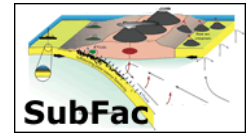


Variable Cl isotopes in Izu Bonin arc volcanic rocks: Inherited or created by subduction processes?

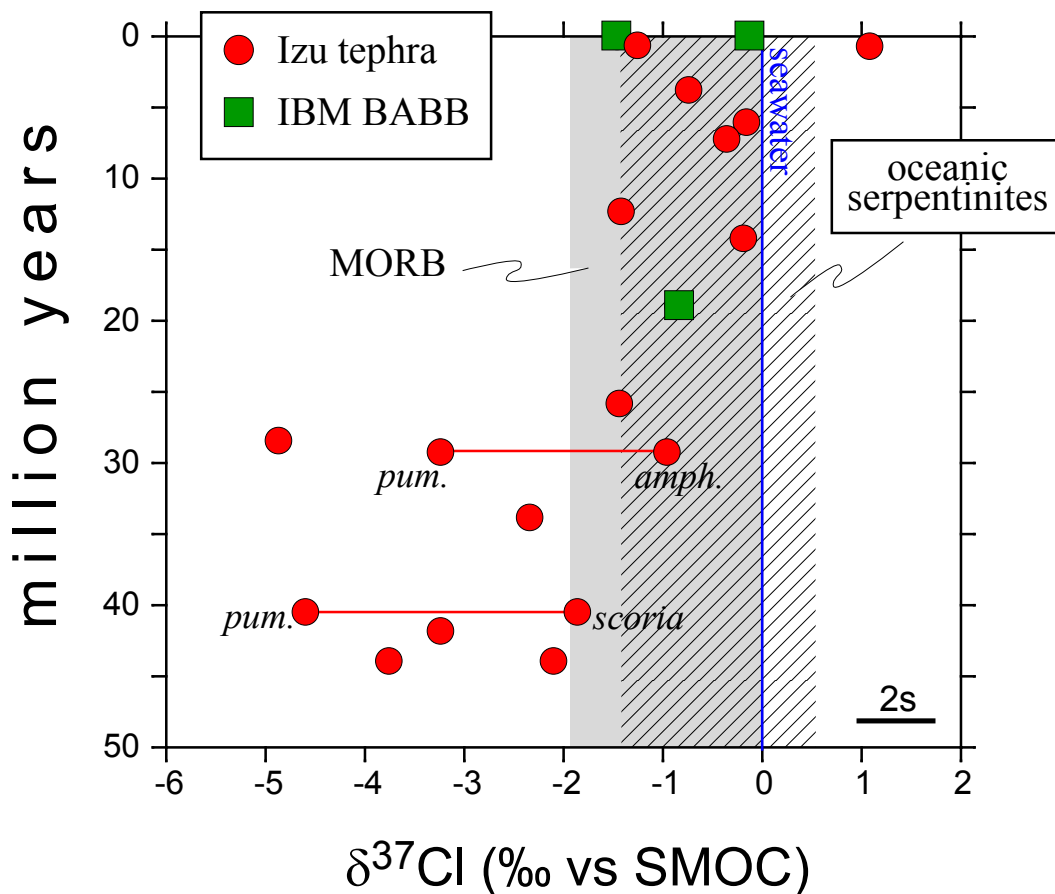


Award: 05-49055 (March 2006)

S. Straub¹, J. Barnes²

¹Lamont-Doherty Earth Observatory of Columbia University; ² University of New Mexico

Chlorine is a highly fluid-mobile element that is strongly redistributed in the Earth's geochemical cycle and that has a limited, but significant range in Cl isotopes. At seawater ratios of $\delta^{37}\text{Cl} = 0$, the mantle and oceanic sediment appear depleted in ^{37}Cl ($\delta^{37}\text{Cl} \sim 0$ to -2 permil, Bonifacie et al., 2008a*; Sharp et al., 2007), while oceanic serpentinites may be enriched in ^{37}Cl with $\delta^{37}\text{Cl}$ of up to $\sim +0.5$ permil (Barnes and Sharp, 2006; Bonifacie et al., 2008a*). In order to understand how subduction processes affect Cl isotopes, we are determining $\delta^{37}\text{Cl}$ values of Izu Bonin magmas erupted between 0-44 Ma. These data are obtained from Izu Bonin tephra drilled at ODP site 782. Pristine ash-sized tephra particles (pumices, scoria) were carefully handpicked under the binocular, and sonicated in double-distilled water and methanol. The data range from $\delta^{37}\text{Cl} = -4.6$ to $+1.1$ permil (see Figure) and expand the range of arc volcanic rocks towards the lighter end. Importantly, the combination of low $\delta^{37}\text{Cl}$ and high Cl abundance (>500 - 3000 ppm) argue against seawater contamination (e.g. Bonifacie et al., 2008b*) and suggest magmatic values. Analytical



work is continuing in order to extend and refine the current data set. We will investigate whether the observed range was inherited from the trench input or may have been created by processes of melt formation and differentiation in the Izu Bonin subduction zone (e.g. fluid release from slab, crystal fractionation, degassing).

Figure: $\delta^{37}\text{Cl}$ (‰ vs seawater) against age in the Izu Bonin arc. Analytical error $< \pm 0.4$ permil in $\delta^{37}\text{Cl}$. Three values of pillow basalt glasses are from the Shikoku backarc basin (c. 19 Ma) and Mariana Trough (zero-age) (this

work). Splits of different material were analyzed in two samples: one sample with pumice and amphibole, and one sample with pumice and scoria. Pumices always have lower Cl isotope ratios which is possibly due to crystal fractionation or degassing. MORB and oceanic serpentinites after Barnes and Sharp (2006), Sharp et al. (2007), Bonifacie et al. (2008b*; 2008a*).

Barnes, J.D. and Sharp, Z.D., 2006. A chlorine isotope study of DSDP/ODP serpentinitized ultramafic rocks: Insights into the serpentization process. *Chem Geol*, 228: 246-265.

Sharp, Z.D., Barnes, J.D., Brearley, A.J., Chaussidon, M., Fischer, T.P., Kamenetsky, V.S., 2007. Chlorine isotope homogeneity of the mantle, crust and carbonaceous chondrites. *Nature*, 446(doi:10.1038/nature05748): 1062-1065.

