An Update on the USGS Parkfield Experiment: September, 2002

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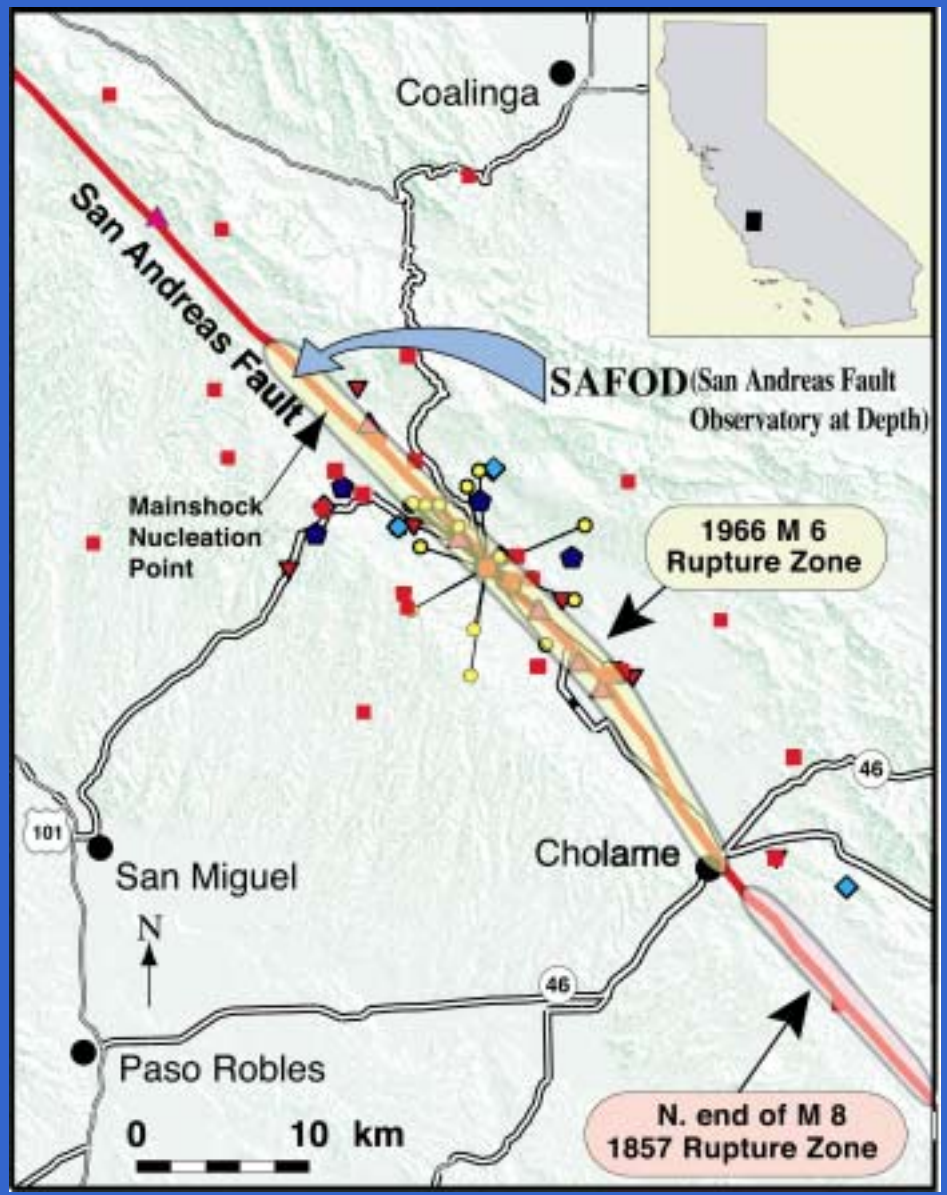
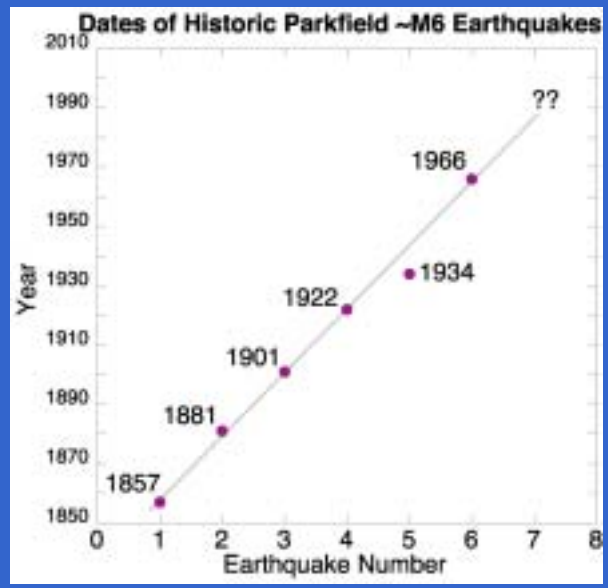
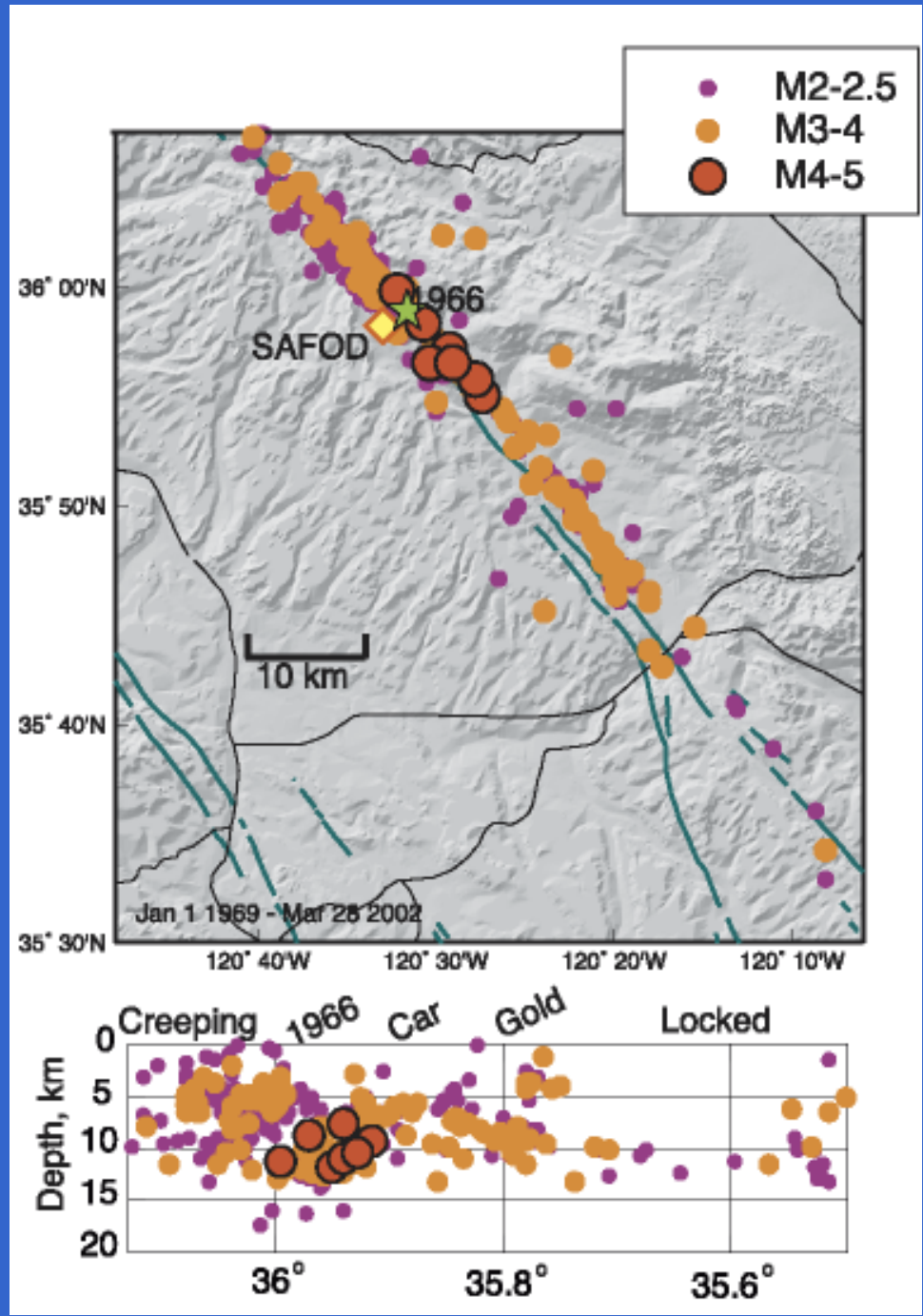
Parkfield Experiment Goals: 2002



