UC **SANTA BARBARA**

Department of Earth Science

Earth Science Colloquium

WEBB 1100 • THURSDAY October 3rd. • 2:00 PM

Montecito Debris Flows
of January 9, 2018 and
flow chronology over the past ~ 100,000 years

Ed Keller

UC Santa Barbara

Our team's studies of the origin and nature of the debris flows concentrated first on field surveys and remote sensing to quantify the origin and magnitudes of the flows within the mountain range and the piedmont. We are quantifying: (a) the magnitude of the sediment sources and their distinctive modes of mobilization; (b) the flow velocities, depths, and boulder transport competence; and (c) the depths and sedimentology of fan deposition. Our new focus is on understanding the rheology of source materials and how rainwater and soil were mixed so intensively to generate viscous flows on the hillslopes. The rate of production of these viscous materials controlled the timing and magnitude of flows emanating from canyons, their capacity to scour boulders from the canyons, their dispersal as within-channel and overbank flows, and their capacity to distribute boulders across the fans.

Relative flow chronology, based on boulder weathering, with limited numerical dating is being developed to correlate paths of prehistoric debris flows. Nearly the entire community on the piedmont Montecito and Santa Barbara is impacted by debris flows that range in age from the late Pleistocene to present. Debris fans are prone to channel avulsions. The 2018 debris flow flowed into sea about 430 m west of the present outlet of Montecito Creek (mapped in 1887 as an active channel on the lower fan). A several thousand-year-old debris flow in lower Montecito Creek fan flowed into the sea at the same location. The flow may be the penultimate event in Montecito. Also present at the site is an uplifted late Holocene marine wave-cut platform, (earthquake terrace) dated at 1,850 ± 310 BP. Two other older debris flows at ~ 17 and 29 ka are present below the wave-cut platform.

Topography of the upper piedmont in Santa Barbara and Montecito is significantly affected by the south -side-up reverse Mission Ridge fault system (MRFS). Examination of weathering rinds of the older Pleistocene debris flows confirm that the Rattlesnake Creek-Mission Ridge debris flow is folded over the ridge. Over time faulting and lateral propagation linked to uplift of marine terraces (uplift rate of ~ 0.5 to 1 m/ky) significantly altered debris flow paths, moving exposure to the hazard ~ 700m west. Paths of debris flows in Montecito are maintained across the relatively low folds and young fault scarps of the MRFS. A main conclusion is that debris flows interact significantly with the Santa Barbara and Montecito landscape, and are modified by uplift, folding and faulting to change flow paths and thus the exposure of people and property to the hazard.