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Quaternary Fault and Fold Database of the United States

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North Tahoe fault (Class B) No. 1649

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Synopsis	The North Tahoe fault bounds steep bathymetric escarpments adjacent to the deepest part of Lake Tahoe. The Lake Tahoe basin is a north-trending graben containing more than 400 m of gently west-tilted sediment. Nearby faults include the Incline Village fault [1650] and the East Tahoe fault [1651]. Offshore, the fault is expressed as abrupt change in slope at base of <430-m-high escarpment, which slopes <45? and appears to exhibit "wine-glass-canyon" dissection and basal fault facets. The fault has been imaged on a seismic reflection profile as a 14-m-high scarp on the floor of Lake Tahoe off Dollar Point, which is associated with warped and offset recent lake sediments; displacements increase with depth indicating recurrent Quaternary movement. Possibly related faults onshore displace Quaternary colluvial deposits on northwest shore of Crystal Bay, along the southeast flank of Mt Baldy where they displace a Pliocene erosion surface 320 m down to the southeast, and on colluvial deposits in the Rifle Peak area

	north of Incline Village. Detailed geologic mapping onshore and a seismic reflection profile and recent detailed bathymetric mapping offshore are the sources of data. Detailed studies of the fault have not been conducted.
Name comments	Refers to faults mapped by Birkeland (1963 #3622), Matthews (1968 #3610), Bonham (1969 #2999), Burnett (1968 #3623), Hyne and others (1972 #3629), Henyey and Palmer (1974 #3628), Grose (1986 #3609), Hawkins and others (1986 #3627), Lewis (1988 #2526), Jennings (1994 #2878), Schweickert and others (1999 #3631), and Gardner and others (2000 #5904). The fault extends from about 7 km north of Incline Village southwestward through Rifle Peak area, along east flank of Mt Baldy and west margin of Crystal Bay, and continues offshore from Stateline Point to Emerald Bay and continues at least to the southwest end of Fallen Leaf Lake (Gardner and others, 2000 #5904). This fault has been referred to as the North Tahoe fault in several publications (e.g., Jennings, 1994 #2878); includes the Rifle Peak fault zone of Lewis (1988 #2526). Gardner and others (2000 #5904) refer to each of the three traces as shown here by different names: the Western Boundary fault, the Kings Beach fault, and the State Line fault (from west to east). A single description is provided here because all traces dip to the east and the surface traces possibly merge east of Tahoe Pines, Calif. **Fault ID:** Fault 102 of Jennings (1994 #2878).
County(s) and State(s)	PLACER COUNTY, CALIFORNIA WASHOE COUNTY, NEVADA
Physiographic province(s)	CASCADE-SIERRA MOUNTAINS
Reliability of location	Poor Compiled at 1:150,000 scale. *Comments:* Most of the length of the fault's inferred location is based on interpretation of high-resolution bathymetric data of the floor of Lake Tahoe (Gardner and others, 2000 #5904), and thus is considered poorly constrained. The faults are shown on large-scale figure 4 of Gardner and others (2000 #5904); they were visually transferred to map of Smith and others (1998 #5905), scale approximately 1:125,000 for digitizing. Fault locations onshore are generally of good quality and based on 1:24,000-scale map of Lewis (1988 #2526) with few additional traces from the

	1:125,000-scale map of Matthews (1968 #3610).
Geologic setting	The North Tahoe fault bounds steep bathymetric escarpments adjacent to the deepest part of Lake Tahoe (Birkeland, 1963 #3622; Matthews, 1968 #3610; Burnett, 1968 #3623; Bonham, 1969 #2999; Hyne and others, 1972 #3629; Grose, 1986 #3609; Hawkins and others, 1986 #3627; Lewis, 1988 #2526; Jennings, 1994 #2878; Schweickert and others, 1999 #3631; Gardner and others, 2000 #5904). The Lake Tahoe basin is a north-trending graben (e.g., Birkeland, 1963 #3622; Durrell, 1965 #3624; Bateman and Wahrhaftig, 1966 #3621; Burnett, 1968 #3623) containing more than 400 m of gently west-tilted sediment (Hyne and others, 1972 #3629). Gardner and others (2000 #5904) best describe the shape of the basin as an old fashioned bathtub with three steep sides to the west, north, and east and a gently dipping side to the south of the lake.
Length (km)	25 km.
Average strike	N24°E
Sense of movement	Normal *Comments:* Not studied in detail; several previous workers agree on a normal sense of movement (e.g., Matthews, 1968 #3610; Bonham, 1969 #2999; Hyne and others, 1972 #3629; Gardner and others, 2000 #5904), and some have inferred sinistral slip from sense of slip on other northeast-striking faults in the region such as the Olinghouse and Dog Valley faults (e.g., Hawkins and others, 1986 #3627; Lewis, 1988 #2526; Schweickert and others, 1999 #3631).
Dip Direction	E
Paleoseismology studies	
Geomorphic expression	Offshore, the fault is expressed as abrupt change in slope at base of <430-m-high escarpment, which slopes <45? (Hyne and others, 1972 #3629) and may exhibit "wine-glass-canyon" dissection and basal fault facets. The fault has been imaged on a seismic reflection profile as a 14-m-high scarp on floor of Lake Tahoe off Dollar Point, which is associated with warped and offset recent lake sediments; displacements increase with depth indicating recurrent Quaternary movement (Hyne and others, 1972 #3629).