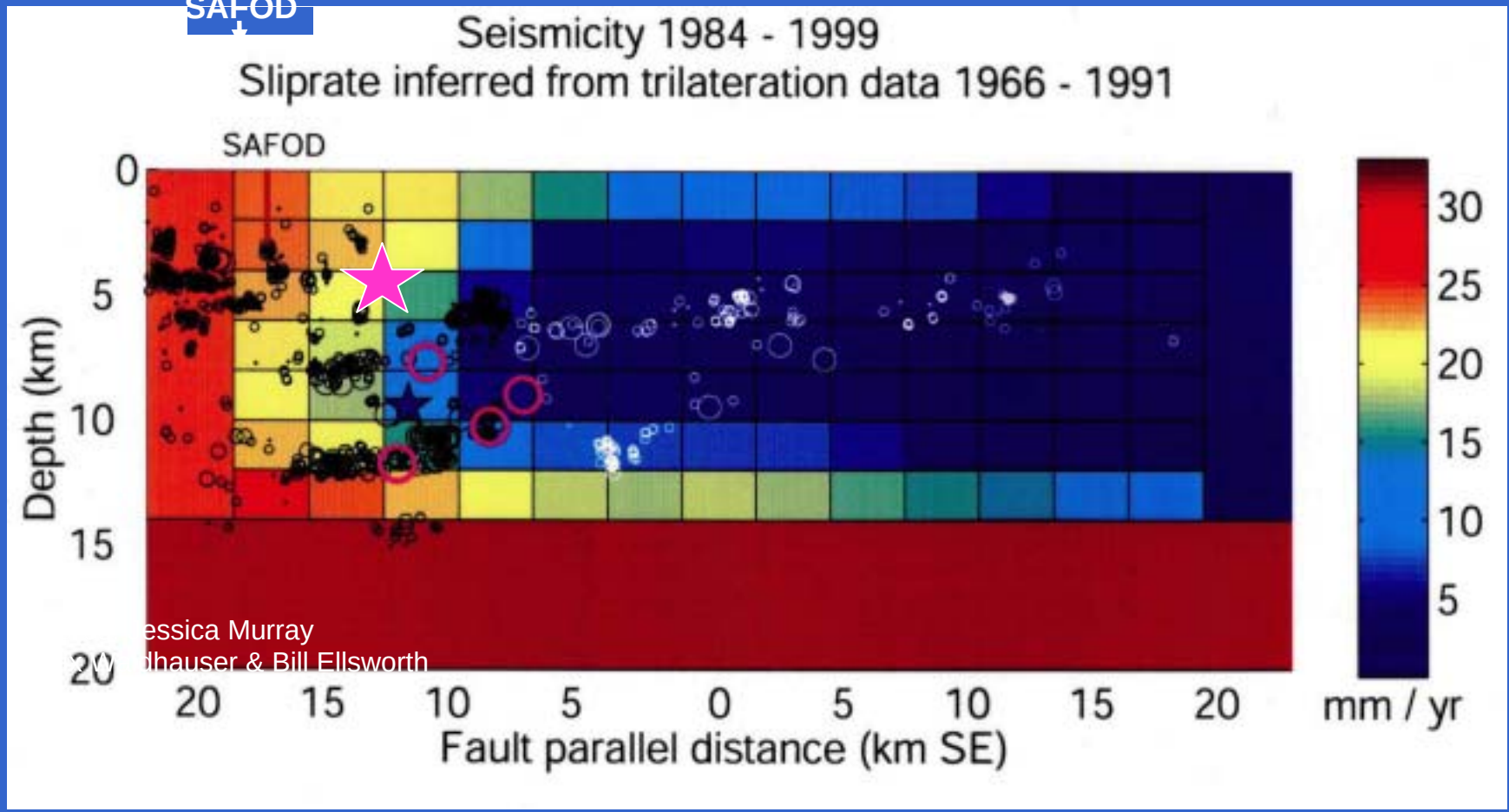


- Observe the build-up and release of stresses on the San Andreas Fault through multiple earthquake cycles.
- Test the feasibility of short-term earthquake prediction.
- Measure near-fault shaking during earthquake rupture, and learn how to predict the amplification of shaking caused by different soil types for improving building codes and designs.

