

# New Paleoseismic Results from the Southern San Jacinto Fault Zone

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## Abstract

New paleoseismic and 3-D trenching studies along the southern San Jacinto system allow for better insight into the dynamics between the Coyote Creek fault (CCF) and Supersition Mountain fault (SMF) for the past 1200 years. Previous work has shown that the CCF ruptures more frequently than the SMF, and with generally smaller displacements (Clark et al., 1972; Pollard and Rockwell, 1995; Gurolo and Rockwell, 1996; Ragona, 2003). However, there is also evidence at two sites on the CCF that suggest that larger SMF events rupture onto and involve the CCF.

We conducted new 3D-trenching to determine slip in the last four large events at Carrizo Wash on the SMF. We resolved displacement on two channels, one offset 7 m by the last four large events, and the other offset 5.5 m in only the last three large events. An additional small event was shown by Ragona (2003) to have produced 10-15 cm of displacement, which is part of the total slip documented for these channels. Combined with prior 3D slip data from the Shoreline site of Gurolo and Rockwell (1996), we resolved that slip averages 1.5-2 m per event. Each site is located at or beneath the shoreline elevation of ancient Lake Cahulla, which has experienced periods of inundation and desiccation at least six times in the past 1200 years from flood waters of the Colorado River. Through analysis and radiometric dating of the lacustrine and fluvial stratigraphy at each site, we have constructed a lake history into which we cast the earthquake history; we document the four large and one small events occurred in the period between about AD 850 and 1500, with no surface ruptures along at least the northern SMF for about 500 years. Combining the displacement of the 4-event channel with the modeled dates of the events yields a slip rate estimate of about 6 mm/yr during the past 1200 years at Carrizo Wash, similar to the rate suggested by Gurolo and Rockwell (1996).

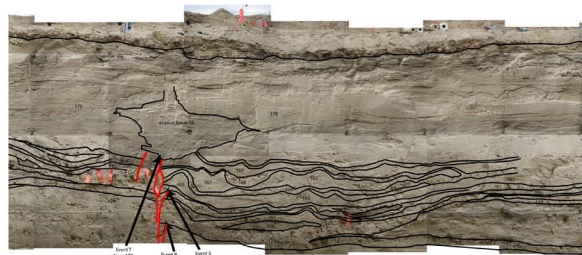
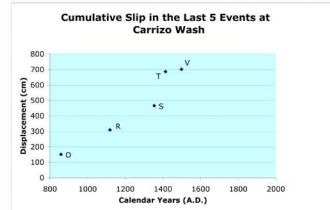
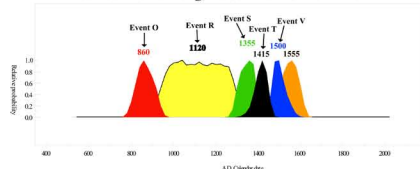
We also conducted a paleoearthquake study on the North Break of the 1968 CCF rupture to understand its relationship to the Middle and South Breaks, as well as check for a SM event signal. The trench, located in Benson Lake playa within the confines of the Ocotillo Wells Airport, was excavated across the mapped surface break from the 1968 rupture. Surprisingly, there were only 4 distinguishably discrete events in the last 3000 years and a clear lack of organization in the fault zone proper down to 3 meters beneath the playa surface. A 3000-year-old C-14 dated sand blow was also exposed across the best-expressed fault within the trench and, although clearly faulted, is apparently offset less than a meter (the width of the trench). Although this fault sustained rupture in 1968, it apparently is not the main long-term active strand of the CCF.

## Carrizo Wash Site

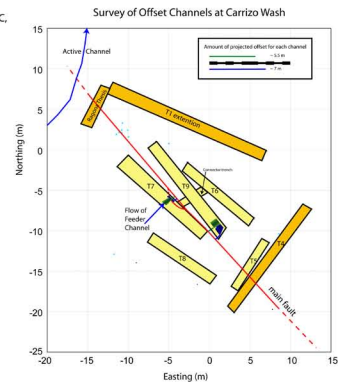
South Break Site	Carrizo Wash Site	Northern Shoreline Site
Stratigraphic Units and Calibrated Ages	Stratigraphic Units	Stratigraphic Units
Unit 10	Unit 10	Unit 10
Unit 9	Unit 9	Unit 9
Unit 8	Unit 8	Unit 8
Unit 7	Unit 7	Unit 7
Unit 6	Unit 6	Unit 6
Unit 5	Unit 5	Unit 5
Unit 4	Unit 4	Unit 4
Unit 3	Unit 3	Unit 3
Unit 2	Unit 2	Unit 2
Unit 1	Unit 1	Unit 1

Correlation Diagram of units across Northern Shoreline and South Break sites with Carrizo Wash with added offset channel units (modified from Ragona, 2003, and continued work in progress).

