Microtexture observation of major fault zones in Taiwan Chelungpu-fault Drilling Project (TCDP) Hole B

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The 2002 Taiwan Chelungpu-fault Drilling Project (TCDP) was undertaken to investigate the faulting mechanism of the 1999 Chi-Chi earthquake. In this presentation, we will report the identification of slip zone and faulting mechanism of the 1999 Chi-Chi earthquake as the result of microstructure of major fault zones (FZB1136, FZB1194 and FZB1242) in the TCDP Hole B.

In the FZB1136, the black gouge is about 14cm of thickness, and includes the BM (black material) clast (the particle of fractured BM disk). We can recognize the newly three shear zones (NSZ1, NSZ2 and NSZ3) accord with low-density zone of X-CT image mostly. The shear zone were composed of an abundant fine-grained matrix supporting rounded to subangular lithic fragments, and exhibited fragmentations of mineral particles and particle size reductions, characterized as cataclastic textures. The arrangement of clay mineral is different at the boundary shear plane clearly, and BM clast exists much at the shear zone. In the FZB1194, about 12 cm of black gouge is admitted in the under side of 2cm BM disk, and include the thin layer gray gouge. The upper boundary in BM disk is clear, and the lower boundary is indistinctness. BM disk shows the Secondary deformation structure of parallel array of clay mineral. The arrangement of clay mineral is different between the BM disk and black gouge. The BM clast and black gouge include the BM clasts, and the long axis of BM clasts in the black gouge is often parallel with arrangement of clay mineral. In the FZB1243, 3cm BM disk exists, and 12 cm black gouge is recognized under side in BM disk. BM disk and black gouge in the FZB1194 also include the BM clast.

The difference in the element concentration between the BM clasts and black gouge was considered using a mapping analysis of EPMA. The clay of BM clast is rich in Fe, Mg, K and poor in Ca, Al than clay of black gouge. We can think that these differences are caused by thermal decomposition of carbonate mineral and difference in clay formation temperature.

As the result of observation of microtexture in the major fault zone, we estimate that the slip zone of 1999 Chi-Chi earthquake seems to be the NSZ2 and /or NSZ3 of FZB1136. The slip temperature of this earthquake is estimated to be not reaching frictional melting. We presume that the fault zone of 1999 Chi-Chi earthquake have formed by the faulting mechanism such as thermal pressurization or elasto-hydrodynamic lubrication.