Jump to Navigation

Quaternary Fault and Fold Database of the United States

As of January 12, 2017, the USGS maintains a limited number of metadata fields that characterize the Quaternary faults and folds of the United States. For the most up-to-date information, please refer to the interactive fault map.

Lower Elysian Park thrust (Class A) No. 134

Last Review Date: 2017-06-14

citation for this record: Bryant, W.A., compiler, 2017, Fault number 134, Lower Elysian Park thrust, in Quaternary fault and fold database of the United States: U.S. Geological Survey website, https://earthquakes.usgs.gov/hazards/qfaults, accessed 12/14/2020 02:13 PM.

Synopsis	Davis and others (1989) interpret the Elysian Park anticlinorium to be formed by stacked fault propagation folds; Elysian Park thrust is the lower ramp. The thrust propagates upward from an assumed detachment at about 15 km to a depth of about 10 km. Shaw and Suppe (1996) prefer a fault-bend fold model that links the Elysian Park fault ramp with the Compton [133] ramp to the west. This is implied by the similar kink band widths (growth triangles) associated with the two ramps. They define two segments of the Elysian Park Thrust (Los Angeles and Whittier) that are offset in the vicinity of the Whittier Narrows earthquake. Schneider and others (1996) define the Los Angeles fault as that responsible for ongoing deformation of the south facing monocline that forms the northern Los Angeles shelf, based on structural reconstruction from well log data and seismic stratigraphy. In well logs they recognize increasing dip with depth, suggesting that fold growth has been by progressive limb rotation. This fanning of dips would preclude the fault-bend

	fold or fault-propagation models from being applicable. Bullard and Lettis (1993) use morphometric parameters, combined with pedogenic age estimates to infer uplift rates at Monterey Park and Montebello Hills. They suggest that these structures are the near surface expression of the underlying Elysian Park thrust, and that there is evidence in the uplift history and pattern that the thrust ramp is segmented at this location. The rates of uplift derived from their methods are lower than those proposed by either the fault-bend fold or the fault-propagation fold models. Ponti and others (1996) determine the amount of slip from present height above sea level, and the faunal restrictions on formation elevation of 0 to -10 m. Correlation of fossil mollusks to sea level highstand is made using amino acid racemization. Uplift, rather than tilt or deformation is recognized in the cores. The source of this uplift is uncertain, but suggests that the Elysian Park/ Los Angeles faults, as modeled, are less active than previously proposed. Ponti and others (1997) do not propose a particular fault geometry, and the small study area may not be representative of slip along the entire northern shelf fault system. [text from Hecker et al., 1998]
Name comments	Structure first modeled by Davis et al. (1989) and was identified as Elysian Park thrust after the Elysian Park folds associated with the fault model. Oskin et al. (2000) referred to a northeast-dipping reverse fault above Puente Hills blind thrust system [185] as Elysian Park fault. Subsequently, Shaw et al. (2002) referred to the deeper thrust ramp originally named by Davis et al. (1989) to be the Elysian Park thrust (lower). For this compilation, the fault is referred to as the Lower Elysian Park thrust (blind). The fault described by Oskin et al. (2000) is referred to in current literature as Upper Elysian Park fault (blind) [218]. **Fault ID:** Refers to number 34 of Hecker et al. (1998) and number 196 of UCERF 3 (Dawson and Weldon, 2013).
County(s) and State(s)	LOS ANGELES COUNTY, CALIFORNIA
Physiographic province(s)	PACIFIC BORDER
Reliability of location	Poor Compiled at 1:550,000 scale. *Comments:* Location of fault from Qt_flt_ver_3-0_Final_WGS84_polyline.shp (Bryant, W.A., written

	communication to K.Haller, August 15, 2017) based on modeling by Shaw and Suppe (1996) and Southern California Earthquake Center Community Fault Model (Plesch and others, 2007).
Geologic setting	Lower Elysian Park thrust and associated fold structures form a segment of the southern boundary of the Transverse Ranges (Oskin and others, 2000). The Los Angeles basin is located at the northwestern margin of the Peninsular Ranges and is overridden on the north and northeast by a series of contractional structures (Wright, 1991; Schneider and others, 1996; Shaw and Suppe, 1996). Oskin and others (2000) consider the Elysian Park anticline as a transitional structure forming a kinematic link between the sinistral-oblique uplift of the Santa Monica Mountains of the Transverse Ranges and the dextral-oblique uplift of the Puente Hills.
Length (km)	50 km.
Average strike	120
Sense of movement	Thrust *Comments:* Davis and others (1989) and Shaw and Suppe (1996) model shallow-dipping thrust faults to account for Pliocene and Quaternary fold deformation.
Dip Direction	NE *Comments:* Davis and others (1989) model an approximately 27° dipping thrust fault propagating from an approximately 13 km deep SW vergent detachment fault. Shaw and Suppe (1996) model a 14–24° dipping thrust ramp based on modeling a fault-bend fold and a 15–30° dipping monoclinal fold limb.
Paleoseismology studies	
Geomorphic expression	
Age of faulted surficial deposits	Davis and others (1989) report that thrust fault offsets Mesozoic undifferentiated crystalline basement rocks, Upper Cretaceous and Paleogene clastic sedimentary rocks, and middle Miocene Topanga Formation. Units overlying Topanga Formation are folded, not faulted.
Historic	

