

**Merging paleoseismic data
for a long-term earthquake chronology
Southern Hayward Fault**

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Principal Investigator:

Patrick Williams

P.O. Box 1492

West Tisbury MA 02575

(508) 274-9618

plw3@earthlink.net

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1. Introduction

In collaboration with USGS co-workers (J.J. Lienkaemper, T.E. Dawson, S.F. Personius, G.G. Seitz, S.J. Heller, and D.P. Schwartz) this project is recovering a long, apparently complete record of paleoearthquakes at the Tule Pond (Tyson's Lagoon) pull-apart basin on the southern Hayward Fault in Fremont, California, with the purpose of establishing an accurate chronology of these events. Primary work in FY 2004-2005 addressed direct linkage of eastern and western fault-trace stratigraphy across ~100-m-wide fault-bounded basin.

2. Current Investigations at the Tule Pond (Tyson's Lagoon) Site

We have continued to characterize the site's event evidence utilizing rupture-specific deformation and scarp-derived colluvial packages. We have also begun to utilize independent liquefaction evidence (see below). During summer-fall 2004 we logged a continuous exposure across the basin, perpendicular to fault trend, and directly correlated two independently studied sites (Figure 1). Until now efforts to correlate the two sections by lithologic character and subfossil constituents were inconclusive. Lateral facies change across the fault-bounded basin, and reoccurrences of bed types vertically and laterally precluded simple correlation across the pond. The section was also extensively sampled to support continuing event-age studies. We are using radiocarbon dating and bayesian statistical analysis to establish a probabilistic model of earthquake ages and recurrence behavior.

3. Accomplishments

This year's pond-wide trench exposure allowed us to merge the count of previously identified events, which now total 10. We also located unique liquefaction evidence of three (almost certainly local) strong-motion events (E5a, E6 and E7) (Figure 1). The timing of these events is well constrained by stratigraphy, and may introduce a new event.



Figure 1. Location map of Lienkaemper et al trenches 2000 – 2004. Additional trenching by Woodward Clyde 1970, Williams 1993- 1994 (W1, W2), Jack Alt, 1998. Approximate location of 2004 trench shown in purple.

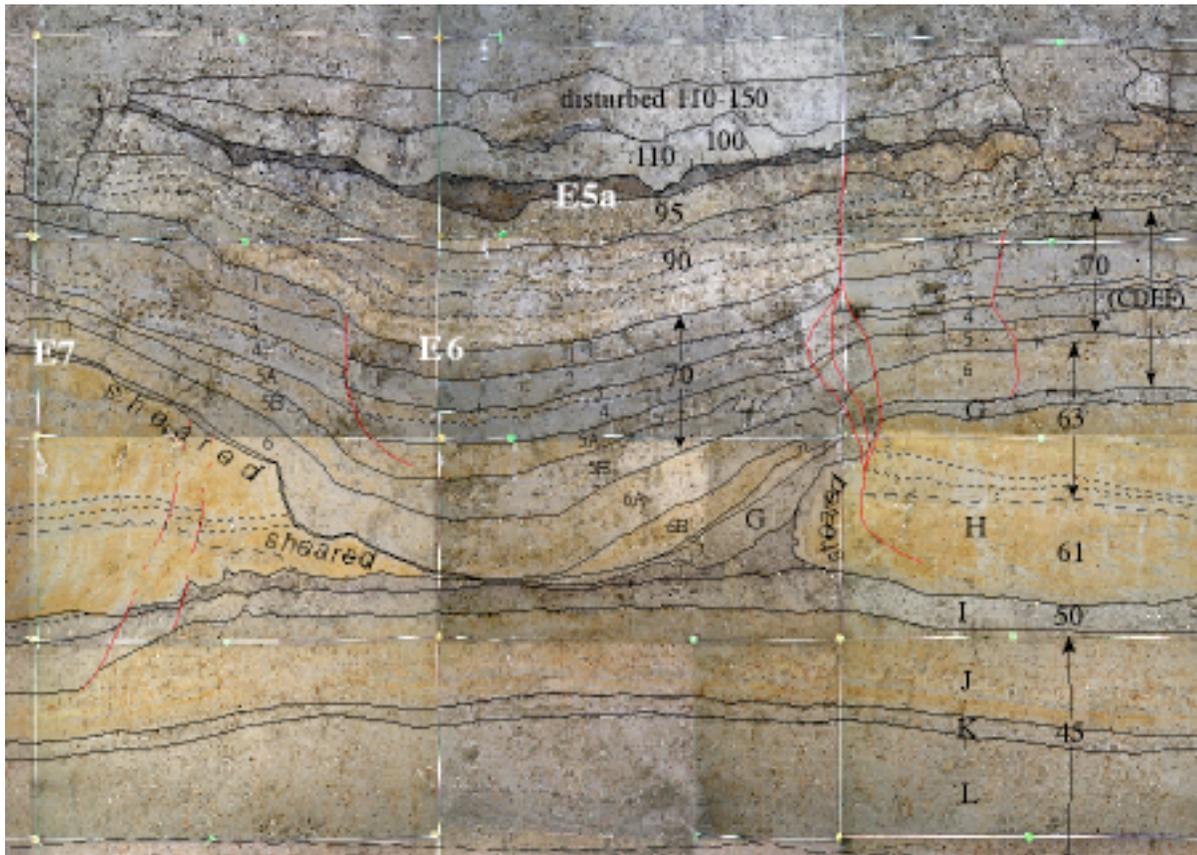


Figure 2. 2x3 meter log of 3-event liquefaction evidence. E6 and E7 are consistent with existing interpretation of primary paleoseismic evidence. E5a supports formerly equivocal evidence at the unit 100/95 boundary.

Ultimately the Tyson's Lagoon (Tule Pond) paleoearthquake record should be useful in judging both the variability of earthquakes on the southern Hayward Fault and of estimating the variability of earthquake process in general. The earthquake record here appears to be complete, or nearly so, for the past ~1800 years. Additional radiocarbon dating and chronological modeling must be done before work on the inter-event times and ages of events may be regarded as complete.

5. **Non-Technical Summary**

This project is recovering a long, apparently complete record of paleoearthquakes at the Tule Pond (Tyson's Lagoon) pull-apart basin on the southern Hayward Fault in Fremont, California, with the purpose of establishing an accurate chronology of these events. The record will be used to characterize past fault behavior, and will be used to anticipate the probable timing of future ruptures.

6. **Reports Published**

Lienkaemper, J.J., P.L. Williams, T.E. Dawson, S.F. Personius, G.G. Seitz, S.J. Heller, and D.P. Schwartz., Logs and Data from Trenches Across the Hayward Fault at Tyson's Lagoon (Tule Pond), Fremont, Alameda County, California, 2001-2003, U.S.G.S. Open-File Report 03-488; <http://geopubs.wr.usgs.gov/open-file/of03-488/>, 2004,