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.

Steens fault zone, Fields Section (Class A) No. 856d

Last Review Date: 2016-04-18

citation for this record: **Personius, S.F., compiler, 2002, Fault number 856d, Steens fault zone, Fields 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 03:16 PM.**

Synopsis	**General:** The nearly 200-km-long Steens fault zone is the most topographically prominent normal fault system in the northern Basin and Range province of west North America. The fault separates the eastern flanks of Steens Mountain and the Pueblo Mountains from the western margins of the Alvord Desert and Pueblo Val southern Oregon and northern Nevada. Steens Mountain and the Pueblo Mountai west-tilted fault blocks comprised of Miocene volcanic rocks, whereas the adjace Alvord Desert and Pueblo Valley are structural basins filled with thousands of me of Tertiary-Quaternary sedimentary fill. **Sections:** This fault has 6 sections. Although detailed studies along the entire fau zone have not been reported, six sections are inferred based on geometry and timi most-recent surface faulting at selected sites (but not on all sections) along the zo Hemphill-Haley and others (1999 #4038) proposed that the Steens fault zone in Oregon be divided into five segments. Herein we retain the five segment names delineated by Hemphill-Haley and others (1999 #4038) as section names, and ad

	sixth, northernmost section based on mapping of Pezzopane (1993 #3544). From to south, these sections are the Crowley [856a], Mann Lake [856b], Alvord [856c Fields [856d], Tum Tum [856e], and Denio [856f] sections. At the north end of th zone, faults in the Crowley section [856a] offset Miocene volcanic rocks a few hundred meters, and may have moved as recently as the middle and late Quaterna Faults in the adjacent Mann Lake section [856b] offset Miocene volcanic rock a minimum of 1600 m, and also may have moved as recently as the middle and late Quaternary. The adjacent Alvord section [856c] forms the steep eastern flank of th High Steens, and has offset Miocene volcanic rock 2–4 km. Trench and fault scar investigations indicate one or more Holocene surface-faulting events along the A section, so both the long-term (Miocene) and Quaternary slip histories indicate th section is the most active part of the Steens fault zone. Slip apparently decreases s of the Alvord section. Faults in the adjacent Fields section [856d] offset Miocene volcanic rock a minimum of 1400 m, and show their youngest movement (latest Quaternary) on short faults that lie on the playa east of the range front. Faults in t Tum Tum section [856e] appear to be slightly older than the youngest movement the playa strands of the Fields section [856d], but are younger than the latest movement on the range front strand of the Fields [856d] and Mann Lake [856b] sections. Trenching of the fault in the Denio section [856d], which is the southern part of the Steens Mountain fault zone, clearly demonstrates Holocene movement
Name comments	**General:** The Steens fault zone forms a steep escarpment between the uplifted St Mountain and Pueblo Mountains, and the western margin of Pueblo Valley and th Alvord Desert. These faults have been mapped by Willden (1964 #3002), Slemm (1966, unpublished Vya 1:250,000-scale sheet), Greene (1972 #3560), Walker an Repenning (1965 #3559), Brown and Peterson (1980 #3585), Hemphill-Haley (19 #3960), Walker and MacLeod (1991 #3646), Dohrenwend and Moring (1991 #28 Pezzopane (1993 #3544), Madin and others (1996 #3479), Weldon and others (20 #5144), and Personius and others (2006 #7386). The fault zone includes faults ma as the Alvord-Steens fault zone of Pezzopane (1993 #3544) and Pezzopane and Weldon (1993 #149), and the Steens fault, Alvord Desert graben, and Pueblo Mo faults of Pezzopane (1993 #3544). Geomatrix Consultants, Inc. (1995 #3593) use name Steens-Alvord Graben faults for all structures in the Alvord Desert area, an delineated three fault source zones: the northern segment, the Western Margin fau zone, and the East Alvord graben fault. The Steens fault zone extends into northe Nevada as the Pueblo Mountains fault zone of dePolo (1998 #2845). Hemphill-H (1987 #3960) named several small structures in the zone (Alvord, Dune Field, Embayment, Kueny Ditch, Serrano Point, Serrano Springs, Smyth Wells, and Wildhorse Creek faults), and included them in a larger Steens fault zone. Hemphi Haley and others (1989 #3958, 1999 #4038) later proposed that the Steens fault z be divided into five segments. Herein we retain the name Steens fault zone for the entire structure in Oregon and Nevada, and use the five segment names delineated Hemphill-Haley and others (1999 #4038) as section names. A sixth, northernmos section is informally defined herein on the basis of mapping by Pezzopane (1993 #3544) and Weldon and others (2002 #5144).

