U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

SCIENTIFIC INVESTIGATIONS MAP 2815
VERSION 1.0

Log and Data from an Investigation of the Orovada Trench Site, Santa Rosa Range Fault Zone, Humboldt County, Nevada

By

Stephen F. Personius, R. Ernest Anderson, Koji Okumura, Shannon A. Mahan, and Dean A. Hancock

2004

All authors are affiliated with the U.S. Geological Survey, Denver, CO 80225. Koji Okumura is also affiliated with the Department of Geography Hiroshima University, Higashi-Hiroshima, 739-8522, Japan.

Manuscript approved for publication January 20, 2004

This map was produced on request, directly from digital files, on an electronic plotter

For sale by the U.S. Geological Survey Information Services
Box 25286, Federal Center, Denver, CO 80225
This map is also available as a PDF at
http://cpg.cr.usgs.gov/pub/sim.html

INTRODUCTION

This report contains field and laboratory data from a trench study of the Santa Rosa Range fault zone near Orovada, Nevada. The fault zone bounds the western margin of the Santa Rosa Range and the eastern margin of the Quinn River Valley in the Basin and Range province of northern Nevada and southeastern Oregon. The trench was excavated in June, 2001, as part of paleoseismic investigations (Personius and others, 2002a, 2002b) of Quaternary faults along several recently established geodetic transects in the northern Basin and Range (for example, Thatcher and others, 1999). Although several investigations of Quaternary faulting have been conducted along the Santa Rosa Range (Dohrenwend and Moring, 1991; Michetti and Wesnousky, 1993; dePolo, 1998; Narwold, 1999, 2001), our study is the first to obtain detailed paleoseismic data

from a trench investigation. We located the trench just west of Santa Rosa Peak, the highest point in the footwall of the fault zone, in hopes of obtaining slip and paleoearthquake timing data from the most active part of the fault zone. The trench was excavated across an 8.5-m-high scarp on the westernmost of two strands that form a 1.5-km-wide left step in the range front, 5 km southeast of Orovada. The scarp crosses an alluvial-fan complex that emanates from several canyons along this part of the Santa Rosa Range. Luminescence dating indicates that the faulted fan is at least as old as the Eetza cycle (MIS 6; Adams and Wesnousky, 1999) of pluvial Lake Lahontan. The trench exposed a thick sequence of silty colluvium faulted against sandy pebble to boulder gravels that comprise the fan.

The purpose of this report is to present photo mosaics and detailed trench logs, scarp profiles, soils data, gamma-ray spectrometer data, luminescence ages, and detailed unit descriptions obtained in this investigation. We do not attempt to use the primary data presented herein to construct a paleoseismic history of this part of the Santa Rosa Range fault zone; that history will be the subject of a future report.

ACKNOWLEDGMENTS

This research was supported by the Earthquake Hazards Reduction Program of the U.S. Geological Survey under a Memorandum of Understanding between the Central Geologic Hazards Team of the USGS and the Winnemucca District Office of the U.S. Bureau of Land Management (BLM). The authors wish to thank Steve Wesnousky and Alessandro Michetti for access to aerial photographs and unpublished data, and personnel of the Winnemucca District Office for assistance in conducting this research on BLM lands. The report was improved by comments from reviewers Dave Lidke and Tim Dawson.

THERMOLUMINESCENCE AGE DATA

We used luminescence dating techniques to determine the ages of alluvial-fan and colluvial sediments exposed in the trench. TL (thermoluminescence) and IRSL (infrared stimulated luminescence—a type of optically stimulated luminescence (OSL) unique to feldspars) techniques date the last time sediment is exposed to sunlight, presumably during deposition (Berger, 1988; Forman and others, 2000). Sampling was done at night using tubes of plastic electrical conduit driven into freshly cleaned trench and pit walls; after extraction, sample tubes were sealed with plastic tape and stored in airtight plastic bags. Dose rates were determined in situ with an Exploranium GR-256 gamma ray spectrometer placed in holes drilled in the trench and pit walls near the sample locations. Field moisture contents of 0.1-17 percent by weight were determined for each sample in the laboratory. A polymineralic, fine-silt-size (4-11μm) fraction was isolated for each sample. Samples were subjected to combinations of sunlight sensitivity tests, anomalous fading tests (Wintle, 1973), total bleach and partial bleach experiments (Wintle and Huntley, 1980; Singhvi and others, 1982) for TL, and additive dose

experiments for IRSL (Aitken, 1998). Our TL and IRSL ages (see logs and table) are generally consistent and in stratigraphic order. The colluvial deposits exposed in the trench range in age from about 6 ka to about 140 ka. The loess deposits in the pit range in age from about 10 ka to about 120 ka; dating results are less certain for the underlying alluvial-fan deposits, but a single sample from these deposits yielded an age of 330-550 ka.

