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Quaternary Fault and Fold Database of the United States

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Long Valley fault zone, southern section (Class A) No. 628b

Last Review Date: 2010-11-09

Compiled in cooperation with the Idaho Geological Survey

citation for this record: **Personius, S.F., and Lewis, R.S., compilers, 2010, Fault number 628b, Long Valley fault zone, southern 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 03:03 PM.**

Synopsis	**General:** The Long Valley fault zone forms the western margin of a large graben that confines Long Valley in western Idaho. The graben lies along the easternmost extent of Miocene Columbia River Basalts, and is floored by a thick sequence of Tertiary and Quaternary sediments deposited in at least two subbasins. Mesozoic metamorphic and intrusive igneous rocks are unconformably overlain by Miocene Columbia River Basalts in West Mountain, which forms the footwall of the Long Valley fault zone. The fault zone is part of the western Idaho fault belt.

	Sections: This fault has 2 sections. Sections are defined following the segmentation model of Knudsen and others (1996 #5889). The northern section defines the northwestern margin of the graben, and the southern section defines the southwestern margin of the graben. The two sections also are delineated by paired subbasins in Long Valley that show different amounts of accumulated sediment. The northern section has the highest long-term (post-Miocene) slip rates (0.3-0.6 mm/yr) and equivocal evidence of post Bull-Lake pre-Pinedale (thus, between 14 and 150 ka) displacement. The southern section has the lower long-term (post-Miocene) slip rates (0.1-0.3 mm/yr), little if any evidence of post Bull-Lake displacement, and some evidence of pre-Bull Lake (Plio-Pleistocene) deformation.
Name comments	**General:** The fault zone that defines the western margin of Long Valley was originally mapped and named after the valley by Capps (1941 #5895). **Section:** This section consists of the Southern segment of the Long Valley fault of Knudsen and others (1996 #5889). **Fault ID:** These structures are part of fault numbers 207 and 219 in the fault compilation of Witkind (1975 #320).
County(s) and State(s)	VALLEY COUNTY, IDAHO
Physiographic province(s)	NORTHERN ROCKY MOUNTAINS
Reliability of location	Poor Compiled at 1:250,000 scale. *Comments:* Fault locations are from 1:250,000-scale mapping of Knudsen and others (1996 #5889) further constrained by satellite imagery and topography at scale of 1:250,000. Reference satellite imagery is ESRI_Imagery_World_2D with a minimum viewing distance of 1 km (1000 m).
Geologic setting	The Long Valley fault zone forms the western margin of a large graben that confines Long Valley in western Idaho. The graben lies along the easternmost extent of Miocene Columbia River Basalts, and is floored by a thick sequence of Tertiary and Quaternary sediments. Mesozoic metamorphic and intrusive igneous rocks are unconformably overlain by Miocene Columbia River Basalts in West Mountain, which forms the footwall of the

	Long Valley fault zone (Schmidt and Mackin, 1970 #512; Newcomb, 1970 #3761; Mitchell and Bennett, 1979 #5894; Fitzgerald, 1982 #5886). The fault is part of the western Idaho fault belt of Hamilton (1963 #6040), a system of north-striking normal faults formed along the western margin of the Idaho batholith.
Length (km)	This section is 29 km of a total fault length of 60 km.
Average strike	N12°W (for section) versus N9°W (for whole fault)
Sense of movement	Normal *Comments:* Faults in this section are mapped as normal faults (Schmidt and Mackin, 1970 #512; Newcomb, 1970 #3761; Mitchell and Bennett, 1979 #5894; Fitzgerald, 1982 #5886).
Dip Direction	E *Comments:* No actual dip measurements have been published, but Knudsen and others (1996 #5889) used dips of 60? and 70? in their analysis of the earthquake potential associated with the Long Valley fault.
Paleoseismology studies	
Geomorphic expression	The southern section of the Long Valley fault zone forms a steep, linear, 1000-m-high escarpment that divides the western margin of Long Valley and the eastern margin of West Mountain. The adjacent graben or subbasin has thinner Tertiary-Quaternary fill deposits than the northern section, suggesting less total fault throw (Kinoshita, 1962 #5897). No fault scarps in last-glacial-maximum (Pinedale-equivalent Pilgrim Cove or McCall) deposits have been described in the numerous investigations of this fault zone (Schmidt and Mackin, 1970 #512; Gilbert and LaForge, 1990 #5888; Personius, 1998 #3508). Some evidence of escarpments in Bull-Lake-equivalent deposits has been observed, but all investigations concluded that these features are most likely related to fluvial erosion (Schmidt and Mackin, 1970 #512; Gilbert and others, 1983 #5887; Gilbert and LaForge, 1990 #5888; Knudsen and others, 1996 #5889).
Age of faulted surficial	The southern section substantially offsets Miocene Columbia River Basalt rocks, but no unequivocal fault scarps in last-glacial-

