



**NATIONAL CENTRE FOR EARTH SCIENCE STUDIES**  
**(An Institution under the Ministry of Earth Sciences, Govt. of India)**  
**P.B. No. 7250, Akkulam, Thiruvananthapuram-695 011, Kerala.**  
**PURCHASE DIVISION**

**Our Ref : PUR-PROC/123/2017-PUR-NCESS**

(To be quoted in all correspondence)

**Dt. 18.05.2017**

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***Sub: e-Procurement Tender***

Dear Sirs,

The ESSO-National Centre for Earth Science Studies (ESSO-NCESS), MoES, Trivandrum is one of the leading R&D institutes in the country for Solid Earth Research. One of the major R&D activities of the ESSO-NCESS is precisely constraining the timing of different geological events as well as finger printing different geological processes through deploying advanced methodologies in the field of isotope geochemistry. Towards this capacity building, it is proposed to acquire a versatile and state of the art Multi Collector Inductively Coupled Plasma Mass Spectrometer (MC-ICPMS) system for multi-element isotope systematics from a range of matrices such as solids and solutions covering the broad fields of geological, planetary, marine, environmental and biological samples with high-precision and accuracy.

The MC-ICPMS should have high-sensitivity, high-mass resolution, mass-bias stability (both short term and long term), good reproducibility and supplied along with all its peripherals (plasma interface, ICP source, desolvating inlet system, auto sampler etc.). Provisions for both solution and solid (laser ablation) mode of sample introduction must exist with seamless integration between the mass spectrometer and the sample introduction systems, both in laser-mode as well as in solution-mode. The instrument must be supported by advanced operating software capable of unattended as well as remote operation through internet and suitable data reduction routines along with capability for real-time monitoring of all important instrumental parameters. The instrument should be capable of measuring the element/isotope systems used in geochemistry from mass 3 to mass 300.

The MC-ICPMS should be integrated to the 213nm Cetac Laser Ablation system that is being procured for in-situ measurements of U-Pb isotopes as per the performance demonstration criteria mentioned in the later sections.

Please send your offer along with descriptive catalogue/ pamphlet for the following items not later than **04.07.2017 at 06.00 PM (Tender Opening at 11.00 AM on 06.07.2017)**. The terms and conditions governing the tender are given at the bottom.

<i>Sl. No</i>	<i>DESCRIPTION</i>	<i>QUANTITY REQUIRED</i>
	<b>Multi Collector Inductively Coupled Mass Spectrometer (MC-ICPMS)</b>	<b>1 Set</b>

**(Detailed specification is attached)**

### **INSTRUCTIONS TO THE TENDERERS AND TERMS AND CONDITIONS**

1. **The quotation should be submitted by e-procurement in PDF format by ‘logging on’ in the website [eprocure.gov.in/eprocure/app](http://eprocure.gov.in/eprocure/app). The total file size of the documents submitted should not exceed 20 MB.**
2. **The technical and financial bids should be submitted separately.**
3. **An EMD of Rs. 14,00,000/- may be submitted by way of bank remittance remitting the amount to our bank account. (Account no: 57059896404; Account Name: National Centre for Earth Science Studies (NCESS); IFSC Code: SBIN0070581; MICR Code: 695009036; Bank: State Bank of India, Akkulam, Trivandrum). The remittance should reflect in our accounts on or before the date of submission. The late remittance will not be valid. Exemption from EMD will be allowed for organizations registered with Central Purchase Organization, National Small Industries Corporation (NSIC) or MoES, Govt. Of India, if the claim is supported by relevant documents. The bank details for the refund of EMD should be furnished along the bid.**
4. **The material should be delivered at NCESS or installed at the specified location and so the quotation should include all the charges for the delivery at NCESS/installation.**
5. **It should be clear whether the quoted amount is inclusive of tax or not. If the tax is extra, the current tax rates should be specifically mentioned. We are eligible for Excise Duty Exemption through DSIR registration and its certificates will be provided in our formats.**
6. **In INR orders, the Customs Duty Exemption Certificate will be given to the supplier upon request. But the entire responsibility of customs clearance and delivery at NCESS will rest with the supplier. High sea sale is not accepted and should not be quoted.**
7. **The technical bid should contain the Details of EMD remitted (or NSIC), Bank Details for refund of EMD, Authorization from manufacturer, Details of Service Centre, Technical details with make, model and specification of each component, Technical Compliance statement, List of Customers, Brochures etc., wherever applicable.**
8. **The offer should be valid for 120 days from the due date of opening of tender.**
9. **The Purchaser reserves right to accept any tender in part or full without assigning any reasons. The enquiry is not a commitment and the purchaser reserves the right to reject or cancel any or all offers.**
10. **Catalogue/Brochure/Manual should be submitted along with the offer wherever necessary.**
11. **Warranty / Guarantee Clause needs to be mentioned necessarily wherever applicable.**
12. **All foreign bank charges will be to the account of beneficiary.**
13. **The purchase will be made on credit basis and the payment will be made after supply and acceptance, by bank transfer.**
14. **In the case of imports, both FCA and CIF/CIP Trivandrum airport prices may be quoted. 90% payment will be made against proof of dispatch documents by LC or wire transfer and balance 10% will be released against acceptance of goods and the receipt of bank guarantee.**
15. **In the event of placement of order, supplier / Indian agent shall provide a Performance Bank guarantee for 10% of the order value valid for warranty period + 60 days.**
16. **Any further changes in the details, like the date of opening or specification, will be posted on our web site only.**

**ADDITIONAL CONDITIONS**

1. **Pre-bid meeting will be conducted on 05.06.2017 at 10.30 AM in NCESS Office.** Interested vendors may attend the pre-bid meeting at their own cost, after informing NCESS by e-mail to [purchase.ncess@nic.in](mailto:purchase.ncess@nic.in) on or before 01.06.2017, confirming their visit to the pre-bid meeting. If no such confirmation of attending the pre-bid meeting has been received from any vendors upto this date, no pre-bid meeting will be held. Any decision/ change regarding pre-bid meeting will be informed through NCESS website. All the clarifications required regarding the tender, including the points to be discussed in pre-bid meeting, should be sent to the e-mail: [kr.batukjoshi@ncess.gov.in](mailto:kr.batukjoshi@ncess.gov.in) with copy to [purchase.ncess@nic.in](mailto:purchase.ncess@nic.in). Late submission/ e-mails will not be considered.
2. Integrity Pact is applicable to this tender. The format of the integrity pact can be downloaded from the web site of NCESS. The Integrity Pact should be filled in and printed on stamp paper worth Rs 500/-. Signed Integrity Pact should be submitted by the bidders at purchase Section, NCESS on or before the date of submission of bid. The bids of only those bidders who have submitted the signed integrity pact by the specified time will be accepted during the bid opening. Late submissions will not be accepted.
3. The independent external monitors for this tender are **Shri Arun Kumar**, Ex Secretary, Oil Industry Development Board (email: [kumararun\\_53@rediffmail.com](mailto:kumararun_53@rediffmail.com)) and **Shri Sushil Gupta**, Ex. Chairman, Central Ground Water Board (email: [sushilanitagupta@yahoo.com](mailto:sushilanitagupta@yahoo.com)) .

Yours faithfully,

Sd/-

Deputy Manager (Purchase)

## SPECIFICATIONS OF MC-ICPMS

1. **ICP source and Sample inlet system:** The ICP source should include a crystal controlled, solid-state ICP generator operating at 27.1 MHz standard programmable RF 2 KW with auto-tuning capability. All torch movement (X-Y-Z) for optimal analytical positioning relative to interface needs to be controlled by computer. It should have options of multi port with mass flow controller units which can be utilized for alternative sample introduction systems such as Laser Ablation System, desolvating inlet system. The ICP source should be compatible with alternative sample introduction systems available commercially such as desolvating inlet systems and Laser Ablation System and *should be capable of analysing in Laser ablation Split Stream (LASS)*. Quotation should include a compatible auto sampler for high sample throughput and a set of nebulizers for sample introduction.
  - i. *Ion extraction:* Ion-sampling interface consisting of standard outer sampler cone and inner skimmer cone designed for long life-times (and easy maintenance) for use with corrosive acid and matrices. Ion extraction system with high voltage region at the expansion chamber preferred considering the geographic position of the laboratory
  - ii. *Inlet System Accessories:*
    - a. Desolvating inlet system: Desolvating nebulizer with PFA spray chamber (with very low oxide and hydride contents) should be quoted. It should have a built in gas flow controller Ar sweep gas and N<sub>2</sub> addition gas. It should have dedicated adjustable temperature controllers for spray chamber and dual preset temperature setting for condenser for organic solvent (-5°C) and water (0°C). Operating voltage should be 220-240 VAC (50Hz).
    - b. Desolvating inlet system for Isotope Ratio Measurement: In addition to the features mentioned above (item 1.ii.a), it should be coupled with a PFA microflow nebulizer and have o-ring free quartz flow path, and be designed to enhance the sample transport efficiency and signal stability. Provision should be there to add a membrane desolvation system.
    - c. Self-aspirating PFA Nebuliser: The nebulizer should have self-aspirating capacity and be made of PFA with provisions of sample flow rates of 20µL, 50µL, 100µL, and 200µL per min.
    - d. Autosampler: The compact autosampler should have small footprint, short sample path (essential for smaller sample size), and a protective cover to prevent sample contamination. It should have dual flowing rinse stations, which can operate in gas displacement or peri-pump mode. It should have at least 48 sample holders and

designed for use with sample volumes as low as 500 $\mu$ L and up to 15ml. Other options of sample rack/vial configuration, if any, should be quoted. The operational voltage should be 240VAC (50Hz). It should be compatible with MC-ICPMS software.

