Fluid-rock interactions in serpentinites subducted to 60-80 km depth

D. PETERS[1]*, T. JOHN[2], M. SCAMBELLURI[3] & T. PETTKE[1]

[1] University of Bern, Institute of Geological Sciences, CH-3012 Bern, Switzerland (*correspondence: daniel.peters@geo.unibe.ch, pettke@geo.unibe.ch)

2 Freie Universität Berlin, Institute of Geological Sciences, Berlin, Germany (timm.john@fu-berlin.de)

3 University of Genova, DIPTERIS, Genova, Italy (marco.scambelluri@dipteris.unige.it)

The HP metamorphic serpentinised peridotites of Erro-Tobbio (Italy) offer a unique possibility to study fluid-rock interactions in subducted ultrabasic rocks that reached 550-650°C at 2-2.5 GPa. They contain metamorphic olivine + Ti-clinohumite in both the rock matrix and veins cutting the rock foliation, interpreted to represent partial serpentinite dehydration fluid pathways [1,2] being variably retrogressed as e.g., indicated by chrysotile/lizardite mesh textures in vein olivine in strongly altered samples. This study in progress aims to constraining the origin of fluid(s) and the scale(s) of fluid-rock interaction based on major to trace element systematics including halogens employing detailed bulk rock (nanoparticulate pressed powder pellet LA-ICP-MS [3] and ion chromatography / liquid ICP-MS analysis), and in situ mineral analysis, with an emphasis on major to trace element data including fluid tracers such as B, As and Sb.

Petrographic observations indicate a multiphase evolution of the HP veins with possibly two generations of diopside growth and different stages of retrograde serpentinisation, whereas serpentinite hosts have remained largely unaffected by retrogression. Bulk serpentinite and vein data reveal prominent increases in Cl, Br, I, and F concentrations relative to primitive mantle, indicating their seawater derivation. Bulk veins are enriched in heavy halogens relative to light ones in comparison to host serpentinites. These patterns indicate either halogen element fractionation upon partial serpentinite dehydration or imperfect equilibration of vein fluids with host rocks upon fluid infiltration, or a combination thereof. In-situ mineral data shall elucidate which of these processes predominates and how prominently the chemical effect of retrogression affects bulk rock data, when trying to attain original fluid compositions and identify fluid migration pathways.

[1] Scambelluri et al. (1995) *Geology, 23*, 459-462. [2] John et al. (2011) *Earth Planet Sci Lett 308*, 65-76. [3] Peters and Pettke (2016) GGR, accepted pending revision.