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Salmon River fault system (Class A) No. 638

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Compiled in cooperation with the Idaho Geological Survey

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Synopsis	Faults of the Salmon River fault system are principally north-striking, down-to-the-east, high-angle faults that cut Miocene and older rocks. The precise location and number of faults associated with this system are not well known. Locally some fault strands have been reported to form relatively fresh fault traces, truncate ridge spurs, and displace fan deposits. No detailed studies have been conducted along these faults and recurrence or slip rate estimates have not been reported. The existing information suggests some Quaternary activity along the two faults shown herein and perhaps activity along other nearby faults in the vicinity of the Salmon River and White Bird, Idaho.

Name comments	Refers to north-striking faults along an adjacent to the Salmon River near White Bird, Idaho. Faults in the vicinity of White Bird are shown on several geologic maps and sketch maps of this region, but they are depicted or generalized differently on many of these. One to several of these faults near White Bird, Idaho, have been referred to as the Little Salmon River fault, Salmon River fault, and Salmon River fault zone. Capps (1941 #5895) mapped a single, northerly striking fault west of the Salmon and Little Salmon Rivers, which he called the Little Salmon River fault. Wagner (1945 #5885) mapped a northerly striking fault west of the Salmon River that he called the Salmon River fault. Bond (1963 #618) mapped mostly north-striking faults west and east of the Salmon River and referred to these faults as the Salmon River fault zone; he also referred to one of these faults as the Salmon River fault, but did not specifically identify its location in the zone of faults. Coffin (1967 #5884) also mapped mostly northerly striking faults east and west of the Salmon River and referred to these faults as the Salmon River fault zone. Mostly northerly striking faults that are shown along and adjacent to the Salmon River near White Bird, Idaho, differ in their portrayal and are unnamed on several regional geologic map compilations (Newcomb, 1970 #3761; Witkind, 1975 #320; Bond, 1978 #5829; Gaston and Bennett, 1979 #5882; Swanson and others, 1981 #3496). Two north-striking Quaternary faults are shown west of the Salmon River, near White Bird, Idaho, on a recent compilation of Miocene and younger faults in Idaho (Breckenridge and others, 2003 #5878). Those two faults also are shown herein and referred to as the Salmon River fault system, which is a slight modification of the name "Salmon River fault zone" as used by Coffin (1967 #5884) and Bond(1963 #618). As shown herein, these two faults of the Salmon River fault system extend for about 15 km along the west side of the Salmon River from about the North Fork of Joe Creek, northward to just north of Sheep Creek. **Fault ID:** A principle fault of this system is shown and described as fault 249 in Witkind (1975 #320). A fault strand of this system appears to be shown and included as the northern part of fault 6 on a sketch map by Capps (1941 #5895).
County(s) and State(s)	IDAHO COUNTY, IDAHO
Physiographic province(s)	COLUMBIA PLATEAU

Reliability of location	Poor Compiled at 1:100,000 scale. *Comments:* Location is based on fault traces shown on the 1:1,000,000-scale fault map of Breckenridge and others (2003 #5878); traces were transferred by inspection to a 1:100,000 scale topographic map of the Grangeville quadrangle and digitized.
Geologic setting	The Salmon River fault system lies along and crosses the eastern boundary of the Columbia Plateaus and Northern Rocky Mountains physiographic provinces. More specifically it cuts the southern boundary of the Clearwater Embayment of the Columbia Plateaus Province. The Clearwater Embayment is an area where the thick sequence of middle Miocene to Pliocene basalt flows of the Columbia Plateau Province to the west, protrudes eastward and overlies pre-existing mountainous topography and older rocks that characterize the northern Rocky Mountains Province to the east (Bond, 1963 #618). The basalt flows in this embayment may locally be as much as 1,200 m thick (Lindgren, 1904 #769). Geologic and fault maps of this region suggest that the Salmon River fault system is a northern part of a north-trending belt of north-striking faults that collectively extend more than 200 km southward from near Grangeville, Idaho, to near Emmett, Idaho (Newcomb, 1970 #3761; Bond, 1978 #5829; Breckenridge and others, 2003 #5878). Bond (1963 #618) reported that the total vertical displacement in the Salmon River fault zone, distributed over as many as five separate faults, is greater than 3,000 ft in the vicinity of White Bird, Idaho. Several authors have noted that north-striking faults of western Idaho are principally late Miocene or younger normal faults that bound tilted fault blocks, and probably represent a northern continuation of the Basin and Range faults to the south (Anderson, 1934 #595; Capps, 1941 #5895; Bond, 1963 #618).
Length (km)	25 km.
Average strike	N13°E
Sense of movement	Normal *Comments:* Reported to be principally down-to-the-east normal faults (Anderson, 1934 #595; Capps, 1941 #5895; Bond, 1963 #618).

