



Phase equilibria constraints on the pressure and temperature evolution of metapelites in the Ivrea Zone

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Over the last few decades the Ivrea Zone in northern Italy has been the focus of numerous petrological, geochemical and structural studies principally because it is inferred to represent an almost complete section through the mid to lower continental crust. This study re-examines the field, petrological and mineral chemical characteristics of metapelites exposed within Val Strona di Omezna, Val Sesia and Val Strona di Postua with an aim to better constraining their metamorphic evolution. Quantitative constraints on metamorphic conditions are based on phase equilibrium modelling calculations using THERMOCALC and the internally consistent dataset of Holland & Powell (1998).

In Val Strona di Omezna, the metapelites show a structural and mineralogical change from mica-schists with the common assemblage $bi\text{-}mu\text{-}sill\text{-}pl\text{-}q\text{-}ilm \pm liq$ at the lowest grades, through metatexitic migmatites ($g\text{-}sill\text{-}bi\text{-}ksp\text{-}pl\text{-}q\text{-}ilm\text{-}liq$) at intermediate grades, to complex diatexitic migmatites ($g\text{-}sill\text{-}ru\text{-}bi\text{-}ksp\text{-}pl\text{-}q\text{-}ilm\text{-}liq$) at the highest grades. The section records a transition from, amphibolite to granulite facies conditions, within which several mappable isograds occur, including the first appearance of K-feldspar and orthopyroxene. The inferred onset of melting in the metapelites occurs around Massiola and is consistent with melting via the breakdown of first muscovite then biotite. Modelled melt fractions of 30–40% are predicted at the highest-grade. The metamorphic field gradient in Val Strona di Omezna is constrained to range from conditions of 3.5–6 kbar at $T \approx 650^\circ\text{C}$ to around 10–12 kbar at $T > 900^\circ\text{C}$. The peak $P\text{-}T$ estimates, particularly for granulite facies conditions are significantly higher than those of most earlier studies.

In Val Sesia and Val Strona di Postua only amphibolite facies mineral assemblages are observed. The metapelites, especially those located next to the contact with the Mafic Complex, contain cordierite (\pm spinel) as a stable phase, implying lower pressures than those recorded in Val Strona di Omezna, and are interpreted as a contact metamorphic effect related to intrusion of the Mafic Complex that overprints regional metamorphism. $P\text{-}T$ estimates for the cordierite-bearing rocks are between 750–850°C and 5–6.5 kbar in Val Sesia and approximately 800–900°C and 5.5–7 kbar for Val Strona di Postua. The lower pressures are consistent with some decompression from the regional metamorphic peak prior to the intrusion of the Mafic Complex. In contrast, metapelites in Val Strona di Omezna show no clear mineralogical evidence for any such overprinting or decompression reaction textures caused by the Mafic Complex. The extrapolated mineral isograds are cross-cut by the Mafic Complex to the south of Val Strona di Omezna, consistent with the intrusion of the Mafic Complex having postdated the high-grade regional metamorphism and anatexis in Val Strona di Omezna.

Reference

Holland, T. J. B. & Powell, R., 1998. *J. Met. Geol.*, 16 (3), 309–343.