

## **From calcite to carbonaceous matter, or how carbonates crumble under pressure**

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Serpentinite devolatilization in subduction zones has the potential to regulate the speciation and mobility of redox-sensitive elements, such as carbon. Here we studied samples from the Monviso ophiolite (Western Alps, Italy), an oceanic lithosphere relict that experienced high pressure and temperature metamorphism (eclogitic facies, 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. A suite of meta-serpentinites and meta-ophicarbonates outcropping near a paleo-oceanic detachment fault in the massif was used to study the fate of carbon during serpentinite dehydration at high-pressure/high-temperature. The large amount of fluids released is supposed to drive carbonate solubilisation. 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 Fourier transform infrared spectroscopy, Raman microimaging and electron microscopy. These observations suggest a partial retention of carbon through the reduction of carbonates during high pressure dehydration of the oceanic lithosphere.