REFERENCES

Adams, K.D., and Wesnousky, S.G., 1999, The Lake Lahontan highstand—Age, surficial characteristics, soil development, and regional shoreline correlation: Geomorphology, v. 30, p. 357-392.

Aitken, M.J., 1998, An introduction to optical dating—The dating of Quaternary sediments by the use of photon-stimulated luminescence: New York, Oxford University Press, 267 p.

Berger, G.W., 1988, Dating Quaternary events by luminescence, in Easterbrook, D.J., ed., Dating Quaternary sediments: Geological Society of America Special Paper 227, p. 13-50.

Birkeland, P.W., 1999, Soils and Geomorphology, third edition: New York, Oxford University Press, 430 p.

dePolo, C.M., 1998, A reconnaissance technique for estimating the slip rate of normal-slip faults in the Great Basin, and application to faults in Nevada, U.S.A.: Ph.D. dissertation, University of Nevada-Reno, 199 p.

Dohrenwend, J.C., and Moring, B.C., 1991, Reconnaissance photogeologic map of young faults in the McDermitt 1 by 2 quadrangle, Nevada, Oregon, and Idaho: U.S. Geological Survey Miscellaneous Field Studies Map MF-2177, 1 sheet, scale 1:250,000.

Forman, S. L., Pierson, J., and Lepper, K., 2000, Luminescence geochronology, in Noller, J.S., Sowers, J.M., and Lettis ,W.R., eds., Quaternary geochronology—Methods and applications: American Geophysical Union Reference Shelf 4, p. 157-176.

Machette, M.N., Haller, K.M., Dart, R.L., and Rhea, S.B, 2003, Quaternary fault and fold database of the United States: U.S. Geological Survey Open-File Report 03-417 (on line database http://qfaults.cr.usgs.gov/faults/).

Michetti, A.M., and Wesnousky, S.G., 1993, Holocene surface faulting along the west flank of the Santa Rosa Range (Nevada-Oregon) and the possible northern extension of the central Nevada seismic belt: Geological Society of America Abstracts with Programs, v. 25, No. 5, p. 120-121.

Narwold, C.F., 1999, Quaternary geology of the northern Quinn River and Alvord Valleys, southeastern Oregon: 1999 Friends of the Pleistocene Field Trip Guide, September 24-26, 1999, 55 p.

_____2001, Late Quaternary soils and faulting along the Quinn River fault zone, northern Nevada, southeastern Oregon: M.S. thesis, Humboldt State University, Arcata, California, 76 p., 4 plates, scale 1:48,000.

Personius, S.F., Anderson, R.E., Okumura, K., and Hancock, D.A., 2002a, Preliminary results of a trench investigation of the Santa Rosa Range fault zone, Humboldt County, Nevada: Geological Society of America Abstracts with Programs, v. 34, No. 4, p. A11.

Personius, S.F., Anderson, R.E., Okumura, K., Mahan, S.A., and Hancock, D.A., 2002b, Preliminary paleoseismology of the Santa Rosa Range fault zone, Humboldt County, Nevada: Geological Society of America Abstracts with Programs, v. 34, No. 6, p. 27.

Personius, S.F., Dart, R.L., Bradley, L.A. , and Haller, K.M., 2003, Map and data for Quaternary faults and folds in Oregon: U.S. Geological Survey Open-File Report 03-095, 581 p., 1 sheet, scale 1:750,000.

Singhvi, A.K., Sharma, Y.P., and Agrawal, D.P., 1982, TL dating of dune sands in Rajasthana, India: Nature, v. 295, p. 313-315.

Soil Survey Staff, 1975, Soil Taxonomy: U.S. Department of Agriculture, Agriculture Handbook No. 436, 754 p.

Thatcher, W., Foulger, G.R., Julian, B.R., Svarc, J., Quity, E., and Bawden, G.W., 1999, Present day deformation across the Basin and Range Province, Western United States: Science, v. 283, p. 1714-1718.

Wintle, A.G., 1973, Anomalous fading of thermoluminescence in mineral samples: Nature, v. 245, p. 143-144.

Wintle, A.G., and Huntley, D.J., 1980, TL dating of ocean sediments: Canadian Journal of Earth Sciences, v. 17, p. 348-360.