

Composition of the Subduction Component Fluid Estimated from Lithium Isotopes in Guatemalan HP-LT Rocks

Simons, Kyla K.
<ksimons@ldeo.columbia.edu>
Lamont-Doherty Earth Observatory of Columbia University
Palisades, NY 10964

Sorensen, Sorena
<sorena@volcano.si.edu>
Smithsonian, Dept. Mineral Sciences, National Museum of Natural History,
Washington, DC 20560

Harlow, George E.
<gharlow@amnh.org>
Dept. Earth and Planetary Sciences,
American Museum of Natural History
New York, NY 10024-5192

Hemming, N. Gary
<hemming@qc.edu>
Queens College, CUNY, Kissena Blvd, Flushing, NY 11367

Brueckner, Hannes K.
<hannes@ldeo.columbia.edu>
Queens College, CUNY, Kissena Blvd, Flushing, NY 11367

Langmuir, Charles H.
<langmuir@eps.harvard.edu>
Department of Earth and Planetary Sciences
Harvard University, 20 Oxford St, Cambridge, MA 02138

Goldstein, Steve
<steveg@ldeo.columbia.edu>
Lamont-Doherty Earth Observatory, 61 Route 9W, Palisades, NY 10964

Hemming, Sidney
<sidney@ldeo.columbia.edu>
Lamont-Doherty Earth Observatory, 61 Route 9W, Palisades, NY 10964

Serpentinite mélangé exposed along the Motagua fault, Guatemala is a Cretaceous age subduction complex resulting from the collision of the Maya and Chortís continental blocks. Lawsonite eclogite, jadeitite, and albitite occur as tectonic blocks within the mélangé. Lawsonite eclogite is interpreted to form at ~2.6 GPa and ~480°C in very wet conditions, along an extremely low geothermal gradient (~5°C/km) in a subduction channel. Jadeitite and albitite are interpreted as crystallization products at shallower conditions (<400°C @ 0.4-1.4 GPa) from fluids ascending along the channel-mantle

wedge margin. Lithium abundances and isotopes have been measured on these rocks using MC-ICP-MS, to better understand the evolution of fluids and fluid exchange during subduction. Several lines of evidence suggest that the rocks were metasomatized in the subduction zone environment. Although the eclogites have MORB affinities (ϵNd , bulk chemistry, REE), their trace element patterns are similar to arc lavas with large enrichments in LILE and Pb as well as depletions in HFSE. Nd vs Sr isotopes for eclogites lie to the right of the mantle array, indicating involvement of seawater. Overall these eclogites resemble their Franciscan Complex (CA) counterparts. Jadeitites are composed almost entirely of jadeite, phengite and albite, and likely represent large veins. They are more enriched in fluid mobile elements than the eclogites, particularly Ba and Li (up to 90ppm), but are not depleted in HFSE. Overall, it is more likely that these rocks were metasomatized by (eclogites) or deposited from (jadeitites) a subduction zone fluid, rather than a melt. Li isotopes for mineral separates (omphacite, jadeite, albite, phengite, garnet, glaucophane) and whole rock values vary between $\delta^7\text{Li}$ -5 and +2‰. This is a more restricted range than that of Zack et al. (2003, EPSL, 208, p.279-290) for Alpine eclogites hosted in metapelites. It is similar however, to our range in $\delta^7\text{Li}$ for Franciscan eclogites (-4 to +1‰). This subduction channel fluid appears to be very enriched in Li concentration and has a range in $\delta^7\text{Li}$ that overlaps with values from island arcs (~ +7 to +1‰). Dehydration of the altered oceanic crust alone does not result in the right combination of Li concentrations and isotope ratios to explain the data. Another component, most likely sediment, is required to account for the large enrichments in Li and Ba. Although the $\delta^7\text{Li}$ values of the fluid vary with depth, the average values are similar to MORB. Our model is also consistent with Li abundance and isotope data of other HP-LT terrains in the literature. In conclusion these rocks are sensitive recorders of fluids in the subduction channel, and can constrain the characteristics of the fluids that give rise to arc volcanism as well as provide some limits on what is subtracted from the downgoing slab and ultimately recycled into the mantle.

This is:

Simons, K.K., Sorensen, S.S., Harlow, G.E., Hemming, N.G., Brueckner, H.K., Goldstein, S., Langmuir, C.H. (2006) Composition of the subduction component fluid estimated from lithium isotopes in Guatemalan HP-LT rocks. *Eos Trans. AGU Spring, Spring Meeting Suppl.*, Abstract V33A-04.