Geophysical Research Abstracts
Vol. 21, EGU2019-8116-1, 2019
EGU General Assembly 2019

Evidence from in situ measurements of δ^7Li in garnets for Li diffusion and isotopic fractionation within garnet

Sarah Penniston-Dorland (1), Lukas Baumgartner (2), Besim Dragovic (3), and Anne-Sophie Bouvier (2)

(1) Department of Geology, University of Maryland, College Park, MD 20742 USA (sarahpd@umd.edu), (2) Institute of Earth Sciences, University of Lausanne, 1015, Lausanne, Switzerland, (3) Department of Geosciences, Boise State University, Boise, ID 83725, USA

Fluids released within subduction zones affect many fundamental earth processes, but very little is understood about processes of fluid transport within subduction zones and the chemistry of the fluids. Traverses across garnets in Franciscan eclogite and amphibolite in which Li and its isotopes were measured *in situ* using SIMS demonstrate the potential for inferring the duration of metamorphic fluid flow and for deciphering fluid chemistry. The Li concentrations of these garnets are very low, in the range of 2 – 5 ppm, with a few values as high as 7 ppm. The measured range of δ^7Li within some Franciscan garnets falls well outside the uncertainty of the measurement (up to $\sim$17 ‰).

Observed variations in δ^7Li occur within crystals over a scale of a few hundred microns, with crystal core-to-rim transects exhibiting troughs of very low δ^7Li (over 10‰ deep) measurements in the mantle region of the garnets, surrounded by higher values in the garnet rims and cores. Garnet rims have lower δ^{18}O values than garnet cores, which have previously been interpreted as the product of infiltration of serpentinite-derived fluids. The low δ^7Li troughs are observed only in garnets from one of two Franciscan localities. The most plausible mechanism to create the observed profiles is electron transfer associated with Li diffusion suggesting that reducing fluids were required to generate the observed variabilities in Li isotopes. These results suggest that *in situ* Li isotopic measurements of garnet provide information about the oxidation state of infiltrating fluids.