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Quaternary Fault and Fold Database of the United States

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Los Osos fault zone, Irish Hills section (Class A) No. 79b

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Synopsis	**General:** Detailed mapping of surficial deposits and paleoseismic trenching investigations (PG&E, 1988 #7833; Lettis and Hall, 1994 #7842) and mapping (Nitchman, 1988 #7846) provide evidence for late Quaternary and locally, Holocene activity along the Los Osos fault zone. These studies confirmed many of the bedrock fault traces mapped by Hall and others (1979 #7840) and identified additional traces within the zone. The central portion of the fault zone meets the criteria of "sufficiently active and well-defined" to warrant zoning under the Alquist-Priolo Special Studies Zone Act (Bryant and Hart, 2007 #7836; Treiman, 1989 #7847). **Sections:** This fault has 4 sections. PG&E (1988 #7833) and Lettis and Hall (1994 #7842) define segments along the fault zone based on differences in physical (*i.e.*, spatial coincidence with

	distinct topographic elements of the San Luis/Pismo structural block (Lettis and others, 1994), en echelon separation of fault traces, intersection with known or inferred branching or crossing structures, and geomorphic character as a range-front fault or intra-range fault) and behavioral (*i.e.*, recency of activity and late Quaternary slip rate). From west to east, these segments are referred to as the Estero Bay, Irish Hills, Lopez Reservoir, and Newsom Ridge segments. Although paleoseismic studies conducted on the two central sections of the fault provide sufficient data to define at least one seismogenic segment boundary, additional data on timing and recency of activity are needed on the two end sections to verify these as seismogenic segments. Segments defined by Lettis and Hall (1989 #7842) are herein described as sections.
Name comments	**General:** Initially mapped by Hall and others (1979 #7840); southwest part of fault as mapped by PG&E (1988 #7833) and Lettis and Hall (1994 #7842) coincides with the Edna fault as mapped by Hall (1973 #7838) and Hall and others (1979 #7840). **Section:** Defined as Irish Hills segment by PG&E (1988 #7833) and Lettis and Hall (1994 #7842); the northwest boundary of the section, which is poorly constrained, is defined by en echelon or branching fault traces and a change in fault strike near Morro Bay basin; the relatively well-constrained southeast boundary is defined by a 1 to 2 km en echelon right step to Lopez Reservoir section, coincident with SE termination of Irish Hills sub-block, a 2 to 4 km right step in range front, and a possible intervening basin of subsidence. **Fault ID:** Refers to number 285 (Los Osos fault zone) of Jennings (1994 #2878).
County(s) and State(s)	SAN LUIS OBISPO COUNTY, CALIFORNIA
Physiographic province(s)	PACIFIC BORDER
Reliability of location	Good Compiled at 1:250,000 scale. *Comments:* Source of traces digitized from base map at 1:250,000 with topographic and bathymetric control; original mapping at 1:24,000 scale (Hall 1973 #7837; PG&E, 1988 #7833; Lettis and Hall, 1994 #7842) and 1:48,000 (Hall and others, 1979 #7840).

Geologic setting	Southwest-dipping reverse fault bounding northern margin of the San Luis Range; fault has a complex history of strike-slip and dip-slip displacement (Hall, 1981 #7839; Lettis and Hall, 1994 #7842). Hall (1981 #7839) interprets the southwestern part of the fault to have experienced late Cenozoic dextral strike-slip and to be part of a larger system of late Cenozoic NW-trending strike-slip faults that are responsible for creating the late Tertiary Santa Maria, Pismo, and Huasna pull-apart depositional basins. An alternative tectonic model (Namson and Davis, 1990 #7845) interprets the presence of an active detachment fault beneath the San Luis Range and does not identify nor discuss implications of an active fault along the northeastern margin of the range.
Length (km)	km.
Average strike	
Sense of movement	Reverse
Dip	22° SW. (near vertical); 30° to 60° (inferred fault dip at depth) *Comments:* 22° SW. dip measured on primary thrust fault exposed in Ingley trench T-2; alternative tectonic models to explain stratigraphic and structural relationships observed at the Ingley, Ellsworth and Cuesta trench sites allow for a 30° to 60° dipping fault at depth (PG&E, 1988 #7833; Lettis and Hall, 1994 #7842).
Paleoseismology studies	Detailed investigations (including detailed mapping of bedrock, Quaternary deposits, and geomorphic features; drilling; seismic refraction profiling; and exploratory trenching) were conducted at three sites to assess the geometry and late Quaternary behavior of the Los Osos fault zone along the Irish Hills section. These sites were informally named the Ingley (79-1), Cuesta (79-2), and Ellsworth (79-3) sites. The results of these studies are described in Lettis and Hall (1994 #7842). Ingley Site (79-1) NW ¼, Sec. 32, T30S, R12E Two faults were identified and trenched at the Ingley site, a northeast-verging (southward-dipping) reverse fault and a nearly vertical to steeply northeast-dipping backthrust. The more southwesterly trace (backthrust) also is exposed in a stream cut along Sycamore Canyon Creek. Stratigraphic and geomorphic evidence of significant late Pleistocene and Holocene reverse displacement on both fault traces. Stratigraphic and structural relationships in

