Annual Project Summary

Paleoearthquake History of the Southern San Jacinto Fault: Investigation of Segment Controls on Rupture History and the Nature of Earthquake Recurrence as Revealed by the Stratigraphic Records of the Past 5-6 events

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Program element I

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Investigations Undertaken – Information on the size and timing of past earthquakes is important in understanding fault behavior, a key element in forecasting future seismic activity. The San Jacinto fault is one of the primary branches of the San Andreas fault system and has produced nearly a dozen earthquakes over M6 during the past century. Of particular interest is the region near the southern termination of the 1968 Borrego Mountain earthquake on the Coyote Creek fault, and its relation to the Superstition Mountain fault. We have continued to develop and study new sites to better understand why the 1968 rupture terminated where it did and to explore the relationship between these two important segments, both in terms of timing of past events as well as size. Our observations lead to better understanding the controls of the dimensions of individual ruptures, and what allows for larger events to

Results – We have almost completed 2D and 3D studies at the “South Break” site, located along the southern portion of the 1968 rupture where slip was reported as only 1 cm. We have found evidence for up to 11 past earthquakes at this site, with over half occurring prior to 3000 years ago. For the past 500 years, we resolved slip for 1968 (we found 6-8 mm of right slip, consistent with that reported after the earthquake.) We also demonstrated by 3D trenching that no other events have ruptured the south break during the past 300 years since the last high stand of Lake Cahuilla. In contrast, the “Middle Break Shoreline” site records 1.4m of dextral slip over this same time interval indicating repeat ruptures of the 25-30cm of slip reported from 1968. Thus, the southern and middle portions of the 1968 rupture apparently have disparate rupture histories.

The penultimate rupture along the southern portion of the Coyote Creek fault occurred between 300 and

350 years ago, between the last two lake stands. We resolved 2.2cm of dextral slip on small-scale sedimentary features, suggesting that this event also produced only minor slip along the southern Coyote Creek fault. We also recognized this event at the Carrizo site, where we resolved 6 cm of slip for this event. We interpret both 1968 and this penultimate event as infrequent "bleed-over" of slip from seismic rupture of the Coyote Creek fault. We note that most Coyote Creek ruptures apparently do not induce slip south of the Middle Break, where the fault exhibits a 3-km-wide releasing step-over. The third event at the South Break site was apparently large and broke a broad portion of the fault zone. We are still resolving slip for the main fault for this event.

We also initiated trenches at a new site along the Middle Break of the 1968 rupture, where we hope to further constrain slip per event. The 1968 rupture trace, that included 25 cm of dextral slip in that event at this new site, is very narrow at only a few cm in width. In contrast, the fault zone below the last lake is over 2m in width and suggests that larger events may infrequently break through this portion of the fault zone. Pending radiocarbon dates will help constrain whether the sediments involved in the broader ruptures correlate to those at the Carrizo of Superstition Mountain sites.

Non-Technical Summary – Information on the size and timing of past earthquakes is important in understanding fault behavior, a key element in forecasting future seismic activity. We continued to develop a precise record of past earthquakes for the southern Coyote Creek and Superstition Mountain faults to better understand this fault zones past behavior. We have now completed studies at four of the proposed sites, and are in the process of completing two more. These data will provide a relatively complete history of ruptures for the past several events, including slip at multiple sites and estimates on the locations of rupture terminations.

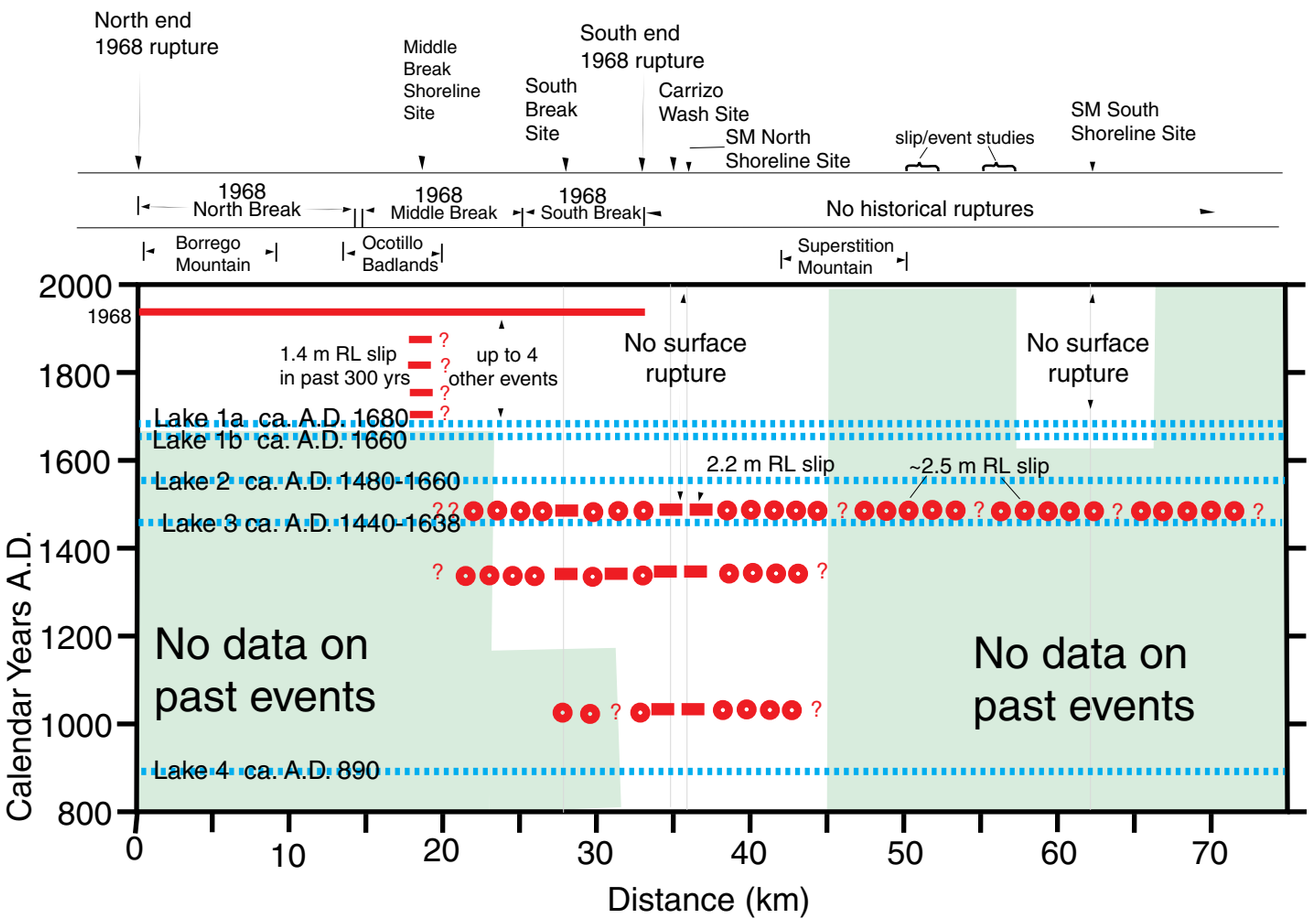

Figure 1. Correlation diagram of ongoing paleoseismic sites along the southern San Jacinto project. The record of earthquakes at each site are being extended as new dates come in, and new trenches are excavated.