Ophicarbonates from Mt. Pollino Massif (southern Apennines): a possible use for geological sequestration of CO_2

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Keywords: Ophicarbonates, serpentinites, stable isotope composition.

A comprehensive study of the ophicarbonate from northern sector of the Mt. Pollino Massif (southern Apennines, Italy) is here presented, in order to add constraints to the tectonic evolution of an important area of the southern Ligurian Tethys. Ophicarbonate formed by serpentinites-hosted carbonate-rich veins and by serpentinites-hosted talc-rich bodies associated with quartz and carbonate veins were collected at two different sites. Both ophicarbonate types derived from lherzolite protoliths and formed under blueschist-facies conditions to high pressure/low temperature (HP/LT) metamorphism but have different paragenesis. Ophicarbonate formed by serpentinites-hosted carbonate-rich veins (OFA) mainly consist of serpentine, amphibole minerals, hydrogarnet, titanite, diopside, clinochlore, magnetite and several carbonate phases (calcite, aragonite, rhodochrosite) whereas the ophicarbonate formed by serpentinites-hosted talc-rich bodies (OPp) are formed by serpentine, amphibole minerals, phyllosilicates, Cr-spinel, dolomite, Mg-calcite, and quartz. On the whole the ophicarbonate are characterized by $\delta^{13}C$ fluctuations indicating a decarbonation trend which, in turn, means that carbonic fluids forming during prograde carbonate dissolution can flow along the slab interfaces promoting carbonate reprecipitation under favorable conditions. In detail, the OPps' samples are characterized by $\delta^{13}C$ fluctuations coupled with a $\delta^{18}O$ shift suggesting an open-system driven decarbonation trend at shallower crustal conditions during the exhumation. Fluid inclusions in the quartz show abundant aqueous and low salinity features (between 0.53 and 3.23 NaCl mass % equivalent) further supporting an open-system decarbonation. The OFAs' ophicarbonate, instead, developed in a closed-system between Upper Eocene and Lower Paleogene (50-53 Ma, $^{87}Sr/^{86}Sr$ data) during the subduction of the slab. The OFA and OPp ophicarbonates thus formed at different times under similar environmental conditions from crustal-derived hydrothermal fluids at low-moderate temperatures having different chemical composition. The mineral assemblages represent evolving conditions of alteration, and an increase in variable activity of the carbonic-rich fluids for OFA and of the carbonic-silica-rich fluids for OPp. Ophicarbonates from the Mt. Pollino Massif are the subject of a project devoted to their possible use for in situ geological sequestration of CO_2 starting from experiments in the laboratory (ex-situ sequestration).