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Development of crystallographic preferred orientation in natural quartz veins during post-magmatic cooling and deformation of granitoid plutons: comparison between Adamello (Avio intrusion; Southern Alps, Italy) and Sierra Nevada (Lake Edison intrusion; California).

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We investigated the microstructure and crystallographic preferred orientation (CPO) of quartz within veins from two different granitoid intrusions (Avio intrusion, (AV) in the Adamello-Italy, and Lake Edison intrusion (LE) in the Sierra Nevada-California). The veins localized post-magmatic crystal-plastic deformation during cooling to the host rock temperature at a depth of about 10 km. They developed during high temperature conditions as tabular fillings of joints and were later deformed by simple shear parallel of the vein wall mainly at $T \geq 500°C$. Synkinematic localized granitoid mylonites at the boundary of the quartz veins show recrystallization of biotite and plagioclase, and formation and recrystallization of myrmekites. The AV samples has been described recently by Pennacchioni et al. (2010). In the study presented here, we introduce a comparison with new data from the LE quartz veins. The collected samples include a complete range from weakly (WDV) to moderately (MDV: with a well-developed foliation, but non-pervasive fine recrystallization) and, lastly, strongly deformed veins (SDV: well-foliated, completely recrystallized to fine aggregates) showing homogeneous (AV) and heterogeneous (LE) strain. The weakly deformed samples consist of large millimetric grains showing coarse (100s microns subgrain size) polygonizations, incipient fine recrystallizations (a few 10s microns grainsize) along discrete conjugate bands and locally strongly interlocked grains. The CPO was determined by X-ray texture goniometry and computer-integrated polarization microscopy (CIP). In the AV, the CPO of WDV is characterized by a dominant peripheral maximum of c-axes showing a small ($< 10°$) synthetic angle with the shear plane - sometimes as a part of a girdle including Y-maxima. In the LE, the CPO of WDV shows different types including a single maximum or girdles oriented from a low synthetic to almost an orthogonal angle in respect to the foliation. The CPO evolution of AV and LE veins are similar in view of that both show the development of a new strong c-axis CPO in the MDV and SDV consisting of a partial YZ girdle centered on the Y axis or an almost single-crystal Y-maximum. These CPOs in MDV and SDV are consistent with dominant prism <a> slip. The CPO evolution of the veins is discussed in terms of two end-member models: (i) the WDV and the MDV-SDV developed at different times and were deformed at different temperatures, or (ii) the WDV represent pristine veins from which MDV-SDV developed with a major change of deformation mechanism during increasing strain.

References

Pennacchioni, G., Menegon, L., Leiss, B., Nestola, F., Bromiley, G., 2010. Development of crystallographic preferred orientation and microstructure during plastic deformation of natural coarse-grained quartz veins. Journal of Geophysical Research 115, B12405, 23 pp., doi:10.1029/2010JB007674.