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Strain rate gradient and stress field variations recorded by deformation microstructures in the quartzo-feldspathic basement of the Vepor Unit, West Carpathians

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The Vepor Unit composed of pre-Alpine basement and Late Palaeozoic to Mesozoic cover sequences is one of the major crustal segments incorporated into the Alpine structure of the Central West Carpathians. The basement consists of large portions of Carboniferous granitoids, which are affected by a Cretaceous orogen-parallel stretching event characterised by the development of subhorizontal planar fabric and east–west trending stretching lineation. The considerable extent of deformed granitoids ($\sim$800 km^2 of mapped units) allowed us to evaluate differences in microstructures, textures and strain with respect to geographic position and pressure–temperature grade.

The metamorphic conditions of deformation were characterized using the thermodynamic modelling in the software Perple_X (Connolly 2005) and the resulting P–T estimates from granitoids range between 380–500 ˚C and 450–850 MPa. Deformation microstructures have been studied along an east–west metamorphic field gradient indicating an increase in P–T conditions towards the structural footwall. Along this gradient, the recrystallization of quartz occurs in the field of rotation recrystallization accommodated dislocation creep while plagioclase and K-feldspar disintegrate into

neocrystallized muscovite–albite matrix. Palaeopiezometry of recrystallized quartz in conjunction with our P–T estimates yields strain rates of $\sim 9\times 10^{-12}$ to $\sim 6\times 10^{-14}$ s^{-1}, indicating an increase in strain rate towards higher temperatures. The strain rate gradient is interpreted to be the result of increased strain partitioning at lower temperatures related to the increase in modal proportion of muscovite–albite matrix. Our new strain rate/temperature/microstructure calibration for quartz limiting the extent of subgrain rotation recrystallization dominated dislocation creep shows a good agreement with previous natural and experimental calibrations.

Regional strain analysis based on shapes of quartz aggregates indicates a transition from prolate to oblate strain symmetry towards the central part of the basement bulge. The shape preferred orientation (SPO) of the recrystallized quartz grains is subhorizontal in the prolate domains and subvertical in the oblate domains. This observation is discussed in the context of stress field variations during the development of the orogen-parallel extension fabrics.

REFERENCES:

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