0.17	40.19	23.15	3.99	2.63	19	25	168	15	3	510	58	61
60	IBM/SRC/REE/GR/(295/02)/GR/PCS/60	18.81	3.73	59.24	264.59	0.86	61.56	5.49	0.27	61.31	17.50	2.49	130.38	22	<1	51	12	<1	672	59	84
61	IBM/SRC/REE/GR/(234/02)/GR/PCS/61	23.89	4.56	35.57	262.10	0.80	72.65	4.68	0.18	41.26	25.67	5.21	8.43	25	22	79	16	<1	610	56	95
	IBM/SRC/REE/GR/(234/02)/GR/PCS/61_CK	26.29	25.26	17.19		22.50			1151.18 ppm	19.48	153.42	8.70		25.66			31	35	433	81.47	163
62	IBM/SRC/REE/GR/(234/02)/GR/PCS/62	23.78	4.31	41.33	239.90	0.80	65.97	4.44	0.17	40.78	24.69	4.42	7.82	21	51	81	12	3	630	57	89
63	IBM/SRC/REE/GR/(234/02)/GR/PCS/63	22.83	4.24	57.56	251.71	0.86	74.39	6.75	0.30	67.53	32.95	6.89	9.94	25	36	94	16	4	567	61	69
64	IBM/SRC/REE/GR/(221/04)/GR/PCS/64	18.53	3.92	58.62	231.31	0.63	31.27	4.73	0.30	69.66	21.55	3.86	5.95	23	<1	129	13	5	490	63	66

S. No.	Sample Id	Be	Ge	As	Rb	Sn	Th	U	Zr (%)	Hf	Nb	Ta	W	Sr	Ba	Cr	Ni	Cu	Zn	Ga	Pb
		in ppm by ICP-MS												in ppm by WD-XRF							
65	IBM/SRC/REE/GR/(221/04)/GR/PCS/65	21.49	5.51	64.38	221.11	0.61	63.48	6.57	0.28	64.00	35.03	6.48	10.47	30	60	152	18	5	579	60	74
66	IBM/SRC/REE/GR/(221/04)/GR/PCS/66	11.55	2.71	35.53	191.80	0.41	15.27	2.37	0.18	40.72	14.32	2.35	8.55	24	<1	124	13	4	359	66	44
67	IBM/SRC/REE/GR/(176/06)/GR/PCS/67	26.18	4.15	40.20	220.69	0.69	74.52	7.26	0.27	60.53	31.96	5.42	6.70	19	67	135	17	5	768	56	92
68	IBM/SRC/REE/GR/(176/06)/GR/PCS/68	25.23	4.45	52.16	229.80	0.63	68.18	6.36	0.24	55.16	30.02	5.55	6.13	23	<1	125	13	3	546	65	73
	IBM/SRC/REE/GR/(176/06)/GR/PCS/68_CK	28.53	25.05	19.68		15.78			1258.58 ppm	20.20	207.10	10.94		36.93			33	18	373	86.85	147
69	IBM/SRC/REE/GR/(176/06)/GR/PCS/69	30.36	4.39	42.07	248.85	0.83	82.61	6.00	0.21	49.25	33.13	6.94	4.87	23	144	130	14	<1	582	60	61
70	IBM/SRC/REE/GR/(122/07)/GR/PCS/70	25.90	4.33	50.68	246.07	0.88	78.50	6.40	0.32	73.32	22.69	3.67	80.47	26	<1	42	10	2	743	64	84
71	IBM/SRC/REE/GR/(122/07)/GR/PCS/71	19.48	4.19	35.26	229.35	0.74	60.20	4.46	0.25	57.06	17.58	3.28	77.98	26	<1	40	15	2	608	55	86
72	IBM/SRC/REE/GR/(122/07)/GR/PCS/72	21.60	4.66	49.98	253.09	0.92	73.05	6.47	0.36	82.41	21.15	4.32	100.06	33	<1	48	15	<1	626	57	105
73	IBM/SRC/REE/GR/(420/92)/GR/PCS/73	23.33	4.99	35.39	237.04	0.94	64.54	6.32	0.48	105.72	18.41	3.84	82.90	33	24	49	14	<1	611	61	96
	IBM/SRC/REE/GR/(420/92)/GR/PCS/73R	22.72	5.01	36.18	240.67	0.94	66.17	6.34	0.49	107.20	19.99	3.91	82.54	35	27	46	16	<1	628	61	90
	NCSDC-73022 (Observed Value)	1.95	1.64	296.14	120.92	6.46	13.64	3.50	254.36	8.07	6.83	1.21	20.17	112	337	5	2	3	27	20	34
	NCSDC-73022 (Certified Value)	2.40	1.74	304.00	130.00	6.70	14.00	3.70	241.00	7.40	6.40	1.23	15.50	106	343	3.6	2.3	3.2	28	19	31

S. No.	Sample Id	Be	Ge	As	Rb	Sn	Th	U	Zr (%)	Hf	Nb	Ta	W	Sr	Ba	Cr	Ni	Cu	Zn	Ga	Pb
		in ppm by ICP-MS												in ppm by WD-XRF							
74	IBM/SRC/REE/MS/(95/07)/RH/PCS/74	2.12	1.64	62.44	115.57	0.25	15.75	2.89	0.12	26.74	5.27	0.97	206.88	13	67	106	11	9	187	34	20
75	IBM/SRC/REE/MS/(95/07)/RH/PCS/75	3.24	1.85	49.85	110.45	0.17	16.77	3.04	0.12	26.99	7.19	1.66	223.02	13	<1	98	13	7	19	32	16
76	IBM/SRC/REE/MS/(95/07)/RH/PCS/76	2.90	1.84	57.84	109.58	0.21	17.34	3.30	0.13	29.54	6.21	1.02	16.49	13	64	166	12	7	114	37	24
	IBM/SRC/REE/MS/(95/07)/RH/PCS/76_CK	5.06	30.17	91.20		8.61			1276.23 ppm	18.31	5.66	0.47		8.68			32	19	115	66.33	101
77	IBM/SRC/REE/MS/(227/97)/RH/PCS/77	3.63	1.79	57.94	106.03	0.16	17.11	3.25	0.14	29.58	7.95	1.85	7.58	14	56	200	16	7	129	36	19
	IBM/SRC/REE/MS/(227/97)/RH/PCS/77_CK	3.50	8.23	20.08		6.92			569.24 ppm	8.72	8.14	1.08		71.1			36	18	149	40.94	< 100
78	IBM/SRC/REE/MS/(227/97)/RH/PCS/78	3.07	1.92	60.25	111.28	0.15	17.19	3.26	0.15	30.56	7.83	2.53	4.58	14	53	198	11	7	120	40	16
79	IBM/SRC/REE/MS/(3037/95)/RH/PCS/79	3.63	1.88	64.30	117.56	0.16	17.55	3.39	0.14	29.70	6.48	1.74	11.41	22	133	119	15	11	201	39	8
80	IBM/SRC/REE/MS/(3037/95)/RH/PCS/80	3.35	2.14	44.66	119.57	0.18	18.08	3.51	0.15	31.61	5.43	1.21	10.73	12	59	120	12	13	185	38	21
81	IBM/SRC/REE/MS/(145/03)/RH/PCS/81	3.01	1.73	41.96	116.56	0.14	16.88	3.08	0.14	28.95	7.93	2.69	7.66	12	53	92	11	<1	160	35	12
82	IBM/SRC/REE/MS/(145/03)/RH/PCS/82	3.40	1.85	63.22	112.65	0.15	16.98	3.25	0.13	27.77	8.11	2.57	3.65	19	98	191	13	8	173	36	27
83	IBM/SRC/REE/GR/(389/05)/GR/PCS/83	19.59	4.25	34.96	205.55	0.57	61.34	5.52	0.30	67.40	26.12	4.89	1.84	17	<1	119	13	<1	514	58	62

S. No.	Sample Id	Be	Ge	As	Rb	Sn	Th	U	Zr (%)	Hf	Nb	Ta	W	Sr	Ba	Cr	Ni	Cu	Zn	Ga	Pb
		in ppm by ICP-MS												in ppm by WD-XRF							
84	IBM/SRC/REE/GR/(389/05)/GR/PCS/84	19.59	3.98	51.09	206.72	0.72	36.87	5.86	0.36	76.05	30.92	6.02	2.11	16	23	114	13	3	549	59	38
85	IBM/SRC/REE/GR/(389/05)/GR/PCS/85	17.69	3.37	43.47	197.75	0.60	36.41	4.85	0.29	66.68	24.40	4.26	1.56	16	<1	120	14	3	440	60	36
86	IBM/SRC/REE/GR/(64/90)/GR/PCS/86	20.60	3.33	51.56	176.77	0.56	62.30	5.58	0.29	59.87	23.70	4.64	2.26	23	<1	148	15	<1	595	55	60
87	IBM/SRC/REE/GR/(66/90)/GR/PCS/87	22.77	3.96	57.00	199.08	0.71	65.38	7.09	0.43	94.39	27.09	5.43	1.44	34	<1	125	13	2	560	57	52
88	IBM/SRC/REE/GR/(68/90)/GR/PCS/88	19.76	3.67	49.92	215.14	0.71	34.36	5.17	0.37	80.52	28.80	6.92	8.26	34	33	108	14	4	524	58	65
	IBM/SRC/REE/GR/(68/90)/GR/PCS/88_CK	29.97	28.71	24.00		24.49			3437.22 ppm	47.16	212.11	12.13		53.48			36	32	391	85.19	234
89	IBM/SRC/REE/GR/(47/05)/GR/PCS/89	18.75	3.71	38.09	227.00	0.75	34.82	4.55	0.25	56.20	21.67	4.01	5.45	23	<1	102	14	7	562	59	64
90	IBM/SRC/REE/GR/(47/05)/GR/PCS/90	18.92	4.02	49.41	222.35	0.74	37.36	5.23	0.27	61.18	25.87	4.19	5.82	25	<1	115	13	2	548	54	74
91	IBM/SRC/REE/GR/(47/05)/GR/PCS/91	16.52	3.15	27.88	202.64	0.79	37.00	4.36	0.22	49.42	17.39	3.62	75.04	20	<1	55	13	9	544	64	32
92	IBM/SRC/REE/GR/(148/07)/GR/PCS/92	22.16	4.47	61.20	218.53	0.80	71.18	6.58	0.44	98.57	21.69	3.62	69.67	30	50	30	16	5	708	66	44
93	IBM/SRC/REE/GR/(148/07)/GR/PCS/93	19.93	4.17	47.85	219.87	0.89	60.57	5.26	0.33	74.03	23.43	4.13	65.12	28	<1	40	18	5	715	64	32
	IBM/SRC/REE/GR/(148/07)/GR/PCS/93R	18.64	4.16	46.14	219.25	0.88	58.39	5.07	0.32	72.96	22.82	3.93	63.80	30	<1	41	16	5	702	60	30
	NCSDC-73022 (Observed Value)	1.84	1.30	259.61	106.51	5.66	11.93	2.97	212.60	6.78	6.51	1.01	15.36	102	348	4	2	3	30	18	30

S. No.	Sample Id	Be	Ge	As	Rb	Sn	Th	U	Zr (%)	Hf	Nb	Ta	W	Sr	Ba	Cr	Ni	Cu	Zn	Ga	Pb
		in ppm by ICP-MS												in ppm by WD-XRF							
	NCSDC-73022 (Certified Value)	2.40	1.74	304.00	130.00	6.70	14.00	3.70	241.00	7.40	6.40	1.23	15.50	106	343	3.6	2.3	3.2	28	19	31
94	IBM/SRC/REE/GR/(148/07)/GR/PCS/94	24.61	4.17	37.60	225.62	0.82	85.19	5.36	0.25	56.95	18.02	2.68	61.05	30	<1	49	10	<1	751	62	74
95	IBM/SRC/REE/GR/(149/07)/GR/PCS/95	19.87	3.49	51.73	226.07	0.79	48.30	5.37	0.32	71.42	17.69	3.11	69.98	18	<1	44	14	<1	615	63	65
96	IBM/SRC/REE/GR/(149/07)/GR/PCS/96	14.85	3.32	44.09	202.30	0.77	54.83	4.49	0.24	54.13	16.12	2.64	69.90	17	<1	44	15	6	602	59	60
97	IBM/SRC/REE/GR/(149/07)/GR/PCS/97	18.14	3.66	64.24	219.59	0.81	33.73	5.85	0.40	87.82	22.16	4.08	10.36	21	<1	93	16	2	589	60	61
98	IBM/SRC/REE/GR/(221/03)/GR/PCS/98	17.97	3.24	42.90	208.98	0.74	36.31	4.03	0.31	71.84	20.96	4.72	7.07	34	<1	96	16	3	602	61	42
99	IBM/SRC/REE/GR/(221/03)/GR/PCS/99	17.75	3.19	49.16	210.17	0.73	35.89	4.41	0.28	66.47	22.29	3.94	4.90	27	<1	107	8	3	552	66	48
100	IBM/SRC/REE/GR/(221/03)/GR/PCS/100	19.70	3.07	51.47	212.22	0.78	67.96	5.95	0.30	68.83	21.29	3.81	47.34	24	<1	79	14	<1	583	55	48
101	IBM/SRC/REE/GR/(217/04)/GR/PCS/101	25.80	4.24	13.79	260.41	1.20	70.20	4.90	0.29	66.57	21.40	5.87	47.89	30	54	30	15	<1	797	57	52
102	IBM/SRC/REE/GR/(217/04)/GR/PCS/102	29.17	4.31	9.30	240.38	1.03	78.40	5.13	0.32	71.19	20.66	4.77	52.28	36	<1	35	8	3	950	60	40
103	IBM/SRC/REE/GR/(217/04)/GR/PCS/103	24.42	4.08	8.33	262.80	1.04	62.35	4.52	0.27	59.83	18.49	5.02	71.44	25	<1	35	11	3	647	59	92

S. No.	Sample Id	Be	Ge	As	Rb	Sn	Th	U	Zr (%)	Hf	Nb	Ta	W	Sr	Ba	Cr	Ni	Cu	Zn	Ga	Pb
		in ppm by ICP-MS												in ppm by WD-XRF							
104	IBM/SRC/REE/GR/(265/04)/GR/PCS/104	25.94	4.75	28.30	225.57	0.99	61.26	5.62	0.33	72.55	27.35	4.57	142.92	30	55	36	15	6	609	66	83
105	IBM/SRC/REE/GR/(265/04)/GR/PCS/105	25.57	4.71	12.42	250.09	0.88	50.13	3.77	0.20	45.59	11.93	1.73	82.10	17	40	44	13	5	508	56	65
106	IBM/SRC/REE/GR/(265/04)/GR/PCS/106	25.52	4.39	13.48	250.78	0.88	45.55	3.12	0.17	42.17	24.27	5.99	10.89	15	51	78	16	3	479	61	70
107	IBM/SRC/REE/GR/(308/02)/GR/PCS/107	25.99	5.04	11.49	261.37	0.88	64.73	6.42	0.61	125.15	27.00	5.53	10.08	32	<1	80	18	6	690	62	102
108	IBM/SRC/REE/GR/(308/02)/GR/PCS/108	26.03	6.32	19.77	252.06	1.26	73.22	8.40	0.89	180.40	51.01	12.42	24.88	37	<1	51	3	5	722	58	108
109	IBM/SRC/REE/GR/(308/02)/GR/PCS/109	26.54	5.14	12.07	267.44	0.86	69.28	4.95	0.27	60.68	22.66	6.87	6.53	21	<1	141	15	<1	625	57	61
110	IBM/SRC/REE/GR/(615/02)/GR/PCS/110	22.76	3.67	11.29	241.51	0.73	49.68	4.30	0.20	43.01	24.48	6.07	2.30	18	<1	120	15	4	484	61	25
	IBM/SRC/REE/GR/(615/02)/GR/PCS/110_CK	11.41	8.26	7.50		10.26			566.55 ppm	9.50	86.47	2.68		56.95			31	27	353	35.7	112
111	IBM/SRC/REE/GR/(615/02)/GR/PCS/111	27.00	4.23	12.26	257.97	0.83	61.31	4.61	0.22	48.77	25.61	6.65	1.80	17	<1	115	11	4	511	46	45

