EARTHSCOPE SEMINAR
PAPER SUMMARY
APRIL 2, 2007
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Paper Title: Internal structure of the San Andreas fault at Parkfield, California

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Overview

This paper uses data collected through magnetotelluric (MT) electrical resistivity data and seismic reflection data to map the internal structure of the San Andreas fault near Parkfield, CA. Previous direct current resistivity measurements had suggested a very complicated near-surface resistivity in this area and the authors hypothesized that this structure continued beneath the near-surface.

Data

MT measurements were taken along a 4km profile near a 1966 M=5.9 earthquake epicenter. The frequencies of the magnetic fields were varied to test resistivity at different depths. To further identify where Salinian Granite is located beneath the southwestern section of the investigation site, the seismic reflection data of the area were analyzed.

Methods

- MT apparent resistivity was plotted with frequency
    - As frequency decreases the depth at which the magnetic fields are sampling increases, so this way of plotting gives the general idea of how resistivity changes with depth
- The apparent resistivities are smoothed into a resisitivity model and then depth is estimated using frequency

Results

- A low resistivity column directly below Middle Mountain
- A correlation between the change in resistivity and seismic velocities with the location of Salinian Granite and other geologic units

Implications

- Options that could have created a very low resistivity column:
    - Serpentinite
    - Clay minerals
    - Fluids present in interconnected pores
    - Fluids in macroscopic cracks
- The most likely culprit is a combination of clay minerals and of fluids in interconnected pores and macroscopic cracks in a significant amount
    - Mantle, crustal, or meteoric in origin
- The fluid may play a significant role in the earthquake cycle

Additional Thoughts

- How do the processes in this study help to find and identify electromagnetic precursors to major earthquakes?
- How active is the role of the fluid in the earthquake cycle of this area?
- How precise are the deeper observations of resistivity?