



Structure of the San Andreas Fault at the San Andreas Fault Observatory at Depth (SAFOD) From Seismic Imaging and Comparisons with Borehole Observations

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We acquired a series of high-resolution (2.5-m CDP spacing) combined seismic reflection and refraction profiles across the San Andreas Fault Observatory at Depth (SAFOD) site, near Parkfield, California. The seismic profiles provide velocity and reflection images of structures and lithologic units observed in the recently drilled SAFOD borehole. Our seismic images show that the San Andreas fault is located within a southwest-dipping, low-velocity zone that is about 1.7 km wide at about 1 km depth, tapering with increasing depth. On the basis of P-wave velocity data, we previously interpreted traces of the San Andreas fault to lie within a wedge of low-velocity sediments (Catchings et al., 2002; BSSA), a result that was confirmed by SAFOD borehole data. Small repeating earthquakes that were the principal target events for SAFOD drilling reside within the wedge of sediments and are probably related to low-strength sedimentary rocks. Our reflection images show that additional strands of the San Andreas fault extend into more competent rock, situated well northeast of the SAFOD target faults. The relatively wide fault zone, inferred from our observations of numerous fault strands on seismic reflection images, suggests that the SAFOD borehole sampled only part of the San Andreas fault zone, which is wider and more structurally complex than previous believed.