Cerium Isotope Measurements of Rock Samples by MC-ICPMS

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In the 1980s, the ^{138}La-^{138}Ce 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 ^{147}Sm-^{143}Nd and ^{176}Lu-^{176}Hf chronometers. However, sufficiently precise isotopic measurements were difficult because of the strong isobaric interferences from ^{142}Nd on ^{142}Ce and ^{138}Ba on ^{138}Ce and because of the small relative abundances of ^{136}Ce (0.185%) and ^{138}Ce (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 ε^{138}Ce (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 (2 σ 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 studie, (±0.31 to ±1.1 [2,3]). Our average measured ε^{138}Ce (CHUR) for JB-3 and JG-1 are -1.69±20ppm and 0.25±20ppm, respectivly, being in good agreement with a previous study [3]. Our study shows an excellent agreement for ε^{138}Ce (CHUR) of BCR-1 and BCR-2 and also a good agreement with previous literature data of BCR-1 [3]. ε^{138}Ce (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 ε^{138}Ce(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 ε^{138}Ce exhibit the expected tight anti-correlation with ε^{143}Nd compositions, even at our improved analytical resolution.

[1] Tanaka &Masuda (1982) *Nature, 300*, 515–518 [2] Bellot et al. (2015) *Geochim. Cosmochimi. Acta, 168*, 261-279 [3] Tanaka et al. (1987) *Nature,* 327, 113-114