### Modeled Events along the Southern San Jacinto Fault



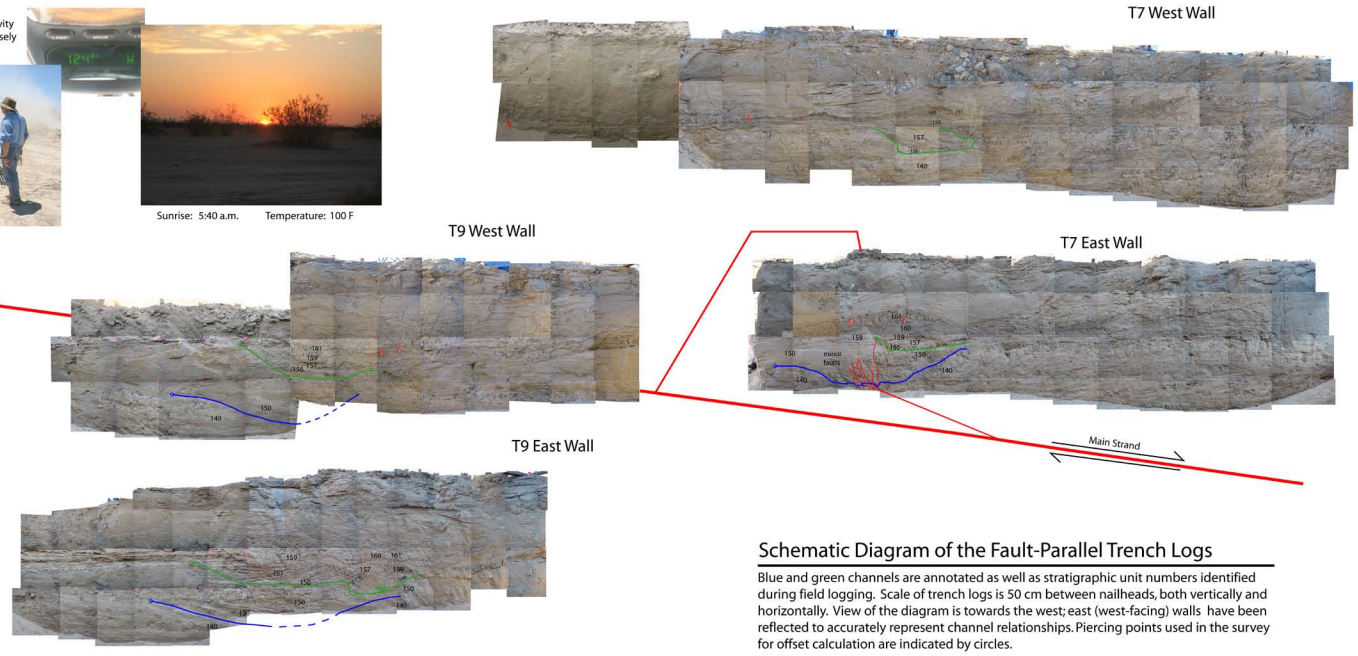
Above, trench 5 shows the extra event 5, presented by my senior thesis last year at SCEC, as well as confirms other events determined by Ragona's thesis (2003).



Trenches in orange are from previous studies, active trenches are in yellow. Green and blue channels correlate to those in the figure with the trench logs.



Sunrise: 5:40 a.m. Temperature: 100 F



### Schematic Diagram of the Fault-Parallel Trench Logs

Blue and green channels are annotated as well as stratigraphic unit numbers identified during field logging. Scale of trench logs is 50 cm between nailheads, both vertically and horizontally. View of the diagram is towards the west; east (west-facing) walls have been reflected to accurately represent channel relationships. Piercing points used in the survey for offset calculation are indicated by circles.

## Southern San Jacinto Faults

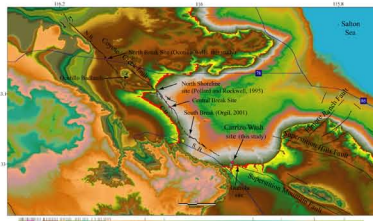
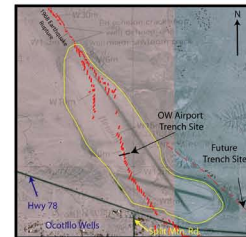
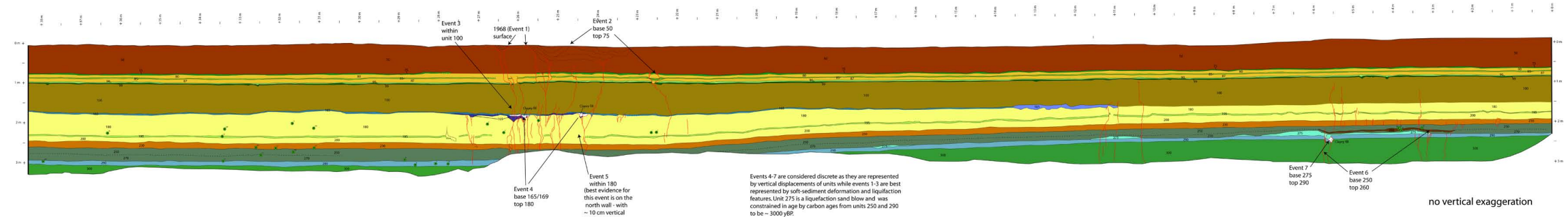


Figure 4. DEM of the 1968 Borrego Mountain Earthquake area. Black lines represent surface trace of the main faults. Colors represent elevation. Color indicates elevation. Red '12' represents the ancient Lake Cahulla shoreline. Light blue '70m' corresponds to the elevation of the Salton Sea lake, each color represent ~1 to 10 m change in vertical elevation. Abbreviations are: SMF: Supersition Mountain Fault; SHF: Supersition Hills Fault; CCF: Coyote Creek Fault; BRF: Brawley Fault. (Modified from Ragona, 2003.)

## Ocotillo Wells



USGS DOQQ aerial photographs annotated with mapped surface ruptures following the 1968 Mag 6.4 Borrego Mountain Earthquake. Yellow line depicts terrain surrounding the airport.



no vertical exaggeration