Model construction of heterogeneous fault deformation at depth: Fault rocks along the Median Tectonic Line, eastern Kii peninsula, SW Japan.

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The spatial distribution (heterogeneity) of deformation along a fault within the seismogenic zone and its deep ductile extension can significantly affect the fault behavior including the generation of earthquakes. However, no realistic models exist to evaluate such effects due to the difficulty of the direct observation of the rock deformation at depth along current active faults. Thus, we examine to construct a model of heterogeneous fault deformation based on the field data along an exhumed fault, the Median Tectonic Line[1][2], eastern Kii peninsula, SW Japan. In this presentation, we examined the fault rocks derived from the Ryoke granitoids which exposed around the Awano-Tabiki outcrop[3][4]. The kinematics, deformation conditions and differential stress that the fault rocks experience were examined, and the types of fault rocks were categorized. These categories provide the guideline to construct the model.

Based on the results of field and microstructural observations, cataclastic and mylonitic rocks are exposed in the vicinity of the MTL and northern side of it, respectively. Cataclastic rocks can be categorized as random fabric cataclasite (RC), foliated cataclasite (FC), ultra cataclasite (UC) and scaly cataclasite (SC) according to the microstructures and mineral compositions. RC is characterized by angular mylonitic fragment and muscovite matrix with absence of or weak foliations. The matrices of FC and UC mainly consist of muscovite and chlorite, and contain the concentration of sphene showing the operation of pressure solution. In UC, the size of fragments is finer and the foliations are more strongly developed than FC. Meanwhile, the matrix of SC is composed only of chlorite. The crystallization temperature of chlorite calculated from their chemical composition[5] indicates that all types of cataclasite were formed at about 250℃. In addition, FC and UC have asymmetric structures showing sinistral sense of shear in which low angle east plunging (similar sense to mylonite[2]), whereas SC has a texture showing dextral sense of shear in which low angle west plunging (similar sense to oldest fault gouge observed at Awano-Tabiki outcrop[3]).

Based on these structural and chemical analyses, four types of cataclasite are exposed in the study area, and they possibly experienced different deformation conditions (kinematics, temperature and strain rate). Further, some ultra mylonites have similar kinematics to FC and UC, suggesting that these fault rocks were formed around brittle-ductile transition zone. Based on same assumption, the oldest fault gouge observed at Awano-Tabiki outcrop[3] and SC were deformed simultaneously. These results show that fault rocks exposed around this study area has continuously experienced and preserved cumulative deformation at deep to shallow depth.

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