#### ICP source and Sample inlet systems

- (i) Torches: Standard spare quartz torches and demountable torches along with Sapphire and Quartz Injectors should be quoted.
- (ii) Spray chambers: Spray chambers of quartz, glass, and PFA which are compatible to the MC-ICPMS should be quoted.
- (iii) Micro-cyclonic spray chamber (Quartz/PFA)  
With low internal volume, faster wash in/wash out characteristics, less spiking, higher aerosol transport efficiency. It should fit any 6mm nebulizer.

2. **Analyzer:** The high voltage for ion acceleration should be  $\geq 6$  kV for a mass range from 3 to 300 at all resolving powers. Analyzer should consist of electrostatic analyzer and an electromagnet, which together can provide high-resolution capability.

- i. **Electrostatic Sector Analyzer (ESA):** The ESA should be stable within better than 50ppm/h
- ii. **Magnet:** High stability of the magnetic field ( $\pm 50$  ppm or better) is required. Magnet should have low hysteresis with temperature control (water cooled or temperature compensation) to enable high resolution (e.g., resolving power  $> 8000$  for Fe isotopes) measurements.
- iii. **Resolving Power:** The instrument should be able to achieve overall high resolution with resolving power ( $R_{\text{edge}(5\%, 95\% \text{ relative to peak height})}$ ) of  $> 8000$  (for mass  $^{56}\text{Fe}$ , which can resolve the molecular interference from Fe isotopes and with flat topped peak). The specification should clearly mention the relative transmission for various resolving powers. The ion source should be equipped with a variable slit to enable low, medium, and high mass resolution modes.

Relative transmission:  $\geq 20\%$  for medium resolution ( $> 6000$ ) and  $\geq 10\%$  for high resolution ( $> 8000$ ).

#### 3. Detectors:

Detector assembly should be composed of at least fourteen Faraday cups (FC) and three (3) ion counting (IC) devices and provision for two (2) Daly detectors. It is important to have sufficient number of Faraday collectors to cater for variety of analytical systems which may involve simultaneous measurement (static mode) of analyte of interest and associated isobaric interferences (for example: Ba(Te,Xe,La,Ce), Cd/Ag(In,Pd,Sn), Te(Sn,Sb,Xe) etc). Collector

array should be static and beam dispersion variable (by electrostatic lenses). This feature not only overcomes problems associated with mechanical movement of collectors but also allows quick change of collector configuration needed for different isotopic systems, especially when using laser ablation sample introduction system.

Scope for additional FC and IC shall be mentioned and may be quoted separately if not included in the package.

(a) Faraday Cups should have

- Dynamic Range: 50V for  $10^{11}\Omega$  resistor as standard and amplifiers with other resistor values as optional should also be quoted
- Noise :  $<20 \mu\text{V}$  @  $10^{11}\Omega$  at 4-5 second integration time
- Faraday RC Decay @  $10^{11}\Omega$  should be  $<10$  ppm after 2 seconds

(b) Ion counting device/Multiplier:

- Type: Long life discrete dynode (typical operational life should be mentioned)
- Dark noise :  $<10$  cpm
- Signal Stability: better than 0.1% per hour @ 1,00,000 cps
- Linearity: better than 0.2% upto  $10^{-13}$  A current
- Mass stability of at least 50 ppm over 60 mts

(c) **Daly detectors:** Two (2) Daly detector, which can be positioned either on low or high mass side should be quoted. It should meet the following performance specifications:

- Dynamic range : 0- 5 million counts
- Signal Stability :  $< 0.1\%/hour$  @ 1,00,000 cps
- Daly/Faraday Gain:  $> 95\%$
- Daly/Faraday gain stability :  $<0.1\%$  (1 RSD) per hour @100,000 cps
- Dark noise :  $< 1$  cps
- Linearity :  $<0.2\%$  in the range of 50,000 – 5,000,000 cps

Up to four or more pre-amplifier boards should have switching option between  $10^{10}$  and  $10^{11}\Omega$  or between  $10^{11}$  and  $10^{12}\Omega$  resistors to enhance the dynamic range of signal measurement whenever needed.

(d) Switching the amplifier connections should be swift and easy through software and should not involve opening the amplifier housing. It should also have a retardation filter (with provision of using up to four retardation filters) to enhance the abundance sensitivity, essential for analysis of some of the isotope systems.

(e) All the amplifiers for the Faraday detectors should be placed in evacuated and temperature controlled (Temperature stability: better than  $\pm 0.1^\circ\text{C}$ ) enclosure to ensure their performance independent of external environment.

(f) **Adjustable collector masks:** Provision to move masks on selected collectors to effectively reduce the collector slit width to obtain higher resolution  $>3000$  (10% valley) required to completely resolve molecular interferences from Iron isotopes etc.

4. **Vacuum System:** Quotation should include the pumping system that can provide maximum sensitivity to the instrument without fractionation especially in low-mass range. Vacuum gauges should be placed at all the necessary positions and should be integrated with the software. Isolation valves should be placed and integrated properly with the software which ensures the minimum vacuum break during accidental power loss or scheduled maintenance. Dry pumping options should be quoted separately.
5. **Retardation Filter:** Retardation filter should be provided in association with at least one ion counter to improve the abundance sensitivity.
6. **Abundance Sensitivity:**(Measured at mass 237 w.r.t. mass  $^{238}\text{U}$ )
  - Without Retardation/RPQ/WARP filter < 3ppm
  - With Retardation/RPQ/WARP filter <500ppb
7. **Enhanced Abundance Sensitivity:** This feature, if available, should be quoted as **optional** item ((Measured at mass 237 w.r.t. mass  $^{238}\text{U}$ )
  - Without Retardation/RPQ/WARP filter < 1ppm
  - With Retardation/RPQ/WARP filter <50ppb
8. **Accuracy of Measurement:** The accuracy ( $\pm 2\sigma$ ) (for available standards) of the isotopic measurements should be demonstrated for the following isotopic ratios:  $^{87}\text{Sr}/^{86}\text{Sr}$  ( $\pm 100$  ppm),  $^{143}\text{Nd}/^{144}\text{Nd}$  ( $\pm 100$ ppm),  $^{176}\text{Hf}/^{177}\text{Hf}$  ( $\pm 4\%$ ),  $^{206}\text{Pb}/^{204}\text{Pb}$  ( $\pm 0.15\%$ ) (The accuracy should be demonstrated with respect to accepted TIMS values).

#### 9. Sensitivity&Precession

The sensitivity and precision required for various elements are given in the following table (with  $10^{11}\Omega$  feedback resistor):

Elements	Sensitivity* V/ppm (using desolvating nebuliser)	Isotopic ratios	Internal Precision (1RSD**) better than	External <sup>†</sup> Precision (1RSD**) better than
Lithium	$\geq 400^{\text{@}}$	$^6\text{Li}/^7\text{Li}$	0.3 ‰	0.3 ‰
Iron	$\geq 60^{\text{@}}$	$\delta^{56}\text{Fe}$	0.05‰	0.05‰
Strontium	$\geq 600^{\text{@}}$	$^{87}\text{Sr}/^{86}\text{Sr}$	10 ppm	20 ppm
Neodymium	$\geq 600^{\text{@}}$	$^{143}\text{Nd}/^{144}\text{Nd}$	10 ppm	20 ppm
Hafnium	$\geq 600^{\text{@}}$	$^{176}\text{Hf}/^{177}\text{Hf}$	10 ppm	20 ppm

Uranium	$\geq 900^{\text{@}}$	$^{235}\text{U}/^{238}\text{U}$	200 ppm	300 ppm
Lead	$\geq 1000^{\text{@}}$	$^{206}\text{Pb}/^{204}\text{Pb}$	100 ppm	100 ppm

\* with dry plasma and solution uptake of  $\sim 0.1$  ml/minute

† Precision is defined as  $1\sigma$  of 10 subsequent runs (sample-standard bracketing). In case of Li and Fe, it should be  $1\sigma$  of five delta values (total analysis time should be close to or less than 20min for each run).