S. No.	Sample Id	Be	Ge	As	Rb	Sn	Th	U	Zr (%)	Hf	Nb	Ta	W	Sr	Ba	Cr	Ni	Cu	Zn	Ga	Pb
		in ppm by ICP-MS												in ppm by WD-XRF							
112	IBM/SRC/REE/GR/(615/02)/GR/PCS/112	25.43	4.33	12.26	247.26	0.82	65.99	4.76	0.22	47.42	28.60	7.32	2.97	20	<1	104	14	<1	566	59	66
113	IBM/SRC/REE/GR/(54/04)/GR/PCS/113	16.75	3.54	10.05	234.92	0.70	41.25	3.69	0.24	48.75	20.53	4.58	2.29	10	<1	151	12	2	480	62	34
	IBM/SRC/REE/GR/(54/04)/GR/PCS/113R	18.37	3.50	9.93	236.04	0.70	45.24	3.72	0.23	48.66	20.13	4.56	2.19	12	<1	159	14	2	490	58	36
	NCSDC-73022 (Observed Value)	1.80	1.75	330.14	139.13	7.01	13.84	3.63	262.62	7.76	7.69	1.46	12.19	101	348	4	2	3	30	20	28
	NCSDC-73022 (Certified Value)	2.40	1.74	304.00	130.00	6.70	14.00	3.70	241.00	7.40	6.40	1.23	15.50	106	343	3.6	2.3	3.2	28	19	31
114	IBM/SRC/REE/GR/(54/04)/GR/PCS/114	16.75	3.26	16.15	225.56	0.69	28.37	3.20	0.23	46.69	16.96	3.28	3.43	11	<1	132	14	<1	389	51	11
115	IBM/SRC/REE/GR/(54/04)/GR/PCS/115	18.74	3.76	16.06	229.29	0.85	49.78	4.26	0.28	58.67	23.94	4.53	19.52	11	<1	77	15	7	506	55	38
116	IBM/SRC/REE/GR/(266/92)/GR/PCS/116	24.32	4.09	11.53	265.92	0.83	52.65	4.28	0.19	43.57	25.74	5.89	6.23	16	<1	110	13	4	482	61	50
117	IBM/SRC/REE/GR/(266/92)/GR/PCS/117	26.77	4.23	13.98	281.72	1.09	50.55	4.64	0.24	55.70	29.09	6.65	7.65	16	<1	96	11	4	594	56	61
118	IBM/SRC/REE/GR/(266/92)/GR/PCS/118	26.31	4.93	11.77	291.63	1.22	72.61	5.71	0.27	60.58	22.75	3.96	109.07	15	<1	44	15	<1	738	55	104
119	IBM/SRC/REE/GR/(87/05)/GR/PCS/119	39.79	6.86	14.55	295.44	1.08	108.34	8.53	0.28	63.41	26.59	4.89	116.76	17	<1	54	17	2	623	64	89

S. No.	Sample Id	Be	Ge	As	Rb	Sn	Th	U	Zr (%)	Hf	Nb	Ta	W	Sr	Ba	Cr	Ni	Cu	Zn	Ga	Pb
		in ppm by ICP-MS												in ppm by WD-XRF							
120	IBM/SRC/REE/GR/(87/05)/GR/PCS/120	33.83	6.68	12.63	292.66	1.08	103.49	7.17	0.24	53.28	26.52	5.36	99.23	21	<1	41	11	<1	599	66	98
121	IBM/SRC/REE/GR/(87/05)/GR/PCS/121	33.42	6.77	18.03	268.03	1.09	110.76	8.35	0.29	63.63	26.49	5.14	117.53	19	52	46	14	4	639	55	87
122	IBM/SRC/REE/GR/(306/03)/GR/PCS/122	26.36	5.03	12.65	250.13	0.89	66.79	5.79	0.30	60.61	19.58	2.44	124.88	21	<1	49	11	<1	595	54	67
123	IBM/SRC/REE/GR/(306/03)/GR/PCS/123	24.60	4.74	10.12	242.39	0.95	64.12	5.92	0.30	61.80	19.60	3.71	64.74	22	<1	52	14	7	582	66	68
124	IBM/SRC/REE/GR/(306/03)/GR/PCS/124	23.03	4.72	11.57	241.96	0.81	57.76	4.58	0.25	52.19	17.79	2.92	149.64	16	<1	60	12	<1	446	58	47
125	IBM/SRC/REE/GR/(320/04)/GR/PCS/125	28.85	5.10	13.53	261.88	0.93	64.37	4.38	0.19	40.19	16.84	2.57	99.13	21	34	57	10	2	570	58	81
126	IBM/SRC/REE/GR/(320/04)/GR/PCS/126	29.13	4.78	13.50	293.50	1.01	63.11	5.17	0.23	48.30	16.80	2.59	116.29	13	<1	60	14	4	500	57	70
127	IBM/SRC/REE/GR/(320/04)/GR/PCS/127	26.68	5.88	12.66	274.95	1.12	85.55	7.03	0.26	55.00	25.84	5.78	85.87	21	120	45	7	3	652	58	117
128	IBM/SRC/REE/GR/(307/02)/GR/PCS/128	22.89	4.21	15.34	262.83	0.65	53.00	4.12	0.27	58.28	27.28	5.32	12.97	21	191	99	10	<1	441	59	53
129	IBM/SRC/REE/GR/(307/02)/GR/PCS/129	25.43	6.77	14.09	279.68	0.86	66.04	5.18	0.26	56.86	38.63	8.84	26.20	14	86	67	10	12	630	59	76

S. No.	Sample Id	Be	Ge	As	Rb	Sn	Th	U	Zr (%)	Hf	Nb	Ta	W	Sr	Ba	Cr	Ni	Cu	Zn	Ga	Pb
		in ppm by ICP-MS												in ppm by WD-XRF							
130	IBM/SRC/REE/GR/(258/06)/GR/PCS/130	47.04	8.07	21.48	319.70	1.23	125.15	7.37	0.58	134.63	54.12	9.90	16.66	44	32	55	14	7	1007	55	173
131	IBM/SRC/REE/GR/(258/06)/GR/PCS/131	22.29	5.12	17.58	266.68	0.63	39.31	3.28	0.26	57.37	26.90	6.18	3.96	33	74	96	16	<1	461	64	57
132	IBM/SRC/REE/GR/(258/06)/GR/PCS/132	32.73	5.27	16.21	300.81	1.12	75.93	6.05	0.57	125.88	35.29	7.00	2.61	33	<1	90	12	2	646	63	137
133	IBM/SRC/REE/GR/(100/04)/GR/PCS/133	22.20	5.33	15.36	257.36	0.84	70.47	5.11	0.18	39.57	38.29	9.43	5.31	14	21	96	13	1	596	62	81
	IBM/SRC/REE/GR/(100/04)/GR/PCS/133R	21.88	5.36	15.90	253.46	0.83	69.50	5.05	0.18	38.81	33.30	9.38	5.08	12	23	100	13	1	603	59	83
	NCSDC-73022 (Observed Value)	2.77	1.82	316.63	134.73	6.77	13.55	3.49	250.53	7.22	8.65	1.40	12.25	110	349	3	2	2	31	17	34
	NCSDC-73022 (Certified Value)	2.40	1.74	304.00	130.00	6.70	14.00	3.70	241.00	7.40	6.40	1.23	15.50	106	343	3.6	2.3	3.2	28	19	31
134	IBM/SRC/REE/GR/(100/04)/GR/PCS/134	16.80	3.97	15.68	222.00	0.68	44.42	3.36	0.13	27.24	22.82	5.18	2.24	11	130	131	13	2	483	55	35
135	IBM/SRC/REE/GR/(100/04)/GR/PCS/135	21.92	6.06	27.29	159.87	0.69	34.40	6.67	0.21	57.42	48.46	10.55	5.70	30	<1	54	13	6	546	65	32
	IBM/SRC/REE/GR/(100/04)/GR/PCS/135_CK	17.58	23.33	27.39		13.75			1704.43 ppm	25.81	182.76	11.72		37.62			41	20	415	83.19	133

S. No.	Sample Id	Be	Ge	As	Rb	Sn	Th	U	Zr (%)	Hf	Nb	Ta	W	Sr	Ba	Cr	Ni	Cu	Zn	Ga	Pb
		in ppm by ICP-MS												in ppm by WD-XRF							
136	IBM/SRC/REE/GR/(219/04)/GR/PCS/136	24.85	4.85	31.01	234.94	3.08	48.69	6.61	0.34	76.53	32.59	2.35	90.66	38	<1	51	15	8	736	61	74
137	IBM/SRC/REE/GR/(219/04)/GR/PCS/137	10.78	2.13	12.01	95.78	1.32	23.15	2.37	0.14	30.79	17.14	0.62	46.59	57	54	39	16	9	666	56	86
138	IBM/SRC/REE/GR/(219/04)/GR/PCS/138	21.17	3.31	24.80	207.13	2.09	41.42	4.33	0.23	53.75	26.13	0.86	67.82	36	<1	46	15	6	722	58	69
139	IBM/SRC/REE/GR/(263/04)/GR/PCS/139	20.70	3.99	27.31	206.37	1.96	39.54	5.12	0.26	56.72	32.90	2.78	2.72	35	<1	134	13	2	663	57	51
140	IBM/SRC/REE/GR/(263/04)/GR/PCS/140	18.87	3.21	22.88	199.33	2.08	34.17	4.09	0.24	62.85	26.92	2.45	3.63	24	<1	116	12	<1	743	66	116
141	IBM/SRC/REE/GR/(263/04)/GR/PCS/141	20.03	3.74	22.01	210.20	1.66	36.93	4.61	0.23	53.73	35.68	2.03	1.15	28	<1	125	12	<1	540	59	29
142	IBM/SRC/REE/GR/(213/04)/GR/PCS/142	25.02	3.82	18.96	196.88	2.80	46.90	4.71	0.28	59.42	20.80	2.18	54.35	56	<1	46	8	<1	699	66	67
143	IBM/SRC/REE/GR/(213/04)/GR/PCS/143	24.21	5.10	24.18	202.29	2.57	49.51	4.86	0.25	58.45	26.29	1.02	76.73	52	<1	47	6	3	687	66	69
144	IBM/SRC/REE/GR/(218/04)/GR/PCS/144	24.14	4.72	27.30	236.66	2.23	49.96	5.61	0.19	42.97	34.68	1.15	87.08	23	33	53	14	10	605	68	80

S. No.	Sample Id	Be	Ge	As	Rb	Sn	Th	U	Zr (%)	Hf	Nb	Ta	W	Sr	Ba	Cr	Ni	Cu	Zn	Ga	Pb
		in ppm by ICP-MS												in ppm by WD-XRF							
145	IBM/SRC/REE/GR/(218/04)/GR/PCS/145	25.75	5.18	20.73	266.26	2.75	63.13	8.18	0.27	70.66	25.53	1.06	54.61	29	<1	47	19	7	1004	63	33
	IBM/SRC/REE/GR/(218/04)/GR/PCS/145_CK	24.44	26.36	21.74		29.81			1280.87 ppm	21.54	181.32	12.35		27.64			35	17	660	83.55	108
146	IBM/SRC/REE/GR/(218/04)/GR/PCS/146	16.26	3.40	14.96	223.14	1.95	33.30	3.72	0.19	42.34	18.03	0.59	78.25	34	<1	63	12	5	755	77	86
147	IBM/SRC/REE/GR/(207/03)/GR/PCS/147	26.60	5.72	16.43	242.27	2.65	74.99	6.06	0.45	111.47	33.07	1.57	67.53	69	70	59	10	6	865	61	45
148	IBM/SRC/REE/GR/(207/03)/GR/PCS/148	21.91	2.98	17.72	231.29	1.87	39.40	3.73	0.28	55.66	16.39	0.61	73.08	30	<1	57	17	2	467	63	85
149	IBM/SRC/REE/GR/(207/03)/GR/PCS/149	27.88	5.67	19.65	240.58	2.21	59.35	4.88	0.36	82.81	38.55	3.31	2.29	50	30	138	10	2	722	59	29
150	IBM/SRC/REE/GR/(365/05)/GR/PCS/150	22.28	3.51	92.63	270.00	2.32	42.61	5.89	0.33	75.88	33.31	5.30	1.94	32	<1	160	12	4	517	65	81
	IBM/SRC/REE/GR/(365/05)/GR/PCS/150R	24.17	3.60	94.44	269.94	2.40	41.46	5.68	0.34	76.90	37.19	5.74	1.62	32	<1	112	17	<1	519	66	81
	NCSDC-73022 (Observed Value)	2.14	1.90	284.74	137.15	5.87	12.68	3.73	248.79	6.66	6.01	1.37	14.74	21	<1	149	14	3	460	59	80
	NCSDC-73022 (Certified Value)	2.40	1.74	304.00	130.00	6.70	14.00	3.70	241.00	7.40	6.40	1.23	15.50	58	<1	139	14	<1	608	65	120

S. No.	Sample Id	Be	Ge	As	Rb	Sn	Th	U	Zr (%)	Hf	Nb	Ta	W	Sr	Ba	Cr	Ni	Cu	Zn	Ga	Pb
		in ppm by ICP-MS												in ppm by WD-XRF							
151	IBM/SRC/REE/GR/(365/05)/GR/PCS/151	25.67	3.55	25.08	251.97	2.17	45.73	5.05	0.27	64.62	21.46	0.71	59.15	49	47	131	11	<1	493	65	101
152	IBM/SRC/REE/GR/(365/05)/GR/PCS/152	27.77	4.55	25.13	325.67	2.21	45.14	5.49	0.30	74.12	36.05	2.92	3.44	39	61	140	17	4	599	71	93
153	IBM/SRC/REE/GR/(94/03)/GR/PCS/153	29.03	6.56	23.53	314.57	2.82	54.95	7.91	0.32	69.51	43.24	3.15	1.73	41	58	144	18	4	593	73	95
154	IBM/SRC/REE/GR/(94/03)/GR/PCS/154	22.34	3.79	17.80	272.22	2.44	42.96	5.34	0.26	57.21	37.12	2.24	1.00	109	353	4	2	2	26	20	33
155	IBM/SRC/REE/GR/(94/03)/GR/PCS/155	27.22	5.43	23.42	292.84	2.11	54.23	8.50	0.35	68.58	43.75	2.29	1.28	106	343	3.6	2.3	3.2	28	19	31
	IBM/SRC/REE/GR/(94/03)/GR/PCS/155_CK	26.59	28.15	23.17		15.08			2009.67 ppm	23.10	196.07	9.18		36.04			37	16	354	94.81	146
156	IBM/SRC/REE/GR/(57/99)/GR/PCS/156	22.85	3.93	21.30	300.05	1.77	36.15	5.73	0.27	54.24	30.10	1.71	1.41	36	50	119	13	<1	535	71	73
157	IBM/SRC/REE/GR/(368/91)/GR/PCS/157	24.43	3.62	14.87	312.73	2.32	41.86	6.09	0.30	65.05	25.21	1.25	1.23	44	<1	129	13	<1	475	64	99
158	IBM/SRC/REE/MS/(131/06)/RH/PCS/158	26.11	4.71	29.22	251.48	2.34	34.77	6.34	0.58	113.74	51.46	3.13	44.72	37	<1	51	13	4	670	64	108
159	IBM/SRC/REE/MS/(131/06)/RH/PCS/159	24.85	4.87	23.72	236.76	2.51	32.19	5.04	0.64	144.93	63.02	7.07	20.18	46	<1	74	15	5	671	63	96

