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West Grande Ronde Valley fault zone, La Grande section (Class A) No. 802b

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Synopsis	**General:** The West Grande Ronde Valley fault forms the western margin of a larg graben system that confines the Grande Ronde Valley in northeastern Oregon. Th graben is formed in Miocene and Pliocene volcanic rocks, and is floored by a thic sequence of Neogene and Quaternary alluvial sediments. The Grande Ronde Vall may be a pull apart basin related to displacement along a regional scale right-late strike-slip fault system. The West Grande Ronde Valley fault zone is divided into sections herein; from north to south, these are the Mount Emily, La Grande, and C Mountain sections. All of these sections form steep, en echelon range fronts, whi intermittently marked by tonal contrasts, linear depressions, range front facets, sp and scarps. Most fault studies in the region infer late Pleistocene and perhaps Hol displacement on the Mount Emily and La Grande sections, and somewhat older l Quaternary displacement on the Craig Mountain section.

	Sections: This fault has 3 sections. The West Grande Ronde Valley fault zone is divided into three sections herein, slightly modified from the divisions of Simpso others (1993 #3596); from north to south, these are the Mount Emily section, the Grande section, and the Craig Mountain section.
Name comments	**General:** The fault zone along the western margin of the Grande Ronde Valley w originally mapped by Hampton and Brown (1964 #3491), and later summarized b Walker (1979 #3576). Parts of the fault zone north of La Grande were named the Ruckel Ridge and Indian Rock faults (Kienle and others, 1979 #3728); faults nea Grande were named the Mount Emily, La Grande, Foothill Road, and Hot Lake fa (Barrash and others, 1980 #3570), and the La Grande fault (Geomatrix Consultan Inc., 1989 #1310). The fault traces included herein were informally grouped as th West Grande Ronde Valley fault by Simpson and others (1993 #3596). Faults alo west side of the Grande Ronde Valley have been included in numerous reconnais Quaternary fault investigations and compilations (Kienle and others, 1979 #3728 Army Corps of Engineers, 1983 #3480; Geomatrix Consultants Inc., 1989 #1310; and others, 1990 #3733; Pezzopane and Weldon, 1993 #149; Pezzopane, 1993 #3 Simpson and others, 1993 #3596; 1995 #3593; Madin and Mabey, 1996 #3575; Personius, 1998 #3508; Wood, 1999 #4042). **Section:** This section includes the La Grande and Foothill segments of the West Grande Ronde Valley fault zone of Simpson and others (1993 #3596) and Person (1998 #3508). Previously named faults in this section include the La Grande, Foo Road, and Hot Lake faults of Barrash and others (1980 #3570) and the La Grande (Geomatrix Consultants Inc., 1989 #1310). **Fault ID:** This structure is part of fault number 13 of Pezzopane (1993 #3544) ar fault number 68a of Geomatrix Consultants, Inc. (1995 #3593).
County(s) and State(s)	UNION COUNTY, OREGON
Physiographic province(s)	COLUMBIA PLATEAU
Reliability of location	Good Compiled at 1:100,000 scale. *Comments:* Location of fault from ORActiveFaults (http://www.oregongeology.org/arcgis/rest/services/Public/ORActiveFaults/MapS downloaded 06/02/2016) attributed to 1:100,000-scale compilation of Ferns and c (2001 #5135).
Geologic setting	The West Grande Ronde Valley fault zone forms the western margin of a large gr system that forms the Grande Ronde Valley. The graben is formed in volcanic roc the Miocene Columbia River Group and the Mio-Pliocene Powder River volcanic

	and is floored by a thick sequence of Neogene and Quaternary alluvial sediments (Hampton and Brown, 1964 #3491; Walker, 1979 #3576; Barrash and others, 198 #3570; Ferns and Madin, 1999 #5160, Ferns, 2001 #5135; Van Tassell and others 2000 #5166). Numerous northwest-trending faults are present throughout the regi some workers attribute graben formation to a pull apart basin related to displacem along a regional scale right-lateral strike-slip fault system (Gehrels and others, 19 #3774). However, no evidence of significant lateral displacement in the Quaterna been found along the West Grande Ronde Valley fault zone (Ferns and Madin, 19 #5160).
Length (km)	This section is 15 km of a total fault length of 48 km.
Average strike	N30°W (for section) versus N19°W (for whole fault)
Sense of movement	Normal, Right lateral *Comments:* Faults in this section are mapped as a normal or high-angle faults (Hampton and Brown, 1964 #3491; Walker, 1979 #3576; Barrash and others, 198 #3570; Walker and MacLeod, 1991 #3646; Pezzopane, 1993 #3544; Simpson and others, 1993 #3596; Ferns and others, 2001 #5135). Some workers attribute form of the Grande Ronde graben to a pull apart basin related to displacement along a regional scale right-lateral strike-slip fault system, and horizontal striations have observed on some faults in the area (Gehrels and others, 1980 #3774). However, evidence of significant lateral displacement in the Quaternary has been found alo West Grande Ronde Valley fault zone (Ferns and Madin, 1999 #5160).
Dip Direction	NE *Comments:* No dip measurements have been published, but Ferns and Madin (19 #5160) used mapped outcrop patterns to estimate dips of 60–70°on the Mount En section [802a]. Simpson and others (1993 #3596) and Geomatrix Consultants, Inc (1995 #3593) modeled the West Grande Ronde Valley fault as a 70° dipping norn fault in their analyses of paleo-earthquake magnitudes. These values are substanti by a dip of 68–70° that can be estimated from the interception depth of the Hot L fault in a geothermal test well (Barrash and others, 1980 #3570) along the Craig Mountain section [802c].
Paleoseismology studies	
Geomorphic expression	The La Grande section forms a complex, steep, en echelon range front, from the vicinity of the mouth of the Grande Ronde River canyon on the north to the mout Ladd Canyon on the south. The section consists of two primary fault strands, a complex strand adjacent to La Grande (La Grande segment of Simpson and other 1993 #3596) and a strand parallel to Foothill Road (Foothill segment of Simpson

