LA-ICP-MS - Laboratory Report 2025

Laser Ablation-Inductively Coupled Plasma-Mass Spectrometry

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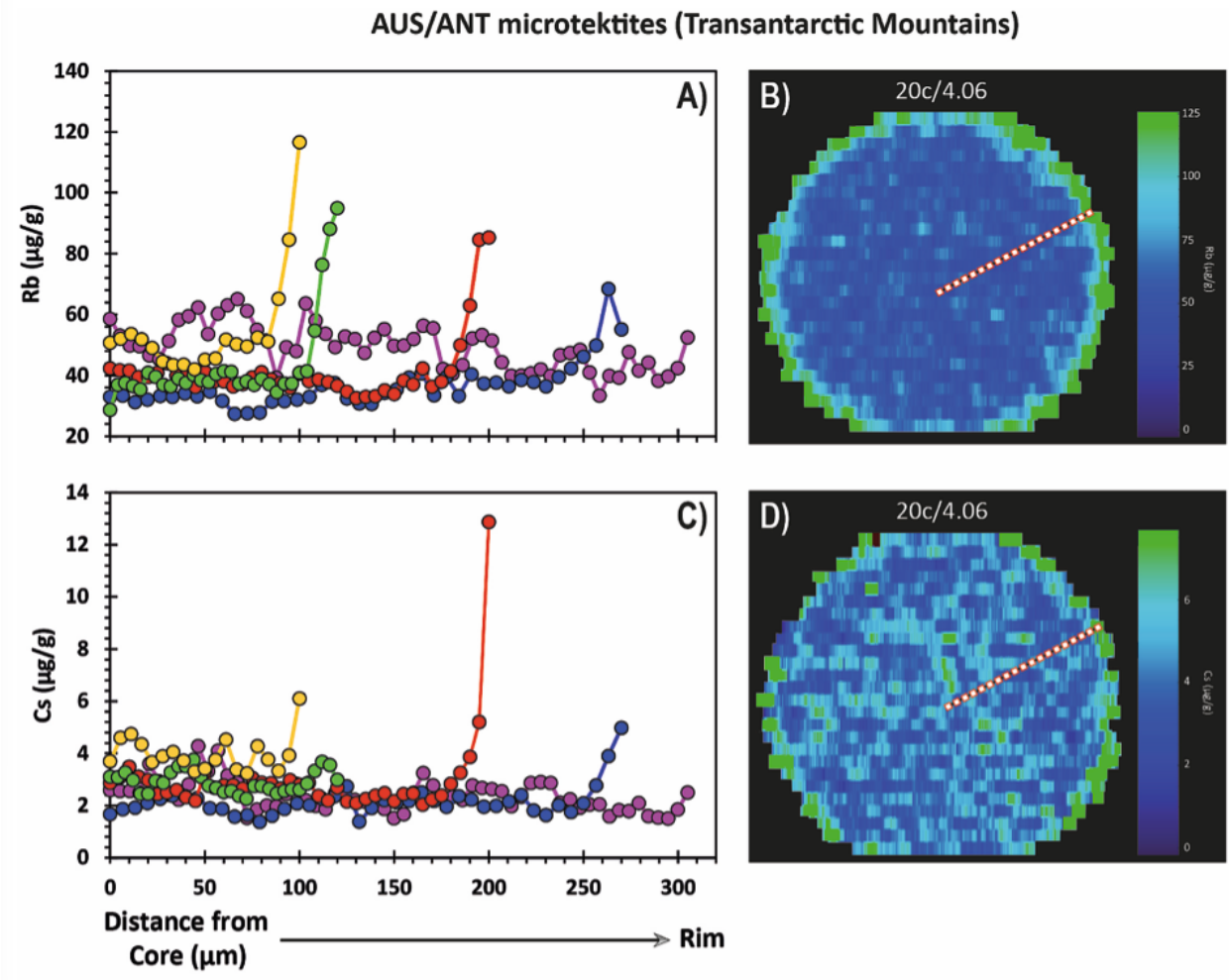

Figure 1. The image shows two elemental maps and corresponding concentration profile of Rb and Cs obtained on a transantarctic microtektite. The maps are obtained using the rastering ablation method and square spot size 8x8 µm (from Del Rio et al., 2025).

Introduction

The LA-ICP-MS laboratory is equipped with a Laser Ablation (LA) system ESI NWR-193 (ArF Excimer Laser) and an Inductively Coupled Plasma-Mass Spectrometer (ICP-MS) PerkinElmer NexION 2000, both installed in 2020. This document reports the activities carried out by the LA-ICP-MS laboratory during 2025, including: 1) personnel and user accesses; 2) current research lines, 3) costs and incomes, 4) education and outreach activities, and 5) scientific production.

1. Personnel and user access

The LA-ICP-MS laboratory is currently managed by Prof. Matteo Masotta. During 2025, the laboratory received the access of 24 users (12 internal users and 12 users from other national and international universities and research institutions), for a total working time of about 200 hours. Additionally, the laboratory has provided service for BSc, MSc and PhD theses, as well as for traineeship activities (about 20 students). The activity of the LA-ICP-MS laboratory is mostly dedicated to scientific projects related to Earth Sciences disciplines (about 90% of the total working time), with the rest of time being dedicated to technical testing and implementation for applications from third parties.