S. No.	Sample Id	Be	Ge	As	Rb	Sn	Th	U	Zr (%)	Hf	Nb	Ta	W	Sr	Ba	Cr	Ni	Cu	Zn	Ga	Pb
		in ppm by ICP-MS												in ppm by WD-XRF							
	IBM/SRC/REE/MS/(131/06)/RH/PCS/159_CK	28.08	25.91	18.95		35.57			3427.60 ppm	54.31	267.56	22.60		37.25			35	18	460	89.99	185
160	IBM/SRC/REE/MS/(411/05)/RH/PCS/160	41.80	10.01	22.05	476.87	4.13	77.30	15.45	1.39	298.33	51.40	4.00	19.45	33	<1	83	15	12	1036	46	72
161	IBM/SRC/REE/MS/(412/05)/RH/PCS/161	46.34	7.86	21.41	593.62	3.75	45.21	5.94	0.64	187.90	41.62	2.51	26.87	24	<1	100	8	15	1053	52	142
	IBM/SRC/REE/MS/(412/05)/RH/PCS/161_CK	40.68	44.77	27.14		46.27			3632.32 ppm	57.93	234.79	8.84		29.79			39	29	811	107.56	214
162	IBM/SRC/REE/MS/(411/05)/RH/PCS/162	73.48	9.76	21.27	482.87	3.77	50.88	6.68	0.63	169.08	48.98	3.22	6.64	32	<1	80	19	9	1043	41	94
163	IBM/SRC/REE/GR/(53/99)/GR/PCS/163	17.32	4.41	25.79	194.00	1.55	33.14	5.60	0.53	101.90	28.64	1.83	12.85	32	<1	76	15	10	487	54	68
164	IBM/SRC/REE/GR/(54/99)/GR/PCS/164	15.83	3.78	28.82	198.41	1.34	26.95	4.14	0.38	80.97	13.03	0.79	70.71	26	<1	56	14	4	472	62	60
165	IBM/SRC/REE/GR/(55/99)/GR/PCS/165	15.73	4.05	20.49	180.43	1.33	25.83	4.61	0.42	81.95	23.34	0.67	69.97	29	43	50	8	5	450	60	63
166	IBM/SRC/REE/GR/(56/99)/GR/PCS/166	15.96	3.93	29.50	203.52	1.27	29.86	4.91	0.46	90.87	25.90	1.71	109.74	28	31	54	14	5	492	61	71
167	IBM/SRC/REE/GR/(196/06)/GR/PCS/167	27.59	4.41	24.52	356.05	2.74	44.14	6.53	0.43	93.83	31.91	2.08	85.61	45	34	57	13	<1	567	63	107

S. No.	Sample Id	Be	Ge	As	Rb	Sn	Th	U	Zr (%)	Hf	Nb	Ta	W	Sr	Ba	Cr	Ni	Cu	Zn	Ga	Pb
		in ppm by ICP-MS												in ppm by WD-XRF							
168	IBM/SRC/REE/GR/(196/06)/GR/PCS/168	39.26	4.93	19.77	339.92	2.60	63.44	7.45	0.36	79.61	27.23	0.88	69.33	51	31	52	18	<1	660	67	213
169	IBM/SRC/REE/GR/(05/14)/GR/PCS/169	28.02	4.92	25.76	339.04	2.72	64.39	8.27	0.63	147.33	30.45	1.92	89.65	45	<1	60	13	<1	507	61	121
170	IBM/SRC/REE/GR/(05/14)/GR/PCS/170	45.03	7.62	24.54	490.19	8.19	103.08	16.19	1.91	482.00	74.74	11.67	56.60	105	<1	32	19	8	714	61	319
171	IBM/SRC/REE/GR/(589/02)/SS/PCS/171	2.88	0.91	30.81	93.82	0.22	6.88	0.96	185.01 ppm	3.88	3.25	0.24	91.86	365	540	112	35	13	44	11	32
172	IBM/SRC/REE/MS/(24/18)/RH/PCS/172	15.03	3.99	21.93	180.00	1.79	18.50	4.26	0.39	84.04	25.83	1.62	61.10	33	42	36	14	21	386	57	39
173	IBM/SRC/REE/GR/(228/06)/GR/PCS/173	33.33	6.12	16.33	380.00	4.51	79.70	11.37	0.62	136.61	52.05	4.81	72.98	40	<1	43	14	4	656	59	106
174	IBM/SRC/REE/GR/(68/07)/GR/PCS/174	42.56	6.51	28.66	435.64	6.07	83.45	11.87	0.73	172.32	36.68	1.71	63.03	70	<1	43	15	<1	681	65	129
175	IBM/SRC/REE/GR/(68/07)/GR/PCS/175	38.43	6.15	25.53	424.23	5.08	76.36	9.75	0.64	159.35	55.13	5.52	50.83	65	<1	64	15	7	741	65	121
	IBM/SRC/REE/GR/(68/07)/GR/PCS/175 R	37.08	6.64	24.18	417.01	5.29	69.46	9.08	0.57 %	154.07	49.62	4.91	45.33	67	<1	60	16	8	746	63	118
	NCSDC-73022 (Observed Value)	2.64	2.05	297.86	136.06	6.54	16.51	4.56	245.39	8.28	6.56	1.45	15.81	110	339	5	2	3	29	18	34
	NCSDC-73022 (Certified Value)	2.40	1.74	304.00	130.00	6.70	14.00	3.70	241.00	7.40	6.40	1.23	15.50	106	343	3.6	2.3	3.2	28	19	31

S. No.	Sample Id	Be	Ge	As	Rb	Sn	Th	U	Zr (%)	Hf	Nb	Ta	W	Sr	Ba	Cr	Ni	Cu	Zn	Ga	Pb
		in ppm by ICP-MS												in ppm by WD-XRF							
176	IBM/SRC/REE/GR/(592/02)/GR/PCS/176	34.22	8.11	34.05	405.10	5.54	89.73	15.15	0.80	209.96	39.90	2.49	93.56	59	<1	64	16	<1	621	64	89
177	IBM/SRC/REE/GR/(592/02)/GR/PCS/177	33.90	5.15	61.57	317.02	4.49	87.58	18.51	1.09	234.14	54.43	6.31	98.91	44	29	76	19	6	648	65	110
178	IBM/SRC/REE/GR/(192/06)/GR/PCS/178	32.82	4.41	45.63	334.96	3.31	62.82	8.88	0.46	106.22	35.40	3.02	136.78	39	<1	54	16	3	747	63	155
179	IBM/SRC/REE/GR/(192/06)/GR/PCS/179	35.59	5.29	56.71	366.90	3.24	73.38	9.89	0.49	106.00	33.93	4.12	94.22	43	22	47	17	<1	686	63	101
180	IBM/SRC/REE/GR/(28/18)/GR/PCS/180	23.34	4.87	71.06	274.83	2.30	48.75	6.51	0.41	90.49	39.48	3.26	91.77	23	<1	45	16	8	677	65	118
181	IBM/SRC/REE/GR/(28/18)/GR/PCS/181	23.55	5.62	72.66	198.99	2.54	31.94	5.04	0.37	82.95	60.25	7.35	74.76	33	26	29	13	11	492	70	56
182	IBM/SRC/REE/GR/(28/18)/GR/PCS/182	18.54	3.49	62.47	185.75	1.98	25.42	5.61	0.47	96.40	48.60	5.38	8.45	30	<1	57	12	8	573	66	66
183	IBM/SRC/REE/GR/(264/04)/GR/PCS/183	30.22	5.05	51.05	292.32	2.70	55.24	7.78	0.45	90.26	54.05	7.03	7.72	22	<1	108	9	4	732	68	92
184	IBM/SRC/REE/GR/(264/04)/GR/PCS/184	21.01	5.10	78.46	271.47	2.09	42.98	6.44	0.40	86.56	25.41	9.97	97.30	23	32	84	10	4	587	62	93
185	IBM/SRC/REE/GR/(264/04)/GR/PCS/185	22.88	3.89	69.80	290.50	2.41	45.63	6.16	0.41	87.11	42.24	4.26	10.40	20	<1	153	15	4	573	64	69

S. No.	Sample Id	Be	Ge	As	Rb	Sn	Th	U	Zr (%)	Hf	Nb	Ta	W	Sr	Ba	Cr	Ni	Cu	Zn	Ga	Pb
		in ppm by ICP-MS												in ppm by WD-XRF							
186	IBM/SRC/REE/GR/(262/04)/GR/PCS/186	34.42	5.05	68.67	338.95	3.43	51.50	6.92	0.47	103.83	29.15	2.43	3.44	24	<1	130	15	2	538	65	81
187	IBM/SRC/REE/GR/(262/04)/GR/PCS/187	29.39	4.66	56.19	329.40	2.68	40.81	4.61	0.44	97.58	30.80	2.95	2.28	30	22	135	16	3	657	71	73
	IBM/SRC/REE/GR/(264/04)/GR/PCS/187_CK	16.24	11.30	7.75		34.85			1103.30 ppm	17.90	72.26	2.53		5.53			28	16	420	44.93	133
188	IBM/SRC/REE/GR/(262/04)/GR/PCS/188	35.19	6.01	55.75	406.43	3.07	81.81	10.45	0.72	165.03	54.04	6.66	2.47	46	42	134	16	<1	931	64	159
189	IBM/SRC/REE/GR/(24/06)/GR/PCS/189	38.73	6.64	64.59	371.89	1.93	88.80	14.80	0.58	108.30	60.15	6.24	4.16	52	27	112	16	6	1010	65	192
190	IBM/SRC/REE/GR/(24/06)/GR/PCS/190	33.48	5.77	46.26	440.04	4.31	67.93	9.80	0.72	162.39	63.13	8.41	3.87	33	33	120	17	4	915	63	94
	IBM/SRC/REE/GR/(24/06)/GR/PCS/190_CK	34.79	31.51	23.51		25.64			2558.03 ppm	33.61	262.17	12.38		38.22			28	24	611	108.22	151
191	IBM/SRC/REE/GR/(61/06)/GR/PCS/191	28.18	6.59	55.06	312.92	3.11	50.21	8.14	0.68	149.53	54.81	7.00	110.30	17	<1	51	6	12	645	61	72
192	IBM/SRC/REE/GR/(61/06)/GR/PCS/192	30.55	6.95	43.68	364.03	3.05	55.44	9.28	0.71	137.42	40.99	4.26	88.01	18	<1	47	14	7	774	57	69
193	IBM/SRC/REE/GR/(61/06)/GR/PCS/193	31.60	5.82	57.86	368.82	3.55	60.61	8.44	0.67	130.66	36.25	3.19	78.34	40	37	42	15	8	712	63	101
	IBM/SRC/REE/GR/(61/06)/GR/PCS/193_CK	30.76	31.89	20.79		33.68			1711.19 ppm	23.96	212.01	13.76		36.78			34	19	455	107.57	187

S. No.	Sample Id	Be	Ge	As	Rb	Sn	Th	U	Zr (%)	Hf	Nb	Ta	W	Sr	Ba	Cr	Ni	Cu	Zn	Ga	Pb
		in ppm by ICP-MS												in ppm by WD-XRF							
194	IBM/SRC/REE/GR/(29/22)/GR/PCS/194	25.39	4.74	65.31	256.52	2.45	35.74	6.68	0.52	91.62	43.51	3.41	141.96	31	<1	57	12	5	364	65	33
195	IBM/SRC/REE/MS/(286/07)/RH/PCS/195	6.64	3.10	47.76	179.52	0.55	26.30	4.63	0.13	27.59	9.95	0.80	109.61	59	120	106	14	14	76	38	21
	IBM/SRC/REE/MS/(286/07)/RH/PCS/195R	6.32	3.48	46.96	178.67	0.58	27.52	5.16	0.12	28.88	9.42	0.93	105.07	56	116	109	12	15	78	40	20
	NCSDC-73022 (Observed Value)	2.81	2.30	309.21	137.06	5.90	13.88	3.77	247.31	8.33	6.65	1.41	14.42	110	338	5	2	2	26	18	33
	NCSDC-73022 (Certified Value)	2.40	1.74	304.00	130.00	6.70	14.00	3.70	241.00	7.40	6.40	1.23	15.50	106	343	3.6	2.3	3.2	28	19	31
196	IBM/SRC/REE/GR/(474/96)/GR/PCS/196	12.39	4.78	80.35	180.38	1.35	23.91	6.37	0.68	121.09	32.24	3.99	90.79	24	122	26	15	8	362	61	51
197	IBM/SRC/REE/GR/(474/96)/GR/PCS/197	12.58	3.08	81.77	211.26	0.92	17.42	2.70	0.29	60.70	15.67	0.84	98.72	28	159	37	14	5	270	70	23
198	IBM/SRC/REE/GR/(331/96)/GR/PCS/198	11.58	3.69	84.58	194.69	0.88	17.84	2.57	0.30	67.39	19.56	2.19	149.96	14	<1	53	12	3	185	63	27
199	IBM/SRC/REE/GR/(331/96)/GR/PCS/199	10.37	3.13	84.29	182.35	0.92	14.71	2.39	0.28	53.62	21.78	3.82	121.50	15	<1	52	14	4	209	68	26
200	IBM/SRC/REE/MS/(78/22)/RH/PCS/200	20.60	5.32	62.29	221.64	2.26	22.21	3.12	0.56	117.97	37.37	2.92	58.46	21	<1	44	14	<1	585	70	60
201	IBM/SRC/REE/MS/(78/22)/GR/PCS/201	35.53	5.55	49.94	421.23	4.07	68.55	13.67	1.16	254.02	60.01	3.54	114.87	39	36	47	15	2	521	55	12

