

The differences in clay minerals between the northern and the southern parts of Chelungpu fault, Taiwan

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In 1999, we obtained a detailed data about motion of fault from the Taiwan Chi-Chi earth quake. The motion represents the high frequency of acceleration and small slip distance in southern part, and low frequency of acceleration and large slip distance in the northern part. Those differences in the fault motion between the southern and northern parts are coincidence with occurrences of deformation textures of rocks which were sampled by drilling of shallow parts of the fault in 2000. In the southern core, a relatively strong deformation structure is preserved in total, and gouge containing fragments of pseudotachylytes and ultracataclasites is observed at the Chi-Chi- earthquake fault, which indicates that the main deformation mechanisms for the southern part of the fault was brittle. On the other hands, in the northern part, sand layer with much amount of water is found at the Chi-Chi- earthquake fault zone, and no breakage of sand grain is observed, which suggests that the deformation mechanism for northern part is independent particulate flow.

The purpose of this study is to reveal the differences in clay minerals between the southern and northern part of the Chi-Chi earthquake fault. And then, we discuss about rock-fluid interaction characterized in fault system.

We analyzed clay minerals by X-ray diffract meter (XRD) after classification of rock types such as sandstone, alteration of sandstone and mudstone, breccia, and gouge. 1.33 micron meter of grains are obtained. Oriented sample was made. XRD analysis was conducted under following condition; 35kV, 15mA, 1 degree per minute of scan rate, and 0.02 degree of scan step. Range of 2 theta was from 2 degree to 35 degree. At first, air-dried condition of samples was measured. After that, ethylene glycol solvated samples was measured.

The result represents that all samples contain smectite, illite, chlorite. No difference in components of clay mineral is observed between the southern and northern site.

We focused on Chlorite which is contained in all analyzed samples. Chlorite is comprised by silicate layer and hydroxide layer. In both layers, there are three sites for iron or magnesium ion, respectively. Total number of iron and magnesium (Y value), or asymmetry of iron between silicate layer and hydroxide layer (D value) is affected by pH of fluid when the chlorite is precipitated.

In the northern site, Y value increases and D value decrease in gouge relatively to that in other rocks. On the other hand, in southern site, Y value decreases and D value increases in gouge which is located just at the Chi-Chi earthquake fault.

This result suggests that pH of fluid differed at the time of fault activities. One of the possibilities of this cause is radical reaction. The differences of deformation mechanisms between the southern site and northern site, brittle failure and independent particulate flow, respectively, may be affected by whether radical reaction occurred or not at the time of chlorite precipitation. Therefore, Y and D value in chlorite records such differences quantitatively.