2. Current research lines

The LA-ICP-MS laboratory is currently operative for the following type of analysis:

- ◊ Trace element analysis in silicate matrixes (about 40% of the working time): performed for in situ determination of trace element concentration in silicate minerals, silicate glasses and silicate melt inclusions. Analyses can be performed either as single spot (spot size varying from 10 to 150 µm) or in squared raster mode to produce elemental maps (raster size varying from 8 to 40 µm; **Figure 1**);
- ◊ U-Pb geochronology on zircons (about 20% of the working time): performed routinely using circular spot size, with spot size ranging from 15 to 30 µm;
- ◊ U-Pb-Th geochronology on other minerals (about 10% of the working time): U-Pb dating of calcite crystals has been successfully attempted (*Di Rosa et al., 2025*);
- ◊ Trace element analysis in sulfides, oxides and metals (about 20% of the working time): analyses of sulphide minerals typically require specific tuning for each mineral type, aimed at balancing the signal intensities of the internal standards in both sample and standard reference material;
- ◊ Trace element and isotopic analysis in carbonates, phosphates and other non-silicate matrixes (out 10% of the working time): mostly performed for archaeometry and paleoenvironmental research.

3. Costs and incomes

The LA-ICP-MS laboratory income for 2025 amounts to a total of 17,800 €. This includes the income from internal (CISUP) user projects (9,000 €) and external user projects (8,800 €). No income from third parties (industry) has been obtained this year. The presence of a technician dedicated to routine and customised analytical work for third parties could possibly increase the income of the laboratory. The total income fully covered the laboratory costs of 2025, mostly related to the purchase of technical gases and consumables for ICP-MS (7,600 €), and part of the regular maintenance contract costs of the ICP-MS (15,000 € per year). No additional unexpected costs occurred in 2025.

4. Education and outreach

The LA-ICP-MS laboratory is yearly involved in laboratory activities and practicals carried out for BSc, MSc and PhD students (24 hours/year), as well as in general demonstration activities carried out in the frame of the orientation programs of the University of Pisa (4 hours/year). During 2025, a relatively large amount of time (approximately 40 hours) has been dedicated to analytical work performed for BSc, MSc and PhD theses (6 students) and for traineeship (2 students).
A short course on LA-ICP-MS technique applied to Earth Sciences has been offered for PhD students from the University of Pisa, also open to PhD students from other Italian universities and research institutions.

5. Scientific production

The scientific production continues a slightly increasing trend over the years. At the beginning of 2026, the following articles containing data obtained in the LA-ICP-MS laboratory were published:

1. Jacobs J., Rocchi S., Bach W., Masotta M., Pedersen L-E.R. (2025) Serpentinite-sediment associations: provenance controlled by competing extensional-contractional tectonic processes during the evolution of the Northern Apennines (eastern Elba Island, Tuscany). *Basin Res.* **37**, e70012.
2. Guelfi R., Maremmani A., Di Rosa M., Meneghini F., Pandolfi L., Marroni M. (2025) Reconstruction of oceanic crust architecture in high-pressure metamorphic ophiolites: a case history from Noceta-Vezzani area (Alpine Corsica, France). *Episodes* https://doi.org/10.18814/epiiugs/2025/025006
3. Del Rio M., Folco L., Mugnaioli E., Goderis S., Masotta M. (2025) Loss and Accretion of Moderately Volatile Elements K and Na in Australasian Microtektites from Antarctica. *Geochim. Cosmochim. Acta* **395**, 212-228.
4. Iannini Lelarge S., Masotta M., Folco L., Ubide T., Suttle M.D., Pittarello L. (2025) Early Differentiation of Planetary Embryos and Formation of Alkali-Rich Achondrites. *Geochemistry* **85**, 126293.
5. Folco F., Mugnaioli E., Masotta M., Glass B.P. (2025) Coesite Discovered in Australasian Microtektites. *Geology* **53** (9), 727-731.
6. Filimon D.I., Groff J.A., Saccani E., Di Rosa M. (2025) Ore Genesis Based on Microtextural and Geochemical Evidence from the Hydrothermal As–Sb Mineralization of the Matra Deposit (Alpine Corsica, France). *Minerals* **15** (8), 814
7. Di Rosa M. Filimon D.I., Groff J.A., Marroni M. (2025) U–Pb dating of carbonate gangue with associated As–Sb mineralization in the Matra Fault (Alpine Corsica, France): constraints for the rifting stage in the Tyrrhenian Sea. *J. Geodyn.*, 102110

8. Coletti G., Borromeo L., Fallati L., Luppichini M., Meroni A., Maspero F., Malinverno E., Bini M., Palli J., Basso D., Vezzoli G., Garzanti E., Bracchi V.A., Savini A., Desbiolles F., Pasquero C., Correggiari A., Cornacchia I., Boschi C., Baneschi I., Cavallo A., Masotta M., Bosio G., Gallerani A., Fusi N., Mariani L., Galli A., Andò S., Bazzicalupo P., Consani S., Lazzarotti M., Taccola G. (2025) Combining instrumental, historical, and coastal marine sedimentary archives to analyse flood variability in northwestern Italy during the last thousand years. *Quat Sci. Advances*, 100289
9. Sanità E., Di Rosa M., Della Porta G., Catanzariti R., Pandolfi L., Marroni M. (2025) Trench sediment heterogeneity controls accretion mechanisms in subduction zone. *Sci. Rep.*, DOI: 10.1038/s41598-025-18508-7
10. Costa S., Masotta M., Colle F., Giacomoni P.P, D'Oriano C., Landi P. (2026) Optimization of lithium diffusion modelling in plagioclase: implications for the assessment of pre-eruptive timescales. *Chem. Geol.* **704**, 123222.
11. Gerontidou I., Koroneos A., Papadopoulou L., Chatzipetros A., Masotta M., Karampelas S. (2026) Magmatic to Subsolidus Evolution of the Variscan Kastoria Pluton (NW Greece): Constraints from Mineral Chemistry and Textures. *Minerals* **16**, 83.