

We focused on two tectono-metamorphic units outcropping in the Western Alps, characterized by a metamorphic peak in UHP conditions. These units belong to the meta-ophiolites of the Internal Piedmont Zone (IPZ) and are in (i) the mid-Susa Valley (Ghignone et al. 2024), and (ii) Upper Pellice Valley (Colle del Baracun; [Ghignone et al. 2023]). The two units are in the same structural position: between the External Piedmont Zone (in blueschist-facies) and the Dora Maira Massif. The units consist of a oceanic suite characterized by a oceanic basement (serpentinite, metagabbro) and metasedimentary cover (metabasite, micaschist and calceschist).

3. Methods

For each unit we selected three samples of Grt-bearing metasediments, making a detailed characterization of the garnet inclusions with optical microscope and micro-Raman spectroscopy. We applied elastic ge-othermobarometry on quartz and zircon inclusions in garnet as well as Zr-in-rutile thermometry to define the metamorphic path of the units. Furthermore, we combined the distribution of inclusions in zoned garnet with multispectral compositional maps (via SEM-EDS), for obtaining a detailed mineral assemblage related to each stage of garnet growth.

4. Garnet inclusions

Lago Superiore Unit

Inclusions of quartz, zircon, coesite, rutile, jadeite, kyanite, chloritoid, epidote, paragonite, florencite and apatite are found in the garnets. Fluid inclusions and amorphous graphite inclusions are also present. Coesite is in the mantle of the garnet. Jadeite and kyanite are preserved only in the mantle of the garnets. Paragonite and epidote have been found associated in the same inclusion with lozenge habit, testifying to the presence of pseudomorphs on former lawsonite.



Susa Valley Unit

Inclusions of quartz, zircon, coesite, rutile, epidote, paragonite, apatite, florencite and anatase are found in garnets. Amorphous graphite inclusions are common and define an internal foliation. Coesite is locally affected by radial cracks and partial substitution in quartz. Epidote and paragonite pseudomorphs after lawsonite are also present. Florencite inclusions are widespread in all the garnets.



5. Micro-Raman analysis

Inclusions in garnet were identified via micro-Raman spectroscopy. The collected spectra of quartz and zircon were used for the application of elastic geothermobarometry (EGB). Raman spectra of coe-site inclusions show a slight shift of the main peaks to the right. Some coesite spectra have been collected on cracked inclusions with initial quartz replacement. In the two units, quartz and zircon inclu-sions show a different shift relative to their position in the garnet.



Application of elastic geobarometry to two meta-ophiolitic UHP units in the Western Alps: comparison and new thermobaric estimates for Alpine metamorphism

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< Upper Pellice Valley The Monviso Massif is divided in Monviso Unit (T = 480-500°C and P = 2.2-2.4 GPa) in and Lago Superiore Unit (T = $500-520^{\circ}$ C and P = 2.8-2.9 GPa) in lower pc basis of tectonometamorphic criterion. Ghignone et al. (2023) estimate a peak of UHP for the Lago Superiore Unit, due to the finding of coesite, of P = 2.8-2.9 GPa and T = 500-520°C and subsequent re-equilibration in greenschist facies (Ghignone et al., 2023). Three samples of the metasedimentary over were analysed arnet micaschist (BR12) net-micaschist (BR16 rnet-micaschist (BR27 Coe-bearing samples M. Palon

In the Susa Valley the IPZ is separated from the EPZ by the SSZ defined by a thick mylonitic zone (Ghignone et al. 2020a; 2020b). In Ghignone et al. (2021a) they identify the metamorphic peak in eclogitic facies at P = 2.7-2.9 GPa, T = 500-530°C





Three samples of the metasedimentary cover were

- garnet mylonitic micaschist (VS15), garnet-micaschist (VS17),
- garnet-metabasite (VS6).





6. Garnet compositional maps



Susa Valley Unit

The SEM-EDS compositional maps on Susa Valley garnets show a zonation defined an almandine-rich core, a mantle and a spessartine-rich

Inclusion	Core	Mantle
Qz		•
Zrn	•	•
Coe	•	
Rt	•	٠
Lws	•	
Ep		•
Pg		•
Flo	•	•





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Each inclusion was referred to each garnet

Compositional zoning is also well evidenced

by the type of inclusions present in each shell.

Lago Superiore Unit

SEM-EDS compositional The maps on LSU garnets show a zo-nation defined by an almandine and spessartine-rich core, almandine-rich mantle and spessartine and grossular-rich rim.

Inclusion	Core	Mantle	Rim
Qz	•		•
Zrn	٠	٠	٠
Coe		•	
Rt	•	•	٠
Jd		•	
Ку		٠	
Cltd	•	•	





Each inclusion was related to the different garnet No inclusions were detected in the rim as it was not always present, thin and discontinuous.



From Raman spectra, the shifts of quartz and zircon were quantified by comparing the collected spectrum with a daily standard (unstrained quartz and zircon). Pressures were calculated for modes 128, 206, 464 cm-1 for quartz and modes 355, 438, 973, 1010 cm-1 for zircon. For the full method, see Angel. et al. (2015).







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Ghignone, S., Scaramuzzo, E., Bruno, M., Franz, A. L. (2023). Am. Mineral. 108, 1368–1375. [10.2138/am-2022-8621] Ghignone S., Gilio M., Borghini A., Boero F., Bruno M., Scaramuzzo, E. (2024), Lithos 472-473. [10.1016/j.lithos.2024.107575]



9. PT path UHP Units in Western Alps

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The two units show similar metamorphic evolutions down to UHP conditions, and follows a similar gradient to that of the coesite-bearing Lago di Cignana unit, which equilibrated at 3.2 GPa-600°C. Thus suggesting that a large volume of oceanic lithosphere was subducted at ca. 100 km depth.

