From Mg/Ca-carbonates to organic compounds at high pressure: the carbon journey at the Monviso meta-ophiolite

Clara Caurant [*1], Baptiste Debret [1], Bénédicte Ménez [1]

[1] Institut de Physique du Globe de Paris - France

The Monviso meta-ophiolite (Western Alps, Italy) is an oceanic lithosphere relict that experienced high pressure and temperature metamorphism (eclogitic facies, P-T conditions of 600°C and 2.5 GPa) during the alpine subduction. Despite its complex metamorphic history, the massif preserves a complete section of the Tethysian oceanic lithosphere. Here we investigate the mechanisms of carbonate solubilisation at high-pressure/high-temperature by studying a suite of meta-serpentinites and meta-ophicarbonates outcropping near a paleo-oceanic detachment fault in the massif. We show that serpentinites preserve typical features related to high pressure metamorphism, such as secondary olivine and titanoclinohumite formed at the expense of antigorite, brucite and magnetite. The meta-ophicarbonates contain two types of primary carbonates – calcite and magnesite – showing different degrees of decarbonation. In contact with antigorite, magnesite displays coronitic textures made of magnetite-dolomite and tremolite-talc-chlorite assemblages. The calcite can present complex coronas made of andradite, magnetite and ilmenite. These coronas are associated with poorly organized carbonaceous matter, as highlighted by FTIR and Raman microspectroscopy and electron microscopy (SEM). These observations suggest a partial retention of carbon through the reduction of carbonates during high pressure dehydration of the oceanic lithosphere. The reactions leading to carbonate reduction and the amount of carbon devolatilized during these processes will be further investigated via an innovative combination of isotope tracers (C, Fe, Cu, Zn) sensitive to the mobility and redox state of carbon in metamorphic fluids.

Key words: subduction, ophicarbonate, serpentinite, devolatilization, abiotic carbonaceous matter

[*]Intervenant

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