Upper and lower continental crust in the sources of ocean island basalts – isotopic and chemical constraints

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Isotopic mapping of ocean island basalts (OIB) has led to the concept of discrete mantle components comprising a depleted MORB mantle (DMM), HIMU, and two types of enriched mantle (EM-1, EM-2) and FOZO [1]. Intermediate compositions are thought to originate from mixing between an EM-1 or EM-2 component and a component somewhere within the FOZO-DMM array. In Sr-Nd-Pb isotope versus very incompatible trace element ratio spaces, however, some OIB suites with EM-type isotopic characteristics define trends that can only be adequately explained if one or more components are chemically and isotopically heterogeneous.

For example, in $^{206}Pb/^{204}Pb$ versus Ba/Nb space, EM-1 trends defined by samples from Tristan da Cunha and the Kerguelen archipelago run oblique to mixing hyperbolas between FOZO-like sources and enriched end-members. This observation suggests that the EM sources themselves have a heterogeneous composition and reflect a compositional continuum rather than discrete components. Ultimately, each EM source may be described as containing a restricted amount of compositionally heterogeneous enriched component. A possible origin of these EM sources is by recycling constant amounts of compositionally heterogeneous upper and lower continental crust together with subduction-modified oceanic lithosphere (FOZO-like). Melting of these sources creates the observed complex mixing arrays. Subduction erosion of continental crust at ancient plate boundaries is thought to be a plausible process for creating and introducing these sources into the mantle.

References

[1] Stracke A., Hofmann, A.W., Hart S.R. (2005) *GC* **6,** doi: 10.1029/2004GC000824.