Final Technical Report
Rupture history of the San Andreas fault at Van Matre Ranch, Carrizo Plain, California: Collaborative research with the University of California, Irvine and Arizona State University

External Grant Award Nos. 04HQGR0080 and 04HQGR0081

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Keywords: Paleoseismology, Trench investigations, Surface deformation, Age dating

Investigations undertaken

The Carrizo Plain has been one of the most productive sections of the San Andreas fault for paleoseismic research, and we think it may hold the potential to reveal a paleoseismic record approaching Pallett Creek in number of earthquakes, and exceeding Pallett Creek in measurement of slip per event and slip rate. Our long-term goal is to document this record. This report summarizes a portion of our work at the Van Matre Ranch (VMR) site in the southern Carrizo Plain during the 2004 project year.

A set of well-preserved channels are offset across the San Andreas fault at the Van Matre Ranch site (35.154N, 119.700W) in the Elkhorn Hills area of the Carrizo Plain. The Van Matre Ranch site is in the southern Carrizo Plain, 18 km southeast of previously developed and spatially clustered paleoseismic sites at Wallace Creek (Sieh and Jahns, 1984; Liu, 2003), Phelan Creeks (Sims, 1994), Phelan fan (Grant and Sieh, 1993) and Bidart fan (Grant and Sieh, 1994). Early work at the Van Matre Ranch site focused primarily on measuring offsets (Sieh, 1977,1979). In the early 1990s, two efforts gathered more data at the site. In 1991, Sieh, Grant and McGill had large scale aerial photography flown and a topographic map produced photogrammetrically for the site (Figure 2). In 1993, Arrowsmith worked with John D. Sims and his group (USGS) at the site to investigate the quality of the stratigraphy and to test models for channel responses to earthquake offset (Sims, et al., 1993).

In the 2004 project year we opened 3 new trenches (T6', T8 and T9) and reopened the original trenches T2 and T3 for detailed logging, stratigraphic correlation, and sampling for radiocarbon dating. We surveyed the site to tie all the trenches into the same coordinate system We also began a new initiative by our group: to conduct our own radiocarbon dating under the supervision of Dr. John Southon, at UCI's new Keck AMS facility devoted to carbon isotopes. We collected 17 samples and dated all of them, at significantly reduced cost.

Results

The results of this project were published as:

Noriega, G. R., Arrowsmith, J R., Grant, L. B., and Young, J. J., Stream Channel Offset and Late Holocene Slip Rate of the San Andreas Fault at the Van Matre Ranch Site, Carrizo Plain, California, Bulletin of the Seismological Society of America, 96, 33--47, 2006. USGS NEHRP support is gratefully acknowledged.

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Non-technical Summary

Because of its great length and high slip rate, the San Andreas fault is the largest sources of seismic hazard in California. The past behavior of the fault is the best indicator of future earthquake potential. The goal of this project is to measure surface displacement, or fault slip, from past earthquakes to quantify the average production rate (slip rate) of large earthquakes on the San Andreas fault in the Carrizo Plain. The data are collected by excavating the fault zone and mapping it at a location where it has displaced several small stream channels.

Reports published

Noriega-Carlos, G. R., Grant, L. B., Arrowsmith, J R. and J. J. Young (2004). Stream Channel offset and preliminary slip rate on the San Andreas fault, at the Van Matre Ranch site, in the Carrizo Plain, California, *Eos Trans. AGU*, 85(47), Fall Meet. Suppl., Abstract G11A-0772.

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The data are available from this site: http://activetectonics.asu.edu/carrizo/VMR/