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Quaternary Fault and Fold Database of the United States

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Beowawe fault (Class A) No. 1151

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Synopsis	The Beowawe fault strikes NNE, is down to the west, and is marked by discontinuous scarps that extend from about 2 km NE of Beowawe, through some subdued bedrock highlands between Bobs Flat and Boulder Flat, and along the relatively gentle western flank of the Tuscarora Mountains to Richmond Mountain. A short isolated scarp southwest of Whirlwind Valley is included with the Beowawe fault, but its connection as a through-going Quaternary structure with the scarps northeast of Beowawe is uncertain. The southern part of the main group of scarps appears to form the structural margin between a basin beneath Whirlwind Valley on the west and the topographically subdued southernmost part of the Tuscarora Mountains in the east. The fault may loose displacement toward the north where similar-age Paleozoic bedrock is exposed across it. However, displacement may increase farther north since the fault forms the structural boundary between a basin (?) beneath Boulder Valley on the west and the

	Tuscarora Mountain on the east. The northernmost part of the fault cuts the piedmont slope directly west of the precipitous western flank of a south-projecting spur of Richmond Mountain. Indirect evidence suggests that its expression as a Quaternary feature is weak. On the basis of 1: 250,000-scale photogeologic reconnaissance of young faults, one short (<3 km) scarp is mapped as formed on deposits or erosion surfaces of late Pleistocene (10–130 ka) age. Other scarps are on deposits or erosion surfaces of middle to early Pleistocene (0.13–1.6 Ma) and (or) late Pleistocene (10–130 ka) age or as features younger than about 500 ka. Thus, the timing of most recent faulting is not well constrained.
Name comments	Name modified from Wallace (1979 #203), who referred to scarps on the western flank of the Tuscarora Mountains and south into the northern part of the Shoshone Range as the Beowawe scarps; the fault bounding Whirlwind Valley was named the Malpais fault by Layman (1984). dePolo (1998 #2845) referred to the faults as the Whirlwind Valley fault zone, an approximately 70-km-long feature that he divided into A and B parts (WI17A, WI17B). Dohrenwend and Moring (1991 #282), on their 1: 250,000-scale photogeologic reconnaissance of young faults, did not recognize young faults in the southern 30-km-long part of the fault zone between the Humboldt River Valley and Bald Mountain in the Shoshone Range, a zone comprising most of the WI17B fault of dePolo. Wallace (1979 #203), on his 1:125,000-scale mapping of young faults, also did not recognize features he estimated to be younger than 500 ka in that zone. Except for an isolated scarp southwest of Whirlwind Valley, as used here the Beowawe fault is restricted to the WI17A part of the Whirlwind Valley fault zone of dePolo (1998 #2845). Along that fault, Wallace (1979 #203) mapped discontinuous scarps (his Beowawe scarps) believed to be younger than about 500 ka. The faults extend discontinuously NNE from about 2 km NE of Beowawe, through some subdued bedrock highlands between Bobs Flat and Boulder Flat, and along the relatively gentle west flank of the Tuscarora Mountains to Richmond Mountain. The short (< 3 km) isolated NNE-trending scarp mapped by Dohrenwend and Moring (1991 #282) at the base of Malpais near Horse Heaven is included herein as part of the Beowawe fault. This scarp is near the southwestern end of the Whirlwind Valley fault zone of dePolo (1998 #2845). Future studies may show connection between this Quaternary feature and those more continuous features NE of Beowawe as shown by dePolo (1998 #2845).

	Fault ID: Referred to as fault WI17A by dePolo (1998 #2845).
County(s) and State(s)	LANDER COUNTY, NEVADA EUREKA COUNTY, NEVADA
Physiographic province(s)	BASIN AND RANGE
Reliability of location	Good Compiled at 1:100,000 scale. *Comments:* Fault traces compiled from the 1:125,000-scale map of young fault scarps by Wallace (1979 #203). That map was compiled mostly from field and photogeologic mapping on 1:60,000-scale aerial photos. The short isolated scarp at the southwest end of the fault was compiled from the 1:250,000-scale map of Dohrenwend and Moring (1991 #282). Scarps are recognized along Whirlwind Valley; although, no published map source detailing their location is known to exist.
Geologic setting	The southern part of the Beowawe fault appears to form the structural margin between a basin beneath Whirlwind Valley on the west and the topographically subdued southernmost part of the Tuscarora Mountains in the east. It may loose displacement to the north where similar-age Paleozoic bedrock is exposed on both sides of the fault west of Bobs Flat (Stewart and Carlson, 1978 #3413). However, displacement may increase northward as it forms the structural boundary between a basin (?) beneath Boulder Valley on the west and the Tuscarora Mountain on the east. The northernmost part of the fault cuts the piedmont slope directly west of the precipitous western flank of south-projecting spur of Richmond Mountain.
Length (km)	44 km.
Average strike	N32°E
Sense of movement	Normal *Comments:* No specific data available; inferred from location and orientation in extensional tectonic province.
Dip Direction	NW
Paleoseismology studies	Site 1151-1 Tuscarora-Malpais trench (Wesnousky and others, 2006 #7559) exposed evidence of two coseismic surface ruptures;

