3D fault zone architecture across the brittle-plastic transition along the Median Tectonic Line, eastern Kii Peninsula, SW Japan

*Takuma Katori[1,2], Norio Shigematsu[1], Jun Kameda[3], Ayumu Miyakawa[1], Tatsuya Sumita[1]

1. Geological Survey of Japan, AIST, 2. Graduate School of Science & Technology, Niigata university, 3. Department of Natural History and Sciences, Hokkaido university

The heterogeneous fault deformation at depth possibly affects the fault behavior significantly including the generation of earthquakes (e.g. Scholtz, 2001). To understand the effect, it is essential to reveal a detailed fault zone architecture (e.g. Norris and Cooper, 2007). In this study the features and extents of fault rocks are described along the Median Tectonic Line (MTL), eastern Kii Peninsula, SW Japan, to reveal a 3D fault zone architecture across the brittle-plastic transition.

3D digital outcrop models (DOMs) (Triantafyllou et al., 2019) were first constructed using SfM-MVS (e.g., Furukawa and Hernández, 2013; Bemis et al., 2014) to provide the precise positions within all of geological descriptions. After the georeferencing, the type of fault rocks were described based on the visual inspections and microstructural observations.

The cataclasites exposed close to the lithological boundary fault (the MTL) were divided into those formed by sinistral faulting around 300 °C and those formed by dextral faulting around 250 °C. The mylonites distributed north of the cataclasites were formed by sinistral faulting and were divided into the lower-temperature mylonite (L-T mylonite) close to the MTL and the higher-temperature mylonite (H-T mylonite) far from the MTL, where the deformation temperatures were below and above 400 °C.

The fault zone architecture was calculated by a least square regression based on the above structural units. The structures formed by the sinistral faulting are oblique to those formed by dextral faulting, indicating that the former structures are older than the later ones.

The structures formed by sinistral faulting experienced uplifting caused by the fault displacement and the deformation around the brittle-plastic transition. Thus, the MTL fault zone records the deformation across the crust. The microstructural observations suggest that the differential stress just below the brittle-plastic transition (L-T mylonite) was about 200 MPa and this value does not significantly change in the deep crust corresponding to the H-T mylonite. In these structures the dipping angles of foliations are steeper in accordance with the decrease of deformation temperature, suggesting these structures represent a listric fault (e.g. Ramsay and Huber, 1987).

Keywords: 3D fault zone architecture, Brittle-Plastic transition, Median Tectonic Line, Cataclasite, Mylonite