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Klamath graben fault system, West Klamath Lake section (Class A) No. 843a

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Synopsis	**General:** The Klamath graben fault system is a group of north and northwest-trending normal faults that form a complex graben system that confines the Klamath Lake basin at the intersection of the northwestern Basin and Range and Cascade Mountains in southern Oregon. These faults offset upper Miocene to Holocene volcanic rocks and Pleistocene and Holocene valley-fill sediments. The Klamath graben fault system is divided into three sections—the West Klamath Lake section, the East Klamath Lake section, and the south Klamath Lake section. The West Klamath Lake and south Klamath Lake sections in part show evidence of latest Quaternary displacement; youngest displacement on the East Klamath Lake section occurred in the Quaternary. **Sections:** This fault has 3 sections. The Klamath graben fault system is divided into three sections herein, following the

	subdivisions of Geomatrix Consultants, Inc. (1995 #3593)—the West Klamath Lake section, the East Klamath Lake section, and the south Klamath Lake section of the Klamath graben fault system.
Name comments	**General:** The overall fault system is generally referred to as the Klamath graben in maps of the region; individual fault names include the East Klamath Lake fault zone (Klinger and others, 1996 #3729; Bacon and others, 1997 #3516; 1999 #3499) and the West Klamath Lake fault zone (Hawkins and others, 1989 #3548; Klinger and others, 1996 #3729). Geomatrix Consultants, Inc. (1995 #3593) informally include faults in the southern part of the graben system in their South Klamath graben source zone. Herein we retain the following names as sections of the Klamath graben fault system: the West Klamath Lake section, the East Klamath Lake section, and the south Klamath Lake section. **Section:** This section includes the West Klamath Lake fault zone of Hawkins and others (1989 #3548), and Klinger and others (1996 #3729); Bacon and others (1997 #3516; 1999 #3499) included the Annie Spring, Red Cone Spring, Sevenmile, Threemile, and Cherry Creek faults in the West Klamath Lake fault zone of Hawkins and others (1989 #3548) and Klinger and others (1996 #3729). **Fault ID:** This group of structures is included in fault number 37 of Pezzopane (1993 #3544) and fault number 52 of Geomatrix Consultants, Inc. (1995 #3593). This is fault number 52a of Geomatrix Consultants, Inc. (1995 #3593).
County(s) and State(s)	KLAMATH COUNTY, OREGON DOUGLAS COUNTY, OREGON
Physiographic province(s)	CASCADE-SIERRA MOUNTAINS
Reliability of location	Good Compiled at 1:100,000 scale. *Comments:* Fault traces are from 1:100,000-scale mapping of Weldon and others (2002 #5648), based on 1:250,000-scale mapping of Smith and others (1982 #3493), 1:100,000-scale mapping of Hawkins and others (1989 #3548) and Bacon and others (1997 #3516), and 1:500,000-scale mapping of Pezzopane (1993 #3544) and Sherrod and Smith (2000 #5165).

Geologic setting	The Klamath graben fault system is a group of north-and northwest-trending normal faults that form a complex graben system at the intersection of the northwestern Basin and Range and Cascade Mountains in southern Oregon. Mount Mazama and Crater Lake may be localized at the intersection of the Klamath graben with the Cascades volcanic province (Bacon, 1983 #3787; Bacon and Nathenson, 1996 #3541; Bacon and others, 1997 #3516). Parts of this fault system were originally mapped by Peterson and McIntyre (1970 #3791), Smith and others (1982 #3493), Smith (1983 #3556; 1988 #3555), Moring (1983 #3554), Hawkins and others (1989 #3548), Walker and MacLeod (1991 #3646), Sherrod and Pickthorn (1992 #3567), Bacon and others (1997 #3516), and Sherrod and Smith (2000 #5165). These faults offset upper Miocene to Holocene volcanic rocks and Pleistocene and Holocene valley-fill sediments.
Length (km)	This section is 91 km of a total fault length of 148 km.
Average strike	N5°W (for section) versus N17°W (for whole fault)
Sense of movement	Normal *Comments:* Faults in this section are mapped as normal or high-angle faults by Peterson and McIntyre (1970 #3791), Smith and others (1982 #3493), Smith (1983 #3556; 1988 #3555), Moring (1983 #3554), Hawkins and others (1989 #3548), Walker and MacLeod (1991 #3646), Pezzopane (1993 #3544), Bacon and others (1997 #3516), and Sherrod and Smith (2000 #5165).
Dip Direction	E; W *Comments:* No structural data on the dip of these faults have been published, but Geomatrix Consultants, Inc. (1995 #3593) used an estimated dip of 70° in their modeling of earthquake potential of faults in the West Klamath Lake section.
Paleoseismology studies	
Geomorphic expression	The West Klamath Lake section consists of a series of fault strands marked by fault scarps on Quaternary deposits. The southern part of the section is marked by en echelon fault strands with 1- to 25-m-high scarps on middle Pleistocene to Holocene surficial deposits (Hawkins and others, 1989 #3548). The lack of extensive alluvial fans at the mouths of canyons that empty into

