Revised Proposal for procurement of four (04) nos. of Electron Probe Micro Analyser (EPMA) Instruments for Geological Survey of India

Geological Survey of India, CHQ, Kolkata

31.05.2024

1.0. Background

The Electron Probe Micro Analyser (EPMA) is a state of the art analytical geoscientific instrument required for high precision major, trace element, rare earth element, Platinum group of element analyses from Beryllium to Uranium for geological/ natural samples. EPMA also aids in identification and quantification of the exact mineral phases responsible for enrichment of any economically important element (e.g. Gold, REE, PGE, critical and strategic elements etc.), including different indicator minerals. The above quantification and elemental distribution within mineral phases helps in estimation of pressure-temperature condition of those mineral phases which can be utilized for analysing the genesis of vital mineral deposits.

The Geological Survey of India currently has five such instruments, out of which three (04) are nearly 15-year old, and requires immediate replacement or backing up with new machines. One of the old EPMA instruments (SX-100) is already replaced/ backed up by a new EPMA instrument (SX-5), already installed at National Center of Excellence for Geoscientific Research (NCEGR), Kolkata in April, 2019. The other three (03) old EPMA instruments (SX-100) installed at NCEGR-Bengaluru, NCEGR-Faridabad, and RHQ, Hyderabad need immediate replacement. Owing to the increased demand of Mission-II samples, GSI also feels it prudent that along with the three (01) new instruments for replacement at NCEGR-Bengaluru, NCEGR-Faridabad, and RHQ, Hyderabad, a new EPMA is required at RHQ, WR, Jaipur too to cater to the augmented current and future demand of this vital and fundamental analysis.

Accordingly, the Central Procurement Committee (CPC) of GSI led by the Director General, GSI in its 30th meeting on 22.03.2024 (copy attached) has decided to procure **four (04)** nos. of new EPMA instruments for **(i)** NCEGR, Faridabad, **(ii)** NCEGR, RSAS Bangalore, **(iii)** Petrology Lab, Southern Region, Hyderabad, and **(iv)** Petrology Lab, Western Region, Jaipur for fulfilling the requirement of GSI, at an estimated all-inclusive cost of INR 85,35,58,272/- (Rupees Eighty five Crore, thirty five lakh fifty eight thousand and two hundred seventy two only) with five years' post-installation warranty and with five years' post-warranty CAMC for four (04) instruments. Keeping the above need and commitment of GSI in mind for the nation building, GSI submitted this proposal to National Mineral Endowment Trust (NMET) in the 1st week of April 2024 to provide the necessary funding support to GSI for procurement of the above four (04) vital instruments.

2.0. Discussion of proposal in the 64th TCC Meeting held on 30.04.2024

To defend the above proposal, GSI attended the 64th Technical-cum-Cost Committee (TCC) meeting of NMET held on on 30th April 2024 and presented the proposal and sought approval for the procurement of 04 nos. of EPMA instruments for GSI. GSI informed the TCC that considering the technical specifications required for the EPMA of earth science applications, in India, there are practically only one global manufacturer that is M/s, Jeol India, since another major player in the market of EPMA, M/s Cameca has stopped manufacturing the above product since 2020. Accordingly, GSI approached M/s Jeol to determine the above estimated cost based on the quotation submitted by M/s Jeol **(Annexure-1).**

In the **64th TCC meeting**, however, the TCC in principle approved the GSI proposal and recommended the same to EC, but observed that the cost proposed by GSI seems quite high, and needs further discussion and exercise for optimisation. The TCC also advised GSI to keep in touch with Dr. E.V.S.S.K. Babu, Scientist (G), NGRI, Member, TCC for finalization of specifications and the cost part further at the earliest.

3.0. Follow-up actions by GSI after the 64th TCC Meeting held on 30.04.2024

Subsequently, Dr. E.V.S.S.K. Babu, Member, TCC shared an information to GSI related to procurement of EPMA by IIMT, Bhubaneswar at a cost of INR 7.3 Crore supplied by M/s, Jeol, and suggested to inquire with the vendor about the reasons for the price difference offered to other Government organizations. GSI team immediately checked the specifications of the EPMA procurement by IIMT, Bhubaneswar vis-à-vis GSI's current proposal submitted to NMET, and its specifications.

The salient points of the differences in specification of the above two instruments are summarised below, which were informed to Dr. E.V.S.S.K. Babu, Member, TCC and Dr. S. Ravi, Chairman, TCC too.