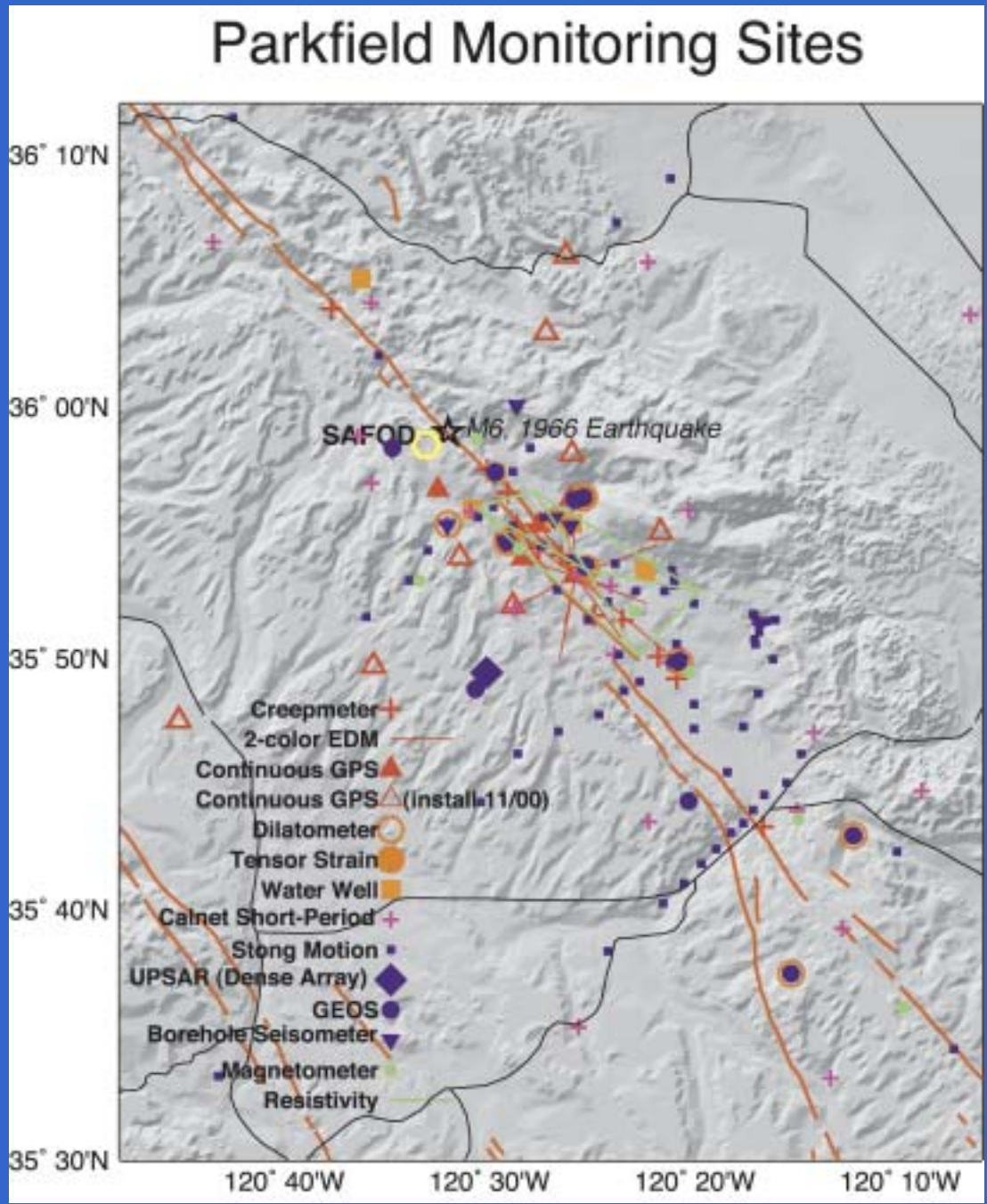
Parkfield Seismicity Jan 1 1969 - March 25 2002



Parkfield Seismicity and Subsurface Slip Rates



Current Parkfield Monitoring Sites (2002)



Hydrologic and Geochemical Monitoring at Parkfield

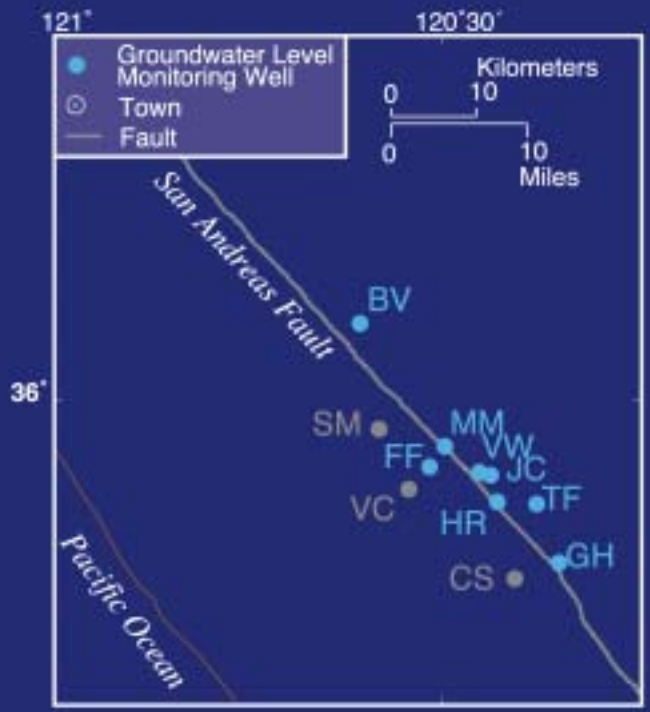
- Groundwater level monitoring at Parkfield was begun with the idea that water levels vary in proportion to crustal strain and could detect accelerated pre-seismic slip

- Geochemical monitoring of radon in groundwater and helium from soil gas near the fault trace were included in the original experiment