	Section: This section was informally named the Fields segment by Hemphill-Hal and others (1989 #3958; 1999 #4038) after the community of Fields, which is loc near the southern end of the section. This section was included in the informally r West Margin fault zone of the Steens-Alvord Graben faults by Geomatrix Consul Inc. (1995 #3593). **Fault ID:** These structures are fault numbers 47, 48, and 49 of Pezzopane (1993 #3544), fault number 62 of Geomatrix Consultants, Inc. (1995 #3593), and fault number V9 of dePolo (1998 #2845).
County(s) and State(s)	HARNEY COUNTY, OREGON
Physiographic province(s)	BASIN AND RANGE
Reliability of location	Good Compiled at 1:24,000 scale. *Comments:* Location of fault from ORActiveFaults (http://www.oregongeology.org/arcgis/rest/services/Public/ORActiveFaults/MapS downloaded 06/02/2016) attributed to 1:24,000-scale mapping of Langer (1991 #7800).
Geologic setting	The Steens fault zone is marked by nearly continuous range-bounding faults on th east side of the Pueblo Mountains and Steens Mountain. The fault zone extends fr near Crowley, Oregon, to the southern end of Bog Hot Valley in northern Nevada Pueblo Mountains and Steens Mountain are major west-tilted fault blocks (Stewa 1978 #2866); the adjacent Alvord Desert and Pueblo Valley are structural basins (grabens) filled with 1–2.5 km of Tertiary-Quaternary sedimentary fill (Cleary an others, 1981 #7385, 1981 #5649; Oldow and others, 2005 #7388). The region is underlain by Miocene volcanic rocks, primarily the Steens Basalt (Willden, 1964 #3002; Walker and Repenning, 1965 #3559; Greene and others, 1972 #3560; Bro and Peterson, 1980 #3585; Minor and others, 1987 #3746; Minor and others, 198 #3747; Walker and MacLeod, 1991 #3646). The Steens fault zone is the longest, prominent normal fault zone in the Basin and Range province of eastern Oregon, appears to truncate the southeastern end of the northwest-trending Brothers fault z (Lawrence, 1976 #3506). Total Miocene vertical displacement of 1.75±0.25 km is reported for a location near Baltazor Hot Spring (Personius and others, 2007 #738 and Brown and Peterson (1980 #3585) estimated offsets of 2,100–3,000 m in Mio rocks at the southern end of the Alvord section.
Length (km)	This section is 16 km of a total fault length of 197 km.
Average strike	N13°E (for section) versus N12°E (for whole fault)

Sense of movement	Normal *Comments:* Faults in this section are mapped as normal or high-angle faults by W and Repenning (1965 #3559), Brown and Peterson (1980 #3585), Walker and MacLeod (1991 #3646), Pezzopane (1993 #3544), and Hemphill-Haley and other (1989 #3958; 1999 #4038).
Dip Direction	E
Paleoseismology studies	
Geomorphic expression	Faults in the Fields section form a north-northeast-trending range front escarpmer between the eastern margin of southern Steens Mountain and the northern end of Pueblo Valley (Hemphill-Haley and others, 1989 #3958; 1999 #4038). The sectio older, partly eroded range-bounding scarps, and a younger set of scarps on alluvia playa sediments 3–5 km east of the range front (Hemphill-Haley and others, 1989 #3958; Pezzopane, 1993 #3544; Hemphill-Haley and others, 1999 #4038). The northern end of the section overlaps with the Alvord section and coincides with a km-wide right step in the range front fault zone that contains numerous short faul various orientations; this boundary may coincide with the eastern termination of t Brothers fault zone (Hemphill-Haley and others, 1989 #3958; 1999 #4038; Narwo 1999 #4045). The southern end of the section is marked by a 5-km-wide gap in Quaternary fault scarps south of Fields (Pezzopane, 1993 #3544; Weldon and oth 2002 #5648) and is also marked by a change from older faulting along the range f part of the Fields section to younger faulting along the Tum Tum section (Hemph Haley and others, 1989 #3958; 1999 #4038). The presence of younger scarps valleyward of the range front may indicate that the more recent ruptures are stepp eastward and appear to be cutting off the large embayment at the north end of the section (Hemphill-Haley and others, 1989 #3958; 1999 #4038).
Age of faulted surficial deposits	Older, eroded scarps are reported along the range front part of the Fields section (Hemphill-Haley and others, 1989 #3958; 1999 #4038), but Madin and others (19 #3479) mapped Holocene displacements, and Narwold and others (1999 #4045) describe Holocene (?) offsets of latest Pleistocene pluvial shorelines on faults in t southern half of the range front part of the section. A set of younger scarps (Hemp Haley and others, 1989 #3958; 1999 #4038) are present on Pleistocene and Holoc deposits east of the range front (Walker and Repenning, 1965 #3559; Madin and others, 1996 #3479; Weldon and others, 2002 #5648).
Historic earthquake	
Most recent prehistoric deformation	latest Quaternary (<15 ka) *Comments:* The range front part of the section has been mapped with latest move

