Jump to Navigation

Quaternary Fault and Fold Database of the United States

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Cortez Mountains fault zone, middle section (Class A) No. 1157b

Last Review Date: 2004-06-15

citation for this record: **Anderson, R.E., compiler, 2004, Fault number 1157b, Cortez Mountains fault zone, middle 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 02:17 PM.**

Synopsis	**General:** The Cortez Mountains are one of many southeast- to east-tilted ranges in north-central Nevada with precipitous west-facing bedrock escarpments that may have resulted from long-term (>1–2 m.y.) accelerated displacement during the latter part of the past 10–14 Ma. The Cortez Mountains fault zone is a major generally northeast trending basin-range fault that separates the basin beneath Crescent Valley on the northwest from the Cortez Mountains on the southeast. The northeastern part of the fault trend northerly, and has a singular fault trace that probably has not been active in the past 15 k.y. The middle part of the fault trends more westerly, and also has a singular fault trace but it clearly displaces middle Holocene sediment. A paleoseismic investigation at Fourmile Canyon suggests that the most recent faulting event along this medial part of the fault occurred at about 2.7–2.6 ka. On the basis of scarp profiling along the entire fault

	zone, the last surface-faulting event was estimated to have produced a mean normal-sense offset of 2.7 m about 3 k.y. ago, which compares well with the preliminary paleoseismic data. The southwestern part of the fault is less conspicuous, but its multiple traces are estimated to have been active in the past 130 k.y. (late Quaternary). **Sections:** This fault has 3 sections. The Cortez Mountains fault zone is herein divided into sections based on abrupt changes in trend and/or shape of the fault trace as well as estimated age of the last surface faulting event (Wallace, 1979 #203). Preliminary results from an ongoing paleoseismic investigation appear to substantiate this partitioning of the fault zone.
Name comments	**General:** Name from dePolo (1998 #2845) who applied it to the main range-bounding fault at the northwestern base of the Cortez Mountains. The fault separates the uplifted Cortez Mountains from the basin beneath Crescent Valley and extends southwest to the northernmost flank of the Toiyabe Range and northeast to the narrow north-northeast-trending, northernmost part of the Cortez Mountains. The feature was referred to as the "northwest flank Cortez Mountains scarps" by Wallace (1979 #203). **Section:** This section extends along the northwestern base of the Cortez Mountains southwest from the concave-west sharp bend directly east of Frenchie Flat to the vicinity of the open-pit mines about 1.5 km west of Mill Creek. **Fault ID:** Fault referred to as WI22 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 trace taken from 1:125,000-scale map of young fault scarps by Wallace (1979 #203). That map is based mostly on photogeologic and field mapping on 1:60,000-scale aerial photos transferred to 1:62,500-scale topographic maps.
Geologic setting	The Cortez Mountains are one of many southeast- to east-tilted ranges in central Nevada (Wallace, 1979 #203). The Cortez

	Mountains fault zone is a major basin-range fault that separates the basin beneath Crescent Valley on the northwest from the Cortez Mountains on the southeast. Wallace (1978 #2648) concluded that formation of the precipitous high bedrock escarpment along the range resulted from long-term (>1–2 m.y.) accelerated displacement during the latter part of the past 10–14 Ma. The northeast section [1604a] strikes north-northeast along the sharply defined western base of the narrow northernmost part of the Cortez Mountains. It apparently forms the eastern structural margin of a narrow eastern arm of the basin beneath Crescent Valley, which is between the Cortez Mountains and the Dry Hills. The middle section [1157b] strikes northeast and separates the main, strongly uplifted part of the Cortez Mountains from the main (broad) part of Crescent Valley. The southwest section [1157c] is marked by a convex-northwest fault along the base of the northern extreme of the very long Toiyabe Range block. It separates that block from the southern part of the basin beneath Crescent Valley and includes a group of short northeast-striking piedmont faults that are distributed west toward Red Mountain.
Length (km)	This section is 33 km of a total fault length of 63 km.
Average strike	N50°E (for section) versus N48°E (for whole fault)
Sense of movement	Normal *Comments:* Friedrich and others (2004 #7770)
Dip Direction	NW
Paleoseismology studies	Site 1157-1. Anke Friedrich (Cal Tech, written commun. 2001) excavated a trench across proximal alluvial-fan deposits at the mouth of Fourmile Canyon, which is about 6 km northeast of the open-pit mines. This trench revealed evidence for one late Holocene surface faulting event (2.8 ± 0.1 ka) in alluvial deposits; no prior event occurred between 2.8 and 6.4 ± 0.1 ka, the age of strata near the base of the exposure (Friedrich and others, 2004 #7770). About 4.6 ±0.4 m of vertical offset is recorded in the trench, and this offset compares well with 2.5 and 5 m offsets determined from scarp profiling along this section of the fault.
Geomorphic expression	The section is mapped by Wallace (1979 #203) as having northwest-facing scarps at the abrupt break in slope between the precipitous northwest-facing bedrock escarpment of the Cortez Mountains and the piedmont slope marginal to Crescent Valley.

