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DETERMINATION OF PALEOEARTHQUAKES, SLIP PER EVENT DATA, AND A HOLOCENE SLIP RATE FOR THE PUENTE HILLS BLIND-THRUST FAULT, LOS ANGELES, CALIFORNIA

The Puente Hills thrust fault (PHT), which generated the 1987 M 6.0 Whittier-Narrows earthquake, is an active blind-thrust fault that lies directly beneath downtown Los Angeles, extending ~ 40-50 km from Beverly Hills to Fullerton, California [Shaw and Shearer, 1999]. Blind-thrust faults have in the past represented an ill-defined seismic hazard because traditional methodologies for acquiring paleoearthquake information require the fault in question be exposed at the surface. In this study, we developed and tested a multi-disciplinary methodology for assessing the earthquake histories of blind-thrust faults, focusing on the forelimb growth triangle of the Santa Fe Springs anticline associated with slip on the PHT. A hollow-stem and bucket-auger borehole transect excavated across the upward projection of the growth triangle identified on petroleum industry and high-resolution seismic reflection profiles exposed a discrete, upward-narrowing zone of south-dipping strata. Stratigraphic correlation across this transect revealed four stratigraphically discrete intervals that show southward thickening, or growth, within a 250-125 m wide zone. Each growth section was deposited after temporally separate slip events on the PHT, revealing evidence for four paleoearthquakes in the past 11,000 years. We have determined slip in each event to between 1.5 and 5 m. These data suggest the PHT ruptures in earthquakes greater than magnitude 7. The minimum slip rate on the Santa Fe Springs segment is 1.1-1.6 mm/yr accommodating ~ 15-30% of the geodetically measured north-south shortening rate across the Los Angeles basin.