- Groundwater level monitoring continues in a reduced number of wells

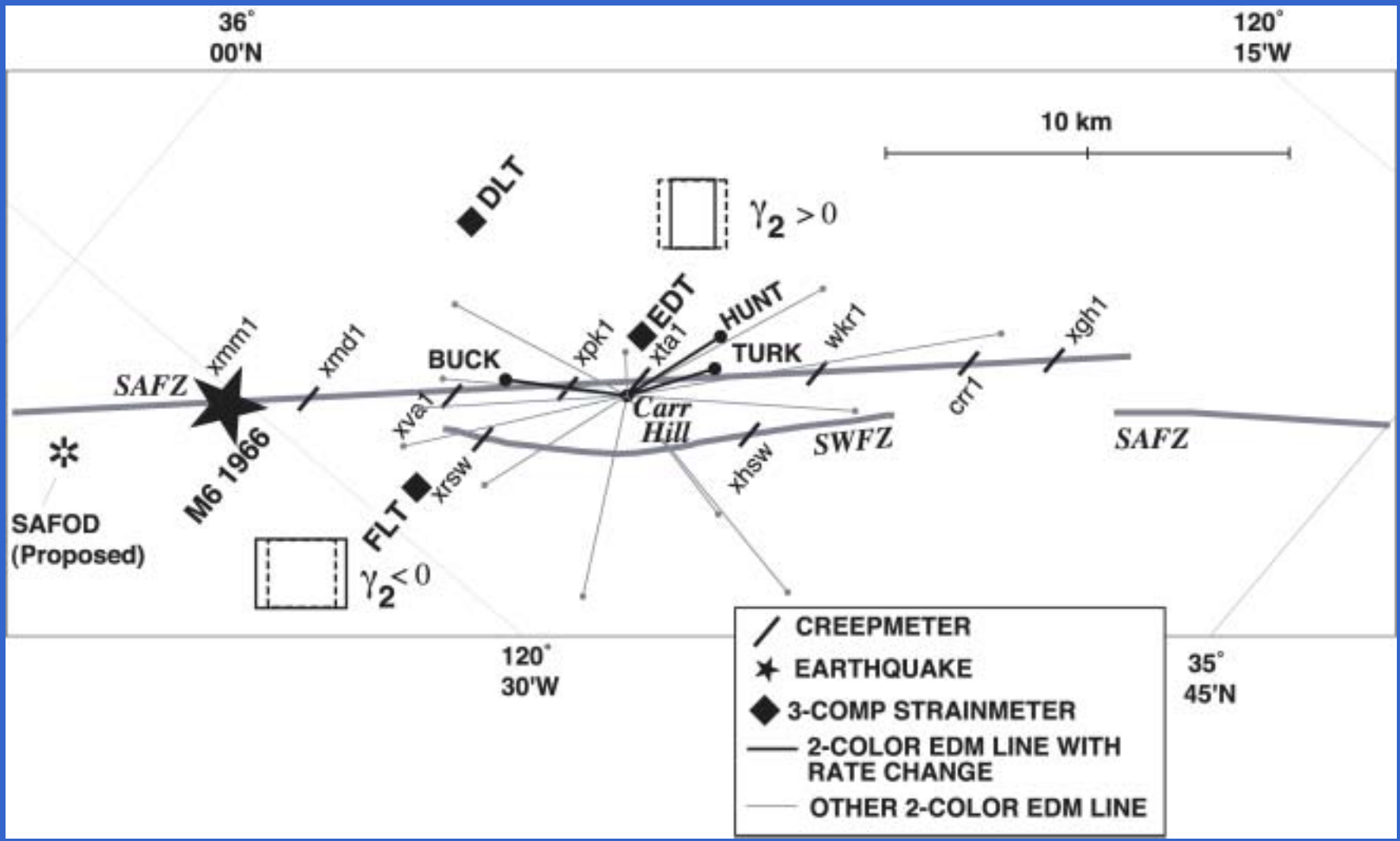
- Geochemical monitoring was discontinued around 1990

