SPEAKER: Dr. Eric Cowgill, U.C. Davis

Long-Term Slip on an Orogen-Scale Fault System: Northwestern Tibet

The extent to which continental deformation is localized along major faults (block-like), or continuously distributed (fluid-like), has been debated for decades. This dispute has centered on the kinematics of the Himalayan-Tibetan collision zone, and particularly whether the Altyn Tagh Fault (ATF) slips at ~10 or ~30 mm/yr. This active, left-slip fault, which is as long as the San Andreas Fault, is the most important structure accommodating Indo-Asian convergence north of the Himalayas and extends for over 1300 km along the north-western margin of the Tibetan Plateau. Here we use ^14 C dates from faulted Holocene landforms (fluvial terrace risers) to determine the first tightly bracketed millennial slip rate for the ATF, and in particular, show that the fault slipped at only 9-13 mm/yr over the last 6-4 ka. This result is incompatible with models in which continental deformation is localized on a few fast-slipping faults, and when combined with GPS and geologic observations, also fails to support models in which deformation is continuously distributed. As a result, we propose a new model of continental deformation in which first-order faults like the ATF define long-lived and steadily slipping domain boundaries with minimal earthquake clustering, whereas the domain interiors are broken into blocks by second-order faults that slip episodically, with strongly clustered seismicity. Although deformation in the domain interiors appears block-like at decadal to centennial time scales, migration of slip within the network of secondary faults continuously reorganizes the block boundaries, producing transient block geometries that are constantly morphing. This model reconciles previous views of continental tectonism by explaining how deformation can simultaneously appear both block-like and distributed.

Biography: Dr. Eric Cowgill is an Assistant Professor in the Department of Geology at the University of California, Davis. Eric obtained is BA degree in Geology from Carleton College in Minnesota in 1991, an MS degree with Darrel Cowan at the University of Washington in 1994, and his PhD with An Yin at the University of California, Los Angeles in 2001. He started at UC Davis in the fall of 2003 following a 2-year postdoc with Kerry Sieh at the California Institute of Technology. To gain insight into the deformational processes controlling the first-order structural architecture of continental deformation zones, his research seeks to quantify the magnitudes and rates of deformation along major (500-1000 km long) intracontinental fault systems to understand their geometric and kinematic evolution. Eric's approach is to integrate field-based structural and neotectonic studies with geochronologic investigations to quantify the deformational behavior of active fault systems, particularly in the poorly understood time interval that lies between the earthquake cycle (~10^2 yr) and the growth of mountain belts (~10^7 yr). Subjects of his work include the active, left-slip Altyn Tagh Fault, the right-slip Karakoram Fault and the Pamir salient in the Indo-Asian collision, as well as thrust belts within the Greater Caucasus and Tarus-Zagros Mountains in the Arabia-Eurasia collision.