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Continuity of slip rates over various time scales on the Puente Hills Blind-thrust Fault, Los Angeles, California

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Our study seeks to assess the history of slip on the Los Angeles segment of the Puente Hills blind-thrust fault system (PHT) from its inception through the Holocene by integrating a suite of geological and geophysical datasets. The PHT presents one of the largest seismic hazards in the United States, given its location beneath downtown Los Angeles. It is also well suited to slip rate studies, as fold scarps formed by slip on the PHT at depth have been continually buried by flood deposits from the Los Angeles and San Gabriel Rivers, preserving a record of uplift in the form of growth stratigraphy. We determined uplift from the growth stratigraphy by measuring the difference in sediment thickness across the folded layers. At our study site above the western segment of the PHT, the fold structure was imaged by industry seismic reflection data and a pair of high-resolution (100 to 700 m depth) seismic reflection profiles acquired by the authors for this study using weight drop and small vibrator sources. The industry and high-resolution profiles were stacked, migrated and depth converted using a velocity model based on the stacking velocities and the Southern California Earthquake Center Community Velocity Model. The shallowest layers of growth stratigraphy were geometrically constrained by lithological correlations across a series of cone penetration tests and continuously cored boreholes. Age control was provided by radiocarbon dating, optically stimulated luminescence (OSL) and infrared stimulated luminescence (IRSL) dating, and sequence-stratigraphic boundaries. Radiocarbon dating was used to constrain individual earthquake event ages in the borehole transect. Using a novel coring procedure, light-protected samples for quartz OSL and feldspar IRSL dating were acquired from a 171-m-deep borehole that we drilled within the growth fold. These samples provided age constraints on growth strata that were tied to prominent seismic reflections and were combined with measures of structural relief to determine uplift and fault slip rates. Below our deepest sample depth (136 m) we utilized the sequence stratigraphic model and well log interpretations of Ponti et al. (2007; US Geological Survey Open-File Report 1013) to constrain uplift through the Pleistocene.