The sample concentration should be  $<1$  ppm for Li,  $<200$  ppb for Sr, Nd, Hf, U and Pb.

\*\* RSD = Relative Standard Deviation

@ using efficient interface pump, desolvating inlet system and suitable combination of sample and skimmer cones.

## 10. Computer, Printer and Software

The MC-ICPMS and other attached supporting system shall be driven from a dedicated computer system having Core i7 or faster processor speed and minimum of 16 GB RAM and 1 TB HDD (or better), and running through latest Windows operating system. Other than this configuration, if any latest available version with higher clock speed, higher RAM and more advanced operating system which can improve overall system performance, should also be quoted. The system should have a separate graphics card that can support multiple displays with preloaded Windows OS. The computer system must include DVD writer with double layer capability for archiving, minimum four number of USB ports, a network card. The computer system should be supplied with two identical 24" LCD screen (or bigger) and a desktop coloured laser printer. Two identical computer systems one with a second license of the software should be supplied for on-line analytical work and off-line data processing.

The software should provide fully integrated operation of the machine and sample inlet systems. It should also support other peripheral systems (such as laser ablation, LASS, autosampler etc). The following should be supported with the machine software: (i) acquisition in full spectrum, peak hopping and time resolved modes, (ii) analysis using isotope ratios, isotope dilution, external and standard calibrations with or without internal standards, (iii) data archival and retrieval functions, data reporting and macro programming of customized analysis routines, (iv) system diagnostics software, (v) various fractionation correction options, procedures for abundance related interference, drift and interference correction and (vi) features related to LASS.

Free software upgrades should be provided with no additional cost and no time limit.

Software for remote handling and online servicing/remote diagnostic (from customer support of the manufacturer) of the instrument is required. Support to be provided from customer side (such as Internet, telephone line, specific cables etc.) should be mentioned clearly. Software for offline data reduction compatible with MC-ICP-MS software should be provided. Licensed version of data reduction software should be quoted preferably of the type Iolite.

#### 11. Instrument Performance

Quotation to include full specification of mass spectrometer performance, including both internal and external precision in measurement for most of the isotope systems mentioned above. The supplier should demonstrate the various performance parameters of the MC-ICPMS system according to those mentioned in the brochure or shown on company's websites and/or quoted in the deal both at factory before delivery and at NCESS, Trivandrum after delivery.

- i. Analytical performance: Quotation to include clear, unambiguous statements of expected routine performance of the various preparation systems in combination with the mass spectrometers. It should state:
  - a. The overall precisions derived from analyses of multiple replicate samples of standard materials, with a clear indication of any effects in relation to sample size.
  - b. Overall sample analysis times and expected throughput of samples per day using batch loading of multi-position sampler/auto-sampler.
  - c. Factory acceptance test should be demonstrated in presence of two of our technical/ scientific personnel(CrP, NCESS)before shipping the instrument and the same should be reproduced during final installation at NCESS as per the following table:

For Solution Mode:			
Strontium	$^{87}\text{Sr}/^{86}\text{Sr}$	1 $\sigma$ internal $\leq$ 10 ppm	1 $\sigma$ external $\leq$ 20 ppm
	$^{84}\text{Sr}/^{86}\text{Sr}$	1 $\sigma$ internal $\leq$ 200 ppm	1 $\sigma$ external $\leq$ 250 ppm
Ratios normalised with respect to $^{86}\text{Sr}/^{88}\text{Sr} = 0.1194$ , NBS SRM987 ( $^{87}\text{Sr}/^{86}\text{Sr} = 0.71025$ )			
Neodymium	$^{142}\text{Nd}/^{144}\text{Nd}$	1 $\sigma$ internal $\leq$ 10 ppm	1 $\sigma$ external $\leq$ 20 ppm
	$^{143}\text{Nd}/^{144}\text{Nd}$	1 $\sigma$ internal $\leq$ 10 ppm	1 $\sigma$ external $\leq$ 20 ppm
	$^{145}\text{Nd}/^{144}\text{Nd}$	1 $\sigma$ internal $\leq$ 10 ppm	1 $\sigma$ external $\leq$ 20 ppm
Ratios normalised with respect to $^{146}\text{Nd}/^{144}\text{Nd} = 0.7219$ , La Jolla Nd Standard ( $^{143}\text{Nd}/^{144}\text{Nd} = 0.511859$ ) or JNDi-1 Standard ( $^{143}\text{Nd}/^{144}\text{Nd} = 0.512104$ )			
Hafnium	$^{176}\text{Hf}/^{177}\text{Hf}$	1 $\sigma$ internal $\leq$ 10 ppm	1 $\sigma$ external $\leq$ 20 ppm
	$^{178}\text{Hf}/^{177}\text{Hf}$	1 $\sigma$ internal $\leq$ 10 ppm	1 $\sigma$ external $\leq$ 25 ppm
	$^{180}\text{Hf}/^{177}\text{Hf}$	1 $\sigma$ internal $\leq$ 20 ppm	1 $\sigma$ external $\leq$ 40 ppm

Ratios normalised with respect of $^{179}\text{Hf}/^{177}\text{Hf} = 0.7325$ , JMC475 ( $^{176}\text{Hf}/^{177}\text{Hf} = 0.282156 \pm 0.000010$ ) or alternative Hf standard			
Lead	$^{207}\text{Pb}/^{206}\text{Pb}$	1 $\sigma$ internal $\leq 20$ ppm	1 $\sigma$ external $\leq 40$ ppm
	$^{208}\text{Pb}/^{206}\text{Pb}$	1 $\sigma$ internal $\leq 20$ ppm	1 $\sigma$ external $\leq 40$ ppm
	$^{204}\text{Pb}/^{206}\text{Pb}$	1 $\sigma$ internal $\leq 100$ ppm	1 $\sigma$ external $\leq 100$ ppm
Ratios normalised to $^{205}\text{Tl}/^{203}\text{Tl} = 2.3875$			
	$^{204}\text{Pb}/^{206}\text{Pb}$	$^{207}\text{Pb}/^{206}\text{Pb}$	$^{208}\text{Pb}/^{206}\text{Pb}$
SRM-981	0.059042	0.91464	2.1681
Uranium	$^{235}\text{U}/^{238}\text{U}$	1 $\sigma$ internal $\leq 200$ ppm	1 $\sigma$ external $\leq 400$ ppm
	$^{234}\text{U}/^{238}\text{U}$	1 $\sigma$ internal $\leq 0.1\%$	1 $\sigma$ external $\leq 0.2\%$
NIST-U-500	$^{234}\text{U}/^{238}\text{U} = 0.010422$	$^{235}\text{U}/^{238}\text{U} = 0.99970$	$^{236}\text{U}/^{238}\text{U} = 0.001519$
For in-situ analysis:			
NIST-600 Glass			
Lead	$^{204}\text{Pb}/^{206}\text{Pb}$	$^{207}\text{Pb}/^{206}\text{Pb}$	$^{208}\text{Pb}/^{206}\text{Pb}$
	$17.049 \pm 0.012$	$0.9095 \pm 0.0006$	$2.169 \pm 0.001$
Zircon 91500	$^{176}\text{Hf}/^{177}\text{Hf}$	1 $\sigma$ internal $\leq 50$ ppm	1 $\sigma$ external $\leq 50$ ppm
	$^{178}\text{Hf}/^{177}\text{Hf}$	1 $\sigma$ internal $\leq 50$ ppm	1 $\sigma$ external $\leq 50$ ppm
	$^{180}\text{Hf}/^{177}\text{Hf}$	1 $\sigma$ internal $\leq 50$ ppm	1 $\sigma$ external $\leq 100$ ppm
Ratios normalised with respect of $^{179}\text{Hf}/^{177}\text{Hf} = 0.7325$			
Laser Ablation analysis in Zircon 91500 standard (if laser ablation system available)			
$(^{176}\text{Hf}/^{177}\text{Hf}) = 0.282284 \pm 0.000030$			

The above mentioned standards/solutions should be provided by the Vendor during installation.