	Dohrenwend and Moring (1991 #282) mapped it as short isolated scarps on Quaternary alluvial fan deposits separated by longer traces of a major range-front fault that typically juxtaposes Quaternary alluvium against bedrock, but generally lacks scarps on Quaternary surficial deposits or erosion surfaces. No detailed descriptions of the scarps are reported, but Pearthree (1989 #238) measured 18 scarp profiles across the Cortez Mountains fault and reported a mean offset of 2.7 m for the last surface-faulting event. Apparently 10 of those profiles were measured across the middle section [1157b], but the data for timing were not analyzed separately. dePolo (1998 #2845) reported preferred maximum basal facet heights of 134 m (110-207 m) for the Cortez Mountains fault. It is unknown along which section that measurement was made.
Age of faulted surficial deposits	On the basis of photogeologic reconnaissance (1:58,000-nominal-scale aerial photos) Dohrenwend and Moring (1991 #282) estimated that the short scarps are developed on deposits or erosion surfaces of either late Pleistocene age (10-130 ka) or latest Pleistocene to Holocene age (0-30 ka) age.
Historic earthquake	
Most recent prehistoric deformation	latest Quaternary (<15 ka) *Comments:* Pearthree (1989 #238) measured 18 profiles across the Cortez Mountains fault and, on the basis of analysis of a subset of 13 of those scarps, estimates a mean age of 3.0 ka for the last surface-faulting event, which agrees well with the timing of the most recent coseismic surface ruputre at Fourmile Canyon of 2.8 ka (Friedrich and others, 2004 #7770).Wallace (1979 #203), on the basis of a reconnaissance investigation of field-observed scarp morphology, estimated the youngest scarps along this section to have formed in the past 12 ka.
Recurrence interval	*Comments:* The Fourmile Canyon trench revealed evidence for one late Holocene surface faulting event (2.8 ± 0.1 ka) in alluvial deposits; no prior event occurred between 2.8 and 6.4 ± 0.1 ka, the age of strata near the base of the exposure (Friedrich and others, 2004 #7770).
Slip-rate	Less than 0.2 mm/yr

category	*Comments:* dePolo (1998 #2845) assigned a reconnaissance vertical slip rate of 0.214 mm/yr based on an empirical relationship between his preferred maximum basal facet height and vertical slip rate. 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 slip 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. Accordingly, the less than 0.2 mm/yr slip-rate category has been assigned to this fault.
Date and Compiler(s)	2004 R. Ernest Anderson, U.S. Geological Survey, Emeritus
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. #7770 Friedrich, A.M., Lee, J., Wernicke, B.P., and Sieh, K., 2004, Geologic context of geodetic data across a Basin and Range normal fault, Crescent Valley, Nevada: Tectonics, v. 23, TC2015, doi:10.1029/2003TC001528. #238 Pearthree, P.A., Demsey, K.A., Bull, W.B., and Slaff, S., 1989, Detailed geomorphic studies of late Quaternary faulting in central Nevada: Technical report to U.S. Geological Survey, Earthquake Hazards Reduction Program, under Contract 14-0001-08-G1360, December 1989, 17 p. #2648 Wallace, R.E., 1978, Geometry and rates of change of fault-generated range fronts, north-central Nevada: Journal of Research of the U.S. Geological Survey, v. 6, no. 5, p. 637-649. #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.

	#240 Wallace, R.E., 1987, Grouping and migration of surface faulting and variations in slip rates on faults in the Great Basin province: Bulletin of the Seismological Society of America, v. 77, no. 3, p. 868-876.