U.S. Geological Survey Earthquake Hazards Reduction Program
Annual Project Summary

Paleoseismic studies of the Peavine fault

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Investigations undertaken

The Peavine fault is a prominent frontal fault bounding the steep northeast side of Peavine Peak in the urbanized north Reno area, western Nevada. The fault is located 5 km or less from the downtown Reno area, and it forms the southern boundary of several basins undergoing rapid urban development, including Cold Spring and Lemmon Valleys. Despite being one of the most significant active faults in western Nevada, the Peavine fault is virtually unstudied and represents one of the largest gaps in understanding of seismic hazards in the Reno area.

Goals of this project are to: 1) examine the paleoseismic history of the Peavine fault through trench investigations and surficial mapping at selected sites; 2) evaluate whether the fault may have been involved in belt-like behavior observed to the south along the Carson Range fault system; and 3) determine whether slip on the fault is dominantly normal, as suggested by geomorphology, or strike-slip, as suggested by its orientation.

Aside from its own seismic hazard, the Peavine fault is important because it is structurally related to the Carson Range fault system (CRFS), a principal Sierra Nevada frontal fault and the primary seismic hazard in western Nevada. The northern end of the CRFS, where its surface expression is truncated by the Truckee River system, projects toward the southeast end of the Peavine fault, and the systems both bound areas of relatively high elevation to the west. The two fault systems are depicted on existing maps (e.g., Bonham and Bingler, 1973; Bingler, 1974; Bell, 1984) as being separated by a 6 to 8 km gap, but they may be more closely linked by obscured fault traces.

Past studies suggest the CRFS has ruptured with belt-like behavior during the late Holocene (Ramelli and others, 2000). The Genoa fault, the most active part of the system, has ruptured twice within the past 2,000 years (Ramelli and others, 1999a). Subsequent studies in the Washoe Valley and Carson City areas (Ramelli and dePolo, 1997; Ramelli and others, 1999b) suggested event timing similar to the Genoa fault, raising the possibility of belt-like behavior along the system. We hope to evaluate whether the Peavine fault might be involved in such sequences.

Geomorphic evidence, including fault facets, large fault scarps, and a steepened range front, suggest slip on the Peavine fault is dominantly normal, but the fault is oriented parallel to major right-lateral Walker Lane faults (e.g., Pyramid Lake, Warm Springs Valley, and Honey Lake fault zones). Direct evidence of the sense-of-slip on the fault is needed to help understand recent geodetic results, and for constraining kinematic tectonic models for the region. In order to evaluate the fault=s sense of slip, we intend to excavate an exposure of the bedrock fault plane at the trench site. If the single-event trench doesn=t expose the bedrock fault, we=ll excavate a third trench specifically for that purpose. Unfortunately, the combination of substantial vertical displacements and bouldery deposits are unfavorable for evaluating lateral offsets through fault-parallel trenching.

Results

Based on analysis of aerial photographs and geologic maps, we interpret the Peavine fault to have a length of approximately 20 km. This length is taken from the fault=s projected intersection with the Carson Range fault system to its apparent termination at the western margin of Cold Spring Valley. The Peavine fault can be divided into four sections having differing geomorphic expressions, although no implications regarding earthquake segmentation are intended by these designations.

Peavine Peak section: The part of the Peavine fault having a prominent geomorphic expression and displaying fault scarps in recent alluvium is only about 3 km long. There is almost 700 m of topographic relief across this section, which occurs along the central part of the fault. Bouldery alluvial deposits are offset at several locations along this section (Bell and Garside, 1987), and include both multiple- and single-event scarps. This section is the primary focus of this study.

Lemmon/Panther Valleys section: To the southeast of the Peavine Peak section, the fault steps left approximately 2.5 km to a distributed section having a more subdued expression and lacking obvious recent scarps. This section consists of left-stepping *en echelon* fault traces, suggesting a right-lateral component of displacement. Topographic relief across the section is at most about 300 m, and decreases toward the southeast. The southeast end of the fault is poorly defined, but is taken to be at the projected intersection with the Carson Range fault system, 5 km or less from the downtown Reno area.

Dry Lake Summit section: Northwest of the Peavine Peak section, the fault extends into a landslide complex cored by Tertiary sediments (Bell and Garside, 1987; Soeller and Nielsen, 1980). Some fault scarps can be traced into this landslide complex, but their expression is much more muted, and stratigraphic relations considerably obscured. Similar to the Peavine Peak section, the Dry Lake Summit section bounds the prominent escarpment on the northeast side of Peavine Peak, and likely has similar activity. The relatively active central part of the fault (i.e., combined Peavine Peak and Dry Lake Summit sections) is thus estimated to be about 7 km long.

Cold Spring section: The northwestern end of the Peavine fault bounds the southwest side

of Cold Spring Valley. Between the Dry Lake Summit and Cold Spring sections, there is a gap in surface expression across a broad alluvial fan surface. The Cold Spring section bounds a low escarpment (about 60 m high) lacking obvious recent scarps, and may have been modified by past stands of White Lake, a small pluvial lake. Soeller and Nielsen (1980) mapped beach deposits in the basin up to an elevation of about 1560 m, slightly above the surface trace of the fault.

A preferred trench site has been identified along the Peavine Peak section, and the permitting process begun. This site has a large, multiple-event scarp, and an inset surface with a much smaller, probably single-event scarp. Our plan is to excavate two or three trenches at this site, one across the multiple-event scarp, and one or two to cross the single-event scarp and expose the bedrock fault plane. Three alternate trench sites have also been identified along the Peavine Peak section. Two of the alternates are sites of historical mining activity, and are thus subject to surface disturbance and the likelihood of encountering historical artifacts. The third alternate has a large multiple-event scarp, but no single-event scarp.

Non-technical Summary: The Peavine fault, which is located 5 km or less from the downtown Reno area, poses a significant earthquake hazard to western Nevada. The fault has created large scarps in recent alluvial deposits, but is poorly studied. Through fault trenching and associated mapping of surficial geology, this study aims to interpret the record of past earthquakes on the fault. This information will greatly improve our understanding of seismic hazards in the urbanized western Nevada region.

Reports published: None

Availability of seismic, geodetic, or processed data: Not applicable.

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