Barium isotopic composition of the mantle constrained by carbonatites

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To investiagate the behaviour of Ba isotopes during carbonatite magmatism and explore the possibility of using carbonatites to constrain the Ba isotopic composition of the mantle, we report high-precision (the long-term external precision of ±0.040‰ on $\delta^{137/134}$Ba, 2SD) analyses of Ba isotopes for (1) carbonatites and silicate rocks from Oldoinyo Lengai, Tanzania and (2) carbonatites from Canada, East Africa, Germany and Greenland.

Natrocarbonatites and petrogenetically associated peralkaline silicate rocks from Oldoinyo Lengai have homogeneous $\delta^{137/134}$Ba (relative to the standard solution NIST SRM3104a) values ranging from +0.005 to +0.033‰. This observation suggests that Ba isotope fractionation during carbonatite petrogenesis is insignificant and, hence, carbonatites can be used to constrain the Ba isotopic composition of the mantle. Most carbonatites from Canada, East Africa, Germany and Greenland display limited variation in $\delta^{137/134}$Ba ranging from -0.069 to +0.086‰, similar to those of the oceanic island basalts (from -0.073 to +0.083‰; [1]).

Collectivelly, the mantle has a relatively homogeneous Ba isotopic composition. Based on the mantle-derived carbonatites and silicate rocks investigated in this work, the average $\delta^{137/134}$Ba value of the mantle is estimated to be +0.023 ± 0.060‰ (2SD), consistent with the average of +0.020 ± 0.095‰ (2SD) of oceanic island basalts [1].

[1] Huang F et al., Goldschmidt2015 Abstract 1331.