

A new UHP unit in the Western Alps: First occurrence of coesite from the Monviso Massif (Italy)

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ABSTRACT

The Western Alps are one of the most studied exhumed subduction-accretionary complexes worldwide. Ultrahigh-pressure (UHP) metamorphism has been documented there since the 1980s. We now report the first discovery of coesite in the meta-ophiolitic suite of the Monviso Massif, corresponding to the fourth UHP unit defined on the Western Alps. Previous petrographic studies and results from thermodynamic modeling already suggested that these Alpine units may have experienced UHP metamorphism, but no occurrences of index minerals, such as coesite, have been reported to date. The newly discovered coesite inclusions from the Monviso Massif occur as intact single crystals (10–60 μm) hosted by garnet. The observations suggest that they have escaped re-equilibration and maintained all the original features from the trapping time. The reduced size of the crystals and the lack of re-equilibration significantly differ from the typical textural features described in past findings (i.e., radial cracks, palisade texture of quartz surrounding coesite relicts). Detailed garnet inclusions analysis and thermodynamic modeling constrained the metamorphic peak conditions at $P = 2.8\text{--}2.9$ GPa and $T = 500\text{--}520$ °C within the coesite stability field.

The Lago Superiore Unit represents the fourth UHP unit discovered on the Western Alps. The UHP metamorphism on the Western Alps was considered rare due to the escape process of unusual units from mantle depths. In our view, the implication of our discovery provides new insight into UHP processes that seem to be more common than expected. Further tectonic reconstructions should take into account the common features observed in the UHP units to better constrain the subduction- and exhumation-related mechanisms that drove the actual stacking of mountain belts.

Keywords: Coesite, UHP, ophiolite, Monviso, Western Alps