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The CPO and deformation processes of K-feldspar in the Kawai mylonites from the Ryoke metamorphic belt, SW Japan

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The temperature of brittle-plastic transition for K-feldspar has been considered to be 500-550 degrees. Under higher temperature condition, K-feldspar is deformed by dislocation creep with development of crystallographic preferred orientation (CPO). Some granitic rocks deformed under lower temperature, upper-greenschist to lower-amphibolite facies condition, include bands of K-feldspar fine-grained aggregates. These fine-grained aggregates are considered to be deformed by diffusion or dissolution-precipitation creep based on their microstructures and random crystallographic orientation. However, some granitic mylonites deformed under these condition include fine-grained K-feldspar bands that show clear CPO, requiring to understand more detailed processes. We discuss the formation and deformation processes of fine-grained K-feldspar aggregates in granitic mylonites based on their microstructures and CPO.

Kawai mylonite zone is sinistral mylonite zone developed in the Cretaceous Ryoke metamorphic belt, SW Japan. The studied samples are mylonites deformed under upper-greenschist to lower-amphibole facies condition and are mostly composed of fine-grained quartz bands and porphyroclasts of plagioclase and K-feldspar.

In moderately deformed mylonites including porphyroclasts maore than 30 % of whole volume, fine-grained K-feldspar aggregates develop between and around porphyloclasts. The fine-grained aggregates can be divided into two types based on their microstructures. Most of type 1 aggregates develop between porphyroclasts and are characterized by straight grain boundaries and elongated grain shape. In most case, their long axes are sub-parallel to relative displacement direction of porphyroclasts. Type 2 aggregates show undulose extinction and are characterized by less elongated grain shape with irregular grain boundaries.

Highly deformed mylonites include fine-grained K-feldspar bands that can be divided into type A and B based on the geometrical relationship with K-feldspar porphyroclasts. Type A aggregates are fine-grained bands that include several porphyroclasts and type B aggregates are thin and long tails on porphyroclasts. Type A aggregates show CPOs with the same orientation as the porphyroclasts and their [100] and [010] axes tend to be sub-parallel to XZ plane. The CPOs for most of type B aggregates gradually rotate from the same orientation as the porphyroclast as away from the porphyroclast and their [100] axes tend to be high angle to XZ plane. The axes of the rotation are sub-parallel to Y-axis of mylonites but the sense of the rotation is variable without particular relation with the sinistral shear sense of mylonitic deformation.

The features described above may indicate that fine-grained K-feldspar aggregates were formed by recrystallization along microcracks and kink boundaries within porphyroclasts, inheriting crystallographic orientation of the host grain, and then were deformed by granular flow associated with dissolution-precipitation processes. Further, present samples indicate that clear CPO originated from host grain can survive after large deformation through granular flow.

Keywords: Granitic ultramylonite, K-feldspar, CPO, EBSD, fine-grained aggregates