The Structure of the Chi-Chi Earthquake, and Its Relationship to Large-Scale Tectonics and Mechanics

John SUPPE
National Taiwan University

The Chi-Chi earthquake is arguably the best constrained and best studied large thrust-belt earthquake from a number of perspectives, including geophysical instrumentation, geodetic constraints on surface displacements, post-earthquake borehole data, and independent structural geologic constraints on subsurface structural geometry of the Chelungpu fault. Here we focus on three aspects: [1] the 3D fault geometry and its control on both coseismic surface displacement and cumulative displacement over many earthquake cycles, with associated cumulative fold growth; [2] the regional structural context of the Chelungpu fault and its relationship to deep lithospheric structure, with special emphasis on the detachment of upper crustal deformation in Taiwan from subduction and extreme bending of the lower crust and upper mantle as illuminated by seismic tomography; and [3] the critical-taper wedge mechanics of the western Taiwan thrust belt on the timescale of many earthquake cycles, which leads to constraints on large-scale fault and upper crustal strength and role of pore-fluid pressures in thrust mechanics in Taiwan.