- d. The pre-shipment testing should be carried out in association with NCESS personnel and could be for a period of 10 working days.

## 12. Additional requirements/items

- i. Name with full credentials and experience of the factory trained service engineers currently on roll in India and place of normal residency must be submitted with the offered quotation. Please indicate how many of them received training on the quoted model. In absence of this document, it will be presumed that there is no after sales service back-up provided.
- ii. Full service manuals with complete circuit diagrams and circuit descriptions to be supplied both as hard copy and CDs, along with diagnostic tools including interface cards and software, plus any specialized mechanical tools required for instrument servicing or repair.
- iii. Quotation should include prices of full sets of spares and consumables for 5 years for each instrument or preparation module. List of consumable to be supplied should be clearly mentioned.

- iv. Quotation should include appropriate *Laser ablation Split Stream (LASS) connector* and related accessories/requirements for simultaneous measurement of insitu U-Pb and Hf isotopes.
- v. Quotation should include the lifting gear of the magnet and other heavy parts to ensure safe placement on the bench during installation.
- vi. Where operation requires provision of liquid gases, compressed air or compressed gases, the quotation should include provision of all appropriate gas cylinders, gas lines, connectors, valves and control systems for these.
- vii. For each module (mass spectrometer, sample inlet system, Laser ablation unit) the quotation should include an indication of all consumables required per full batch of samples.
- viii. Should include certification to supply of spares, servicing and up gradation, where possible, for at least 10 years.
- ix. Any ancillary instrument/equipment necessary to run the system, in addition to the above, should also be indicated and price quoted.
- x. Comprehensive hands-on onsite training during the installation at NCESS on preventive maintenance, operations and application software of the instrument should be provided to the NCESS personnel. Vendors should quote all inclusive for travel, accommodation etc.
- xi. Post-installation, application related training (hands-on and in-depth training on the operation, maintenance and application) of the MC-ICPMS system by factory engineer for a period of not less than 15 working days at NCESS should be carried out.
- xii. Two NCESS scientific personnel have to be trained at the factory site in operation, maintenance and application, after a period of exposure time on the instrument.
- xiii. List of user laboratories (in India and Abroad) of similar instrument configuration and geological application must be provided with contact details (e-mail) of the person-in-charge of the instrument, model and date of installation.
- xiv. A complete list of Indian Users and the systems that are being handled shall be provided with the name and address of the contact person against each user institute.

### 13. Warranty and maintenance

3-years warranty from the date of satisfactory installation & acceptance of the instrument by NCESS. Quotation should include additional four years comprehensive onsite maintenance of the instrument (all modules) and sub-systems (including the spares and consumables) outside the warranty of 3 years. Machine down-time during warranty period should be accounted for to allow and extend the warranty period.

#### 14. Accessories, spares and consumables

A comprehensive list of accessories, spares and consumables with catalogue/part number and cost should be provided. The offer should also include following essential accessories and quoted preferably in Indian rupees.

- i) 50 KVA reliable 3-phase UPS (only from reputed brands/ manufacturers) with one hour back up time with power output quality as per instrument's requirements should also be quoted separately.
- ii) A fume exhaust system that comply the international standards should be supplied and installed at the site for removal of the gases emerging from MC-ICPMS system.

#### 15. Pre-installation requisites

Vendor should suggest site specifications and pre- installation requirement.

#### 16. Supply of Standards/Reference material/ tool kit.

Following isotope standards, enriched spikes and pure mass spectroscopy grade element solutions as mentioned below should be quoted to cover the intended applications.

##### **[A] Required standards and spikes for solution mode**

Alternative standards can be offered for those no longer available.

##### **Standards**

- i. Fe: IRMM 014
- ii. Mg: SRM 980
- iii. Sr: SRM 987
- iv. Nd: JNdi-1
- v. Mo: JMC ICP standard & Isotope standard
- vi. Li: JB2 & LSVEC
- vii. B: NIST SRM 951
- viii. PGE (Pt, Ir, Pd, Os) standard
- ix. Hf (JMC475) standard
- x. Re standard
- xi. Ca standard

- xii. Ni standard
- xiii. Mn standard
- xiv. Cr standard
- xv. Pb standard
- xvi. Ag standard
- xvii. Zr standard
- xviii. Si standard
- xix. W standard
- xx. U standard
- xxi. Tl standard

**[B] Enriched isotopes (Spikes)**

- i.  $^7\text{Li}$
- ii. Fe ( $^{57}\text{Fe}$  and  $^{58}\text{Fe}$ )
- iii.  $^{85}\text{Rb}$
- iv.  $^{84}\text{Sr}$
- v. Mo ( $^{95}\text{Mo}$ ,  $^{97}\text{Mo}$  and  $^{100}\text{Mo}$ )
- vi. Ca ( $^{48}\text{Ca}$ ,  $^{43}\text{Ca}$ ,  $^{42}\text{Ca}$ )
- vii.  $^{150}\text{Nd}$
- viii.  $^{152}\text{Sm}$
- ix.  $^{183}\text{W}$
- x.  $^{185}\text{Re}$
- xi.  $^{190}\text{Os}$
- xii.  $^{229}\text{Th}$
- xiii. Pb ( $^{202}\text{Pb}$  and  $^{205}\text{Pb}$ )
- xiv. B
- xv.  $^{236}\text{U}$ ,  $^{233}\text{U}$
- xvi.  $^{178}\text{Hf}$
- xvii. PGE ( $^{104}\text{Pd}$ ,  $^{105}\text{Pd}$ ,  $^{191}\text{Ir}$ ,  $^{193}\text{Ir}$ ,  $^{198}\text{Pt}$ ,  $^{100}\text{Ru}$ ,  $^{101}\text{Ru}$ ),
- xviii.  $^{191}\text{In}$ ,  $^{193}\text{In}$
- xix.  $^{25}\text{Mg}$

**[C] Zircon / NIST standards**

- i. Zircon 91500
- ii. BB 6
- iii. GJ1
- iv. Pleisovoice
- v. NIST-600
- vi. NIST-U 500

Supply of all the reference standards and spikes mentioned above should be included in the quotation.

The tool kit for regular maintenance should be supplied along with the instrument.

17. Compliance certificate for the above mentioned specifications and items must be provided.



**NATIONAL CENTRE FOR EARTH SCIENCE STUDIES**

P.B. No. 7250, MEDICAL COLLEGE P.O., AKKULAM, THIRUVANANTHAPURAM-695 011, INDIA

Tel: 91-471-2511531

*Fax: 91-471-2442280*

e-mail: [purchase@ncess.gov.in](mailto:purchase@ncess.gov.in)

**TENDER FORM**

Tender No. & Date : **PUR-PROC/123/2017-PUR-NCESS Dt. 18.05.2017.**  
Due Date : **04.07.2017 (06.00 AM).**  
Date of Opening : **06.07.2017 (11.00 AM).**  
Venue of Opening : National Centre for Earth Science Studies, P.B.No.7250,  
Medical College P.O., Thiruvananthapuram – 695 011.  
Description of stores : **Multi Collector Inductively Coupled Mass Spectrometer  
(MC-ICPMS)**  
Quantity : **1 Set**

Sirs,

The Chief Manager on behalf of the Director, National Centre for Earth Science Studies (NCESS), invites bids for the supply of stores mentioned above. The tender documents are classified as Annexure-A and Annexure-B. Annexure-A is a specimen tender form meant for suppliers and the bid should contain all the details specified therein. The instructions to the tenderers and the general terms and conditions applicable to the Purchase Orders placed by NCESS are given under Annexure-B. Those who are able to quote for the stores in accordance with the above requirements, may please furnish their offer through eprocurement, on or before the last date and time specified in the tender.

Any deviations from the terms and conditions of the Annexure-B must be clearly indicated in the offer.

