Fluid-rock interaction along a HP/LT vein system (New Caledonia)

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Large amounts of fluids are released at high-pressure conditions from subducting slabs due to breakdown of hydrous minerals. Channelized flow of these fluids induces the formation of HP-vein systems within the slab allowing high fluid fluxes over larger distances. Fluid-rock interaction along the flow structures can lead to significant mobilization and transport of trace elements. A well-preserved example of such a vein system is located in the Pouébo Eclogite Mélange (PEM) in the NE part of New Caledonia. The PEM consists of exhumed fragments of a HP/LT metamorphic belt that reached eclogite-facies peak conditions at c. 44 Ma [1] [2].

The studied vein-wall rock association comprises individual, m-long, cm-thick HP-veins with a grt-qtz-phg assemblage and omp-rich metasomatic reaction selvages (3-5 cm). These gradually pass into an amph-omp-ep rich host rock with inclusion-rich grt porphyroblasts. Geothermobarometry reveals 1.9-2.2 GPa (Grt-Cpx-Phe) and 540±15 °C (Zr-in-rutile) for all zones. Rb-Sr mineral isochrons constrain vein formation ages to c. 38-41 Ma.

A network of dm-long, narrow (<0.5 cm) grt-qtz-phg veins cross-cutting the host rock characterizes a local in-situ drainage system for fluids towards the larger transport veins. Garnet trace-element zoning indicates that this drainage network formed by progressive, temperature increase related dehydration reactions, e.g. involving lawsonite breakdown. Profiles of Li-concentrations and δ^7Li isotopic data sampled perpendicular to the vein, combined with major and trace element mass-balance calculations, show that dehydration and eclogitisation of the selvage occurred by diffusive element transport towards the large vein. We propose that short lived, high fluxes of external fluids formed and passed through the transport veins. Following the concept of porosity waves [3], a high fluid pressure (P_f) head formed the transport vein while the low P_f tail of such waves induced drainage of the wall-rock system through the dehydration-vein network.

[1] Clarke et al. (1997), *Journal of Petrology* **38**, 843-876. [2] Spandler et al. (2005), *Tectonics* **24**, TC3003. [3] Connolly & Podladchikov (2015), *Geofluids* **15**, 269-292.