deposits	maximum (Pinedale-equivalent Pilgrim Cove) or older Bull-Lake-equivalent Timber Ridge deposits have been identified (Schmidt and Mackin, 1970 #512; Gilbert and others, 1983 #5887; Gilbert and LaForge, 1990 #5888; Knudsen and others, 1996 #5889). Schmidt and Mackin (Schmidt and Mackin, 1970 #512) and Knudsen and others (1996 #5889) noted Plio-Pleistocene sediments near Pearsol Creek that are tilted 10? to 20? westward into either the southern section of the fault zone or the Cascade fault [627]. Based on pollen assemblages, these deposits are thought to be glacio-lacustrine sediments associated with a pre-Bull-Lake glacial episode and thus their deformation reflects a period of deformation some time in the Plio-Pleistocene prior to deposition of Bull-Lake-equivalent deposits (Schmidt and Mackin, 1970 #512; Knudsen and others, 1996 #5889).
Historic earthquake	
Most recent prehistoric deformation	undifferentiated Quaternary (<1.6 Ma) *Comments:* The high, steep, and linear range front associated with the southern section is probably indicative of Quaternary displacement, but a lack of unequivocal fault scarps in Bull-Lake-equivalent Timber Ridge deposits indicates that extensive faulting predates the 140-150 ka age (Colman and Pierce, 1986 #5896) of these deposits. Tilting of glacio-lacustrine sediments associated with a pre-Bull-Lake glacial episode probably reflects a period of deformation some time in the Plio-Pleistocene on either the southern section of the Long Valley fault or the nearby Cascade fault [627] (Schmidt and Mackin, 1970 #512; Knudsen and others, 1996 #5889). The section is mapped as a major Quaternary (<1.6 Ma) structure by Breckenridge and others (2003 #5878).
Recurrence interval	10,000-20,000 years *Comments:* Knudsen and others (1996 #5889) used long-term slip rates of 0.1-0.3 mm/yr to estimate a range of recurrence of 10,000-20,000 years for 1-2 m displacements on the southern section.
Slip-rate category	Less than 0.2 mm/yr *Comments:* Several estimates of offset of Columbia River Basalt rocks across the southern section using mapping of Schmidt and

	Mackin (1970 #512) and gravity data of Kinoshita (1962 #5897) have been described: The estimated thickness of the basin fill from the gravity data and height of the range front escarpment, and projections of dipping surface exposures of Columbia River Basalt rocks yield fault-displacement estimates of 3,000-3,300 m (Gilbert and others, 1983 #5887) and 1,000-3,000 m (Knudsen and others, 1996 #5889). The age of fault initiation is poorly known, but estimates range from 14.7 Ma to about 10 Ma (Fitzgerald, 1982 #5886; Knudsen and others, 1996 #5889). Knudsen and others (1996 #5889) used Columbia River Basalt offsets of 1,000-3,000 m and an age of fault initiation of 10 Ma to estimate long-term slip rates of 0.1-0.3 mm/yr across the southern section. No estimates of Quaternary slip rates have been described, which may well be <0.2 mm/yr.
Date and Compiler(s)	2010 Stephen F. Personius, U.S. Geological Survey Reed S. Lewis, Idaho Geological Survey
References	#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. #5896 Colman, S.M., and Pierce, K.L., 1986, Glacial sequence near McCall, Idaho: Weathering rinds, soil development, morphology, and other relative-age criteria: Quaternary Research, v. 25, p. 25-42. #5886 Fitzgerald, J.E., 1982, Geology and basalt stratigraphy of the Weiser Embayment, west-central Idaho, *in* Bonnichsen, B., and Breckenridge, R.M., eds., Cenozoic geology of Idaho: Idaho Bureau of Mines and Geology Bulletin 26, p. 103-128. #5888 Gilbert, J.D., and LaForge, R.C., 1990, Seismotectonic study for Deadwood Dam, Boise project, Idaho: U.S. Bureau of Reclamation Seismotectonic Report 90-2, 40 p., 2 pl. #5887 Gilbert, J.D., Piety, L., and LaForge, R., 1983, Seismotectonic study for Black Canyon Dam, Boise project, Idaho: U.S. Bureau of Reclamation Seismotectonic Report 83-7, 73 p., 8 pl.

#6040 Hamilton, W., 1963, Metamorphism in the Riggins region, western Idaho: U.S. Geological Survey Professional Paper 436, 95 p.

#5897 Kinoshita, W.T., 1962, A gravity survey of part of the Long Valley district, Idaho: U.S. Geological Survey Open-File Report 62-73, 11 p.

#5889 Knudsen, K.L., Wong, I., Sawyer, T.L., Bott, J., Silva, W., and Lettis, W.R., 1996, Seismotectonic evaluation, Cascade Dam, Boise project, west-central Idaho: Final Report prepared for U.S. Department of the Interior, Bureau of Reclamation, 198 p., 3 pls.

#5894 Mitchell, V.E., and Bennett, E.H., 1979, Geologic map of the Baker quadrangle, Idaho: Idaho Bureau of Mines and Geology Geologic Map Series, Baker 2° quadrangle, 1 sheet, scale 1:250,000.

#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.

#3508 Personius, S.F., 1998, Surficial geology and neotectonics of selected areas of western Idaho and northeastern Oregon: U.S. Geological Survey Open-File Report 98-771, 25 p.

#512 Schmidt, D.L., and Mackin, J.H., 1970, Quaternary geology of Long and Bear Valleys, west-central Idaho: U.S. Geological Survey Bulletin 1311-A, 22 p., 2 pls.

#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.