PARKFIELD GROUNDWATER-LEVEL MONITORING WELLS

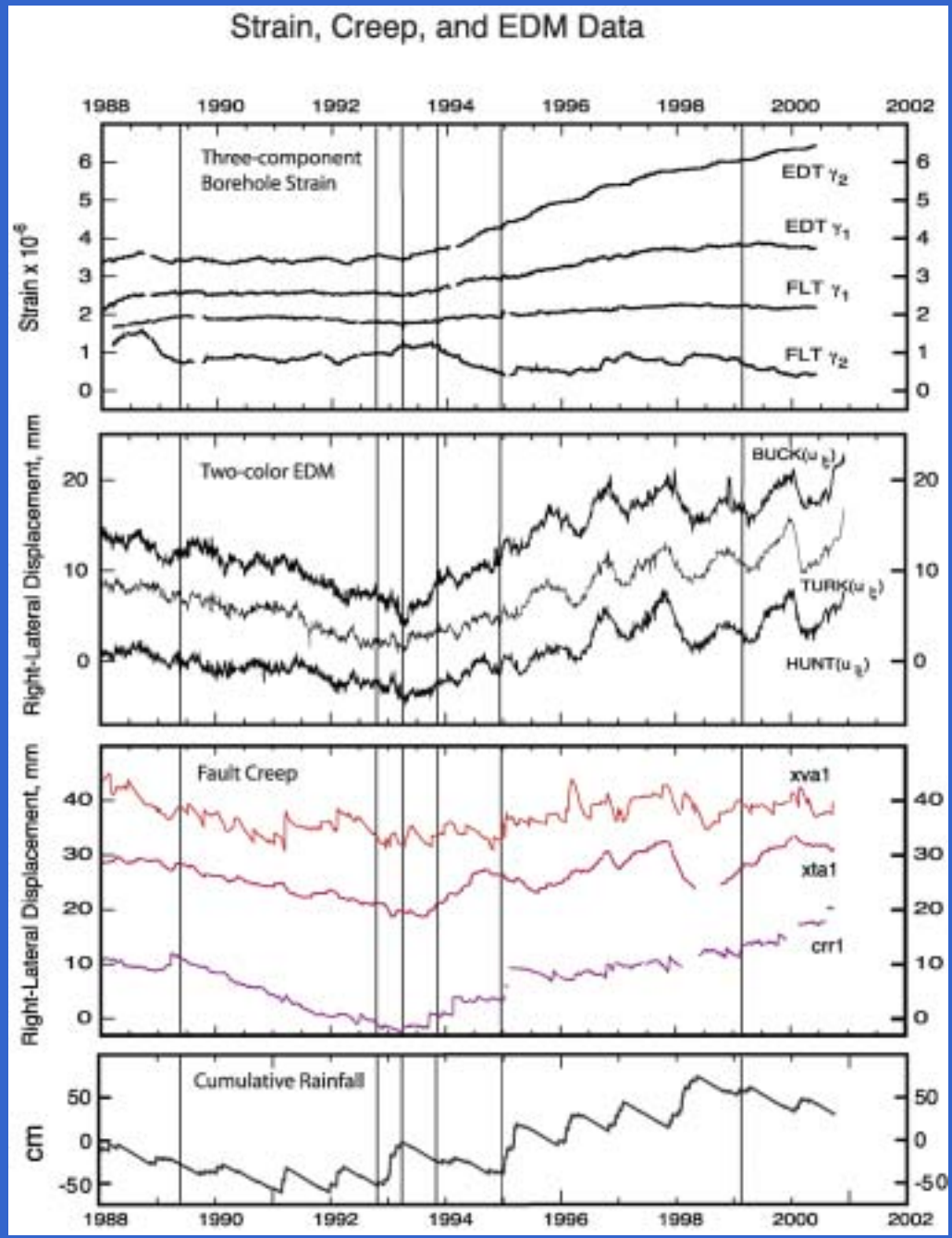


Depths, m:	
BV	30
FF	122
GH	88
HR	127
JC	153
MM	85,241
SM	305
TF	177
VW	1000
VC	167

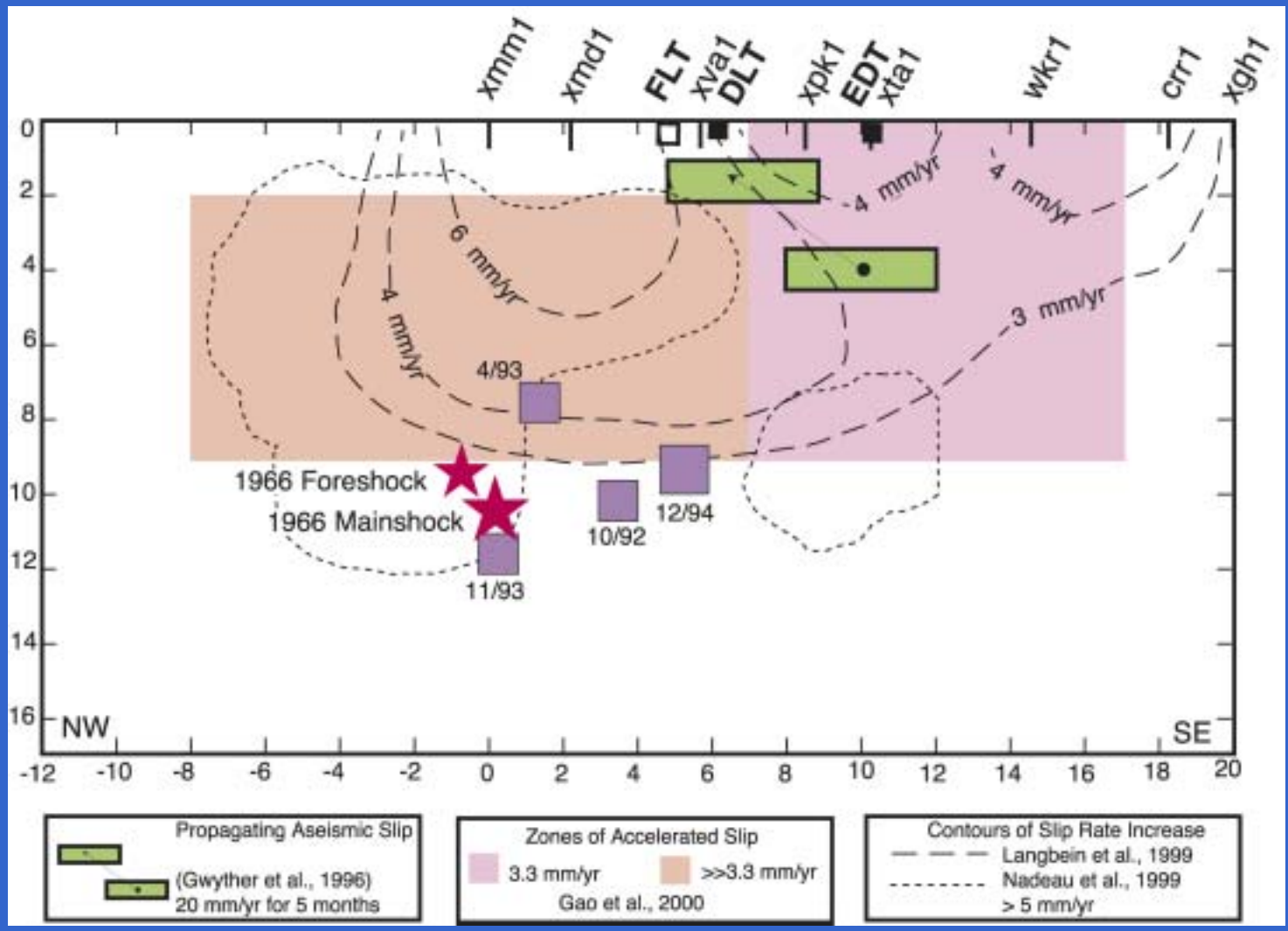
Slip-rate Changes Detected by Borehole Strainmeters, 2-color EDM, and Creepmeters



