Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.17422

Tracing fluid infiltration in subducted oceanic crust at high pressure conditions

PROF. DANIELA RUBATTO[1,2], DR. MORGAN WILLIAMS[3], THORSTEN MARKMANN[1], PIERRE LANARI[1] AND JÖRG HERMANN[1]

[1]University of Bern
[2]University of Lausanne
[3]CSIRO

Presenting Author: daniela.rubatto@geo.unibe.ch

The release of aqueous fluids during dehydration of subducted oceanic crust drives important chemical exchanges between the subducted lithologies and between the slab and the overlying mantle. The dynamics of fluid flow within the slab has been investigated in a unique remnant of deeply subducted oceanic crust exposed at Lago di Cignana (Western Alps). The sequence consists of a serpentinite base, overlain by eclogite and capped by a sedimentary package.

Garnet in the eclogite preserves normal growth zoning and a fairly homogeneous oxygen isotope composition of 7-8 ‰ (*in situ* SIMS analyses). Most metasediments contain garnet with discontinuous zoning, representing deviations from closed-system prograde growth and suggesting ingress of external fluids. In these samples, the oxygen isotopic composition of garnet is extremely variable, with $\delta^{18}O$ values ranging from typical metasedimentary values of ~18 ‰ in cores down to very low 2 ‰ in some rims. Phengite shows a range of $\delta^{18}O$ values between 8-18 ‰. Particularly large variations in $\delta^{18}O$ are observed in samples that are close to the boundary between eclogites and metasediments. Petrological modelling of a sample showing the highest range of $\delta^{18}O$ in both garnet and phengite allows constraints to be placed on the stage of the *P-T* path at which external fluids entered the rock and caused the large isotopic shift in the major rock-forming minerals.

Influx of fluids from dehydration of eclogites occurred close to the high-pressure peak. Serpentinites are identified as the main source of fluids that fluxed the unit during exhumation. Fluids were focused through parts of the sequence, probably due to the contrast in permeability between metasediments and eclogites. However, closely associated metasediments vary considerably in their degree of fluid-rock interaction. These observations suggest that the permeability of rock types is a transient and heterogeneous phenomenon, dependent not only on lithology but also on more localised processes, such as deformation and mineral reactions with negative volume change.