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Microstructures and deformation temperature of carbonate mylonites in Shajigami shear zone at eastern margin of Abukuma Mountains, Northeastern Japan

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Microstructural analysis is essential for estimating the deformation conditions of plastically deformed rocks. In this study, we analyze the microstructures of carbonate mylonites and deformation conditions in natural shear zone to reconstruct tectonics. Carbonate mylonites originated from late Carboniferous Tateishi Formation and mylonitized in middle Cretaceous by the strike-slip motion of Shajigami shear zone in the eastern margin of the Abukuma Mountain, Northeastern Japan.

Microstructural analysis was carried out by optical microscope and electron backscattered diffraction (EBSD) mapping to determine grain size, aspect ratio, shape preferred orientation (SPO) and crystallographic preferred orientation (CPO) of calcite aggregates.

Pervasive deformation twins and dynamically recrystallized grains are observed. Although most porphyroclasts show symmetric structure, some show asymmetric structure that indicates dextral shear sense. Mean dynamically recrystallized grain size is 16-67 μm , and it decreases close to the shear zone. CPOs show that *c*-axes concentrate normal to the shear plane or slightly rotate to the shear sense. The strong CPOs suggest that the dominant deformation mechanism is dislocation creep. SPOs show the foliation which is slightly oblique or almost parallel to the shear plane. However, we observed the SPOs parallel to the shear plane at the location 150 m away from the shear zone. The 3D dynamically recrystallized grain shapes are between plane-strain ellipsoid and oblate ellipsoid. The grain shapes tend to be relatively polygonal close to the shear zone, while more elongated further away from the shear zone. The distribution of the carbonate mylonite originated from same Tateishi Formation is known to be about 5 km apart from the Shajigami shear zone (Tateishi location). However, based on many aspects of differences in microstructures among both locations such as SPOs of recrystallized grains, we infer that the deformation of Shajigami shear zone was not related to one at Tateishi location. The pervasive dynamic recrystallization suggests that the deformation temperature was at least 200°C. Observed type \square and type \square twin morphologies (Burkhard, 1993) of calcite grains suggest deformation temperature below 300°C.

These results indicate that the deformation of the Shajigami shear zone was in the range from 200 to 300°C and deformation was stronger near the shear zone. In addition, the polygonal grain shape

close to the shear zone suggests that the deformation temperature is higher close to the shear zone. Furthermore, SPOs show that pure shear component is larger than simple shear component in terms of SPOs that almost parallel to the shear plane away from the shear zone. This study including several additional results will provide the microstructural development of carbonate mylonites in natural strike-slip shear zones deformed near the brittle-ductile condition of the upper crust.