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Lemhi fault, May section (Class A) No. 602b

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Compiled in cooperation with the Idaho Geological Survey

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Synopsis	**General:** The Lemhi fault is a 135-km-long, southwest-facing, normal fault along the southwestern base of the Lemhi Range. Several workers have defined differing numbers of segments; thus, the extent to which large ruptures of various ages have crossed or stopped at the various proposed segment boundaries remains undetermined. Accordingly, the Lemhi fault was divided into six sections based on mapping, morphological data, dating, and trenching of scarps and the surfaces they offset. The four southern sections are better studied than the two northern sections. All but the two end sections are known to have had Holocene or postglacial surface ruptures. The few determinations of individual recurrence intervals of large surface ruptures vary

	from approximately 6 to 20 k.y. The central part of the fault appears to have had higher slip rates than the end parts. **Sections:** This fault has 6 sections. Numerous investigators have attempted to define segments of Lemhi fault based on a variety of methodologies. Baltzer (1990 #432) defines four segments along the northern 80 km of fault based on trenching studies and mapping of Quaternary deposits, Turko (1988 #4642) and Turko and Knuepfer (1991 #227) define a minimum of six to nine segments based on analysis of scarp-morphology data, Haller (1988 #27) and Crone and Haller (1991 #186) define six segments based on scarp-morphology studies, and Stickney and Bartholomew (1987 #85) provide descriptions of scarps at six localities. The segmentation model of Baltzer (1990 #432) is used in this compilation for the northern part of fault because of its recency and level of detail of the investigation. The middle section boundary of the Lemhi fault, that between sections 602c (Big Gulch) and 602d (Warm Creek), was located in essentially the same place by Haller (1988 #27), Turko (1988 #4642), and Baltzer (1990 #432). South of that section boundary, the three section names of Turko and Knuepfer (1991 #227) and Baltzer (1990 #432) are used. However, for the southern boundaries of these three sections (602d, 602e, and 602f), the locations of Haller (1988 #27) are used, because they are described in the greatest geographic detail and are, therefore, the easiest to identify on topographic maps and in the field for future study and testing. These locations, which Haller (1988 #27) showed on a 1:250,000-scale topographic base, are consistent with those of Turko and Knuepfer (1991 #227) within the spacing of their data points along the Lemhi fault.
Name comments	**General:** Both Anderson (1934 #595) and Baldwin (1951 #427) recognized Basin and Range style of faulting in this area, as well as large amounts of throw across this and nearby faults and the recency of their movement. Baldwin (1951 #427) is probably one of the earliest to use the name Lemhi fault for this structure. The fault extends entire length of Lemhi Range, although study area of Baldwin did not encompass entire fault. **Section:** The name "May segment" is used by Haller (1988 #27) and Crone and Haller (1991 #186) for the northernmost segment of Lemhi fault. Baltzer (1990 #432) uses the same name for his second northernmost segment; the section defined here follows that of Baltzer (1990 #432). Thus, this section extends from between Dry Gulch and Spring Gulch on the north, to near Big

	Creek on the south; the southern boundary is near a 60? change in strike of the fault, a 3-km-wide, right echelon step, and a 5-km-long gap in scarps. The May segment of Baltzer (1990 #432) contains the southern part of Ellis segment and all of the Falls Creek segment of Turko and Knuepfer (1991 #227) and southern part of May segment and all of Patterson segment of Haller (1988 #27) and Crone and Haller (1991 #186). All authors generally agree that the southern segment boundary is within a few kilometers of Big Creek. Janecke (1993 #6550) documents the complexity of faulting in a 13 x 5.5 km zone in the footwall at this boundary. Discussion of part of this segment in Stickney and Bartholomew (1987 #85) uses the name of Patterson scarp. It is also shown as Patterson segment and Falls Creek segment in Montana Bureau of Mines and Geology digital database (Stickney, written commun., 1992). **Fault ID:** Refers to number 115 ("unnamed series of faults along southwest flank Lemhi Range") in Witkind (1975 #320).
County(s) and State(s)	CUSTER COUNTY, IDAHO LEMHI 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 1:250,000-scale maps of Haller (1988 #27; original mapping at 1:24,000 or 1:62,500), 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 Lemhi fault is a high-angle, down-to-the southwest, range-front normal fault that separates the Lemhi Range to the northeast from the Pahsimeroi and Little Lost River valleys to the southwest.

