Jump to Navigation

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Lost River fault, Willow Creek hills section (Class A) No. 601g

Last Review Date: 2010-11-09

Compiled in cooperation with the Idaho Geological Survey

citation for this record: **Haller, K.M., and Wheeler, R.L., compilers, 2010, Fault number 601g, Lost River fault, Willow Creek hills section, 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 03:02 PM.**

Synopsis	**General:** The Lost River fault is a 130-km-long, southwest-facing, normal fault along the southwestern base of the Lost River Range. Most investigators agree that the main fault has six segments, but the extent to which large ruptures of various ages have crossed or stopped at the various segment boundaries remains unresolved. Accordingly, the Lost River fault was divided into sections based on mapping, morphological study, dating, and trenching of scarps and the surfaces they offset—the six sections (a–f) correspond to the segments that make up the main fault. The seventh section consists of a complex of

	discontinuous scarps [601g] that link the main Lost River fault to the smaller, antithetic Lone Pine normal fault [604] to the west. Work during the years following the 1983 Borah Peak earthquake concentrated on the northern sections where surface ruptures formed during the earthquake, whereas work during the late 1960s and 1970s, followed by additional studies during the 1990s concentrated on the southern sections. All but the northernmost and the two southernmost sections show evidence of latest Quaternary surface ruptures. The few determinations of individual recurrence intervals of large surface ruptures vary from 1 to nearly 100 k.y. Slip rates determined at specific points along the fault vary between less than 0.1 mm/yr to approximately 0.2 mm/yr, and the southern sections appear to have had slower late Quaternary rates than the middle sections. Paleoseismic data suggest that the three central parts of the fault possibly ruptured within a few thousands of years of each other during the early Holocene. **Sections:** This fault has 7 sections. Scott and others (1985 #76) defined segmentation of Lost River fault and is the source of section names except northernmost segment [601a], which was renamed by Crone and others (1985 #18; 1987 #19) to be consistent with other segment names. Scarps formed during Borah Peak earthquake across Willow Creek hills [601g] are included as part of this fault. The on-trend, discontinuous scarps south of range (as mapped by Kuntz and others, 1984 #293) are described separately as part of the Idaho Rift systems fault [3501].
Name comments	**General:** Anderson (1934 #595) first reported that the southwest side of the Lost River Range was bounded by a fault. However, Baldwin (1951 #427) later recognized Basin and Range style faulting in this area, as well as recent movement and large amounts of throw across this and nearby faults. Baldwin's 1951 article is probably one of earliest to use the name Lost River fault for this structure, which extends along the entire length of the southwest flank of Lost River Range from near Arco, Idaho, on the south to near Challis, Idaho, on the north **Section:** Refers to discontinuous scarps in Willow Creek hills that formed during 1983 Borah Peak earthquake. The scarps extend from the range-front part of Lost River fault (near Arentson Gulch) northwestward over crest of Willow Creek hills (to near Sheep Creek). Also referred to as the Willow Summit segment in Montana Bureau of Mines and Geology digital database (Stickney

	and Bartholomew, written commun. 1992 #556). Wallace (1984 #197) informally named this part of the 1983 surface rupture the Arentson Gulch fault.
County(s) and State(s)	CUSTER COUNTY, IDAHO
Physiographic province(s)	NORTHERN ROCKY MOUNTAINS
Reliability of location	Good Compiled at 1:24,000 scale. *Comments:* Location of the scarps is based on 1:24,000-scale maps of Crone and others (1985 #18; 1987 #19), further constrained by satellite imagery and topography at scale of 1:24,000. Reference satellite imagery is ESRI_Imagery_World_2D with a minimum viewing distance of 1 km (1,000 m).
Geologic setting	This part of east-central Idaho and southwest Montana is made of Precambrian and Paleozoic rocks that were shortened by folding and faulting and were thrust northeastward during the late Mesozoic. Mid- to late Cenozoic extension broke the thrust complex into northwest-trending basins and ranges and continues today. The Lost River fault is a high-angle, down-to-the-southwest, range-front normal fault, with a minor sinistral component of slip. The fault bounds the southwest side of the Lost River Range and separates the range from Round Valley, Antelope Flat, Thousand Springs Valley, Barton Flat, and the Big Lost River. In its north-central portion, the Lost River fault is joined from the west by the much shorter, northeast-dipping Lone Pine fault [604]. The two normal faults bound an intervening graben. The much greater length and larger topographic relief of the Lost River fault indicate that it is probably the master fault, and that the Lone Pine fault probably terminates against it at depth. Hypocentral locations and focal mechanisms of earthquakes in 1983 and 1984 and their numerous aftershocks support this suggestion (Doser and Smith, 1985 #276; Jackson, 1994 #833). Densmore and others (2005 #7016) suggest that maximum throw across the Lost River fault is 4–6 km.
Length (km)	This section is 6 km of a total fault length of 127 km.
Average strike	N66°W (for section) versus N35°W (for whole fault)

