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UC **SANTA BARBARA**
Department of Earth Science

Earth Science Colloquium

THURSDAY May 21st., 2020 • 2:00 PM

Chronology and Recurrence of High-Magnitude Debris Flows in the Santa Barbara & Montecito, CA Areas

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Massive debris flows devastated Montecito, California on January 9th, 2018. The damage from the flow resulted in 23 deaths and greater than $200 million in property damage. Given this destruction, the community fears the possibility of another event. Prior to this study, the recurrence interval of large magnitude debris flows in Santa Barbara, California and the surrounding area was unknown despite evidence of them in nearly every canyon. Certainly small to moderate flows following wildfire are common and very large events are rare, but approximately how rare? The evidence of past debris flows occurs as large boulder fields and boulder levees along the banks of the streams that flow out of the canyon mouths and into the city. A major limitation to understanding how often these events happen is the applicability of traditional dating methods. This study employs the calibrated rate of weathering rind thickness development linked to numerical dates (^{14}C, ^{21}Ne exposure dating, soil chronology, and incision rates) to estimate the amount of time since the deposition of boulders through debris flow processes. Over the 30 measured debris flow sites, results indicate that there are at least 17 distinct debris flow events represented in the deposits of our study area. These events are estimated to have occurred over the span of last ~100kyr, indicating a maximum recurrence interval of 5.6kyr. However, since the age control is much better for the younger events, if we instead use the history of the last ~9kyr in which there has been at least 5 events, the resulting recurrence interval is ~1.7kyr. Based on these values, probability estimations suggest that there is approximately a 5% chance of another event happening in the next 100 years. Overall, this study has improved the understanding of the chronology of high magnitude debris flows and the general understanding of the geomorphic history of the area.

Magmatism, deformation, and metamorphism in the Sevier hinterland, east-central NV

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New geologic mapping, microstructural analysis, and U-Pb geochronology in the Deep Creek Range and Kern Mountains of eastern Nevada sheds light onto the processes operative at mid crustal levels in the hinterland of the Cretaceous Sevier orogeny. This project focuses on three areas where metamorphic grade increases from sub-greenschist to amphibolite facies over distances of less than a few kilometers and is accompanied by a dramatic increase in cleavage development and strain in the vicinity of Cretaceous plutons. U-Pb LA-ICP-MS geochronology of zircon from these plutons and metamorphic monazite from the country rock indicate that prograde metamorphism is likely ~80 Ma and coincident with the emplacement of at least one of these plutons, but that crustal melting and emplacement of shallow level plutons continued at least until 70 Ma, during the latest stages of Sevier shortening. The deformational aureoles surrounding these plutons, as well as folding and doming of the country rock suggest that they were emplaced as granite cored diapirs that transported heat from deeper in the crust, allowing for ductile strain and amphibolite grade metamorphism to be exhibited at shallower levels. These plutons were fluid rich crustal melts formed during regional crustal thickening, and it is likely that this fluid rich environment decreased the strength of the country rock and increased porphyroblast growth rates, allowing these plutons to more extensively deform and metamorphose the country rock.