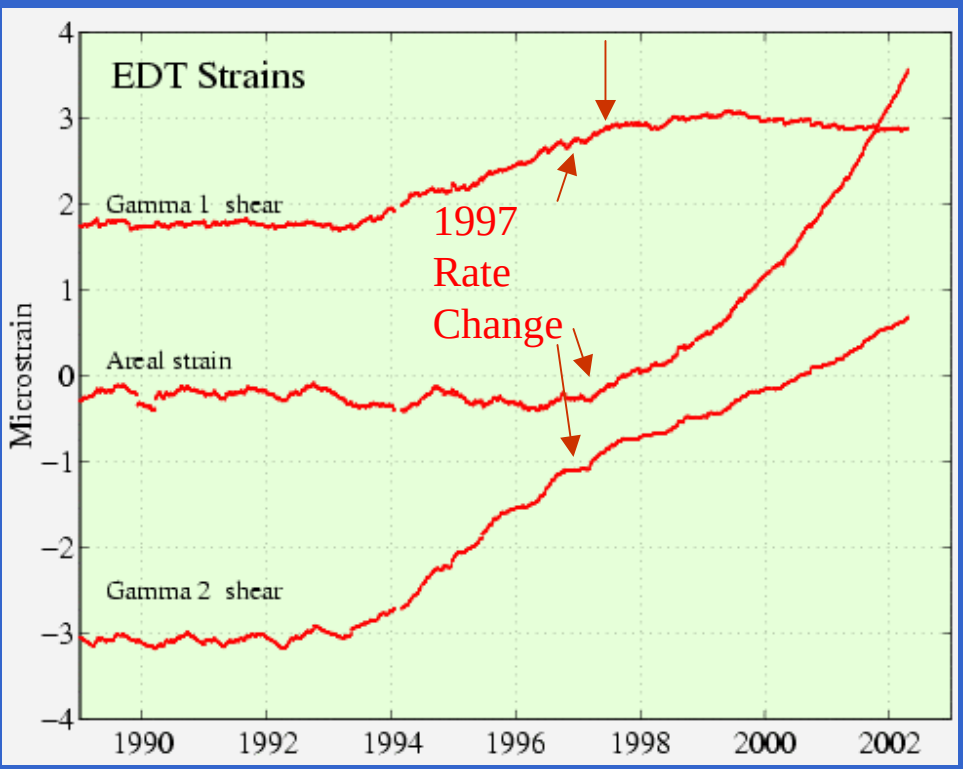
1993 Strain-rate change

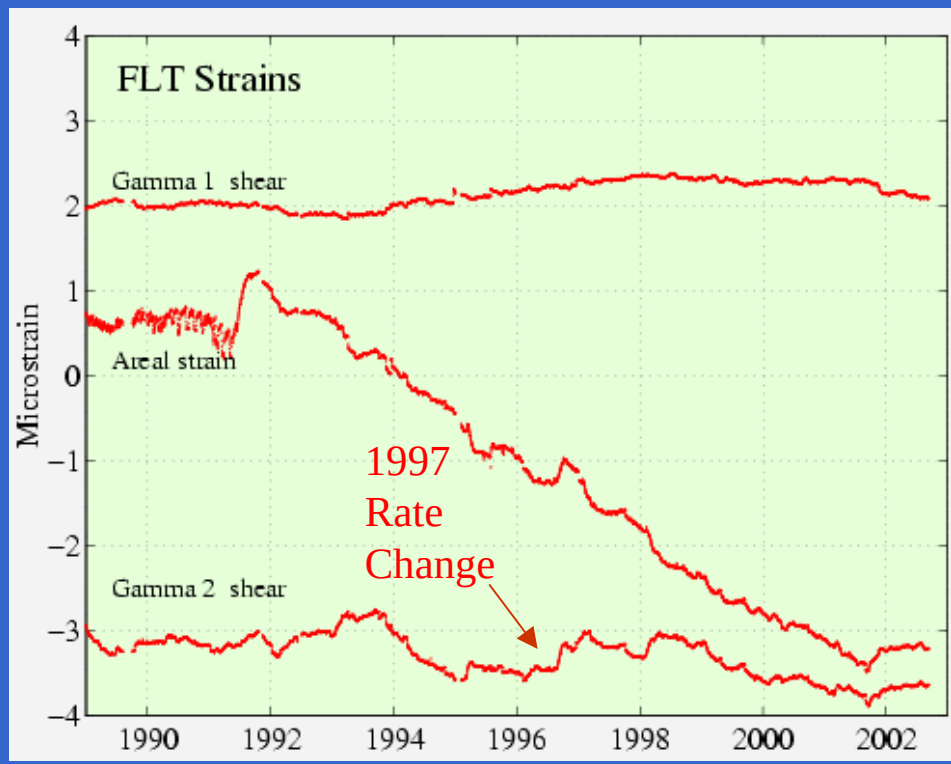


Models for 1993 Strain-rate Change



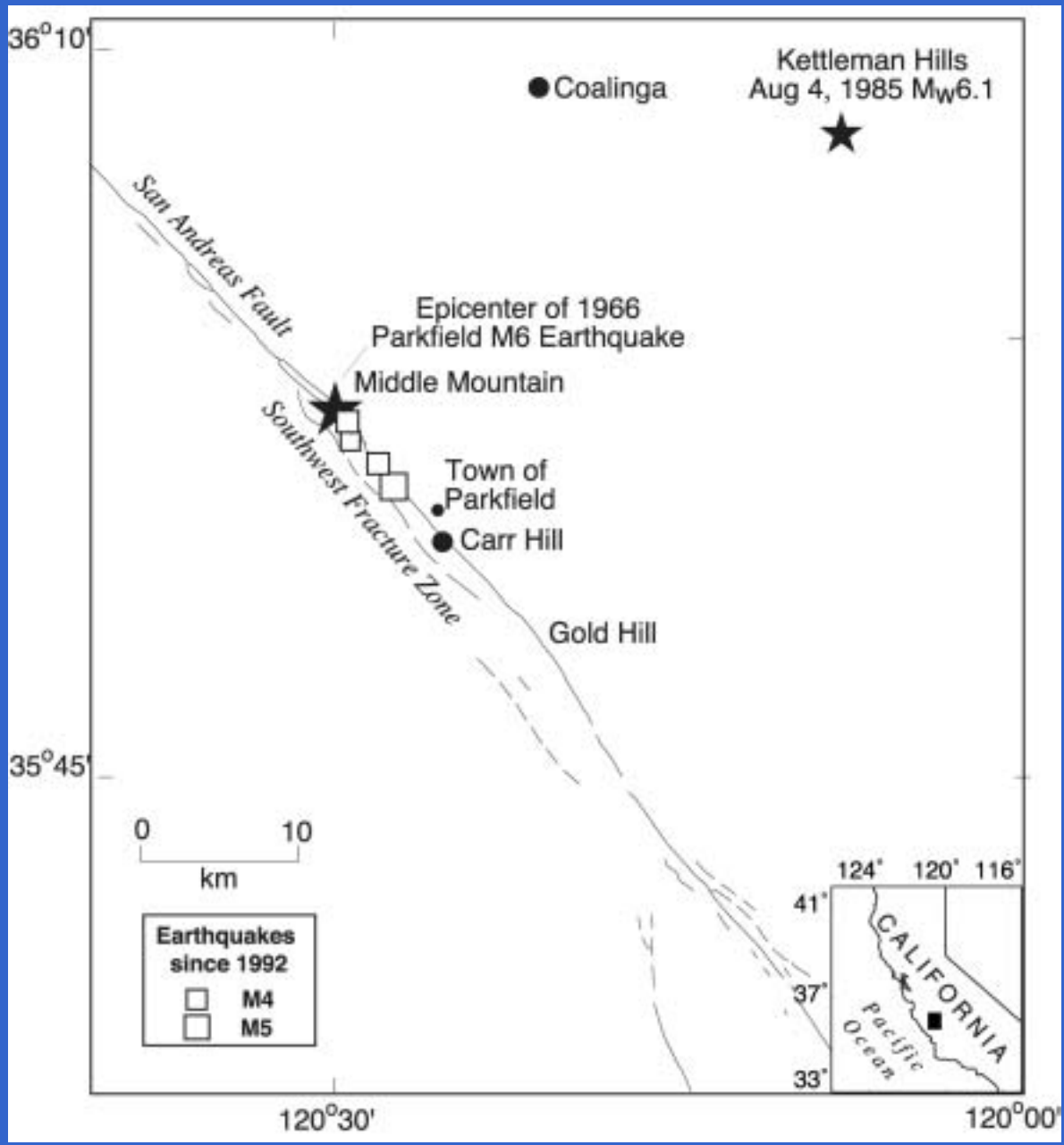
Updated Strainmeter Data Showing Subsequent Rate Changes



