Goldschmidt 2021 Abstract
https://doi.org/10.7185/gold2021.5945

Along dip variations of subduction fluid compositions revealed by primary fluid inclusions: a 30-80 km depth record across the Schistes Lustrés complex (W. Alps)

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The Queyras-Monviso traverse of the Schistes Lustrés complex, represents a stack of underplated nappes of oceanic rocks subducted from blueschist- to eclogite-facies conditions.

This study reports salinities and gas contents (derived from Raman spectroscopy data) of primary fluid inclusions (FI) trapped in high pressure veins from metasediments and metamafic rocks. These data provide a snapshot of compositions of fluids present at peak burial conditions from ~30 to 80 km depth along a cold subduction zone.

FI trapped in lawsonite- and carpholite-bearing veins in metasediments contain moderately saline aqueous fluids (mean salinity of 4.6 wt% NaCl eq.) with small amounts of CO_2 and CH_4 in the vapor phase. Salinity decrease with increasing grade is interpreted to reflect progressive dilution of initial seawater-like pore fluid by low-salinity fluids released locally by successive dehydration reactions. Few higher salinities in the uppermost metasedimentary-dominated tectonic unit suggest brine infiltration from embedded blocks of margin units that contain evaporites. CO_2 and CH_4 appear to be locally released from fluid interaction with carbonates and carbonaceous matter-rich pelitic horizons, respectively.

FI in metagabbro high pressure omphacite veins record higher salinities (mean salinity about 17 wt% NaCl eq.) with small amounts of N_2 in eclogitic veins only, and a variety of daughter minerals indicative of complex salt systems. These high salinities are interpreted as partly inherited from seafloor high-temperature hydrothermal alteration of gabbros, resulting in phase separation and brine formation. Progressive breakdown of hydrothermal Cl-rich amphiboles to glaucophane (blueschist-facies) and then omphacite (eclogite-facies) and release of trapped FI brines could account for these high salinity fluids.

Fluid signatures of metasediments and metamafics are globally characteristic of each rock type, and local fluid signatures and redox conditions appear to be preserved within units, likely due to restricted and transient fluid circulation.

FI in Alpine metasediments show salinities and gas contents comparable with other subducted fragments of oceanic lithosphere worldwide, whereas fluid salinities of Alpine metagabbros are higher than salinities recorded elsewhere, either due to (1) higher-temperature hydrothermal alteration and brine formation in Alpine metagabbros (compared to metavolcanics) or (2) more restricted infiltration by sediment-derived fluids compared to block-in-mélange subduction complexes.