Salient points of comparison of the EPMA proposed by GSI to NMET and procured recently by IMMT, Bhubaneswar

- The EPMA offered to GSI has 5 spectrometers with customised crystal set-ups (including large crystal and special crystals for detecting very lighter elements like C, O, B, Be etc). On the other hand, the instrument supplied to IIMT contains only three spectrometers where either two or four regular crystals are accommodated.
- Resolution of SE and BSE images are better in GSI's proposed instruments than the one mentioned in the document of IIMT.
- GSI has asked for customised standard blocks where in each block fluorescent mineral will be there to check the beam and also asked for a dated monazite standard while IIMT did not mentioned about this kind of requirement in their PO.
- The warranty and AMC/CAMC clause for the next 10 years for GSI is 5 years warranty+5 years CAMC, for IIMT it is 3 years warranty+2 years CAMC+5 years AMC.
- GSI's proposed purchase also has factory-based training of geoscientists by the vendor.
- GSI has asked for additional spares and consumables for the next five years for the EPMA instrument and the accessories like chiller, carbon coater and UPS.
- 1 hour power back-up of the UPS has been asked by GSI in comparison to 30 minutes power back-up asked by IIMT.
- GSI has asked for 2 nos. of additional computers and 2 nos. of printers in compare to just 1 no. of printer asked by IIMT.
- GSI incorporates peripheral equipment like Oscilloscope, Cubivac Vacuum Desiccator, Vacuum cleaner, ultrasonic bath and some laboratory furniture which costs around 0.4% of the total cost which is not mentioned by IIMT.
- The specifications of IIMT machine are mostly suitable for metallurgical use, and not normally followed in earth sciences.

GSI team invited the vendor (M/s, Jeol) for further discussions on **8th May 2024**, and later had a VC meeting under the chairmanship of DDG & NMH-IV, GSI also on **9th May 2024**. GSI inquired with vendor (M/s Jeol India) about the reasons for price variations offered for IIMT, Bhuvaneshwar and the budgetary offer provided to GSI. The vendor conveyed that the EPMA instrument supplied to IIMT, Bhuvaneshwar is completely different in configuration and was customized to suit their metallurgical applications, and that is completely different than the EPMAs suitable for earth science applications. During discussion, the vendor conveyed that the stated estimated price provided earlier to GSI **(Annexure-1)** is based on certain criteria that include timing of the order, prise rise in crystals and semi-conductors in global market due to war in Europe, cost of transportation and categorization of GSI under commercial category and addition of custom duty etc. GSI further requested the vendor to share details of similar type of supplies by them in recent times to other institutes in India with similar kind of specification.

The vendor also conveyed that recently the firm has received a PO from IISER, Berhampur which was shared with GSI **(Annexure-2)**. The specifications and the offer price of IISER-Berhampur instrument and the recent proposed one by GSI to NMET was compared**,** the details are as under.

Price comparison of EPMAs of GSI proposal-2024 with the EPMA offered to IISER, Berhampur in November 2023 by the vendor (M/s Jeol)			
Revised Budgetary estimate of the proposed EPMA for GSI in 2024*		**Actual Cost of EPMA, IISER, Berhampur (P.O. of March 2024, copy of the P.O. attached)**	
Particulars	**Estimated cost per unit**	**Particulars**	**Actual cost**
Part-A: Main Equipment		**Part-A: Main Equipment**	
EPMA Instrument with the accessories like UPS, Chiller, Pumps, PC, Carbon coater including **5 years warranty (X)**	17,00,000USD (14,19,50,000INR according to conversion rate as on 09.05.2024)	EPMA including accessories, supply, delivery, installation and 5 years comprehensive warranty with an operator for 3 years	12,50,648 USD (10,44,19,165 INR according to conversion rate as on 09.05.2024)
10% Discount offered on bulk purchase of 4 Instruments **(Y)**	1,70,000USD (1,41,95,000INR according to conversion rate as on 09.05.2024)		
EPMA Instrument with the accessories like UPS, Chiller, Pumps, PC, Carbon coater including 5 years warranty after discount **(X-Y)**	15,30,000 USD (127755000INR according to conversion rate as on 09.05.2024)		
PART B: CAMC (of the instrument and all the accessories) post-warranty		**PART B: CAMC (of the instrument and all the accessories) post-warranty**	
CAMC for the 1st year	66,68,000 INR	CAMC for the 1st year	42,90,000 INR
CAMC for the 2nd year	66,68,000 INR	CAMC for the 2nd year	44,85,000 INR
CAMC for the 3rd year	66,68,000 INR	CAMC for the 3rd year	46,80,000 INR
CAMC for the 4th year	66,68,000 INR	CAMC for the 4th year	48,75,000 INR
CAMC for the 5th year	66,68,000 INR	CAMC for the 5th year	50,70,000 INR
Laboratory furniture	8,33,500 INR		
Total	3,41,73,500 INR	Total	2,34,00,000 INR
18% GST	61,51,230 INR	GST	42,12,000 INR
Total (USD converted to INR)	**16,80,79,730**	**Total (USD converted to INR)**	**13,20,31,165**

- In addition, some of the important peripheral equipment like Oscilloscope, Ultrasonicator bath, Cubivac Vacuum Desiccator used for servicing of the EPMA instrument and for proper storage of the spares and consumables have not been added by IISER, Berhampur.
- Some important laboratory furniture and computers have been proposed by GSI along with the instrument to avoid further procedural delays in procurement, which have not been included by IISER, Berhampur.
- It has been confirmed by the firm M/s Jeol India Pvt. Ltd. that according to their global policy, there is 25% educational discount for academic institution which does not apply to organizations like GSI **(Annexure-3)**.
- GSI proposal includes supply of necessary consumables and spares for EPMA and accessory instruments for a period of 05 years which is not incorporated in IISER proposal.
- GSI proposal also includes factory site application training for officers of GSI whereas, IISER, Berhampur proposed for onsite (at IISER, Berhampur) application training only.