	Inglely trench T-2 across the primary reverse fault strongly suggest multiple surface-faulting events with the most recent event occurring in the late Holocene (see PG&E, 1988 for a copy of the detailed trench log). Cuesta Site (79-2) SE ¼, Sec. 32, T30S, R12E Three trenches were excavated across a series of scarps, spring lines, and tonal lineaments that define a 300 m wide zone of recent faulting at the base of the range front. Northeast-dipping faults exposed in the Cuesta trenches are interpreted to be secondary, sympathetic deformation in the hanging wall of a reverse or thrust fault at depth that probably intersects the surface to the N-NE of the trench location. Complex structural relationships in trench exposes suggest some of the deformation is inherited from a former, perhaps strike-slip style, period of deformation. Ellsworth Site (79b-3) SW ¼, Sec. 32, T30S, R12E The Ellsworth trench T-1 was excavated to assess fault behavior and geometry along one of the traces mapped by Hall and others (1979 #7840) within the low foothills of the Irish Hills. Stratigraphic evidence from this trench suggest southwest side down reverse reactivation of a near vertical to NE-dipping (75° NE.) strike-slip fault.
Geomorphic expression	Well-defined range-front fault over most of length; geomorphic features indicative of Quaternary faulting (*i.e.*, prominent spring lines, linear and arcuate topographic scarps, linear tonal contrasts, linear stream segments, deflected drainages, side-hill benches, stream nick-points, and linear faceted ridge spurs) are well expressed along the central 8 to 10 km of this section between the town of Los Osos in the NW and San Luis Obispo city limits to the southeast. The northwestern and southeastern ends of the Irish Hills section have poor geomorphic expression, due to decreasing rates of displacement towards the ends of the section and/or modification of surface expression by eolian and fluvial processes.
Age of faulted surficial deposits	Late Pleistocene and Holocene alluvium, colluvium, and eolian deposits (35%); Pliocene (?) Pleistocene alluvium (30%); Pre-Quaternary bedrock (35%) (PG&E, 1988 #7833; Lettis and Hall, 1994 #7842).
Historic earthquake	
Most recent	latest Quaternary (<15 ka)

prehistoric deformation	*Comments:* Paleoseismic investigations document multiple late Pleistocene and Holocene surface-faulting events.
Recurrence interval	
Slip-rate category	Between 0.2 and 1.0 mm/yr *Comments:* 0.2 to 0.8mm/yr; reported slip rate based on vertical displacement of marine terraces at western end of section, displacement of fluvial terraces at eastern end, and displacement history recorded in Ingley trench T-2 and assumed fault dip of 30° to 60° at depth (PG&E, 1988 #7833; Lettis and Hall, 1994 #7842).
Date and Compiler(s)	2016 Kathryn L. Hanson, AMEC Environment & Infrastructure (AMEC E&I) William A. Bryant, California Geological Survey
References	#7836 Bryant, W.A., and Hart, E.W., 2007, Fault-rupture hazard zones in California: California Geological Survey Special Publication 42, 42 p., ftp://ftp.consrv.ca.gov/pub/dmg/pubs/sp/Sp42.pdf. #7837 Hall, C.A., Jr., 1973, Geologic map of the Morro Bay South and Port San Luis Quadrangles, San Luis Obispo County, California: U.S. Geological Survey Miscellaneous Field Studies Map MF-511, scale 1:24,000. #7838 Hall, C.A., Jr., 1973, Geology of the Arroyo Grande quadrangle, California: California Division of Mines and Geology Map Sheet 24, scale 1:48,000, 8 p. #7839 Hall, C.A., Jr., 1981, Map of geology along the Little Pine fault, parts of the Sisquoc, Foxen Canyon, Zaca Lake, Bold Mountain, Los Olivos, and Figueroa Mountain quadrangles, Santa Barbara County, California: U.S. Geological Survey Miscellaneous Field Studies Map MF-1285, scale 1:24,000. #7840 Hall, C.A., Jr., Ernst, W.G., Prior, S.W., and Wiese, J.W., 1979, Geologic map of the San Luis Obispo-San Simeon region, California: U.S. Geological Survey Miscellaneous Investigations Series I-1097, 3 sheets, scale 1:48,000.

	#2878 Jennings, C.W., 1994, Fault activity map of California and adjacent areas, with locations of recent volcanic eruptions: California Division of Mines and Geology Geologic Data Map 6, 92 p., 2 pls., scale 1:750,000. #7842 Lettis, W.R., and Hall, N.T., 1994, Los Osos fault zone, San Luis Obispo County, California, *in* Alterman, I.B., McMullen, R.B., Cluff, L.S., and Slemmons, D.B., eds., Seismotectonics of the central California Coast Ranges: Boulder, Colorado, Geological Society of America Special Paper 292, p. 73–102. #7845 Namson, J.S., and Davis, T.L., 1990, Late Cenozoic fold and thrust belt of the southern Coast Ranges and Santa Maria Basin, California: American Association of Petroleum Geologists Bulletin, v. 74, p. 467–492. #7846 Nitchman, S.P., 1988, Tectonic geomorphology and neotectonics of the San Luis Range, San Luis Obispo County, California: University of Nevada at Reno, unpublished Master''s thesis, 120 p. #7833 Pacific Gas and Electric (PG&E), 1988, Final report of the Diablo Canyon Long Term Seismic Program for the Diablo Canyon Power Plant: U.S. Nuclear Regulatory Commission Docket Nos. 50-275 and 50-323. #7847 Treiman, J.A., 1989, Los Osos Fault Zone, San Luis Obispo County, California: California Department of Conservation, Division of Mines and Geology Fault Evaluation Report FER-200, 11 p., 1 plate.