Dip Direction	E *Comments:* These faults are described as principally high-angle, down-to-the east, normal faults (Anderson, 1934 #595; Capps, 1941 #5895; Bond, 1963 #618), which suggests they probably dip steeply (about 60?-90?) and mostly to the east.
Paleoseismology studies	
Geomorphic expression	Several authors have reported that north-striking faults of this region are responsible for the north-trending topographic depression(s) occupied by the Salmon and Little Salmon drainages (Anderson, 1934 #595; Capps, 1941 #5895; Wagner, 1945 #5885; Bond, 1963 #618). These faults are mostly expressed in Miocene and older rock and have been reported to be partly expressed by the gentle west dip (about 5?-20?) of Miocene basalt flows towards these north-striking faults (Capps, 1941 #5895; Wagner, 1945 #5885; Bond, 1963 #618). Coffin (1967 #5884) noted that numerous north- and east-striking faults are present east and west of the Salmon River near White Bird, Idaho. He mapped and discussed two of the larger of the north-trending faults, which from a graben, and reported that gouge zones and abrupt changes in topography mark these faults. Coffin (1967 #5884) further reported that he did not observe any fresh scarps and that "fault-like" scarps he observed are caused by erosion of blocks in a graben and by erosional retreat of slopes. Anderson (1934 #595) reported a northwest-trending scarp in Miocene basalt near White Bird, east of the Salmon River and east of the faults shown herein. Also, east of the Salmon River and near White Bird, Kirkham and Johnson (1929 #5903) observed and measured active fissures and faults, but they concluded that this surface activity was related to mass movement or gravity faulting, and as such not obviously related to tectonic faulting at depth. Bond (1963 #618) reported observations of relatively fresh fault traces, truncated spurs, and faulted fan deposits along the Salmon River fault. He did not, however, specifically identify the Salmon River fault among the faults he included in his Salmon River fault zone, nor did he elaborate on the specific locations of the features observed.
Age of faulted surficial deposits	Along the southern part of the Salmon River fault system as shown herein, Coffin (1967 #5884) mapped and indicated that Miocene basalts and sediments are the youngest faulted units in

	the area he mapped. Coffin (1967 #5884) further reported that no fresh scarps are present in alluvial or terrace deposits to suggest recent active faulting. Several other regional geologic maps that include this area also suggest that Miocene rocks are the youngest faulted units along and near faults of this system (Newcomb, 1970 #3761; Gaston and Bennett, 1979 #5882; Swanson and others, 1981 #3496). Bond (1963 #618), however, reported observations of relatively fresh fault traces, truncated spurs, and faulted fans along the Salmon River fault; he did not elaborate on the possible age of the fans, but, presumably, they are Pleistocene or Holocene in age.
Historic earthquake	
Most recent prehistoric deformation	undifferentiated Quaternary (<1.6 Ma) *Comments:* The timing of the most recent prehistoric faulting event along faults of the Salmon River fault system is not tightly constrained. Based mostly on physiographic evidence, several authors have concluded that much of the late Cenozoic faulting in the region of the Salmon River fault system is post-Miocene, and probably mostly late Pliocene with some waning activity continuing in the Pleistocene (Anderson, 1934 #595; Capps, 1941 #5895; Bond, 1963 #618). A preliminary map by Hilt and others (1994 #785) of probable Holocene and late Quaternary faults in Idaho does not show any faults of this age near Whitebird, Idaho, nor in areas nearby. No unequivocal evidence for Quaternary offset along faults of the Salmon River fault system has been reported. The two faults of this system that are shown herein, also are shown on a map of Miocene and younger faults in Idaho by Breckenridge and others (2003 #5878) and are indicated on that map to have been active in the late Quaternary. The map by Breckenridge and others (2003 #5878), however, does not report evidence for the age assignments shown on the map. Bond (1963 #618) reported observations of relatively fresh fault traces, truncated spurs, and faulted fans along the Salmon River fault, which suggests Pleistocene or younger movement on at least some fault strands of this system. Depending on the age of the faulted fans observed, these observations made by Bond (1963 #618) could even indicate late Quaternary (<130 ka) or younger activity. Accordingly, however, the Salmon River fault system is more conservatively assigned a Quaternary (<1.6 Ma) age for the time of the most recent prehistoric faulting event until further studies are conducted.