Yours sincerely,  
Sd/-  
Chief Manager



#### 4. Technical Compliance Statement for Multi Collector Inductively Coupled Mass Spectrometer (MC-ICPMS)

Sl. No.	Detailed Condition/Specification	Complied (Y/N)	Deviation
<b>SPECIFICATIONS</b>			
	<p>1. <b>ICP source and Sample inlet system:</b> The ICP source should include a crystal controlled, solid-state ICP generator operating at 27.1 MHz standard programmable RF 2 KW with auto-tuning capability. All torch movement (X-Y-Z) for optimal analytical positioning relative to interface needs to be controlled by computer. It should have options of multi port with mass flow controller units which can be utilized for alternative sample introduction systems such as Laser Ablation System, desolvating inlet system. The ICP source should be compatible with alternative sample introduction systems available commercially such as desolvating inlet systems and Laser Ablation System and <i>should be capable of analysing in Laser ablation Split Stream (LASS)</i>. Quotation should include a compatible auto sampler for high sample throughput and a set of nebulizers for sample introduction.</p> <p>i. <i>Ion extraction:</i> Ion-sampling interface consisting of standard outer sampler cone and inner skimmer cone designed for long life-times (and easy maintenance) for use with corrosive acid and matrices. Ion extraction system with high voltage region at the expansion chamber preferred considering the geographic position of the laboratory</p> <p>ii. <i>Inlet System Accessories:</i></p> <p>a. Desolvating inlet system: Desolvating nebulizer with PFA spray chamber (with very low oxide and hydride contents) should be quoted. It should have a built in gas flow controller Ar sweep gas and N2 addition gas. It should have dedicated adjustable temperature controllers for spray chamber and dual preset temperature setting for condenser for organic solvent (-5°C) and water (0°C). Operating voltage should be 220-240 VAC (50Hz).</p> <p>b. Desolvating inlet system for Isotope Ratio Measurement: In addition to the features mentioned above (item 1.ii.a), it should be coupled with a PFA microflow nebulizer and have o-ring free quartz flow path, and be designed to enhance the sample transport efficiency and signal</p>		

stability. Provision should be there to add a membrane desolvation system.

- c. Self-aspirating PFA Nebuliser: The nebulizer should have self-aspirating capacity and be made of PFA with provisions of sample flow rates of 20 $\mu$ L, 50 $\mu$ L, 100 $\mu$ L, and 200 $\mu$ L per min.
- d. Autosampler: The compact autosampler should have small footprint, short sample path (essential for smaller sample size), and a protective cover to prevent sample contamination. It should have dual flowing rinse stations, which can operate in gas displacement or peri-pump mode. It should have at least 48 sample holders and designed for use with sample volumes as low as 500 $\mu$ L and up to 15ml. Other options of sample rack/vial configuration, if any, should be quoted. The operational voltage should be 240VAC (50Hz). It should be compatible with MC-ICPMS software.

#### ICP source and Sample inlet systems

- (i) Torches: Standard spare quartz torches and demountable torches along with Sapphire and Quartz Injectors should be quoted.
- (ii) Spray chambers: Spray chambers of quartz, glass, and PFA which are compatible to the MC-ICPMS should be quoted.
- (iii) Micro-cyclonic spray chamber (Quartz/PFA)  
With low internal volume, faster wash in/wash out characteristics, less spiking, higher aerosol transport efficiency. It should fit any 6mm nebulizer.

2. **Analyzer:** The high voltage for ion acceleration should be  $\geq 6$  kV for a mass range from 3 to 300 at all resolving powers. Analyzer should consist of electrostatic analyzer and an electromagnet, which together can provide high-resolution capability.

- i. **Electrostatic Sector Analyzer (ESA):** The ESA should be stable within better than 50ppm/h
- ii. **Magnet:** High stability of the magnetic field ( $\pm 50$  ppm or better) is required. Magnet should have low hysteresis with temperature control (water cooled or temperature compensation) to enable high resolution (e.g., resolving power  $> 8000$  for Fe isotopes)

measurements.

- iii. **Resolving Power:** The instrument should be able to achieve overall high resolution with resolving power ( $R_{\text{edge}(5\%, 95\% \text{ relative to peak height})}$ ) of  $>8000$  (for mass  $^{56}\text{Fe}$ , which can resolve the molecular interference from Fe isotopes and with flat topped peak). The specification should clearly mention the relative transmission for various resolving powers. The ion source should be equipped with a variable slit to enable low, medium, and high mass resolution modes.

Relative transmission:  $\geq 20\%$  for medium resolution ( $>6000$ ) and  $\geq 10\%$  for high resolution ( $>8000$ ).

### 3. Detectors:

Detector assembly should be composed of at least fourteen 14 Faraday cups (FC) and three (3) ion counting (IC) devices and provision for two (2) Daly detectors. It is important to have sufficient number of Faraday collectors to cater for variety of analytical systems which may involve simultaneous measurement (static mode) of analyte of interest and associated isobaric interferences (for example: Ba(Te, Xe, La, Ce), Cd/Ag(In, Pd, Sn), Te(Sn, Sb, Xe) etc). Collector array should be static and beam dispersion variable (by electrostatic lenses). This feature not only overcomes problems associated with mechanical movement of collectors but also allows quick change of collector configuration needed for different isotopic systems, especially when using laser ablation sample introduction system.

Scope for additional FC and IC shall be mentioned and may be quoted separately if not included in the package.

#### (a) Faraday Cups should have

- Dynamic Range: 50V for  $10^{11}\Omega$  resistor as standard and amplifiers with other resistor values as optional should also be quoted
- Noise :  $<20 \mu\text{V}$  @  $10^{11}\Omega$  at 4-5 second integration time
- Faraday RC Decay @  $10^{11}\Omega$  should be  $<10 \text{ ppm}$  after 2 seconds

#### (b) Ion counting device/Multiplier:

- Type: Long life discrete dynode (typical operational life should be mentioned)
- Dark noise :  $<10 \text{ cpm}$

- Signal Stability: better than 0.1% per hour @ 1,00,000 cps
- Linearity: better than 0.2% upto  $10^{-13}$  A current
- Mass stability of atleast 50 ppm over 60 mts

(c) **Daly detectors:** Two (2) Daly detector, which can be positioned either on low or high mass side should be quoted. It should meet the following performance specifications:

- Dynamic range : 0- 5 million counts
- Signal Stability : < 0.1%/hour @ 1,00,000 cps
- Daly/Faraday Gain: > 95%
- Daly/Faraday gain stability : < 0.1% (1 RSD) per hour @ 100,000 cps
- Dark noise : < 1 cps
- Linearity : < 0.2% in the range of 50,000 – 5,000,000 cps

Up to four or more pre-amplifier boards should have switching option between  $10^{10}$  and  $10^{11}\Omega$  or between  $10^{11}$  and  $10^{12}\Omega$  resistors to enhance the dynamic range of signal measurement whenever needed.

(d) Switching the amplifier connections should be swift and easy through software and should not involve opening the amplifier housing. It should also have a retardation filter (with provision of using up to four retardation filters) to enhance the abundance sensitivity, essential for analysis of some of the isotope systems.

(e) All the amplifiers for the Faraday detectors should be placed in evacuated and temperature controlled (Temperature stability: better than  $\pm 0.1^\circ\text{C}$ ) enclosure to ensure their performance independent of external environment.

(f) **Adjustable collector masks:** Provision to move masks on selected collectors to effectively reduce the collector slit width to obtain higher resolution >3000 (10% valley) required to completely resolve molecular interferences from Iron isotopes etc.

4. **Vacuum System:** Quotation should include the pumping system that can provide maximum sensitivity to the instrument without fractionation especially in low-mass range. Vacuum gauges should be placed at all the necessary positions and should be integrated with the software. Isolation valves should be placed and integrated properly with the software which ensures the minimum vacuum break during accidental power loss or scheduled maintenance. Dry pumping options should be quoted separately.

5. **Retardation Filter:** Retardation filter should be provided in association with at least one ion counter to improve the abundance

sensitivity.

6. **Abundance Sensitivity:**(Measured at mass 237 w.r.t. mass  $^{238}\text{U}$ )
- Without Retardation/RPQ/WARP filter < 3ppm
  - With Retardation/RPQ/WARP filter <500ppb
7. **Enhanced Abundance Sensitivity:** This feature, if available, should be quoted as **optional** item ((Measured at mass 237 w.r.t. mass  $^{238}\text{U}$ )
- Without Retardation/RPQ/WARP filter < 1ppm
  - With Retardation/RPQ/WARP filter <50ppb
8. **Accuracy of Measurement:** The accuracy ( $\pm 2\sigma$ ) (for available standards) of the isotopic measurements should be demonstrated for the following isotopic ratios:  $^{87}\text{Sr}/^{86}\text{Sr}$  ( $\pm 100$  ppm),  $^{143}\text{Nd}/^{144}\text{Nd}$  ( $\pm 100$ ppm),  $^{176}\text{Hf}/^{177}\text{Hf}$  ( $\pm 4\%$ ),  $^{206}\text{Pb}/^{204}\text{Pb}$  ( $\pm 0.15\%$ ) (The accuracy should be demonstrated with respect to accepted TIMS values).

