Composition of fluids released along a subduction interface with increasing depth: insights from fluid inclusions analysis on the Schistes Lustrés - Monviso transect (Western Alps)

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Important amounts of fluids are released in subduction zones by successive dehydration reactions occurring both in the previously hydrated oceanic crust (and mantle) and overlying sedimentary cover. The release and circulation of such fluids in rocks have major consequences on both their mechanical and chemical behavior. Indeed, the presence of a free fluid phase strongly modifies the rock rheology, fracturing properties, and could be implicated in both intermediate-depth earthquake and slow slip events nucleation. Moreover, the scale of mass transfer, associated chemical changes in infiltrated rocks and element recycling in subduction zones are controlled by both the rock permeability and the amount and composition of such fluids. Thus, there is a crucial need to identify the major fluid sources, amounts and pathways to better constrain their impact on subduction dynamics.

Metamorphic veins, as well as mineralized fractures and shear zones in exhumed fossil subduction zones are the best witnesses of fluid-rock interactions and fluid circulation pathways. However, their interpretation in terms of fluid sources, residence time, scale of circulation requires a good knowledge of the composition of potential fluid sources. In order to determine the composition of the fluid released by both oceanic crust and sediments at various depth along their subduction, we analyzed the composition of fluid inclusions contained in vein minerals formed at peak P-T conditions, in rock units buried at various depths in the Alpine subduction zone.

The Schistes Lustrés complex is a slice-stack representing the deep, underplated part of the former Alpine accretionary wedge. These Alpine Tethys rocks are mainly composed of oceaniccalcshists with fewer mafic and ultramafic rocks, buried to various depths before exhumation. From West to East, the juxtaposed Schistes Lustrés units show increasing peak P-T conditions from blueschist (300-350°C - 1.2-1.3 GPa) to eclogite facies (580°C - 2.8 GPa). This study focuses on the Schistes Lustrés - Monviso transect, which shows an almost continuous increase in metamorphic grade.

In the Schistes Lustrés blueschist-facies sediments, fluid inclusions were analyzed in quartz from
high-pressure veins, i.e. quartz that co-crystallized with prograde to peak metamorphic minerals such as lawsonite and Fe-Mg carpholite. In the metamorphosed mafic rocks, we analyzed fluid inclusions from the peak metamorphic assemblages, i.e. glaucophane +/- omphacite in blueschist facies rocks, omphacite in eclogite-facies slices. Raman spectroscopy data on these fluid inclusions suggest that fluids released during dehydration of calcshists in blueschist-facies conditions are aqueous fluids with low-salinity and small amounts of CO$_2$ and CH$_4$. In contrast, eclogitic fluids released from metagabbros are highly saline brines with low N$_2$ content. These results, which will be associated with LA-ICP-MS analysis of fluid inclusions in metasedimentary quartz veins, will contribute to better constrain the evolution of composition of the fluids liberated by dehydration reactions with depth and protolith composition along the subduction interface.