Fluid and Mass Transfer along Transient Paleo-Subduction Interfaces in the Italian Alps

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The carbonate-bearing Schistes Lustrés (SL) metasedimentary unit, in the Italian Alps, underwent syn-deformational fluid-rock interaction focused along major structures thought to be transient subduction interfaces [1]. The SL occurs in tectonic slivers underplated at blueschist to eclogite-facies conditions (1.2-2.5GPa and 350-550°C). The contact between the SL and overlying crustal gneisses was mapped at a scale of 1:1000 across transects at Ollomont (350-400°C, 1.2-1.4GPa) and Breuil-Cervinia (425-450°C, 1.3-1.6GPa). Both sections contain abundant mafic lenses but differ in their deformation characteristics. At Ollomont deformation was accommodated by a serpentinite shear zone, whereas at Breuil Cervinia, there is a band of progressive mylonitization approaching the contact. Deformation mostly occurred by crystal plasticity with concomitant recrystallization. Carbon mobility apparently was enhanced by paired pressure-solution and vein formation, as evidence for decarbonation reactions (e.g., calc-silicate phases) is largely lacking.

Within ~400m, approaching the contacts, $\delta^{18}O$ (VSMOW) of carbonate decreases from +22‰ to +14‰ [2], and $\Delta^{13}C_{Cc-Gr}$ has uniform values of ~16‰ and ~11‰ for Ollomont and Breuil-Cervinia [3], the latter consistent with equilibration at estimated temperatures of 350°C and 425°C, respectively. Whole-rock $\delta^{15}N$ (AIR) shows no obvious change across transects, +4.3±0.8‰ at Ollomont and +4.3±0.5‰ at Breuil-Cervinia, despite depletion of N near the faults. Large ion lithophile elements (LILE) Rb, Cs, and Ba, housed along with N in phengite, decrease in whole-rock concentration relative to K approaching the interface.

Together, decreasing $\delta^{18}O$ and loss of N and LILE approaching the contacts reflect infiltration by fluid likely derived in mafic/ultramafic rocks at greater depth. The presence of carbonate-bearing veins within cms of dissolution features indicates that some of the C was internally sourced, with mobility limited to the m scale. Ongoing work evaluates the extent of fluid-rock interaction along shear zones bounding individual tectonic slivers forming the SL duplex structure.

[1] Angiboust et al. (2014) Lithos **205**, 298-321. [2] Jaeckel et al. (2018) Geosphere **14**, 2355-2375. [3] Kraft (2018) Lehigh University M.S. thesis.