Barium isotopic characteristics of metamorphic rocks from continental subduction zones

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The strong enrichment of Ba in continental crustal rocks relative to the mantle (hundreds of ppm vs. several ppm) makes Ba isotopes a potential sensitive tracer of crustal recycling. Continental crust can be deeply subducted and recycled to the convective mantle, resulting in significant heterogeneity in the mantle. In order to investigate the Ba isotopic characteristics of recycled continental crustal materials, we report high-precision (±0.05‰ on $\delta^{137/134}$Ba, 2SD) Ba isotopic compositions of 49 felsic and mafic metamorphic rocks with different metamorphic degrees from the Dabie-Sulu orogenic belt in east-central China.

The metamorphic rocks display a wide range of $\delta^{137/134}Ba_{SRM3104a}$ from -0.44‰ to +0.48‰, which is similar to that of the upper continental crust (from -0.47‰ to +0.35‰; [1]) but much wider than that of the mantle (0.03±0.05‰, 2SD; [2]).The $\delta^{137/134}$Ba values vary from -0.06‰ to +0.22‰ in felsic schists, and from -0.05‰ to +0.31‰ in greenschists. These variations may reflect protolith heterogeneity. Except for two samples with extreme $\delta^{137/134}$Ba values (-0.44‰ and +0.48‰), the other amphibolites and eclogites have similar Ba isotopic compositions (from -0.20‰ to +0.25‰) relative to greenschists, indicating that the recycled continental crustal rocks have highly variable Ba isotopic compositions and such a characteristic could be preserved through subduction zones. Therefore, recycling of continental crutal materials with high Ba contents and highly variable Ba isotopic compositions may produce significant Ba isotopic heterogeneity in the mantle.

[1] Nan et al. (2018) GCA, 233, 33-49;
[2] Li et al. (2017) Goldschmidt Abstract, 05c, 2297.