#### 9. Sensitivity&Precession

The sensitivity and precision required for various elements are given in the following table (with  $10^{11}\Omega$  feedback resistor):

Elements	Sensitivity* V/ppm (using desolvating nebuliser)	Isotopic ratios	Internal Precision (1RSD**) better than	External† Precision (1RSD**) better than
Lithium	$\geq 400^{\text{@}}$	$^6\text{Li}/^7\text{Li}$	0.3 ‰	0.3 ‰
Iron	$\geq 60^{\text{@}}$	$\delta^{56}\text{Fe}$	0.05‰	0.05‰
Strontium	$\geq 600^{\text{@}}$	$^{87}\text{Sr}/^{86}\text{Sr}$	10 ppm	20 ppm
Neodymium	$\geq 600^{\text{@}}$	$^{143}\text{Nd}/^{144}\text{Nd}$	10 ppm	20 ppm
Hafnium	$\geq 600^{\text{@}}$	$^{176}\text{Hf}/^{177}\text{Hf}$	10 ppm	20 ppm
Uranium	$\geq 900^{\text{@}}$	$^{235}\text{U}/^{238}\text{U}$	200 ppm	300 ppm
Lead	$\geq 1000^{\text{@}}$	$^{206}\text{Pb}/^{204}\text{Pb}$	100 ppm	100 ppm

\*with dry plasma and solution uptake of ~0.1 ml/minute

† Precision is defined as  $1\sigma$  of 10 subsequent runs (sample-standard bracketing). In case of Li and Fe, it should be  $1\sigma$  of five delta values (total analysis time should be close to or less than 20min for eachrun).

The sample concentration should be <1 ppm for Li, <200 ppb for Sr, Nd, Hf, U and Pb.

\*\* RSD = Relative Standard Deviation

@ using efficient interface pump, desolvating inlet system and suitable combination of sample and skimmer cones.

#### 10. Computer, Printer and Software

The MC-ICPMS and other attached supporting system shall be driven from a dedicated computer system having Core i7 or faster processor speed and minimum of 16 GB RAM and 1 TB HDD (or better), and running through latest Windows operating system. Other than this configuration, if any latest available version with higher clock speed, higher RAM and more advanced operating system which can improve overall system performance, should also be quoted. The system should have a separate graphics card that can support multiple displays with preloaded Windows OS. The computer system must include DVD writer with double layer capability for archiving, minimum four number of USB ports, a network card. The computer system should be supplied with two identical 24" LCD screen (or bigger) and a desktop coloured laser printer. Two identical computer systems one with a second license of the software should be supplied for on-line analytical work and off-line data processing.

The software should provide fully integrated operation of the machine and sample inlet systems. It should also support other peripheral systems (such as laser ablation, LASS, autosampler etc). The following should be supported with the machine software: (i) acquisition in full spectrum, peak hopping and time resolved modes, (ii) analysis using isotope ratios, isotope dilution, external and standard calibrations with or without internal standards, (iii) data archival and retrieval functions, data reporting and macro programming of customized analysis routines, (iv) system diagnostics software, (v) various fractionation correction options, procedures for abundance related interference, drift and interference correction and (vi) features related to LASS.

Free software upgrades should be provided with no additional cost and no time limit.

Software for remote handling and online servicing/remote diagnostic (from customer support of the manufacturer) of the instrument is required. Support to be provided from customer side (such as Internet, telephone line, specific cables etc.) should be mentioned clearly.

Software for offline data reduction compatible with MC-ICP-MS software should be provided. Licensed version of data reduction software should be quoted preferably of the type Iolite.

#### 11. Instrument Performance

Quotation to include full specification of mass spectrometer performance, including both internal and external precision in measurement for most of the isotope systems mentioned above. The supplier should demonstrate the various performance parameters of the MC-ICPMS system according to those mentioned in the brochure or shown on company's websites and/or quoted in the deal both at factory before delivery and at NCESS, Trivandrum after delivery.

i. Analytical performance: Quotation to include clear, unambiguous statements of expected routine performance of the various preparation systems in combination with the mass spectrometers. It should state:

- a. The overall precisions derived from analyses of multiple replicate samples of standard materials, with a clear indication of any effects in relation to sample size.
- b. Overall sample analysis times and expected throughput of samples per day using batch loading of multi-position sampler/auto-sampler.
- c. Factory acceptance test should be demonstrated in presence of two of our technical/ scientific personnel (CrP, NCESS) before shipping the instrument and the same should be reproduced during final installation at NCESS as per the following table:

For Solution Mode:			
Strontium	$^{87}\text{Sr}/^{86}\text{Sr}$	1 $\sigma$ internal $\leq$ 10 ppm	1 $\sigma$ external $\leq$ 20 ppm
	$^{84}\text{Sr}/^{86}\text{Sr}$	1 $\sigma$ internal $\leq$ 200 ppm	1 $\sigma$ external $\leq$ 250 ppm
Ratios normalised with respect to $^{86}\text{Sr}/^{88}\text{Sr} = 0.1194$ , NBS SRM987 ( $^{87}\text{Sr}/^{86}\text{Sr} = 0.71025$ )			
Neodymium	$^{142}\text{Nd}/^{144}\text{Nd}$	1 $\sigma$ internal $\leq$ 10 ppm	1 $\sigma$ external $\leq$ 20 ppm
	$^{143}\text{Nd}/^{144}\text{Nd}$	1 $\sigma$ internal $\leq$ 10 ppm	1 $\sigma$ external $\leq$ 20 ppm
	$^{145}\text{Nd}/^{144}\text{Nd}$	1 $\sigma$ internal $\leq$ 10 ppm	1 $\sigma$ external $\leq$ 20 ppm
Ratios normalised with respect to $^{146}\text{Nd}/^{144}\text{Nd} = 0.7219$ , La Jolla Nd Standard ( $^{143}\text{Nd}/^{144}\text{Nd} = 0.511859$ ) or JNDi-1 Standard ( $^{143}\text{Nd}/^{144}\text{Nd} = 0.512104$ )			
Hafnium	$^{176}\text{Hf}/^{177}\text{Hf}$	1 $\sigma$ internal $\leq$ 10 ppm	1 $\sigma$ external $\leq$ 20 ppm
	$^{178}\text{Hf}/^{177}\text{Hf}$	1 $\sigma$ internal $\leq$ 10 ppm	1 $\sigma$ external $\leq$ 25 ppm

	$^{180}\text{Hf}/^{177}\text{Hf}$	1 $\sigma$ internal $\leq 20$ ppm	1 $\sigma$ external $\leq 40$ ppm
Ratios normalised with respect of $^{179}\text{Hf}/^{177}\text{Hf} = 0.7325$ , JMC475 ( $^{176}\text{Hf}/^{177}\text{Hf} = 0.282156 \pm 0.000010$ ) or alternative Hf standard			
Lead	$^{207}\text{Pb}/^{206}\text{Pb}$	1 $\sigma$ internal $\leq 20$ ppm	1 $\sigma$ external $\leq 40$ ppm
	$^{208}\text{Pb}/^{206}\text{Pb}$	1 $\sigma$ internal $\leq 20$ ppm	1 $\sigma$ external $\leq 40$ ppm
	$^{204}\text{Pb}/^{206}\text{Pb}$	1 $\sigma$ internal $\leq 100$ ppm	1 $\sigma$ external $\leq 100$ ppm
Ratios normalised to $^{205}\text{Tl}/^{203}\text{Tl} = 2.3875$			
	$^{204}\text{Pb}/^{206}\text{Pb}$	$^{207}\text{Pb}/^{206}\text{Pb}$	$^{208}\text{Pb}/^{206}\text{Pb}$
SRM-981	0.059042	0.91464	2.1681
Uranium	$^{235}\text{U}/^{238}\text{U}$	1 $\sigma$ internal $\leq 200$ ppm	1 $\sigma$ external $\leq 400$ ppm
	$^{234}\text{U}/^{238}\text{U}$	1 $\sigma$ internal $\leq 0.1\%$	1 $\sigma$ external $\leq 0.2\%$
NIST-U-500	$^{234}\text{U}/^{238}\text{U} = 0.010422$	$^{235}\text{U}/^{238}\text{U} = 0.99970$	$^{236}\text{U}/^{238}\text{U} = 0.001519$
For in-situ analysis:			
NIST-600 Glass			
Lead	$^{204}\text{Pb}/^{206}\text{Pb}$	$^{207}\text{Pb}/^{206}\text{Pb}$	$^{208}\text{Pb}/^{206}\text{Pb}$
	$17.049 \pm 0.012$	$0.9095 \pm 0.0006$	$2.169 \pm 0.001$
Zircon 91500	$^{176}\text{Hf}/^{177}\text{Hf}$	1 $\sigma$ internal $\leq 50$ ppm	1 $\sigma$ external $\leq 50$ ppm
	$^{178}\text{Hf}/^{177}\text{Hf}$	1 $\sigma$ internal $\leq 50$ ppm	1 $\sigma$ external $\leq 50$ ppm
	$^{180}\text{Hf}/^{177}\text{Hf}$	1 $\sigma$ internal $\leq 50$ ppm	1 $\sigma$ external $\leq 100$ ppm
Ratios normalised with respect of $^{179}\text{Hf}/^{177}\text{Hf} = 0.7325$			
Laser Ablation analysis in Zircon 91500 standard (if laser ablation system available) ( $^{176}\text{Hf}/^{177}\text{Hf}$ ) = $0.282284 \pm 0.000030$			

The above mentioned standards/solutions should be provided by the Vendor during installation.