	others, 1993 #3596); these strands are separated by a left step south of La Grande appear to intersect further south near Ladd Marsh (Ferns and others, 2001 #5135) Foothill strand is marked by alignment of topographic benches, linear benches, sp tonal contrasts, and vegetation lineaments along the range (Simpson and others, 1 #3596; Ferns and others, 2001 #5135). Simpson and others (1993 #3596) and Personius (1998 #3508) describe a 2- to 5-m-high scarp on an older fluvial terrace the north end the of the Foothill strand. The La Grande strand is expressed as a st linear range front, with small (1- to 3-m-high) fault scarps on late Quaternary allu deposits at several canyon mouths, and larger scarps (~20 m) in older landslide deposits near the southern end of the strand (Simpson and others, 1993 #3596; Personius, 1998 #3508). The minor strand (the "eastern splay") identified by Pers (1998 #3508) is a few hundred meters east of the La Grande range front north of Grande. This 11- to 12-m-high fault scarp is about 1.5 km long, is on middle Pleistocene or older hillslope and landslide deposits, and has scarp-slope angles c 27° (Personius, 1998 #3508). The possible relationship of the eastern splay to eith the more prominent strands in the La Grande section is open to question; the east splay could be a splay of the La Grande strand that has been isolated by Holocene alluvial deposits, or it could be a northern continuation of the Foothill strand. The possibility may be supported by a possible connection between the Foothill strand a lineament mapped north of the Grande Ronde River (Barrash and others, 1980 #3570; Simpson and others, 1993 #3596).
Age of faulted surficial deposits	Faults in the La Grande section offset volcanic rocks of the Miocene Columbia R Group and Mio-Pliocene Powder River volcanic field, and also offset Quaternary surficial deposits (Ferns and others, 2001 #5135). Simpson and others (1993 #359 describe tonal contrasts and vegetation lineaments in young (late Pleistocene or Holocene) valley-fill sediments along the southern end of the Foothill strand. Pers (1998 #3508) used limited soils data to infer an age of 60–140 ka for the fluvial deposits offset near the northern end of the Foothill strand; Simpson and others (1 #3596) assign a late Pleistocene or older age, based on the hummocky and dissec expression of these deposits. Alluvial deposits that are 5–10 m above modern drainages are offset in several locations along the La Grande strand; these deposit thought to be late Pleistocene in age (Simpson and others, 1993 #3596; Personius 1998 #3508). Landslide deposits with larger displacements are offset near the sou end of the La Grande strand; these deposits are probably middle Pleistocene or ol (Personius, 1998 #3508). The colluvial and landslide deposits offset by the easter splay are probably middle Pleistocene or older (Personius, 1998 #3508). Ferns an others (2001 #5135) describe Z-shaped benches that mark faulted bedrock alluvia contacts in late Quaternary deposits.
Historic earthquake	
Most recent prehistoric	latest Quaternary (<15 ka)

deformation	*Comments:* Simpson and others (1993 #3596) and Ferns and others (2001 #5135) the presence of scarps on young alluvium to infer late Pleistocene and perhaps Holocene displacement on the La Grande and Foothill strands of the La Grande section. Personius (1998 #3508) used limited fault scarp profiles on the eastern sp and the presence of fault scarps on the La Grande strand to infer late Pleistocene (128 ka) displacement on the La Grande section. Geomatrix Consultants, Inc. (198 #1310; 1995 #3593), Pezzopane (1993 #3544), and Weldon and others (2002 #56 also infer latest Quaternary (<10–20 ka) displacement on the La Grande section o West Grande Ronde Valley fault zone.
Recurrence interval	
Slip-rate category	Less than 0.2 mm/yr *Comments:* No published slip rates are available, but displacement across the faul zone in Miocene Columbia River basalts is 430–700 meters (Barrash and others, #3570), and Ferns and others (2001 #5135) showed similar offsets in Miocene Pc River volcanic field rocks across the La Grande section. Fault scarps are 2-5 m hi middle or late Pleistocene alluvium, so both long- and short-term offset measurer yield low rates of displacement. Geomatrix Consultants, Inc. (1995 #3593) use of data from Simpson and others (1993 #3596) to estimate rates of 0.01–0.05 mm/yr all of the West Grande Ronde Valley fault zone. Rates may be higher than those estimated by Geomatrix Consultants, Inc. (1995 #3593) because Van Tassell and ((2000 #5161) used regional mapping and well data to calculate a subsidence rate mm/yr for the last 9 Ma for the southwestern part of the La Grande basin.
Date and Compiler(s)	2002 Stephen F. Personius, U.S. Geological Survey Kathleen M. Haller, U.S. Geological Survey
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