Improvements on high-precision Eu isotope analysis by MC-ICP-MS

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Europium (Eu) has two stable isotopes, ^{151}Eu and ^{153}Eu. No isotopic variation was observed of the two isotopes (^{153}Eu/^{151}Eu = 1.0916) at precision of ~1 per mil [1]. Later researchers found the ^{153}Eu/^{151}Eu ratio of terrestrial rocks and meteorites was constant within one ε unit [2]. The magnitude of Eu enrichment or depletion in a sample, calculated as a "Eu anomaly", is a so classic and fascinating geological parameter. We have a strong desire to know whether there are isotopic fractionation at various Eu anomaly samples. So the first is to further improve the analytical precision.

In this preliminary work, we developed a simple and feasible approach for high precision Eu isotopes analysis by a nu plasma 1700 MC-ICP-MS in China University of Geosciences. Instrumental mass bias was calibrated by a sample-standard bracketing method using a pure Eu solution, NIST3117a, as the bracketing standard. Eu isotope data are reported as $\delta^{153}Eu_{NIST3117a}$ ($\delta^{153}Eu_{NIST3117a}$ = $[(^{153}Eu/^{151}Eu)_{sample}/(^{153}Eu/^{151}Eu)_{NIST3117a}-1)]\times1000$). Two desolvating systems, CETAC Aridus II™ and ESI apex Q, were coupled for more stable sample introduction. The long-term precision and accuracy of NIST3117a is 0.000±0.017‰ (2SD, n=282). The result is better than that without desolvating system (-0.009±0.081‰, 2SD, n=14) or just using Aridus II (0.001±0.031‰, 2SD, n=117). All data were obtained at similar signal intensity.

We also measured $\delta^{153}Eu_{NIST3117a}$ for other two pure Eu solutions, including Alfa Aesar 35753 (-0.011±0.018‰, 2SD, n=68) and NCS GSBG62052-90 (0.009±0.021‰, 2SD, n=63). In the whole long-term test, without complex calibration, slight Eu isotopic variation of the three standard solutions have been observed. Therefore, the improved approach will facilitate the further study of Eu isotopes.

[1] Chang et al. (1994), Int. J. Mass Spectrosc. Ion Proc. **139**, 95–102.
[2] Moynier et al. (2006), Geochim. Cosmochim. Acta **70**, 4287–4294.