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Deep subduction of continental crust? New structural and metamorphic results from the Monte Rosa nappe at Mezzalama, Val d'Ayas, Italy

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The Monte Rose nappe consists of pre-Variscan paragneisses, which were intruded by Permian-age granitic bodies. The current position of the basement complex resides within the collisional Austroalpine-Penninic wedge, and derives originally from the upper crust of the pre-alpine distal European passive margin. During the Alpine orogeny, the Monte Rosa incurred a high-P imprint interpreted as subduction of continental crust below the overriding Austroalpine units. The peak pressure conditions for subduction have been inferred from "whiteschist" bodies (chloritoid, talc, phengite, quartz + kyanite/garnet) that occur as local hydrothermal alterations within the metagranite throughout the nappe. Recent studies revealed peak conditions for these whiteschist bodies are between 2.2 and 2.5 GPa and ∼570 °C, whereas locally, host metagranites exhibit ca. 1.4 GPa and ∼550 °C. The reasons for this disparity in peak P are currently disputed and need to be further investigated as it is essential for the reconstruction of the tectonic history of the Monte Rosa nappe to confirm whether pressure of ca. 1.4 GPa (∼48 km lithostatic depth) or ca. 2.4 GPa (∼82 km lithostatic depth) is representative for the maximum burial depth of the nappe. This study will present: (i) new detailed structural geological maps of the Monte Rosa basement exposed at the Mezzalama field area, upper Ayas valley, N. Italy and (ii) new petrological data from basement paragneiss samples in close proximity to the high-P whiteschist bodies.

Detailed structural analysis in the study area shows strong strain partitioning within the metagranite. The highest strain intensities are present: (1) near the intrusion-country rock contact, and (2) surrounding the high-pressure whiteschist lenses. Several phases of deformation are observed from early top-N weak augen gneiss shear zones to later top-S mylonite shear zones associated with intense folding. Large areas of the metagranites are undeformed and show pristine magmatic textures, even preserving original intrusive contacts with country rock paragneisses which indicates the structural coherence of the Monte Rosa nappe in the study area. Here, we have collected samples of basement paragneiss for detailed petrological analysis in order to verify peak Alpine metamorphic conditions. Preliminary mineralogical observations include garnet, muscovite, chloritoid, staurolite, chlorite, aluminosilicate, plagioclase, quartz and biotite. Textural observations suggest two generations of garnet growth exist: primary large grained garnets developed inclusion rich rims, coinciding with secondary finer grained garnet growth with inclusion rich cores.