Final Report on Investigation of Structures of the San Jacinto Fault near Anza, California, Using Fault-Zone Trapped Waves

(USGS Grant 1434-95-G-2622)

Program Element 1.1

(July 30, 1996)

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Scientific Significance

The San Jacinto fault zone (SJFZ) is currently the most seismically active fault system in southern California. Since 1890 at least six earthquakes greater than M6 were associated with this fault zone. Geological, seismological and geodetic data imply a slip rate of 10 to 15 mm/yr for the SJFZ since the mid-Pleistocene. The total displacement along the entire SJFZ southeast of Hemet is about 29 km right laterally since early Tertiary. The Anza area has particular significance because it is considered to be a candidate site for an impending M6 earthquake. Historically, the Anza segment of the SJFZ has experienced three large earthquakes in the past 1000 years with the last main shock ~250-300 years ago. The locations and dates of the latest large events with M>6 suggest that none have ruptured the Anza seismic gap since 1890. It therefore appears that the another large earthquake may

be due on the Anza segment. On the other hand, small earthquake epicenters near the Anza seismic slip gap define a 20 km quiescent segment of the San Jacinto fault (SJF) bounded to the northwest and southeast by areas of relatively high seismicity. This length of the locked fault segment suggests potential for an M~6.5 earthquake if the entire segment ruptures at once.

In this study, we used fault-zone trapped waves to delineate the fine structure and segmentation of the SJF in the Anza area. Because the features (including amplitudes and frequencies) of the fault-zone trapped waves are strongly dependent on the fault geometry and physical properties, these waves can be used as a probe of the state of the fault zone. For example, observations and modeling of fault-zone trapped modes at the San Andreas near Parkfield allow us to resolve a 100-150 m wide fault core-zone where the shear velocity is reduced by 30-50 percent (Li et al., 1990). We also used trapped modes to delineate a 180 m wide low-velocity zone with shear velocity 2.2 km/s along the surface breaks of the Landers, California, earthquake of 1992 (Li et al., 1994a,b). The low-velocity zone either at Parkfield or at Landers extends from the surface to a depth of at least 10 km. The fault-zone trapped wave data collected at Landers also provide us the information of the fault segmentation and continuity there.