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Quaternary Fault and Fold Database of the United States

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West Cache fault zone, Junction Hills fault (Class A) No. 2521b

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Compiled in cooperation with the Utah Geological Survey

citation for this record: **Black, B.D., DuRoss, C.B., Hylland, M.D., and Hecker, S., compilers, 2004, Fault number 2521b, West Cache fault zone, Junction Hills fault, in Quaternary fault and fold database of the United States: U.S. Geological Survey website, https://earthquakes.usgs.gov/hazards/qfaults, accessed 12/14/2020 02:55 PM.**

Synopsis	**General:** Zone of three related east-dipping faults along the western side of Cache Valley in northern Utah and southern Idaho. All the faults show evidence for recurrent late Quaternary activity. The earthquake-timing, recurrence-interval, and slip-rate estimates for the West Cache fault zone reflect the consensus values of the Utah Quaternary Fault Parameters Working Group (Lund, 2004 #6733). The preferred values of Lund (2004 #6733) approximate "mean" values based on available paleoseismic-trenching data, and the minimum and maximum values

	approximate two-sigma (5th and 95th percentile) confidence limits. The confidence limits incorporate both epistemic (e.g., data limitation) and aleatory (e.g., process variability) uncertainty (Lund, 2004 #6733). **Sections:** This fault has 3 sections. This fault zone has been divided into sections from north to south: the Clarkston fault [2521a], the Junction Hills fault [2521b], and the Wellsville fault [2521a] by Black and others (2000 #4778). Bedrock faults in three nearby areas may be associated with the West Cache fault zone, but are not included by Solomon (1999 #4395) due to a lack of demonstrable continuity with the fault zone and a lack of paleoseismic data. They are: (1) the Dayton fault [2370], 11 km east of the Clarkston fault in north-central Cache Valley; (2) the Hyrum fault [2374], on the southwest side of Cache Valley in the southern Wellsville Mountains; and (3) several faults near the town of Mantua [2373], in the interior of the Wellsville Mountains and Wasatch Range southwest of the Hyrum fault.
Name comments	**General:** **Section:** The Junction Hills fault is the central section of the West Cache fault zone as defined by Black and others (2000 #4778). Hecker (1993 #642) referred to this as the Cache Butte area fault. **Fault ID:** Refers to fault number 6-15 in Hecker (1993 #642).
County(s) and State(s)	CACHE COUNTY, UTAH
Physiographic province(s)	BASIN AND RANGE
Reliability of location	Good Compiled at 1:50,000 scale. *Comments:* Mapped or discussed by Solomon (1999 #4395) and Biek and others (2003 #6758). Mapping from Solomon (1999 #4395).
Geologic setting	Generally north-trending normal faults along the west side of Cache Valley. Cache Valley is adjacent to the boundary between the Basin and Range and Middle Rocky Mountains structural provinces, and is a north-south structural basin formed by repeated movement on the west-dipping East Cache fault zone [2352] and east-dipping West Cache fault zone [2521]. The valley

	was occupied intemittently by Pleistocene Lake Bonneville until about 17 ka, when a substantial volume of water drained from the lake due to failure of the Red Rock Pass threshold at its north end.
Length (km)	This section is 24 km of a total fault length of 59 km.
Average strike	N23°E (for section) versus N31°W,N38°W,N38°W (for whole fault)
Sense of movement	Normal
Dip Direction	E
Paleoseismology studies	A natural stream-cut exposure (site 2521-1) at Roundy Farm, about 2 km southwest of Cache Junction, provides the only conclusive evidence of late Quaternary faulting on the Junction Hills fault (Solomon, 1999 #4395). Black and others (2000 #4778) logged the stream-cut exposure and found evidence for two surface-faulting earthquakes. A single radiocarbon age estimate on a bulk-soil sample from the base of a colluvial wedge approximates the age of the most recent event on the fault. The penultimate event could not be directly dated.
Geomorphic expression	The Junction Hills fault is poorly expressed as a discontinuous down-to-the-east normal fault trace, beginning at the range front east of Short Divide and continuing southeastward along the eastern margins of the Junction Hills and Cache Butte to east of the northern Wellsville Mountains. For most of its length, the fault is concealed by Lake Bonneville deposits and locally by Holocene to upper Pleistocene landslide debris (Solomon, 1999 #4395). The only conclusive evidence of Quaternary displacement is associated with three short lineaments northeast of Cache Butte. Fault scarps at the surface along the lineaments are subtle and subdued due to degradation from repeated plowing (Solomon, 1999 #4395). Oviatt (1986 #4629) reports 2.4 m of displacement in the basal transgressive gravel of Lake Bonneville in a stream cut across the central lineament, and evidence for multiple pre-Bonneville events; Black and others (2000 #4778) easured 2.9 m of most-recent-event displacement in the stream cut, and also indicate observing evidence of a pre-Bonneville event.
Age of faulted surficial	Late Pleistocene

