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North Canyon fault (Class A) No. 3507

Last Review Date: 2010-10-27

Compiled in cooperation with the Idaho Geological Survey

citation for this record: **Machette, M.N., and Neier, R.S., compilers, 2010, Fault number 3507, North Canyon 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 02:51 PM.**

Synopsis	This is a north-northwest trending, high-angle, down-to-the-southwest, normal fault that bounds the east side of the Pocatello Valley and the west margin of Samaria Mountain. The Pocatello Valley lies near the northeastern margin of the Basin and Range province. The range front of Samaria Mountain rises steeply to about 700 m above Pocatello Valley. Gravity data indicates that the valley fill is much thinner in Pocatello Valley than in the nearby Curlew and Malad Valleys, suggesting that the Pocatello Valley is a relatively young basin developing in what has been a major mountain mass. The East Pocatello fault may have as much as 1,400 m of structural throw in the Neogene. The 1975 Pocatello Valley earthquake (ML 6.0) caused some basin

	subsidence in the area, but no surface rupturing was reported.
Name comments	Beus (1968 #6547) originally named it the North Canyon fault for a south- and east-trending canyon that flows from Samaria Mountain into the Malad Valley. Witkind (1975 #320) referred to these as the "unnamed faults along the west side Samaria Mtn." McCalpin and others (1992 #613) used the informal name "eastern margin fault." Hilt and others (1994 #785) used the name Pocatello Valley fault, but there are faults on both the east and west margins of the valley, thus this name is not explicit. Rember and Bennett (1979 #6543) did not show a fault trace on the eastern side of Pocatello Valley. The fault, as shown by McCalpin and others (1992 #613), extends along the western margin of Samaria Mountain from its intersection with the Woodruff fault [3508] (on the north) to about 2 km north of the Idaho/Utah border (on the south). Original name is used in this compilation. **Fault ID:** Referred to as fault 31 by Witkind (1975 #320).
County(s) and State(s)	ONEIDA COUNTY, IDAHO
Physiographic province(s)	BASIN AND RANGE
Reliability of location	Good Compiled at 1:100,000 scale. *Comments:* Beus (1968 #6547) described the bedrock stratigraphy east of the fault and showed the fault on the map, but did not discuss the structure. Platt (1977 #5158) mapped the geology of the area and thought that the fault was active (recent) (Platt, 1975 #6548). Platt also shows two en echelon fault traces, the northern one being slightly to the west of the southern one. McCalpin and others (1992 #613) modified the fault trace from Platt (1977 #5158) and showed it on their figure 4. The trace is from Platt (1977 #5158) at 1:48,000 scale as modified by McCalpin and others (1992 #613) and is further constrained by satellite imagery and topography at scale of 1:100,000. Reference satellite imagery is ESRI_Imagery_World_2D with a minimum viewing distance of 1 km (1,000 m).
Geologic setting	North-northwest-trending, high-angle, down-to-southwest, normal fault (Witkind, 1975 #320) on the eastern margin of Pocatello Valley. The valley lies near the northeastern margin of the Basin

	and Range Province (Beus, 1968 #6547). The range front of Samaria Mountain rises about 700 m above Pocatello Valley. Gravity data collected by Harr and Mabey (1976 #6546) indicates that the valley fill is much thinner in Pocatello Valley (about 400 m) than nearby Curlew (to the west) and Malad (to the east) Valleys. This observation led Harr and Mabey (1976 #6546) to conclude that "Pocatello Valley is a relatively young basin developing in what has been a major mountain mass." Nevertheless, the North Canyon fault may have as much as 1,400 m of structural throw in the Neogene (Garr, 1988 #6545).
Length (km)	7 km.
Average strike	N15°W
Sense of movement	Normal
Dip Direction	W
Paleoseismology studies	Garr (1988 #6545; also reported in McCalpin and others, 1992 #613) excavated three trenches across scarps to confirm fault origins and a third trench in valley bottom sediment to investigate evidence for soft-sediment deformation. 3507-1. Trench 1 was located on a prominent scarp at the mouth of Elevator Hollow. This trench revealed tectonically deformed (warped) sediment, but no direct evidence of faulting, such as brittle fault ruptures. Although not explicitly stated, the origin of the scarp may be lacustrine. 3507-2. Trench 2 was excavated about 400 m south of Trench 1 (3507-1) at the base of a faceted spur. There were no discrete faults or shear zones in any of the colluvial units exposed in the trench, and thus no conclusive evidence for surface rupture. McCalpin and others (1992 #613) reported that "some kind of progressive flexure has occurred over the last 95 ka within 20-m downslope of the inferred range-front fault in bedrock, unaccompanied by any surface faulting." They found that the overall geometry in trench 2 indicated older deposits are warped more than younger ones, which allowed them to estimate the 95-ka age based on an assumed constant rate of flexure of 25?/k.y. The stratigraphy was interpreted to indicate monoclinal folding and displacement without surface rupture, and aseismic creep was favored as the mechanism for deformation of the sediment.

