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Quaternary Fault and Fold Database of the United States

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Bare Mountain fault (Class A) No. 1079

Last Review Date: 1998-06-09

citation for this record: **Anderson, R.E., compiler, 1998, Fault number 1079, Bare Mountain fault, 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	The Bare Mountain fault is a range-front normal fault that places the triangular-shaped Bare Mountain structural block against the Crater Flat basin (on the east). It is located in the southernmost part of the Goldfield sector of the Walker Lane structural belt. The uplifted Bare Mountain block is comprised mostly of Proterozoic and Paleozoic sedimentary rocks whereas, in the downfaulted Crater Flat basin, rocks are overlain by Tertiary and Quaternary volcanic and sedimentary rocks that fill the basin. Total post-Paleozoic throw is estimated to be about 2.6 km. The Bare Mountain fault has been subdivided into five segments, but the fault is considered herein as a simple one because the segments are rather short and the segmentation scheme is not based on contrasts in paleoseismic behavior. Also, on the basis of detailed mapping and trenching, it appears that the Bare Mountain fault probably ruptured along its full 20-km-long trace. The surface trace of the fault is defined by a sharp break in slope at a

	bedrock/alluvium contact that is mostly depositional. The actual fault trace is mostly concealed by alluvium, but the fault is exposed in a few places. In those exposures, both natural and excavated, the fault is expressed as sheared bedrock in contact with silica- and carbonate-cemented alluvium ranging in age from Tertiary to Quaternary. At only two places are fault scarps developed on Quaternary alluvium. These scarps are 100–400 m long and represent 3 m or less of apparent displacement. Holocene deposits are not faulted, whereas late Pleistocene and older surficial deposits are faulted. The best-constrained rate of deformation is an average of 0.01 mm/yr; this data is derived from detailed mapping and trench investigations at three locations. This deformation rate is controversial, as noted in the comments below under slip rate.
Name comments	Name taken from Piety (1995 #915) as equivalent to the Bare Mountain fault zone of Swadley and others (1984 #1664). The fault extends along the eastern base of Bare Mountain, from Joshua Hollow on the north to Black Marble (hill) on the south, a distance of almost 20 km. **Fault ID:** Referred to as BM by Piety (1995 #915) and as DV2 by dePolo (1998 #2845).
County(s) and State(s)	NYE COUNTY, NEVADA
Physiographic province(s)	BASIN AND RANGE
Reliability of location	Good Compiled at 1:100,000 scale. *Comments:* Location taken from Reheis and Noller (1991 #1195) who mapped the fault at 1:100,000 scale based on aerial photographs at 1:12,000 and 1:60,000 scales. The fault has been remapped at 1:12,000 scale by Anderson and Klinger (1996 #3422), but there is no significant difference in the trace compared to the earlier fault maps.
Geologic setting	The north-striking Bare Mountain fault is a range-front fault that bounds the triangular-shaped Bare Mountain structural block against the Crater Flat basin on the east (Swadley and others, 1984 #1664; Reheis, 1988 #1527; Carr and Monsen, 1988 #2307; Monsen and others, 1992 #1586). Bare Mountain is a 1-km-high

	range block bounded by Crater Flat on the east and Amargosa Desert on the west. It is located in the southernmost part of the Goldfield sector of the Walker Lane structural belt as defined by Stewart (1988 #1654). The uplifted Bare Mountain block is comprised mostly of Proterozoic and Paleozoic sedimentary rocks whereas, in the downfaulted Crater Flat basin, rocks are overlain by Tertiary and Quaternary volcanic and sedimentary rocks that fill the basin. Total throw is estimated at 2.6 km (Ackermann and others, 1988 #1437).
Length (km)	18 km.
Average strike	N2°W
Sense of movement	Normal *Comments:* Geologic mapping shows that the fault has primarily dip-slip movement (Monsen and others, 1992 #1586).
Dip	50–70° E. *Comments:* Dip possibly increases southward from 50° in the north to 70° in the south near Wildcat Peak (Monsen and others, 1992 #1586).
Paleoseismology studies	The Bare Mountain fault was mapped and studied in detail because of its proximity (about 15 km) to the proposed high-level nuclear waste repository at Yucca Mountain (Anderson and Klinger, 1996 #3422, 1996 #3875). Trenches were excavated at three sites. From north to south, these are referred to as Tarantula Canyon (site 1079-1), Wildcat Peak (site 1079-2), and Sterling (site 1079-3), and trench logs were published for each by Anderson and Klinger (1996 #3422). These trench logs and supporting data are interpreted to indicate that no deposits younger than late Pleistocene (10–130 ka) have been displaced by faulting (Anderson and Klinger, 1996 #3422). However, evidence for multiple surface-rupturing events was found at the two trench (sites 1079-2 and 1079-3) near the southern end of the fault. At both of these trenches (Wildcat Peak and Sterling), well developed soils with argillic horizons and strongly developed calcium carbonate indicate that substantial time had elapsed between the most-recent event and the penultimate surface-rupturing event (Anderson and Klinger, 1996 #3422). For the Wildcat peak site, this interpretation differs from an earlier one by

