New Mapping and Submersible Observations of Recent Activity on the San Clemente Fault

Details

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Abstract

Three recent cruises to the southern San Clemente fault in the southern California borderland focused on active tectonic and bio-geologic processes associated with this major offshore fault system. We have combined new multibeam data collected in 1998-2000 with existing multibeam and sounding data to produce a new bathymetric grid for the southern borderland. The new grid reveals both broad and fine scale tectonic geomorphic relationships along the San Clemente, San Diego Trough and other fault systems. The dominant dextral nature of the borderland faults is revealed by offset drainages, offset basement highs, and the numerous restraining and releasing bends that control the vertical tectonics on both fine and regional scales. For example, San Clemente Island itself is offset right laterally some 40 km from the submerged Fortymile Bank to the east. On a smaller scale, numerous restraining and releasing bends control the development of related folds along the San Clemente fault. Polyphase deformation is apparent along the fault where one restraining bend is undergoing active uplift as indicated by shifting channels and Holocene-Pleistocene growth strata. Superimposed on this uplift are four smaller restraining-releasing bend pairs, mirroring the

larger uplift at a smaller scale. Several late Pleistocene regional stratigraphic marker beds can be correlated to nearby ODP sites where the have been dated. These markers allow kinematic modeling to determine the slip-rate of the fault, work presently in progress. At outcrop scale, ALVIN observations of the San Clemente fault on the northern flank of Navy Fan reveal a recent Holocene scarp 0.3-1.5 m in height. The scarp is a single event scarp, indicated by the lack of multiple slope breaks and uniform "weathering" and bioturbation. The lightly bioturbated fresh scarp offsets Holocene and late Pleistocene strata, indicating a Holocene event that likely had a magnitude greater than 6.

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