Determining orientations of in-situ horizontal principal stresses based on electrical images of borehole failures at TCDP Hole-B

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Orientations of in-situ horizontal principal stresses were determined by using both drilling induced borehole compressive failures (breakouts) and tensile fractures from electrical images obtained in the Hole-B of Taiwan Chelungpu-fault Drilling Project (TCDP). Overall, the orientation of the in-situ maximum horizontal principal stress SHmax is parallel to the dip direction of rock formations in the studied depth of 950-1350 m. However, SHmax orientations in the depth of 1130 m and 1190 m seem to be perpendicular to the dip direction of the formations.

The 1999 Chi-Chi, Taiwan earthquake (Mw7.6) produced spectacular surface faulting with vertical displacements of up to 8 m on the Chelungpu-fault [Ma et al., 2000]. In order to solve riddles about the mechanism of earthquake generation and the rupture propagation of the fault, Taiwan Chelungpu-fault Drilling Project (TCDP) was undertaken [Mori et al., 2002]; and two holes, Hole-A with maximum depth 2000 m and Hole-B with 1350 m were drilled. For scientific purposes, one of the main issues is to determine the spatial distribution of in-situ stress and, in particular, to determine the shear stress and normal stress on the fault planes before, during, and after the earthquake. A wire logging of Fullbore Formation Micro-Imager (FMI) was conducted to obtain electrical images of borehole wall in the Hole-B. We analyzed both the drilling induced borehole failures and fractures by using these images to determine orientations of horizontal in-situ principal stresses. Preliminary results of the stress orientation determination will be shown.