Characteristics of fault rock properties and structural distribution of the Chelungpu fault in Dakeng area

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Abstract

On Sep 21 of 1999, a destructive earthquake took place in the Chi-Chi Town of central western Taiwan. The surface rupture during the Chi-Chi earthquake is along the N-trending Chelungpu fault at about 100km in length. The northern rupture reaches the largest displacement of ~8.5 m. Interesting on the propagation of northern rupture leads that Taiwan Chelungpu-fault Drilling Project (TCDP) aims to understand the seismic faulting by investigating lithology distribution and analyzing core samples. Due to information limitation from few drilling holes, it is complementary to evaluate the characteristics of fault rock and deformation distribution on the surface outcrop.

In this study, we mapped lithology and deformation structures and analyzed the fault gouge samples along the Dali riverbed closed to the TCDP drilling site in Dakeng area. Most of stratigraphy in the study area is the Chinshui Shale. By using core information from the Dakeng No.1 of the Central Geological Survey and the TCDP Hole-A, we can confirm the fault zone location from the field survey. Based on field mapping, most of strike-slip faults is sinistral fault, which crosscut dextral fault. The crosscutting relationship is distinct at the locations of 20 m, 100 m, and 160 m away from the surface rupture. At the same locations, bedding was bended and the direction of the maximum stress rotated to N030° from the regional direction of N110°.

Microstructural and magnetic analyses of fault rock samples with foliated gouge, which has the similar occurrence of the 1999 Chi-Chi slip zone located at 1111m depth of TCDP Hole-A, provided the crucial information on slip zone properties. The long-axis direction of clasts changed from N037° in the hanging wall to N053° in the foliated gouge and back to N025° in the footwall, suggesting that maximum stress within the foliated gouge rotated clockwisely. The aspect ratio of clasts reached the maximum in the lower black gouge (ultracataclasite?). Results of anisotropy of magnetic susceptibility also indicate that relative clockwise rotation of maximum stress direction within foliated gouge, compared with the wall rock. The observations showed that the development of sinistral fault and foliated gouge might be related to clockwise block rotation due to the effect of Peikang basement.