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Great Valley thrust fault system, Coalinga (GV 13) section (Class A) No. 28m

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Synopsis	**General:** The Great Valley thrust fault system is a seismically active blind thrust fault and fold belt that marks the boundary between the Coast Ranges and the Great Valley. The Great Valley thrust fault system can be described as a complex system of east vergent, shallow-dipping blind thrust faults and associated west-vergent shallow to moderately dipping backthrust faults. Quaternary deformation in the western Sacramento Valley is characterized by uplift, tilting, asymmetric folding, and, locally, by both west and east-vergent thrust faulting (Unruh and Moores, 1992). Significant seismic events associated with the Great Valley thrust fault system include: 1892 earthquake series (up to Mw6.5 based on shaking intensities) that probably occurred along the Gordon Valley thrust [28d2] (O'Connell and others 2001); 1982 Mw5.5 New Idria earthquake that occurred along the Great Valley 12 section [28l] (Ekström and others 1992); 1985 Mw6.5

	Coalinga earthquake that occurred along the Coalinga section [28m] (Ekström and others 1992); and the 1985 Mw6.1 Kettleman Hills-North Dome earthquake that occurred along the Kettleman Hills-North Dome section [28n] (Ekström and others 1992). Wong and others (1988) summarized these events and additional seismicity along the Great Valley thrust fault system. Slip rate estimates for the thrust fault system generally are based on uplift rates of specific stratigraphic horizons and fault dips, which are sometimes measured from deep seismic reflection lines, and sometimes from structural modeling. A paleoseismic study at the Lone Tree Creek site (403-1) involving trench excavations exposed deformed terraces deposits, but did not expose faulting along the San Joaquin fault [403], which may be the near surface expression of the Orestimba section [28g]. Estimated late Quaternary dip-slip rates along the Great Valley thrust fault system range from about 0.1 mm/yr for the Great Valley 01 section, 1–3 mm/yr for the Mysterious Ridge [28c] section, 0.4–0.6 mm/yr for the Orestimba [28g] section, and about 3 mm/yr for the Kettleman Hills-North Dome [28n] section. **Sections:** This fault has 14 sections. From north to south the section names are: Great Valley 01 [28a], Great Valley 02 [28b], Mysterious Ridge (GV 03) [28c], Trout Creek (GV 04a) [28d1], Gordon Valley (GV 04b [28d2], Orestimba (GV 07) [28g], Quinto (GV 08) [28h], Laguna Seca (GV 09) [28i], Panoche Hills (GV 10) [28j], Great Valley 11 [28k], Great Valley 12 [28l], Coalinga (GV 13) [28m], and Kettleman Hills-North Dome (GV 14) [28n]. The blind Great Valley thrust fault system originally was divided into 14 sections by WGNCEP (Working Group on Northern California Earthquake Potential, 1996) and Petersen and others (1996) in order to model the fault system for purposes of seismic hazard assessment. Subsequent probabilistic seismic hazard assessment models (UCERF 2-Wills and others 2008) revised the sections, replacing GV 05 [028e] with the Mt. Diablo thrust (blind) [353] and GV 06 [028f] with the Midland fault [506] and Pittsburg-Kirby Hills fault zone [246]. Wakabayashi and Smith (1994) first proposed dividing the Great Valley thrust fault system into between 18 and 25 segments, based on structural geology, geomorphology, and historical seismicity.
Name comments	**General:** Refers to the blind thrust fault and fold belt that is located along the west side of the Great Valley. Has been referred to as the Coast Range-Sierra Nevada boundary zone by Wong and others (1988), Coast Range-Central Valley boundary zone by Wakabayashi and Smith (1994) (they also refer to this structure as

	the Coast Range-Central Valley thrust system in their Figure 1), and the Great Valley thrust fault system by WGNCEP (Working Group on Northern California Earthquake Potential, 1996). Great Valley thrust fault system will be used in this compilation. **Section:** Coalinga (GV 13) section corresponds with Wakabayashi and Smith’s (1994) segment 16 and segment GV 13 of WGNCEP (Working Group on Northern California Earthquake Potential, 1996). Rupture along this section produced the 1983 Mw6.5 Coalinga earthquake. The section is centered on the Coalinga anticline and extends from the Black Mountain area southeast to a distinct right step to the Kettleman Hills-North Dome section [28n]. **Fault ID:** Refers to numbers GV 01 to GV 14 of WGNEP (Working Group on Northern California Earthquake Potential, 1996).
County(s) and State(s)	FRESNO COUNTY, CALIFORNIA
Physiographic province(s)	PACIFIC BORDER
Reliability of location	Poor Compiled at 1: 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) attributed to Plesch and others (2007).
Geologic setting	The Great Valley thrust fault system delineates the boundary between the Coast Ranges and the Great Valley (also referred to as the Central Valley). The Great Valley thrust fault system as defined in this compilation extends for about 475 km along the west side of the Great Valley. The fault system is complex and consists of both shallow west-dipping blind thrust faults and associated east-dipping shallow to moderate dipping thrust and reverse faults. Both fault-bend folding and fault-propagation folding have been hypothesized for the Great Valley thrust fault system and it is likely that one or the other model best explains the data for any specific fault section. For example, the Coalinga section [28m] is best explained by the fault-bend fold model (Namson and Davis, 1990; Guzofski and others 2007), while