	Upper Klamath Lake may indicate late Quaternary subsidence (downfaulting) along the margins of the upper Klamath basin (Smith, 1983 #3556; Sherrod and Pickthorn, 1992 #3567). Some faults in the northern part of the section are marked by 11- to 160-m-high scarps on middle and late Pleistocene volcanic rocks (Bacon and others, 1997 #3516; 1999 #3499).
Age of faulted surficial deposits	Faults in the southern part of the section offset middle and late Pleistocene (10–150 ka) glacial moraines 12–25 m and early Holocene (pre-Mazama, 7–10 ka) alluvium 1–2 m (Hawkins and others, 1989 #3548). Faults in the northern part of the section (Annie Spring and Red Cone Spring faults) offset volcanic rocks that have K-Ar or Ar/Ar ages of 24–205 ka (Bacon and others, 1997 #3516).
Historic earthquake	
Most recent prehistoric deformation	late Quaternary (<130 ka) *Comments:* Bacon and others (1997 #3516) used K-Ar or Ar/Ar ages of offset lava flows to determine that the youngest event on faults in the northern part of the section (Annie Spring and Red Cone Spring faults) occurred sometime after 24±9 ka. Hawkins and others (1989 #3548) used geomorphic position, regional correlations, soils analysis, and the presence or absence of Mazama ash to determine that the youngest event on faults in the southern part of the section occurred 7–10 ka. Sherrod (1993 #3510) assigned an age of <35 ka for activity on faults in the West Klamath Lake section. The September 1993 Klamath Falls earthquakes swarm, with maximum magnitudes of 5–6, probably occurred on faults in the West Klamath Lake section, but no measurable surface rupture accompanied these earthquakes (Qamar and Meagher, 1993 #3384; Sherrod, 1993 #3510). Pezzopane (1993 #3544) and subsequent compilations (Geomatrix Consultants Inc., 1995 #3593; Madin and Mabey, 1996 #3575; Weldon and others, 2002 #5648) inferred a variety of ages of faulting, including latest Quaternary (<10–20 ka) for the youngest faults in the section. A conservative age category is assigned herein.
Recurrence interval	3–10 ka *Comments:* Bacon and others (1997 #3516) used calculated slip rates and a displacement per event of 1–3 m to estimate an

	average recurrence interval of about 3–10 ka for the West Klamath Lake fault zone; Bacon and others (1999 #3499) used similar slip rates and a displacement per event of 1–2 m to estimate an average recurrence interval of about 3–7 ka.
Slip-rate category	Between 0.2 and 1.0 mm/yr *Comments:* Hawkins and others (1989 #3548) used regional correlations to estimate the ages of offset glacial deposits (130–150 ka) and measured offsets of 21–25 m to estimate a long term slip rate of 0.17 mm/yr for faults on the southern part of the West Klamath Lake fault zone. Pezzopane (1993 #3544) inferred an average slip rate of about 0.5–1 mm/yr across the Klamath graben. Geomatrix Consultants, Inc. (1995 #3593) used preferred slip rates of 0.15–0.5 mm/yr in their analysis of earthquake hazards associated with various sections of the Klamath graben fault system. Bacon and others (1997 #3516; 1999 #3499) used K-Ar and Ar/Ar ages of displaced volcanic rocks (24–205 ka) and measured offsets of >11 m and <160 m to calculate a long term average slip rate of about 0.3 mm/yr.
Date and Compiler(s)	2002 Stephen F. Personius, U.S. Geological Survey
References	#3787 Bacon, C.R., 1983, Eruptive history of Mount Mazama and Crater Lake Caldera, Cascade Range, USA: Journal of Volcanology and Geothermal Research, v. 18, p. 57–115. #3541 Bacon, C.R., and Nathenson, M., 1996, Geothermal resources in the Crater Lake Area, Oregon: U.S. Geological Survey Open-File Report 96-663, 34 p. #3499 Bacon, C.R., Lanphere, M.A., and Champion, D.E., 1999, Late Quaternary slip rate and seismic hazards of the West Klamath Lake fault zone near Crater Lake, Oregon Cascades: Geology, v. 27, no. 1, p. 43-46. #3516 Bacon, C.R., Mastin, L.G., Scott, K.M., and Nathenson, M., 1997, Volcano and earthquake hazards in the Crater Lake region, Oregon: U.S. Geological Survey Open-File Report 97-487, 30 p., 1 pl., scale 1:100,000. #3593 Geomatrix Consultants, Inc., 1995, Seismic design mapping, State of Oregon: Technical report to Oregon Department of Transportation, Salem, Oregon, under Contract 11688, January 1995, unpaginated, 5 pls., scale 1:1,250,000.

