Source Characteristics of Earthquakes Along the Northern San Jacinto Fault Zone and Faults Within Northern Baja California, Mexico (1915-1956)

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Objective: Between 1915 and 1956 two earthquakes with magnitude > 6.0 occurred along the northern San Jacinto fault, and seven earthquakes occurred along faults in northern Baja California. The source processes of these earthquakes will be determined through waveform modeling of regional and teleseismic body waves. Foreshocks and aftershocks of these earthquakes will be relocated using a bootstrap technique, and focal mechanisms will be determined through grid searches of first motion data. Data from available geological and geophysical studies will provide additional constraints on fault processes. The information obtained from the study will be used to determine the rupture length, moments, and causative faults associated with the earthquakes on the northern San Jacinto fault, and the nature of faulting and rate of moment release within Baja California. The latter information is needed to evaluate how plate motion from the Gulf of California is being transferred across Baja California to the San Andreas, Imperial, and San Jacinto fault systems and how it may affect the recurrence rates of earthquakes within southern California.

Progress to Date: The past five months of this project have been devoted to data acquisition and analysis. Tasks completed during this time period include:

(1) Waveform modeling of earthquakes along the northern San Jacinto fault has been completed and a paper on the results is in preparation for the Bulletin of the Seismological Society of America. The modeling results suggest that the 1918 (M=6.8) San Jacinto earthquake occurred along a fault with an orientation similar to that of the Claremont branch of the San Jacinto fault at a depth of 8 km. Data for the 1923 (M=6.3) San Bernardino earthquake are limited to waveforms from one station and a few first motion polarities, however these data indicate that the event did not occur along a strike-slip fault with orientation similar to the San Jacinto fault near San Bernardino. The orientation that best fits the data is similar to the strike of the Banning fault.

(2) Waveform modeling of earthquakes associated with the February 9-15, 1956 San Miguel sequence is in progress. Preliminary results of the modeling suggest 1.2x10**19 N-m of moment was

released during the sequence. The mainshock on February 9 appears to be composed of 2 to 3 subevents. The February 15 aftershock also appears to be a double event. A change in strike from 120° for the mainshock to 100° and 130° for the February 14 and 15 aftershocks is consistent with changes in the trend of surface faulting observed along the San Miguel fault. Results of the modeling will be presented at the 1991 Spring meeting of the American Geophysical Union at a special session on historic earthquakes. A special volume of Pure and Applied Geophysics will be published on the papers presented at the session.

(3) Waveform data for the remaining Baja earthquakes has been collected and digitized. Waveform modeling will commence once the study of the 1956 San Miguel sequence is completed.

(4) All mainshocks, aftershocks, and foreshocks in Baja, California have been relocated. Collection of first motion data for the events has been completed and is awaiting analysis.

(5) The PI has been sharing analysis software with Dr. Craig Nicholson at the University of California, Santa Barbara. Dr. Nicholson is completing a study of historic earthquakes along the San Andreas fault zone in southern California sponsored by the USGS. The PI and Dr. Nicholson hope to collaborate on a paper that will summarize the results of their studies of historic earthquakes in southern California.