	O’Connell and others (2001) consider that the fault-propagation fold model best explains deformation along the Mysterious Ridge [28c], Trout Creek [28d1], and Gordon Valley [28d2] sections. Maximum structural relief is about 7–10 km for the fault sections along the west side of the Sacramento Valley (sections [28c], [28d1 and 28d2]; O’Connell and others 2001).
Length (km)	This section is 39 km of a total fault length of km.
Average strike	130
Sense of movement	Thrust *Comments:* Based on focal mechanism of the 1983 Mw6.5 Coalinga earthquake. Structure is complex and involves both east-vergent thrust faults and west-vergent reverse faults (backthrusts).
Dip	10–15° SW. *Comments:* Based on structural models by Namson and others (1990), Wentworth and Zoback (1990), and Guzofski and others (2007). Stein and Ekström (1992) preferred a fault-propagation fold model to explain the Coalinga structural setting. In contrast, Namson and others (1990) and Guzofski and others (2007) preferred a fault-bend fold model.
Paleoseismology studies	
Geomorphic expression	Coalinga anticline is a northeast-vergent, southeast plunging anticlinal structure that delineates at the surface a complex zone of southwest-dipping blind thrust faults and northeast-dipping high angle reverse faults. Atwater and others (1990) noted that evidence of anticlinal uplift at Los Gatos Creek is very subtle and can best be inferred by the 1.5 m of apparent convergence of the 2 ka 14C yr BP alluvial plain toward the recent alluvial plain between Pleasant Valley and the axial part of the Coalinga anticline.
Age of faulted surficial deposits	Fault is blind and does not directly offset late Quaternary deposits. Fold deformation affects strata of the Corcoran Clay Member of the Tulare Formation. The top of Tulare Formation correlates approximately with 0.6 Ma Friant Ash Member of Turlock Lake Formation (Atwater and others, 1990; Marchand and Allwardt, 1981). Atwater and others (1990) reported that it is

	probable that fluvial deposits in Los Gatos Creek, dated between 5,000 and 2,000 14C yr BP are deformed due to growth of the Coalinga anticline.
Historic earthquake	Coalinga earthquake 1983
Most recent prehistoric deformation	latest Quaternary (<15 ka) *Comments:* Timing of the most recent paleoevent is not well constrained. Atwater and others (1990) observed deformation of 5,000 14C yr BP fluvial datum in Los Gatos Creek, suggesting growth of Coalinga anticline of probably less than a few tenths of a meter per 1,000 years.
Recurrence interval	200 to 1000 years (late Quaternary) *Comments:* Wentworth and Zoback (1990) estimated a late Quaternary recurrence interval of 300–600 years for Coalinga-type earthquakes.
Slip-rate category	Between 1.0 and 5.0 mm/yr *Comments:* Stein and Ekström (1992) estimated a long-term (2–3 m.y.) fold uplift rate of about 0.4 mm/yr at Coalinga, based on structural relief of about 1 km of the Coalinga fold. The 1983 Mw6.5 Coalinga earthquake produced 0.7 m of observed coseismic fold growth associated with 1.5–3.0 meters of fault slip. Stein and Ekström (1992) assumed this observed fault slip and fold growth relationship is characteristic and inferred a long term slip rate of 1–2 mm/yr. Namson and Davis (1988) inferred a slip rate of 2–3 mm/yr, based on calculations using balanced cross sections at New Idria. Atwater and others (1990) suggest a lower slip rate based on deformation of late Holocene fluvial deposits of Los Gatos Creek. They infer a fold growth rate of a few tenths of a meter per 1,000 years, based on deformed late Holocene fluvial deposits of Los Gatos Creek.
Date and Compiler(s)	2017 William A. Bryant, California Geological Survey
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