Os同位体比と白金族元素から見たEM-1成分の由来

Os isotope ratios and PGE abundances of the Pitcarn basalts: Implication for the EM-1 source

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It is widely known that subduction recycled materials are involved in producing the chemical and isotopic heterogeneities observed in oceanic island basalts (OIB). The type of recycled material present in the Enriched Mantle 1 (EM-1) source, which have radiogenic Sr, unradiogenic Nd, and unradiogenic Pb isotope compositions compared to those of depleted mantle source, has been widely debated. Oceanic crust with pelagic sediment (e.g., Chauvel et al., 1992), delaminated subcontinental lithospheric mantle (SCLM) (e.g., Hauri and Hart, 1993), subducted oceanic plateaus (Gasperini et al., 2000) and just single melting process involving pristine mantle (Collerson et al., 2010) have all been invoked as the EM-1 source. The rocks from Pitcairn hotspot are well known to have a strong EM-1 flavor. Recently, Garapic et al. (2015) suggested that the high Ti abundances in the Pitcairn basalts are possibly related to recycled pyroxenites in the Pitcairn mantle source. We have measured Os isotope ratios and major and trace element abundances including the platinum group elements (PGE) in the basalts from Pitcairn Island to elucidate the origin of the EM-1 signature of these basalts.
The Os isotope ratios for the samples with Os > 20 pg/g range from 0.135 to 0.152 and are similar to those measured in previous studies on EM-1-type basalts (~0.150 for samples with Os > 50 pg/g and ~0.180 with Os > 20 pg/g from Reisberg et al., 1993; Eisele et al., 2002; Garapic et al., 2015). The Os, Ir and Ru concentrations of the Pitcairn basalts are roughly correlated with MgO and Ni contents and tend to be lower than those of other OIB such as Hawaii and Canary Islands. Whereas Pd and Re concentration are similar to those for other OIBs. The chondrite-normalized PGE patterns of studied samples show systematic variation with or against the degree of the EM-1 flavor (e.g., decreasing of the $^{206}Pb/^{204}Pb$ and $^{143}Nd/^{144}Nd$ isotope ratios). Since crustal materials normally show large fractionation between I-PGE and P-PGE and the crustal materials have higher Os isotope ratios than mantle, the simple assimilation of crustal materials cannot explain our data. We carefully try to make an assumption of the source magma components to explain the genesis of Pitcairn Island basalts based on our data combined with previous studies.

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