	Possibly related faults onshore displace Quaternary colluvial deposits on northwest shore of Crystal Bay (Grose, 1986 #3609; Lewis, 1988 #2526), bound southeast flank of Mt Baldy (Matthews, 1968 #3610; Burnett, 1968 #3623; Hawkins and others, 1986 #3627; Lewis, 1988 #2526) where they displace a Pliocene erosion surface 320 m down to the southeast (Lewis, 1988), and are expressed as 1- to 7-m-high scarps, including compound scarps, on glacial moraines as young as latest Pleistocene (probable Tioga age) and on colluvial deposits in the Rifle Peak area north of Incline Village (Lewis, 1988 #2526; Lewis and Grose, 1988 #2527).
Age of faulted surficial deposits	Holocene; latest Pleistocene; Quaternary; Quaternary-Tertiary; Tertiary. Quaternary lake sediments as young as Holocene in age are displaced offshore (Hyne and others, 1972 #3629; Gardner and others, 2000 #5904), latest Pleistocene glacial till (Tioga-aged) is faulted onshore in the Rifle Peak area (Lewis, 1988 #2526; Lewis and Grose, 1988 #2527), and undifferentiated Quaternary colluvium (Grose, 1986 #3609) and Quaternary-Tertiary alluvial deposits (Bonham, 1969 #2999) are reportedly faulted on the shore of Crystal Bay; Quaternary-Tertiary deposits of Bonham (1969 #2999) elsewhere include mid to late Pleistocene (i.e., Donner- and Tahoe-aged) deposits. Hyne and others (1972 #3629) show lake sediments warped and offset greater amounts with increasing depth across the southern part of the North Tahoe fault. Faults west and northwest of Incline Village juxtapose Tertiary volcanic rocks against Cretaceous granitic rocks (Matthews, 1968 #3610; Burnett, 1968 #3623; Bonham, 1969 #2999).
Historic earthquake	
Most recent prehistoric deformation	latest Quaternary (<15 ka) *Comments:* Although timing of most recent paleoevent is not well-constrained, a latest Quaternary time is suggested from offshore studies (Hyne and others, 1972 #3629; Gardner and others, 2000 #5904) and detailed geologic mapping onshore (Lewis, 1988 #2526; Lewis and Grose, 1988 #2527).
Recurrence interval	
Slip-rate	Between 0.2 and 1.0 mm/yr

category	*Comments:* Not studied in detail. Lewis (1988 #2526) reported an average long-term slip rate of 0.1 mm/yr based on 320 m vertical offset of a Pliocene (4 Ma) erosion surface in the Mt Baldy area. However, the 14-m-high scarp (scarp height approximates vertical separation because adjacent floor of Tahoe is horizontal) on "most recent sediments" (Hyne and others, 1972 #3629), implies a higher slip rate and is the basis of the slip-rate category assignment. Lahren and others (1999 #3630) speculated that "The Tahoe basin... likely accommodates much of the 12 mm/yr NW [-directed dextral] motion between the Sierra Nevada block and the BRP [Basin and Range Province]", however they presented no evidence in support of this contention.
Date and Compiler(s)	2000 Thomas L. Sawyer, Piedmont Geosciences, Inc. Kathleen M. Haller, U.S. Geological Survey
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	3, p. 306-313. #5905 Smith, J.L., Stone, J.C., Rowe, T.G., and Gardner, J.V., 1998, Selected hydrologic features of Lake Tahoe Basin and surrounding area, California and Nevada, 1998: U.S. Geological Survey Open-File Report 98-649, 1 sheet, scale approximately 1:125,000.