Characteristics of deformation structure and palaeo-stress, and fault clay from Taiwan Chelung-pu fault Drilling Project

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The Chi-Chi earthquake (Mw=7.3) attacked the central Taiwan on 21st Sep. 1999. The chelung-pu fault extending about 90 km and striking NS direction was activated in this earthquake. We obtained the distribution of displacement along fault plane in detail from this activity. According to the displacement information, large slip was distributed especially in the northern part of this fault, and the large slip area reached about 1km in depth.

In 2004, Taiwan Chelun-pu fault Drilling Project (TCDP) was conducted to drill about 2km in depth penetrating the fault rocks activating in 1999 around 1km in depth.

The Purpose of this study is to understand the distribution of deformation structure and palaeo-stress, and the characteristics of fault clay around seismogenic fault zone using the TCDP core.

From the detailed observation of deformation structure, three zone of fault zones were identified, 1111m, 1153m and 1222m. Those zones are composed fault gouge and fault breccia with minor black material. The frequencies of fault gouge, fault breccia, mineral veins and open crack were examined. Fault gouge and fault breccia are concentrated around 1111m and 1153m with less mineral veins and open cracks. On the other hand, fault gouge and fault breccia do not concentrate around 1222m zone, but mineral veins and open crack strongly concentrate around the zone. This result may indicate that the fluid conduits concentrate around 1222m fault zone.

Palaeo stress analysis was conducted by multiple inversion method. Faults are divided into two groups as upper zone and lower zone bounded 1122m. The upper zone represent low angle EW compression which is coincide with the modern direction estimating fault slip. Lower zone shows two direction of stress fields. One is the same as that of upper zone. Another is lateral slip regime as EW compression and NS extension.

Fault clay analysis was done by X-Ray diffraction. Clay components are smectite, illite, and chlorite. Chlorites are characterized by Fe-Mg constitution. In 1111m zone, chlorite represents no differences between deformed rocks and host rocks. On the other hands, in 1222m zone, some characteristics are identified between deformed rocks and host rocks

On the basis of the observation of distribution of deformation, palaeo stress result and clay mineral analysis, fluid concentration around 1222m mechanically and chemically bounded between upper and lower zone. This kind of fault rock architecture should be examined in more detail as the seismogenic fault rocks.