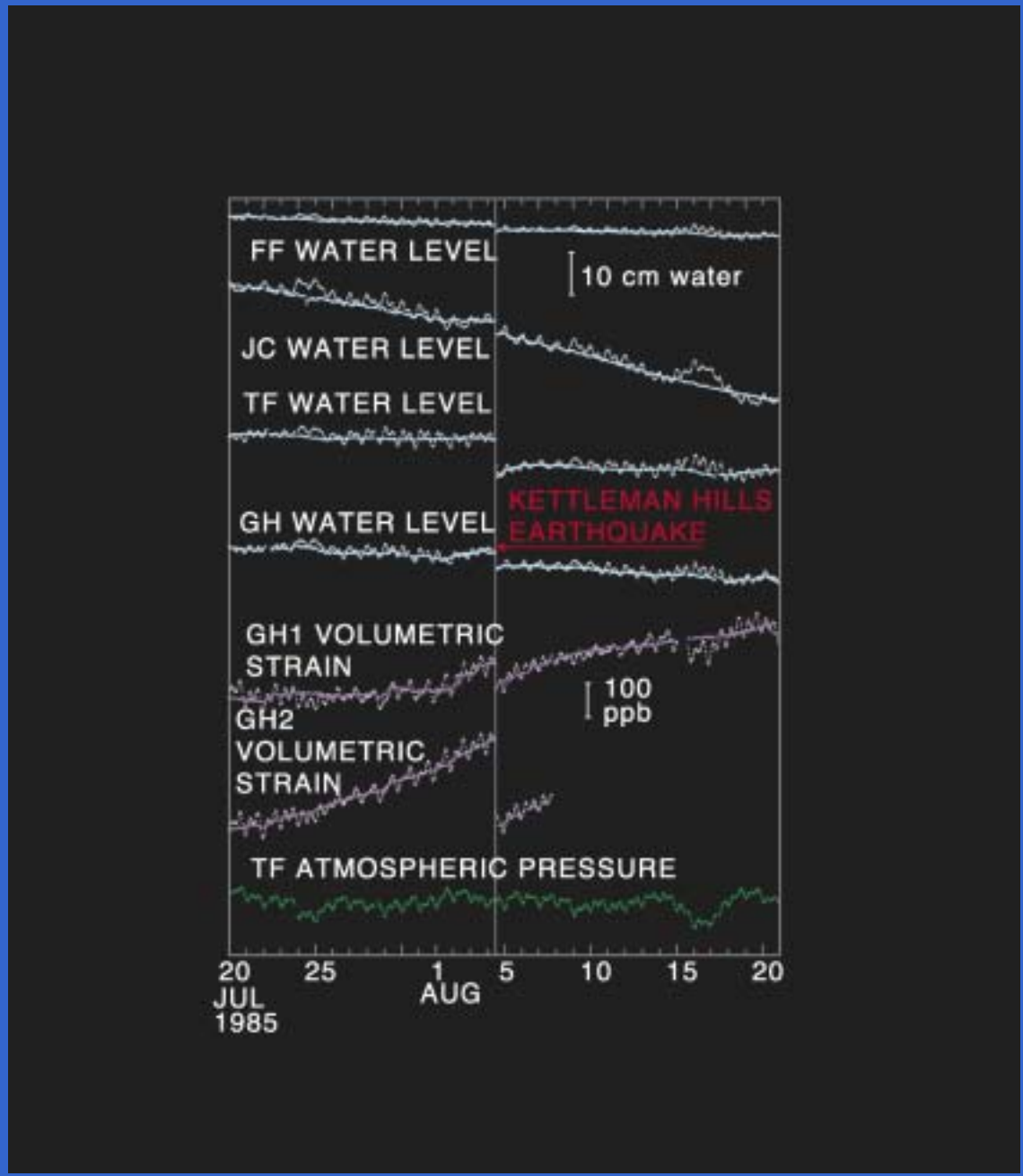


Source: R. Gwyther, M. Mee, M. Gladwin, CSIRO

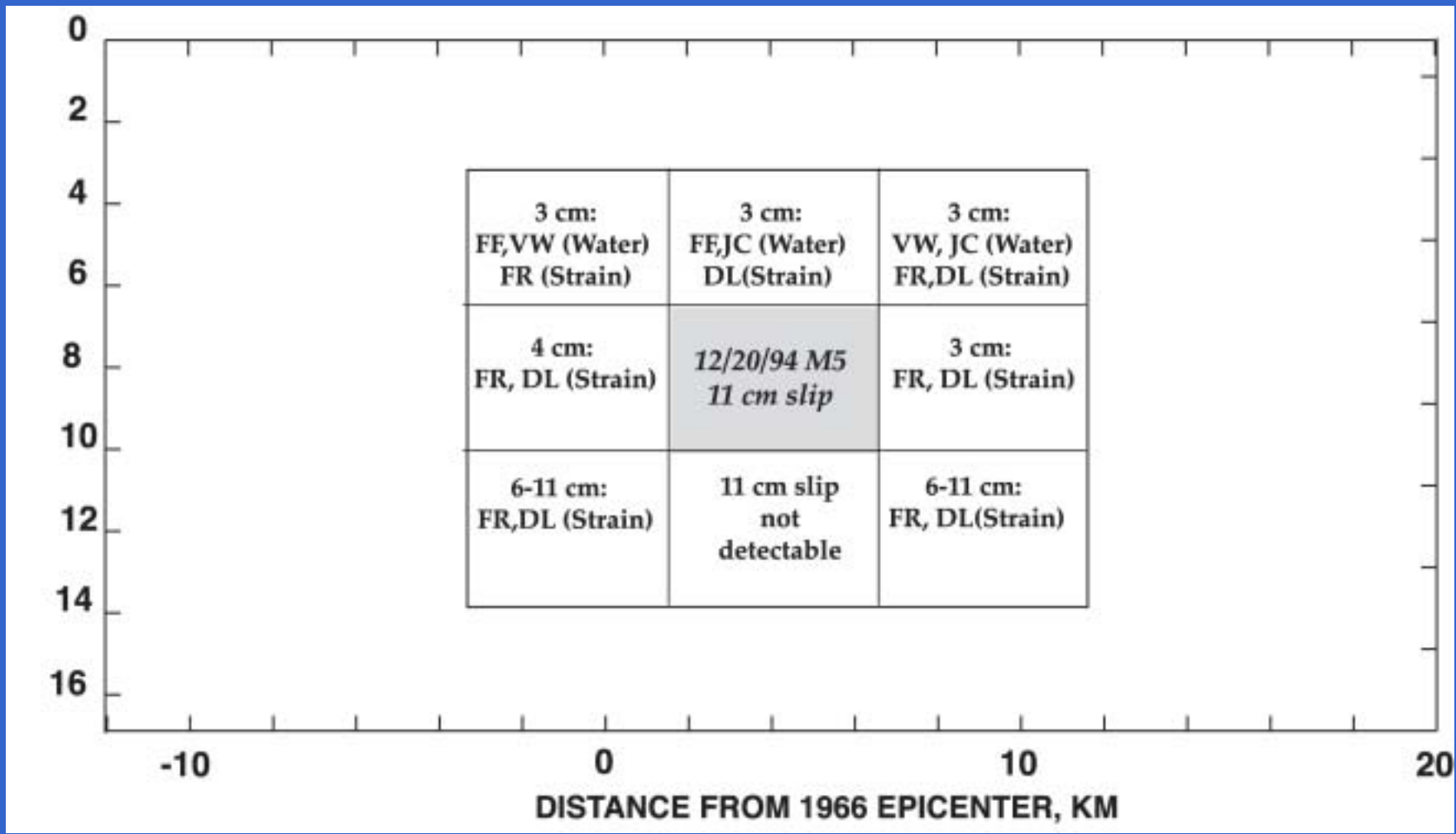
Water-level Changes before 1985 Kettleman Hills earthquake: Possible precursors?



