Quaternary Fault and Fold Database of the United States

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Santa Rosa Range fault system, Santa Rosa Peak section (Class A) No. 1508c

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Synopsis	**General:** This long fault zone consists of two parts, a northern, northeast-striking zone of distributed faulting, and a north-striking southern part marked by nearly continuous range-bounding and piedmont faults; the latter part forms an escarpment between the western margin of the Santa Rosa Range and the eastern margin of the Quinn River Valley in northern Nevada and southeastern Oregon. The Santa Rosa Range is a major east-tilted fault block and the adjacent Quinn River Valley is a graben filled with thousands of meters of Tertiary-Quaternary fill. The Santa Rosa Range fault system is herein divided into three sections, from north to south, the Owyhee River, Quinn River, and Santa Rosa Peak sections, based on fault geometry and recency of fault movement. At the northern end of the system, faults in the

Owyhee River section form a broad zone of northeast-striking, down-to-the-northwest and down-to-the-southeast fault scarps in Miocene to Pleistocene volcanic rocks. A few faults at the western end of the section have latest Quaternary displacements, but the most-recent event on most faults in the section appears to have occurred in the middle or late Pleistocene. A 7-km-wide gap in Quaternary fault scarps separates the northeast-striking Owyhee River section from the north-striking Quinn River section at the northern end of the Quinn River Valley. The Quinn River section has three distinct parts: 1) a north-striking northern part consisting of the High Peaks fault, which forms the eastern margin of the upper Quinn River Valley, 2) a northwest-striking piedmont fault, the Hot Springs Hills fault, and 3) a southeastern part that parallels the north-trending western flank of the Santa Rosa Range. The freshest fault morphology is found along the High Peaks and Hot Springs Hills faults, so apparently the most-recent fault activity on the fault system has stepped onto the piedmont Hot Springs Hills fault and has abandoned the western margin of the Santa Rosa Range north of Canyon Creek. The most-recent event on this section appears to have occurred in the latest Quaternary. The Quinn River and Santa Rosa Peak sections are separated by an echelon right step and a nearly 90° bend in the range front near Flat Creek in northern Nevada. The Santa Rosa Peak section is primarily characterized by a prominent range front with a secondary piedmont fault zone. The piedmont faults included in the section are expressed as small, west-facing scarps on Lahontan (13 ka) lacustrine deposits and post-Lahontan alluvium on the floor of the Quinn River Valley. The range-front fault oversteepens the base of the range, juxtaposes Quaternary alluvium against older bedrock, and is also characterized by rare west-facing scarps in alluvium. The most-recent event on the Santa Rosa Peak section also appears to have occurred in the latest Quaternary, but it is unknown if the latest events on the two southern sections occurred at the same time. The location and recency of fault movement may indicate that the Santa Rosa Range fault system is the northern extension of the central Nevada seismic belt.

Sections: This fault has 3 sections. Although detailed studies along the entire fault zone have not been completed, three sections are inferred based on geometry of the zone, the northernmost, northeast-striking Owyhee River section, and two north-striking sections, the Quinn River and Santa Rosa Peak sections. The Owyhee River section is separated from the Quinn

