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Plagioclase deformation in upper-greenschist facies meta-pegmatite mylonites from the Austroalpine Matsch Unit (Eastern Alps, Italy)

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Feldspars are common rock forming minerals as they are stable over a wide range of bulk rock compositions and metamorphic conditions within the Earth′s crust. The deformation mechanisms of feldspar play an important role in rheological models for the crust and therefore have received considerable attention in studies on natural rocks and in experimental studies. The interaction of frictional and viscous deformation mechanisms and the onset of crystal plastic deformation in feldspars occur over a broad range of pressures and temperatures.

In this work, we present new microstructural, textural and mineral chemical data of plagioclase from Permian metapegmatites within the Austroalpine Matsch Unit in Southern Tyrol (Italy). These crystalline basement rocks were deformed and metamorphosed at conditions close to the greenschist/amphibolites facies transition at 480±26°C during the Cretaceous (Habler et al., 2009). The investigated samples have been collected from meter-scale shear zones which typically occur at boundaries of lithological subunits. The southern tectonic boundary of this unit is commonly referred to as the "Vinschgau Shear Zone" (Schmid & Haas, 1989).

We applied the Electron Backscatter Diffraction method to investigate the grain- and subgrain-boundaries and the nature of effective deformation mechanisms in plagioclase. Large albite porphyroclasts in the mylonitic Permian metapegmatites show grain internal traces of dissolution surfaces and the formation of new, strain-free grains with straight grain boundary segments and partly 120° grain boundary triple junctions in dilatant sites. The aggregates of new grains neither have a lattice preferred orientation nor a crystallographic orientation relation with the adjacent clast, and are characterized by the lack of grain internal deformation, suggesting that these are new precipitates rather than clast-fragments or recrystallized subgrains. Furthermore, the porphyroclasts show cracks and kinks, associated with continuous crystal lattice rotations by up to 15° and the formation of subgrain boundaries with a maximum of 7° misorientation. The various microstructures within single plagioclase porphyroclasts are interpreted as the result of dissolution and precipitation creep (DPC) coupled with contemporaneous brittle and incipient dynamic recrystallization.

The compositional variability of newly grown plagioclase grains (ab2-4 and ab10-11) in pressure shadows of pre-existing albite-clasts in the mylonitic matrix is supposed to have formed during DPC at upper-greenschist facies deformation conditions.

New microstructural and crystallographic orientation data from Permian metapegmatite plagioclase document various contemporaneously active deformation mechanisms. These cover both, brittle and crystal plastic mechanisms. Together with new mineral chemical data these results point to a single deformation event in the T-range of Cretaceous deformation as inferred from the metapelitic host rock (Habler et al., 2009).

References
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