

Recycling age of oceanic crust estimated with FOZO and HIMU type OIBs

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In order to estimate a timescale for material cycling in the Earth, a method was developed in which the recycling ages of oceanic crusts were determined by combining the Pb and Nd isotopic compositions of ocean island basalts (OIBs). This method was based on three assumptions: (1) source areas of FOZO (focal zone) and HIMU (high- μ) type OIBs consist primarily of recycled oceanic crust and DMM (depleted MORB mantle or surrounding upper-mantle peridotite); (2) the model age of recycled oceanic crust in an OIB source is identical to its recycling age; and (3) present-day oceanic crust compositions can represent those of the ancient oceanic crusts. Assuming these assumptions to be valid, each OIB source has two unknowns and two equations: (a) the model age, which should be identical to recycling age, (b) the mixing ratio of recycled oceanic crust and DMM and (c) equations of the Pb–Pb and Nd model ages. Therefore, the recycling age of oceanic crust and the mixing ratio are uniquely determined from a single set of OIB isotopic compositions. The advantage of this approach is that it enables the estimation of the age distribution of recycled oceanic crusts within each hotspot, as determined by the OIB isotopic diversity. The obtained recycling ages of oceanic crusts in HIMU sources were characterized by single peaks at 1.7 Ga for Pacific HIMU and 1.9 Ga for Atlantic HIMU. In contrast, the age distributions of FOZO hotspots ranged over 0.88 to 2.6 Ga and included multiple peaks.

The issue of this method is the effect of sediment on the estimated recycling ages because the sediments are ubiquitously present on the top of oceanic crust. Another issue is that FOZO source may contain a small amount of primitive component. Contamination with the primitive component should change to the isotopic composition of the OIB, thereby affecting the recycled age of oceanic crust. In this presentation, the recycling ages of oceanic crust will be evaluated using FOZO and HIMU type OIBs. Furthermore, the effect of contamination of primitive components and sediment on the recycling ages will also be discussed.