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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.

Cebollita Mesa fault (Class A) No. 2140

Last Review Date: 2016-04-22

Compiled in cooperation with the New Mexico Bureau of Geology & Mineral Resources

citation for this record: **Machette, M.N., and Jochems, A.P., compilers, 2016, Fault number 2140, Cebollita Mesa 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 02:21 PM.**

Synopsis	The Cebollita Mesa fault has seemingly young (<15 ka) movement, which is anomalous in the sense that there are few mapped Quaternary faults in this region, and in the Colorado Plateaus Province in general. However, field studies have shown that the fault has been recurrently active in the late Quaternary. Single-event scarps on the fault are about 2–2.5 m high, whereas older, late (?) Pleistocene, alluvium has compound (multiple-event) scarps as much as 8 m high. No dating has been conducted to refine the timing of last movement, slip rate, or recurrence interval for this down-to-the-west normal fault.
Name	This Quaternary fault was named by Levish and others (1992

comments	#1715) for Cebollita Mesa, a Pliocene basalt-covered mesa located about 8 km east and northeast of the fault. The fault was first shown by Machette (1978 #1223) on the geologic map of the Socorro 1° x 2° quadrangle, but was overlooked by Machette and McGimsey (1983 #1024) in their later fault compilation. Maxwell (1986 #1720) made the first detailed geologic map that showed the fault, whereas Levish (1992 #1715) characterized its late Quaternary history as part of a dam hazards study. The fault is mapped for about 13 km across the toe slope of dissected Cretaceous bedrock hills. It extends from the north side of Bonine Canyon on the south, north past Head Windmill and New Mexico State Highway 117. About 1 km north of the highway, the fault disappears beneath a young basalt flow.
County(s) and State(s)	CIBOLA COUNTY, NEW MEXICO
Physiographic province(s)	COLORADO PLATEAUS
Reliability of location	Good Compiled at 1:24,000 scale. *Comments:* Trace from approximately 1:100,000-scale geologic map of Levish and others (1992 #1715) and 1:62,500-scale geologic map of Maxwell (1986 #1720) combined with accurate placement using photogrammetric methods.
Geologic setting	The fault offsets the toe slope of dissected Cretaceous bedrock hills west of Cebollita Mesa. To the north, the fault disappears beneath a late Holocene basalt flow, but may continue further as suggested by as much as 300 m of down-to-the-west displacement on two normal faults imaged by shallow seismic-reflection profiling (Kelly and Reynolds, 1989 #1738). The Cebollita Mesa fault is subparallel to (but west of) similarly oriented normal faults that Maxwell (1986 #1720) maps as cutting Pliocene basalts of Cebollita Mesa.
Length (km)	13 km.
Average strike	N4°E
Sense of movement	Normal *Comments:* As mapped by Maxwell (1986 #1720) and seen in natural exposures by Levish and others (1992 #1715).

Dip Direction	W *Comments:* Although not mentioned by Levish and others (1992 #1715), the faults exposed in natural exposure have high-angle (near vertical) dips near the surface (Dan Levish, oral commun., 1988).
Paleoseismology studies	
Geomorphic expression	The fault forms a north-trending, left-stepping series of three en echelon scarps. Levish and others (1992 #1715) measured four scarp profiles: one (P-1) on the northern strand and three (P-2 to P-4) on the southern half of the southern strand. These profiles document single-event scarps of about 2.2–2.5 m height (1.9–2.0 m surface offset) and compound (multiple-event) scarps of about 6.0–8.5 m height (5.2–7.5 m surface offset). All four of the profiled scarps have modest maximum scarp-slope angles of 10–16°, but they are formed on relatively fine-grained, easily eroded sediment. Analysis of this data by Levish and others (1992 #1715) suggested that the younger scarps are late Pleistocene or Holocene in age, whereas as the larger scarps have morphology indicative of late Pleistocene movement. The scarp data suggests that the morphometric data from the younger scarps (P-3 and P-4) are similar to the Drum Mountains scarps (early Holocene) and the Bonneville shoreline (~17.5–18 ka). Conversely, the compound scarps have nearly identical maximum scarp-slope angles as the single-event scarps, suggesting that the steepness of all the scarps is controlled by the younger (<15 ka) event.
Age of faulted surficial deposits	Maxwell (1986 #1720) mapped the faults as offsetting fine-grained Quaternary alluvium derived from Cretaceous sedimentary rock to the east. The smaller scarps are formed on alluvium of the lowest fluvial terrace, whereas the compound scarps are on alluvium that forms the next highest fluvial terrace. These deposits are likely to be latest or late Pleistocene in age (<130 ka). Levish and others (1992 #1715) reported that the scarps are locally muted (buried) by eolian sand. No studies or detailed mapping have been conducted to refine the age of the Quaternary sediment that are offset by the fault. To the north of New Mexico State Highway 117, the fault disappears beneath the McCartys basalt flow, which is estimated to be of late Holocene age, 2.4–3.9 ka (Laughlin and others, 1994 #7439; Maxwell, 1986 # 1720; Dunbar and Phillips, 2004 #7424).

