

High precision analysis of selenium isotopes using the double-Wien filter of the Neoma MC-ICP-MS/MS

ELSA DOLLINGER¹ AND OLIVIER ROUXEL²

¹Geo-Ocean, Univ Brest, CNRS, Ifremer, UMR6538

²Geo-Ocean, Univ Brest, CNRS, Ifremer, UMR6538

Selenium (Se) occurs in many valences from -2 to +6 in a variety of geological settings and aqueous environments. Se has six isotopes from mass 74 to 82 providing promising tracers of selenium's biogeochemical cycles. Since the pioneer work in the early 2000s using thermal ionization mass spectrometry and Multi-Collector Inductively Coupled Plasma Mass Spectrometry (MC-ICP-MS) [1] coupled with a Hydride Generator (HG) [2], numerous studies have improved analytical techniques for Se isotope analysis.

Here, we evaluate the performance a recently available MC-ICP-MS (Neoma MS/MS, Thermo Scientific) equipped with a collision/reaction cell (CRC) and a pre-cell mass filter (MS/MS) for high-precision Se isotope ratio measurements. We evaluate the effect of different setup parameters of the MS/MS, CRC, and sample introduction system on the overall performance (e.g. sensitivity, interferences, mass bias corrections). We show that the addition of O₂ in the CRC allows for a near-quantitative removal of Ar₂⁺ and Ar₂H⁺ interferences (0.1% remaining with O₂ = 0.5 mL/min). We also identify significant contribution of Se hydrides (SeH) ranging from 0.01 to 0.06% (SeH⁺/Se⁺). Both corrections for residual Ar₂ and SeH interferences are incorporated into the instrumental mass fractionation correction scheme using a Se double-spike (⁷⁴Se-⁷⁷Se) approach [3]. Using this new technique, sample were introduced into the HG at a concentration of about 3.7-10 µg/L to produce 1.6-6.9 V on the ⁷⁸Se. Se isotopic composition are expressed in delta notation relative to the international standard NIST SRM3149 and results obtained for in-house standards were in line with those measured in previous studies [2][4]. We determined $\delta^{82/77}\text{Se} = 0.01 \pm 0.13\text{‰}$ (2s, n= 73) for SRM3149, $\delta^{82/77}\text{Se} = -2.70 \pm 0.13\text{‰}$ (2s, n= 4) for MH495 and $\delta^{82/77}\text{Se} = -0.64 \pm 0.14\text{‰}$ (2s, n= 23) for SPEX4 standards.

This new method is promising for Se isotopic measurements in a wide range of applications requiring high-sensitivity measurements and will be applied to investigate Se isotope systematics of seafloor hydrothermal fluids and seawater.

[1] Johnson et al. (1999) *GCA* 63, 2775-2783.

[2] Rouxel et al. (2002) *GCA* 66, 3191-3199.

[3] Siebert et al. (2001) *G3* 2, 1525-2027.

[4] Carignan & Wen (2007) *Chem. Geol.* 239, 129-140.