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Using quartz textures to characterize exhumation channel shear zones in the Erzgebirge, N-Bohemian Massif

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Mid-crustal exhumation channels of former intracontinental suduction zones can be observed in collisional orogens as exemplified by a well exposed shear zone sequence in the Erzgebirge (N-Bohemian Massif). Here, the extrusion of deeply subducted continental material into a pre-existing medium to high grade metamorphic nappe pile can be observed (Willner et al., 2002, this study). Isothermal decompression of the channel rocks caused advective heat transfer into the wall rocks characterized by heating-decompression. Kinematic indicators reveal a top to WNW overthrusting of the channel rocks onto the medium pressure gneiss complex in the foot wall and a top to ESE underthrusting in the roof shear zone indicating a general WNW exhumation direction. Progressive grain size reduction towards the shear zones indicates strain concentration towards the channel boundaries.
Despite the well constrained general features of the exhumation channel the development of the quartz fabric in the particular zones is under discussion. Here we present results from detailed studies of quartz texture analyses by time-of-flight neutron diffraction (ToF) and electron backscatter diffraction (EBSD) measurements. The combination of both methods allows the characterization of the global quartz textures as well as the investigation of texture forming processes at micro-scale.
Quartz crystallographic preferred orientation (CPO) can be distinguished into two characteristic endmembers. In central parts of the upper and lower shear zone suite [0001] pole figures exhibit small girdle distributions around z or x (strain coordinates of the shear zone) and point to a {10-11}, i.e. the positive rhombs maxima in z (group 1). In contrast, the channel center as well as the foot and hanging wall of the channel, i.e. the peripheral parts of the shear zone suites are characterized by a pronounced point [0001] maxima in y (group 2) and a higher texture strength. Moreover, microstructural observations and EBSD analyses point to a higher SGR than GBM recrystallization with the dominant misorientation axes <0-110> and <11-21> in group 1. Additionally, a low intergranular misorientation density, calculated over the grain kernel average misorientation (gKAM, Kilian and Heilbronner, 2017) is recognized in this group. In contrast, group 2 is dominated by GBM recrystallization, a high gKAM and the misorientation axes <0001>. In conclusion, the textural differences of group I and II can be explained by the various interplay of GBM and SGR recrystallization and the involved crystallographic misorientation axes.

References

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