S. No.	Sample Id	Be	Ge	As	Rb	Sn	Th	U	Zr (%)	Hf	Nb	Ta	W	Sr	Ba	Cr	Ni	Cu	Zn	Ga	Pb
		in ppm by ICP-MS												in ppm by WD-XRF							
202	IBM/SRC/REE/MS/(77/22)/RH/PCS/202	12.15	4.34	47.37	258.34	2.20	20.30	3.25	0.40	78.02	46.97	4.13	62.00	34	<1	33	13	6	392	45	106
203	IBM/SRC/REE/MS/(38/21)/RH/PCS/203	11.96	3.72	57.43	154.89	1.78	12.02	1.36	0.29	70.62	44.96	4.88	18.15	41	410	18	15	16	428	56	35
204	IBM/SRC/REE/MS/(38/21)/RH/PCS/204	35.18	5.84	39.60	399.64	3.88	73.18	16.79	1.16	211.40	52.95	5.15	29.41	33	32	52	15	7	565	55	<1
205	IBM/SRC/REE/MS/(236/06)/RH/PCS/205	63.71	7.52	33.95	279.30	2.62	35.81	4.91	0.39	49.43	37.80	3.76	11.36	39	<1	55	13	23	162	58	19
206	IBM/SRC/REE/GR/(255/91)/GR/PCS/206	26.05	5.52	35.25	327.75	2.22	45.58	6.55	0.47	93.98	20.27	1.79	55.81	36	34	64	16	5	474	61	114
207	IBM/SRC/REE/MS/(PN113)/RH/PCS/207	22.83	5.43	42.30	273.87	2.31	23.88	1.93	0.63	126.69	52.73	7.64	30.80	26	<1	33	15	5	598	75	66
	IBM/SRC/REE/MS/(PN113)/RH/PCS/207_CK	13.05	25.15	16.51		15.31			1694.67 ppm	28.11	104.02	5.27		18.21			33	22	423	85.62	139
208	IBM/SRC/REE/MS/(PN113)/RH/PCS/208	35.19	7.07	66.72	218.56	4.24	77.28	15.37	1.64	333.45	57.43	6.37	33.10	27	72	45	16	7	1026	51	148
209	IBM/SRC/REE/MS/(PN112)/RH/PCS/209	21.00	3.98	53.27	203.18	1.47	30.20	5.86	0.35	63.56	42.93	5.10	39.73	76	343	19	14	9	468	53	56
210	IBM/SRC/REE/MS/(PN111)/RH/PCS/210	13.25	3.21	61.32	187.27	1.26	12.74	2.78	0.33	92.54	40.18	5.68	16.57	37	34	13	15	5	447	66	18

S. No.	Sample Id	Be	Ge	As	Rb	Sn	Th	U	Zr (%)	Hf	Nb	Ta	W	Sr	Ba	Cr	Ni	Cu	Zn	Ga	Pb
		in ppm by ICP-MS												in ppm by WD-XRF							
211	IBM/SRC/REE/GR/(30/85)/GR/PCS/211	15.03	4.65	73.49	213.77	1.48	24.81	6.97	0.76	130.34	33.21	2.46	111.46	28	<1	37	3	7	430	62	54
212	IBM/SRC/REE/GR/(17/94)/GR/PCS/212	15.05	4.48	76.25	199.05	1.44	31.39	6.69	0.71	138.02	37.77	3.28	109.13	32	28	49	15	5	435	59	65
213	IBM/SRC/REE/GR/(17/95)/GR/PCS/213	10.00	4.92	71.40	193.19	1.54	34.30	6.88	0.65	126.98	34.65	2.42	105.31	71	460	39	13	7	447	64	53
214	IBM/SRC/REE/GR/(18/95)/GR/PCS/214	15.17	4.59	77.18	207.86	1.34	32.12	5.82	0.59	115.03	26.73	2.25	87.39	27	<1	47	16	7	412	63	61
215	IBM/SRC/REE/GR/(3062/95)/GR/PCS/215	20.55	4.21	69.27	184.46	1.17	42.27	5.83	0.29	56.91	42.19	3.79	9.12	21	<1	82	14	3	345	66	59
	IBM/SRC/REE/GR/(3062/95)/GR/PCS/215R	20.56	4.50	72.02	201.37	1.21	43.16	5.93	0.29	56.73	41.54	3.53	8.03	20	<1	85	13	3	349	63	61
	NCSDC-73022 (Observed Value)	2.31	2.15	314.83	132.95	5.61	12.96	3.89	236.19	7.35	6.15	1.37	16.14	109	346	4	3	2	27	18	33
	NCSDC-73022 (Certified Value)	2.40	1.74	304.00	130.00	6.70	14.00	3.70	241.00	7.40	6.40	1.23	15.50	106	343	3.6	2.3	3.2	28	19	31

CK: Check Sample; R: Repeat Sample

Annexure VI: Analytical Results: Rare Earth Elements (REE), Sc and Y

Sr No.	Sample Id	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Sc	Y	TREE (REE+ Sc +Y)	LREE (La-Sm)	HREE (Eu-Gd)
		in ppm by ICP-MS																		
1	IBM/SRC/REE/MS/(354/05)/RH/PCS/01	235.70	417.11	53.80	214.96	49.14	5.97	54.50	11.47	73.20	14.68	39.95	5.93	35.45	4.86	5.05	459.84	1681.62	970.72	246.02
2	IBM/SRC/REE/MS/(354/05)/RH/PCS/02	251.59	429.48	67.13	227.50	48.10	5.73	50.50	10.15	65.62	12.92	36.45	5.39	30.65	4.28	3.58	418.56	1667.66	1023.80	221.72
3	IBM/SRC/REE/MS/(32/01)/RH/PCS/03	249.18	352.60	61.15	229.17	48.51	5.62	49.58	9.39	58.13	11.40	31.56	4.71	27.50	3.85	3.91	378.63	1524.89	940.61	201.75
4	IBM/SRC/REE/MS/(33/01)/RH/PCS/04	213.29	337.06	50.87	210.14	49.24	5.96	54.32	11.36	75.01	15.58	44.14	6.62	37.77	5.34	4.96	519.98	1641.64	860.60	256.10
5	IBM/SRC/REE/GR/(73/09)/GR/PCS/05	320.68	529.17	91.99	369.68	67.46	5.72	79.73	17.74	124.14	26.65	78.92	12.44	71.95	10.02	8.41	930.72	2745.41	1378.98	427.31
6	IBM/SRC/REE/GR/(264/91)/GR/PCS/06	395.04	631.72	107.30	415.67	71.50	5.94	80.40	17.29	119.01	25.77	76.22	12.03	71.25	9.95	8.61	928.15	2975.85	1621.23	417.86
	IBM/SRC/REE/GR/(264/91)/GR/PCS/06_CK	233.45	450.51	68.46	290.52	64.59	4.69	66.71	9.4	63.38	12.07	36.59	5.07	33.53	4.53	3.46	338.77	1685.73	1107.53	235.97
7	IBM/SRC/REE/GR/(16/94)/GR/PCS/07	595.73	986.50	167.40	645.74	112.61	9.44	127.79	27.94	195.95	42.29	125.29	19.22	111.74	15.26	13.20	1500.00	4696.11	2507.99	674.93
8	IBM/SRC/REE/GR/(62/93)/GR/PCS/08	449.43	701.53	125.63	479.45	83.06	6.52	93.62	20.43	141.06	29.96	88.50	13.62	78.62	10.92	8.78	1100.00	3431.13	1839.10	483.24
9	IBM/SRC/REE/GR/(107/88)/GR/PCS/09	410.24	654.14	111.16	427.79	74.46	6.24	84.96	18.48	127.65	27.10	79.76	12.31	70.87	9.86	8.03	976.63	3099.68	1677.80	437.22

Sr No.	Sample Id	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Sc	Y	TREE (REE+ Sc +Y)	LREE (La-Sm)	HREE (Eu-Gd)
10	IBM/SRC/REE/GR/(08/95)/GR/PCS/10	435.36	700.89	117.81	442.43	76.01	6.00	85.70	18.37	126.34	26.70	78.24	11.89	68.55	9.43	7.78	974.21	3185.73	1772.51	431.22
11	IBM/SRC/REE/GR/(205/09)/GR/PCS/11	358.12	544.43	91.66	269.03	58.35	4.69	65.46	14.22	98.40	21.36	65.07	10.35	62.79	8.99	6.30	736.61	2415.83	1321.59	351.33
12	IBM/SRC/REE/GR/(136/09)/GR/PCS/12	355.04	544.84	94.04	330.56	61.01	4.85	68.11	14.58	99.82	21.10	63.04	9.90	59.59	8.57	6.30	742.17	2483.53	1385.49	349.57
13	IBM/SRC/REE/GR/(266/91)/GR/PCS/13	234.06	382.62	51.97	198.45	42.23	3.22	46.33	10.13	68.88	14.58	41.98	6.44	38.11	5.39	2.64	484.81	1631.83	909.33	235.06
14	IBM/SRC/REE/GR/(427/02)/GR/PCS/14	264.95	425.05	68.65	233.78	50.32	4.75	52.54	10.88	73.80	15.86	47.13	7.48	46.21	6.91	5.35	529.66	1843.33	1042.74	265.58
15	IBM/SRC/REE/GR/(272/93)/GR/PCS/15	217.88	350.58	49.42	195.18	43.81	4.43	47.12	9.91	65.61	13.64	39.60	6.09	37.48	5.63	4.20	454.04	1544.62	856.87	229.51
16	IBM/SRC/REE/GR/(271/93)/GR/PCS/16	278.98	443.26	76.75	236.21	51.24	4.90	56.30	11.97	80.57	17.00	49.34	7.69	47.04	6.83	5.14	575.97	1949.20	1086.45	281.64
17	IBM/SRC/REE/GR/(240/02)/GR/PCS/17	255.23	392.51	53.01	203.30	42.18	3.51	42.68	8.95	58.74	12.26	35.90	5.69	35.06	5.30	3.62	379.65	1537.58	946.23	208.08
18	IBM/SRC/REE/GR/(241/02)/GR/PCS/18	223.39	357.86	48.69	192.45	40.87	4.05	43.39	8.81	60.73	13.17	39.61	6.17	36.25	5.04	4.61	451.19	1536.26	863.25	217.21
	IBM/SRC/REE/GR/(241/02)/GR/PCS/18_CK	151.63	293.66	44.7	193.22	36.79	2.8	33.66	3.24	17.65	3.08	9	1.13	7.55	1.01	1.04	79.41	879.57	720.00	79.12
19	IBM/SRC/REE/GR/(31/06)/GR/PCS/19	382.99	698.32	115.24	456.66	76.02	7.11	79.90	17.67	122.28	25.54	74.58	11.44	66.34	8.91	5.02	784.23	2932.26	1729.22	413.79
20	IBM/SRC/REE/GR/(231/02)/GR/PCS/20	231.13	371.54	51.69	201.45	42.47	4.06	44.58	9.42	63.61	13.59	39.76	6.37	38.78	5.85	4.55	435.65	1564.48	898.27	226.01

Sr No.	Sample Id	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Sc	Y	TREE (REE+ Sc +Y)	LREE (La-Sm)	HREE (Eu-Gd)
	IBM/SRC/REE/GR/(231/02)/GR/PCS/20R	221.78	353.90	49.40	191.95	40.29	3.79	42.80	9.01	61.08	12.90	38.15	6.03	37.24	5.44	4.19	425.42	1503.39	857.34	216.44
	NCSDC-73022 (Observed Value)	53.53	96.17	11.28	41.55	8.24	1.44	7.71	1.42	8.75	1.78	5.09	0.82	4.87	0.75	13.11	32.23			
	NCSDC-73022 (Certified Value)	40.00	79.00	8.90	33.00	6.20	1.36	5.50	0.91	5.20	1.04	3.00	0.49	3.10	0.48	13.80	28.00			
21	IBM/SRC/REE/GR/(10/18)/GR/PCS/21	220.58	383.62	49.34	186.29	37.60	3.45	36.74	7.66	51.62	10.65	32.18	5.31	34.03	5.42	3.96	276.29	1344.73	877.42	187.06
22	IBM/SRC/REE/GR/(510/02)/GR/PCS/22	192.37	319.55	44.31	174.27	37.29	3.75	39.08	8.18	54.49	11.29	32.62	5.23	32.60	5.09	3.73	310.15	1273.98	767.78	192.32
23	IBM/SRC/REE/GR/(511/02)/GR/PCS/23	401.78	665.45	115.39	479.23	92.21	8.74	118.61	26.67	187.81	40.27	115.18	16.98	94.65	13.19	12.56	1400.00	3788.73	1754.06	622.10
24	IBM/SRC/REE/GR/(616/02)/GR/PCS/24	281.54	419.10	71.05	215.18	42.84	4.10	45.19	9.82	66.58	14.09	40.67	6.40	39.39	5.87	4.24	447.05	1713.12	1029.71	232.12
25	IBM/SRC/REE/GR/(322/91)/GR/PCS/25	299.88	427.94	67.00	210.32	42.09	3.89	44.71	9.77	68.33	14.69	44.66	7.15	43.53	6.51	4.03	465.15	1759.63	1047.23	243.23
26	IBM/SRC/REE/GR/(71/90)/GR/PCS/26	196.44	315.47	42.21	160.90	32.14	2.93	32.79	7.30	48.39	10.41	31.74	5.03	31.07	4.64	3.09	267.06	1191.60	747.15	174.30
27	IBM/SRC/REE/GR/(86/91)/GR/PCS/27	271.92	426.20	74.19	230.25	51.11	4.99	56.57	12.18	82.63	17.54	51.27	7.96	47.15	6.81	3.19	562.59	1906.54	1053.68	287.09
28	IBM/SRC/REE/GR/(30/07)/GR/PCS/28	276.86	448.71	77.41	241.68	55.20	5.53	63.77	14.18	99.28	21.57	63.83	9.99	59.95	8.59	7.50	723.76	2177.84	1099.87	346.70

Sr No.	Sample Id	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Sc	Y	TREE (REE+ Sc +Y)	LREE (La-Sm)	HREE (Eu-Gd)
	IBM/SRC/REE/GR/(30/07)/GR/PCS/28_CK	147.25	288.21	44.49	199.51	45.58	4.02	48.09	7.02	46.5	9.31	28.02	3.68	23.5	3.21	2.72	239.74	1140.85	725.04	173.35
29	IBM/SRC/REE/GR/(219/91)/GR/PCS/29	1700.00	2300.00	337.35	1100.00	96.40	8.05	72.33	11.31	67.57	13.62	39.33	5.87	35.14	4.94	3.24	467.56	6262.70	5533.75	258.16
30	IBM/SRC/REE/GR/(220/91)/GR/PCS/30	376.18	568.55	104.39	402.31	67.26	6.11	70.95	15.46	104.97	21.42	59.75	8.82	49.08	6.70	4.13	637.08	2503.16	1518.69	343.26
31	IBM/SRC/REE/GR/(222/91)/GR/PCS/31	204.64	302.44	41.90	159.27	32.73	3.11	35.69	7.66	52.60	11.07	32.34	5.14	31.62	4.83	3.17	335.35	1263.57	740.97	184.08
32	IBM/SRC/REE/GR/(66/00)/GR/PCS/32	211.45	333.53	51.50	181.89	37.57	3.53	37.71	7.91	52.95	11.24	33.22	5.22	31.90	4.75	3.11	307.80	1315.30	815.95	188.45
	IBM/SRC/REE/GR/(66/06)/GR/PCS/32_CK	104.31	188.63	32.31	136.78	25.98	2.08	27.3	2.99	16.97	2.79	7.73	0.94	5.95	0.77	0.57	64.12	620.22	488.01	67.52
33	IBM/SRC/REE/GR/(228/91)/GR/PCS/33	347.55	624.61	112.67	452.01	76.91	7.45	79.09	15.12	95.06	19.68	58.18	8.93	52.71	7.42	4.09	639.51	2601.01	1613.76	343.65
34	IBM/SRC/REE/GR/(302/02)/GR/PCS/34	405.48	648.72	125.73	486.96	76.71	7.34	75.13	14.32	89.23	17.25	48.30	7.51	45.44	6.74	4.43	569.36	2628.65	1743.60	311.26
35	IBM/SRC/REE/GR/(302/02)/GR/PCS/35	355.41	613.05	113.61	455.08	73.30	6.84	69.92	13.55	82.92	16.39	46.22	7.16	44.16	6.66	4.30	530.41	2438.99	1610.45	293.82
	IBM/SRC/REE/GR/(302/02)/GR/PCS/35_CK	200.35	390.95	64.66	272.8	53.53	4.22	47.33	5.05	26.17	3.99	10.71	1.25	8.34	1.11	0.92	91.78	1183.16	982.29	108.17
36	IBM/SRC/REE/GR/(302/02)/GR/PCS/36	328.47	568.72	104.69	403.74	66.08	6.19	65.59	12.69	79.13	15.63	44.24	6.81	42.32	6.37	4.42	524.34	2279.43	1471.70	278.97

