

**PALEOSEISMIC INVESTIGATION OF THE HOLOCENE SLIP RATE  
ON THE GREENVILLE FAULT,  
EASTERN SAN FRANCISCO BAY AREA, CALIFORNIA**

**FINAL TECHNICAL REPORT**

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**Program Elements:**

I (Products for Earthquake Loss Reduction), and

II (Research on Earthquake Occurrence and Effects)

Keywords: paleoseismology, trench investigations, age dating, slip rates

**U.S. Geological Survey**

**National Earthquake Hazards Reduction Program**

**Award Number 00HQGR0055**

February, 2002

"This research was supported by the U.S. Geological Survey (USGS), Department of the Interior, under USGS award number 00HQGR0055. The views and conclusions in this document are those of the author and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the U.S. Government."

## ABSTRACT

We conducted a preliminary investigation of the dextral Greenville fault at a site near Laughlin Road in northeastern Livermore Valley to evaluate the Holocene slip rate on the fault, and to test a kinematic model for restraining transfer of slip from the Greenville fault to the Concord fault across the late Cenozoic Mt. Diablo anticline. At the Laughlin Road site, the Greenville fault is expressed by a west-facing scarp that crosses a small alluvial fan. Our approach to evaluating the slip rate at this site was to excavate two trenches parallel to and on opposite sides of the fault, and study the exposures for well-defined and laterally restricted channel deposits that may have been offset by right-lateral displacement on the fault. Two fault-normal trenches also were excavated at the site to document the location of the Greenville fault relative to the fault-parallel trenches and to examine the exposures for evidence of the 1980 Livermore earthquake sequence that reportedly ruptured through the site.

Trench exposures revealed a sequence of alluvial-fan deposits, that in the fault-normal trenches was extensively disrupted by a zone of high-angle faults, some exhibiting sub-horizontal slickensides on clay gouge. Several fractures extend upwards from the fault zone to or near the modern ground surface, that apparently are related to the 1980 Livermore earthquake sequence. Two channel-fill units and a large paleo-channel exposed in the fault-parallel trenches have been right-laterally offset 17 to 25 m along the Greenville fault, based on detailed trench logging, total-station surveying, comparison of channel morphology, and stratigraphic and soil relationships. Available age constraints for these offset features are currently limited to 6 AMS radiocarbon dates on pedogenic calcium carbonate that suggest a limiting minimum age range of 4.1 to 8.5 ka. Based on these data, we provide a preliminary estimate of the Holocene right-lateral slip rate of  $4.1 \pm 1.8$  mm/yr, or less, for the main trace of the Greenville fault.