Lithium isotopic signature of the Indian Ocean DUPAL source

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The Indian Ocean MORBs have been well-known to differ in Sr-Nd-Pb isotopic composition from the North Atlantic and the East Pacific MORBs. The anomaly discovered in the Indian Ocean mantle, named DUPAL anomaly, has been then interpreted to be due to large-scale mantle contamination, either by ancient recycled sediments or by delaminated subcontinental lithosphere. Lithium (Li) isotope ratios have been used to track subducted near-surface material in the mantle. It is therefore expected that the Li stable isotope ratios provide complementary information to familiar radiogenic isotope tracers regarding the nature of DUPAL anomaly. Then, we analyzed Li isotope ratios of fresh N-MORB glasses recovered from the Rodrigues Triple Junction (RTJ), Indian Ocean and North Atlantic.

The results reveal that a systematic difference is not observed in δ^7Li values between the RTJ Indian Ocean N-MORB (+3.2±1.6‰, 2SD) and the North Atlantic N-MORB (+3.1±0.7‰, 2SD), while the ^{143}Nd/^{144}Nd ratios of the RTJ Indian Ocean N-MORBs are significantly lower than those of the North Atlantic N-MORBs. In contrast, the E-MORB-type enriched mantle source is characterized by higher δ^7Li value (>+5‰) than the depleted mantle (DM) value (δ^7Li= ca. +3‰) [1]. Thus, the E-MORB-type enriched mantle source and that causing the DUPAL signature in Indian MORB source have quite different δ^7Li signatures. Based on Hf isotope data, it was recently proposed that the lower continental crust as a possible cause for the DUPAL anomaly in Indian Ocean MORBs [2]. Our Li isotope results also support the idea that significant amounts of recycled lower continental crust could produce the DUPAL isotopic signatures of the Indian Ocean MORB source. In the case of our samples, about 20±10% of Li can be attributed to incorporation of recycled lower continental crust in the source of the RTJ Indian Ocean MORBs, which agrees with the previous estimation using Os, Pb, Sr, and Nd isotopes [3].

References

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