earthquake	
Most recent prehistoric deformation	undifferentiated Quaternary (<1.6 Ma) *Comments:* Age of the most recent event is poorly constrained. Davis and others (1989) assumed the Mw5.9 1987 Whittier Narrows earthquake was caused by rupture along the lower Elysian Park thrust. Later work by Shaw and Shearer (1999) showed that, based on relocation of the Whittier Narrows hypocenter, the earthquake was probably associated with the Puente Hills blind thrust system [185]. Shaw and Suppe (1996) stated that the seismic reflection data used cannot resolve Holocene strata. However, they further stated that structural relief and near surface folding of horizons along the Elysian Park trend indicate that the underlying fault slipped in late Quaternary time.
Recurrence interval	*Comments:* Shaw and Suppe (1996) estimated a recurrence interval of about 340 yrs, based on their modeled slip rate of 1.7 mm/yr (1.3–2.1 mm/yr range) associated with assumed Mw6.6 earthquakes. If the entire Lower Elysian Park thrust were to rupture in a Mw6.9 event, a recurrence interval of about 540 yrs is indicated.
Slip-rate category	Between 1.0 and 5.0 mm/yr *Comments:* Davis and others (1989) estimated a slip rate of 2.5– 5.2 mm/yr, based on slip derived from a fault propagation fold model. Modeled contractional slip is 10 km to 11.4 km over a time span of 2.2 Ma to 4.0 Ma. Age of deformed lower member of Fernando Formation is based on calcareous nannoplankton biostratigraphy. Shaw and Suppe (1996) reported a preferred slip rate of 1.7 mm/yr (2.1 mm/yr maximum, 1.3 mm/yr minimum). Time span of slip rate is 2.5 Ma, based on deformed marker horizon inferred to be near top of Repetto Formation. Contractional slip of 4.8 km is model-derived from kink band width of Compton-Los Alamitos [133] structure. Hecker and others (1998) reported the following uncertainties for slip rate estimation by both Davis and others (1989) and Shaw and Suppe (1996): a. slip derived using modeled fault geometry; b. layers of assumptions from nested models; c. assumptions or models used in obtaining age estimates; d. results not fully documented. It is not certain how the long term geologic slip rate correlates to a late Quaternary slip rate.
Date and	2017

Compiler(s)	William A. Bryant, California Geological Survey
References	#8454 Bullard, T.F., and Lettis, W.R., 1993, Quaternary fold deformation associated with blind thrust faulting, Los Angeles Basin, California: Journal of Geophysical Research, v. 98, no. B5, p. 8349–8369. #8455 Davis, T.L., Namson, J., and Yerkes, R.F., 1989, A cross section of the Los Angeles area—Seismically active fold and thrust belt, the 1987 Whittier Narrows earthquake, and earthquake hazard: Journal of Geophysical Research, v. 94, no. B7, p. 9644–9664 #8456 Dawson, T.E., and Weldon, R.J., III, 2013, Appendix B – Geologic slip-rate data and geologic deformation model, *in* Field, E.H., and others, Uniform California earthquake rupture forecast, version 3 (UCERF3)—The time-independent model: U.S. Geological Survey Open-File Report 2013–1165, 97 p., California Geological Survey Special Report 228, and Southern California Earthquake Center Publication 1792, http://pubs.usgs.gov/of/2013/1165/. #6118 Hecker, S., Kendrick, K.J., Ponti, D.J., and Hamilton, J.C., 1998, Fault map and database for southern California, Long Beach 30'x60' quadrangle: U.S. Geological Survey Open-File Report 98-129, http://quake.wr.usgs.gov/research/seismology/scfaults/lb/index.html. #8457 Oskin, M., Sieh, K., Rockwell, T., Miller, G., Guptill, P., Curtis, M., McArdle, S., and Elliot, P., 2000, Active parasitic folds on the Elysian Park anticline—Implications for seismic hazard in central Los Angeles, California: Geological Society of America Bulletin, v. 112, p. 693–707. #8407 Plesch, A., Shaw, J.H., Benson, C., Bryant, W.A., Carena, S., Cooke, M., Dolan, J., Fuis, G., Gath, E., Grant, L., Hauksson, E., Jordan, T., Kamerling, M., Legg, M., Lindvall, S., Magistrale, H., Nicholson, C., Niemi, N., Oskin, M., Perry, S., Planansky, G., Rockwell, T., Shearer, P., Sorlien, C., Süss, M.P., Suppe, J., Treiman, J., and Yeats, R., 2007, Community Fault Model (CFM) for southern California: Bulletin of the Seismological Society of America, v. 97, p. 1793–1802. #8458 Ponti, D.J., Quinn, J.P., Hillhouse, J.W., and Powell, C.L. II, 1996, Quaternary chronostratigraphic constraints on deformation in

the northern Los Angeles Basin, California: Southern California Earthquake Center 1996 Annual Meeting, Palm Springs, California, p. 70.

#8459 Schneider, C.L., Hummon, C., Yeats, R.S., and Huftile, G.J., 1996, Structural evolution of the northern Los Angeles basin, California, based on growth strata: Tectonics, v. 15, p. 341–355.

#8408 Shaw, J., and Suppe, J., 1996, Earthquake hazards of active blind-thrust faults under the central Los Angeles basin, California: Journal Geophysical Research, v. 101, p. 8623–8642.

#8460 Shaw, J.H., and Shearer, P.M., 1999, An elusive blind-thrust fault beneath metropolitan Los Angeles: Science, v. 283, p. 1516–1518.

#8461 Shaw, J.J., Plesch, A., Dolan, J.F., Pratt, T.L., and Fiore, P., 2002, Puente Hills blind-thrust system, Los Angeles, California: Bulletin of the Seismological Society of America, v. 92, no. 8, p. 2946–2960.