Interaction between Mineralization, Geometry, and Deformation Behavior at the Atotsugawa and Ushikubi fault system, central Japan

Kiyokazu OOHASHI[1]; Kenta Kobayashi[2]

[1] Grad. Sch. Sci. & Tech., Niigata Univ.; [2] Dept. Geol., Niigata Univ.

Shear zones, fault related rocks, and mineralizing agent (Fault Mineralization) along the fault is a results of the fault activity from the past until today, thus these are essential matters for elucidate about the ancient fault activity, and prediction of its future. But, the research examples discussed about those interaction are very few. Because of that, we studied focusing below point on the Atotsugawa, Ushikubi fault system, located along the boundary between Toyama and Gifu prefectures, northern central Japan. 1) We perform not only usual mention of occurrence on fault but also positive elucidation of physical and/or chemical action on fault surface. 2) To make the characteristic features clear of fault (shear zone) geometry, fault zone architecture, composition of intra-fault material, and examine those relationship on fault activity, 3) To solve the essential question that when shear zones were generated and how evolved on Atotsugawa, Ushikubi fault system, 4) Synthetically interpret 1)-3), we argue that interaction between fault geometry, intra-fault material, and deformation (coseismic/interseismic) behavior.

The Ushikubi fault where is main object of this study showing pretty complicated shear zone and also has brittle fault rocks. At the study area, this shear zone has two left bend structure. The geometry of the shear zone indicates it was originated from a sinistral strike-slip fault. In addition, the observation of polished sections and thin sections supports the result. As a result of consideration of regional stress field, this shear zone was generated as a sinistral strike-slip fault in Late Cretaceous time, and has been inversely reactivated as the Ushikubi active fault (Oohashi and Kobayashi, 2008a).

On the other hand, the fault-related rocks occuring along the Ushikubi fault characteristically contains black-colored fine matrix. According to XRD and TEM-EDS analyses of this black-colored material, the graphite and low crystallizad carbon were detected. Moreover, pseudotachylyte-like black injection vein existing in the ancient stage(sinistral stage) fault rocks which is lacking in the black-colored matrix. On the other hand, fault gouge and fault breccia which are rich in black-colored matrix showing fluxion texture remarkably. Result of SEM-EDS analysis and EDS elemental mapping, black matrix of pseudotachylyte-like injection vein contains carbon, and also found the evidence of thermal decomposition in the calcite of the side wall (protolith). We think that this carbonaceous material and graphite was generated at H_2, He, CH_4, CO_2 atmosphere (Oohashi and Kobayashi, 2008b: this meeting). This chemical reaction was activated by coseismic thermal heating, and it can regard as fault related carbon-fixation reaction(Graphitic Fault Mineralization).

Incidentally, frequency of occurrence on black fault rocks has regional difference, and the place where exists left bend structure is rich in carbonaceous material. Hence the CO_2 was provided as a gas and/or fluid condition, it seems probable that enhanced fluid flow and precipitation of carbonaceous material occurred in time of bend structure worked as dilatational jog. This bend structure seems to become compressional barrior in today's regional stress field, but no exists of fragmentational barrier in bend area. In addition, according to paleoseismologic data from trench excavation across this bend structure, there is not detected difference of behavioral segment (Miyashita et al., 2005). On the other hand, some geodetic observation suggest that possibility of aseismic fault creep motion on Atotsugawa fault. It seems probable that graphite produced by fault mineralization induced dynamic and static strength decrease on fault surface.