	based on radiocarbon analysis the events occurred about 7450±112 cal years BP and 18701 ± 582 cal years B.P. The thickness of the colluvial wedges place a minimum bound on the vertical offset during the penultimate and most recent events of ~2 m and ~0.7 m, respectively.
Geomorphic expression	Scarps along the Beowawe fault face northwest. In the southern part, where the fault bounds Whirlwind Valley and cuts through the bedrock hills north and south of Interstate Highway 80, Dohrenwend and Moring (1991 #282) mapped the fault as a major range-front structure probably characterized by juxtaposition of bedrock and Quaternary alluvium. But the escarpments along that trace have moderate to subdued geomorphic expression and lack most of the features those authors list as characteristic of tectonically active fronts of major mountain ranges. Also, dePolo (1998 #2845) reported a preferred maximum height of 122 m (98–146 m) for a basal fault facet along the Whirlwind fault, but it is unlikely that the feature he measured is along the Beowawe fault as compiled here. In the central part of the fault (at the west margin of Boulder Flat), Dohrenwend and Moring (1991 #282) mapped the fault as having west-facing scarps on Quaternary deposits or erosion surfaces about 1 km west of the piedmont-hillslope break of the Tuscarora Mountains. Those authors do not map the fault farther north along the western base of Richmond Mountain in the Tuscarora Mountains. Wallace (1979 #203), however, mapped a north-striking young fault scarp on the piedmont west of the southern part of Richmond Mountain and another near Richmond Summit. No details are available on scarp morphology. The lack of concordance in location, extent, and characterization of various parts of this fault in published maps and reports may be taken as an indication that its expression as a Quaternary feature is weak.
Age of faulted surficial deposits	On the basis of their 1: 250,000-scale photogeologic reconnaissance of young faults, Dohrenwend and Moring (1991 #282) mapped one short (< 3 km) scarp as formed on deposits or erosion surfaces of late Pleistocene (10–130 ka) age. Other scarps are mapped as formed on deposits or erosion surfaces of early to middle and (or) late Pleistocene (130 ka to 1.6 Ma) age.
Historic earthquake	
Most recent prehistoric	middle and late Quaternary (<750 ka)

deformation	*Comments:* The timing of most recent faulting is not well constrained. Wallace (1979 #203) estimated it no more precisely than in about the past 500 ka, and Dohrenwend and Moring (1991 #282) estimate that a short (< 3 km) scarp is formed on a late Pleistocene (10–130 ka) deposit or erosion surface. the conservative estimate here is based on Wallace (1979 #203).
Recurrence interval	10 k.y. (<19 ka) *Comments:* Assuming the radiocarbon ages reflect the approximate time of earthquakes, the results suggest a return time of about 10,000 years between the last two surface rupture events (Wesnousky and others, 2006 #7559).
Slip-rate category	Less than 0.2 mm/yr *Comments:* dePolo (1998 #2845) assigned a reconnaissance vertical displacement rate of 0.231 mm/yr based on an empirical relationship between his preferred maximum basal facet height and vertical rate to both parts of this fault as he depicted it. 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 displacement rate reflects a long-term average. However, the late Quaternary characteristics of this fault (overall geomorphic expression, continuity of scarps, age of faulted deposits, etc.) suggest the slip rate during this period is of a lesser magnitude. Results from the Tuscarora-Malpais trench suggest a slow rate of slip in the past 20 k.y. (Wesnousky and others, 2006 #7559). Accordingly, the less than 0.2 mm/yr slip-rate category has been assigned to this fault.
Date and Compiler(s)	2006 R. Ernest Anderson, U.S. Geological Survey, Emeritus Kathleen M. Haller, U.S. Geological Survey
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. #7774 Layman, E.B., 1984, A simple Basin and Range fault

	model for the Beowawe geothermal system, Nevada: Transactions of the Geothermal Resources Council, v. 8, p. 451-456. #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. #7559 Wesnousky, S.G., Barron, A.D., Briggs, R.W., Caskey, S.J., Kumar, Senthil, and Owen, L., 2005, Paleoseismic transect across the northern Great Basin: Journal of Geophysical Research, v. 110, B05408, 25 p.