Recurrence interval	*Comments:* Breckenridge and others (2003 #5878) show faults of the Salmon River fault system as late Quaternary faults on their compilation of Miocene and younger faults in Idaho, suggesting the recurrence interval may be <130 k.y. However, definitive evidence for late Quaternary activity along the Cedar Creek fault has not been reported.
Slip-rate category	Less than 0.2 mm/yr *Comments:* No age or stratigraphic data for surficial deposits nor scarp-height data are available to serve as a basis for estimating slip rate. Based on the sparse evidence reported for Quaternary activity and the lack of definitive evidence for late Quaternary activity along these faults, they are herein assigned a slip rate of less than 0.2 mm/yr until further studies are conducted.
Date and Compiler(s)	2003 David J. Lidke, U.S. Geological Survey Reed S. Lewis, Idaho Geological Survey
References	#595 Anderson, A.L., 1934, A preliminary report on recent block faulting in Idaho: Northwest Science, v. 8, p. 17-28. #618 Bond, J.G., 1963, Geology of the Clearwater Embayment: Idaho Bureau of Mines and Geology Pamphlet 128, 83 p., 2 pls. #5829 Bond, J.G., 1978, Geologic map of Idaho: Idaho Bureau of Mines and Geology, 1 sheet, scale 1:500,000. #5878 Breckenridge, R.M., Lewis, R.S., Adema, G.W., and Weisz, D.W., 2003, Miocene and younger faults in Idaho: Idaho Geological Survey Map 8, 1 sheet, scale 1:1,000,000. #5895 Capps, S.R., 1941, Faulting in western Idaho and its relation to the high placer deposits: Idaho Bureau of Mines and Geology Pamphlet 56, 20 p., 1 pl., scale 1:500,000. #5884 Coffin, P.E., 1967, Geology of the Slate Creek quadrangle, Idaho County, Idaho: Moscow, University of Idaho, unpublished M.S. thesis, 57 p. #5882 Gaston, M.P., and Bennett, E.H., 1979, Geologic map of the Grangeville quadrangle, Idaho: Idaho Geological Survey

	Geologic Map Series GM-9, 1 sheet, scale 1:250,000. #785 Hilt, A.P., Breckenridge, R.M., and Sprenke, K.F., compilers, 1994, Preliminary neotectonic map of Idaho: Idaho Geological Survey Technical Report 94-1, 1 sheet, scale 1:1,000,000. #5903 Kirkham, V.R.D., and Johnson, M.M., 1929, Active faults near White Bird, Idaho: Journal of Geology, v. 37, no. 7, p. 700-711. #769 Lindgren, W., 1904, A geological reconnaissance across the Bitterroot Range and Clearwater Mountains in Montana and Idaho: U.S. Geological Survey Professional Paper 27, 123 p. #3761 Newcomb, R.C., 1970, Tectonic structure of the main part of the basalt of the Columbia River Group Washington, Oregon, and Idaho: U.S. Geological Survey Miscellaneous Geologic Investigations I-587, 1 sheet, scale 1:500,000. #3496 Swanson, D.A., Anderson, J.L., Camp, V.E., Hooper, P.R., Taubeneck, W.H., and Wright, T.L., 1981, Reconnaissance geologic map of the Columbia River Basalt Group, northern Oregon and western Idaho: U.S. Geological Survey Open-File Report 81-797, 35 p., 5 pls., scale 1:250,000. #5885 Wagner, W.R., 1945, A geological reconnaissance between the Snake and Salmon Rivers north of Riggins, Idaho: Idaho Bureau of Mines and Geology Pamphlet 74, 16 p., 1 pl. #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.