

Appendix 1 - Buyer's requirement specification

1 Purpose of the procurement

This tender concerns the purchase of a Multi-Collector Inductively Coupled Plasma Mass Spectrometer (MC-ICP-MS).

2 The scope and content of the procurement

The MC-ICP-MS instrument will be installed within the new PlasmaLab at the Department of Geosciences, UiT The Arctic University of Norway, Tromsø, and is also part of the ERC synergy grant i2B (Into the Blue: Resolving Past Arctic Greenhouse Climate) and the Centre of Excellence iC3 (Centre for Ice, Cryosphere, Carbon and Climate).

We plan for the PlasmaLab infrastructure to be completed and ready for instrument installation by late 2027. We expect that the tenderers will be available during the tender period to answer technical questions and provide advice regarding the specifications of the mass spectrometry laboratory. The mass spectrometry laboratory will also house an ICP-MS for trace element analysis, a laser ablation system, that will interface between the ICP-MS and the MC-ICP-MS, an ICP-optical emission spectrometer for high throughput elemental analysis in solution, and a clean laboratory for low-blank solution preparation.

The PlasmaLab will facilitate state-of-the-art research in the field of geosciences, while also functioning as a hub for high-resolution isotope and trace element analysis for a broad array of research areas at UiT (including paleoclimatology and paleoceanography, hard-rock geology, archaeology, chemical oceanography and clinical medicine) and applications within the mining industry.

The MC-ICP-MS will be used to determine accurate and precise isotope ratio compositions for a wide range of elements in both solutions and in-situ (when coupled to a laser ablation system) for various sample types, including marine sediments and carbonates, fossils (e.g., foraminifera), rocks, seawater, ice, archaeological materials, synthetic materials, and possibly biological samples. The instrument will be optimized for determination of isotope ratio concentrations of e.g., Nd, Sr, U, B, Cr, Fe, Zn, Ba, Si, Mg and Cu in geological, environmental or biological matrices.

3 Requirements for documentation, information etc.

The equipment shall be CE-approved and comply with relevant rules and regulations. Relevant certifications/documentations shall be enclosed, including but not limited to:

- User manual
- Software instructions/guides
- Site requirements

- Maintenance instructions
- Troubleshooting guides

Additional requested information, not subject to evaluation:

- Provide collector configurations for a range of isotope systems, including, but not exclusive to, B, Sr, Nd, Fe, U, Si.
- Describe the capability of the instrument/system to remove isobaric interferences during isotope analysis.
- Describe the extent to which the instrument can be modified after installation to include, for example collision-reaction-cell or mass filter technology, if not already included.
- Please provide any additional information about your system/instrument that might be useful for users.

4 Training

Training must be delivered on site at UiT in English and should be available for at least four members of UiT staff.

Training must be carried out immediately, or shortly (within 2 months), after successful installation and testing of the instrument at UiT.

Training must include the full operation of the instrument from sample loading through analysis (including aspects such as tuning, cup configurations), data processing, basic maintenance (e.g., torch and cone cleaning and changing), integration to an autosampler and desolvating nebulizer, software use, and general troubleshooting.

In addition, the supplier must agree to offer support for the use of a laser ablation system when coupled to the MC-ICP-MS when a laser ablation system is available to UiT. This is to include coupling to the instrument, operation, and how the MC-ICP-MS software interacts with the laser ablation system.

There should be an option for additional training packages, including for example, factory training. The extent and cost of any additional training packages should be detailed in the tender response.

5 Table of requirements

The requirements in the table of requirements form the basis for the Supplier's description of its solution specification, cf. Appendix 2.

The different requirements have different priority.

Priority A = Absolute requirements that must be fulfilled. Tenders that do not fulfil all the absolute requirements will be rejected.

Priority B = Important requirements that should be fulfilled, but it is not an absolute requirement. Answers will be of great importance for the evaluation of the tender. The requirements are weighted higher than C-requirements.

Priority C = Conditional requirements that should be fulfilled, but it is not an absolute requirement. Answers will be of importance for the evaluation of the tender. The requirements are weighted lower than B-requirements.

No.	Priority	Description
1		Technical functionality
1.1	A	The supplier must offer a MC-ICP-MS instrument capable of precise measurements of isotope ratios for a wide range of elements across the mass range lithium to uranium. The supplied system must incorporate an inductively coupled plasma ion source, magnetic mass separator, multiple detectors.
1.2	A	The offered system must include a low-uptake PFA nebulizer (in range of 50-100 µl/min), peristaltic pump, and appropriate tubing.
1.3	A	The offered system must include an autosampler (similar to the ESI 2DX or the Cetac ASX112) and a desolvating nebulizer (similar to the ESI Apex Omega or the Cetac Aridus 3). Describe the make and specifications of the equipment offered.
1.4	A	The instrument must have the capability to interface with a laser ablation system (for example, the NWR 193 or Teledyne IRIDIA) for in-situ analysis, as well as in a split stream configuration with an ICP-MS.
1.5	A	The supplier must provide a control PC (installed with Windows-based operating software and software to allow remote access for software updates and remote diagnostics) and a monitor. Provide technical specifications of the PC.
1.6	A	The supplier must provide all necessary pumps and chillers for the operation of the instrument. Please detail the options available and provide technical specifications.

