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Great Valley thrust fault system, Quinto (GV 08) section (Class A) No. 28h

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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:** Anderson and Piety (2001) interpreted a 17–21 km long fault they name the Quinto blind thrust. The Quito thrust extends south from Garzas Creek to the vicinity of San Luis Reservoir and corresponds to the southern half of GV 08 [28h]. Quinto section proposed by Anderson and Piety (2001) generally corresponds to the southern part of GV 08 as defined by Petersen and others (1996) and WGNCEP (Working Group on Northern California Earthquake Potential, 1996). The Petersen and others (1996) GV 08 generally corresponds with segments 10 and 11 of Wakabayashi and Smith (1994). An approximately 5 km-wide right step over delineates the southern boundary between the Orestimba section [28g] and the Quinto section. **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)	MERCED COUNTY, CALIFORNIA STANISLAUS COUNTY, CALIFORNIA
Physiographic province(s)	PACIFIC BORDER
Reliability of location	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 Anderson and Piety (2001).
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 23 km of a total fault length of km.
Average strike	146
Sense of movement	Thrust *Comments:* WGNCEP (Working Group on Northern California Earthquake Potential, 1996), Anderson and Piety (2001).
Dip	20–30° SW. *Comments:* Anderson and Piety (2001) assume a dip between 20° and 30°. It is not clear what data they used for the assumed dips for the Quinto thrust (blind), but they do cite personal communication of R.H. O'Connell for the Laguna Seca thrust (blind) located farther the south.
Paleoseismology studies	
Geomorphic expression	Anderson and Piety (2001) reported that the northern part of the Quinto thrust (blind) between Garzas Creek to just south of Quinto Creek is delineated by a subdued northeast–facing fold scarp along the boundary between the Diablo Range and the San Joaquin Valley.
Age of faulted surficial deposits	Lettis (1982) and Anderson and Piety (2001) mapped uplifted Los Banos alluvial surfaces. The deformed Middle Los Banos surface is estimated to be 250±50 ka, based on soil profile development and relative weathering characteristics (Anderson and Piety, 2001).
Historic earthquake	

Most recent prehistoric deformation	late Quaternary (<130 ka) *Comments:* The timing of the most recent paleoevent is not well constrained. To the north (Orestimba section [28g]) Sowers (1998) identified two deformed terraces surfaces and a younger, non-deformed surface. The youngest deformed terrace surface reported by Sowers (1998) is the T5 surface from 29–47 ka. The un-deformed T3 surface is 16-32 ka, and the older T 7 surface is 55–83 ka.
Recurrence interval	
Slip-rate category	Between 0.2 and 1.0 mm/yr *Comments:* Anderson and Piety (2001) mapped an uplifted Los Banos age surface at Mustang Creek. The 250±50 ka surface projects about 30 m above the San Joaquin Valley margin, suggesting an uplift rate of 0.1–0.15 mm/yr. Based on the assumption that the fault dips 30°, Anderson and Piety (2001) estimated a late Quaternary slip rate of 0.2–0.3 mm/yr.
Date and Compiler(s)	2017 William A. Bryant, California Geological Survey
References	#8410 Anderson, L.W., and Piety, L.A., 2001, Geologic seismic source characterization of the San Luis-O'Neill area, eastern Diablo Range, California, for B.F. Sisk and O'Neill Forebay dams, San Luis unit, Central Valley Project, California: U.S. Bureau of Reclamation, Seismotectonic Report 2001-2, 76 p., 3 appendices. #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: Journal of Geophysical Research, v. 97, p. 4843–4864. #8414 Guzofski, C.A., Shaw, J.H., Lin, G., and Shearer, P.M., 2007, Seismically active wedge structure beneath the Coalinga anticline, San Joaquin basin, California: Journal of Geophysical Research, v. 112, B03S05, doi:10.1029/2006JB00446. #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.

#5353 Lettis, W.R., 1982, Late Cenozoic stratigraphy of the western margin of the central San Joaquin Valley, California: U.S. Geological Survey Open-File Repot 82-526, 203 p., scale 1:24,000.

#8415 Lettis, W.R., 1982, Geologic map of Late Cenozoic deposits of the west-central San Joaquin Valley, California: U.S. Geological Survey Open-File Report 82-526, scale 1:24,000.

#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, *in* Rymer, M.J., And Ellsworth, W.L., eds., The Coalinga, California, earthquake of May 2, 1983: U.S. Geological Survey Professional Paper 1487, p. 79–96.

#8420 O'Connell, D.R.H., Unruh, J.R., and Block, L.V., 2001, Source characterization and ground-motion modeling of the 1892 Vacaville-Winters earthquake sequence, California: Bulletin of the Seismological Society of America, v. 91, p. 1471–1497.

#4860 Petersen, M.D., Bryant, W.A., Cramer, C.H., Cao, T., Reichle, M.S., Frankel, A.D., Lienkaemper, J.J., McCrory, P.A., and Schwartz, D.P., 1996, Probabilistic seismic hazard assessment for the State of California: California Department of Conservation, Division of Mines and Geology Open-File Report 96-08 (also U.S. Geological Open-File Report 96-706), 33 p.

#8421 Sowers, J.M., 1998, Monoclinal folding of fluvial terraces along the San Joaquin fault near Tracy, California: U.S. Geological Survey National Earthquake Hazards Reduction Program, Final Technical Report, Award No. 1434-HQ-97-GR-03011.

#8424 Unruh, J.R., Loewen, Bradley. A., and Moores, E.M., 1995, Progressive arcward contraction of a Mesozoic–Tertiary fore-arc basin, southwestern Sacramento Valley, California: Geological Society of America Bulletin, v. 107, p. 38–53.

#7001 Wakabayashi, J., and Smith, D.L., 1994, Evaluation of recurrence intervals, characteristic earthquakes, and slip rates associated with thrusting along the Coast Range-Central Valley geomorphic boundary, California: Bulletin of the Seismological

	Society of America, v. 84, p. 1960–1970. #8427 Wong, I.G., Ely, R.W., and Kollmann, A.C., 1988, Contemporary seismicity and tectonics of the northern and central Coast Ranges-Sierran Block boundary zone, California: Journal of Geophysical Research, v. 93, p. 7813–7833. #1216 Working Group on Northern California Earthquake Potential (WGNCEP), 1996, Database of potential sources for earthquakes larger than magnitude 6 in northern California: U.S. Geological Survey Open-File Report 96-705, 40 p.

Questions or comments?