Subsequently, as inquired by the NMET-Secretariat through email **(Annexure-4)**, along with the above comparison, GSI was also requested to compare prices and specifications of the last EPMA purchased by GSI in 2018 at Kolkata. As advised, the same was also carried out with the GSI PO of 2018 for a SX-5 EPMA purchased from M/s Cameca **(Annexure-5)**, and the same is as under.

Price comparison of GSI - 2024 with the EPMA procured by GSI and installed at NCEGR, Kolkata in April, 2019			
Revised Budgetary estimate of the proposed EPMA for GSI in 2024*		**Actual Cost of the EPMA for GSI, NCEGR, Kolkata (P.O. of 2018, copy of the P.O. is attached)**	
Particulars	**Estimated cost per unit**	**Particulars**	**Actual cost**
Part-A: Main Equipment		**Part-A: Main Equipment**	
EPMA Instrument with the accessories like UPS, Chiller, Pumps, PC, Carbon coater including **5 years warranty (X)**	17,00,000USD (14,19,50,000 INR according to conversion rate as on 09.05.2024)	EPMA including accessories, supply, delivery, installation and **warranty of 1 year**	13,44,476 EURO (10,59,98,488 INR according to conversion rate as on 2018)
10% Discount offered on bulk purchase of 4 Instruments **(Y)**	1,70,000USD (1,41,95,000INR according to conversion rate as on 09.05.2024)		
EPMA Instrument with the accessories like UPS, Chiller, Pumps, PC, Carbon coater including 5 years warranty **after discount (X-Y)**	15,30,000 USD (12,77,55,000INR according to conversion rate as on 09.05.2024)		
PART B: CAMC (of the instrument and all the accessories) post-warranty		**PART B: AMC (instrument and all the accessories without spares and preventive maintenance) post-warranty**	
CAMC for the 1st year	66,68,000 INR	AMC for the 1st year without spares and preventive maintenance	10,00,000 INR
CAMC for the 2nd year	66,68,000 INR	AMC for the 2nd year without spares and preventive maintenance	10,00,000 INR
CAMC for the 3rd year	66,68,000 INR	AMC for the 3rd year without spares and preventive maintenance	10,00,000 INR
CAMC for the 4th year	66,68,000 INR	AMC for the 4th year without spares and preventive maintenance	10,00,000 INR
CAMC for the 5th year	66,68,000 INR		
Laboratory furniture	8,33,500 INR		
Total	3,41,73,500 INR	Total	40,00,000 INR
18% GST	61,51,230 INR	GST	7,20,000 INR
Total (USD converted to INR)	**16,80,79,730**	**Total (USD converted to INR)**	**11,07,18,488**

- During VC on 09.05.2024, M/s, Jeol was informed with all the above observations of GSI concerning higher price estimated and offered by them compared to the instrument supplied by them to IISER-Berhampur, and the similar instrument purchased by GSI in 2018 at Kolkata, and was requested strongly to revise the estimated price of current proposal submitted earlier. The vendor after discussion with GSI on 09.05.2024, submitted their revised quotation on their final offer price of **INR 67,23,18,920/-** for **04 EPMAs** having the same specifications as offered earlier with each unit costing **INR 16,80,79,730/- (inclusive of all)** which was immediately shared with the Chairman, TCC, and NMET-Secretariat on 09.05.2024 **(Annexure-6)**.

The Director General, GSI however observed further that still the cost offered by the vendor to GSI (**INR 16,80,79,730/-)** is **INR 3,60,48,565/-** costlier than the cost offered by them to IISER, Berhampur **(INR 13,20,31,165/-).** The DG, GSI requested M/s, Jeol for further discussion on

this issue led by their Managing Director regarding the estimated price. The first meeting with DG, GSI happened over VC on 24.05.2024 when DG, GSI offered them to consider further discount to the price offered by them on 09.05.2024 and requested them to visit GSI HQ., Kolkata for a physical meeting on this issue on 29.05.2024. After discussion on both the days, as per the request of DG, GSI, M/s, Jeol has given their **final** and the **last** offer as **TOTAL Delivery Duty Paid (DDP) Price** of **USD 7428,000/-** for **04 EPMAs** with the same specifications **having 5-year warranty plus 5-year post-warranty CAMC on 30.05.2024 (Annexure-7).** Considering the current average USD to INR exchange rate as INR 84/- per USD, the above estimated cost for 04 EPMAs comes to **INR 62,39,52,000/- (Rupees Sixty-two Crore, thirty-nine lakh, fifty-two thousand only) which is inclusive of IGST and Customs Duty.**

4.0. Discussion on the revised GSI proposal of 04 EPMAs at the 65th TCC meeting

GSI attended the **65th meeting** of the **NMET TCC** on 30th May 2024 and informed the TCC about the above revised proposal with revised estimated cost and sought approval from the committee for procurement of 04 new EPMAs for GSI as per the same specifications mentioned earlier. The committee appreciated the effort taken by GSI, the technical help rendered by Dr. EVSSK Babu, Member, TCC and approved the revised proposal in principle of procurement of four (04) new EPMAs with the same specifications **having 5-year warranty plus 5-year post-warranty**, at an estimated **TOTAL Delivery Duty Paid (DDP) Price** of **USD 7428,000/-** that is **INR 62,39,52,000/- (Rupees Sixty-two Crore, thirty-nine lakh, fifty-two thousand only)** which is inclusive of IGST and Customs Duty **(Annexure-7)**.

