Cerium Isotope Measurements of Rock Samples by MC-ICPMS

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In the 1980s, the 138La-138Ce Geochronometer (half-life 1.02 x 10^11 years) was first introduced [1]. The system is useful in understanding the timing of geochemical processes involving light rare earth elements (REE) especially when combined with the 147Sm-143Nd and 176Lu-176Hf chronometers. However, sufficiently precise isotopic measurements were difficult because of the strong isobaric interferences from 142Nd on 142Ce and 138Ba on 138Ce and because of the small relative abundances of 136Ce (0.185%) and 138Ce (0.251%). By now, more precise protocols for Ce isotope measurements have become available by using the newest generation of MC-ICPMS devices.

In this study, the Ce isotopic composition of 10 geochemical reference materials from various geological settings (BCR-2, BCR-1, BHVO-2, JR-1, JA-2, JB-3, JG-1, JR-1, JB-1b and AGV-1) as well as one in-house La Palma basalt were determined. To calculate the data relative to CHUR, the ε138Ce (CHUR) value for Willbold-AMES of 3.24±0.23 (2σ s.d.) was used [2]. By repetitive processing of each sample, the reproducibility was proved to be better than ±30 ppm (2σ r.s.d.) for BCR-2, BCR-1, BHVO-2, JA-2, JB-3, JG-1, JA-2, JB-1b, AGV-1 and LP-1. The average uncertainty could be reduced to only ±0.23ppm, which is significantly smaller than reported in previous studies, (±0.31 to ±1.1 [2,3]). Our average measured ε138Ce (CHUR) for JB-3 and JG-1 are -1.69±20ppm and 0.25±20ppm, respectively, being in good agreement with a previous study [3]. Our study shows an excellent agreement for ε138Ce (CHUR) of BCR-1 and BCR-2 and also a good agreement with previous literature data of BCR-1 [3]. ε138Ce (CHUR) of BCR-2 and BHVO-2 overlap only slightly with a recent TIMS study. [2]. JR-1 showed inhomogenity in the first run and were processed again. The ε138Ce(CHUR) values vary from -1.15 to +0.31 for JR-1. In particular, the JR-1 sample seems to be heterogenous. Collectively, our measured ε138Ce exhibit the expected tight anti-correlation with ε143Nd compositions, even at our improved analytical resolution.