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 in two different granitoid intrusions (the Adamello Avio intrusion, Adamello (AD), and Sierra Nevada Lake Edison intrusion (LE)). The veins localized post-magmatic crystal-plastic deformation during cooling to the host rock temperature at a depth of ca. 10km. They developed during high temperature conditions as tabular filling of joints and were then deformed by simple shear parallel of the vein wall mainly at T ≥ 500°C. Synkinematic localized granitoid mylonites at the boundary of the quartz veins show recrystallization of biotite and plagioclase, and formation and recrystallization of mirmechites. The AD samples have been described in a recent paper by Pennacchioni et al. (2010) and here we present the 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 ti fine aggregates) showing homogeneous (AD) and heterogeneous (LE) strain. The weakly deformed samples consist of large millimetric grains showing coarse (100s microns subgrain size) polygonization, incipient fine recrystallization (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 AD, the CPO of WDG is characterized by a dominant peripheral maximum of c-axis rotated making a small (< 10°) synthetic angle with the shear plane in the AD sometimes as a part of a girdle including Y-maxima. In the LE, the CPO of WDV show different types including a single maximum or a girdle oriented in a full range of orientations to the foliation from a low synthetic angle to almost orthogonal. The CPO evolution of AD and LE veins are similar in 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 CPO in MDV and SDV is consistent with a 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 opened and were deformed at different temperatures, or (ii) the WDV represent the pristine veins from which MDV-SDV and there is a major change of deformation mechanism during 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.