5.0. Key analytical capabilities of EPMA:

5.1. Identification and quantification of the exact mineral phase responsible for enrichment of any economically important element (e.g. Gold, REE, PGE, critical and strategic elements etc.)

5.2. Identification of different indicator minerals as path finder to economic deposits

5.3. Quantification and elemental distribution within mineral phases helping in estimation of pressure-temperature condition of those mineral phases which can be utilized for analyzing the genesis of mineral deposits

5.4. Monazite dating of different rocks helping in determining age of important geological events

6.0. Background Information:

6.1. **History of EPMA in GSI:** The first EPMA instrument in GSI was installed at Faridabad in 1998. Later because of its age and frequent break-down, a new EPMA instrument was installed in 2010. During this time SX100 was also installed at NCEGR-Bengaluru, and RHQ, SR, Hyderabad. However, the second oldest EPMA in GSI came at NCEGR, Kolkata, when SX-100 (Make: Cameca, France) was installed in 2004, and 15 years, a new EPMA-SX Five (Make: Cameca, France) was installed in NCEGR-Kolkata in 2019 to back up/ replace the old SX-100. The SX-100 of Kolkata analysed **10,535 samples** including **2,07,364 point analysis** since 2004. On average, each of the EPMA laboratories analyzes around 500-550 nos. of samples per year (for more than 100 projects) which has increased in recent years (600-650 nos.) as the number of M-II projects is gradually increasing.

6.2. **NCEGR, Bengaluru:** The existing EPMA instrument (Model No. **SX100**, make -M/s **Cameca**, **France**) was installed in EPMA Laboratory, NCEGR, RSAS, Bangalore in **April, 2009**, and the instrument has been running for the last **15 years** successfully generating high quality analytical data of a total of **5285 nos. of samples** including **1,29,771 point analyses**. The instrument has been rigorously used to fulfill all the EPMA requirements of SU: Karnataka and Goa; NCEGR, RSAS, Bangalore and Central Region of GSI. Apart from that, several organizations such as IISC, Bangalore, University of Mysore, and Pondicherry University etc. have utilized the facility of EPMA in NCEGR, RSAS, Bengaluru. Now, the instrument is under an extended CAMC till 2025, however, because of its age, non-availability of spare parts, it has a total downtime of **572** days in last 15 years, and off late

during last 2-3 years, it has been facing frequent issues. Currently, it is down and non-functional because of malfunctioning of major spare parts – HV Tank. Its allotted samples are being diverted to other centers (Hyderabad and Kolkata). Now, the instrument is under an extended CAMC till 2025.

6.3. **NCEGR, Faridabad:** The EPMA instrument (Model No. **SX100**, make - M/s **Cameca, France**) was installed in the EPMA Laboratory, NCEGR, Faridabad in **May, 2010** and the same has been running for the **last 14 years** successfully generating high quality analytical data of a total of **6956 nos. of samples**, including **1,54,015 point analyses**. The instrument has been rigorously used to fulfill all the EPMA requirements of entire northern and western regions of GSI. Apart from that, several organizations such as Subros Ltd Noida, Delhi University, L&T MHPS Boilers Ltd Noida etc. have utilized the facility of EPMA in NCEGR, Faridabad. Now, the instrument is under an extended CAMC till 2025, however, because of its age, non-availability of spare parts, it has a total downtime of **326** days in last 14 years, and off late during last 2-3 years, it has been facing frequent issues of malfunction/ break down. Currently, it is working, and analyzing samples after a major repair.

6.4. **RHQ, SR, Hyderabad:** The EPMA instrument (Model No. **SX100**, make - M/s **Cameca, France**) was installed in EPMA Laboratory of Petrology Division, GSI, SR, Hyderabad, in **April, 2010**. Till date, it has analyzed more than **5760 samples** including **1,78,000 point analyses** during the last **14** years and the optimal utilization of the instrument led to generation of huge number of analytical data. This facility has excelled in maintaining high quality standards throughout its serving period. Several organizations such as IIT (ISM) Dhanbad, Osmania Univ., Hyderabad, Andhra Univ., Visakhapatnam, Midwest Granite Pvt. Ltd., Hyderabad, CSIR-NGRI, Asst. Commissioner of Custom Office Vizag have utilized the facility of EPMA at Hyderabad. Off late, like NCEGR centers at Bengaluru, and Faridabad, because of its age, EPMA at Hyderabad has also been affected with frequent downtime (**160 days**). This instrument is also on CAMC till 2025.

6.5. The above all three EPMA instruments are facing frequent break-down in recent years due to technical glitches because of its old age, and since the OEM (M/s, Cameca, France) of the instrument has now stopped manufacturing EPMA, in future the vital spare parts may not be available which in turn may cause prolonged downtime of these instruments, and will lead to severe operational issues of vital sample analysis in GSI, and will affect progress of vital FS Programs of critical Mission-II, I, and IV items of GSI where the EPMA analytical results are prerequisite.