- d. The pre-shipment testing should be carried out in association with NCESS personnel and could be for a period of 10 working days.

#### 12. Additional requirements/items

- i. Name with full credentials and experience of the factory trained service engineers currently on roll in India and place of normal residency must be submitted with the offered quotation. Please indicate how many of them received training on the quoted model.

	<p>In absence of this document, it will be presumed that there is no after sales service back-up provided.</p> <ul style="list-style-type: none"> <li>ii. Full service manuals with complete circuit diagrams and circuit descriptions to be supplied both as hard copy and CDs, along with diagnostic tools including interface cards and software, plus any specialized mechanical tools required for instrument servicing or repair.</li> <li>iii. Quotation should include prices of full sets of spares and consumables for 5 years for each instrument or preparation module. List of consumable to be supplied should be clearly mentioned.</li> <li>iv. Quotation should include appropriate <i>Laser ablation Split Stream (LASS) connector</i> and related accessories/requirements for simultaneous measurement of insitu U-Pb and Hf isotopes.</li> <li>v. Quotation should include the lifting gear of the magnet and other heavy parts to ensure safe placement on the bench during installation.</li> <li>vi. Where operation requires provision of liquid gases, compressed air or compressed gases, the quotation should include provision of all appropriate gas cylinders, gas lines, connectors, valves and control systems for these.</li> <li>vii. For each module (mass spectrometer, sample inlet system, Laser ablation unit) the quotation should include an indication of all consumables required per full batch of samples.</li> <li>viii. Should include certification to supply of spares, servicing and up gradation, where possible, for at least 10 years.</li> <li>ix. Any ancillary instrument/equipment necessary to run the system, in addition to the above, should also be indicated and price quoted.</li> <li>x. Comprehensive hands-on onsite training during the installation at NCESS on preventive maintenance, operations and application software of the instrument should be provided to the NCESS personnel. Vendors should quote all inclusive for travel, accommodation etc.</li> <li>xi. Post-installation, application related training (hands-on and in-depth training on the operation, maintenance and application) of the MC-ICPMS system by factory engineer for a period of not less than 15 working days at NCESS should be carried out.</li> <li>xii. Two NCESS scientific personnel have to be trained at the factory site in operation, maintenance and application, after a period of exposure time on the instrument.</li> </ul>		
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xiii. List of user laboratories (in India and Abroad) of similar instrument configuration and geological application must be provided with contact details (e-mail) of the person-in-charge of the instrument, model and date of installation.

xiv. A complete list of Indian Users and the systems that are being handled shall be provided with the name and address of the contact person against each user institute.

### 13. **Warranty and maintenance**

3-years warranty from the date of satisfactory installation & acceptance of the instrument by NCESS. Quotation should include additional four years comprehensive onsite maintenance of the instrument (all modules) and sub-systems (including the spares and consumables) outside the warranty of 3 years. Machine down-time during warranty period should be accounted for to allow and extend the warranty period.

### 14. **Accessories, spares and consumables**

A comprehensive list of accessories, spares and consumables with catalogue/part number and cost should be provided. The offer should also include following essential accessories and quoted preferably in Indian rupees.

- i) 50 KVA reliable 3-phase UPS (only from reputed brands/manufacturers) with one hour back up time with power output quality as per instrument's requirements should also be quoted separately.
- ii) A fume exhaust system that comply the international standards should be supplied and installed at the site for removal of the gases emerging from MC-ICPMS system.

### 15. **Pre-installation requisites**

Vendor should suggest site specifications and pre- installation requirement.

### 16. **Supply of Standards/Reference material/ tool kit.**

Following isotope standards, enriched spikes and pure mass spectroscopy grade element solutions as mentioned below should be quoted to cover the intended applications.

#### **[A] Required standards and spikes for solution mode**

Alternative standards can be offered for those no longer available.

#### **Standards**

- i. Fe: IRMM 014
- ii. Mg: SRM 980

- iii. Sr: SRM 987
- iv. Nd: JNdi-1
- v. Mo: JMC ICP standard & Isotope standard
- vi. Li: JB2 &LSVEC
- vii. B: NIST SRM 951
- viii. PGE (Pt, Ir, Pd, Os) standard
- ix. Hf (JMC475) standard
- x. Re standard
- xi. Ca standard
- xii. Ni standard
- xiii. Mn standard
- xiv. Cr standard
- xv. Pb standard
- xvi. Ag standard
- xvii. Zr standard
- xviii. Si standard
- xix. W standard
- xx. U standard
- xxi. Tl standard

**[B] Enriched isotopes (Spikes)**

- i.  $^7\text{Li}$
- ii. Fe ( $^{57}\text{Fe}$  and  $^{58}\text{Fe}$ )
- iii.  $^{85}\text{Rb}$
- iv.  $^{84}\text{Sr}$
- v. Mo ( $^{95}\text{Mo}$ ,  $^{97}\text{Mo}$  and  $^{100}\text{Mo}$ )
- vi. Ca ( $^{48}\text{Ca}$ ,  $^{43}\text{Ca}$ ,  $^{42}\text{Ca}$ )
- vii.  $^{150}\text{Nd}$
- viii.  $^{152}\text{Sm}$
- ix.  $^{183}\text{W}$
- x.  $^{185}\text{Re}$
- xi.  $^{190}\text{Os}$
- xii.  $^{229}\text{Th}$
- xiii. Pb ( $^{202}\text{Pb}$  and  $^{205}\text{Pb}$ )
- xiv. B
- xv.  $^{236}\text{U}$ ,  $^{233}\text{U}$
- xvi.  $^{178}\text{Hf}$
- xvii. PGE ( $^{104}\text{Pd}$ ,  $^{105}\text{Pd}$ ,  $^{191}\text{Ir}$ ,  $^{193}\text{Ir}$ ,  $^{198}\text{Pt}$ ,  $^{100}\text{Ru}$ ,  $^{101}\text{Ru}$ ),
- xviii.  $^{191}\text{In}$ ,  $^{193}\text{In}$
- xix.  $^{25}\text{Mg}$

**[C] Zircon / NIST standards**

	<p>i. Zircon 91500</p> <p>ii. BB 6</p> <p>iii. GJ1</p> <p>iv. Pleisovoice</p> <p>v. NIST-600</p> <p>vi. NIST-U 500</p> <p>Supply of all the reference standards and spikes mentioned above should be included in the quotation.</p> <p>The tool kit for regular maintenance should be supplied along with the instrument.</p> <p>17. Compliance certificate for the above mentioned specifications and items must be provided.</p>		
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**Delivery Terms:**

Place of Delivery: Stores, National Centre for Earth Science Studies, P.B.No.7250, Medical College P.O., Thiruvananthapuram – 695 011, Kerala, India.

I / We understand the instructions to the tenderers and General Terms and Conditions of the Contract governing supplies detailed in Annexure-B. I/We have thoroughly examined the specifications of the stores referred above and my/our offer is to supply stores strictly in accordance with and subject to the terms and conditions stipulated in Annexure-B.

