Lithological heterogeneity in the sources of Emeishan and Tarim large igneous provinces: a Zn/Fe and Zn isotope perspective

CHUN YANG, SHENG-AO LIU, ZE-ZHOU WANG

State Key Laboratory of Geological Processes and Mineral Resources, China University of Geosciences, Beijing 100083, China (Correspondence: karlyang@cugb.edu.cn)

The Earth's deep interior is chemically heterogeneous as a consequence of the continuous subduction of oceanic crust. Identification of the nature of recycling oceanic crust in sources of large igneous provinces is crucial for understanding the compositional heterogenity of the deep Earth. Due to the distinct difference of Zn isotope composition of marine carbonates (average $\delta^{66}Zn_{JMC\text{-}3709L}$ of ~1‰) compared with the mantle (~0.2‰), recycling carbonates in mantle sources, if any, would be recorded by Zn isotopes of basaltic magmas [1]. In addition, Zn/Fe is also a proxy for lithology in basalt sources [2].

In order to characterize the compositional heterogeneity of deep mantle, high-precision Zn isotope data were presented for Permian picritic and basaltic lavas from the Emeishan and Tarim large igneous provinces (ELIP & TLIP), together with major-trace element and Sr-Nd isotope data. The primary magma composition is estimated to have MgO content of 25.8 wt% for picritic lava flows in the ELIP, which corresponds to a potential temperature (T=1650 °C) of the primary picritic liquid. All picrites and basalts analyzed have extremely homogeneous Zn isotope composition (0.29±0.04‰, 2s.d.), which is indistinguishable from global oceanic basalt average (0.28±0.05‰, 2s.d) [3]. However, the Tarim basalts have higher Zn concentrations and elevated Zn/Fe and Fe/Mn ratios than typical OIBs and lavas from ELIP.

These data suggest a pyroxenite-dominated source for Tarim LIP whereas a peridotite-dominated source for Emeishan LIP. No evidence exists for recycling of marine carbonates into sources of the two studied LIPs and thus into the deep mantle (>660 km). This supports the recent experimental results that subducted carbonated oceanic crust would have undergone redox-freezing and melting in the mantle transition zone (410–660 km) [4].

[1] Liu *et al.* (2016) *Earth and Planetary Science Letters* **444**, 169-178. [2] Le Roux *et al.* (2010) *Geochimica et Cosmochimica Acta* **74**, 2779-2796. [3] Wang *et al.* (2017) *Geochimica et Cosmochimica Acta* **198**, 151-167. [4] Thomson *et al.*, (2016) *Nature* **529**, 76-79.