Sr No.	Sample Id	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Sc	Y	TREE (REE+ Sc +Y)	LREE (La-Sm)	HREE (Eu-Gd)
37	IBM/SRC/REE/GR/(146/03)/GR/PCS/37	238.31	374.34	52.52	211.74	48.12	4.51	54.36	11.95	80.50	16.87	48.34	7.63	46.51	7.11	3.85	526.89	1733.54	925.03	277.77
38	IBM/SRC/REE/GR/(146/03)/GR/PCS/38	274.13	415.44	73.48	230.23	52.55	5.08	56.76	11.73	78.38	16.52	48.49	7.79	49.62	7.51	4.90	538.88	1871.50	1045.82	281.89
39	IBM/SRC/REE/GR/(146/03)/GR/PCS/39	46.43	82.59	14.22	58.06	10.43	0.83	8.80	1.69	11.77	2.93	11.75	2.83	26.42	5.53	2.10	73.26	359.66	211.73	72.56
40	IBM/SRC/REE/GR/(584/02)/GR/PCS/40	224.93	364.12	47.64	183.14	37.86	3.40	38.88	8.26	54.93	11.32	33.75	5.55	36.08	5.69	2.94	283.88	1342.36	857.69	197.85
41	IBM/SRC/REE/GR/(584/02)/GR/PCS/41	269.88	376.65	51.07	185.88	36.66	3.35	38.52	7.88	51.00	10.34	29.69	4.70	30.46	4.68	1.97	257.97	1360.70	920.15	180.63
42	IBM/SRC/REE/GR/(584/02)/GR/PCS/42	201.44	323.61	40.35	149.74	31.68	2.89	33.40	7.03	45.67	9.19	26.64	4.43	30.16	5.07	2.36	232.53	1146.18	746.83	164.46
43	IBM/SRC/REE/GR/(27/06)/GR/PCS/43	335.33	525.19	92.66	276.56	55.99	5.22	59.26	12.43	81.38	16.94	47.80	7.39	45.24	6.45	3.91	542.59	2114.34	1285.73	282.11
44	IBM/SRC/REE/GR/(27/06)/GR/PCS/44	187.89	293.77	43.74	157.64	33.74	3.19	35.83	7.34	48.10	10.04	29.15	4.74	30.90	5.07	2.40	275.70	1169.24	716.78	174.36
45	IBM/SRC/REE/GR/(27/06)/GR/PCS/45	247.07	384.89	59.10	211.71	44.91	4.29	46.08	9.35	59.95	12.24	34.78	5.58	36.44	5.77	2.87	372.62	1537.65	947.68	214.48
46	IBM/SRC/REE/GR/(99/04)/GR/PCS/46	221.51	333.17	45.32	165.94	36.12	3.12	40.81	8.98	61.10	12.95	37.87	5.96	36.61	5.48	2.70	400.78	1418.44	802.08	212.89
47	IBM/SRC/REE/GR/(99/04)/GR/PCS/47	242.48	371.20	51.32	189.67	38.50	3.14	40.71	9.02	60.58	12.90	37.56	5.87	36.09	5.36	2.68	384.89	1491.98	893.17	211.24
	IBM/SRC/REE/GR/(99/01)/GR/PCS/47_CK	180.89	331.8	51.97	204.06	40.18	2.84	45.23	4.89	28.98	5.12	14.81	1.8	11.02	1.45	0.84	124.31	1050.19	808.90	116.14

Sr No.	Sample Id	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Sc	Y	TREE (REE+ Sc +Y)	LREE (La-Sm)	HREE (Eu-Gd)
48	IBM/SRC/REE/GR/(99/04)/GR/PCS/48	269.65	399.73	58.24	191.98	39.37	3.51	44.87	9.90	68.25	14.59	43.23	6.86	42.20	6.29	3.46	467.41	1669.55	958.97	239.71
49	IBM/SRC/REE/GR/(448/02)/GR/PCS/49	269.80	365.96	49.39	180.50	34.37	3.05	34.95	7.08	47.73	10.05	29.82	4.77	31.43	4.90	2.68	258.03	1334.52	900.03	173.78
50	IBM/SRC/REE/GR/(448/02)/GR/PCS/50	284.28	390.56	53.35	196.12	36.63	3.08	35.81	7.37	48.98	10.24	30.75	4.98	31.88	5.08	2.50	258.72	1400.32	960.93	178.17
51	IBM/SRC/REE/GR/(448/02)/GR/PCS/51	306.85	424.72	59.42	223.91	40.42	3.63	42.15	8.59	55.60	11.77	35.10	5.84	38.35	6.42	3.82	328.22	1594.80	1055.32	207.45
52	IBM/SRC/REE/GR/(233/02)/GR/PCS/52	225.63	328.20	48.22	185.05	36.43	3.21	37.40	7.41	47.47	9.87	29.59	5.06	33.44	5.72	3.09	277.63	1283.41	823.52	179.17
53	IBM/SRC/REE/GR/(233/02)/GR/PCS/53	262.08	354.66	57.46	202.22	38.92	3.33	38.62	7.68	48.12	10.00	29.90	5.12	32.46	5.63	3.08	277.89	1377.17	915.33	180.86
	IBM/SRC/REE/GR/(233/02)/GR/PCS/53 R	256.53	343.71	51.92	197.76	37.98	3.20	37.98	7.57	47.28	9.83	28.86	4.86	31.74	5.45	2.53	270.42	1337.62	887.90	176.77
	NCSDC-73022 (Observed Value)	39.92	78.03	8.79	32.55	6.40	1.35	5.33	0.90	5.07	0.99	2.85	0.49	2.90	0.49	13.90	27.89			
	NCSDC-73022 (Certified Value)	40.00	79.00	8.90	33.00	6.20	1.36	5.50	0.91	5.20	1.04	3.00	0.49	3.10	0.48	13.80	28.00			
54	IBM/SRC/REE/GR/(233/02)/GR/PCS/54	310.34	428.20	60.37	240.06	50.14	4.85	56.98	12.01	80.76	17.25	52.14	8.64	53.78	8.58	5.74	603.18	1993.02	1089.10	295.00
55	IBM/SRC/REE/GR/(232/02)/GR/PCS/55	268.23	372.18	52.15	196.80	38.96	3.69	42.38	9.05	60.88	13.02	39.97	6.63	41.14	6.55	3.47	453.89	1609.01	928.32	223.33
56	IBM/SRC/REE/GR/(232/02)/GR/PCS/56	267.61	355.09	48.54	185.04	34.95	3.46	39.67	8.32	55.72	12.08	36.97	6.23	39.59	6.64	3.34	372.15	1475.40	891.23	208.69

Sr No.	Sample Id	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Sc	Y	TREE (REE+ Sc +Y)	LREE (La-Sm)	HREE (Eu-Gd)
57	IBM/SRC/REE/GR/(232/02)/GR/PCS/57	254.95	364.01	50.85	199.51	39.72	3.85	44.08	9.16	61.27	13.30	40.48	6.83	43.79	7.13	4.48	465.86	1609.25	909.03	229.88
58	IBM/SRC/REE/GR/(295/02)/GR/PCS/58	269.09	392.49	55.89	210.95	43.09	3.94	47.58	10.22	69.12	14.77	44.61	7.39	44.82	7.06	3.47	506.80	1731.29	971.52	249.50
59	IBM/SRC/REE/GR/(295/02)/GR/PCS/59	247.46	353.72	49.83	183.51	35.93	3.18	37.31	7.56	48.10	9.82	29.03	4.77	30.28	5.12	2.31	266.26	1314.20	870.44	175.19
60	IBM/SRC/REE/GR/(295/02)/GR/PCS/60	272.54	379.73	53.09	203.19	40.68	3.55	44.74	9.43	62.56	13.25	40.25	6.70	42.04	6.86	3.30	418.59	1600.51	949.24	229.40
61	IBM/SRC/REE/GR/(234/02)/GR/PCS/61	375.32	537.74	100.55	294.07	57.14	5.13	61.15	12.32	75.80	14.63	40.09	6.05	37.19	5.97	2.01	498.79	2123.94	1364.82	258.33
	IBM/SRC/REE/GR/(234/02)/GR/PCS/61_CK	233.47	403.64	65.99	277.5	55.89	4.26	66.79	7.42	42.73	7.19	18.41	2.2	13.74	1.88	1.18	171.21	1373.50	1036.49	164.62
62	IBM/SRC/REE/GR/(234/02)/GR/PCS/62	285.05	430.72	67.94	243.88	49.83	4.40	52.53	10.86	66.56	13.21	36.72	5.62	33.93	5.59	2.11	382.00	1690.96	1077.43	229.43
63	IBM/SRC/REE/GR/(234/02)/GR/PCS/63	341.76	475.04	83.77	250.51	51.14	4.51	55.72	11.85	76.96	16.12	47.49	7.70	46.81	7.48	3.32	541.28	2021.46	1202.21	274.65
64	IBM/SRC/REE/GR/(221/04)/GR/PCS/64	286.19	430.31	59.61	228.38	45.68	4.45	51.42	10.86	71.50	14.67	43.22	6.90	41.43	6.53	3.70	503.99	1808.85	1050.17	250.98
65	IBM/SRC/REE/GR/(221/04)/GR/PCS/65	342.47	512.76	106.43	360.14	69.45	6.81	76.27	15.47	98.09	19.64	53.10	7.96	44.82	6.87	3.50	655.30	2379.08	1391.25	329.04
66	IBM/SRC/REE/GR/(221/04)/GR/PCS/66	125.81	214.90	30.91	121.25	25.52	2.64	28.07	6.03	38.02	7.55	20.97	3.31	20.70	3.52	2.16	194.12	845.47	518.38	130.80
67	IBM/SRC/REE/GR/(176/06)/GR/PCS/67	297.75	464.31	76.26	255.41	55.52	5.34	61.23	13.05	85.33	17.07	48.34	7.51	42.57	6.53	3.04	578.01	2017.27	1149.24	286.97

Sr No.	Sample Id	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Sc	Y	TREE (REE+ Sc +Y)	LREE (La-Sm)	HREE (Eu-Gd)
68	IBM/SRC/REE/GR/(176/06)/GR/PCS/68	286.86	485.74	91.03	286.64	63.74	6.05	70.23	14.95	94.95	18.85	52.14	7.87	44.31	6.70	2.96	619.09	2152.11	1214.01	316.04
	IBM/SRC/REE/GR/(176/06)/GR/PCS/68_CK	197.21	393.99	62.82	277.07	62	4.88	63.36	8.5	50.15	8.77	23.15	2.78	15.82	2.02	1.25	206.87	1380.64	993.09	179.43
69	IBM/SRC/REE/GR/(176/06)/GR/PCS/69	317.10	507.41	92.26	284.85	59.86	5.41	63.63	13.11	80.65	15.47	41.84	6.18	35.85	5.56	2.60	498.22	2030.01	1261.49	267.69
70	IBM/SRC/REE/GR/(122/07)/GR/PCS/70	391.71	573.90	100.64	302.70	62.41	5.92	68.06	13.97	88.74	18.01	51.30	8.24	50.49	7.80	3.57	609.37	2356.84	1431.36	312.54
71	IBM/SRC/REE/GR/(122/07)/GR/PCS/71	296.56	481.11	62.88	248.21	48.47	4.43	50.18	10.13	63.85	12.80	36.36	6.00	36.77	6.10	2.65	399.93	1766.44	1137.23	226.63
72	IBM/SRC/REE/GR/(122/07)/GR/PCS/72	371.48	563.09	100.22	296.77	58.05	5.25	62.82	12.98	82.58	16.72	47.83	7.53	45.53	7.24	3.83	581.36	2263.30	1389.62	288.49
73	IBM/SRC/REE/GR/(420/92)/GR/PCS/73	346.25	584.47	107.14	367.25	76.92	7.05	87.14	19.09	124.74	25.51	71.78	11.18	64.73	9.85	5.14	823.17	2731.41	1482.04	421.06
	IBM/SRC/REE/GR/(420/92)/GR/PCS/73R	351.55	586.97	108.18	406.79	77.23	7.11	88.63	19.44	126.01	25.74	72.68	11.28	65.78	10.00	5.48	830.04	2792.91	1530.71	426.68
	NCSDC-73022 (Observed Value)	38.86	75.52	8.65	31.87	5.87	1.28	5.28	0.89	4.99	1.00	2.85	0.48	2.93	0.50	13.57	27.39			
	NCSDC-73022 (Certified Value)	40.00	79.00	8.90	33.00	6.20	1.36	5.50	0.91	5.20	1.04	3.00	0.49	3.10	0.48	13.80	28.00			
74	IBM/SRC/REE/MS/(95/07)/RH/PCS/74	123.82	187.82	23.76	94.09	17.09	0.76	16.62	3.17	19.72	4.04	11.63	1.90	11.80	2.00	3.41	116.98	638.63	446.59	71.65
75	IBM/SRC/REE/MS/(95/07)/RH/PCS/75	126.37	193.23	24.17	96.33	17.83	0.86	17.43	3.25	20.44	4.17	12.14	1.96	12.20	2.00	3.56	119.46	655.41	457.94	74.45

Sr No.	Sample Id	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Sc	Y	TREE (REE+ Sc +Y)	LREE (La-Sm)	HREE (Eu-Gd)
76	IBM/SRC/REE/MS/(95/07)/RH/PCS/76	138.27	210.65	26.57	104.48	19.25	0.92	18.95	3.57	22.31	4.56	13.28	2.13	13.69	2.14	4.16	129.22	714.14	499.21	81.56
	IBM/SRC/REE/MS/(95/07)/RH/PCS/76_CK	73.26	936.2	21.16	335.1	13.54	0.56	13.17	1.49	7.29	1.01	38.59	0.38	2.66	0.42	1.33	25.48	1471.64	1379.26	65.57
77	IBM/SRC/REE/MS/(227/97)/RH/PCS/77	132.69	200.34	25.09	98.90	18.51	0.90	18.27	3.45	21.49	4.36	12.86	2.04	12.80	2.17	3.72	127.10	684.67	475.52	78.34
	IBM/SRC/REE/MS/(227/97)/RH/PCS/77_CK	72.52	124.69	19.95	84.14	15.56	0.66	19.11	1.62	8.98	1.5	4.34	0.56	3.73	0.57	1.23	39.73	398.89	316.86	41.07
78	IBM/SRC/REE/MS/(227/97)/RH/PCS/78	137.84	209.38	26.23	102.80	19.04	0.85	18.41	3.46	21.95	4.49	12.97	2.12	13.05	2.15	3.77	128.53	707.03	495.29	79.44
79	IBM/SRC/REE/MS/(3037/95)/RH/PCS/79	140.21	214.93	27.06	106.38	19.40	1.08	19.25	3.63	22.29	4.53	13.12	2.14	13.22	2.17	4.96	131.83	726.19	507.99	81.42
80	IBM/SRC/REE/MS/(3037/95)/RH/PCS/80	135.78	207.95	26.51	105.46	20.04	0.94	19.98	3.77	23.37	4.81	14.12	2.29	14.05	2.33	4.04	137.66	723.11	495.74	85.66
81	IBM/SRC/REE/MS/(145/03)/RH/PCS/81	131.71	195.02	24.72	97.31	17.59	0.75	17.45	3.23	20.25	4.31	12.41	2.01	12.53	2.12	3.27	125.32	669.98	466.33	75.06
82	IBM/SRC/REE/MS/(145/03)/RH/PCS/82	137.14	206.02	26.07	102.87	18.74	0.99	18.74	3.47	21.79	4.40	12.67	2.04	13.26	2.08	4.84	127.80	702.91	490.83	79.44
83	IBM/SRC/REE/GR/(389/05)/GR/PCS/83	266.85	452.35	76.70	263.82	57.19	5.80	59.20	11.96	73.07	14.52	40.33	6.49	40.15	6.56	3.58	480.61	1859.20	1116.92	258.09
84	IBM/SRC/REE/GR/(389/05)/GR/PCS/84	311.92	455.24	68.08	247.57	47.11	4.60	48.49	9.53	58.27	11.76	34.02	5.64	37.59	6.31	3.71	435.53	1785.36	1129.91	216.21