	River section by a 7-km-wide gap in Quaternary fault scarps and a sharp change in fault strike near Blue Mountain Pass. The Quinn River and Santa Rosa Peak sections are separated by an echelon right step and a nearly 90° bend in the range front near Flat Creek in northern Nevada. The Quinn River and Santa Rosa Peak sections have range-front and piedmont fault zones, but the Santa Rosa Peak section has a much higher, more abrupt range front. The Owyhee River section is characterized by broad groups of northeast-striking scarps.
Name comments	**General:** **Section:** This section is herein informally named after Santa Rosa Peak, the most prominent geographic feature in this part of the Santa Rosa Range. **Fault ID:** These structures are included in fault numbers 50 and 51 of Pezzopane (1993 #3544), fault number 63 of Geomatrix Consultants, Inc. (1995 #3593), and fault numbers MD2A and MD2B of dePolo (1998 #2845). The Nevada portion of this section is fault number MD2A of dePolo (1998 #2845).
County(s) and State(s)	HUMBOLDT COUNTY, NEVADA
Physiographic province(s)	BASIN AND RANGE
Reliability of location	Good Compiled at 1:100,000 scale. *Comments:* Fault locations primarily are based on unpublished 1:100,000-scale mapping of Michetti and Wesnousky (1993 #2540) which was produced from analysis of 1:12,000-scale low-sun-angle aerial photography transferred to the base maps and field checked. Additional faults were located from 1:250,000-scale maps of D.B. Slemmons (1966, unpublished McDermitt 1:250,000-scale map), and all fault locations were checked against the 1:250,000-scale map of Dohrenwend and Moring (1991 #284).
Geologic setting	This long fault zone consists of two parts, a northern, northeast-striking zone of distributed faulting formed in Pliocene (?) and Miocene volcanic rocks of the Owyhee plateau, and a north-striking southern part marked by nearly continuous range-bounding and piedmont fault zones (Michetti and Wesnousky,

	1993 #2540; Narwold and Pezzopane, 1997 #3011; Narwold, 2001 #3010) that offset Pliocene (?) and Miocene volcanic rocks of the McDermitt Caldera complex (Walker and Repenning, 1966 #3586; Walker and MacLeod, 1991 #3646). The latter part forms an escarpment between the western margin of the Santa Rosa Range, a major east-tilted fault block (Stewart, 1978 #2866), and the eastern margin of the Quinn River Valley, a graben filled with 1,200 to 2,450 m of Tertiary-Quaternary fill (Erwin and others, 1985 #3009; Erwin, 1988 #3008). The Santa Rosa Range fault system may be a northern extension of the central Nevada seismic belt, a north-trending zone of historic surface ruptures (Pezzopane and Weldon, 1993 #149; Michetti and Wesnousky, 1993 #2540; Pezzopane, 1993 #3544).
Length (km)	This section is 43 km of a total fault length of 141 km.
Average strike	N1°E (for section) versus N15°E (for whole fault)
Sense of movement	Normal *Comments:* Faults in this section are mapped as normal or high-angle faults by Dohrenwend and Moring (1991 #284) and Michetti (1993 #2540). Narwold and Pezzopane (1997 #3011) report a possible component of dextral shear on faults in their Quinn River fault zone, but Narwold (2001 #3010) concluded that the Quinn River fault zone has undergone primarily normal displacement.
Dip Direction	W
Paleoseismology studies	Personius and others (2002 #5651; 2002 #5652) conducted trench investigations at two sites along the Santa Rosa section. A trench on a small (0.5-m-high) piedmont fault scarp 7.5 km SW of Orovada that offsets shorelines of the youngest (Sehoo) highstand of Lake Lahontan collapsed during excavation and had to be abandoned before it could be logged. However, geomorphic relations clearly indicate the youngest event on the piedmont trace post-dates the 13-ka age (Adams and Wesnousky, 1999 #3982) of the shoreline (Michetti and Wesnousky, 1993 #2540). A second trench was excavated on the range front fault southeast of Orovada. Site 1508-1. The Orovada trench was excavated across an 8.5-m-high scarp on the westernmost of three subparallel strands that form a 1.5-km-wide left step in the range front 5 km southeast of

