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Quaternary Fault and Fold Database of the United States

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Western Humboldt Range fault zone (Class A) No. 1635

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Synopsis	This long, mostly continuous zone is comprised of range-front normal faults and piedmont faults along the prominent western fronts of the Humboldt and West Humboldt Ranges. The zone includes short piedmont faults on slopes adjacent to these ranges. The Humboldt ranges have been tilted about 10–15° east since Tertiary time. The entire length of the fault zone shows evidence of rupture since the highstand of Lake Lahontan at about 13 ka. Sources of data include detailed topical studies of the fault zone involving detailed photogeologic mapping, scarp morphology studies, and trenching; regional and detailed geologic mapping; and reconnaissance photogeologic mapping.
Name comments	Refers to faults on the western side of the Humboldt Range and West Humboldt Range that were mapped by more than a century

	ago by Russell (1885 #3549). More recent mapping has been conducted by Silberling and Wallace (1967 #3025), Wallace and others (1969 #3027), Slemmons (1968, unpublished Reno 1:250,000-scale map; 1974, unpublished Lovelock 1:250,000-scale map), Johnson (1977 #2569), Wallace (1979 #203), Davis (1983 #3026), Anderson and others (1983 #416), Bell (1984 #105), and Dohrenwend and others (1991 #285). The fault extends from near Mill City southwest to the south margin of Humboldt Sink. dePolo (1998 #2845) referred to this long fault zone as the Western Humboldt Range fault system. **Fault ID:** Includes fault number LL21A and LL21B (Western Humboldt Range fault zone) of dePolo (1998 #2845).
County(s) and State(s)	CHURCHILL COUNTY, NEVADA PERSHING COUNTY, NEVADA
Physiographic province(s)	BASIN AND RANGE
Reliability of location	Good Compiled at 1:100,000 scale. *Comments:* Fault locations are primarily based on 1:31,680-scale map of Anderson and others (1983 #416), 1:62,500-scale map of Silberling and Wallace (1967 #3025), and 1:62,500-scale map of Wallace and others (1969 #3027), and 1:24,000-scale map of Davis (1983 #3026). Additional fault locations are from 1:250,000-scale maps of Slemmons (1968, unpublished Reno 1:250,000-scale map; 1974, unpublished Lovelock 1:250,000-scale map), Bell (1984 #105), and Dohrenwend and others (1991 #285).
Geologic setting	This long mostly continuous range-front normal fault locally crosses the piedmont and bound the prominent western fronts of the Humboldt and West Humboldt Ranges. South of the mouth of Limerick Canyon, the fault zone continues to the south margin of Humboldt Sink, a deep sediment-filled Neogene basin (Russell, 1885 #3549; Silberling and Wallace, 1967 #3025; Slemmons, 1968, unpublished Reno 1:250,000-scale map; 1974, unpublished Lovelock 1:250,000-scale map; Wallace and others, 1969 #3027; Johnson, 1977 #2569; Wallace, 1979 #203; Anderson and others, 1983 #416; Davis, 1983 #3026; Dohrenwend and others, 1991 #285). The Humboldt Range has been tilted about 10–15° east since the Tertiary (Stewart, 1978 #2866) and topographic relief is

	greater than 1 km (Wesnousky and others, 2006 #7559).
Length (km)	105 km.
Average strike	N21°E
Sense of movement	Normal *Comments:* Shown as normal faults on published maps (Silberling and Wallace, 1967 #3025; Wallace and others, 1969 #3027; Anderson and others, 1983 #416; Dohrenwend and others, 1991 #285).
Dip	83° NW. *Comments:* Anderson and others (1983 #416) reported this dip for a fault in unconsolidated sediment exposed in a trench across a northeast-striking piedmont fault near Rye Patch Dam (site 1635-1).
Paleoseismology studies	Site 1635-1, Rye Patch Reservoir: Trench was excavated across a northwest-facing, 1.5- to 1.9-m-high, post-Lahontan scarp (<13 ka) by Anderson and others (1983 #416) near the east shore of Rye Patch Reservoir, about 4 km west of Standard Mine. The trench exposed a single planar fault in beach gravel and overlying colluvial gravel. The exposure was interpreted to represent a single paleoearthquake. No dateable material was found to further constrain the time of the most recent paleoearthquake on this fault (Anderson and others, 1983 #416), other than being younger than the lacustrine deposits related to the highest young stand of Lake Lahontan (approximately 13 ka; Adams, 1997 #3003). Site 1635-2 Humboldt trench (Wesnousky and others, 2006 #7559) exposed evidence of the most recent coseismic surface rupture, which resulted in little vertical deformation and occurred about 4626±181 cal yr BP. The penultimate event resulted in 2.7 m of vertical offset; its maximum age is younger than Lake Lahonton.
Geomorphic expression	The northern part of the fault is expressed as the prominent western front of the Humboldt Range and as a series of echelon scarps along piedmont faults. In at least five places, the faults offset highstand shoreline features (<13 ka; Anderson and others, 1983 #416) and piedmont-slope deposits of all ages, except those

