Structural analyses of fault zone architecture and fault rocks developed in the Rokko Fault Zone, southwest Japan

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Fault zone architectures and their related fault rocks are closely related to the long-term activities and tectonic history of faults. Studying on architectures of active fault, therefore, provide important information for accessing the long-term faulting behaviors and understanding the tectonic environment, fault scale and history. This study reports the analytic results of macro- and meso-micro structures of Rokko Fault Zone, one of the major fault of the Arima-Takatsuki Tectonic Line (ATTL), southwest of Japan.

Field investigations and meso-structural analyses reveal that the Rokko Fault Zone is composed of wide damage zones including cataclasite zone, and narrow fault core zone composed of fault breccias and gouge. The damage zone is characterized by numerous fractures, which are asymmetrically developed in the both sides of fault, ranging in a wide zone from 320 m to 850m within the intact host Rokko granitic rocks in the southeastern side and 30-50m within the Arima rhyolitic tuff in the northwestern side. Meso- and micro-structural analyses show that the damage zone consists mainly of fractured host rocks, foliated and non-foliated cataclasite, fault breccias, and numerous of single and complex network veins of pseudotachylyte and cataclastic rocks composed of fine-grained fragments and matrix showing dark-reddish-, greenish-, brownish-gray in color, and fault gouge varying from sub-millimeters to ˜20 cm in width. The fault gouge developed along the main fault plane show a layering structural feature with gray, brown to black in color. Micro-structural and XRD analyses shows that the fault gouge, veinlet cataclastic rocks, pseudotachylyte veins are composed of fine-grained matrix and angular to sub-angular fragments of various sizes ranging from sub-microns to a few millimeters, which are originated from the country granitic rocks.

Based on the field investigations, meso-micro structural features and powder X-ray diffraction analytical results of the fault zone archtectures and fault rocks developed in the Rokko Fault Zone, we conclude that i) the asymmetric distribution of damage zone on the both sides of the fault zone is developed in a tectonic contraction area between the ATTL and Rokko Fault Zones; ii) the veinlet pseudotachylyte observed in this study are generated by crushing rather than melting, iii) the layering structures of gouge and network vein occurrences of the pseudotachylyte and dark-reddish catalastic rocks formed by multiple seismic faulting events occurred in the Rokko Fault Zone; iv) strong deformation caused by repeated seismic slipping along the fault zone is concentrated in the core zone of less than 20 cm in width, accompanied with a wide damage zone of up to 900 m.