

Barium isotopic composition of the upper continental crust

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Barium isotopes have attracted increasing attention over the past few years. Previous studies of terrestrial samples showed significant fractionation of Ba isotopes in seawater [1], rivers [2] and few terrestrial igneous rocks [3]. However, the Ba isotopic compositions of upper continental crust (UCC), the most important reservoirs of Ba on the Earth, are still unknown.

To constrain the average Ba isotopic compositions of continental crust and study the Ba cycling during weathering process, we analyzed Ba isotopes of granites, loess, river sediments, and glacial diamictites (70 samples in total). Barium isotopes were measured using a Neptune plus MC-ICP-MS with two methods: sample-standard bracketing with Ce correction and a double spike method. The errors (2SD) of $\delta^{137/134}\text{Ba}$ (denoted as $[(^{137/134}\text{Ba})_{\text{sample}} / (^{137/134}\text{Ba})_{\text{SRM3104a}} - 1] \times 1000$) better than 0.050‰ and 0.035‰, respectively. Repeated measurements by the two methods show good consistence within error.

Loess samples define a narrow range of Ba isotopic compositions ($\delta^{137/134}\text{Ba} = -0.019\%$ to $+0.027\%$) with an average of $0.001 \pm 0.031\%$ (2SD, $n=18$). $\delta^{137/134}\text{Ba}$ in granites ranges from -0.153% to $+0.094\%$ with an average of $0.000 \pm 0.124\%$ ($n=22$). Compared to loess and granites, glacial diamictites and the sediments have a larger dispersion in $\delta^{137/134}\text{Ba}$, from -0.172% to $+0.362\%$ in glacial diamictites, and from -0.157% to $+0.343\%$ in river sediments.

Overall, our results show that different components of the upper continental crust have heterogeneous Ba isotopic compositions, with most samples have $\delta^{137/134}\text{Ba}$ close to $0.005 \pm 0.168\%$ (2SD, $n=70$). It implies that chemical weathering may significantly fractionate Ba isotopes and lead to the variable Ba isotopic composition in the UCC.

[1] Horner et al. (2015) *EPSL*, **430**, 511-522.

[2] Cao et al. (2016) *EPSL*, **434**, 1-9.

[3] Nan et al. (2015) *JAAS*, **30**, 2307-2315.