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Mechanisms of brittle-ductile flow during strain localization along middle crust fault zones -case study from the Hefangkou detachment fault zone, Yunmengshan, North China

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As a typical tectonite from the middle crustal fault zones, S-C mylonite provides important clues on deformation of rocks at the middle-lower crustal level. Microstructural studies and EBSD crystallographic preferred orientation analysis of quartz and biotite have been conducted on the granitic S-C mylonites from the Hefangkou detachment fault zone in Yunmengshan, North China. Through x-ray diffraction experiment, the space groups and cell parameters of fine-grained biotite grains were determined. In the mylonites, deformation of porphyroclastic feldspar grains is dominated by intragranular microfracturing. Bulging recrystallization around the porphyroclasts are popular in the rocks. Quartz grains were dynamically recrystallized via subgrain rotation recrystallization. The recrystallized quartz grains also show oblique foliations due to progressive shearing. Extremely fine biotite grains were derived from large host crystals and are aligned along C foliations.
The c- axis fabrics of quartz in oblique foliation possess Y-maxima which demonstrate a prism<a> slip system in the dynamically recrystallized quartz grains. A deformation temperature of ca. 550 -650°C is estimated. The c-axis fabric of quartz grains along the S-foliations progressively change from Y-axis maximum to Z-axis maximum resulted from passive rotation of quartz grains instead of activation of a new slip system within quartz grains during formation of the C-foliations. The {001} of the very fine biotite grains are distributed along a great circle normal to the X direction. The {100} and {010} of the biotite grains, however, are randomly distributed.
The microstructural and fabric data suggest that the C-foliations are zones of high strains or narrow channels of brittle-ductile flow. Dynamic recrystallization, frictional slipping, passive grain rotation and channeled flow of extremely fine grains were coevally prevailing during the progressive mylonitization.