	3507-3 Trench 3 (Garr, 1988 #6545) was excavated in the valley fill to look for evidence of soft-sediment deformation.
Geomorphic expression	Forms steep topography from the Pocatello Valley (on the west) to Samaria Mountain (on the east). Platt (1977 #5158) reports steep mountain front topography, truncated spurs between canyons, and lake-bottom sediment that is tilted east close to the fault, all implying relatively young and active subsidence or tilting of the valley. In addition, Platt (1977 #5158) mentions scarps along the fault, whereas neither Garr (1988 #6545) nor McCalpin and others (1992 #613) found or mapped unequivocal fault scarps on the east margin of the valley. Quantitative geomorphologic techniques (mountain-front sinuosity ratios and valley-floor width to height ratios) indicate that the ranges bounding Pocatello Valley are slightly to moderately active (Garr, 1988 #6545; McCalpin and others, 1992 #613) with higher rates of activity on the east margin (this fault) than on the west. Shorelines of Lake Utaho (a separate but allied component of Lake Bonneville) are deformed by as much as 6.4 m (profile C-C' of Garr, 1988 #6545), with the majority (4.6-6.4 m) of the elevation change resulting from lowering of the downdropped (western) block. Garr (1988 #6545) trenched two scarps to investigate whether they had a tectonic origin.
Age of faulted surficial deposits	Holocene and late Pleistocene beds (warped, not faulted according to Garr, 1988 #6545; McCalpin and others, 1992 #613), Permian/Pennsylvanian rocks of the Oquirrh Formation.
Historic earthquake	
Most recent prehistoric deformation	latest Quaternary (<15 ka) *Comments:* Holocene and latest Pleistocene sediments are warped but not faulted at the surface (McCalpin and others, 1992 #613). The steep range front and abundant seismic activity suggest Holocene movement, but no unequivocal fault scarps have been found (Witkind, 1975 #320; Garr, 1988 #6545; McCalpin and others, 1992 #613). Trenching by Garr (1988 #6545) suggests deformation, but no brittle rupture of Lake Bonneville sediment. McCalpin and others (1992 #613) suggested that the deformation (warping and folding) is by incremental creep or aseismic displacement that doesn't propagate to the surface. Conversely, Pierce and Morgan (1992 #539) show this as a major Holocene fault and Breckenridge and others (2003 #5878) classified it as a

	major Quaternary fault. There has been some controversy as to whether or not there was surface rupture during the March 27, 1975, Pocatello Valley earthquake (ML 6.0). No surface ruptures have been identified from the work of Garr (1988 #6545) and McCalpin and others (1992 #613) nor were ruptures found during a postearthquake survey by Rogers and others (1975 #3389). McCalpin and others (1992 #613) tentatively assigned this earthquake to the western margin fault [3506] of Pocatello Valley based on the epicentral location and focal mechanisms derived by Arabasz and McKee (1979 #5875). Conversely, there probably was localized valley floor subsidence of about 13 cm as reported by Bucknam (1976 #5876) on the basis of geodetic data (releveling of benchmarks).
Recurrence interval	Greater than 15-95 k.y. (<95 ka) *Comments:* McCalpin and others (1992 #613) suggest that the recurrence for surface ruptures is greater than 15 to less than 95 k.y. based on their trenching studies.
Slip-rate category	Less than 0.2 mm/yr *Comments:* Slip rate is unknown, but probably is low based on rates for other similar structures in the area. McCalpin and others (1992 #613) calculated a post-Lake Utaho (<15 ka) subsidence rate of 0.3 mm/yr based on 4.5 m lowering of Utaho shorelines. They also qualified this calculation by stating that it seems to be "excessive in light of the overall structural relief and age of the valley." This rate is nearly three times that of the West Pocatello Valley fault [3506] where there is a preserved fault scarp. In addition, the general lack of fault-formed scarps along the modern range front of Samaria Mountain argues for a lower slip rate than that calculated by McCalpin and others (1992 #613). McCalpin and others (1992 #613) concluded that there is no displacement of any Lake Utaho deposits, indicating that no ML 6.2 to 6.3 events have occurred in the past 15 ka.
Date and Compiler(s)	2010 Michael N. Machette, U.S. Geological Survey, Retired Ricky S. Neier, University of Idaho
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