

# 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](#).

## Great Valley thrust fault system, Mysterious Ridge (Great Valley 03) section (Class A) No. 28c

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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**

**General:** Refers to the blind thrust fault and fold belt that is

<b>comments</b>	<p>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.</p> <p><b>Section:</b> Mysterious Ridge section is equivalent to Segments 3 and 4 of Wakabayashi and Smith (1994). Section extends from Salt Creek on the north southeast to the vicinity of Esparto. Mysterious Ridge section proposed by Unruh and others (1997) generally corresponds to the southern 2/3rd of the GV 03 Section delineated by Petersen and others (1996) and WGNCEP (Working Group on Northern California Earthquake Potential, 1996). The southern end of Mysterious Ridge segment is delineated by transition from fault-bend folding to fault propagation folding to the south (O’Connell and others 2001).</p> <p><b>Fault ID:</b> Refers to numbers GV 01 to GV 14 of WGNCEP (Working Group on Northern California Earthquake Potential, 1996).</p>
<b>County(s) and State(s)</b>	YOLO COUNTY, CALIFORNIA COLUSA COUNTY, CALIFORNIA
<b>Physiographic province(s)</b>	PACIFIC BORDER
<b>Reliability of location</b>	<p>Poor Compiled at 1:508,150 scale.</p> <p><i>Comments:</i> Location of fault from Qt_ft_ver_3-0_Final_WGS84_polyline.shp (Bryant, W.A., written communication to K.Haller, August 15, 2017) attributed to 1:508,150-scale map (O’Connell and Unruh, 2000).</p>
<b>Geologic setting</b>	<p>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</p>

	<p>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; Guzowski 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).</p>
<b>Length (km)</b>	This section is 66 km of a total fault length of km.
<b>Average strike</b>	152
<b>Sense of movement</b>	<p>Thrust</p> <p><i>Comments:</i> Unruh and others (1995)</p>
<b>Dip</b>	<p>20–25° W.</p> <p><i>Comments:</i> Unruh and others (1997); O'Connell and Unruh (2000).</p>
<b>Paleoseismology studies</b>	
<b>Geomorphic expression</b>	<p>Mysterious Ridge section delineated by asymmetric Rumsey Hills anticline, a fold with a complexly folded and faulted west limb. The Sweitzer fault is a prominent backthrust fault associated with the Mysterious Ridge section that is delineated by a prominent west-facing escarpment in Mesozoic sedimentary rocks and locally displaces rocks of the Plio-Pleistocene Tehama Formation.</p>
<b>Age of faulted surficial deposits</b>	Plio-Pleistocene Tehama Formation is locally displaced by Sweitzer fault.
<b>Historic earthquake</b>	
<b>Most recent prehistoric deformation</b>	<p>undifferentiated Quaternary (&lt;1.6 Ma)</p> <p><i>Comments:</i> Timing of the most recent paleoevent is not known.</p>

	<p>Plio-Pleistocene Tehama Formation is tilted and locally faulted. Unruh and others (1995) indicate that onset of the most recent deformation along the Mysterious Ridge section is post-Tehama, possibly between 1.0 and 0.45 Ma.</p>
<b>Recurrence interval</b>	
<b>Slip-rate category</b>	<p>Between 1.0 and 5.0 mm/yr</p> <p><i>Comments:</i> Unruh and others (1995) estimate that a late Quaternary slip rate of 1–3 mm/yr is needed to account for the uplift and folding of the Rumsey Hills.</p>
<b>Date and Compiler(s)</b>	<p>2017 William A. Bryant, California Geological Survey</p>
<b>References</b>	<p>#8413 Ekström, G., Stein, R.S., Eaton, J.P., and Eberhart-Phillips, D., 1992, Seismicity and geometry of a 110-km-long blind thrust fault—2. The 1985 Kettleman Hills, California, earthquake: <i>Journal of Geophysical Research</i>, v. 97, p. 4843–4864.</p> <p>#8414 Guzowski, C.A., Shaw, J.H., Lin, G., and Shearer, P.M., 2007, Seismically active wedge structure beneath the Coalinga anticline, San Joaquin basin, California: <i>Journal of Geophysical Research</i>, v. 112, B03S05, doi:10.1029/2006JB00446.</p> <p>#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.</p> <p>#8418 Namson, J.S., Davis, T.L., and Lagoe, M.B., 1990, Tectonic history and thrust-fold deformation style of seismically active structures near Coalinga, <i>in</i> Rymer, M.J., And Ellsworth, W.L., eds., <i>The Coalinga, California, earthquake of May 2, 1983</i>: U.S. Geological Survey Professional Paper 1487, p. 79–96.</p> <p>#8419 O’Connell, D.R.H, and Unruh, J.R., 2000, Updated seismotectonic evaluation of the faults within 10 km of Monticello dam, Solano Project, California: U.S Bureau of Reclamation Seismotectonic Report 99-5, 101 p. 1 appendix, 7 plates.</p> <p>#8420 O’Connell, D.R.H., Unruh, J.R., and Block, L.V., 2001,</p>

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