#3548 Hawkins, F.F., Foley, L.L., and LaForge, R.C., 1989, Seismotectonic study for Fish Lake and Fourmile Lake Dams, Rogue River Basin Project, Oregon: U.S. Bureau of Reclamation Seismotectonic Report 89-3, 26 p., 2 pls.

#3729 Klinger, R.E., Vetter, U.R., and Ryter, D.W., 1996, Seismotectonic study for Gerber Dam Klamath Project, California-Oregon: U.S. Bureau of Reclamation Seismotectonic Report 96-1, 51 p., 1 pl.

#3575 Madin, I.P., and Mabey, M.A., 1996, Earthquake hazard maps for Oregon: State of Oregon, Department of Geology and Mineral Industries Geological Map Series GMS-100, 1 sheet.

#3554 Moring, B., 1983, Reconnaissance surficial geologic map of the Medford 1 x 2 quadrangle, Oregon-California: U.S. Geological Survey Miscellaneous Field Studies Map MF-1528, 2 sheets, scale 1:125,000.

#3791 Peterson, N.V., and McIntyre, J.R., 1970, The reconnaissance geology and mineral resources of eastern Klamath County and western Lake County, Oregon: State of Oregon, Department of Geology and Mineral Industries Bulletin 66, 70 p., 1 pl., scale 1:250,000.

#3544 Pezzopane, S.K., 1993, Active faults and earthquake ground motions in Oregon: Eugene, Oregon, University of Oregon, unpublished Ph.D. dissertation, 208 p.

#3384 Qamar, A., and Meagher, K.L., 1993, Precisely locating the Klamath Falls, Oregon, earthquakes: Earthquakes and Volcanoes, v. 24, p. 129-139.

#3510 Sherrod, D.R., 1993, Historic and prehistoric earthquakes near Klamath Falls, Oregon: Earthquakes and Volcanoes, v. 24, no. 3, p. 106-120.

#3567 Sherrod, D.R., and Pickthorn, L.B.G., 1992, Geologic map of the west half of the Klamath Falls 1° by 2° quadrangle, south-central Oregon: U.S. Geological Survey Miscellaneous Investigations Map I-2182, 1 sheet, scale 1:250,000.

#5165 Sherrod, D.R., and Smith, J.G., 2000, Geologic map of

	upper Eocene to Holocene volcanic and related rocks of the Cascade Range, Oregon: U.S. Geological Survey Geologic Investigations Map I-2569, 2 sheets, scale 1:500,000. #3556 Smith, J.G., 1983, Geologic map of the Sky Lakes Roadless Area and Mountain Lakes Wilderness, Jackson and Klamath Counties, Oregon: U.S. Geological Survey Miscellaneous Field Studies Map MF-1507-A, 1 sheet, scale 1:62,500. #3555 Smith, J.G., 1988, Geologic map of the Pelican Butte quadrangle, Klamath County, Oregon: U.S. Geological Survey Geologic quadrangle Map GQ-1653, 1 sheet, scale 1:62,500. #3493 Smith, J.G., Page, N.J., Johnson, M.G., Moring, B.C., and Gary, F., 1982, Preliminary geologic map of the Medford 1x2 quadrangle, Oregon and California: U.S. Geological Survey Open-File Report 82-955, 1 sheet, scale 1:250,000. #3646 Walker, G.W., and MacLeod, N.S., 1991, Geologic map of Oregon: U.S. Geological Survey, Special Geologic Map, 2 sheets, scale 1:500,000. #5648 Weldon, R.J., Fletcher, D.K., Weldon, E.M., Scharer, K.M., and McCrory, P.A., 2002, An update of Quaternary faults of central and eastern Oregon: U.S. Geological Survey Open-File Report 02-301 (CD-ROM), 26 sheets, scale 1:100,000.