6.6. **RHQ, WR, Jaipur:** During FS 2023-24, 72 items under Mission –II in GSI, WR for mineral exploration have been taken up which resulted in substantial increase in the quantum of work load for EPMA studies for the correct identifications of ore mineral phases, silicates, their relationship with the gangue minerals and other petro-mineralogical studies. This quantity will increase further from next FS onwards due to augmentation in number of Mission-II items in GSI in all mineral-rich regions. EPMA analyses help in developing mineral system approach in the study area and aids in targeting new areas from known to unknown approach in exploration. This persistence demand for increasing the number of samples for EPMA studies pertaining to M-I, M-II and M-IV of GSI, WR, and other mineral-rich regions, and also equip GSI in entirely with the latest analytical capabilities, a new EPMA installation exclusively for WR, and other mineral rich Regions at RHQ, WR, Jaipur with special focus in analyzing Mission-II samples of GSI is a need of the hour.

7.0. Rationale for procurement of 04 nos. of new EPMA Instruments:

7.1. The rationale of procurement of four (04) EPMAs in GSI is for strengthening and updating its existing analytical capabilities for coping up with the augmented demand of fundamental mineral identification of phases, correctly in the future in a time-bound manner. This endeavour will enhance GSI's technical prowess in analysing large number geological samples in the future to augment country's ever-growing need for the strategic and critical mineral resources. Keeping the above need and commitment of GSI in mind for the nation building, GSI submits this proposal to National Mineral Endowment Trust (NMET) to provide the necessary funding support to GSI for the procurement of the above four (04) vital

instruments. Out of the four proposed new instruments, three are meant to replace 14-15 year-old fleet of three existing EPMAs, and another at a new place with dedicated focus on the regional needs and mineral investigation projects. The intent of increasing the in-house capacity is also for supplementing the progress of GSI's continued venture into the newer realms of exploration of critical and strategic minerals vis-à-vis to have a suitable replacement to the existing facility to a modern and up-scaled instrument to continue the quality and hassle-free services for at least 10 more years in the future (5 year Standard warranty+5 year post-warranty CAMC support) in order to achieve the desired aspirations and future requirements of GSI and the mineral exploration industries.

8.0. Technical specifications of each of the EPMA Instruments

Sl.	**Specification**	
General Specification		
State of the art electron probe micro analyser (EPMA) for high precision major, trace element, rare earth element, Platinum group of element analysis from Beryllium to Uranium for mainly geological natural samples as well as non-geological samples and projects including environment projects. Five vertical mounted wavelength dispersive spectrometer (WDS) with diffracting crystals in combination of LDE-LiF-PET-TAP (or equivalent crystals) along with special crystals capable of light element analysis and large diffracting crystals, one energy dispersive spectrometer (EDS), secondary (SE) and backscattered electron detectors (BSE), reflected and transmitted light optics and other standard accessories. Fully automated (with manual override) operation for all the important functions as desired. Capability of automated analysis, high resolution imaging including optical microscope imaging (plane and cross polarised and reflected with variable field of view) and multi element X-ray mapping. Beam current regulation suitable for accurate trace element analysis. Automatic Z focusing, high resolution TV camera monitors or equivalent high-resolution enlarged display (at least 23") option for the optical microscopic image. Separate displays (at least 23") for vacuum systems, BSE, result and real time analysis. All operational software including those for chemical dating of minerals. X-ray mapping both qualitative and quantitative and quantitative age mapping. Suitable standards for REE, silicate, oxide, sulphide, PGE and light element analysis and a standard block (dated monazite grain) for calibration of elements for chemical dating. Tungsten/LaB6/CeB6 filament assembly, sample holders for 2 & 4 thin sections (25mm×46mm each) with stub holder (25mm diameter each). Comprehensive warranty, on site and factory training on maintenance and applications.		
1	**Performance specifications**	**Quantity**
	a) Detectable element range for quantification: Be to U **b) Accelerating Voltage range:** 0.2 to 30 kv or more in steps of 0.5 kv or less **c) Probe/ Beam Current range:** 1pA to 1 µA with high beam current stability of ± 0.05% per hour and ± 0.3% or better for 12 hours for reliable, reproducible and accurate unattended analysis. Beam current regulation should be of high range for analysis of trace Element-REE-PGE. Beam diameter adjustment with very less variation.	
2	**High Stability Electron Column and Gun with inter–changeable W and LaB6/CeB6 cathodes.**	
	a) High vacuum in column for longer life of filament.	