	in the middle and late Quaternary by Pezzopane (1993 #3544) an Geomatrix Consultants, Inc. (1995 #3593). Hemphill-Haley and others (1989 #3958; 1999 #4 describe the "older" range front escarpment as similar in age to faulting along the Mann Lake section, but Madin and others (1996 #3479) and Narwold and others (#4045) map or describe some faults along the southern half of the range front as a in the Holocene. Weldon and others (2002 #5648) mapped parts of the range fron as active in the latest Quaternary (<18 ka), and other parts as active in the middle late Quaternary (<780 ka). Faults east of the range front offset Holocene deposits (Walker and Repenning, 1965 #3559), and have been mapped with latest moveme the Holocene or latest Pleistocene by Pezzopane (1993 #3544), Geomatrix Consu Inc. (1995 #3593), Madin and others (1996 #3479), and Weldon and others (2002 #5648).
Recurrence interval	
Slip-rate category	Less than 0.2 mm/yr *Comments:* No slip studies have been reported on faults in the Fields section. Wa and Repenning (1965 #3559) show a minimum offset of about 1400 m and Brow Peterson (1980 #3585) infer about 2100 m of offset of Miocene Steens Basalt nea southern part of the section; these rocks have K-Ar ages of 15–17 Ma (Sherrod an others, 1989 #3745). These data suggest low rates of long-term slip.
Date and Compiler(s)	2002 Stephen F. Personius, U.S. Geological Survey
References	#3585 Brown, D.E., and Peterson, N.V., 1980, Preliminary geology and geotherm resource potential of the Alvord Desert Area, Oregon: State of Oregon, Departme Geology and Mineral Industries Open-File Report O-80-10, 57 p., 2 pls., scale 1:250,000. #5649 Cleary, J., Lange, I.M., Qamar, A.I., and House, H.R., 1981, Gravity, isoto and geochemical study of the Alvord Valley geothermal area, Oregon: Geological Society of America Bulletin, Part II, v. 92, p. 934-962. #2845 dePolo, C.M., 1998, A reconnaissance technique for estimating the slip rat 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. #281 Dohrenwend, J.C., and Moring, B.C., 1991, Reconnaissance photogeologic of young faults in the Vya 1° by 2° quadrangle, Nevada, Oregon, and California: Geological Survey Miscellaneous Field Studies Map MF-2174, 1 sheet, scale 1:250,000.

#3593 Geomatrix Consultants, Inc., 1995, Seismic design mapping, State of Oreg Technical report to Oregon Department of Transportation, Salem, Oregon, under Contract 11688, January 1995, unpaginated, 5 pls., scale 1:1,250,000.

#3560 Greene, R.C., Walker, G.W., and Corcoran, R.E., 1972, Geologic map of tl Burns quadrangle, Oregon: U.S. Geological Survey Miscellaneous Geologic Investigations I-680, 2 sheet, scale 1:250,000.

#3960 Hemphill-Haley, M.A., 1987, Quaternary stratigraphy and late Holocene faulting along the base of the eastern escarpment of Steens Mountain, southeaster Oregon: Humboldt State University, unpublished M.S. thesis, 84 p., 1 pl., scale 1:24,000.

#4038 Hemphill-Haley, M.A., Carver, G.A., and Burke, B., 1999, Late Quaternar stratigraphy and Holocene faulting along the eastern margin of Steens Mountain, southeastern Oregon, *in* Quaternary geology of the northern Quinn River and Alv Valleys, southeastern Oregon: Friends of the Pleistocene field trip guide, Septemb 24-26, 1999, Appendix 5, p. 1-26.

