Geophysical Research Abstracts, Vol. 7, 04166, 2005
SRef-ID: 1607-7962/gra/EGU05-A-04166

0.0.1 FOZO, HIMU and the rest of the mantle zoo

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The parameter μ describes the $^{238}U/^{204}Pb$ ratio of an Earth reservoir. Mantle domains labeled HIMU (high μ) originally defined reservoirs with the most radiogenic Pb isotope ratios observed in basalts from a select number of ocean islands, St. Helena in the Atlantic Ocean and the Cook-Austral islands in the South Pacific Ocean. While some authors use the term HIMU in this original sense, others refer to HIMU as a widespread component in many MORB and OIB sources. Here we show that highly radiogenic Pb isotope signatures in MORB and OIB originate from two different sources. In addition to the classical HIMU component observed at St. Helena and the South Pacific, we define a component with slightly less radiogenic Pb but significantly more radiogenic Sr isotope signatures than St. Helena type HIMU. This component lies at the extension of the (Atlantic and Pacific) MORB array in a Sr-Pb isotope ratio diagram and is argued to be a ubiquitous component in both MORB and OIB sources, and is so possibly present in the entire mantle. The inferred role of this component in the mantle and its inferred genetic origin closely resemble those originally suggested for a mantle component termed FOZO by Hart and co-workers. By re-defining the composition, the origin, and the role of FOZO in the mantle, we establish a simple conceptual framework, which explains the isotopic variability in both MORB and OIB with the lowest number of components. OIB are grouped into St. Helena type OIB and basalts from islands that diverge from the MORB-FOZO array towards various isotopically “enriched” compositions (EM). The apparent ubiquity of FOZO in the mantle and the calculated isotopic evolution of compositionally

diverse MORB suggest that normal mantle melting and continuous subduction and aging of that crust during recycling through the mantle are the dominant causes of the MORB-FOZO array. In contrast to FOZO, St. Helena-type OIB are quite rare, and if an origin by recycling of oceanic crust is also postulated, the production of St. Helena-type OIB sources has to be a special and rare combination of age and composition of subduction-modified recycled oceanic crust.