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.

Pleasant Valley fault zone, Sou Hills section (Class A) No. 1136d

Last Review Date: 2000-08-14

citation for this record: **Anderson, R.E., and Machette, M.N., compilers, 2000, Fault number 1136d, Pleasant Valley fault zone, Sou Hills section, 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 02:18 PM.**

Synopsis	**General:** The M7+ 1915 Pleasant Valley earthquake formed four right-stepping en echelon surface ruptures with down-to-the-west displacement. The fault zone is located in part of the Basin and Range that is generally characterized by down-to-the west faults that may be linked in the subsurface by a through-going zone of extension accommodated by a series of right steps. The local geologic setting is slightly different for each section. The two central sections have the most prominent historical fault scarps and are marked by prehistoric scarps indicating multiple late Quaternary displacements. Return periods on these sections are probably measured in many thousand years, but the slip rate on the Pearce section may be high. The two end sections are less active and contain only sparse evidence of prehistoric displacements. Five trenches have been excavated along the central sections, but the results remain largely unpublished.

	Sections: This fault has 4 sections. The four sections correspond approximately to the four main scarps formed during the 1915 Pleasant Valley earthquake. From north to south, they are the China Mountain [1136a], Tobin [1136b], Pearce [1136c], and Sou Hills [1136d] sections.
Name comments	**General:** Name applied here to the four main faults that were activated in the 1915 Pleasant Valley earthquake to form the "1915 scarps" mapped by Wallace (1984 #169). dePolo (1998 #2845) referred to three of the faults, and a fourth not activated in 1915, as the Pleasant Valley fault system (his faults WI7A, -7B, -7C, and ?7D, respectively). He did not include the northernmost 1915 fault rupture (his China Mountain fault, WI6) in the system. As used here, the Pleasant Valley fault zone extends from the north end of China Mountain (which is also the north end of the Tobin Range) about 60 km S25!W to the area between the Sou Hills and the Stillwater Range. The four sections form a right-stepping echelon pattern in a belt of deformation about 6 km wide and 60 km long. The fault referred to as WI7D by dePolo, is described as unnamed faults [1145]. **Section:** Referred to as the Sou Hills scarps by Wallace (1979 #203) and as part of the Pleasant Valley fault system by dePolo (1998 #2845). Following Dohrenwend and Moring (1991 #282), the Sou Hills section extends from the center of Pleasant Valley (west of Little Miller Basin in the Tobin Range) south-southwest mainly along the west base of the Sou Hills to the west base of Fencemaker Ridge in the Stillwater Range. Faults along the north and south ends of the section did not rupture in the 1915 Pleasant Valley earthquake. **Fault ID:** Refers to fault WI7A of dePolo (1998 #2845).
County(s) and State(s)	PERSHING COUNTY, NEVADA
Physiographic province(s)	BASIN AND RANGE
Reliability of location	Good Compiled at 1:100,000 scale. *Comments:* The north and central parts of the section are compiled from the 1:62,500 mapping of historic fault scarps by Wallace (1979 #203), a map made mainly from field and

	photogeologic study of 1:60,000 aerial photos. The south part of the section is compiled from the 1:250,000-scale map of Dohrenwend and Moring (1991 #282) which was produced by analysis of 1:58,000-nominal-scale color-infrared photography transferred directly to 1:100,000-scale topographic quadrangle maps enlarged to scale of the photographs.
Geologic setting	The four sections of the Pleasant Valley fault zone form a right-stepping echelon pattern. The primary sense of movement is down-to-the-west. According to Muller and others (1951 #4357), the Tobin Range is bounded on both sides by well defined fault scarps, but along the eastern front the fault is overlapped by Tertiary gravel, whereas on the western side there is evidence of progressive fault-related east tilting of Tertiary lavas. Rupture on the four sections during the 1915 Pleasant Valley earthquake may reflect failure on a deep crustal zone of extension oriented about N25?E (Wallace, 1984 #169). Despite their displacement-sense similarity, the geologic setting is different for each section. The Tobin and Pearce sections, the two central sections, are both major range-front faults that bound the ranges and place bedrock against basin-fill sediment of the Pleasant Valley. The Tobin section, along the main Tobin Range block, has a strongly convex-west trace. In contrast, the Pearce section is comparatively straight and bounds an east-tilted block that is secondary to the main Tobin Range block. Despite the presence of historic rupture, it is not clear how movement was transferred between the Pearce and Tobin sections, the ends of which overlap about 1.5 km but are separated by about 3.5-km-wide right step. The Sou Hills section, the southern section, bounds the Sou Hills on the west and extends north into the medial part of Pleasant Valley. It is part of a structural transfer zone where the predominant sense of late Cenozoic displacement changes from down-to-the-east at the east base of the Stillwater Range to down-to-the-west at the western base of the Tobin Range. As the Sou Hills are approached along these opposed-sense major range-front faults, fault throw and continuity decrease and the timing and average strike changes (Fonseca, 1988 #134). The China Mountain section at the northern end of the Tobin Range is one of several north-striking normal faults that cut the Paleozoic and Mesozoic rock of China Mountain. It may bound the China Mountain block and place bedrock against basin fill in the southernmost part of Pumpernickel Valley (Stewart and Carlson, 1978 #3413). The surface trace of the 1915 surface rupture along China Mountain is actually located 200-300 m upslope of the base