Historic earthquake	
Most recent prehistoric deformation	latest Quaternary (<15 ka) *Comments:* Timing of most recent surface faulting based on scarp-morphology data (Levish and others, 1992 #1715) that is consistent with the continuity of the scarps, and expression on the lowest of the fluvial terraces of local streams that cross the scarps.
Recurrence interval	
Slip-rate category	Less than 0.2 mm/yr *Comments:* It appears that the slip rate probably falls in the less than 0.2 mm/yr category because the 1.9–2.0 m of offset from the most recent event was the result of strain accumulation over 15–120 k.y.
Date and Compiler(s)	2016 Michael N. Machette, U.S. Geological Survey, Retired Andrew P. Jochems, New Mexico Bureau of Geology & Mineral Resources
References	#7424 Dunbar, N.W., and Phillips, F.M., 2004, Cosmogenic ^{36}Cl ages of lava flows in the Zuni-Bandera volcanic field, north-central New Mexico, U.S.A., *in* Cather, S.M., McIntosh, W.C., and Kelley, S.A., eds., Tectonics, geochronology, and volcanism in the Southern Rocky Mountains and Rio Grande Rift: New Mexico Bureau of Geology and Mineral Resources Bulletin 160, p. 309–317. #1738 Kelly, T.E., and Reynolds, C.B., 1989, Structural geology of the Malpais Valley, San Rafael, New Mexico, *in* Anderson, O.J., Lucas, S.G., Love, D.W., and Cather, S.M., eds., Southern Colorado Plateau: New Mexico Geological Society, 40th Field Conference, September 28-October 1, 1989, Guidebook, p. 119-121. #7439 Laughlin, A.W., Poths, J., Healey, H.A., Reneau, S., and WoldeGabriel, G., 1994, Dating of Quaternary basalts using the cosmogenic ^{3}He and ^{14}C methods with implications for excess ^{40}Ar: Geology, v. 22, p. 135–138.

	#1715 Levish, D.R., Vetter, U.R., Ake, J.P., and Piety, L.A., 1992, Seismotectonic study for Black Rock Dam, Bureau of Indian Affairs, Pueblo of Zuni, New Mexico: Bureau of Reclamation Seismotectonic Report 92-3, 62 p. #1024 Machette, M.N., and McGimsey, R.G., 1983, Map of Quaternary and Pliocene faults in the Socorro and western part of the Fort Sumner 1° x 2° quadrangles, central New Mexico: U.S. Geological Survey Miscellaneous Field Studies Map MF-1465-A, 12 p. pamphlet, 1 sheet, scale 1:250,000. #1223 Machette, M.N., compiler, 1978, Preliminary geologic map of the Socorro 1° by 2° quadrangle, central New Mexico: U.S. Geological Survey Open-File Report 78-607, 1 sheet, scale 1:250,000. #1720 Maxwell, C.H., 1986, Geologic map of El Malpais Lava Field and surrounding areas, Cibola County, New Mexico: U.S. Geological Survey Miscellaneous Investigations Map I-1595, 1 sheet, scale 1:62,500.