	in active washes. Whereas range-front scarps generally trend north-south, the scarps on the piedmont trend generally southwest and form a large-scale left stepping pattern. Scarp height decreases away from the range front and in all cases die out before they reach the deeply incised Humboldt River. Scarps at the bedrock-alluvium contact exhibit oversteepened slopes at the base of faceted spurs. Scarp heights range from more than 45 m on an old, dissected fan near Imlay to about 1.5 m on post-Lahontan alluvial fans and lacustrine deposits below the Lahontan high shoreline. Maximum scarp angles range from less than 15° to greater than 30°, with smaller scarps generally having gentler slopes. Topographic profiles across one of the piedmont scarps near Rye Patch Dam indicate a single surface-rupturing event in post-Lahontan time (<13 ka). Profiles of compound scarps along the range front at Wright and Horse Canyons suggest at least three events separated in time by several thousand years (Silberling and Wallace, 1967 #3025; Wallace and others, 1969 #3027, Slemmons, 1974, unpublished Lovelock 1:250,000-scale map; Johnson, 1977 #2569; Wallace, 1979 #203; Anderson and others, 1983 #416; Davis, 1983 #3026; Dohrenwend and others, 1991 #285). To the south, the less prominent front of the West Humboldt Range has less continuous scarps than to the north. Of note are the prominent, long gaps where the geomorphic expression of the fault is less obvious (Russell, 1885 #3549; Wallace and others, 1969 #3027, Slemmons, 1968, unpublished Reno 1::250,000-scale map; 1974, unpublished Lovelock 1::250,000-scale map; Johnson, 1977 #2569; Wallace, 1979 #203; Anderson and others, 1983 #416; Dohrenwend and others, 1991 #285). dePolo (1998 #2845) reports a maximum preferred basal fault facet height of 171 m (146–195 m) for the northern part of the fault and 122 m (98-171 m) for the southern part.
Age of faulted surficial deposits	Nearly all Quaternary piedmont-slope deposits, including those as young as latest Quaternary (<15 ka), are offset along the fault, as well as Quaternary-Tertiary gravel deposits (Silberling and Wallace, 1967 #3025; Wallace and others, 1969 #3027; Johnson, 1977 #2569; Wallace, 1979 #203; Anderson and others, 1983 #416; Davis, 1983 #3026; Dohrenwend and others, 1991 #285).
Historic earthquake	
Most recent prehistoric deformation	latest Quaternary (<15 ka) *Comments:* The most recent deformation according to Wesnousky

	and others (2006 #7559) occurred about 4626±181 cal yr BP but produced little vertical offset. Wallace (1977 #2569) and Anderson and others (1983 #416) suggested that the most recent event may have occurred between 8 and 12 ka (Anderson and others, 1983 #416), which is consistent with faulted Lake Lahontan highstand features.
Recurrence interval	*Comments:* Profiles of compound scarps along the range front at Wright and Horse Canyons suggest at least three events separated in time by several thousand years (Silberling and Wallace, 1967 #3025; Wallace and others, 1969 #3027, Slemmons, 1974, unpublished Lovelock 1:250,000-scale map; Johnson, 1977 #2569; Wallace, 1979 #203; Anderson and others, 1983 #416; Davis, 1983 #3026; Dohrenwend and others, 1991 #285). Long recurrence interval is suggested by the most recent coseismic surface rupture occurring 4626±181 cal yr BP and the penultimate event about 19 ka (Wesnousky and others, 2006 #7559).
Slip-rate category	Less than 0.2 mm/yr *Comments:* dePolo (1998 #2845) assigned a reconnaissance vertical displacement rate of 0.312 mm/yr for the northern part of the fault and 0.231 mm/yr for the southern part based on an empirical relationship between his preferred maximum basal facet height and vertical displacement 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 rate reflects a long-term average. However, the late Quaternary characteristics of this fault (overall geomorphic expression, continuity of scarps, age of faulted deposits, one event in past 13 k.y., etc.) suggest that 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)	2006 Kenneth Adams, Piedmont Geosciences, Inc. Thomas L. Sawyer, Piedmont Geosciences, Inc. Kathleen M. Haller, U.S. Geological Survey
References	#3003 Adams, K.D., 1997, Late Quaternary pluvial history, isostatic rebound, and active faulting in the Lake Lahontan basin, Nevada and California: Reno, University of Nevada, unpublished Ph.D. dissertation, 169 p.

#416 Anderson, L.W., Hawkins, F.F., and LaForge, R., 1983, Seismotectonic study for Rye Patch Dam Humboldt Project, Nevada: U.S. Bureau of Reclamation Seismotectonic Report 83-6, 29 p., 5 pls.

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#3026 Davis, J.O., 1983, Geologic map of the Rye Patch Reservoir south quadrangle, Nevada: Nevada Bureau of Mines and Geology Map 76, scale 1:24,000.

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