	Reheis (1988 #1527) that suggested early Holocene (9 ka) displacement. At the northern (Tarantula Canyon) site, there was apparently only one surface-faulting event in the past 100–200 ka, also suggesting long inter-event times.
Geomorphic expression	The Bare Mountain fault extends from Joshua Hollow (about 5 km north of Tarantula Canyon) south to the southeastern end of Black Marble (hill), a distance of almost 20 km, along which its trace is defined by a sharp break in slope at a bedrock/alluvium contact that is mostly depositional. The actual fault trace is mostly concealed by alluvium, but the fault is exposed in a few places. In those exposures, both natural and excavated, the fault is expressed as sheared bedrock in contact with silica- and carbonate-cemented alluvium ranging in age from Tertiary to Quaternary. Scarps are developed on Quaternary alluvium at only two locations along the fault. These scarps are only 100–400 m long and represent 3 m or less of apparent displacement (Anderson and Klinger, 1996 #3422). dePolo (1998 #2845) reports a maximum preferred basal fault facet height of 207 m.
Age of faulted surficial deposits	Detailed mapping of surficial deposits along the Bare Mountain fault identified seven major units ranging from Miocene to Holocene age (Anderson and Klinger, 1996 #3422). Quaternary units include deposits of early, middle, and late Pleistocene, late Pleistocene to Holocene, and late Holocene age. According to Anderson and Klinger (1996 #3422), Holocene deposits are not faulted, whereas late Pleistocene (10–130 ka) and older surficial deposits are faulted. These age determinations are based on soil development, comparisons of relative age estimates, and on TL ages from unaltered and unfaulted deposits from two trenches. An earlier study (Reheis, 1988 #1527) of a hand-excavated pit at one of the trench sites indicated 1.75 m of vertical displacement in early Holocene deposits estimated to be about 9 ka.
Historic earthquake	
Most recent prehistoric deformation	late Quaternary (<130 ka) *Comments:* Reheis (1988 #1527) divided the Bare Mountain fault into five segments, but the fault is considered a simple one herein because the segmentation was not based on contrasts in paleoseismic behavior. Also, on the basis of detailed mapping and trenching at three sites, Anderson and Klinger (1996 #3422) concluded that the Bare Mountain fault probably ruptured along

	its full 20-km-long trace during the late Pleistocene (10–130 ka). However, Reheis (1988 #1527) indicated 1.75 m of vertical displacement of Holocene deposits estimated to be about 9 ka. This younger timing estimate is not in accord with the limited distribution of fault scarps.
Recurrence interval	*Comments:* Even though numerical-age estimates are limited and precise values of recurrence cannot be obtained, the relative-age data indicate that the recurrence interval for moderate- to large-magnitude surface-rupturing earthquakes is on the order of many tens of thousands of years (Anderson and Klinger, 1996 #3422).
Slip-rate category	Less than 0.2 mm/yr *Comments:* Various vertical displacement rates have been reported for the Bare Mountain fault, although most are poorly constrained. Based on uplift rates calculated from apatite fission-track thermochronometry and interpretation of alluvial-fan sedimentation, Ferrill and others (1996 #2491) argued that the long-term vertical rate increases toward the south and suggested that it could be as high as 0.28 mm/yr. On the basis of the study of the morphology and distribution of alluvial-fan deposits adjacent to Bare Mountain, Ferrill and others (1996 #2491) further suggest the vertical displacement rate at the south may be approximately 0.2 mm/yr. However, this determination has been challenged by Anderson and others (1997 #2401). Their best-constrained slip rate appears to be an average of 0.01 mm/yr as a result of detailed mapping, relative age determinations (soil stratigraphy and development) and trench investigations at the Tarantula Canyon, Wildcat Peak, and Sterling sites (Anderson and Klinger, 1996 #3422). dePolo (1998 #2845) assigned a preferred reconnaissance vertical slip rate of 0.008 mm/yr based on the data presented by Anderson and Klinger (1996 #3422). The late Quaternary characteristics of this fault (overall geomorphic expression, continuity of scarps, age of faulted deposits, etc.) support a low slip rate. Accordingly, the less than 0.2 mm/yr slip-rate category has been assigned to this fault.
Date and Compiler(s)	1998 R. Ernest Anderson, U.S. Geological Survey, Emeritus
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