Geophysical Research Abstracts
Vol. 12, EGU2010-9763-4, 2010
EGU General Assembly 2010
© Author(s) 2010

The age of subducted component in the source of Hawaiian plume

A.V. Sobolev (1,2,3), A.W. Hofmann (1), K.-P. Jochum (1), D.V. Kuzmin (1,4), and B. Stoll (1)

(1) Max Planck Institute of Chemistry, Geochemistry, Mainz, Germany (alexander.sobolev@mpic.de, +49-(0)6131-371351), (2) V.I. Vernadsky Institute of Geochemistry, RAS, Moscow, Russia, (3) LGCA, University Joseph Fourier, Grenoble, France, (4) V.S. Sobolev Institute of Geology and Mineralogy, SB RAS, Novosibirsk, Russia

The Hawaiian mantle plume contains significant amounts of subducted and recycled oceanic crust. Knowing the time scale of such recycling would be important to improve our understanding of rates of mantle circulation. Lead isotope data, when interpreted as model isochrons, have yielded source differentiation ages between 1 and 2 Gy, but this interpretation is far from unique.

We have discovered highly radiogenic strontium (87Sr/86Sr up to 0.7082) in severely Rb-depleted (Rb/Sr=0.01) melt inclusions from Mauna Loa, which match the isotopic composition of 300-500 m.y. old or modern seawater, whereas seawater older than 500 m.y. is significantly less radiogenic. Direct assimilation of modern seawater or its derivatives is not consistent with the very low concentrations of B (0.3 ppm) and Cl (10 ppm) in the melt. Thus, seawater must have contaminated the Mauna Loa source rock, prior to subduction, imparting a unique “time stamp” on this source, which subsequently lost other water specific components (B, Cl) during subduction. Small amounts of seawater-derived components in the plume source may be common but can be identified clearly only in ultra-depleted melts originating from generally highly depleted source components.

Relations between 187Os/188Os ratios of rocks and composition of olivines (Mn/Fe and Ni/(Mg/Fe)) imply a similar age for the pyroxenitic component of the Hawaiian plume (down to 500 m.y). In addition, the estimated age of recycled component in this plume agrees with the youngest reconstructed age of subduction nearest to its present location (ca 400 m.y.).

Our result for Hawaii suggests an average circulation rate of crust through entire mantle of 1-2 cm/year.