	of the west-facing bedrock escarpment. The main 1915 rupture [1136b, 1136c] has a convex-west trace, possibly suggesting convex-upward fault geometry rather than the listric geometry tentatively suggested by Wallace (1984 #169).
Length (km)	This section is 23 km of a total fault length of 70 km.
Average strike	N24°E (for section) versus N13°E (for whole fault)
Sense of movement	Normal *Comments:* Although the main displacement is normal, Fonseca (1988 #134) noted a left-stepping pattern of scarps, suggesting a right-lateral component of movement.
Dip Direction	NW
Paleoseismology studies	
Geomorphic expression	As mapped by Dohrenwend and Moring (1991 #282), and compiled here, only the central part of the Sou Hills section follows a well-defined west-facing bedrock escarpment. Dohrenwend and Moring (1991 #282) mapped faults in the Sou Hills as mainly west-facing scarps on Quaternary deposits or erosion surfaces or on Tertiary volcanic and sedimentary rock, and locally they mapped faults juxtaposing Quaternary alluvium and bedrock. These scarps are generally short (< 3.5 km) and discontinuous, although Wallace (1979 #203) mapped a narrow band of nearly continuous scarps formed by the 1915 Pleasant Valley earthquake. Soils considered of be of late Pleistocene age are widely developed on stable surfaces in the Sou Hills, providing a basis for estimating the original length and surface offset of young faulting events. On the basis of about 200 scarp profiles, Fonseca (1988 #134) suggested that most single-event prehistoric and historic surface ruptures are < 1.5 m (offset), with a few in the 2-3 m range with a maximum value of 4 m. dePolo (1998 #2845) reported a preferred maximum basal fault facet of 85 m (61-110 m).
Age of faulted surficial deposits	According to photogeologic reconnaissance mapping by Dohrenwend and Moring (1991 #282) the age of deposits or surfaces on which scarps are formed decreases southward from early to middle and (or) late Pleistocene (0.01-1.5 Ma) to late Pleistocene (10-130 ka) to latest Pleistocene (10-30 ka) and (or)

	Holocene (<10 ka). Some of the fault traces are in Tertiary rock.
Historic earthquake	Pleasant Valley earthquake 1915
Most recent prehistoric deformation	latest Quaternary (<15 ka) *Comments:* The time of most prehistoric faulting event is not dated. On the basis of age estimates made from scarp profiles and soils, Fonseca (1988 #134) estimated that the last prehistoric down-to-the-west surface rupture occurred prior to early Holocene time (i.e., in the latest Pleistocene). Soils of probable middle Holocene age are only faulted by the historic event. However, young (late Holocene) prehistoric ruptures in the area are probably related to earthquakes that originated in Dixie Valley or the Stillwater Gap, and possibly having the same source as the 1915 surface ruptures.
Recurrence interval	
Slip-rate category	Less than 0.2 mm/yr *Comments:* No detailed data exists to determine slip rates for this fault. dePolo (1998 #2845) assigned a reconnaissance vertical slip rate of 0.184 mm/yr based on an empirical relationship between his preferred maximum basal facet height and vertical slip rate. The size of the facets (tens to hundreds of meters, as measured from topographic maps) indicates they are the result of many seismic cycles, and thus the derived slip rate reflects a long-term average. The late Quaternary characteristics of this fault (overall geomorphic expression, continuity of scarps, age of faulted deposits, etc.) substantiate a low slip rate during this period. Accordingly, the less than 0.2 mm/yr slip-rate category has been assigned to this fault.
Date and Compiler(s)	2000 R. Ernest Anderson, U.S. Geological Survey, Emeritus Michael N. Machette, U.S. Geological Survey, Retired
References	#2845 dePolo, C.M., 1998, A reconnaissance technique for estimating the slip rate of normal-slip faults in the Great Basin, and application to faults in Nevada, U.S.A.: Reno, University of Nevada, unpublished Ph.D. dissertation, 199 p. #282 Dohrenwend, J.C., and Moring, B.C., 1991, Reconnaissance photogeologic map of young faults in the Winnemucca 1° by 2°

quadrangle, Nevada: U.S. Geological Survey Miscellaneous Field Studies Map MF-2175, 1 sheet, scale 1:250,000.

#134 Fonseca, J., 1988, The Sou Hills—A barrier to faulting in the central Nevada seismic belt: Journal of Geophysical Research, v. 93, no. B1, p. 475-489.

#4357 Muller, S.W., Ferguson, H.G., and Roberts, R.J., 1951, Geology of the Mount Tobin quadrangle, Nevada: U.S. Geological Survey Geologic quadrangle Map GQ-0007, 1 sheet, scale 1:125,000.

#3413 Stewart, J.H., and Carlson, J.E., 1978, Geologic map of Nevada: U.S. Geological Survey, Special Geologic Map, 1, scale 1:500,000.

#203 Wallace, R.E., 1979, Map of young fault scarps related to earthquakes in north-central Nevada: U.S. Geological Survey Open-File Report 79-1554, 2 sheet, scale 1:125,000.

#169 Wallace, R.E., 1984, Fault scarps formed during the earthquakes of October 2, 1915, *in* Pleasant Valley, Nevada, and some tectonic implications, *in* Faulting related to the 1915 earthquakes in Pleasant Valley, Nevada: U.S. Geological Survey Professional Paper 1274-A, p. A1-A33, 1 pl., scale 1:62,500.