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Quaternary Fault and Fold Database of the United States

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Luna Butte fault (Class A) No. 579

Last Review Date: 2017-01-17

citation for this record: **Personius, S.F., and Lidke, D.J., compilers, 2017, Fault number 579, Luna Butte fault, 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 03:04 PM.**

Synopsis	The Luna Butte fault is a northwest-trending fault zone marked by right-lateral strike-slip and normal faults, and it is commonly coincident with anticlines of similar trend. The fault zone offsets Miocene and Pliocene volcanic and sedimentary rocks. No scarps in Quaternary deposits have been described, but stratigraphic and geomorphic evidence suggest displacement along the fault during the middle and (or) late Quaternary. A subsidiary thrust splay, the Oak flat fault, may have undergone late Pleistocene or Holocene displacement.
Name comments	Lineaments and fault and fold traces of various orientations have been mapped as the Luna Butte (or Buttes) fault, Luna Butte trend, and Turner Butte-Rock Butte lineament (Bela, 1982 #3584; U.S. Army Corps of Engineers, 1983 #3480; Anderson, 1987 #3492; Tolan and Reidel, 1989 #3765; Pezzopane, 1993 #3544; Geomatrix Consultants Inc., 1995 #3593; Anderson and others,

	2013 #7411). The Luna Butte fault is principally a northwest-striking fault zone that extends southeastward from near the little Klickitat River along the north flank of the Simcoe Mountains, to about the Columbia River
County(s) and State(s)	KLICKITAT COUNTY, WASHINGTON
Physiographic province(s)	COLUMBIA PLATEAU
Reliability of location	Good Compiled at 1:250,000 scale. *Comments:* Fault traces are from 1:250,000 geologic map compilations by Schuster and others (1997 #3760) and Walsh and others (1987 #3579); fault traces were transferred directly onto a registered mylar overlay and digitized at 1:250,000 scale. This part of the 1:250,000-scale geologic maps was compiled from 1:100,000-scale geologic maps by Walsh (1986 #5189) and Phillips and Walsh (1987 #4660).
Geologic setting	The Luna Butte fault is a northwest-striking structure formed in Miocene Columbia River basalts and Miocene and Pliocene sedimentary rocks, in the southern part of the Yakima fold belt (Swanson and others, 1981 #3496; Bela, 1982 #3584; Anderson, 1987 #3492; Walsh and others, 1987 #3579). The Yakima fold belt, a structural-tectonic sub province of the western Columbia Plateaus Province, consists of a series of generally east-trending narrow asymmetrical anticlinal ridges and broad synclinal valleys formed by folding of Miocene Columbia River basalt flows and sediments (Reidel and others, 1989 #5553; 1994 #3539). Anticlinal ridges of the Yakima fold belt began to grow in Miocene time (about 16-17 Ma), concurrent with eruptions of Columbia River basalt flows, and continued during Pliocene time and may have continued to the present (Reidel and others, 1989 #5553; 1994 #3539). The northwest-striking Luna Butte fault is one of several northwest-striking faults, which appear to cut east-trending folds and faults of the Columbia Hills structures [#568]. Several authors have reported that these northwest-striking faults are at least in part younger features that cut and offset easterly trending, Yakima fold belt structures such as those of the Columbia Hills (Myers and others, 1979 #5175; Bentley and others, 1980 #4667; Geomatrix Consultants Inc., 1995 #3593).

Length (km)	31 km.
Average strike	N24°W
Sense of movement	Right lateral, Normal *Comments:* The Luna Butte fault is commonly coincident with and parallel to a northwest trending anticline; in places it is mapped as a down-to-the-northeast or down-to-the-southwest normal fault, and in other places is mapped as a right-lateral strike slip fault (Swanson and others, 1981 #3496; Bela, 1982 #3584; Walsh, 1986 #5189; Anderson, 1987 #3492; Walsh and others, 1987 #3579; Phillips, 1987 #4660; Tolan and Reidel, 1989 #3765). Some east-trending fold axes of the Columbia Hills structures [#568] appear to be offset by the fault and others are mapped across the fault without apparent displacement (Walsh and others, 1987 #3579; Schuster and others, 1997 #3760).
Dip	90° *Comments:* No actual dip measurements have been published, but Geomatrix Consultants, Inc. (1995 #3593) modeled the Luna Butte fault as a vertical strike-slip fault in their analysis of paleo-earthquake magnitudes. The parts of the fault trace that are mapped as normal faults may not have vertical dips.
Paleoseismology studies	
Geomorphic expression	The Luna Butte fault is coincident with lineaments and short uplifts (anticlines) along part of its length (Swanson and others, 1981 #3496; Bela, 1982 #3584; U.S. Army Corps of Engineers, 1983 #3480; Anderson, 1987 #3492; Tolan and Reidel, 1989 #3765; Anderson and others, 2013 #7411). S.K. Pezzopane, (pers. commun., 1993, in Geomatrix Consultants Inc., 1995 #3593) noted the good geomorphic expression of faulting along the Luna Butte fault.
Age of faulted surficial deposits	The Luna Butte fault offsets Miocene and Pliocene volcanic and sedimentary rocks (Swanson and others, 1981 #3496; Bela, 1982 #3584; Anderson, 1987 #3492; Walsh and others, 1987 #3579 Anderson and others, 2013 #7411). A possible east-west trending thrust(?) splay of the fault, the Oak Flat fault, may offset late Pleistocene or Holocene alluvial deposits (U.S. Army Corps of Engineers, 1983 #3480; Anderson, 1987 #3492; Walsh and others,

	1987 #3579; Pezzopane, 1993 #3544; Geomatrix Consultants Inc., 1995 #3593), and probable late Pleistocene glacio-fluvial sediments are offset along the Luna Butte fault a few kilometers north of the Columbia River (Anderson, 1987 #3492).
Historic earthquake	
Most recent prehistoric deformation	middle and late Quaternary (<750 ka) *Comments:* Anderson (1987 #3492) and Anderson and others (2013 #74110) describe offsets in probable late Pleistocene glacio-fluvial deposits along the Luna Butte fault a few kilometers north of the Columbia River. The U.S. Army Corps of Engineers (1983 #3480) used regional structural relationships to suggest that youngest movement on the fault occurred more than 1 Ma, but airphoto analysis by S.K. Pezzopane (pers. commun., 1993, in Geomatrix Consultants Inc., 1995 #3593) and Geomatrix Consultants, Inc. (1995 #3593) suggest that the Luna Butte fault has good geomorphic expression of faulting and may have been active in the middle or late Quaternary (<700-780 ka). Based on this information, a middle and late Quaternary age (<750 ka) for the time of most recent prehistoric faulting is assigned herein to the Luna Butte fault.
Recurrence interval	
Slip-rate category	Less than 0.2 mm/yr *Comments:* No slip data are available for the Luna Butte fault, but the lack of scarps in Quaternary deposits suggests low rates of Quaternary slip. Geomatrix Consultants, Inc. (1995 #3593) used estimated slip rates of 0.01-0.1 mm/yr in their analysis of earthquake hazards associated with the Luna Butte fault.
Date and Compiler(s)	2017 Stephen F. Personius, U.S. Geological Survey David J. Lidke, U.S. Geological Survey
References	#3492 Anderson, J.L., 1987, The structural geology and ages of deformation of a portion of the southwest Columbia Plateau, Washington and Oregon: University of Southern California, Ph. D dissertation, 283 p., 7 pls., scale 1:24,000. #7411 Anderson, J.L., Tolan, T.L., and Wells, R.E., 2013, Strike-slip faults in the western Columbia River flood basalt province,

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