High-precision Ba isotope analysis method by MC-ICP-MS

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Barium is a fluid-mobile and incompatible trace element in terrestrial rocks. Previous studies on Mg, Ca and Sr isotopes found that there were significant alkaline earth element isotope fractionation in natural samples. We expect Ba isotopes may also be fractionated during weathering, hydrothermal, biogeochemical processes. However, Ba isotope data of natural samples are rare in literature.

In this study, we established a method for high precision Ba isotopes analysis by a Neptune plus MC-ICP-MS in the University of Science and Technology of China. Bio-Rad AG50W-X12 resin was used to separate Ba from matrix elements (Na, K, Ca, Mg, Al, Sr, Fe, Rb, etc.). Instrumental mass bias was calibrated by a sample-standard bracketing method using the pure Ba solution NIST3104a as the bracketing standard. Ba isotope data are reported as $\delta^{137}Ba$ ($\delta^{137}Ba= [(^{137}Ba/^{134}Ba)_{sample}/(^{137}Ba/^{134}Ba)_{NIST3104a}-1)]\times1000$). To ensure the precision and accurancy of this method, we keep tracking the Ba isotope data of one synthetic standard. This standard is a mixture of NIST3104a and rock matrix and was purified through the whole chemical procedure. The $\delta^{137}Ba$ of the synthetic standard is -0.006±0.045‰ (2σ, n=30), representing the long-term precision and accurancy of our method.

We also measured $\delta^{137}Ba$ for eight reference materials, including BHVO-2 (0.044 ± 0.035‰, 2σ), BCR-2 (0.050 ± 0.039‰, 2σ), W2 (0.035 ± 0.022‰, 2σ), AGV-1 (0.047 ± 0.040‰, 2σ), GSP-2 (0.013 ± 0.046‰, 2σ), RGM-1 (0.142 ± 0.030‰, 2σ), JA-2 (0.038 ± 0.048‰, 2σ) and JB-2 (0.085 ± 0.035‰, 2σ), respectively. The offset of $\delta^{137}Ba$ values between BHVO-2, JB-2 and JA-2 are consistent with the published data within analytical errors [1]. With our current precision, the slight Ba isotope fractionation in igneous rock standards (such as RGM-1 vs. GSP-2) can be well resolved. Therefore, it is possible to use Ba isotope as a novel tracer for geochemical studies.

[1] Miyazaki, T. et al.(2014) *J. Anal. At. Spectrom*, **29**, 483-490.