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Quaternary Fault and Fold Database of the United States

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Hogsback fault, southern section (Class A) No. 732b

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Compiled in cooperation with the Utah Geological Survey

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Synopsis	**General:** The Hogsback fault is comprised of middle to late Pleistocene (?) age fault scarps near the North Flank and Darby-Hogsback thrust faults in the Uinta Mountains in northeastern Utah and southwestern Wyoming. It is generally poorly expressed by discontinuous scarps and alignment of drainages. One trench was excavated near the southern end of the scarps, but the timing of the most recent movement as well as its Quaternary history is not well constrained.

	Sections: This fault has 2 sections. Sections are based on inferred segmentation of the fault from reconnaissance investigations by West (1989 #824). He mentioned that evidence of faulting is less distinct to the south of Chapman Butte, but he also suggested that it is in part due to the presence of glacial deposits and glacial topography in the south.
Name comments	**General:** West (1989 #824; 1992 #826) used the name Darby-Hogsback fault to refer to the parts of similarly named thrust faults that exhibit normal reactivation. Isolated scarps and fault-related features were named after local geographic features. From north to south they are Muddy Creek lineament, Meeks Cabin/Thunderbolt Mountains scarps, and Elizabeth Ridge scarps. This structure was also referred to as the Hogsback fault in a later publication (West, 1993 #825). The Hogsback name is used in this compilation owing to prior use of the confusing and multiple Darby-Hogsback term by West, author of the most pertinent research. The fault extends from about 6 km north of Interstate 80 south in southwestern Wyoming to the North Fork Mill Creek, south of Elizabeth Mountain in northeastern Utah. **Section:** No name was suggested by West (1989 #824) for the southern part of the fault, but it is considered herein as the southern section of the Hogsback fault. This informally named section extends from southern end of Chapman Butte in Wyoming south to North Fork Mill Creek in Utah; northern end of section approximately located and not shown by West (1989 #824). Includes Hecker's (1993 #642) Elizabeth Ridge scarps in northeastern Utah. **Fault ID:** Includes Hecker's (1993 #642) fault number 12-14 (Elizabeth Ridge scarps).
County(s) and State(s)	SUMMIT COUNTY, UTAH UINTA COUNTY, WYOMING
Physiographic province(s)	MIDDLE ROCKY MOUNTAINS WYOMING BASIN
Reliability of location	Good Compiled at 1:100,000 scale. *Comments:* Mapped or discussed by West (1988 #4464, 1989 #824, 1994 #4412), Sullivan and others (1988 #4437), and Piety and Vetter (1999 #4463). Fault traces transferred from 1:100,000-scale map of West (1989 #824).

Geologic setting	North-striking fault is generally parallel to and east of Muddy Creek and its tributaries in Wyoming. Down-to-west normal reactivation of the Laramide-age Darby-Hogsback thrust, a major east-directed low-angle thrust fault of the Overthrust Belt, is thought to have occurred during the Quaternary. The northeast- to east-trending scarps at the south end of the fault roughly parallel the Tertiary-age North Flank fault of the Uinta Mountains. Normal faulting may have initiated 250–600 ka with possible maximum vertical displacement of 200 m based on apparent separation of Quaternary surfaces (West, 1989 #824); West indicates that earlier studies indicate similar amounts of separation of the Wasatch Formation (Eocene). However, most of the geomorphic features are lineaments and escarpments that are paralleled by streams, so much of the measured relief could be erosional rather than tectonic.
Length (km)	This section is 38 km of a total fault length of 53 km.
Average strike	N4°E (for section) versus N7°E (for whole fault)
Sense of movement	Normal *Comments:* (West, 1989 #824)
Dip	45–80° W. *Comments:* Dip of fault is schematically shown by West (1989 #824; 1992 #826; 1993 #825) as 80° W. in upper 1 km, flattening to 45° W. at 2 km, and subhorizontal at 4 km.
Paleoseismology studies	Site 732-1. West (1989 #824) excavated one trench, the Elizabeth Ridge trench, which was completed in 1984. The trench was located 1 km north of Elizabeth Pass and crossed a down-to-south, uphill-facing, 2.5-m-high scarp. No datable material was recovered from the trench. Evidence of fault origin was inconclusive, but the preferred interpretation for formation of the scarp is tectonic.
Geomorphic expression	The fault is expressed as linear drainage alignments, lineaments, and subdued west-facing scarps on Pleistocene terrace and pediment surfaces. The amount of east-directed tilt of terrace surfaces increases with increasing age of the surfaces suggesting recurrent movement. The southern part of the fault (Elizabeth Ridge scarps) is expressed as southwest-trending scarps, one of

