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Neotectonic and Paleoseismic Investigation of the San Andreas Fault System, San Gorgonio Pass

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We continued our work along the San Andreas fault in the region of San Gorgonio Pass throughout 2000. We completed another season of field work at the Burro Flats paleoseismic site.

We also submitted to the JGR a manuscript entitled "Complexities of the San Andreas Fault near San Gorgonio Pass: Implications for Large Earthquakes." The full text and figures may be accessed via the Seismological Laboratory preprint website at http://web-service.gps.caltech.edu/preprints

The abstract of the manuscript follows.

Geologic relationships and patterns of crustal seismicity constrain the three-dimensional geometry of the active portions of the San Andreas fault zone near San Gorgonio Pass, southern California. Within the 20-km-wide contractional stepover between two strike-slip segments of the fault zone, folds and dextral-reverse and dextral-normal faults form an east-west belt of active structures. The dominant structure within the stepover is the San Gorgonio Pass-Garnet Hill fault, a dextral-reverse fault assemblage that dips moderately northward. Within its hanging wall block are subsidiary active dextral and dextral-normal faults. These faults relate in complex but understandable ways to the strike-slip faults that bound the stepover.

The pattern of crustal seismicity beneath these structures includes a 5- to 7-km high east-west-striking step in the base of crustal seismicity, which corresponds to the down-dip limit of rupture of the 1986 North Palm Springs earthquake. We infer that this step has been produced by slip on the linked San Gorgonio Pass-Garnet Hill-Coachella Valley Banning (SGP-GH-CVB) fault. This association enables us to construct a structure contour map of the fault plane.

The large step in the base of seismicity down-dip from the SGP-GH-CVB fault system probably reflects a several-km offset of the mid-crustal brittle-plastic transition. U/Th thermochronometry supports our interpretation that this south-under-north thickening of the crust has created the region's 3 km of topographic relief. We conclude that future large earthquakes generated along the San Andreas fault in this region will have a multiplicity of mostly specifiable sources with dimensions of 1 to 20 km. Despite their complexity, the most important of these sources have now been mapped and characterized. Two tasks in seismic hazard evaluation may now be attempted with greater confidence: first, the construction of synthetic seismograms that make useful predictions of ground shaking, and second, theoretical investigations of the role of this complexity in retarding the propagation of future seismic ruptures.