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The continental Etirol-Levaz slice (Western Alps, Italy): Tectonometamorphic evolution of an extensional allochthon

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The Etirol-Levaz slice (ELS) in the western Valtournenche of Italy is a continental fragment trapped between two oceanic units, the eclogite-facies Zermatt-Saas Zone in the footwall and the greenschist-facies Combin Zone in the hanging wall. It has been interpreted as an extensional allochthon derived from the Adriatic continental margin and stranded inside the Piemont-Ligurian oceanic domain during Jurassic rifting (Dal Piaz et al., 2001; Beltrando et al., 2010). The slice consists of Variscan high-grade gneisses, micaschists and metabasics overprinted under eclogite-facies conditions during Early Tertiary Alpine subduction.
Eclogites generally consist of garnet + omphacite ± epidote ± amphibole ± phengite ± quartz. We investigate their metamorphic history using equilibrium phase diagrams, mineral compositions, and textural relations between prograde, peak, and retrograde phases. In sample FD328, garnets have compositions of Alm52-61 Grs18-41 Prp5-22 Sps0.5-2 and typical growth zoning. Some garnet grains are brittlely fractured, strongly corroded and overgrown by epidote. Amphibole occurs as a major phase in the matrix and shows a progressive evolution from glaucophane in the core to pargasitic hornblende towards the rim. Sample FD329 with a particular Ca-rich bulk composition (18.3 wt% Ca) displays two distinct garnet generations. Perfectly euhedral cores show compositions of Grs42-45 Alm47-51 Prp3-6 Sps2-7 and typical prograde growth zoning. These cores are overgrown by irregularly shaped rims characterised by an initial rise in Mn and the Fe-Mg ratio. Omphacite in this sample with jadeite-contents of 19-28 mol% apparently has been fractured and annealed by jadeite-poor (7-12 mol%) omphacite suggesting brittle behaviour at eclogite-facies conditions or two high-pressure stages with lower metamorphic conditions in between.
We discuss whether the ELS experienced the same monocyclic metamorphic history as the Zermatt-Saas Zone or not. Some of our observations suggest that the ELS experienced two independent stages of high-pressure metamorphism during the Alpine orogeny, e.g. as proposed by Rubatto et al. (2011) for the Sesia Nappe. A lower-pressure stage in between might have been associated with brittle fracturing of high-pressure phases like garnet, glaucophane, and omphacite while the second generations of these minerals might indicate a new stage of increasing pressures and/or temperatures.

References

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