	b) Electron optical column with suitable electromagnetic lenses for focusing electron beam, liner tube for elimination of stray electrons, Faraday cage, range of automated /manual functions for column alignment, focus, astigmatism, correction, beam size resolution, filament heating etc. (beam focus to be maintained as beam voltage is varied).	
3	**Secondary electron detection and imaging systems with a secondary electron image resolution of 6nm (W) and 5nm (LaB6/CeB6) or better.**	
4	**Backscatter electron detector and imaging systems with topographical, compositional display with BSE resolution of at last 15 nm or better at 25KV/10 nm or better at 30KV. BSE image must be very clear with proper contrast in real time.**	
5	**Optical Microscopy System:**	
	Reflected and transmitted light viewing with polarizer with zooming capacity variable field of view with capacity for low magnification to high magnification (5x-100x), high resolution, Automatic Z focusing and high-resolution CCD TV Camera and separate display (at least 23") option for the optical microscopic image.	
6	**Multi viewing capability permitting simultaneous observation of real-time images (Separate displays with at least 23" monitors for optical image, SE/BSE image, Software/control systems and real time analysis/result)**	
7	**Spectrometer Specifications:**	
	Five vertical Wave Length Dispersive Spectrometer (WDS) with diffracting crystals in such a combination that one set of LiF/LiFL PET/PETL TAP/TAPL/RAP/ADP (or equivalent crystals) is always available for analysis even with three operational spectrometers without resorting to crystal flipping. a) At spectrometer 1: Two large crystal PETL/LPET/PET, LDE1L/LTAP/ADP or equivalent crystals. b) At spectrometer 2: Two large crystal LiFL/LLIF/LiF, LDE6L/PC3/LSA200 or equivalent crystals. c) At spectrometer 3: Two large crystal LiFL/LLIF/LiF, TAPL/LPET/PET or equivalent crystals. d) At spectrometer 4: (Four diffracting crystal LiF, PET, TAP & LDEB/PC1 or equivalent crystals) or (two diffracting crystals PC1/LDEB/LSA55, TAP/RAP or equivalent crystals). e) At spectrometer 5: (Four diffracting crystal LiF, PET, TAP & LDE2/PC2 or equivalent crystals) or (two diffracting crystals PC2/LDE2/LSA120, PET or equivalent crystals). All the spectrometers should have a fully focused Rowland circle (higher radius of Rowland circle will be preferred to minimize peak overlap in WDS) capable of doing precision analysis of REE, PGE & other rare metals. Least overlaps in peak and background in WD spectra, specifically in case of analysing PGE and REE should be ensured. Autofocus for non-level specimens into Rowland circle, automatic crystal change position control with optical encoders, proportional counters for full range of wavelength should be available. Count rate reproducibility should be better than +0.5% after crystal repositioning, peak to back ground ratio should be better than 100:1 for heavy elements	

	and 10:1 for light elements. High workable vacuum level should be maintained in the chamber and spectrometer to do accurate analyses with LaB6/CeB6/W filament.	
8	Specimen chamber and stage with air airlock to isolate electron optical column, permitting fast sample loading & exchange without venting of the entire chamber, X, Y, Z orthogonal stage movement, automated stage controls with specimen positioning, optical encoding system ensuring absolute positioning of stage with 1µ accuracy for reliable unattended analysis. High speed (15mm/sec) stage drive in X and Y directions.	
9	Electron column should be sturdy preferably with provision for isolation of gun area from rest of the instrument for creating vacuum and venting. Pneumatic vacuum systems with safety devices, control systems and continuing monitoring, isolated sub systems with high workable vacuum in gun, column, chamber and spectrometer to increase the filament life, beam stability and analytical accuracy. Vacuum systems should be capable of reaching analysis level condition in the main chamber under 45 minutes from initiation of pumping and sample interchanging time should be low (< 3 min) with air locking facility.	
10	**Computer and Printers**	
	Two computers: Host control system, data acquisition and processing system, preferably PC (Windows) based. Two printers (one colour laser for elemental mapping and one black and white laser for data Printing) along with scanning and copying facility	2 Nos. 2 Nos.
11	**EPMA total software packages**	2 - licenses
	a) Latest EPMA total software packages (2 license) applicable to geological work and compatible with Microsoft Windows including EPMA operations /control software, high level software package for qualitative and quantitative X-ray analysis with all matrix corrective routines for light as well as heavy element etc. (PAP/ZAF/Phi/Rho-Z. etc.) image acquisition and processing software including X-Ray mapping of area, line scans, image overlay etc. b) Software for age determination (chemical dating or Monazite etc.) With isotopic plots (isochron, weighted average, histogram etc. Software for quantitative X-ray mapping and age mapping. c) There should be a single and fully integrated user friendly software for imaging, EDS and WDS. d) Software should have X-ray ratemeter for showing live count for the different elements. e) Software should have an option to check beam sensitivity in terms of count vs time graph. f) Software should have an option to create mosaic of BSE image and X-ray map	
12	**EDS SYSTEM:**	1 No
	The EPMA should be attached with EDS system, with multi-element (Be-U) analysis capability. The EDS system should be capable of continuous live analysis, live EDS mapping. Simultaneous screening analysis during SEM observation should be possible.	

