

28 January 2000

John D. Unger - MS 905A
Grants Program Manager
External Research
Earthquakes Hazards Program
U.S. Geological Survey
Reston, VA 20192

Dear John,

This is a brief progress report required for the second year of funding of my FY1999 NEHRP Grant, **99HQGROO84** entitled **Theodolite Measurements of Creep Rates on San Francisco Bay Region Faults**. I have been conducting the same basic research program funded by NEHRP and the USGS for more than 20 years. We continued measuring creep (aseismic slip) rates on San Francisco Bay region active faults. Over the past 20.3 years, we have made over 2400 creep measurements, with 164 of these occurring during 1999. I continue to have four experienced part-time research assistants that work with me on this project.

We presently have regular measurement sites at 29 localities on active faults, plus data from four sites that had to be abandoned. Locations of the San Francisco Bay region sites are shown on

[\(Fig1\)](#) that is attached to this report. We also have one measurement site on the San Andreas fault in the Point Arena area and two on the Maacama fault in Willits and Ukiah that do not appear on [\(Fig 1\)](#). We continue to remeasure most sites with a history of creep about once every two to three months and most sites without any creep history about once every three to four months. In addition to our ten regular sites on the Hayward fault, we have established 24 additional sites in conjunction with J. Lienkaemper of the USGS. We began measuring each of these additional sites annually in July, August 1994 and last measured them in August-September 1999.

Details regarding the results of our measurements since September 1979, including the results from 1999, are in my annual report which was submitted to the USGS in late 1999 and will not be repeated here.

In addition to the routine remeasuring of our already established sites, there are a few other things to report for 1999:

1. We reestablished our measurement Site 12 at D Street in Hayward. This is an important historical creep site, being one of the first ever monitored by creep-meters. We began regular measurements at this site in June 1980 and continued until road construction destroyed the site in mid-1997. Following a lengthy construction period, we reestablished the site and began regular measurements again on 12 June 1999.

2. We continued measuring two relatively new sites on the Calaveras fault that we established in early 1997. We believe we finally had enough data to include for the first time

the results from Site 32 at Welsh Creek Road and Site 33 at the Coyote Ranch in our most recent annual report submitted in late 1999.

3. We continued having logistical problems at Site 20, our only site on the Green Valley fault. Because of increased industrial activity in the area, of the old measurement large trucks now almost always block arrays. Two new arrays established in 1999 were both destroyed by unanticipated construction. We do not have any valid new data from this site since 28 February 1999. We hope to reestablish and/or begin remeasuring this site sometime in 2000.

4. For logistical reasons we had to abandon Site 15, our only measurement site on the West Napa fault. Our last measurement was on 16 January 1999 at which time our data indicated zero net surface slip after 18.5 years of measurements. We do not intend to reestablish this site or any other on the non-creeping West Napa fault.

Sincerely yours,

Jon
Jon S. Galehouse
Professor of Geology Emeritus
San Francisco State University

Mailing address: P. O. Box 140
Twain, CA 95984
Phone: 530-283-5665
Fax: 530-283-4576
Email: galehouse@snowcrest.net

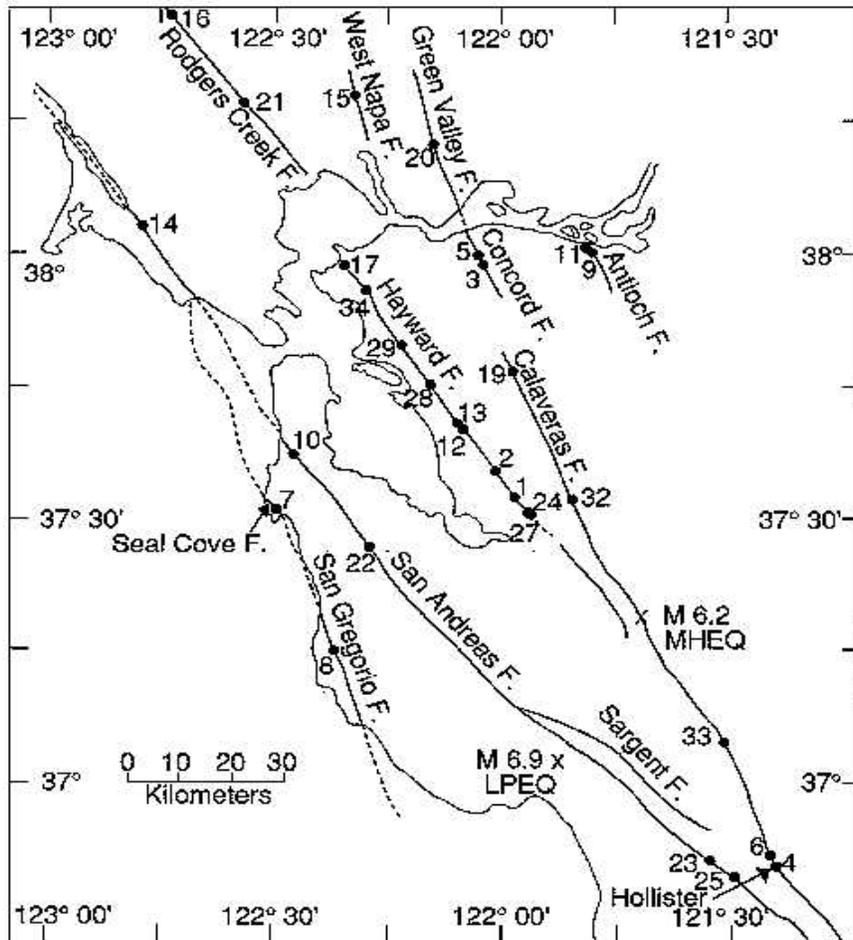


Figure 1. Numbered dots are San Francisco State University theodolite creep measurement sites. Epicenters and magnitudes are indicated for the 24 April 1984 Morgan Hill earthquake (MHEQ) and the 17 October 1989 Loma Prieta earthquake (LPEQ).