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Scientific Drilling into the San Andreas Fault: The SAFOD Experiment

The SAFOD experiment has two complementary sets of scientific objectives. First, we seek to constrain, through direct sampling and measurement, the many hypotheses that currently exist about the composition, state (stress, pore pressure, temperature, etc) and on-going physical and chemical processes in an active, plate-bounding fault zone. Second, we plan to establish a long-term observatory directly within the active fault to study the processes associated with initiation, propagation and arrest of seismic rupture. The SAFOD experiment will be carried out at a site characterized by creep and regularly repeating small earthquakes near Parkfield, CA.

In addition to drilling through the fault zone and making a broad suite of geophysical measurements, we will sample a continuous profile of fault-zone rocks and fluids and measure stress and pore pressure conditions within the SAFOD borehole. In this manner, we will compare and contrast the state of stress and crustal strength of the currently active San Andreas fault zone with that of the adjacent crust. After the sampling and downhole measurements phases of the experiment, we will deploy a suite of seismic, strain, pore pressure and temperature monitoring equipment in the fault zone. We will then use these instruments to monitor directly the process of strain accumulation and release during the cycle of repeating microearthquakes as well as monitor any changes in pore pressure and temperature that might occur through time. We will also have the capability to directly observe the earthquake nucleation process in the very near field and address a number of outstanding questions about the dynamics of earthquake rupture.