Stress-Induced Seismic Velocity Anisotropy and Physical Properties in the SAFOD Pilot Hole in Parkfield, California

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A comprehensive suite of geophysical logs was collected in the pilot hole for the SAFOD (San Andreas Fault Observatory at Depth) from a depth of 775mdown to 2200 m in the highly fractured Salinian granite adjacent to the San Andreas Fault in Parkfield, California. In this paper, we describe the relationship between stress orientation and shear-wave velocity anisotropy, in addition to the nature and distribution of faults and fractures, and petrophysical properties such as P- and S-wave velocity, density. The numerous macroscopic fractures and faults in the crust intersected by the Pilot hole have extremely varied orientations. However, the direction of maximum horizontal compression is very consistent with the fast polarization direction of the shear waves. The most likely cause of the seismic anisotropy appears to be the preferential closure of fractures in response to the anisotropic stress state. Three distinct shear zones are characterized by anomalous physical properties, an absence of borehole breakouts (associated with high stress), and both increased velocity anisotropy and low seismic velocities indicating the presence of anomalously low stresses within these intervals.