Barium isotope characteristic of the Hawaiian lavas

XIAOYUN NAN [1], JINTING KANG[1], HUIMIN YU[1], SHICHUN HUANG[2], FANG HUANG[1]

[1] School of Earth and Space Sciences, University of Science and Technology of China, Hefei, Anhui 230026, China
[2] Department of Geoscience, University of Nevada, Las Vegas, NV 89154, United States

The trace element and isotopic variability in oceanic island basalts (OIB) can be used to constrain the heterogeneity of the mantle source, which is commonly related to the recycling of oceanic crust associated with sediments[1], mantle metasomatism[2], and delamination of lower continental and oceanic crust[3]. Significant barium (Ba) isotope fractionation among terrestrial samples have been recently observed[4], and Ba isotopes have been used to trace crustal recycling into the MORB mantle[5].

Here we present the first Ba isotope data of Hawaiian basalts from Mauna Kea and Koolau, measured on a Neptune Plus MC-ICP-MS at the University of Science and Technology of China, with a long-term precision of $\delta^{137/134}$Ba better than 0.04‰ (2SD). These two volcanoes define the two geochemical extremes among the Hawaiian shield lavas. We use our Ba isotope data on Hawaiian lavas to constrain the geochemical and isotopic heterogeneities in their mantle sources, i.e., the Hawaiian plume.

$\delta^{137/134}$Ba of Koolau and Mauna Kea basalts range from -0.03‰ to 0.15‰, and -0.08‰ to 0.1‰, respectively. Both datasets display sizable Ba isotopic variation compared to the relatively homogeneous Ba isotope composition of N-MORB in East Pacific Ocean ($\delta^{137/134}$Ba of 0.02‰ to 0.06‰)[5]. Part of the $\delta^{137/134}$Ba variation in Hawaiian lavas must result from post-magmatic alteration, because measurements of multiple samples from the same lava units reveal sizable $\delta^{137/134}$Ba variation. For examples, six samples from submarine Unit 293 at Mauna Kea have $\delta^{137/134}$Ba ranging from -0.08‰ to 0.03‰ that is correlated with Ba/Rb. The altered sample KOO-17A from Koolau, which is from an olivine-rich portion of the same flow as KOO-17, has highly elevated Ba isotope composition (0.15‰) compared to KOO-17 (0.05‰).

[1] Hofmann and White. (1982) EPSL, **57**, 421-436.
[2] Pilet et al. (2005) EPSL, **236,** 148-166.
[3] McKenzie and O'Nions. (1995) J. Petrol., **36,** 133-159.
[4] Charbonnier et al. (2018) Science Bulletin, **63,** 385-94.
[5] Nielsen et al. (2018) Science advance, **4,** eaas8675.