Understanding Quaternary deformation across the San Andreas fault system

TO seminar May 27th 2014

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To understand the processes and mechanisms driving fault growth and crustal deformation it is essential to characterize the mechanical behavior and interactions of faults across a system and their fluctuations through time. Geologic slip rates along individual fault strands, across fault zones, and entire fault systems provide critical information on these aspects of crustal deformation and on the recurrence of past earthquakes. This seminar presents new geomorphologic, neotectonic, and geochronologic data that constrains Quaternary fault slip rates for the southern San Andreas fault system in California (comprising the San Andreas, San Jacinto, and Elsinore fault zones), with important implications for seismic hazard in the region. Although the potential for a large magnitude earthquake on the southern San Andreas fault zone is clearly high, the amount of slip accommodated by its individual fault strands is poorly constrained. The Mission Creek fault strand of the San Andreas fault zone in the central Indio Hills has generally been considered subordinate, but new slip rate estimates, based on Uranium-series dating of pedogenic carbonate and ^{10}Be cosmogenic exposure age dating of Quaternary deposits with well-preserved fault displacements over three different time intervals, indicate an unexpectedly high and constant slip rate of ~22-25 mm/yr over the past ~100 kyr. Combined with published paleoseismic studies for the Mission Creek fault strand, which show an average earthquake recurrence interval of 225 years for the past 5 events since 900 AD, this implies an average slip per event of ~4.5 m. As the last earthquake to rupture this section of the Mission Creek fault strand occurred over 300 years ago (ca. 1690), these results indicate ca. 6.5 to 7.5 m of strain accumulation, and a significant potential for a large magnitude earthquake along this fault strand.