Sr No.	Sample Id	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Sc	Y	TREE (REE+ Sc +Y)	LREE (La-Sm)	HREE (Eu-Gd)
85	IBM/SRC/REE/GR/(389/05)/GR/PCS/85	203.98	345.10	49.09	203.06	44.01	4.33	47.14	9.54	58.69	11.53	32.86	5.51	33.99	5.66	3.04	334.77	1392.30	845.24	209.25
86	IBM/SRC/REE/GR/(64/90)/GR/PCS/86	236.64	358.51	49.41	195.19	41.17	3.83	44.97	9.48	61.77	12.51	35.47	5.72	35.59	5.79	3.11	372.49	1471.64	880.92	215.12
87	IBM/SRC/REE/GR/(66/90)/GR/PCS/87	307.40	486.26	85.50	262.72	55.26	4.90	60.71	13.14	86.93	17.92	51.07	8.13	48.21	7.41	4.54	636.66	2136.75	1197.14	298.41
88	IBM/SRC/REE/GR/(68/90)/GR/PCS/88	307.66	478.82	70.89	250.97	50.93	4.09	54.31	11.48	74.18	15.28	44.37	7.00	41.81	6.46	3.96	511.81	1934.04	1159.27	258.99
	IBM/SRC/REE/GR/(68/90)/GR/PCS/88_CK	215.79	420.33	62.84	261.86	52.76	3.8	53.21	7.02	41.66	7.09	23.46	2.6	16.36	2.24	2.12	167.38	1340.52	1013.58	157.44
89	IBM/SRC/REE/GR/(47/05)/GR/PCS/89	334.41	488.12	84.99	249.78	46.63	4.23	48.41	10.01	64.92	13.42	39.31	6.32	37.73	6.09	2.83	419.73	1856.92	1203.93	230.44
90	IBM/SRC/REE/GR/(47/05)/GR/PCS/90	312.82	489.65	88.17	267.25	52.02	4.53	52.95	11.10	71.50	14.91	43.21	6.92	41.38	6.59	2.84	490.45	1956.29	1209.91	253.10
91	IBM/SRC/REE/GR/(47/05)/GR/PCS/91	329.75	419.75	55.27	208.27	40.16	3.54	41.44	8.80	57.92	12.15	36.59	6.14	38.27	6.40	2.54	312.43	1579.42	1053.21	211.24
92	IBM/SRC/REE/GR/(148/07)/GR/PCS/92	375.19	599.75	105.48	317.66	65.30	5.98	70.53	14.93	98.40	20.33	59.41	9.27	55.00	8.41	4.64	700.31	2510.61	1463.39	342.27
93	IBM/SRC/REE/GR/(148/07)/GR/PCS/93	372.92	553.10	96.06	287.44	57.64	5.00	60.73	12.26	77.66	15.93	45.86	7.40	45.12	7.22	3.48	537.12	2184.93	1367.16	277.17
	IBM/SRC/REE/GR/(148/07)/GR/PCS/93 R	369.22	536.71	94.46	279.54	56.18	4.90	59.04	12.04	76.71	15.62	44.95	7.21	43.62	6.94	3.69	538.03	2148.87	1336.12	271.04
	NCSDC-73022 (Observed Value)	34.52	58.02	7.62	28.45	5.07	1.13	4.64	0.75	4.45	0.86	2.49	0.43	2.57	0.41	11.96	24.30			

Sr No.	Sample Id	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Sc	Y	TREE (REE+ Sc +Y)	LREE (La-Sm)	HREE (Eu-Gd)
	NCSDC-73022 (Certified Value)	40.00	79.00	8.90	33.00	6.20	1.36	5.50	0.91	5.20	1.04	3.00	0.49	3.10	0.48	13.80	28.00			
94	IBM/SRC/REE/GR/(148/07)/GR/PCS/94	321.74	510.41	91.65	278.47	58.89	5.35	61.96	12.79	79.88	15.72	43.39	6.79	40.26	6.59	3.10	532.71	2069.71	1261.16	272.73
95	IBM/SRC/REE/GR/(149/07)/GR/PCS/95	252.21	386.75	56.61	233.46	49.28	4.66	50.31	10.61	68.52	14.26	42.55	7.05	42.20	6.79	3.14	485.90	1714.30	978.32	246.95
96	IBM/SRC/REE/GR/(149/07)/GR/PCS/96	242.53	353.95	52.60	214.97	43.91	4.11	45.11	9.17	56.76	11.61	33.68	5.65	35.40	5.95	2.86	311.55	1429.80	907.95	207.44
97	IBM/SRC/REE/GR/(149/07)/GR/PCS/97	285.60	432.35	61.49	239.44	47.74	4.62	51.88	10.86	71.00	14.79	44.07	7.14	43.91	6.93	4.11	519.06	1845.01	1066.63	255.22
98	IBM/SRC/REE/GR/(221/03)/GR/PCS/98	289.29	407.43	54.60	198.18	37.30	3.40	39.34	8.16	52.40	10.71	31.31	5.25	33.14	5.50	3.47	298.06	1477.54	986.80	189.21
99	IBM/SRC/REE/GR/(221/03)/GR/PCS/99	293.03	390.24	56.27	205.38	39.12	3.31	40.97	8.61	56.14	11.43	33.95	5.57	33.91	5.48	2.98	306.30	1492.69	984.04	199.37
100	IBM/SRC/REE/GR/(221/03)/GR/PCS/100	251.36	362.30	49.01	187.16	41.49	3.88	46.82	10.24	68.33	14.13	42.18	6.92	42.23	6.78	3.36	466.08	1602.26	891.31	241.50
101	IBM/SRC/REE/GR/(217/04)/GR/PCS/101	392.07	478.02	87.31	235.77	45.89	3.65	46.26	9.72	60.57	13.01	35.85	5.76	35.63	5.79	3.92	424.49	1883.74	1239.06	216.26
102	IBM/SRC/REE/GR/(217/04)/GR/PCS/102	393.89	506.94	92.71	252.39	48.90	3.79	49.21	10.22	64.12	13.47	37.06	5.85	35.67	5.85	4.04	437.95	1962.05	1294.84	225.23
103	IBM/SRC/REE/GR/(217/04)/GR/PCS/103	371.14	460.35	84.06	236.09	44.62	3.50	44.37	9.09	57.18	12.29	33.47	5.40	33.86	5.58	3.61	398.92	1803.53	1196.27	204.73

Sr No.	Sample Id	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Sc	Y	TREE (REE+ Sc +Y)	LREE (La-Sm)	HREE (Eu-Gd)
104	IBM/SRC/REE/GR/(265/04)/GR/PCS/104	338.19	430.93	80.52	250.98	55.44	5.76	56.92	12.30	78.43	17.03	46.62	7.49	45.21	7.35	6.16	572.23	2011.57	1156.07	277.11
105	IBM/SRC/REE/GR/(265/04)/GR/PCS/105	302.46	421.84	85.22	266.25	55.13	4.55	53.76	11.06	67.29	13.90	36.54	5.53	33.43	5.55	2.79	434.40	1799.69	1130.89	231.61
106	IBM/SRC/REE/GR/(265/04)/GR/PCS/106	302.78	409.75	85.44	258.68	51.90	4.25	51.99	10.58	63.39	13.02	34.33	5.13	30.41	4.93	2.54	389.37	1718.49	1108.55	218.03
107	IBM/SRC/REE/GR/(308/02)/GR/PCS/107	353.01	522.13	93.91	376.07	64.27	4.65	67.22	14.73	94.54	20.09	55.38	8.83	53.00	8.30	7.41	677.68	2421.20	1409.38	326.74
108	IBM/SRC/REE/GR/(308/02)/GR/PCS/108	441.12	647.42	117.77	488.73	83.89	5.87	87.24	19.11	124.97	27.03	75.26	12.10	71.95	10.99	10.58	910.64	3134.67	1778.92	434.53
109	IBM/SRC/REE/GR/(308/02)/GR/PCS/109	372.67	584.68	106.33	423.53	66.34	5.65	66.54	13.53	83.42	18.93	45.18	6.87	41.47	6.17	3.57	566.53	2411.42	1553.55	287.77
110	IBM/SRC/REE/GR/(615/02)/GR/PCS/110	255.94	366.90	50.83	193.38	40.45	3.48	40.54	8.57	54.14	11.54	31.87	5.25	32.55	5.49	2.87	385.60	1489.39	907.49	193.42
	IBM/SRC/REE/GR/(615/02)/GR/PCS/110_CK	162.76	287.19	43.61	177.15	36.45	2.88	36.6	4.61	26.79	4.8	13.29	1.72	10.72	1.47	1.09	111.24	922.37	707.16	102.88

Sr No.	Sample Id	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Sc	Y	TREE (REE+ Sc +Y)	LREE (La-Sm)	HREE (Eu-Gd)
111	IBM/SRC/REE/GR/(615/02)/GR/PCS/111	306.65	432.62	77.43	226.65	47.31	4.17	49.07	10.25	63.77	13.54	37.73	6.04	37.72	6.37	3.13	465.57	1788.03	1090.66	228.67
112	IBM/SRC/REE/GR/(615/02)/GR/PCS/112	336.42	456.44	81.01	235.10	47.67	4.17	48.28	10.33	65.24	13.88	38.69	6.26	38.33	6.37	2.83	454.81	1845.83	1156.64	231.54
113	IBM/SRC/REE/GR/(54/04)/GR/PCS/113	256.10	324.23	44.98	170.01	32.56	2.84	31.71	6.43	40.28	8.82	25.56	4.27	28.32	4.75	3.10	253.10	1237.05	827.88	152.98
	IBM/SRC/REE/GR/(54/04)/GR/PCS/113R	256.77	322.88	44.77	170.72	32.69	2.88	31.63	6.49	40.77	8.89	25.36	4.23	28.43	4.80	3.20	251.45	1235.98	827.83	153.49
	NCSDC-73022 (Observed Value)	41.59	81.17	9.17	34.26	6.43	1.36	5.45	0.94	5.34	1.10	3.06	0.49	3.12	0.49	14.99	30.85			
	NCSDC-73022 (Certified Value)	40.00	79.00	8.90	33.00	6.20	1.36	5.50	0.91	5.20	1.04	3.00	0.49	3.10	0.48	13.80	28.00			
114	IBM/SRC/REE/GR/(54/04)/GR/PCS/114	197.58	262.23	37.28	138.48	26.38	2.39	25.74	5.31	34.17	7.64	22.49	3.90	26.16	4.67	3.63	219.46	1017.51	661.94	132.48
115	IBM/SRC/REE/GR/(54/04)/GR/PCS/115	269.29	347.01	48.69	185.29	36.01	3.20	34.59	7.16	44.96	9.97	28.91	4.87	31.88	5.47	3.80	284.19	1345.28	886.29	171.00
116	IBM/SRC/REE/GR/(266/92)/GR/PCS/116	264.21	392.27	75.35	229.64	49.22	4.30	48.73	10.22	63.15	13.13	35.25	5.42	32.67	5.34	2.81	414.75	1646.47	1010.69	218.22
117	IBM/SRC/REE/GR/(266/92)/GR/PCS/117	280.03	419.18	78.23	228.16	43.12	3.56	41.03	8.58	54.46	11.95	34.26	5.44	33.45	5.45	3.29	398.00	1648.19	1048.73	198.18

Sr No.	Sample Id	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Sc	Y	TREE (REE+ Sc +Y)	LREE (La-Sm)	HREE (Eu-Gd)
118	IBM/SRC/REE/GR/(266/92)/GR/PCS/118	363.41	500.31	93.34	276.45	54.50	4.39	51.91	10.78	67.49	14.63	41.62	6.63	40.23	6.39	3.60	476.69	2012.37	1288.01	244.07
119	IBM/SRC/REE/GR/(87/05)/GR/PCS/119	430.50	713.77	139.82	561.95	94.01	8.29	92.75	19.12	115.14	23.61	59.56	8.50	46.81	7.02	3.64	741.34	3065.84	1940.06	380.80
120	IBM/SRC/REE/GR/(87/05)/GR/PCS/120	437.48	686.42	132.49	534.95	86.19	7.18	83.31	17.09	100.89	20.16	51.71	7.40	40.80	6.09	3.17	621.26	2836.58	1877.52	334.62
121	IBM/SRC/REE/GR/(87/05)/GR/PCS/121	446.68	722.04	139.56	560.14	92.04	7.93	90.77	18.65	112.79	22.62	57.76	8.20	44.70	6.66	3.65	706.06	3040.24	1960.46	370.07
122	IBM/SRC/REE/GR/(306/03)/GR/PCS/122	347.64	501.87	93.05	348.26	64.42	5.85	64.73	13.68	83.81	17.52	47.60	7.41	43.74	6.81	3.77	575.58	2225.73	1355.25	291.14
123	IBM/SRC/REE/GR/(306/03)/GR/PCS/123	327.04	478.89	90.19	304.60	60.59	5.60	61.01	12.85	79.00	16.48	43.87	6.58	39.35	6.18	3.73	548.91	2084.88	1261.33	270.91
124	IBM/SRC/REE/GR/(306/03)/GR/PCS/124	262.12	418.02	78.90	275.00	53.81	4.96	52.40	10.84	66.50	13.95	37.36	5.84	35.36	5.70	3.23	472.86	1796.84	1087.85	232.90
125	IBM/SRC/REE/GR/(320/04)/GR/PCS/125	388.54	563.85	104.72	403.48	59.12	5.07	54.60	10.46	61.23	12.07	31.68	4.99	30.96	5.13	2.41	414.62	2152.94	1519.71	216.20
126	IBM/SRC/REE/GR/(320/04)/GR/PCS/126	343.45	488.17	89.98	266.65	51.89	4.35	47.48	9.57	56.84	11.56	30.84	4.97	30.55	5.13	3.02	380.05	1824.49	1240.13	201.29

