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Lithologic control on canyon morphology

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High-resolution interferometric swath (117 kHz) and CHIRP (1-5.5 kHz) data acquired across the La Jolla and Scripps submarine canyons, offshore southern California illuminate the interplay between geologic substrate and canyon morphology. Specifically, we examined the controls on canyon morphology, secondary canyon formation and the distance over which the bathymetry is influenced by the presence of the canyon. Here we present the detailed morphology of oblique incision features, the stratigraphy along canyon walls, as well as a Holocene isopach map. At the canyon edges, the slope of the canyon's upper reaches is highly variable. The La Jolla branch of the canyon is markedly asymmetric and highlights the role of lithology in canyon morphology, as back-dipping blocks within the deformation zone of the Rose canyon fault control the orientation of secondary canyons along the northern side. Conversely in the Scripps branch of the canyon, the secondary incisions appear to be retrogressive failures within the modern unconsolidated sediments, the stability of which controls the morphology of the upper reaches of the canyon. The seismic data also reveal acoustically laminated horizontal layers above the transgressive surface, at the base of the modern sediments, mostly located either along the canyon edges or on highs within the canyon. Based on the acoustic character and dive samples, these deposits are interpreted to be lagoonal or estuarine deposits formed during the last transgression when the canyon served as a coastal inlet. This study contributes to our understanding of lithologic control on canyon morphology along active margins such as the U.S.A. South West Coast where submarine canyons that originate in shallow water are ubiquitous.

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