Stamp and Signature of the Tenderer

ANNEXURE B

**INSTRUCTIONS TO THE TENDERERS AND GENERAL TERMS AND CONDITIONS OF THE CONTRACT**

1. **PRICES:** Tenders shall be made in ENGLISH and submitted with price for delivery at National Centre for Earth Science Studies, Akkulam, Medical College PO, Thiruvananthapuram-11, Kerala and in the case of Rupee bid and it shall be FCA and CIF Trivandrum airport in the case of foreign currency bid. However, Packing & Forwarding charges, inland freight & other related charges, freight, statutory levies etc. need to be specifically indicated in the Quotation.
2. **RIGHTS OF THE PURCHASER:** The Purchaser shall be under no obligation to accept the lowest or any other tender and shall be entitled to accept or reject any tender in part or full without assigning any reason whatsoever.
3. **VALIDITY OF OFFER:** The prices quoted should be firm and quotation has to be valid for a period of 120 days from the date of opening of tender.
4. **CATALOGUE:** Tenderers shall furnish Leaflet/Technical Literature of the Stores offered by him along with the offer.
5. **THE DOCUMENTS TO BE ATTACHED:**
  - 1) A list of not less than five Indian Customers who have bought the same instrument within the last two years, with contact details, is to be furnished along with the tender.
  - 2) The bidders shall necessarily furnish details of Authorised Service Provider in India. Dealers who are authorised to quote on behalf of the Principals shall provide valid Authorised Dealership Certificate from the Principals.
6. **AGENCY COMMISSION:** In case the tenderer is represented for an overseas supplier in India, he shall furnish the agency agreement / authorization certificate issued by the overseas supplier and the offer should indicate the percentage of agency commission (on ex-works value) included in the quoted price. The purchase order/contract will however, be placed only with the principals concerned directly. The purchaser shall pay the amount of agency commission, which is included in the quoted price, to the Indian Agent directly in equivalent Indian Rupee after customs clearance and acceptance of the goods, based on a bill from the Indian Agent. The commission will be paid at the exchange rate at which the Principals are paid.
7. **INSURANCE:** Transit Insurance if felt necessary, will be arranged by the purchaser directly with his underwriters against import orders placed with the overseas principals. However, no transit insurance is needed for the indigenous orders and stores shall be supplied under carrier's /supplier's risk.
8. **MODE AND TERMS OF PAYMENT:**

IMPORT ORDERS:

NET 30 days / Documents through bank / Sight Draft or Irrevocable Letter Of Credit. However, the purchaser prefers payment on Net 30 days or Documents through Bank in the case of imports worth below Rs.1 lakh. **All bank charges outside India are to the account of supplier.**

**INDIGENOUS ORDERS:**

Full payment within 45 days of receipt and successful installation of stores at Purchaser's Site.

9. **WARRANTY:** The supply made by the supplier shall be of best quality and workmanship shall be in accordance with the specifications stipulated in the Purchase Order. Defects / deficiencies shall be made good by the supplier free of cost, notified within the applicable warranty period. Warranty shall be for a minimum period of 36 months from the date of putting into operation of stores or 42 months from the date of delivery whichever is earlier.
10. **SUBMISSION OF TENDERS:** The quotation should be submitted by e-procurement in PDF format by 'logging on' in the website [eprocure.gov.in/eprocure/app](http://eprocure.gov.in/eprocure/app)
11. **ENGINEER'S SERVICE MANUAL AND INSTRUCTION MANUAL:** The Engineer's Service Manual including Circuit Diagram and Instruction Manual (Original Copies) of the equipment shall be supplied along with the delivery/shipment by the supplier in the event of a purchase order. This aspect should be clearly indicated in the offer.
12. **DELIVERY/SHIPMENT:**
  - i) The time for delivery of the stores stipulated in the purchase order shall be deemed to be the essence of the contract and delivery must be completed not later than the period specified therein.
  - ii) Failure and termination: If the contractor fails to deliver the stores or any part thereof within the period prescribed for such delivery, the purchaser shall be entitled at his option either;
    - a) to recover from the contractor as agreed liquidated damages and not by way of penalty, a sum of 2% of the price of any stores which the supplier has failed to deliver as aforesaid, for each month or part of a month, during which the delivery of such stores may be in arrears or
    - b) to purchase elsewhere, without notice to the contractor on the account and at the risk of the contractor, the stores not delivered or there of a similar description (where others exactly complying with the particulars are not in the opinion of the purchaser readily procurable, such opinion being final) without cancelling the contract in respect of the portion of stores not yet due for delivery.
    - c) to cancel the contract or a portion thereof and if so desired, to purchase or authorize to purchase of stores not so delivered or others of similar description (where others exactly complying with the particulars are not in the opinion of the purchaser readily procurable, such opinion being final) at the risk and cost of the contractor.
13. **LAW GOVERNING THE CONTRACT:** The contract shall be governed by the laws of India for the time being in force. The marking of all stores supplied must comply with the requirements of Indian Acts relating to Merchandise Marks and all the rules made under such Acts.

14. **JURISDICTION:** The courts within the local limits of Thiruvananthapuram, the place from the purchase order is issued, will be the jurisdiction to deal with and decide any matter arising out of the contract subject to the clause 18 hereof.
15. **INDEMNITY:** The contractor shall at all, times indemnify the purchaser against all claims which may be made in respect of stores for infringement of any right protected by patent, registration of design or trade mark and shall take all risk of accidents or damage which may cause a failure of the supply from whatever cause arising and the entire responsibility for the sufficiency of all the means used by him for the fulfilment of the contract.
16. **ARBITRATION:** Not withstanding anything contained in clause 16 above, in the event of any question, dispute or difference arising under these conditions or any condition contained in the purchase order or in connection with this contract (except as to any matters the decision of which is specially provided for by these conditions) the same may be referred to the sole arbitration of the Director, Centre for Earth Science Studies, Thiruvananthapuram or some other person appointed by him, there will be no objection that the arbitrator is a Govt. servant, who has to deal with matters to which the contract relates or that in the course of his duties as a Government servant he has expressed views on all or any of the matters in the disputes or difference. The award of the arbitrator shall be final and binding on the parties to this contract.

Terms of this contract: -

If the arbitrator be the Director, NCESS, (i) in the event of his being transferred or vacating his office by resignation or otherwise, it shall be lawful for his successor in the office either to proceed with the reference himself, or to appoint another person as arbitrator to (ii) in the event of his being unwilling or unable to act for any reason, it shall be lawful for the Director, NCESS to appoint another person as arbitrator;

**Or**

If the arbitrator be a person appointed by the Director, NCESS, in the event of his dying, neglecting or refusing to act, or resigning or being unable to act for any reason, it shall be lawful for the Director, NCESS, to proceed with the reference himself or to appoint another person as arbitrator in place of the outgoing arbitrator.

Subject as aforesaid, the Arbitration Act, 1940 and the rule there under and any statutory modifications thereof for the time being in force shall be deemed to apply to the arbitration proceeding under this clause. The arbitrator shall have the power to extend with the consent of the purchaser and the contractor the time for making and publishing the award. The venue of arbitration shall be the place as the purchaser in the absolute discretion may determine.

**16. EXERCISING THE RIGHTS & POWERS OF THE PURCHASER:** All the rights, discretions and power of the purchaser under the contract shall be exercisable by and all notices on behalf of the purchaser shall be given by the Director or the Chief Manager (i/c) of Centre for Earth Science Studies and any reference to 'the opinion of the purchasers' in the terms and conditions contained in this general conditions of the contract shall mean and be construed as reference to the opinion of any of the persons mentioned in this clause.

**18. EXEMPTION FROM PAYMENT OF DUTIES AND CONCESSIONAL SALES TAX:**  
The purchaser is eligible for availing customs duty exemption and excise duty exemption under the relevant rules.

**19. SPARES & ACCESSORIES:** offers for plant/machinery/equipment/instrument shall also state prices or essential accessories, optional accessories and spares necessary for 5 years of

satisfactory operation of the machinery/equipment/instrument offered. Prices for accessories and spares shall be itemised, offers where only lump sum prices are indicated are liable to be ignored. Particular care must be taken to list out each item of spare and quantity recommended and also individual price for these items

20. **QUANTITY:** The purchaser reserves the right to accept or reject lowest or any offers in whole or in part without assigning any reason. It would therefore be in the interest of the tenderers to clearly understand that the purchaser may accept offers for any quantity of his choice and hence, the percentage of reduction, if any in the price quoted in case of acceptance of tender in whole or part shall be clearly stated.
21. **TRAINING:** The contractor shall, in special cases, if required by the Purchaser provide facilities for the practical training of the purchaser's engineers and technical personnel in respect of repair, maintenance or operation of the plant/machinery/ equipment/ instrument offered at their manufacturing plant in India or abroad. The cost for such training (including travelling, boarding and other related expenses) and the number of trainees and duration of training and any other terms if any, should be indicated separately in the offer.
22. **INSTALLATION & COMMISSIONING:** In the event of an order, the supplier shall arrange satisfactory installation and commissioning of the plant/machinery equipment/ instrument at purchaser's site, free of cost.
23. **SERVICE SOFTWARE/TOOLS:** The service software, tools required if any for the repair/maintenance of the plant/machinery/equipment/instrument shall be quoted separately.

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