

Evidence from in situ measurements of $\delta^7\text{Li}$ in garnets suggests control of subduction fluid composition on Li isotopic fractionation within garnet

SARAH C. PENNISTON-DORLAND,¹ LUKAS P. BAUMGARTNER,² BESIM DRAGOVIC,³ ANNE-SOPHIE BOUVIER²

¹Department of Geology, University of Maryland, College Park, MD 20742, USA

²Institute of Earth Sciences, University of Lausanne, 1015, Lausanne, Switzerland

³Department 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 the fluid chemistry. The Li concentrations of these garnets is very low, in the range of 2 – 5 ppm, with a few values as high as 7ppm. The measured range of $\delta^7\text{Li}$ within some Franciscan garnets falls well outside the uncertainty of the measurement (up to $\sim 17\text{‰}$). While we are still working on a full calibration of the Li-isotope machine fractionation for different garnet compositions, these variations seem to be real. The reproducibility of the UWG standard ($\sim 4\text{ ppm Li}$) is better than 3.5‰ (2σ).

Observed variations in $\delta^7\text{Li}$ occur within crystals over a scale of a few hundred microns, with half traverses exhibiting troughs of very low $\delta^7\text{Li}$ measurements in the mantle region of the garnets, surrounded by higher values in the garnet rims and cores. Garnet rims have lowered $\delta^{18}\text{O}$ values compared to cores that have previously been interpreted as the product of infiltration of serpentinite-derived fluids. These results suggest a role for fluids in creating the observed variability, and the unusual trough pattern also suggests a role for diffusion. The low $\delta^7\text{Li}$ troughs are observed only in garnets from one of two Franciscan localities. Nevertheless, garnets are similar in composition from the two localities. This contrast suggests that some aspect of the chemistry of the fluids may be responsible for the differences between the two localities.