Sr No.	Sample Id	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Sc	Y	TREE (REE+ Sc +Y)	LREE (La-Sm)	HREE (Eu-Gd)
127	IBM/SRC/REE/GR/(320/04)/GR/PCS/127	413.53	613.92	114.80	461.58	77.84	6.49	77.83	16.79	102.50	20.97	54.78	8.15	47.18	7.26	3.40	644.36	2671.39	1681.68	341.95
128	IBM/SRC/REE/GR/(307/02)/GR/PCS/128	252.98	390.14	73.30	235.07	50.72	4.79	49.72	9.95	60.46	12.50	33.86	5.52	33.95	5.55	3.42	413.23	1635.16	1002.20	216.31
129	IBM/SRC/REE/GR/(307/02)/GR/PCS/129	366.28	621.37	124.81	514.40	83.37	7.47	74.62	14.10	79.16	15.34	39.94	6.05	36.14	5.75	3.79	497.76	2490.37	1710.24	278.57
130	IBM/SRC/REE/GR/(258/06)/GR/PCS/130	597.23	865.01	176.42	714.84	119.99	10.58	119.73	25.16	152.04	30.46	78.78	11.73	68.49	10.37	6.65	988.97	3976.45	2473.49	507.35
131	IBM/SRC/REE/GR/(258/06)/GR/PCS/131	387.23	599.37	107.49	404.26	56.39	4.69	50.19	9.43	54.99	11.24	29.43	4.67	29.08	4.57	3.40	393.19	2149.62	1554.74	198.29
132	IBM/SRC/REE/GR/(258/06)/GR/PCS/132	416.85	605.13	111.90	428.58	67.61	6.07	66.02	14.47	93.12	20.13	55.50	9.17	55.62	8.93	6.94	676.92	2642.96	1630.07	329.04
133	IBM/SRC/REE/GR/(100/04)/GR/PCS/133	324.58	521.43	99.54	425.97	80.62	7.63	86.06	19.62	125.99	25.76	67.17	9.85	53.77	7.91	2.48	785.85	2644.24	1452.14	403.77
	IBM/SRC/REE/GR/(100/04)/GR/PCS/133R	317.03	511.02	97.89	416.68	79.99	7.46	84.48	19.37	123.85	25.62	65.94	9.65	52.66	7.80	2.71	782.74	2604.88	1422.61	396.82
	NCSDC-73022 (Observed Value)	40.75	80.20	8.97	33.78	6.24	1.34	5.20	0.91	5.11	1.05	3.06	0.47	2.94	0.48	14.58	29.22			

Sr No.	Sample Id	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Sc	Y	TREE (REE+ Sc +Y)	LREE (La-Sm)	HREE (Eu-Gd)
	NCSDC-73022 (Certified Value)	40.00	79.00	8.90	33.00	6.20	1.36	5.50	0.91	5.20	1.04	3.00	0.49	3.10	0.48	13.80	28.00			
134	IBM/SRC/REE/GR/(100/04)/GR/PCS/134	201.74	340.23	49.52	211.60	53.66	5.18	55.91	12.82	81.55	16.59	43.47	6.57	38.30	5.86	1.88	495.55	1620.45	856.75	266.27
135	IBM/SRC/REE/GR/(100/04)/GR/PCS/135	358.84	612.10	112.41	464.08	83.42	10.24	86.94	19.25	127.57	27.53	76.71	12.08	72.66	11.06	3.98	884.70	2963.55	1630.85	444.02
	IBM/SRC/REE/GR/(100/04)/GR/PCS/135_CK	176.29	377.72	58.91	263.87	61.18	6.78	57.98	9	57.9	10.81	30.45	4.02	25.04	3.33	1.75	239.77	1384.80	937.97	205.31
136	IBM/SRC/REE/GR/(219/04)/GR/PCS/136	212.58	472.54	69.60	265.64	63.54	6.57	71.95	14.81	114.26	19.99	55.75	8.81	52.72	7.40	1.18	559.55	1996.89	1083.90	352.26
137	IBM/SRC/REE/GR/(219/04)/GR/PCS/137	113.06	267.41	35.19	148.72	38.54	3.48	41.45	8.57	68.13	10.95	29.52	4.50	25.79	3.84	0.42	282.80	1082.38	602.93	196.23
138	IBM/SRC/REE/GR/(219/04)/GR/PCS/138	149.43	354.96	53.09	199.12	45.35	5.05	56.62	13.70	95.62	18.32	53.91	8.13	45.77	6.66	0.59	475.05	1581.37	801.95	303.78
139	IBM/SRC/REE/GR/(263/04)/GR/PCS/139	170.55	441.93	61.52	221.06	51.90	5.54	60.67	13.22	105.61	21.10	55.98	9.20	57.51	8.81	0.76	515.18	1800.51	946.95	337.63
140	IBM/SRC/REE/GR/(263/04)/GR/PCS/140	180.31	378.13	57.12	222.34	47.91	4.34	52.11	11.16	76.91	15.24	44.71	6.77	39.36	6.51	0.90	408.28	1552.10	885.81	257.12

Sr No.	Sample Id	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Sc	Y	TREE (REE+ Sc +Y)	LREE (La-Sm)	HREE (Eu-Gd)
141	IBM/SRC/REE/GR/(263/04)/GR/PCS/141	187.34	460.11	63.15	244.09	52.65	5.34	58.01	11.76	89.51	17.12	49.34	7.02	40.80	6.51	0.85	434.06	1727.66	1007.33	285.41
142	IBM/SRC/REE/GR/(213/04)/GR/PCS/142	215.78	517.49	76.38	286.95	68.27	6.58	71.21	17.20	116.12	22.30	62.37	9.50	53.85	7.15	0.65	585.03	2116.85	1164.87	366.29
143	IBM/SRC/REE/GR/(213/04)/GR/PCS/143	243.44	567.79	85.10	323.67	71.60	7.16	75.29	15.79	115.12	22.73	60.99	9.32	51.90	7.65	0.68	537.92	2196.15	1291.60	365.95
144	IBM/SRC/REE/GR/(218/04)/GR/PCS/144	223.14	559.79	77.98	283.09	61.91	5.60	63.06	13.21	102.76	18.61	56.95	8.64	47.82	6.84	0.79	392.77	1922.97	1205.92	323.49
145	IBM/SRC/REE/GR/(218/04)/GR/PCS/145	284.11	687.63	100.74	343.78	102.84	5.93	71.25	15.72	113.52	23.00	66.13	10.61	59.15	8.24	0.80	561.47	2454.90	1519.09	373.54
	IBM/SRC/REE/GR/(218/04)/GR/PCS/145_CK	207.24	389.11	63.71	274.64	60.39	4.45	63.64	8.09	48.6	8.55	22.68	2.71	15.7	2.1	1.21	196.67	1369.49	995.09	176.52
146	IBM/SRC/REE/GR/(218/04)/GR/PCS/146	206.99	465.61	66.09	245.00	47.42	3.65	41.95	9.18	66.78	14.14	37.57	6.16	35.08	5.30	0.98	356.29	1608.19	1031.10	219.81
147	IBM/SRC/REE/GR/(207/03)/GR/PCS/147	306.10	788.68	104.89	334.58	78.63	6.48	80.12	18.91	129.14	27.49	76.05	11.89	65.71	8.96	1.05	710.60	2749.28	1612.89	424.74

Sr No.	Sample Id	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Sc	Y	TREE (REE+ Sc +Y)	LREE (La-Sm)	HREE (Eu-Gd)
148	IBM/SRC/REE/GR/(207/03)/GR/PCS/148	206.51	478.33	61.83	219.69	41.67	3.28	41.64	9.29	70.13	13.85	42.39	6.37	37.76	5.48	0.54	409.28	1648.04	1008.02	230.19
149	IBM/SRC/REE/GR/(207/03)/GR/PCS/149	273.70	678.33	89.04	324.74	67.35	5.30	70.98	15.44	106.10	20.98	61.01	8.34	50.31	7.66	0.90	566.90	2347.08	1433.16	346.12
150	IBM/SRC/REE/GR/(365/05)/GR/PCS/150	230.24	498.84	69.63	229.19	49.24	4.03	55.26	12.33	96.00	18.66	56.59	8.15	46.67	6.52	0.88	540.43	1922.64	1077.13	304.20
	IBM/SRC/REE/GR/(365/05)/GR/PCS/150R	209.88	518.18	69.24	238.59	49.79	4.00	54.96	13.29	90.10	18.85	54.94	8.40	44.93	6.41	0.79	532.20	1914.54	1085.68	295.88
	NCSDC-73022 (Observed Value)	38.63	83.12	10.18	32.37	6.37	1.33	5.09	0.87	5.77	0.96	2.93	0.48	3.07	0.43	15.60	28.19			
	NCSDC-73022 (Certified Value)	40.00	79.00	8.90	33.00	6.20	1.36	5.50	0.91	5.20	1.04	3.00	0.49	3.10	0.48	13.80	28.00			
151	IBM/SRC/REE/GR/(365/05)/GR/PCS/151	214.17	512.91	65.17	219.51	44.19	3.88	51.46	11.75	87.94	16.07	46.64	7.20	40.76	5.93	0.70	450.51	1778.78	1055.94	271.62
152	IBM/SRC/REE/GR/(365/05)/GR/PCS/152	225.68	454.17	71.81	237.58	48.22	3.73	52.44	10.90	76.48	15.10	45.28	7.19	43.10	6.41	0.64	490.46	1789.18	1037.45	260.63
153	IBM/SRC/REE/GR/(94/03)/GR/PCS/153	351.75	857.16	112.83	414.52	92.36	6.91	83.14	18.60	132.51	24.60	65.51	9.79	52.62	7.04	0.92	675.42	2905.68	1828.61	400.73
154	IBM/SRC/REE/GR/(94/03)/GR/PCS/154	289.28	607.81	79.11	286.05	55.46	4.16	54.22	12.34	91.95	16.52	51.84	7.23	40.35	5.94	0.69	468.78	2071.73	1317.71	284.54

Sr No.	Sample Id	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Sc	Y	TREE (REE+ Sc +Y)	LREE (La-Sm)	HREE (Eu-Gd)
155	IBM/SRC/REE/GR/(94/03)/GR/PCS/155	261.06	651.04	88.99	311.12	70.11	5.54	67.56	14.74	111.53	21.42	64.42	9.82	56.39	7.06	1.17	624.29	2366.27	1382.33	358.49
	IBM/SRC/REE/GR/(94/03)/GR/PCS/155_CK	246	484.64	71.61	304.84	64.97	4.94	64.93	8.29	51.14	9.51	26.38	3.28	20.08	2.52	1.81	215.58	1580.52	1172.06	191.07
156	IBM/SRC/REE/GR/(57/99)/GR/PCS/156	224.10	574.29	72.56	257.33	56.60	4.96	53.90	11.47	77.51	15.87	43.98	7.05	42.59	6.22	1.15	408.16	1857.75	1184.89	263.55
157	IBM/SRC/REE/GR/(368/91)/GR/PCS/157	254.26	509.21	72.64	238.23	50.96	3.75	52.01	11.40	86.78	16.95	54.84	8.64	42.03	6.27	0.78	521.71	1930.47	1125.29	282.68
158	IBM/SRC/REE/MS/(131/06)/RH/PCS/158	261.25	651.83	84.04	306.70	62.28	6.54	68.07	15.20	115.69	21.11	61.59	9.41	46.77	6.38	2.84	555.51	2275.21	1366.10	350.77
159	IBM/SRC/REE/MS/(131/06)/RH/PCS/159	258.65	591.74	78.98	281.43	60.32	6.45	61.86	13.84	100.27	20.08	57.41	9.54	52.79	7.35	2.42	537.81	2140.94	1271.13	329.59
	IBM/SRC/REE/MS/(131/06)/RH/PCS/159_CK	271.34	479.74	72.19	299	61.14	5.6	60.91	7.14	39.59	6.29	19.61	2.22	15.26	2.27	2.98	156.65	1501.93	1183.41	158.89
160	IBM/SRC/REE/MS/(411/05)/RH/PCS/160	639.76	1300.00	199.68	685.72	139.26	8.49	136.87	29.27	215.53	38.88	109.57	17.52	96.72	13.62	2.18	1200.00	4833.05	2964.42	666.46
161	IBM/SRC/REE/MS/(412/05)/RH/PCS/161	609.30	1200.00	167.11	665.48	128.33	8.31	132.03	24.84	141.70	24.90	60.06	8.94	49.14	6.88	1.09	749.63	3977.73	2770.22	456.79

Sr No.	Sample Id	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Sc	Y	TREE (REE+ Sc +Y)	LREE (La-Sm)	HREE (Eu-Gd)
	IBM/SRC/REE/MS/(412/05)/RH/PCS/161_CK	594.08	848.67	146.46	626.76	119.3	6.5	122.46	11.93	60.16	8.79	28.03	2.47	14.54	2.01	2.86	215.01	2810.03	2335.27	256.89
162	IBM/SRC/REE/MS/(411/05)/RH/PCS/162	868.56	1800.00	284.05	1000.00	167.52	11.56	174.51	30.95	205.63	31.58	72.13	9.87	51.98	6.63	1.29	841.29	5557.55	4120.13	594.84
163	IBM/SRC/REE/GR/(53/99)/GR/PCS/163	223.03	571.73	77.99	286.88	62.50	6.26	70.65	16.44	130.38	25.74	70.95	11.28	64.71	8.55	2.21	683.82	2313.13	1222.13	404.96
164	IBM/SRC/REE/GR/(54/99)/GR/PCS/164	180.07	430.96	56.55	202.25	47.09	4.91	48.09	11.38	84.69	16.13	51.66	8.21	50.25	7.43	1.66	499.32	1700.65	916.92	282.75
165	IBM/SRC/REE/GR/(55/99)/GR/PCS/165	178.83	465.06	56.99	216.38	52.54	4.78	51.56	11.83	92.32	17.71	55.01	9.06	54.61	7.94	1.80	546.73	1823.14	969.78	304.82
166	IBM/SRC/REE/GR/(56/99)/GR/PCS/166	177.76	444.63	59.37	247.64	54.26	4.86	54.21	11.73	97.50	20.81	58.97	9.09	54.72	8.10	2.19	577.26	1883.10	983.66	319.98
167	IBM/SRC/REE/GR/(196/06)/GR/PCS/167	273.52	576.99	85.96	298.53	61.89	5.04	66.52	15.24	107.18	22.44	63.19	10.50	63.90	9.03	1.18	642.30	2303.41	1296.90	363.04
168	IBM/SRC/REE/GR/(196/06)/GR/PCS/168	336.91	769.83	103.09	364.63	76.60	6.23	83.47	17.61	137.58	24.62	64.89	10.09	63.75	7.99	0.95	638.77	2706.99	1651.06	416.21
169	IBM/SRC/REE/GR/(05/14)/GR/PCS/169	328.19	719.98	93.85	325.17	70.73	5.64	72.49	14.95	106.75	20.72	62.54	10.77	64.94	8.82	1.36	668.60	2575.50	1537.92	367.62
170	IBM/SRC/REE/GR/(05/14)/GR/PCS/170	420.73	959.51	147.37	556.36	130.92	11.76	139.23	30.02	228.04	44.87	129.98	21.24	127.40	17.74	3.44	1200.00	4168.61	2214.89	750.29

