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Carson City fault (Class A) No. 1653

Last Review Date: 1999-10-13

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Synopsis	This nearly continuous, north-northeast-striking fault zone has: (1) a main east-dipping, range-front fault extending from Indian Hill north to "C" Hill; (2) a distributed zone of short, west-dipping faults bounding the west side of Indian Hill on the east side of Jacks Valley; and (3) intrabasin faults that splits off the range-front fault at "C" Hill and strikes north and then northeast through downtown Carson City to east of Lone Mountain; fault zone may be related to the Carson Range fault [1285], based on proximity, and similar sense of displacement. The distributed zone of faults on the east side of Jacks Valley is expressed as short, west-facing scarps on Quaternary alluvium and Quaternary-Tertiary gravel. East-dipping faults associated with the range-front fault extend south into the Indian Hill area and are expressed as east-facing scarps on Quaternary-Tertiary gravel and juxtapose this unit against Quaternary alluvium. Faults along the main range-front fault are expressed by uplifted terraces, hill-side

	scarps, and an oversteepened range-front that has maximum basal fault facets heights ranging from 85 to 134 m. The intrabasin faults within Carson City are expressed as east and southeast-facing scarps on Holocene and Pleistocene alluvium. A north-trending scarp just west of Minnesota Street in Carson City is 13 m high and an east-trending scarp two blocks north of U.S. Highway 50 represents 5 m of vertical offset. Detailed surficial and bedrock mapping are the sources of data.
Name comments	Refers to faults mapped by Matthews (1968 #3610), Slemmons (1968, unpublished Reno 1:250,000-scale map), Bingler (1977 #3639), Trexler (1977 #3640), Pease (1979 #2566; 1980 #2560; 1980 #2880), Trexler and Bell (1979 #2634), Bell and Trexler (1979 #2420), Bell and Pease (1980 #2418), Bell (1984 #105), Greene and others (1991 #3487), Ramelli and others (1994 #2573; 1999 #3636), and Dohrenwend and others (1996 #2846) extending from Lone Mountain south through Carson City to the east side of Jacks Valley. These faults are part of the Carson City segment of the Carson Range fault system and are collectively referred to as the Carson City fault by Ramelli and others (1994 #2573; 1999 #3636). **Fault ID:** Refers to fault R14E of dePolo (1998 #2845).
County(s) and State(s)	CARSON CITY COUNTY, NEVADA DOUGLAS COUNTY, NEVADA
Physiographic province(s)	CASCADE-SIERRA MOUNTAINS BASIN AND RANGE
Reliability of location	Good Compiled at 1:100,000 scale. *Comments:* Fault locations are primarily based on 1:100,000-scale map of Ramelli and others (1994 #2573) that was, in part, based on compilation of 1:24,000-scale maps of Trexler (1977 #3640), Trexler and Bell (1979 #2634), and Pease (1980 #2560; 1980 #2880). Additional fault traces are from 1:24,000-scale maps of Bingler (1977 #3639) and Bell and Trexler (1979 #2420).
Geologic setting	This nearly continuous, north-northeast-striking fault zone has: (1) a main east-dipping, range-front fault extending from Indian Hill north to "C" Hill; (2) a distributed zone of short, west-dipping faults bounding the west side of Indian Hill on the east side of Jacks Valley; and (3) an intrabasin section that splits off

	the range-front section at "C" Hill and trends north and then northeast through downtown Carson City to east of Lone Mountain (Matthews, 1968 #3610; Bingler, 1977 #3639; Trexler, 1977 #3640; Bell and Trexler, 1979 #2420; Pease, 1980 #2560; 1980 #2880); southern end of fault zone appears to splay northeastward from the Genoa fault [1285] at the base of Genoa Peak, suggesting that the two faults may be related.
Length (km)	16 km.
Average strike	N21°E
Sense of movement	Normal *Comments:* (Matthews, 1968 #3610; Bingler, 1977 #3639; Trexler, 1977 #3640; Bell and Trexler, 1979 #2420; Trexler and Bell, 1979 #2634; Pease, 1980 #2560; 1980 #2880).
Dip Direction	E *Comments:* Trench logs of Pease (1979 #2566) show that the exposed parts of the faults are steeply dipping.
Paleoseismology studies	Site 1653-1. Trenches T-2 (northern) and T-3 (southern) of Pease (1979 #2566) were located in T14N, R19E, sec. 18.; both trenches record multiple events. The most recent event had about 1 m of vertical displacement that occurred within the past 2 k.y.; the penultimate event is inferred to have occurred between 200,000 and 700,000 yr ago. Trench logs are provided but few other details are reported. Site 1653-2 C Hill trench (Ramelli and others, 1999 #5906) exposed a narrow fault zone that juxtaposes alluvium against bedrock. Two coseismic surface ruptures are interpreted and an older unconstrained event. The most recent event occurred about 390±40 yr BP; the penultimate event occurred after 2590±130 yr BP and probably resulted in larger displacement.
Geomorphic expression	Range-front faults are expressed as east-facing scarps on Quaternary-Tertiary gravel, uplifted terraces, hillside scarps, and an oversteepened range-front with maximum basal fault facets heights ranging from 85 to 134 m (Matthews, 1968 #3610; Pease, 1980 #2560; 1980 #2880; Ramelli and others, 1994 #2573; dePolo, 1998 #2845). The distributed zone of faults on the east

