

Temperature and Pore Fluid Pressure on the Chelungpu Fault at a Depth of 1111 m During the 1999 Chi-chi, Taiwan, Earthquake

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On 20 September 1999 the $M_s7.6$ Chi-Chi earthquake ruptured the Chelungpu fault in central Taiwan. In 2005 the Taiwan Chelungpu-fault Drilling Project was launched to drill two deep holes cutting the fault plane. In this study, based on a 1-D conduction equation and 2-D faulting model the thermal history and pore fluid pressures at depths 1110.37–1111.34 m in Hole-A are inferred from the spatial distribution of temperature rise observed at depths, together with the thermal and mechanical constants measured from the core samples. Results suggest that the heat strength was ~ 7.04 °C m within a heated layer of ~ 5 mm on the fault. The temperature first increased and then decreased with time, and decayed with the distance from the fault plane. The peak temperature at the center of heated layer could be higher than 1100 °C in a very short time span during faulting. Thus, a small amount of pseudotachylites could be formed in the slip zone. Quartz plasticity might also be operative during faulting. Outside this slip zone, the temperature rise was low and thus clay minerals were stable during faulting. The evaluated pore-fluid factor and pore fluid pressure are, respectively, 0.94 and 22.46 MPa. This suggests the existence of a suprahydrostatic state in the fault zone during the earthquake.