Structural modeling of the western Transverse Ranges: An imbricated thrust ramp thrust architecture?

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Recent studies provide evidence for large thrust fault earthquakes in the Western Transverse Ranges of California. However, the diverse set of conflicting structural models for this region highlights the lack of understanding of the subsurface geometry of faults. A more robust structural model is required to assess the seismic risk of Western Transverse Ranges. Toward this goal, we incorporate the full range of geologic, geodetic and vertical motion data from uplifted fluvial and marine terraces as inputs and constraints on our forward modelling of the first order structures that produced the Transverse Ranges. Using fault-related folding methods, we predict vergence direction and geometry of the major faults at depth, and use these structures to model the evolution of the Transverse Range since the late Pliocene. The forward modeling predictions are in good agreement with the observed geology and deformation. Our results suggest that the Western Transverse Range is comprised of a southward verging imbricate thrust system, with the dominant faults dipping as a ramp-ramp to the north that steepen as they shoal from ~20˚ degrees at depth to ~60˚ near the surface. By including the full range of observations in our forward modeling efforts, we address fundamental questions regarding the structural geometry and kinematics of the region, which allows for a better understanding of earthquake and tsunami potential.

Citation
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