Os, Pb and Nd isotopic geochemistry of Permian Emeishan Continent Flood Basalts: Insights to source of large igneous province

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The magmatic reservoir of continental flood basalt (CFB) in a large igneous province (LIP) has been a highly debated topic. It has been suggested that the CFBs such as high and low-Ti basalts may be derived from different sources, e.g., shallow subcontinental lithospheric mantle (SCLM), asthenospheric mantle and deep plume-related mantle. Os-Re isotopic systematics can offer important constraints on sources of OIB and CFB, therefore it may be used to distinguish the different possible melt reservoirs. This paper reports the first Os-Re isotopic data of CFBs from Late Permian Emeishan LIP in the Southwest China. 21 CFB samples including both low- and high Ti basalts from four representative sites within the Emeishan LIP have been analyzed for their Os and Pb isotopic composition. The low and high Ti basalts yield the distinct Os signatures in the 187Os/188Os and Os content field. The low-Ti basalts with highest Os concentration (400 ppt) have a radiogenic Os isotopic compositions similar to that of plume-derived oceanic island basalts (OIB). As the Os isotopic compositions of basalts with relatively high Os concentration (typically more than 50 ppt) represent the mantle source Os isotopic composition, this result infers a genetic link to a mantle plume source. On the other hand, the high-Ti basalts with high Os concentration (over 50 ppt) show an unradiogenic Os isotopic signature, suggesting that a sub-continental lithosphere mantle (SCLM) component most likely contributes to generation of their magmas. Despite a crustal assimilation may also be detected in some Emeishan basalt samples with low Os concentrations (less than 50 ppt), its contribution seems to play an unimportant role in the formation of this LIP. Combining the Pb and Nd isotopic tracer with the Os data, we conclusively demonstrate that the low-Ti basalic magmas in a LIP are mainly contributed from a mantle plume reservoir, whereas the high-Ti basaltic magmas are derived from a SCLM reservoir or contaminated by rather amount lithospheric mantle material when the high-Ti basaltic magmas ascent up through the SCLM.