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Standard Doping Method for Silver Isotope Analysis in Silicate Rocks with Low Silver Abundance

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Due to the extremely low abundance of silver in the Earth's crust and mantle, it remains great challenges to obtain accurate silver isotope data in silicate rocks, which makes it difficult to define the silver isotope composition of the major reservoirs in the Earth. A silver single standard doping experimental method was proposed in this study, which enables to produce accurate δ^{109}Ag values with significant improvement in accuracy and stability of data acquisition, with referring the analysis protocol for Sb isotope [1].

An in-house silver isotope standard reference material (AG-NJU) that is different in δ^{109}Ag of NIST SRM 978a, was doped into sample solution prior to ion exchange to make the silver content of samples to reach a higher level, that is equivalent to the standard reference material of NIST 978a. A correction procedure was proposed based on the mass balance equation: $R_i^{mix} = f R_i^{sample} + (1-f) R_i^{AG-NJU}$, and the true value of the silver isotope composition of the original sample can be derived from the mixing law equation of the double spike method [2]. On the basis of the external reproducibility of ±0.04‰ from reduplicate analysis and the internal precision of ±0.031‰ from single analysis in silver isotopic measurement in natural samples in our laboratory, the evaluation of error propagation implies that the optimum doping proportion of standard material to sample of 2:8 would ensure accurate silver isotope analysis in silicates with an acceptable measurement uncertainty of ±0.04 to ±0.06‰. This study might provide new insights into the analytical strategy of silver isotopes in terrestrial and extra-terrestrial rocks.

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