Sense of movement	Normal *Comments:* Although predominantly normal with small sinistral component, localized dextral and reverse movement also was noted (Crone and others, 1987 #19).
Dip Direction	S; N
Paleoseismology studies	
Geomorphic expression	Surface ruptures from the 1983 Borah Peak earthquake are superimposed on older scarps of unknown age along much of the Willow Creek hills section. The complex and discontinuous 1983 surface ruptures that characterize the Willow Creek hills strand [601g] are a surficial representation of the complexity of the fault at depth. The concentration and distribution of aftershocks, as well as inconsistent focal mechanisms, suggest that slip was accommodated on a complex network of faults near a bedrock asperity (Crone and others, 1987 #19).
Age of faulted surficial deposits	
Historic earthquake	Borah Peak earthquake 1983
Most recent prehistoric deformation	late Quaternary (<130 ka) *Comments:* No studies have addressed pre-1983 faulting on this fault. The presence of scarps in the landscape suggests that an earlier event probably occurred since 130 ka.
Recurrence interval	
Slip-rate category	Less than 0.2 mm/yr *Comments:* Low slip-rate category is assigned based on the generally low topographic relief and small scarps that formed in 1983.
Date and Compiler(s)	2010 Kathleen M. Haller, U.S. Geological Survey Russell L. Wheeler, U.S. Geological Survey, Emeritus

References	#595 Anderson, A.L., 1934, A preliminary report on recent block faulting in Idaho: Northwest Science, v. 8, p. 17-28. #427 Baldwin, E.M., 1951, Faulting in the Lost River Range area of Idaho: American Journal of Science, v. 249, p. 884-902. #18 Crone, A.J., Machette, M.N., Bonilla, M.G., Lienkaemper, J.J., Pierce, K.L., Scott, W.E., and Bucknam, R.C., 1985, Characteristics of surface faulting accompanying the Borah Peak earthquake, central Idaho, *in* Stein, R.S., and Bucknam, R.C., eds., Proceedings of workshop XXVIII on the Borah Peak, Idaho, earthquake: U.S. Geological Survey Open-File Report 85-290, v. A, p. 43-58. #19 Crone, A.J., Machette, M.N., Bonilla, M.G., Lienkaemper, J.J., Pierce, K.L., Scott, W.E., and Bucknam, R.C., 1987, Surface faulting accompanying the Borah Peak earthquake and segmentation of the Lost River fault, central Idaho: Bulletin of the Seismological Society of America, v. 77, p. 739-770. #7016 Densmore, A.L., Dawers, N.H., Gupta, S., and Guidon, R., 2005, What sets topographic relief in extensional footwalls?: Geology, v. 33, no. 6, p. 453-456. #276 Doser, D.I., and Smith, R.B., 1985, Source parameters of the 28 October 1983 Borah Peak, Idaho, earthquake from body wave analysis: Bulletin of the Seismological Society of America, v. 75, p. 1041-1051. #833 Jackson, S.M., 1994, Seismic evidence of conjugate normal faulting—The 1984 Devil Canyon earthquake sequence near Challis, Idaho: Boise, Idaho, Boise State University, unpublished M.S. thesis, 156 p. #293 Kuntz, M.A., Skipp, B., Scott, W.E., and Page, W.R., compilers, 1984, Preliminary geologic map of the Idaho National Engineering Laboratory and adjoining areas, Idaho: U.S. Geological Survey Open-File Report 84-281, 23 p., 1 pl., scale 1:100,000. #76 Scott, W.E., Pierce, K.L., and Hait, M.H., Jr., 1985, Quaternary tectonic setting of the 1983 Borah Peak earthquake, central Idaho: Bulletin of the Seismological Society of America, v. 75, p. 1053–1066.

#78 Skipp, B., and Hait, M.H., Jr., 1977, Allochthons along the northeast margin of the Snake River Plain, Idaho, *in* Heisey, E.L., Norwood, E.R., Wach, P.H., and Hale, L.A., eds., Rocky Mountain thrust belt geology and resources: Wyoming Geological Association, 29th Annual Field Conference, Teton Village, Wyoming, Guidebook, p. 499-515.

#556 Stickney, M.C., and Bartholomew, M.J., 1992 written commun., Preliminary map of late Quaternary faults in western Montana (digital data): Montana Bureau of Mines and Geology (digital version of MBMG Open-File Report 186), 1 pl., scale 1:500,000.

#197 Wallace, R.E., 1984, Eyewitness account of surface faulting during the earthquake of 28 October 1983, Borah Peak, Idaho: Bulletin of the Seismological Society of America, v. 74, p. 1091-1094.

#320 Witkind, I.J., 1975, Preliminary map showing known and suspected active faults in Idaho: U.S. Geological Survey Open-File Report 75-278, 71 p. pamphlet, 1 sheet, scale 1:500,000.