	The EDS system should have following specifications or better. • Effective detection area: 30 mm^2 • Detectable elements: Be to U • Energy resolution: 129 eV (Mn-Ka FWHM) • There should be a single and fully integrated user friendly software for imaging, EDS and WDS.	
13	**Standard blocks**	
	• Standards: Full set of standards required for geological works: preferably natural standards. • Standards of metals and simple compounds for instrument calibration, beam viewing and focusing. • Standards for calibrating Rare Earth Elements from La to Lu along with Y. • Standards for calibrating Nb, Ta, Hf, Te, Bi, Zr, W, Cd, Mo, Cs, Se, Sc, Ga, Ge, • Geological natural standards (e.g. orthoclase, albite, Jadeite, wollastonite, diopside, olivine, kyanite, apatite, andradite, periclase, rutile, hematite, chromite, pyrite, chalcopyrite, arsenopyrite, sphalerite, barite, galena, gahanite, etc.) for calibrating common elements occurring in silicate, sulphide and oxide minerals (Na, Mg, Al, Si, P, S, K, Ca, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Ga, Ge, As, Se, Ag, Sn, Sb, Ba, Au, Hg) including standard for calibrating Cl. • Standards for calibrating Platinum Group of Element (PGE). • Standards for calibrating lighter elements like B, C, Be, N, F, O including natural standard of tourmaline for calibrating B and beryl/crysoberyl for calibrating Be. • Standards for calibrating Rb, Sr, Re, Os. • Geochronology standards (natural) for calibrating U, Th, Pb for monazite dating with a dated natural homogenous monazite grain standard. • Each of the standard block should preferably have Zircon/SnO_2 for checking beam location and andradite for crystal verification whenever required (without the necessity of switching over to other holder for beam location and crystal verification)	
14	**Specimen holders along with shuttle holders.**	3 Nos.
	• 1 sample holder capable of holding two samples in combination of rectangular thin sections of 47mm×25mm×1mm size and two circular stubs with 25-26 mm diameter-15 mm thickness for keeping standards blocks. • 1 sample holder capable of holding 4 samples of only rectangular thin sections of 45mm×25mm×1mm size or equivalent • 1 sample holder capable of holding 6 or more samples of only circular stubs with 25-26 mm diameter and 15 mm thickness.	
15	**One Air cooled top branded water Chiller (low noise)**	1 No.
	One Air cooled re-circulating water chiller for EPMA unit with heavy duty monitor capable of continuous running (24 hrs-365 days) with electronically /digitally controlled thermostat and flows control with sufficiently large tank	

	capacity to take care of short-term temperature fluctuations including one extra pump, essential spares and consumable for five years.	
16	**Top branded Uninterrupted power supply (UPS) system**	2 nos.
	Two UPS (1+1) or as per requirement of the EPMA instrument and its auxiliary units to support all units of the lab. UPS should be branded company with the parallel redundancy compatible with the EPMA instrument and its auxiliary units with uninterruptible power supply with surge resistant with minimum one hour backup along with best quality batteries as per requirement.	
17	**Carbon Coater**	1 No.
	Carbon coater from a branded company/same manufacturer including essential spares and consumables for five years along with UPS and chiller (if required) fulfilling the following necessary conditions and technical demonstration of the carbon coater model to be supplied has to be given prior to finalising the model. i. Oil free pump for creating vacuum in the chamber of the carbon coater. ii. Highest vacuum in the chamber should reach up to 4×10^{-6} mb. iii. Vacuum level should not drop below 10^{-4} mb during evaporation/sputtering/processing. iv. In case of total coating process consuming more than 1 hr for a single run, stage should be large enough for accommodating at least 6 nos. of rectangular thin sections of 47mm×25mm×1mm size or 10 nos. of circular stubs with 25-26 mm diameter and 15 mm thickness for coating at single run. The coating process should be carbon rod based. v. 500 nos. of carbon rods of grade-1 with 99.9% pure carbon should be supplied along with the carbon coater. vi. Exact Thickness monitor of the carbon deposition on the sample should be included with the coater. vii. The cleaning process of the chamber should be easy and quick after completion of the coating. Technical demonstration of the carbon coater model to be supplied has to be given prior to finalising the model.	
18	**Gas Cylinders and Gauges (regulators)**	
	Filled-in Nitrogen- 2 nos and P-10 (or any other gas for quantification) cylinders- 2 nos (each cylinder of 7 M3 or equivalent capacity) of Indian make should be provided by the supplier. The indenting division will take care of their re-filling subsequently. Gauges (regulators) for calibration manifold of Nitrogen gas and P-10 gas (2 nos. for P-10 and 2 nos. for N_2) for proportional counters/ venting purpose. These should be of Indian make and provided by supplier.	2 nos. cylinders and 2 nos. of gauges for each type of gas
19	**Oscilloscope**	1 No.
	Digital Oscilloscope which is usually required during servicing of EPMA specially for spectrometer servicing with at least the following specification i. 4 channel ii. 200 MHz Bandwidth	

