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Quaternary Fault and Fold Database of the United States

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Cortez Mountains fault zone, southwest section (Class A) No. 1157c

Last Review Date: 2000-06-15

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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:** The primary fault of this section extends along the front of the Cortez Mountains from the vicinity of the open-pit mines about 1.5 km west of Mill Creek southwest across Cortez Canyon to the northwestern base of the northernmost Toiyabe Range. The section has an overall convex-northwest trace. Its northeast end is close to intersecting the northern section of the Simpson Park Mountains fault zone [1178a], and is echelon to the middle section of the Cortez Mountains fault zone [1157b]. Because of this structural misalignment, and because Wallace (1979 #203) characterized the scarps as older than those along the adjacent middle section, it is considered herein as a separate older section of the Cortez Mountains fault zone. Other faults included in this section are widely distributed mainly northeast and east-striking structures that extend westward toward Rocky Pass in the northern Toiyabe Range and extending northwest into southern Crescent Valley. Those faults are based on the photogeologic mapping of scarps on Quaternary deposits or erosion surfaces by Dohrenwend and Moring (1991 #282). Their structural relation ship to the main range-bounding fault is not known. **Fault ID:** Fault referred to as WI22 by dePolo (1998 #2845).
County(s) and	

County(s) and State(s)	LANDER COUNTY, NEVADA
Physiographic province(s)	BASIN AND RANGE
Reliability of location	Good Compiled at 1:100,000 scale. *Comments:* The main fault trace is 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. The fault traces distributed to the west are taken from the 1:250,000-scale photogeologic compilation of Dohrenwend and Moring (1991 #282) who used aerial photos at nominal 1:58,000-scale.
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 19 km of a total fault length of 63 km.
Average strike	N57°E (for section) versus N48°E (for whole fault)
Sense of movement	Normal

	Comments: Normal sense is inferred from location in an extensional tectonic province and evidence of normal faulting at one site to the south (Friedrich and others, 2004 #7770).
Dip Direction	NW
Paleoseismology studies	
Geomorphic expression	The primary fault in this section is mapped by Wallace (1979 #203) as a concealed fault trace. Unlike the other two sections of the Cortez Mountains fault zone to the northeast, only a short (<2 km) part of the main trace (between Copper Canyon and Cortez Canyon) is marked by an abrupt break in slope between the precipitous bedrock escarpment and the piedmont slope. The remainder of the trace follows an irregular and rather gradual topographic transition zone between piedmont and range, and appears to bend southward and enter the range in the area where the fault separates into west-distributed multiple faults. Dohrenwend and Moring (1991 #282) mapped it as a major range-front fault that is generally characterized by juxtaposition of Quaternary deposits against bedrock, but not by scarps on Quaternary deposits or on erosion surfaces. The distributed faults that comprise the southwestern part of the fault zone extend into the Toiyabe Range and from there into the eastern part of a small, unnamed basin that separates the Red Mountains on the west. These scarps face northwest and are relatively short (<3 km) (Dohrenwend and Moring, 1991 #282). No detailed descriptions of these scarps are reported, but they were probably not active during the late Quaternary (Dohrenwend and Moring, 1991 #282). 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, four of those profiles were measured across the southwest section [1157c]. 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) estimate the short scarps that are distributed northwest of the main fault to be developed mainly on deposits or erosion surfaces of middle to early Pleistocene age (0.13–1.6 Ma); one scarp is on deposits of questionable late Pleistocene (10-130 ka) age.

Historic earthquake	
Most recent prehistoric deformation	middle and late Quaternary (<750 ka) *Comments:* Timing of the most recent event is not clear based on the published information available; however, the youngest permissible age category is indicated here. 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 500 ka. Dohrenwend and Moring (1991 #282) show several short scarps in the zone of distributed faults cutting deposits of indeterminate age. 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, estimated a mean age of 3.0 ka for the last surface-faulting event. It appears that four of those profiles were measured across the southwest section [1157c]; however his general timing estimate probably does not apply to this section of the fault zone.
Recurrence interval	
Slip-rate category	Less than 0.2 mm/yr *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)	2000 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.