Thermo-dynamic forward modelling of the monazite and xenotime evolution during prograde metamorphism in the Ivrea-Verbano-Zone (N Italy)

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The proper quantification of rates and timescales is critical for our understanding of processes working on Earth. For example, time scales and rates of heating, cooling and exhumation of metamorphic and igneous rocks remain a key problem in tectonics.

Absolute ages and rates of processes are preferentially derived from dating accessory minerals such as zircon, monazite, xenotime, allanite, rutile and titanite. The emerging field of petrochronology relates absolute ages with the petrological information derived from the same minerals. For this approach a comprehensive understanding of accessory mineral petrology is crucial.

The Kinzigite-Formation in the Ivrea-Verbano-Zone offers intensively interlayered lithologies with identical P-T(-d) evolution but strongly varying rock geochemistries, ranging from meta-pelitic, -psammite/-greywacke to -basic rocks with minor calcsilicate and marble. The Val Strona di Omegna transect represents an almost complete section through the mid to lower continental crust with mid-amphibolite facies conditions in the SE and granulite facies conditions in the NW. Previous investigations have shown, that all lithologies comprise the accessory minerals of interest.

P-T phase diagram calculations, e.g. pseudosections, allow to extract P-T information from bulk rock chemistries and mineral paragenesis. Hence it can be a powerful technique to link ages derived from accessory minerals to P-T conditions .

Monazite and xenotime growth and composition will be modelled in the KNCMnFMASH-Y-Ce-P system using the GIBBS program (Spear et al., 1982; Spear, 1988) with the same methodology and thermodynamic data as used in Spear and Pyle 2010. Bulk rock chemistries derived from ICP-MS analysis are available from mid- to upper-amphibolite facies rocks of the Kinzigite Formation from Val Strona di Omegna. Pseudosections in addition to petrographic findings will be presented for a better comprehension of the evolution of xenotime and monazite during prograde metamorphism in the Ivrea-Verbano-Zone.