

**Physical properties and processes observed from core and drill cuttings from  
the San Andreas fault at depth, SAFOD Borehole Study Site,  
Parkfield, California**

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The SAFOD (San Andreas Fault Observatory at Depth) borehole provides an excellent opportunity to study the *in situ* conditions adjacent to a seismically active portion of the San Andreas fault zone via direct sampling of deformed and altered rocks. Drill cuttings and core from Phases 1- 3 to a depth of 3.2 km have and continue to be examined to determine lithology, provenance, deformational textures, and potential fluid-rock interactions within the fault zone and adjacent host rocks. Here, we emphasize data from 10,000 to 11,000 ft MD where two active slip surfaces were interpreted from geophysical logging data during Phase 2 drilling at 10,480 and 10,830 ft MD (by M.D. Zoback, [www.earthscope.org/data/safod](http://www.earthscope.org/data/safod)).

Rock sequences sampled within this interval may represent the lower Great Valley Formation and possibly portions of the Franciscan Formation. Greenish-gray to grayish-red sandstones, dark green to gray to black siltstones and mudstones, serpentinite mudstones and clasts, and foliated fault gouge comprised of cataclasite, clay gouge, and/or sheared serpentinite are observed. Facies interpretations shed insight into the potential provenance, structural relationships, and tectonic processes associated with these rocks. The presence of serpentinite of both tectonic and also detrital origin, may strongly control the geophysical signatures and deformation behavior within the fault zone.

Initial review of the velocity data show great variability with depth and are weakly correlated to the amount of cataclasis, alteration, and microfractures obtained through cuttings analyses. However,  $V_p$  and  $V_s$  are in some cases positively correlated with regions of increased cataclasis and alteration, suggesting that cementation or strain hardening may be occurring at depth. Continued review of these data coupled with analyses of whole rock core samples will help to refine these correlations. A primary goal of this work is to quantitatively merge geological measurements with geophysical parameters at the sub-m to m-scale, the scale at which fault zone processes transmit seismic energy and control fluid flow, in order to better understand these processes that are active within the fault zone at the depths at which earthquakes occur.