	side of Jacks Valley is expressed as short, west-facing scarps on Quaternary alluvium and Quaternary-Tertiary gravel (Pease, 1980 #2560; 1980 #2880). Intrabasin faults within Carson City are expressed as east and southeast-facing scarps on Holocene and Pleistocene alluvium (Trexler, 1977 #3640; Trexler and Bell, 1979 #2634). A north-trending scarp just west of Minnesota Street in Carson City is 13 m high and an east-trending scarp two blocks north of U.S. Highway 50 represents 5 m of vertical offset (Ramelli and others, 1994 #2573). Pease (1979 #2566) suggests that many of the scarps have bevels that clearly represent as many as 2 or 3 faulting events.
Age of faulted surficial deposits	Holocene; Pleistocene; Tertiary. Bingler (1977 #3639), Trexler (1977 #3640), and Pease (1980 #2880) mapped faults displacing alluvial units ranging in age from Holocene through Pleistocene to Tertiary.
Historic earthquake	
Most recent prehistoric deformation	latest Quaternary (<15 ka) *Comments:* A latest Quaternary time is indicated from mapping of Pease (1979 #2566) and Trexler and Bell (Trexler and Bell, #2634; 1979 #3641), who suggested that some of the faults in this zone may have ruptured in the past 3 k.y.; which is consistent with studies by Slemmons (1968, unpublished Reno 1:250,000-scale map).
Recurrence interval	*Comments:* Pease (1979 #2566) estimated a number of recurrence intervals for the individual fault traces in this zone. They range from a few thousands of years to hundreds of thousands of years.
Slip-rate category	Less than 0.2 mm/yr *Comments:* Ramelli and others (1999 #5906) interpret the available data from their trench to suggest that on average 1 m of vertical displacement per 1500 yr. 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. Even though, the late Quaternary characteristics of this fault (overall geomorphic expression, continuity of scarps, age of faulted deposits, etc.) indicate young movement, Pease (1979 #2566) suggests that intervals between faulting events could be hundreds of thousands of years. Accordingly, the less than 0.2 mm/yr slip-rate category has been assigned to this fault.
Date and Compiler(s)	1999 Kenneth Adams, Piedmont Geosciences, Inc. Thomas L. Sawyer, Piedmont Geosciences, Inc.
References	#105 Bell, J.W., 1984, Quaternary fault map of Nevada—Reno sheet: Nevada Bureau of Mines and Geology Map 79, 1 sheet, scale 1:250,000. #2418 Bell, J.W., and Pease, R.C., 1980, Soil stratigraphy as a technique for fault activity assessment in the Carson City area, Nevada, *in* Evernden, J.F., ed., Earthquake hazards along the Wasatch and Sierra-Nevada frontal fault zones: U.S. Geological Survey Open-File Report 80-801, p. 577-600. #2420 Bell, J.W., and Trexler, D.T., 1979, Earthquake hazards map, New Empire quadrangle: Nevada Bureau of Mines and Geology Map 1Bi, scale 1:24,000. #3639 Bingler, E.C., 1977, New Empire geologic map: Nevada Bureau of Mines and Geology Map 59, scale 1:24,000. #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. #2846 Dohrenwend, J.C., Schell, B.A., Menges, C.M., Moring, B.C., and McKittrick, M.A., 1996, Reconnaissance photogeologic map of young (Quaternary and late Tertiary) faults in Nevada, *in* Singer, D.A., ed., Analysis of Nevada's metal-bearing mineral resources: Nevada Bureau of Mines and Geology Open-File Report 96-2, 1 pl., scale 1:1,000,000. #3487 Greene, R.C., Stewart, J.H., John, D.A., Hardyman, R.F., Silberling, N.J., and Sorensen, M.L., 1991, Geologic map of the Reno 1° by 2° quadrangle, Nevada and California: U.S. Geological Survey Miscellaneous Field Studies Map MF-2154-A,

scale 1:250,000.

#3610 Matthews, R.A., 1968, Geologic map of the north half of the Lake Tahoe Basin, California and Nevada: California Division of Mines and Geology Open-File Report, scale 1:62,500.

#2560 Pease, R.C., 1979, Genoa quadrangle—Earthquake hazards map: Nevada Bureau of Mines and Geology Map 1Ci, 1 sheet, scale 1:24,000.

#2566 Pease, R.C., 1979, Scarp degradation and fault history south of Carson City, Nevada: Reno, University of Nevada, unpublished M.S. thesis, 90 p.

#2880 Pease, R.C., 1980, Geologic map of the Genoa 7 1/2-minute quadrangle: Nevada Bureau of Mines and Geology Map 1Cg, 1 sheet, scale 1:24,000.

#3636 Ramelli, A.R., Bell, J.W., dePolo, C.M., and Yount, J.C., 1999, Large-magnitude, late Holocene earthquakes on the Genoa fault, west-central Nevada and eastern California: Bulletin of the Seismological Society of America, v. 89, p. 1458-1472.

#2573 Ramelli, A.R., dePolo, C.M., and Bell, J.W., 1994, Synthesis of data and exploratory trenching along the northern Sierra Nevada fault zone: National Earthquake Hazards Reduction Program, Final Technical Report, 65 p., scale 1:100,000.

#5906 Ramelli, A.R., dePolo, C.M., and Bell, J.W., 1999, Paleoseismic studies of the northern Sierra Nevada frontal fault zone: Technical report to U.S. Geological Survey, Reston, Virginia, under Contract 1434-HQ-97-GR-03043, 16 p.

#3640 Trexler, D.T., 1977, Geologic map-Carson City folio: Nevada Bureau of Mines and Geology Map 1Ag, scale 1:24,000.

#2634 Trexler, D.T., and Bell, J.W., 1979, Earthquake hazards map, Carson City quadrangle: Nevada Bureau of Mines and Geology Map 1Ai, scale 1:24,000.

#3641 Trexler, D.T., and Bell, J.W., 1979, Earthquake hazard maps of Carson City, New Empire, and South Lake Tahoe quadrangles: Technical report to U.S. Geological Survey, Reston,

	Virginia, under Contract 14-08-001-G-494.