	Orovada, Nev. (Personius and others, 2002 #5651, 2002 #5652; Personius and Mahan, 2005 #7764); the trench exposed evidence of four coseismic surface ruptures. The scarp crosses an old alluvial-fan complex that emanates from McConnell Creek and several other canyons along this part of the Santa Rosa section. Luminescence dating indicates that the faulted fan is at least as old as the Eetza cycle (MIS 6, Adams and Wesnousky, 1999 #3982) of pluvial Lake Lahontan. The presence of multiple colluvial wedges and intervening buried soils were used to infer at least four surface-rupturing earthquakes on this strand of the Santa Rosa section since fan deposition. The trench exposed a thick sequence of silty colluvial deposits and buried soils faulted against fan alluvium. Luminescence dating of the colluvial sediments yielded the following preliminary ages for these events: most-recent event—11–15 ka; penultimate event—90–94 ka; third event—136–137 ka; fourth event—>140 ka. The trench was not deep enough to expose fan deposits in the hanging wall so the post-fan paleoseismic record may be incomplete, but nearby stream exposures indicate that nearly all of the post-fan sediment in the hanging wall was exposed in the trench. The thicknesses of colluvial wedges (1-1.5 m) were as used to estimate displacements of 1-2 m/event. Scarp profiling and luminescence dating were used to determine a long-term slip rate at the Orovada trench site. Topographic profiles indicate about 7 m of surface offset across the trenched scarp. An older untrenched scarp just uphill from the trench has about 4 m of surface offset, and the eastern range-front strand, located about 1 km east of the trench site at the mouth of McConnell Creek, offsets the same fan surface about 3 m. The age of the offset fan is poorly constrained, but several luminescence ages suggest that the alluvium is quite old. The loess deposits overlying fan alluvium exposed in a soil pit in the footwall yielded an age of about 120 ka, and a less precise age from the underlying alluvium yielded an age of 330–550 ka. The oldest age from post-fan colluvium exposed in the trench was about 137 ka, so the fan surface is likely at least 140 ka and may be much older. The combined slip data indicate a long-term average slip rate across both range-front traces at the latitude of the trench site of <0.1 mm/yr.
Geomorphic expression	This section is characterized by both a steep range front fault and a recently active piedmont fault zone (D.B. Slemmons, 1966, unpublished McDermitt 1:250,000-scale map, Michetti and Wesnousky, 1993 #2540). Piedmont faults in this section are expressed as small (<1 m high) west-facing scarps on Lahontan

	(13 ka) lacustrine deposits and post-Lahontan alluvium on the floor of the Quinn River Valley, 3-6 km west of the Santa Rosa Range (D.B. Slemmons, 1966, unpublished McDermitt 1:250,000-scale map, Dohrenwend and Moring, 1991 #284; Michetti and Wesnousky, 1993 #2540). The range-front fault lies along the oversteepened base of the range, which slopes about 20° to 24° (Michetti and Wesnousky, 1993 #2540), and juxtaposes Quaternary alluvium against older bedrock; rare west-facing scarps are present in a few places where late Quaternary alluvium is preserved at the mouths of a few of the larger canyons (Dohrenwend and Moring, 1991 #284). dePolo (1998 #2845) reported a preferred value of 256 m for the maximum fault facet height along this part of the fault.
Age of faulted surficial deposits	Dohrenwend and Moring (1991 #284) reported faults that displace early to late Pleistocene alluvium, and Michetti and Wesnousky (1993 #2540) report offsets of late Pleistocene shorelines of Lake Lahontan along the piedmont scarps herein included in the Santa Rosa Peak section.
Historic earthquake	
Most recent prehistoric deformation	latest Quaternary (<15 ka) *Comments:* Results from the Orovada trench site (Personius and Mahan, 2005 #7764) indicate latest Quaternary (11–15 ka) coseismic surface rupture at the trench site. Holocene ages were also reported by D.B. Slemmons (1966, unpublished McDermitt 1:250,000-scale map) and Michetti and Wesnousky (1993 #2540).
Recurrence interval	
Slip-rate category	Less than 0.2 mm/yr *Comments:* dePolo (1998 #2845) assigned a reconnaissance vertical slip rate of 0.525 mm/yr based on an empirical relationship between his preferred maximum basal facet height and vertical slip rate. The size of the facets (tens to hundreds of meters, as measured from topographic maps) indicates they are the result of many seismic cycles, and thus the derived slip rate reflects a long-term average. Better constrained data from the Orovada trench site (Personius and others, 2002 #5651, 2002 #5652; Personius and Mahan, 2005 #7764) indicate a long-term

	average vertical displacement rate across the three subparallel strands near the Orvada trench <<0.1 mm/yr.
Date and Compiler(s)	2002 Kenneth Adams, Piedmont Geosciences, Inc. Stephen F. Personius, U.S. Geological Survey Thomas L. Sawyer, Piedmont Geosciences, Inc.
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Questions or comments?