deposits	
Historic earthquake	
Most recent prehistoric deformation	latest Quaternary (<15 ka) *Comments:* One radiocarbon age estimate places the most recent event on the Junction Hills fault between 8.25 and 8.65 ka (Black and others, 2000 #4778). An older pre-lake event is evidenced by a degraded-scarp free face of unknown age, overlain and modified by transgressive lake sediments. The older event occurred prior to lake transgression across the stream-cut site around 22.5 ka. Lund (2004 #6733) reports the following paleoearthquake chronology, based on the trench investigations of Black and others (2000 #4778): Z 8250-8650 cal yr BP Y >22 ka Event Z is based on one radiocarbon age estimate between 8.25 and 8.65 ka (Black and others, 2000 #4778). An older pre-lake event is evidenced by a degraded-scarp free face of unknown age, overlain and modified by transgressive lake sediments. The older event occurred prior to lake transgression across the stream-cut site around 22.5 ka.
Recurrence interval	10-25 k.y. *Comments:* Consensus recurrence-interval range reported in Lund (2004 #6733) based on available paleoseismic data. Black and others (2000 #4778) estimate a minimum elapsed time of approximately 13.8 k.y. between events Z and Y, based on radiocarbon dating and the estimated timing for lake transgression across the site. However, the timing of the penultimate event is poorly constrained, and therefore the recurrence interval could be much longer than 13.8 k.y.
Slip-rate category	Less than 0.2 mm/yr *Comments:* Evans (1991 #4425) estimates an long-term average slip rate of 0.04-0.06 mm/yr based on 600 to 1,200 m of net slip on the West Cache fault zone in the vicinity of the Junction Hills fault since the Miocene onset of Cache Valley extension. Solomon (1999 #4395) estimates a maximum slip rate of 0.11-0.16 mm/year since the latest Pleistocene, based on observed displacement of Lake Bonneville sediments, and the limited data from the Roundy Farm stream-cut exposure suggest a maximum late Quaternary slip rate of 0.21 mm/yr (Black and others, 2000

	#4778). Black and others (2000 #4778) estimate a paleoseismic slip rate of 0.2 mm/yr, based on 2.9 m of slip during the most recent event, and a minimum recurrence interval of 13.8 ky between the two youngest events. Lund (2004 #6733) indicates a slip rate of 0.1 mm/yr (preferred), and a consensus minimum-maximum range of 0.05-0.2 mm/yr, based on available paleoseismic information. The broad slip-rate range reflects uncertainty in the elapsed time between the two most recent events.
Date and Compiler(s)	2004 Bill D. Black, Utah Geological Survey Christopher B. DuRoss, Utah Geological Survey Michael D. Hylland, Utah Geological Survey Suzanne Hecker, U.S. Geological Survey
References	#6758 Biek, R.F., Oaks, R.Q., Jr., Janecke, S.U., Solomon, B.J., and Swenson Barry, L.M., 2003, Geologic maps of the Clarkston and Portage quadrangles, Box Elder and Cache Counties, Utah and Franklin and Oneida Counties, Idaho: Utah Geological Survey Map 194, 41 p. pamphlet, scale 1:24,000. #4778 Black, B.D., Giraud, R.E., and Mayes, B.H., 2000, Paleoseismic investigation of the Clarkston, Junction Hills, and Wellsville faults, West Cache fault zone, Cache County, Utah: Utah Geological Survey Special Study 98, 23 p., http://ugspub.nr.utah.gov/publications/special_studies/SS-98.pdf. #4425 Evans, J.P., 1991, Structural setting of seismicity in northern Utah: Utah Geological Survey Contract Report 91-15, 37 p. #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. #4629 Oviatt, C.G., 1986, Geologic map of the Cutler Dam quadrangle, Box Elder and Cache Counties, Utah: Utah Geological and Mineral Survey Map 91, 7 p. pamphlet, scale 1:24,000.

	#4395 Solomon, B.J., 1999, Surficial geologic map of the West Cache fault zone and nearby faults, Box Elder and Cache Counties, Utah: Utah Geological Survey Map 172, 20 p. pamphlet, 2 sheets, scale 1:50,000.