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Quaternary Fault and Fold Database of the United States

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Lost River fault, Warm Springs section (Class A) No. 601b

Last Review Date: 2010-11-09

Compiled in cooperation with the Idaho Geological Survey

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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:** Defined and named by Scott and others (1985 #76). Extends from Devils Canyon southeast to Willow Creek hills. Also shown as Gooseberry Creek segment in Montana Bureau of Mines and Geology digital database (Stickney and Bartholomew, written commun., 1992 #556).
County(s) and	

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 scarps 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 16 km of a total fault length of 127 km.
Average strike	N32°W (for section) versus N35°W (for whole fault)
Sense of movement	Normal *Comments:* Normal sense of movement inferred based on topographic expression of range front.

Dip Direction	SW
Paleoseismology studies	Two trenches 7.5 km apart have been excavated on the Warm Spring section (Schwartz and Crone, 1988 #75). Trench 601-4 on the south side of an unnamed creek approximately 2 km northwest of Gooseberry Creek. Trench 601-5 (Schwartz and Crone, 1988 #75) on the south side of a small drainage approximately 0.8 km northwest of Sheep Creek. The degree of soil development in both trenches suggest that one pre-1983 surface faulting event has occurred since the latest Pleistocene.
Geomorphic expression	Nearly continuous, morphologically young scarps, many of which were offset less than 1 m in 1983 (Crone and others, 1987 #19). Pre-1983 scarps are as much as 5.7 m high (Crone and Haller, 1991 #186).
Age of faulted surficial deposits	
Historic earthquake	Borah Peak earthquake 1983
Most recent prehistoric deformation	latest Quaternary (<15 ka) *Comments:* Trenching studies (Schwartz and Crone, 1988 #75) suggest one pre-1983 faulting event in the past 12 k.y., which occurred shortly prior to 5,200-6,200 14C yr. Morphology of scarps that did not rupture in 1983 also suggests an age younger than pre-1983 scarps on the Thousand Springs section (601c, also estimated to be Holocene).
Recurrence interval	 *Comments:* Rupture of this section during the 1983 earthquake may not be primary and thus the timing of the historic rupture should not be considered for determining recurrence interval. Trenching has documented only one older surface rupture since the latest Pleistocene.
Slip-rate category	Less than 0.2 mm/yr *Comments:* No published slip rate is known, but there is no direct evidence suggesting this part of the fault is characterized by a slip rate nearly twice that of the Thousand Springs section (which is >0.2 mm/yr). The only data available suggests single event 5.7-m-

	high scarps are on latest Pleistocene (<12 ka) deposits. The interval prior to that event is unknown; thus, a value calculated on the basis of these data is invalid.
Date and Compiler(s)	2010 Kathleen M. Haller, U.S. Geological Survey Russell L. Wheeler, U.S. Geological Survey, Emeritus
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