Multiple influences on the calcium isotopic compositions of basalts:evidence from the Cenozoic basalts of eastern China

XUNAN MENG[1], YONGSHENG HE[1*], JIAN HUANG[2*], SHAN KE[1], SHUGUANG LI[1]

[1] State Key Laboratory of Geological Processes and Mineral Resources, China University of Geosciences, Beijing 100083, China

[2] CAS Key Laboratory of Crust-Mantle Materials and Environments, University of Science and Technology of China, Hefei 230026, China

(*correspondences: heys@cugb.edu.cn; jianhuang@ustc.edu.cn)

Calcium is abundant in all carbonates that have lower $\delta^{44/42}$Ca (an average of ~0.30‰) relative to the upper mantle (0.51‰). Calcium isotopes are a potential tool to trace ancient marine carbonates recycled into the mantle [1]. Low δ^{26}Mg and high δ^{66}Zn of Cenozoic basalts from eastern China suggest the presence of recycled carbonates in their mantle sources [2, 3, 4]. To evaluate whether Ca isotope ratios of basalts can be an effective tracer of recycled carbonates, we conducted high-precision Ca isotopic analyses on the Cenozoic basalts from eastern China. These basalts have $\delta^{44/42}$Ca ranging from 0.24‰ to 0.40‰, systematically lower than those of the upper mantle and terrestrial mafic rocks (0.41‰) [5]. Lack of correlations between $\delta^{44/42}$Ca and CaO or LOI suggest insignificant effect of differentiation and post-magma alteration. $\delta^{44/42}$Ca of these basalts do not correlate with the indices of recycled carbonates or carbonate-present partial melting, e.g. $^{87}Sr/^{86}Sr$, Sr/Nb, Zr/Hf, Ca/Al, Hf/Hf* and Ti/Ti* either. Thus, the low $\delta^{44/42}$Ca of the Cenozoic basalts can not be simply attributed to the recycled carbonates. Another mechanism is necessary either to offset the isotopic effect of recycled carbonates, or to produce the low $\delta^{44/42}$Ca. The Cenozoic basalts have distinctly high $(Dy/Yb)_N$ up to 3.6, suggesting abundant residual garnet in their sources. Garnet has higher $\delta^{44/42}$Ca relative to its coexisting clinopyroxene [6]. Isotope fractionation during mantle partial melting with abundant residual garnet may have contributed to the low $\delta^{44/42}$Ca of the Cenozoic basalts. In this regard, low $\delta^{44/42}$Ca basalts may not necessarily reflect a signal of recycled carbonates, and using Ca isotopes to trace recycled carbonates need more cautions.

[1] Huang *et al.* (2011) *GCA.* [2] Yang *et al.* (2012) *CG.* [3] Huang *et al.* (2015) *GCA.* [4] Liu *et al*. (2016) *EPSL.* [5] He *et al.* (2017) *GGR.* [6] Magna *et al.* (2015) *EPSL.*