Dynamic recrystallization and CPO of plagioclase: examples of mafic mylonites from the Hidaka metamorphic belt and Kohistan Arc

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We report microstructures and crystallographic preferred orientations of dynamically recrystallized plagioclase grains in three mafic mylonite samples from the Hidaka metamorphic belt and the Kohistan Arc, and discuss dominant slip systems and dynamic recrystallization mechanisms of plagioclase.

The Pankenushi gabbro mylonite from the Hidaka metamorphic Main Zone developed through dynamic recrystallization of plagioclase and formation of fine-grained polymineralic aggregate by a decomposition reaction of pyroxenes at a pressure-temperature condition of ca. 500 MPa and 670 degrees C. Dynamically recrystallized plagioclase grains (An51˜59; grain sizes mostly of 15-51 microns) in matrix have subgrain boundaries, grain boundaries with bulging, and a weak shape preferred orientation anticlockwise oblique to the mylonitic foliation. Dynamically recrystallized plagioclase grains also exhibit a distinct crystallographic preferred orientation such that their (001) and [1-10] are oriented clockwise oblique to the mylonitic foliation and lineation, respectively, by 10˜15 degrees. Such crystallographic preferred orientation suggests the dominance of (001)[1-10] in plagioclase, which is known as a slip system secondary to (010)[001] (e.g. Olsen and Kohlstedt, 1984; Kruse et al., 2001). If (001)[1-10] is dominant, then the (001) and [1-10] maxima oblique to the foliation and lineation imply a dextral sense of shear, which is consistent with the sense of shear indicated by the oblique shape preferred orientation of dynamically recrystallized plagioclase grains and asymmetric tails around pyroxene porphyroclasts. Dynamically recrystallized plagioclase grains adjacent to plagioclase porphyroclasts whose crystallographic orientations are mostly unrelated to those of the adjacent porphyroclasts, as well as very rare adjacent grain pairs with misorientation angles of 5˜15 degrees indicate that dynamic recrystallization of plagioclase occurs by grain boundary migration, but not by subgrain rotation.

We also discuss dominant slip systems and dynamic recrystallization mechanisms of plagioclase in an amphibolite mylonite sample from the Hidaka metamorphic Western Zone and in a metagabbro mylonite from the Kohistan Arc, based on similar data described above. Preliminary results indicate that crystallographic preferred orientations of dynamically recrystallized plagioclase grains in these two samples differ each other and also from that of those plagioclase grains in the Pankenushi gabbro mylonite sample. Plagioclase in these three samples deformed at different pressure-temperature conditions, and therefore the dominant slip system and dynamic recrystallization mechanism of plagioclase may change according to deformation conditions as those of quartz and olivine.