

Advances in high-precision lithium isotopic measurements with the NeomaTM MC-ICP-MS (ThermoFischer Sci.)

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Lithium isotopes ($\delta^7\text{Li}$) are key tracers in Earth and Environmental Sciences, used for studying continental weathering, past climate, hydrothermal systems, and biogeochemical processes. High-precision $\delta^7\text{Li}$ measurements rely on MC-ICP-MS, but analyzing low Li samples remain challenging.

This study evaluates the Thermo Fischer Sci. Neoma MC-ICP-MS (without MS/MS) operational since Sept. 2024 at LOV. Two setups were tested: with (1) Apex Omega and (2) Cetac Aridus III desolvator. Samples were introduced via a microFAST Isotope DualLoop (ESI) locally configured to reduce overnight evaporation. Each desolvator was assessed with and without the Dual Loop system. Measurements were performed on unpurified 3 ppb lithium standards: LSVEC ($\delta^7\text{Li} = 0\text{‰}$) and Li7-N ($\delta^7\text{Li} = 30.2 \pm 0.3\text{‰}$)¹ using a standard bracketing technique. Analyses were performed in low-resolution mode, achieving Li sensitivity up to 6000V/ppm.

With the Apex Omega, repeated LSVEC and Li7-N measurements without the dual loop yielded average $\delta^7\text{Li}_{\text{LSVEC}} = -0.02\text{‰} \pm 0.1\text{‰}$ (2SD, n=16) and $\delta^7\text{Li}_{\text{Li7-N}} = 30.01\text{‰} \pm 0.2\text{‰}$ (2SD, n=28). Using the Dual Loop injector, we get similar values, with $\delta^7\text{Li}_{\text{LSVEC}} = -0.003\text{‰} \pm 0.1\text{‰}$ (2SD, n=33) and $\delta^7\text{Li}_{\text{Li7-N}} = 30.35\text{‰} \pm 0.3\text{‰}$ (2SD, n=75). In both cases a persistent memory effect (1%-6% of the ^7Li signal) remains challenging. Despite this, the data accuracy and reproducibility for pure Li solutions are correct compared to data published for low-Li reference materials². For the Aridus III desolvator, sensitivity matched that of Apex Omega, but the Dual Loop is crucial to maintain precision: $\delta^7\text{Li}_{\text{LSVEC}} = 0.03\text{‰} \pm 0.1\text{‰}$ (2SD, n=24), $\delta^7\text{Li}_{\text{Li7-N}} = 30.7\text{‰} \pm 0.2\text{‰}$ (2SD, n=19). Efforts are ongoing to lower Li concentration and mitigate memory effects.

Overall, the NeomaTM MC-ICP-MS enables rapid, high-precision $\delta^7\text{Li}$ values at the ppb level. Future work will focus on biological reference materials and further configuration assessments.

references

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- (2) Thibon, F., Weppe, L., Montanes, M., Telouk, P., Vigier, N. Lithium Isotopic Composition of Reference Materials of Biological Origin TORT-2, DORM-2, TORT-3, DORM-4, SRM-1400 and ERM-CE278k. *JAAS* **2021** 36 (7), 1381–1388