#3958 Hemphill-Haley, M.A., Page, W.D., Burke, R., and Carver, G.A., 1989, Holocene activity of the Alvord Fault, Steens Mountain, southeastern Oregon: Technical report to Woodward-Clyde Consultants, under Contract Grant No. 14-0 0001-G1333, March 1989, 45 p.

#7800 Langer, V.W., 1991, Geology and petrologic evolution of the silicic to intermediate volcanic rocks underneath Steens Mountain Basalt, SE Oregon: Cor Oregon State University, unpublished Master"s thesis, 121 p., 1:24,000-scale map http://ir.library.oregonstate.edu/xmlui/handle/1957/11083.

#3506 Lawrence, R.D., 1976, Strike-slip faulting terminates the Basin and Range province in Oregon: Geological Society of America Bulletin, v. 87, p. 846-850.

#3479 Madin, I.P., Ferns, M.F., Langridge, R., Jellinek, A.M., and Priebe, K., 19 Final report to Bonneville Power Administration U.S. Department of Energy Port General Electric Company—Geothermal resources of southeast Oregon: State of Oregon, Department of Geology and Mineral Industries Open-File Report OFR-0 4, 41 p., 6 pls.

#3746 Minor, S.A., Rytuba, J.J., Goeldner, C.A., and Tegtmeyer, K.J., 1987, Geol map of the Alvord Hot Springs quadrangle, Harney County, Oregon: U.S. Geolog Survey Miscellaneous Field Studies Map MF-1916, 1 sheet, scale 1:24,000.

#3747 Minor, S.A., Rytuba, J.J., Meulen Vander, D.B., Grubensky, M.J., and Tegtmeyer, K.J., 1987, Geologic map of the Wildhorse Lake quadrangle, Harney

County, Oregon: U.S. Geological Survey Miscellaneous Field Studies Map MF-1
1 sheet, scale 1:24,000.

#4045 Narwold, C.F., 1999, Road log days 2 and 3, *in* Quaternary geology of the
northern Quinn River and Alvord Valleys, southeastern Oregon: Friends of the
Pleistocene field trip guide, September 24-26, 1999, p. 23-55.

#3544 Pezzopane, S.K., 1993, Active faults and earthquake ground motions in Or
Eugene, Oregon, University of Oregon, unpublished Ph.D. dissertation, 208 p.

#149 Pezzopane, S.K., and Weldon, R.J., II, 1993, Tectonic role of active faulting
central Oregon: Tectonics, v. 12, p. 1140-1169.

#3745 Sherrod, D.R., Minor, S.A., and Vercoutere, T.L., 1989, Geologic map of t
Sheepshead Mountains, Harney and Malheur Counties, Oregon: U.S. Geological
Survey Miscellaneous Field Studies Map MF-2079, 1 sheet, scale 1:50,000.

#2866 Stewart, J.H., 1978, Basin-range structure in western North America—A r
in Smith, R.B., and Eaton, G.P., eds., Cenozoic tectonics and regional geophysics
the western cordillera: Geological Society of America Memoir 152, p. 1-31, scale
1:2,500,000.

#3646 Walker, G.W., and MacLeod, N.S., 1991, Geologic map of Oregon: U.S.
Geological Survey, Special Geologic Map, 2 sheets, scale 1:500,000.

#3559 Walker, G.W., and Repenning, C.A., 1965, Reconnaissance geologic map
Adel quadrangle, Lake, Harney, and Malheur Counties, Oregon: U.S. Geological
Survey Miscellaneous Geologic Investigations I-446, 1 sheet, scale 1:250,000.

#5648 Weldon, R.J., Fletcher, D.K., Weldon, E.M., Scharer, K.M., and McCrory,
2002, An update of Quaternary faults of central and eastern Oregon: U.S. Geolog
Survey Open-File Report 02-301 (CD-ROM), 26 sheets, scale 1:100,000.

#5144 Weldon, R.J., Fletcher, D., Scharer, K.M., and Weldon, E.M., 2002, New r
active faults in central and eastern Oregon: Geological Society of America Abstra
with Programs, v. 34, no. 5, p. A-106.

#3002 Willden, R., 1964, Geology and mineral deposits of Humboldt County, Ne
Nevada Bureau of Mines and Geology Bulletin 59, 154 p., scale 1:250,000.

Questions or comments?

Facebook Twitter Google Email
Hazards