	which is uphill facing and down to the south; the other two are downhill and north facing. These scarps have apparent displacements of about 1.5–2.5 m and are subparallel to the North Flank thrust fault. The east scarp is on the Gilbert Peak erosion surface, which is cut across the Oligocene Bishop Conglomerate. Trenching revealed no direct evidence for faulting, although geomorphic evidence is more in line with a tectonic rather than an erosional origin. The subdued expression of the scarps (maximum scarp angles of about 5 degrees) suggests that these scarps are substantially older than similar discordant scarps at the south end of the Bear River fault zone [730].
Age of faulted surficial deposits	Fault offsets the Bigelow Bench surface (West, 1989 #824) in Wyoming, which has been variously described as being 150–600 ka (late middle Pleistocene) to 300-600 ka (middle Pleistocene).
Historic earthquake	
Most recent prehistoric deformation	middle and late Quaternary (<750 ka) *Comments:* Inconclusive relations in the trench resulted in limited information on the timing of the most recent event, but West (1989 #824) believed that surface rupture of this fault occurred prior to the most recent rupture of the Bear River fault zone [730], which is thought to be late Holocene. West (1989 #824) further suggested that the most recent event on this section of the Darby-Hogsback fault may be middle to late Pleistocene, if the Bigelow Bench surface is as young as 150 ka. A conservative estimate of middle and late Quaternary time (<750 ka) is used here.
Recurrence interval	*Comments:* West (1989 #824) suggested that the late Quaternary recurrence interval might be approximated by that of the nearby Bear River fault zone [730] because of analogous tectonic setting, thus, a recurrence interval of a few thousand years. Several other faults in the region [728 and 729] also are reported to have similar short recurrence intervals during the Holocene. These likely represent temporal clustering that is not characteristic of the long term activity of any of these faults. Lund (2004 #6733) indicates that insufficient paleoseismic data exist to determine the timing, number, or recurrence of surface-faulting earthquakes for the Hogsback fault.

Slip-rate category	Less than 0.2 mm/yr *Comments:* Poorly-constrained estimates of vertical displacement rate range from 0.33–1.5 mm/yr (West, 1989 #824) for the fault. The highest estimate (1.5 mm/yr) is based on inferring a rate similar to that of the Bear River fault zone [730]. A lower rate of 0.33–1.33 mm/yr is obtained based on 200-m offset of 150–600 ka surface (Bigelow Bench). A later publication suggested that the age of Bigelow Bench surface is 300–600 k.y. (Schlenker, 1988 #6738), which would suggest a vertical displacement rate of less than 1 mm/yr. West (1994 #4412) also indicates a very low long-term geologic slip rate, based on 1.5–2.5 m of maximum displacement from scarp-profile data across the Oligocene Bishop Conglomerate. Thus, the 0.2–1 mm/yr slip-rate category is assigned here due to the recent suggestion that the surface is older then 150 k.y., and because the majority of the cited rates are less than 1 mm/yr. Lund (2004 #6733) indicates that in the absence of substantive paleoseismic data, and given the large uncertainty in the amount and timing of fault displacement, the slip rate is highly questionable.
Date and Compiler(s)	2004 James P. McCalpin, GEO-HAZ Consulting, Inc. Bill D. Black, Utah Geological Survey Christopher B. DuRoss, Utah Geological Survey Suzanne Hecker, U.S. Geological Survey
References	#4336 Black, B.D., Hecker, S., Jarva, J.L., Hylland, M.D., and Christenson, G.E., 2000, Quaternary fault and fold database and map of Utah: Technical report to U.S. Geological Survey, Reston, Virginia, under Contract 98QGR1029, October 2000, unpaginated, 1pl., scale 1:500,000. #642 Hecker, S., 1993, Quaternary tectonics of Utah with emphasis on earthquake-hazard characterization: Utah Geological Survey Bulletin 127, 157 p., 6 pls., scale 1:500,000. #6733 Lund, W.R., 2005, Consensus preferred recurrence interval and vertical slip rate estimates—Review of Utah paleoseismic-trenching data by the Utah Quaternary Fault Parameters Working Group: Utah Geological Survey Bulletin 134, compact disk. #4463 Piety, L.A., and Vetter, U.R., 1999, Seismotectonic report for Flaming Gorge Dam, Colorado River Storage Project, northeastern Utah: U.S. Bureau of Reclamation Seismotectonic

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