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# Deformation of plagioclase accommodated by solution-precipitation process

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Plagioclase is widely distributed in upper to lower crust. Its rheological behaviors have therefore been considered to be important to understand the crustal strength. Especially in high strain zones, deformation of plagioclase can be a load-bearing framework of rocks. Deformation of plagioclase has mainly been classified as two mechanisms; grain-size-insensitive creep (dislocation creep) and grain-size-sensitive creep (diffusion creep and/or grain boundary sliding) Grain-size-insensitive creep is characterized by formations of crystallographic preferred orientations (CPOs), which are indicatives of some slip systems (e.g., Kruse et al, 2001 for plagioclase). As experimentally investigated, the transition of these two deformation mechanisms of plagioclase are expected to occur within the grain size of 15-70 um under exposed P-T conditions as well as water contents, stress, strain conditions, etc. (Rybacki and Dresen, 2004).

In addition, several authors proposed that solution-precipitation creep can be important for mineral aggregates in the crust (e.g., Imon et al. 2002; Wintsch and Yi, 2002). Solution-precipitation creep has been argued mainly for quartz, which is widely yielded in middle-upper crustal rocks as well as plagioclase (e.g., Hippert, 1994; Vernooij et al., 2006). It is generalized that the solution-precipitation process occurs with dissolution of minerals under higher normal stress and precipitation under lower normal stress. CPO developments may be controlled by dissolution and growth rates, gradients of chemical potential, and diffusion rate of fluid with dissolved component to precipitation sites, as computationally simulated by Bons and den Brok (2000). In this point, the solution-precipitation process is partly similar to pressure solution. Also, observations for natural samples indicate that solution-precipitation creep can occur by reactions (Imon et al., 2002)

In solution-precipitation creep of feldspar group, the CPOs may be formed (Heidelbach et al., 2000; experiment for albite) or not (or not preserved) (Menegon et al., 2008; observation for natural K-feldspar). In spite of its universal presence in the crust, knowledge on solution-precipitation creep of feldspar group is thus limited, compared to the solution-precipitation creep of quartz and studies for grain-size-sensitive and -insensitive creeps of minerals including feldspar group.

In this study therefore, we focus on plagioclase which is included in granitoid mylonite within inner ductile shear zone in the Ryoke metamorphic belt, SW Japan. We obtain information of textural observations, compositions, and crystallographic orientations. The comparisons of their results with the large plagioclase grains which behaved as rigid body during deformation (porphyroclasts) are done, and the relations to the fabrics are discussed. We also compare our results for plagioclase with a lot of previous knowledge on the solution-precipitation process of quartz. Then, we shall try to figure out the solution-precipitation creep of plagioclase.

Keywords: solution-precipitation creep, compositional change, crystallographic orientation, green-schist facies condition