

In situ determination of Sb isotopes by fs-LA-MC-ICP-MS

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Antimony (Sb) is a redox sensitive metalloid that occurs in the environment mostly as Sb^{III} and Sb^V. A previous experimental study [1] indicated isotope fractionation of around 1‰ during reduction of Sb^V to Sb^{III}. Therefore, Sb isotopes could provide valuable information about the role of oxidative weathering of Sb ore deposits. To explore weathering of Sb-bearing minerals, we developed a procedure for in situ Sb isotope analyses by femtosecond LA-MC-ICP-MS at high spatial resolution (~20 µm).

In order to verify our analytical protocols for Sb isotope analyses, synthetic stibnite, homogeneous with respect to the major elements, was used as an in-house standard and was analysed by both femtosecond LA- and by solution MC-ICP-MS. The internal uncertainty of the LA measurements is better than 0.05‰, while replicate measurements of the in-house standards yield a precision of <0.08‰ (2σ). In order to correct instrumental mass bias, a Sn standard (NIST SRM 3161a) [2] was introduced during both analytical procedures. Since no certified Sb isotope standard is currently available, δ¹²³Sb values were always recalculated relative to NIST SRM 3102a. Analyses by laser ablation and solution of the in-house standards agreed within 0.1‰ (δ¹²³Sb).

In contrast to chromatographically purified isotope analyses via solution, laser ablation analyses may be affected by mass interferences from Te and AgO. Therefore, a series of Sb standard solutions, doped with different levels of interfering elements was measured. The isobaric interference of ¹²³Te on ¹²³Sb can be corrected up to a Te/Sb ratio of 0.2 within analytical uncertainties. Due to very low oxide rates, the effect of the ¹⁰⁷Ag-¹⁶O interference on ¹²³Sb was insignificant (<0.05‰) up to a Ag/Sb ratio of 2.

First in situ Sb isotope analyses of natural boulangerite, senarmontite and tetrahedrite reveal significant isotopic variations in δ¹²³Sb of up to 0.4‰ within a single grain. These spatial isotopic variations could be the result of mineral weathering at small scales.

[1] Rouxel et al. (2003), *Chem. Geol.* **200**, 25-40.

[2] Tanimizu et al. (2011), *Geochem. J.* **45**, 27-32.