Sr No.	Sample Id	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Sc	Y	TREE (REE+ Sc +Y)	LREE (La-Sm)	HREE (Eu-Gd)
171	IBM/SRC/REE/GR/(589/02)/SS/PCS/171	27.78	59.48	7.01	24.22	4.72	1.08	4.93	0.84	6.18	1.15	3.29	0.45	2.88	0.38	7.09	34.80	186.29	123.22	21.17
172	IBM/SRC/REE/MS/(24/18)/RH/PCS/172	188.53	472.37	59.74	235.76	50.31	7.29	52.86	11.25	83.41	16.72	47.92	8.03	44.59	6.08	2.86	456.33	1744.03	1006.70	278.14
173	IBM/SRC/REE/GR/(228/06)/GR/PCS/173	319.49	639.89	101.30	394.95	83.25	6.65	89.36	20.46	176.31	30.94	93.32	13.73	86.12	11.03	1.42	870.31	2938.54	1538.89	527.93
174	IBM/SRC/REE/GR/(68/07)/GR/PCS/174	385.24	873.00	112.95	393.66	82.69	5.85	83.04	17.98	136.95	26.08	81.64	12.71	83.78	12.54	1.56	752.34	3062.02	1847.54	460.58
175	IBM/SRC/REE/GR/(68/07)/GR/PCS/175	351.17	837.42	113.83	385.71	86.37	6.56	87.37	18.24	127.77	26.13	79.01	12.14	79.52	11.48	1.35	737.29	2961.35	1774.50	448.23
	IBM/SRC/REE/GR/(68/07)/GR/PCS/175R	347.88	767.77	102.17	336.86	77.15	6.24	80.27	17.31	119.31	24.75	67.75	11.51	66.81	10.91	1.18	696.80	2734.66	1631.83	404.85
	NCSDC-73022 (Observed Value)	42.78	81.83	10.82	36.35	6.92	1.44	5.92	0.97	6.43	1.17	3.36	0.56	3.59	0.55	14.54	31.86			
	NCSDC-73022 (Certified Value)	40.00	79.00	8.90	33.00	6.20	1.36	5.50	0.91	5.20	1.04	3.00	0.49	3.10	0.48	13.80	28.00			
176	IBM/SRC/REE/GR/(592/02)/GR/PCS/176	485.20	969.27	150.72	554.13	110.25	7.96	114.95	24.99	180.21	34.91	100.32	16.27	104.07	14.53	1.77	981.33	3850.90	2269.58	598.22
177	IBM/SRC/REE/GR/(592/02)/GR/PCS/177	284.51	602.51	100.08	341.93	85.26	6.51	102.06	25.87	220.14	45.54	133.63	21.44	114.77	15.63	2.13	1300.00	3402.01	1414.29	685.59

Sr No.	Sample Id	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Sc	Y	TREE (REE+ Sc +Y)	LREE (La-Sm)	HREE (Eu-Gd)
178	IBM/SRC/REE/GR/(192/06)/GR/PCS/178	271.99	566.72	81.62	280.43	65.40	6.08	77.98	17.27	142.24	27.38	84.74	13.06	73.30	9.96	1.19	812.78	2532.15	1266.17	452.02
179	IBM/SRC/REE/GR/(192/06)/GR/PCS/179	416.93	726.20	120.50	425.17	92.93	8.13	98.65	21.43	161.15	32.22	84.86	13.87	77.63	10.99	1.44	861.73	3153.83	1781.73	508.93
180	IBM/SRC/REE/GR/(28/18)/GR/PCS/180	218.33	577.53	78.45	305.03	70.34	6.31	70.80	14.18	115.70	23.25	63.61	9.77	59.14	8.38	1.18	611.28	2233.29	1249.68	371.15
181	IBM/SRC/REE/GR/(28/18)/GR/PCS/181	238.95	554.48	77.67	283.13	68.38	6.62	67.65	15.61	123.71	24.86	69.95	10.27	64.30	9.41	2.74	715.79	2333.54	1222.60	392.40
182	IBM/SRC/REE/GR/(28/18)/GR/PCS/182	254.89	544.33	66.76	271.11	60.23	6.02	64.68	14.04	105.54	21.32	62.26	9.45	54.26	8.64	2.42	643.31	2189.24	1197.31	346.20
183	IBM/SRC/REE/GR/(264/04)/GR/PCS/183	299.07	713.98	101.55	393.63	88.97	8.61	100.62	20.20	146.23	28.63	89.28	12.20	66.89	8.95	1.26	845.46	2925.55	1597.21	481.61
184	IBM/SRC/REE/GR/(264/04)/GR/PCS/184	327.92	500.53	89.50	313.24	64.02	6.25	63.55	13.91	109.80	21.55	63.12	10.05	58.22	8.32	1.07	595.54	2246.60	1295.21	354.78
185	IBM/SRC/REE/GR/(264/04)/GR/PCS/185	209.74	482.79	68.49	253.84	55.05	5.93	62.08	14.12	102.11	22.40	66.78	10.13	59.37	8.74	1.01	594.88	2017.47	1069.91	351.66
186	IBM/SRC/REE/GR/(262/04)/GR/PCS/186	376.26	759.70	101.01	358.33	67.37	5.71	61.73	13.59	104.54	21.09	59.29	9.01	53.16	8.36	0.94	581.13	2581.22	1662.67	336.48

Sr No.	Sample Id	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Sc	Y	TREE (REE+ Sc +Y)	LREE (La-Sm)	HREE (Eu-Gd)
187	IBM/SRC/REE/GR/(262/04)/GR/PCS/187	314.97	612.61	75.66	261.63	53.32	4.14	52.30	11.99	88.64	16.38	45.16	7.41	45.92	6.60	0.95	465.11	2062.79	1318.18	278.54
	IBM/SRC/REE/GR/(264/04)/GR/PCS/187_CK	218.36	362.51	54.25	221.5	41.12	3.01	57.56	5.46	33.13	5.47	15.01	1.83	11.32	1.58	1.55	134.63	1168.29	897.74	134.37
188	IBM/SRC/REE/GR/(262/04)/GR/PCS/188	457.54	1100.00	140.89	477.30	96.47	7.54	103.47	22.99	153.81	31.75	87.43	12.96	72.99	10.14	1.65	921.95	3698.90	2272.21	503.10
189	IBM/SRC/REE/GR/(24/06)/GR/PCS/189	438.55	985.22	143.14	532.12	121.23	10.91	126.74	28.17	203.60	38.62	114.34	18.40	104.44	14.73	2.44	1100.00	3982.64	2220.26	659.94
190	IBM/SRC/REE/GR/(24/06)/GR/PCS/190	372.48	815.25	107.98	416.81	89.83	6.88	86.49	20.12	153.29	30.80	87.06	14.06	77.03	12.04	1.65	866.77	3158.54	1802.36	487.77
	IBM/SRC/REE/GR/(24/06)/GR/PCS/190_CK	241.28	453.74	68.23	291.42	55.18	3.6	66.09	6.72	39.47	6.67	18.53	2.24	13.67	1.88	1.49	164.48	1434.69	1109.85	158.87
191	IBM/SRC/REE/GR/(61/06)/GR/PCS/191	338.65	701.65	122.18	445.53	93.13	8.16	94.68	19.22	138.81	26.90	73.83	11.30	70.55	10.50	1.32	841.26	2997.69	1701.14	453.97
192	IBM/SRC/REE/GR/(61/06)/GR/PCS/192	345.95	822.61	126.80	474.49	89.59	8.91	95.76	18.22	125.90	24.45	67.62	11.66	69.27	9.59	1.47	717.95	3010.26	1859.45	431.39
193	IBM/SRC/REE/GR/(61/06)/GR/PCS/193	426.94	972.52	120.16	417.62	90.86	8.13	98.12	22.25	164.95	31.40	90.16	13.73	88.20	11.27	1.36	939.26	3496.93	2028.11	528.21
	IBM/SRC/REE/GR/(61/06)/GR/PCS/193_CK	256.49	453.64	73.08	299.29	57.3	4.11	63.23	7.12	40.38	7.05	21.73	2.2	12.63	1.67	1.17	165.96	1467.05	1139.80	160.12

Sr No.	Sample Id	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Sc	Y	TREE (REE+ Sc +Y)	LREE (La-Sm)	HREE (Eu-Gd)
194	IBM/SRC/REE/GR/(29/22)/GR/PCS/194	271.78	639.98	93.85	347.78	67.25	6.80	62.32	13.40	106.05	21.51	62.22	10.10	55.50	6.81	1.12	594.01	2360.46	1420.63	344.70
195	IBM/SRC/REE/MS/(286/07)/RH/PCS/195	165.48	338.94	42.84	165.28	31.98	2.95	25.44	3.97	22.09	4.64	13.60	2.34	16.31	2.47	4.78	126.64	969.75	744.53	93.80
	IBM/SRC/REE/MS/(286/07)/RH/PCS/195R	170.68	372.20	48.84	170.95	31.43	2.87	25.82	3.86	22.55	4.35	13.54	2.30	16.11	2.70	4.63	128.03	1020.84	794.10	94.09
	NCSDC-73022 (Observed Value)	41.64	81.53	9.16	35.06	6.66	1.63	6.07	1.02	6.80	1.13	3.54	0.50	3.30	0.54	14.41	32.45			
	NCSDC-73022 (Certified Value)	40.00	79.00	8.90	33.00	6.20	1.36	5.50	0.91	5.20	1.04	3.00	0.49	3.10	0.48	13.80	28.00			
196	IBM/SRC/REE/GR/(474/96)/GR/PCS/196	218.31	565.29	70.67	275.44	67.79	7.78	73.98	15.99	129.73	27.16	82.58	11.94	65.72	10.08	2.91	782.83	2408.19	1197.49	424.96
197	IBM/SRC/REE/GR/(474/96)/GR/PCS/197	150.29	312.09	47.60	180.20	37.24	4.56	36.62	8.00	54.06	10.74	30.31	4.96	30.69	4.76	2.07	297.71	1211.90	727.41	184.70
198	IBM/SRC/REE/GR/(331/96)/GR/PCS/198	129.11	308.99	43.39	150.28	36.46	4.38	35.71	8.23	66.54	13.29	41.57	6.54	37.75	5.70	1.42	365.04	1254.38	668.22	219.71
199	IBM/SRC/REE/GR/(331/96)/GR/PCS/199	140.61	320.11	38.74	151.06	33.93	3.63	37.10	7.22	51.01	10.81	31.40	4.86	31.53	4.48	1.70	288.24	1156.44	684.45	182.04
200	IBM/SRC/REE/MS/(78/22)/RH/PCS/200	246.90	558.68	76.24	296.95	64.84	8.09	64.57	13.48	98.29	18.76	54.09	8.16	48.44	7.19	4.17	530.78	2099.59	1243.60	321.04

Sr No.	Sample Id	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Sc	Y	TREE (REE+ Sc +Y)	LREE (La-Sm)	HREE (Eu-Gd)
201	IBM/SRC/REE/MS/(78/22)/GR/PCS/201	335.02	699.61	107.18	348.13	89.67	7.37	98.69	26.18	213.00	46.22	136.53	21.42	117.83	16.74	2.38	1400.00	3665.95	1579.60	683.98
202	IBM/SRC/REE/MS/(77/22)/RH/PCS/202	238.88	540.67	79.65	282.32	57.97	8.18	60.53	12.91	85.87	13.79	37.90	6.41	35.68	4.88	3.18	436.50	1905.32	1199.49	266.15
203	IBM/SRC/REE/MS/(38/21)/RH/PCS/203	219.30	511.46	70.94	255.21	53.90	7.57	51.30	10.74	69.51	12.47	29.78	4.59	30.82	4.28	6.89	362.58	1701.33	1110.81	221.04
204	IBM/SRC/REE/MS/(38/21)/RH/PCS/204	253.74	747.36	90.98	326.41	100.12	8.56	120.34	31.89	244.74	47.49	145.03	24.67	141.29	18.87	2.05	1400.00	3703.56	1518.61	782.90
205	IBM/SRC/REE/MS/(236/06)/RH/PCS/205	440.64	953.80	136.60	502.08	95.85	9.04	82.01	14.56	104.19	20.10	63.68	9.22	49.01	6.73	0.71	613.31	3101.54	2128.98	358.54
206	IBM/SRC/REE/GR/(255/91)/GR/PCS/206	326.43	743.81	89.88	368.30	84.27	7.04	95.67	20.15	151.56	29.74	84.76	13.30	77.28	11.34	1.52	792.67	2897.70	1612.69	490.82
207	IBM/SRC/REE/MS/(PN113)/RH/PCS/207	315.67	709.90	96.88	369.24	77.65	8.99	80.36	14.24	105.57	20.92	57.17	9.86	55.75	7.61	2.02	558.46	2490.30	1569.35	360.46
	IBM/SRC/REE/MS/(PN113)/RH/PCS/207_CK	220.26	424.88	67.14	284.42	58.15	5.54	59.27	6.09	30.48	4.55	14.04	1.52	10.42	1.64	1.69	112.33	1302.42	1054.85	133.55
208	IBM/SRC/REE/MS/(PN113)/RH/PCS/208	557.66	1200.00	159.74	607.01	126.30	12.21	131.10	30.70	263.05	52.05	148.84	23.85	142.06	20.59	3.17	1600.00	5078.33	2650.71	824.45

Sr No.	Sample Id	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Sc	Y	TREE (REE+ Sc +Y)	LREE (La-Sm)	HREE (Eu-Gd)
209	IBM/SRC/REE/MS/(PN112)/RH/PCS/209	219.16	535.73	66.75	251.55	57.44	9.61	56.42	14.10	106.23	20.69	59.30	9.42	53.98	7.44	13.02	590.55	2071.38	1130.64	337.18
210	IBM/SRC/REE/MS/(PN111)/RH/PCS/210	174.13	359.71	50.40	215.38	44.96	6.54	46.21	9.06	70.37	13.10	39.33	5.91	36.27	5.86	5.70	394.02	1476.96	844.58	232.66
211	IBM/SRC/REE/GR/(30/85)/GR/PCS/211	204.92	480.28	68.75	268.03	62.17	6.76	70.25	15.08	107.58	23.03	70.97	11.17	66.53	9.38	2.48	691.21	2158.59	1084.15	380.75
212	IBM/SRC/REE/GR/(17/94)/GR/PCS/212	251.05	599.26	83.09	308.65	74.59	7.36	76.97	17.53	137.11	27.56	79.01	11.71	69.72	9.68	2.34	690.61	2446.23	1316.64	436.64
213	IBM/SRC/REE/GR/(17/95)/GR/PCS/213	207.46	593.63	77.01	295.70	71.47	7.51	76.50	17.62	140.29	26.76	82.60	13.63	72.42	10.53	2.36	790.51	2486.01	1245.27	447.88
214	IBM/SRC/REE/GR/(18/95)/GR/PCS/214	245.43	596.97	79.34	290.19	63.97	6.58	68.37	15.92	121.25	24.98	73.78	11.81	63.56	8.98	1.89	719.81	2392.84	1275.90	395.23
215	IBM/SRC/REE/GR/(3062/95)/GR/PCS/215	200.53	497.78	58.45	226.21	52.91	5.70	55.63	12.69	94.51	17.84	57.92	8.85	53.57	7.42	1.90	508.66	1860.57	1035.88	314.13
	IBM/SRC/REE/GR/(3062/95)/GR/PCS/215R	206.79	513.18	65.36	252.33	53.64	5.51	56.89	12.53	99.07	19.36	53.98	8.82	48.92	7.67	1.80	544.62	1950.48	1091.31	312.74
	NCSDC-73022 (Observed Value)	42.18	83.29	10.07	36.34	6.36	1.41	5.74	0.88	5.62	1.15	3.37	0.57	3.57	0.55	14.16	30.75			
	NCSDC-73022 (Certified Value)	40.00	79.00	8.90	33.00	6.20	1.36	5.50	0.91	5.20	1.04	3.00	0.49	3.10	0.48	13.80	28.00			

CK: Check Sample; R: Repeat Sample