Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

SMP046-02 Room:201B Time:May 27 08:45-09:00

Deformation of granitoids in brittle-ductile transition: insights from the Asuke shear zone

Junichi Fukuda[1]*

[1]Dept. Earth & Space Sci., Osaka Univ.

Under brittle-ductile transition, various kinds of fault rocks such as mylonite, cataclasite and pseudotachylyte are formed. It is important to study these rocks to comprehensively understand the processes of inland earthquake generation. Especially, quartz in fault rocks shows various types of recrystallization processes sensitively in response to experienced temperature, pressure and stress; bulging, subgrain rotation, grain boundary migration, which has been investigated experimentally (Hirth and Tullis, 1992). In natural systems, extrapolations of experimental results often give good results to estimate the above parameters (Jerabek et al., 2007; Stipp and Tullis, 2008). Therefore, investigations of quartz texture would give the processes which are experienced during shear deformation. In addition, the slip systems of quartz, induced by plastic deformation, are indicatives of the conditions of shear deformation, and they have been studied from experiments and analyses of natural samples (Reviews in Passchier and Trouw, 1996; Toy et al., 2008). However, a lot of reports for recrystallization processes and slip systems of quartz so far focus on regions where plastic deformation of rocks is dominated. Therefore, studies for mineral textures in brittle-ductile transitions are limited.

Based on the above questions, this study focuses on one of the representative areas of brittle-ductile transition in Japan; the Asuke shear zone, Aichi prefecture. The studied area consists of Inagawa granite as host rock (Kanaori et al., 1991; Sakamaki et al., 2006), and the major mineral constituents in studied rocks are quartz, plagioclase, K-feldspar, amphibole, and biotite. The fault rocks in the Asuke shear zone are basically cataclasite, and partly mylonite on outcrop scale. Under optical microscopy, quartz fine grains less than 1 um are recognized around large quartz grains up to 3 mm. Plagioclase and K-feldspar are fragmentated by brittle deformation, and fine grains in micrometer scales can be recognized. It has been discussed that these grain-size-reduction processes are induced by above dynamic recrystallization (bulging or subgrain rotation in this case) or introductions of clacks (Vernnoij et al., 2006a). Moreover, Vernooij et al. (2006b) suggested that dissolution-precipitation process partly contributes to grain size reduction. Also, it has been argued that dauphine twinning may induce dynamic recrystallization of quartz (Lloyd, 2004; Stipp et al., 2008) or not (Neumann, 2000). These grain-size-reduction processes as well as slip systems can be inferred from analyses of crystallographic preferred orientations (CPOs) and misorientation axes. In this study therefore, we use electron backscatter diffraction (EBSD) and measure relationship of crystallographic orientations between quartz fine grains and host large grains. Then, I will discuss the grain-size-reduction processes of quartz in brittle-ductile transition. Also, surfaces of quartz grains are observed by using scanning electron microprobe (SEM). Grain-size-reduction processes and contributions of fluid will be discussed from their morphologies, together with the EBSD results. In addition to analyses for quartz, deformation mechanisms of feldspars are investigated: The compositions of feldspars between fine grains in micrometer scales and porphyroclasts are determined. EBSD analyses and observations of grain morphologies by SEM for feldspar fine grains are performed. Then, I will discuss deformation mechanisms of feldspar fine grains (in this case, grain boundary sliding or possibility of solution-precipitation creep).

Keywords: quartz recrystallization, grain morphology, feldspar deformation, composition, electron backscatter diffraction