Length (km)	This section is 33 km of a total fault length of 136 km.
Average strike	N44°W (for section) versus N51W (for whole fault)
Sense of movement	Normal
Dip	85° W *Comments:* Dip of fault is from trench exposure, site 602-2 in this compilation (Baltzer, 1990 #432).
Paleoseismology studies	One trench has been excavated across this part of the fault. Site 602-2 was located approximately 100 m south of Falls Creek (Baltzer, 1990 #432). Baltzer (1990 #432) describes structural and stratigraphic evidence for a single surface rupture between 7 and 12 ka. The trench log shows a main fault zone that comprises two southwest-dipping normal faults approximately 1.5 m apart. A wedge of fault colluvium abuts against the southwestern normal fault; a second wedge abuts against the northeastern normal fault and buries the first wedge. However, neither the text nor the trench description indicate whether Baltzer (1990 #432) interpreted the two wedges to have formed during the same earthquake, during which the two faults would have formed simultaneously as two parallel fault strands, or during two earthquakes widely separated in time. The two colluvial wedges are approximately 0.9 m thick where they abut the faults, and Baltzer (1990 #432) cites these values as the vertical stratigraphic separations across each fault, for a total separation of 1.8 m across the main fault zone. However, the figured trench log shows several offset stratigraphic units, and their vertical separations are 1.2 m on the northeastern fault and at least 1.6 m on the southeastern fault. A graben extends 13 m southeastward from the main fault zone to an antithetic fault, across which vertical stratigraphic separation is 0.9 m (cited in the text) or 1.2-1.5 m (measured on the figure). Thus, it is unclear whether the Falls Creek trench revealed evidence for one or two surface rupturing events, and how much the displacement occurred per event.
Geomorphic expression	Many scarps are on bedrock high on mountain front, and locally they are characterized by generally continuous, morphologically young scarps on alluvium (Haller, 1988 #27).
Age of faulted	

Age of faulted surficial deposits	Early Holocene and older alluvium and colluvium; Tertiary bedrock (Baltzer, 1990 #432).
Historic earthquake	
Most recent prehistoric deformation	latest Quaternary (<15 ka) *Comments:* Based on trenching study of Baltzer (1990 #432), time of faulting is constrained to 7-12 ka. The young constraining age is based on the presence of Mazama ash infilling a preexisting graben, and older limit is based on presence of scarp on a postglacial deposit at trench site. Morphology of the scarps also indicates an early to mid-Holocene age (Haller, 1988 #27).
Recurrence interval	*Comments:* Baltzer (1990 #432) documents a recurrence of 10-20 k.y. in the abstract, but the data are not presented so the recurrence value cannot be confirmed. The data from the single trenching site near Falls Creek documents only a single event from which no recurrence interval information can be deduced.
Slip-rate category	Less than 0.2 mm/yr *Comments:* Scott and others (1985 #76) suggested a slip rate of 0.3 mm/yr for the central part of Lemhi fault based on an analogy with the central part of the Lost River fault [601]. More recent, fault specific geomorphic studies suggest that this part of the fault has a low slip rate based on the general absence of large scarps on latest Quaternary deposits that would be expected (Haller, 1988 #27). Thus the analogy of Scott and others (1985 #76) may not be appropriate. Baltzer (1990 #432) suggests that this segment has the highest postearly Wisconsin uplift rate of any on the northern Lemhi fault, but the post-Pinedale rate is lower than other segments. In the absence of data that can be used to better constrain a slip rate, the lowest slip-rate category is assigned here based on the overall geomorphic expression and character of the fault.
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.

#432 Baltzer, E.M., 1990, Quaternary surface displacement and segmentation of the northern Lemhi fault, Idaho: Binghamton, State University of New York, unpublished M.S. thesis, 88 p., 2 pl., scale 1:62,500.

#186 Crone, A.J., and Haller, K.M., 1991, Segmentation and the coseismic behavior of Basin and Range normal faults—Examples from east-central Idaho and southwestern Montana, *in* Hancock, P.L., Yeats, R.S., and Sanderson, D.J., eds., Characteristics of active faults: Journal of Structural Geology, v. 13, p. 151-164.

#27 Haller, K.M., 1988, Segmentation of the Lemhi and Beaverhead faults, east-central Idaho, and Red Rock fault, southwest Montana, during the late Quaternary: Boulder, University of Colorado, unpublished M.S. thesis, 141 p., 10 pls.

#6550 Janecke, S.U., 1993, Structures in segment boundary zones of the Lost River and Lemhi faults, east central Idaho: Journal of Geophysical Research, v. 98, no. B9, p. 16,223-16,238.

#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.

#85 Stickney, M.C., and Bartholomew, M.J., 1987, Seismicity and late Quaternary faulting of the northern Basin and Range province, Montana and Idaho: Bulletin of the Seismological Society of America, v. 77, p. 1602-1625.

#4642 Turko, J.M., 1988, Quaternary segmentation history of the Lemhi Fault, Idaho: Binghamton, State University of New York, M.A. thesis, 91 p.

#227 Turko, J.M., and Knuepfer, P.L.K., 1991, Late Quaternary fault segmentation from analysis of scarp morphology: Geology, v. 19, p. 718-721.

#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.