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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.

Cliff fault (Class A) No. 2111

Last Review Date: 2016-03-29

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

citation for this record: **Personius, S.F., and Jochems, A.P., compilers, 2016, Fault number 2111, Cliff 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 Cliff fault offsets piedmont facies sediment of the Ceja Formation and deposits of two middle Pleistocene terraces of the Rio Salado. Offset relations with these terraces indicate that the time of last movement is bracketed between the approximately 120 ka age of the oldest unfaulted terrace and the approximately 220–180 ka age of the youngest faulted terraces.
Name comments	The Cliff fault was first mapped by Denny (1941 #1293), but he did not show offset in surficial deposits. Machette (1978 #1400; 1982 #1401) and Machette and McGimsey (1983 #1024) remapped and named the Cliff fault for the Cliff triangulation station (site 2111-1), where the fault is particularly well exposed.

	Fault ID: Fault number 11 of Machette (1982 #1401) and fault number 10 of Machette and McGimsey (1983 #1024).
County(s) and State(s)	SOCORRO COUNTY, NEW MEXICO
Physiographic province(s)	BASIN AND RANGE
Reliability of location	Good Compiled at 1:24,000 scale. *Comments:* Fault trace is from 1:24,000-scale maps of Machette (1978 #1400), Chamberlin and others (2001 #7474), and Connell and McCraw (2007 #7475).
Geologic setting	The Cliff fault is located in an intrabasin setting, antithetic to the main rift-margin faults (Loma Pelada [2113] and Loma Blanca [2112] faults) in this part of the Belen sub-basin of the Albuquerque basin.
Length (km)	19 km.
Average strike	N2°W
Sense of movement	Normal
Dip	60° W *Comments:* Dip measurement is from upper 30 m of exposed sedimentary rocks (Machette, 1978 #1400).
Paleoseismology studies	Although no trenches have been excavated along this fault, spectacular erosion along the fault near the Cliff triangulation station (site 2111-1) yields trench-like exposures. The best summary of a chronology for the Cliff fault appears in Machette (1978 #1433). His study indicates that the Cliff surface (erosional surface on sediment of the Sierra Ladrones Formation) was relatively stable for about 300 k.y., then was faulted about 6 m sometime between 120 ka and 140 ka.
Geomorphic expression	The Cliff fault is well expressed in basin-fill sediment near the Cliff triangulation station (Machette, 1978 #1433). Calcic soils that formed on the erosional Cliff surface for about 300 k.y.

	appear to be faulted about 6 m in section, but the associated scarps are masked by colluvium and eolian sand. At its northern end, Connell and McCraw (2007 #7475) mapped approximately 2.5 km of both east- and west-down scarps 1.8–9 m high on stream alluvium with stage III pedogenic carbonate (unit Qvm3). To the south, the fault forms subtle scarps on two alluvial terraces of Rio Salado (units Qag and Qaf) but a younger (approximately 120-ka) inset terrace of the Rio Salado (unit Qae) appears to be unfaulted. Sion and others (2013 #7477) confirmed that this unfaulted terrace (their unit Qte) overlaps the Cliff fault. The scarps on alluvial units Qag and Qaf appear to be about 6 m high, although this is difficult to determine because the terraces have an eolian cover.
Age of faulted surficial deposits	The Cliff fault offsets Pliocene sediments of the Ceja Formation (Machette, 1978 #1400; Connell and McCraw, 2007 #7475), the Cliff surface (approximately 440 ka) and late middle Pleistocene (approximately 220 and 180 ka) alluvial terrace deposits of the Rio Salado (Machette, 1978 #1400; 1978 #1433; Machette and McGimsey, 1983 #1024). All of these age estimates are based on pedogenic calcium carbonate contents and regional rates of soil formation (Machette 1978 #1433). Sion and others (2013 #7477) correlated the oldest unfaulted terrace deposit (their unit Qte) with a 122±18-ka surface.
Historic earthquake	
Most recent prehistoric deformation	late Quaternary (<130 ka) *Comments:* Offset relations and quantitative soils studies of alluvial terrace deposits of the Rio Salado and the Cliff surface indicate that the age of last movement is bracketed between the approximately 120 ka soil age of the oldest unfaulted terrace and the approximately 140 ka soil age of the youngest faulted terrace (Machette, 1978 #1433; Machette and McGimsey, 1983 #1024). However, Sion and others' (2013 #7477) oldest unfaulted terrace deposit (their unit Qte) is correlated with a 122±18-ka surface; thus, evidence is weak for late Quaternary (<130-ka) movement.
Recurrence interval	*Comments:* No movement has occurred on this fault since the most recent event at 120–140 ka, thus reflecting an incomplete recurrence interval. In addition, the penultimate event appears to

	have occurred around 440 ka, as determined from quantitative analyses of soil development.
Slip-rate category	Less than 0.2 mm/yr *Comments:* Low slip-rate category assigned based on fault scarp data of Machette (1978 #1433) and age estimates of Machette and McGimsey (1983 #1024).
Date and Compiler(s)	2016 Stephen F. Personius, U.S. Geological Survey Andrew P. Jochems, New Mexico Bureau of Geology & Mineral Resources
References	#7474 Chamberlin, R.M., Cather, S.M., Nyman, M., W., and McLemore, V.T., 2001, Geologic map of the Lemitar 7.5-minute quadrangle, Socorro County, New Mexico: New Mexico Bureau of Geology and Mineral Resources Open-File Geologic Map 38, scale 1:24,000. #7475 Connell, S.D., and McCraw, D.J., 2007, Preliminary geologic map of the La Joya NW quadrangle, Socorro County, New Mexico: New Mexico Bureau of Geology and Mineral Resources Open-File Geologic Map 140, scale 1:24,000. #1293 Denny, C.S., 1941, Quaternary geology of the San Acacia area, New Mexico: Journal of Geology, v. 49, p. 225-260. #1400 Machette, M.N., 1978, Geologic map of the San Acacia quadrangle, Socorro County, New Mexico: U.S. Geological Survey Geologic quadrangle Map GQ-1415, 1 sheet, scale 1:24,000. #1433 Machette, M.N., 1978, Late Cenozoic geology of the San Acacia-Bernardo area, *in* Hawley, J.W., ed., Guidebook to Rio Grande rift in New Mexico and Colorado: New Mexico Bureau of Mines and Mineral Resources Circular 163, p. 135-137. #1401 Machette, M.N., 1982, Quaternary and Pliocene faults in the La Jencia and southern part of the Albuquerque-Belen basins, New Mexico—Evidence of fault history from fault-scarp morphology and Quaternary geology, *in* Grambling, J.A., and Wells, S.G., eds., Albuquerque Country II: New Mexico Geological Society, 33rd Field Conference, November 4-6, 1982, Guidebook, p. 161-169.

	#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. #7477 Sion, B.D., Phillips, F.M., Axen, G.J., and Harrison, B., 2013, Using Quaternary fluvial terraces as structural indicators of magma body-related uplift, Socorro, NM: Abstract EP53A-0742 presented at 2013 Fall Meeting, AGU, San Francisco, California, 9-13 December.