

SEISMICITY AND ACTIVE SEISMIC STRUCTURES IN THE VALLE DE LA TRINIDAD, BAJA CALIFORNIA, MEXICO

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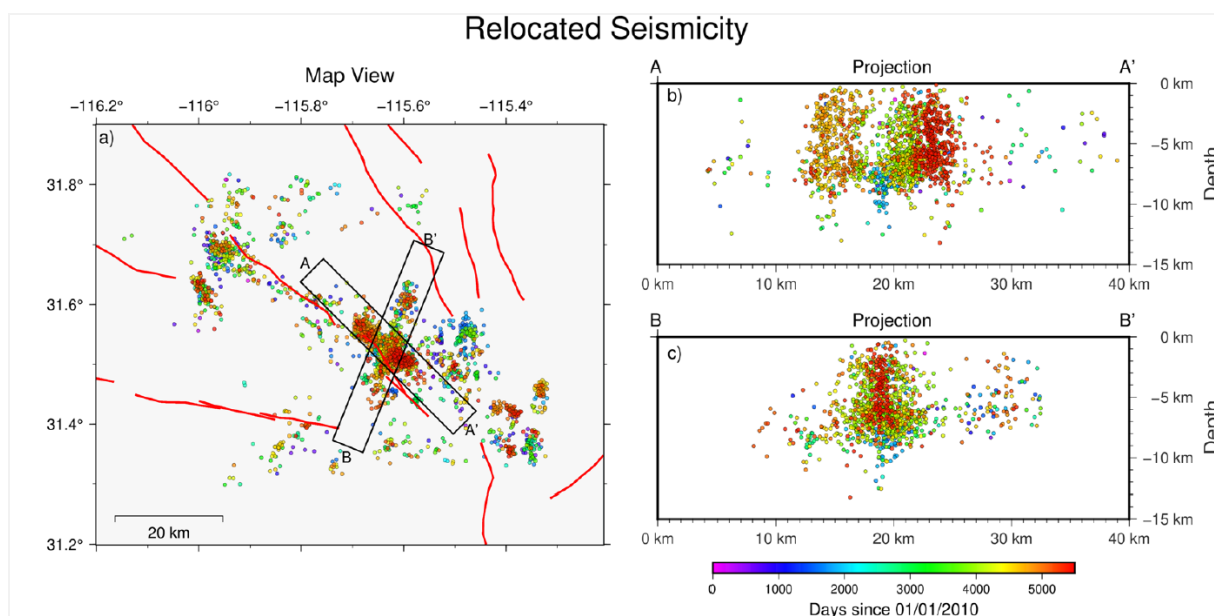
Abstract

The Valle de la Trinidad region in northern Baja California is situated within a seismically active zone at the boundary between the Pacific and North American plates, characterized by complex fault interactions and significant crustal deformation. We investigate the seismicity of this region between 2010 and 2024 to better characterize active structures and earthquake interactions. Using waveform-based double difference relocation, we refine the hypocentral locations of 4010 earthquakes with magnitudes ranging from ML 0.3 to 5.1 recorded by the Seismic Network of Northwest Mexico (RESNOM), significantly reducing epicentral and depth uncertainties. The relocated seismicity reveals clear alignment with the San Miguel fault and a previously unmapped intersecting structure, indicating that both faults are actively accommodating regional strain. Moment tensor inversions of the events with $ML \geq 4$ show consistent right-lateral strike-slip mechanisms, with nodal planes aligned with both structures, although ambiguity remains regarding the exact fault that ruptured. The August 17, 2020 seismic

sequence, initiated by an ML 4.7 foreshock and an ML 5.1 mainshock, demonstrates that triggering across intersecting faults may control rupture evolution. Temporal changes in focal mechanisms, from strike-slip to normal faulting, suggest stress field variations during the sequence. These results highlight the seismotectonic complexity of fault intersections in the Peninsular Ranges and emphasize the need to reassess seismic hazard models to incorporate the role of previously unmapped structures.

Keywords: Baja California peninsula, Valle de la Trinidad, seismicity, relocation of epicenters, moment tensor inversion, seismic sequence

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Map view (a) and cross-sections (b and c) of relocated seismicity from 2010 to 2024. Earthquake locations are clearly aligned with the San Miguel Fault and an intersecting structure.

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