	iii. 1 GSa/s Real Time Sampling rate iv. X-Y mode	
20	**Ultrasonicator bath with at least 15 lit. capacity**	1 No.
21	**Vacuum desiccator**	1 No.
	Cubivac type vacuum desiccators of polycarbonate material and 30 lit capacity along with a vacuum pump for safe storage of standards, filaments, apertures and other delicate spares and consumables used in EPMA in vacuum.	
22	**Vacuum cleaner**	1 No.
	Vacuum cleaner of reputed brand with both suction and blower for cleaning the electronic cabinet and boards of EPMA from a distance.	
23	**Additional Furniture (apart from EPMA instrument table)**	
	Two nos. branded computer tables Two wooden sturdy tables heavy duty (Customised as per Lab / Instrument requirement). Six nos. reputed/branded company revolving lab working chairs	2 Nos. 2 Nos. 6 Nos.
24	**Installation, Training, Warranty, & CAMC:**	
	a) Complete installation at user site with all costs included until signature of user or acceptance certificate of equipment. b) The installation of the instrument will be immediately followed by 10 days on-site operational training for the officers who will be using the instrument. Acceptance certificate of the instrument will be issued by GSI after completion of the operational training. c) Three weeks (15 working days) training at manufacturer's site (1 week maintenance training and 2 weeks application training) for the officers of EPMA Lab, GSI at least after 3 months from installation of Instrument. The cost of travelling including visa charges (cost of travel from India to manufacturer's site and back and cost of travel within the city for the entire training period), stay and food for the officers during the training at manufacturer's site will be covered by the supplier. d) **Five-year warranty of main instrument and all its ancillaries (Chiller, UPS system, Coater etc.), after completion of warranty, 5 years CAMC of main instrument and all its ancillaries (Chiller, UPS system, Coater etc.) (Including all the spares & consumables). During CAMC, Five days Factory engineer/ foreign engineer visit in every year will be mandatory. No extra cost will be bear by the customer.** e) Regarding response to attend the trouble shooting of the instrument and its ancillaries systematic penalty clause should be imposed on the service provider. 10% penalty will be deducted in failing to attend a trouble shoot within 7 days. 25 % penalty will be deducted in failing to attend a trouble shoot within 15 days. 35% penalty will be deducted in failing to attend a trouble shoot within 21 days. 50% penalty will be deducted in failing to attend a trouble shoot within 30 days. f) All installation/maintenance kits, manuals, circuit diagrams, etc to be provided. Essential spares for control and vacuum system should be provided. LAB6/W filaments, filament fixing assembly (2 nos.), spectrometer kits, pump kits, vacuum gauge etc from OEM company for	

	a period of 5 years should be supplied (LaB6 filaments for 5 years should not be supplied all at a time, these should be supplied as and when asked by the indenting division over the 5 years warranty period of the instrument).	
25	The supplier responsibility will include the following tests and measures of the EPMA lab site: a) Tests for floor vibration and vibration treatment if required. b) Tests for Spurious magnetic field and remedial c) Antistatic flooring to avoid damage to the instrument by avoiding static electricity	
26	**Technical Demonstration**	
	Onsite demonstration of all the technical specifications by the OEM within India in the similar type of instrument (during TEC Technical) is mandatory before opening the price bid	
27	The manufacturer should provide: a) At least 10 years' experience in manufacturing this type of instrument. b) List of installations of this instrument in India with year of installation. c) List of specially trained service engineers for EPMA only, available in India.	
28	The manufacture should provide spares and services for next 10 years or more.	

9.0. Fund Requirement: The total estimated cost for the four (04) nos of EPMA with 5 (five) years warranty and 5 (five) years post-warranty CAMC including the custom duty, IGST, GST on CAMC cost, and other statutory Govt. duties/ taxes is furnished below:

Total estimated cost of the 04 nos. of EPMA with 5 year warranty + 5 year post-warranty CAMC*	**USD 7428,000/-**
Total estimated cost converted to INR as on 30.05.2024 (@ Rs.84/ USD$)	**INR 62,39,52,000/-** (Rupees Sixty-two Crore, thirty-nine lakh, fifty-two thousand only) which is inclusive of IGST and Customs Duty **(refer Annexure-7).**

* The standard CAMC rate per year for such state-of-the-art, high-end instruments can be tentatively be considered as about 5% of the base instrument cost.

10.0. Procurement challenges and Timeline for procurement, Installation, Commissioning, and Payment liability:

As far as GSI's knowledge goes, there is no domestic manufacturer for this high-end EPMA instrument in India. One of the main manufacturers of EPMA was – **M/s, Cameca, France** which has recently stopped manufacturing EPMA, although they are still providing the CAMC support to the old instruments of GSI till 2025, but as mentioned earlier, may not continue further because of non-availability of spares. As per GSI's knowledge, EPMA is currently manufactured by two global companies – **M/s Jeol Ltd., Japan,** and **M/s Shimadzu Corporation, Japan**. The above foreign manufacturers operate in India through their Indian branch/ sales and support partner. The EPMA of Shimadzu make installed in India is however still not used in geological applications. Those are restricted to metallurgical applications only. Moreover, as per the prevailing Govt. of India norms, and regulations, timeline for procurement of four (04) nos. of EPMA may take 6-7 months' time as mentioned below for obtaining approvals etc., as per the prevalent GoI norms. One of the manufactures (M/s Jeol

India Private Ltd.) during their in-house presentation indicated that M/s JEOL will take maximum of 12 months post-PO to supply the machines in India. Based on the above, the following tentative timeline of procurement, supply, and commissioning, and payment liabilities are proposed.

	FY 2024-25											
	Apr	**May**	**Jun**	**July**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**
Proposal submission to NMET												
Approval by NMET												
Tendering Phase – I												
MII Exempt. Approval												
Tendering Phase II & issue of PO												
Manufacturing phase												
	FY 2025-26											
	Apr	**May**	**Jun**	**July**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**
Manufacturing phase												
Shipment & LOC payment (90%)												
	FY 2026-27											
Payment after commissioning and training (10%)												
CAMC cost payment will start w.e.f. FY 2031-2032 onwards till FY 2035-2036.												