UC **SANTA BARBARA**

Department of Earth Science

Speakers Club

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Coastal Cliff Erosion Rates, Patterns, and Processes During the 2015-16' El Niño in Santa Barbara, CA

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Coastal cliffs are a feature of geomorphic and societal significance, and the risk of coastal erosion and damage to homes and infrastructure is likely to increase and expand around the world as sea levels rise. Therefore, increased interest has been placed on understanding rates, patterns, and processes of coastal cliff erosion. In this study, sequential terrestrial LiDAR scans and 3D volumetric change detection was used to quantify erosion rates and patterns at the cliff base, middle, and top as well as characterize the fundamental mechanisms that govern erosion on soft shale cliffs in Santa Barbara, CA. Surveys were collected at several sites along the coast during the 2015-16 El Niño and seasonally through 2017. Daily measurements of beach elevation and offshore wave pressure sensor data were used to draw correlations between cliff base erosion and significant wave height, wave energy flux, water level, and wave impact hours over the El Niño winter. We document cliff base erosion being propagated sequentially to the middle and top of the cliff, and rates of each cliff segment converged at all sites over the course of the study. The base and middle of the cliff exhibited strong coupling, and erosion preferentially occurred during the winter and spring months when waves regularly impacted the cliff. In contrast, cliff top failures were temporally variable, but most prevalent with increased rainfall the following year. The El Nino winter did not produce higher than average cliff top erosion rates and is likely attributed to the anomalously low rainfall. Young et al. (2018) also noted this occurrence in San Diego, Ca. However, cliff base erosion rates at sites where waves regularly impact the cliff were similar to long term averages, and cliff top rates increased the following year. In Santa Barbara, CA, cliff base erosion appears to be the long-term driver of coastal cliff retreat and erosion rates and patterns recorded in this study suggests that cliff base erosion is translated to the top of the cliff relatively quickly.

Structural Evolution of an Extensional Terrane Margin, Colorado River Extensional Corridor, CA

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The lower Colorado River region and eastern Mojave Desert is a well-known natural laboratory for the study of continental extension. The Colorado River extensional corridor (CREC) is an area of extreme crustal extension (>100%) which borders areas of moderate to minimal (<15%) extension to the west. The transition from highly extended to moderately extended domains is poorly constrained but often modeled as a discrete detachment fault breakaway which intersects the surface.

New detailed (1:5000 scale) geologic mapping in ranges marginal to the CREC reveals strain field heterogeneities and structural complexity incompatible with simple detachment breakaway models. The dominant extension direction (NW-SE) observed in the study area is orthogonal to commonly observed NE-SW directed extension in the central CREC. Multiple phases of brittle deformation including strike-slip and oblique-slip faulting suggests the presence of a variable and evolving stress field during Miocene rifting in the region.

The complex history of faulting, sedimentation, and volcanism along the CREC margin calls into question the validity of simple detachment fault breakaway models with respect to the transition from highly to moderately extended domains.