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Microstructural evolution of amphibolite-eclogite facies quartz veins under low greenschist facies deformation condition

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Quartz veins in poly-metamorphic settings often accommodate the latest deformation state and therefore can provide important information. Identification of microfabric (microstructure and crystallographic preferred orientation, CPO) evolution of quartz during mylonitization, and especially of the grain-scale interplay between brittle and crystal-plastic processes, has different relevant implications: e.g., on understanding the efficiency of fluid mobility through deforming quartz that can dramatically influence the rheology and the degree of chemical exchange. However, in order to interpret the microstructure and the related deformation processes it is necessary to relate these especially to the deformation temperature. Particularly the CPO and the Ti-in-qtz geothermometry is used to constrain the deformation temperature. However, both methods have to be applied with great caution because even when many times used some fundamental processes are not fully understood yet.

Here we present results from deformed quartz veins from the Prijakt Nappe (Autroalpine Unit, Schober Mountains, Central Eastern Alps). These veins localized ductile shear and eventually seismic faulting (recorded by the occurrence of pseudotachylytes) within Eo-Alpine eclogite-facies shists. The veins formed shortly after the eclogitic peak, but the temperature of their deformation remains unconstrained. CL imaging reveals critical details for understanding the role of microfracturing and fluid-rock interaction during initial stages of shear localization, the onset of dynamic recrystallization and the resetting of the Ti-in-quartz geochemistry. Even when optical-light-microscopy and EBSD analysis indicate crystal plastic deformation by subgrain rotation CL and orientation contrast (OC) imaging gives evidence of brittle stage of deformation at least for some of the deformation microstructure. Microshear zones show a bulk dark-CL, but still bright tones in cores of new recrystallized grains similar to the CL signature of the host coarse quartz crystals. CL dark tones also match with the pattern of subgrain boundaries. This reflects fluid permeability pathways along subgrain and grain boundaries (identified by widespread fluid inclusions) and the associated partial resetting of Ti concentrations. The CPO of the new grains within the micro-shear zones rotate with the sense of shear around the kinematic Y-axis and

cannot be related to the activity of specific slip systems. In contrast the partial single girdle of c-axis within the ultramylonite with its elongated substructured grains and its characteristic layered microstructure can be related to the activity of several slip systems. Misorientation axis analysis indicates that prism