		Please include information on storage restrictions, e.g. distance from instrument.
1.7	A	The instrument must have the capacity to carry out pre-programmed automated measurements without the need for user interaction for periods of at least 12 hours.
1.8	A	The instrument must be capable of simultaneous detection of at least 9 isotopes on Faraday detectors.
1.9	B	Describe the quantity of Faraday detectors included in the instrument and the dynamic range capable from the use of pre-amplifier resistors.
1.10	B	Describe the options for supplying ion counting devices (e.g, SEMs, Daly's), including information on whether the detector configuration can be modified after the instrument has been installed at UiT.
1.11	B	Provide case studies/testimonials from current users (at least two) of your system. This should include applications to a range of isotope measurements, including, but not exclusive to, B, Sr, Nd, Fe isotopes. It is desirable that the applications are comparable to those stated in Section 2 The scope and content of the procurement.
1.12	B	Describe the performance in V/ppm that your solution can produce for a range of isotopes (using standard spray chamber and nebulizer, uptake rate $\leq 100 \mu\text{l}/\text{min}$, using Faraday detectors with $10^{11} \Omega$ amplifiers), including, but not exclusive to total B, Sr, Nd and Fe in both wet and dry plasma modes. Report routinely achievable intensity, detail the sample introduction system, the concentration of the solutions aspirated, the solution uptake rate. Higher sensitivity is scored higher.
1.13	B	Specify the accuracy and precision your solution can produce while measuring $^{11}\text{B}/^{10}\text{B}$, $\delta^{56}\text{Fe}$, $^{87}\text{Sr}/^{86}\text{Sr}$, and $^{143}\text{Nd}/^{144}\text{Nd}$ in isotopically natural solutions. Reference material should be relevant to the following applications: • B isotopes in biogenic carbonates such as foraminifera and corals • Nd isotopes in marine sediments and seawater • Sr isotopes in bones • Fe isotopes in marine sediments and seawater • Si isotopes in silicate minerals and seawater

		Use Faraday detectors with $10^{11} \Omega$ amplifiers. Please also state the solution ng/g concentration. Please describe how such precision is achieved and provide relevant evidence as to how you can achieve this. Your response should include whether the data provided was obtained in a single run, or over long periods of time and at which concentration levels, mass resolution settings, and integration times these were achieved. It is desirable that all means and standard deviations should be based on multiple consecutive analyses, over a longer period of time. Higher accuracy and precision are scored higher.
1.14	B	Specify the accuracy and precision your solution can produce in laser ablation mode (using a 193nm laser ablation system) for the following: • $^{11}\text{B}/^{10}\text{B}$ of standard material relevant to the analysis of biogenic carbonates (e.g., corals) • U/Pb of zircon Report which system is used, the acquisition parameters or other specifications/configurations utilized in the analysis, and routinely achievable precision. Higher accuracy and precision are scored higher.
1.15	B	Provide signal-to-noise ratio and dark noise levels for all detectors. Higher signal-to-noise ratio and lower dark noise levels are scored higher.
1.16	B	State the instruments mass resolving power in standard transmission mode, including how mass resolving power is calculated. Explain how this can be adjusted and detail any ion transmission losses that may accompany operation of the instrument in high, medium and very high mass resolving power.
2		Training, service, warranty
2.1	A	The system must be available for delivery no more than six months after signing the contract and the issuing of a purchase order.

		Suppliers must have the capacity to install and test the system at a date later than that of the delivery. Please specify if there are any limitations on this.
2.2	A	Training must be delivered on-site at UiT in English and should be available for at least four members of UiT staff. Training should cover items specified in Section 4. Training. Please detail the extent of the standard training.
2.3	A	Warranty for at least 24 months must be included in the system offer, commencing after testing and approval of the instrument at UiT, and should cover the entire system (including parts, labour and onsite engineer visits).
2.4	B	It is desirable that a warranty for 36 months is included in the system offer, commencing after testing and approval of the instrument at UiT, and should cover the entire system (including parts, labour and onsite engineer visits).
2.5	B	It is desirable that a maintenance contract is offered following the end of the warranty period for three years (costs inclusive of travel and subsistence, parts, and labour). Describe what is included in the offered service and maintenance contracts.
2.6	B	Describe the service response time and cost on-site at UiT inside and outside of warranty/maintenance contracts. Provide anticipated waiting times for high, medium, and low priority maintenance tasks for calls, remote troubleshooting, and engineer visits to UiT. Describe how you manage and evaluate the priority of maintenance tasks. Indicate the expected time taken to ship and deliver spare parts to UiT from the time of request. Provide testimonials (from at least two customers) to demonstrate how MC-ICP-MS service has been delivered to remote sites (such as northern Scandinavia) inside and outside of warranty and service contracts, and the customers' evaluation of this service.
2.7	B	Describe how any warranty and maintenance agreements extends to third party items (e.g., autosampler, desolvating nebulizer).
3		Environment and sustainability
3.1	A	The instrument must have a lifespan of at least 5 years from the date of successful testing at UiT.

3.2	B	Efforts must be made to reduce the environmental impacts of shipping and delivery of the instrument: discuss how this is achieved, with consideration to factors such as, but not limited to, CO ₂ emissions and packaging materials.
3.3	B	Describe how the production of noise and heat from the system is reduced. This should include reference to the ability of housing any pumps and chillers at a distance from the instrument and suggestions as to how to manage the system's noise and heat output.
3.4	B	Please describe your approach to managing suppliers within your own supply chain in a manner that minimises the risks of modern slavery, and non-compliance with International Labour Organisation (ILO) conventions. This may include how you monitor and audit your supply chain, and any policies your organisation has in place. Your response should provide assurance that you have taken reasonable, proactive steps in addressing modern slavery risks in your supply chain.