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Deformation-related reaction and (re)equilibration processes: Natural examples from the southern Ötztal-Stubai Complex (Eastern Alps, Italy/Austria)

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Deformation processes influence reaction and nucleation kinetics and thus contribute to the occurrence and progress of mineral reactions. For example, i) lattice defects may act as nucleation sites, ii) strain partitioning may generate pathways for material transport or prohibit material transport in other domains, iii) dynamic recrystallisation may enable compositional changes of recrystallising material, or iv) deviatoric stress may induce a preferred direction of mineral growth (*Vernon*, 2004, with references). Deformation does not only affect syn- but also post-tectonic crystallization processes in case of pre-existing deformation-induced spatial heterogeneities.

In the current study, the interaction of deformation and reaction processes has been investigated using microstructural and major element mineral compositional data from polymetamorphic metapelites and metapegmatites from the southern portion of the Austroalpine Ötztal-Stubai Complex in the Eastern Alps. The studied rock units had experienced polymetamorphism and/or magmatism in Ordovician-Silurian, Carboniferous and/or Permian times, and were to variable extent affected by lower amphibolite to upper greenschist facies metamorphism during the Cretaceous extrusion of eclogite facies metamorphic rocks in their southerly adjacent footwall (*Sölva et al.*, 2005). The current investigation focused on the Cretaceous tectonometamorphic imprint in order to test a correlation of reaction- and reequilibration-processes with extrusion-related W-directed shear deformation.

Several examples yielded a clear relation of reaction and deformation processes. In metapelites, syn-tectonic breakdown of pre-Cretaceous staurolite to chloritoid dis-

plays enhanced reaction progress within C' planes of SCC' fabrics as well as chloritoid crystallisation in wings of staurolite clasts displaying stair stepping. In the matrix, fine grained dynamic recrystallisation of plagioclase with significantly lower Ca-content than medium grained plagioclase-clasts also evidences a syn-tectonic mineral reaction. Besides, differently oriented fractures in staurolite clasts are filled with chloritoid or paragonite, respectively, and therefore indicate differing phase assemblages related with different deformation microstructures.
Within metapegmatites, magmatic andalusite shows the phase transformation to kyanite nucleating at grain-internal microfractures. Crystallisation of radiating kyanite aggregates initiated within internal andalusite domains and proceeded towards the rim. Furthermore, the microfractures not only acted as nucleation sites, but also as growth barriers during kyanite crystallisation.
Understanding the correlation and interaction of deformation and reaction processes is a prerequisite for the identification of phase equilibrium/disequilibrium conditions, rock rheology and any constraint on the PTtD evolution of metamorphic rocks.

Sölva H, Grasemann B, Thöni M, Thiede RC, Habler G (2005) The Schneeberg Normal Fault Zone: Normal faulting associated with Cretaceous SE-directed extrusion in the Eastern Alps (Italy/Austria). Tectonophysics 401: 143-166.

Vernon RH (2004) A practical guide to Rock Microstructure. Cambridge, Cambridge University Press, 594 pages.