Constraining P-T conditions of non-coaxial deformation between subducted continental units: a case study from the Dora-Maira Massif, Western Alps

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The exhumation of subducted continental units within orogenic wedges is driven by ductile shear zones. Thus, elucidating the P-T conditions of non-coaxial deformation is necessary to develop coherent tectonic models. This study examines the boundary between the Sanfront-Pinerolo Unit (Vialon, 1966) and the Ricordone Unit (Bonnet et al., 2022) in the Western Alps. Meso- to microstructural investigations reveal the presence of a km-thick high-strain zone associated with a top-to-the W-SW sense of shear that affected both units. To constrain the metamorphic condition of the mylonitic zone, we selected the most representative sample for mineral chemical analyses and subsequent thermodynamic modelling study. Phengitic (Si = 3.27–3.49 a.p.f.u.) and muscovitic (Si = 3.10–3.22 a.p.f.u.) white mica, biotite and chlorite define a spaced to continuous mylonitic foliation (Sp). Cm-size plagioclase is characterized mostly by albite cores, generally showing an internal foliation (Si) mainly concordant and locally discordant with respect to the external one (Sp). These observations indicate an inter- to syn-tectonic (syn-Sp) albite growth. Oligoclase rims, static on the Sp, represent the last stage of plagioclase growth. Epidote is pre-tectonic relative to the Sp and shows compositions halfway between epidote s.s. and zoisite, as well as allanitic cores. Almandine-rich garnets are homogeneous in composition and syn-tectonic relative to the Sp. They are characterized by strain shadows with biotite and muscovite. Rutile crystals are systematically rimmed by ilmenite. The presence of pre-tectonic epidote and phengite indicates a higher-pressure stage before the main deformational event under higher temperature conditions (Dp), while oligoclase static growth around albite highlights a post-Dp retrograde path. Also, Grt-Bt geothermometer, for the Dp event, returns T > 530 °C. Considering the nearby existing estimations (Avigad et al., 2003; Groppo et al., 2019), our new preliminary constraints could further implement the partially known metamorphic evolution of the investigated Alpine mylonite.

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