EarthScope resources and the multi-disciplinary search for seismogenic faults

Vincent S. Cronin, Geology Department, Baylor University, Waco, TX 76798-7354, Vince_Cronin@baylor.edu

Several damaging earthquakes have occurred in recent decades along existing faults that had not previously been mapped, or along known faults that were not recognized as seismogenic. Three resource sets associated with EarthScope (and their respective data management infrastructures) are particularly useful in recognizing seismogenic faults, making them excellent candidates for continued support and development beyond the current EarthScope Project: dense seismograph networks, PBO-style geodetic GPS networks, and airborne LiDAR surveys of structurally active areas. Geodetic GPS allows determination of the present-day crustal strain of an area, which is likely to be manifested by seismogenic faulting. With dense seismograph networks come better single-event focal locations, better data for joint-relocation studies, the possibility of developing 3-D crustal velocity models that will yield optimal single-event locations, and a more abundant supply of well-constrained focal mechanism solutions. Given more accurate focal locations and focal mechanism solutions, the approximate locations of seismogenic faults can be discerned by 3-D mapping of foci combined with analysis of seismo-lineaments on the ground surface (Cronin et al., 2008, Env. & Eng. Geosci., v. 14, p. 199-219). Seismo-lineaments can be used to define areas for airborne laser swath mapping, particularly in areas where fault mapping is incomplete or non-existent and where vegetation obscures the ground surface. Aerial LiDAR has proven effective in detecting geomorphic indicators of faulting. LiDAR-based geomorphic analysis combined with seismo-lineament analysis and traditional paleoseismology allows the surface location and offset history of seismogenic faults to be documented. That documentation provides critical information for seismic hazard source models used by earthquake engineers in probabilistic seismic hazard assessments, (hopefully) leading to a reduction in earthquake losses through well designed and administered building codes. Beyond the academic search for understanding about our planet, EarthScope resources will help us recognize seismic hazards and manage seismic risk.