

# HISTORIC AND PALEOSEISMIC BEHAVIOR OF THE SOUTH-CENTRAL SAN ANDREAS FAULT BETWEEN CHOLAME AND THE CARRIZO PLAIN

Submitted by Ramón Arrowsmith and Jeri J. Young  
Department of Geological Sciences  
Arizona State University  
Tempe, AZ 85287-1404  
Collaborative project with Lisa Grant, University of California, Irvine

## Introduction

In this project, we strive to improve our understanding of the rupture potential of the San Andreas Fault (SAF) in the Parkfield-Cholame-northern Carrizo Plain area, and provide data for evaluating models of fault behavior and seismic hazard in Southern California. This is accomplished by 1) analysis of offset landforms and historic survey data along the northern portion of the 1857 rupture, and 2) paleoseismic trench investigation.

## Recent Rupture History of the San Andreas Fault Southeast of Cholame in the Northern Carrizo Plain

Our emphasis in the past year was the augmentation of a paleoseismic investigation along the San Andreas Fault at the LY4 site. This included 8 weeks of field effort by Young and a visitor from Italy (INGV), Laura Colini, with regular supervision by Arrowsmith and Grant and help from 5 field assistants. We were fortunate to have field review from Fumal, Stenner, Rockwell, Schwartz, Lienkaemper, and Seitz. Grant has also supervised a review of historic land survey data for determination of 1857 earthquake deformation in the area.

Our earlier work is in review at the Bulletin of the Seismological Society of America: Stone, E. M., Arrowsmith, J. R., Grant, L. B., Recent Rupture History of the San Andreas Fault Southeast of Cholame in the Northern Carrizo Plain, Bulletin of the Seismological Society of America, 36 manuscript pages and 9 figures, in revision.

**Abstract.** We conducted a paleoseismic study on the San Andreas fault (SAF) southeast of Cholame, CA to investigate the record of earthquakes within an 80 km paleoseismic data gap that exists between Parkfield and the Carrizo Plain. At the LY4 site, located 37.5 km southeast of Highway 46 along the SAF, we excavated a fault-perpendicular trench on an alluvial fan that emanates from the Temblor Mountains to the northeast and crosses the fault trace at the distal end of the fan. We found evidence of four ruptures within the stratigraphy. Because of limitations in the production and preservation of datable material, the only age constraints are radiocarbon dates on a paleosol three units below the oldest event horizon and the presence of recently introduced exotic pollen species in an upper unit. The radiocarbon dates indicate there have been at least four surface rupturing events at the LY4 site since 1070-1280 cal AD. The presence of exotic (historic) pollen in a unit possibly cut by the youngest event suggests that it may have occurred after 1873 and therefore might have ruptured during the 1881 Parkfield event.

The current work is reported in a manuscript in preparation:  
Young, J. J., Arrowsmith, J R., Colini, L., and Grant, L. B., Earthquake and offset history along the Cholame segment of the San Andreas Fault, California, Bulletin of the Seismological Society of America, special issue on the San Andreas Fault.

It will be summarized at the Spring SSA meeting.

**SSA abstract for Young, et al.** We have conducted a paleoseismic study along the Cholame segment of the San Andreas fault to determine the dates of earthquakes and the amount of lateral offset of the last one or two events. The LY4 site is located approximately 37.5 km southeast of Highway 46 and comprises 3 fault perpendicular trenches, 2 parallel trenches, and several hand dug trenches, including re-excavation of the LY4-99 fault perpendicular trench investigated by Stone et al. Abruptly truncated sand and silt layers that are not correlative to units across the fault zone indicate the oldest earthquake, L3. The vertical displacement, fracturing and shearing of a sandy silt unit radiocarbon dated at 1410 to 1460 cal AD and an alluvial fan gravel deposit provide evidence for event L2. The vertical offset and fracturing of a silty sand unit that appears to overlie the main break in units from event L2 suggests the youngest rupturing event, L1. Tectonic silt-filled fractures that dissect historic gray-tan silts and sands suggest a ground shaking event or a triggered slip event, L0, which occurred after 1857. Event L3 is loosely bracketed by the laminated silt age of 1039 to 1285 cal AD in LY4-99 and the 1410 to 1460 cal AD age estimate for the sandy silt. Event L2 and event L1 occurred sometime after the deposition of the 1410 to 1460 aged sandy silt and sometime before historic settlement which began in the 1860's. The ground-shaking event occurred after the Euro-American settlement began in the 1860's. The age of the events mentioned above indicate recurrence intervals of 306 to 221 years based on three interpreted events and 459 to 333 years based on 2 events. The edge of the deformed alluvial fan deposit cross the San Andreas at an oblique angle and provides piercing points for measuring right lateral offset. The alluvial fan edge has an estimated offset of 3.0 +/- 0.25 meters for event L2 and possibly event L1.

## Publications and products

Manuscript in revision:

Stone, E. M., J. R. Arrowsmith, and L. B. Grant, Recent rupture history of the San Andreas fault, southeast of Cholame in the northern Carrizo Plain, California, in revision for Bulletin of the Seismological Society of America.

Manuscript in preparation:

Young, J. J., Arrowsmith, J R., Colini, L., and Grant, L. B., Earthquake and offset history along the Cholame segment of the San Andreas Fault, California, Bulletin of the Seismological Society of America, special issue on the San Andreas Fault.

Abstracts and conference presentations (not including SCEC Annual Meeting)

- Stone, E. M., J. R. Arrowsmith, and L. B. Grant, Possible Post-1857 surface rupture of the San Andreas fault southeast of Cholame in the northern Carrizo Plain, Seismological Research Letters, v. 71 (1), p. 228-229, 2000.
- Young, J. J. , Arrowsmith, J. R., Colini, L. and Grant, L. B., Recent surface ruptures along the Cholame segment of the San Andreas fault, EOS Trans. Am. Geophys. Union, v. 81, no. 48, p. F925, 2000.
- Young, J., Colini, L., Arrowsmith, J. R. and Grant, L. B., Recent ruptures along the Cholame segment of the San Andreas Fault, California, Seismological Research Letters, v. 72 (2), 2001.
- Runnerstrom, E. E., Grant, L. B., Arrowsmith, J. R., Stone, E. M., and Rhodes, D. D., Preliminary measurement of earthquake displacement and post-1857 strain accumulation along the Cholame segment of the San Andreas fault, Seismological Research Letters, v. 72 (2), 2001.