1985 Kettleman Hills Earthquake: Pre-earthquake Water-level Changes

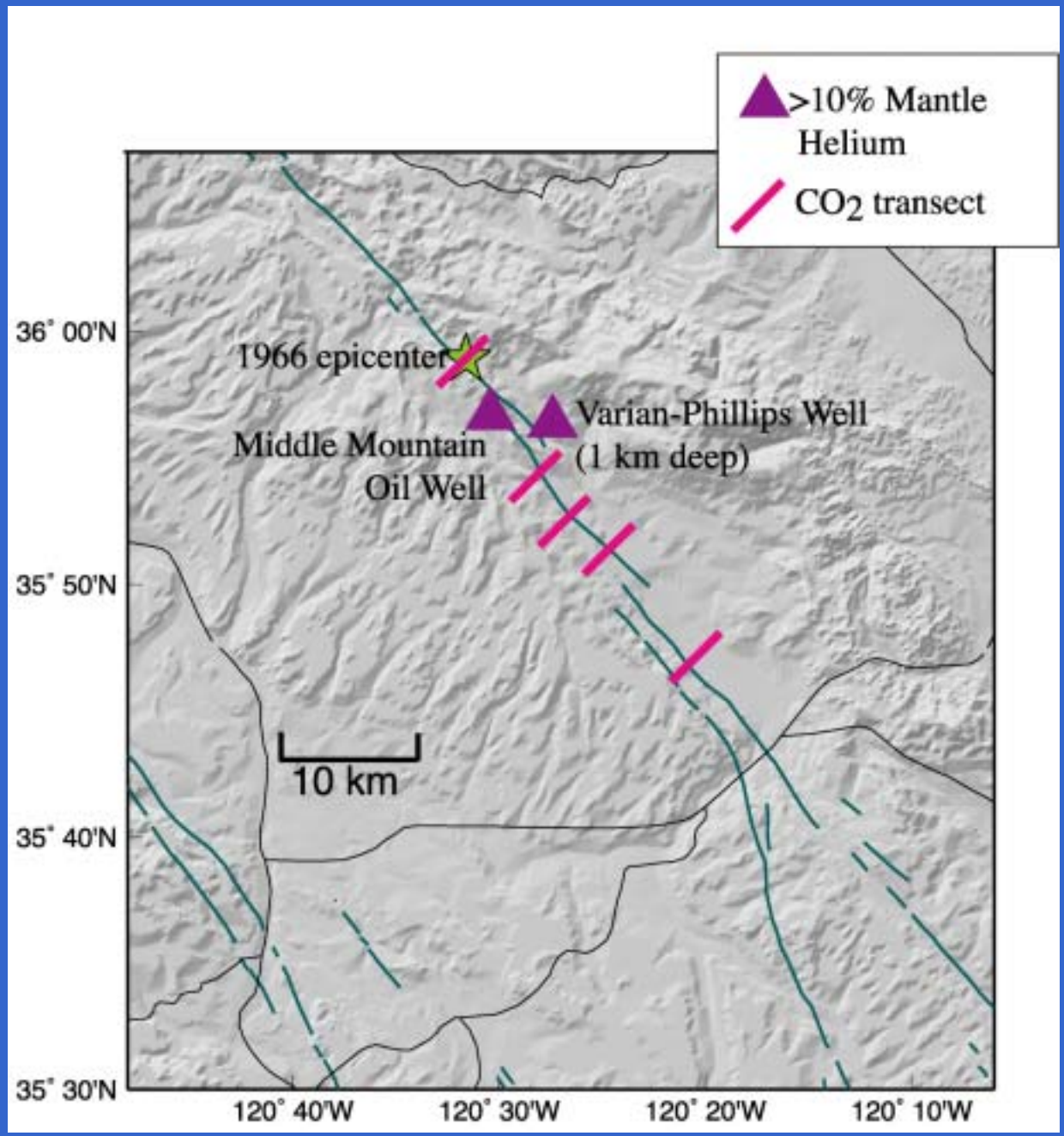


Amount of Slip That Could be Detected by Parkfield Water Wells and Borehole Strainmeters

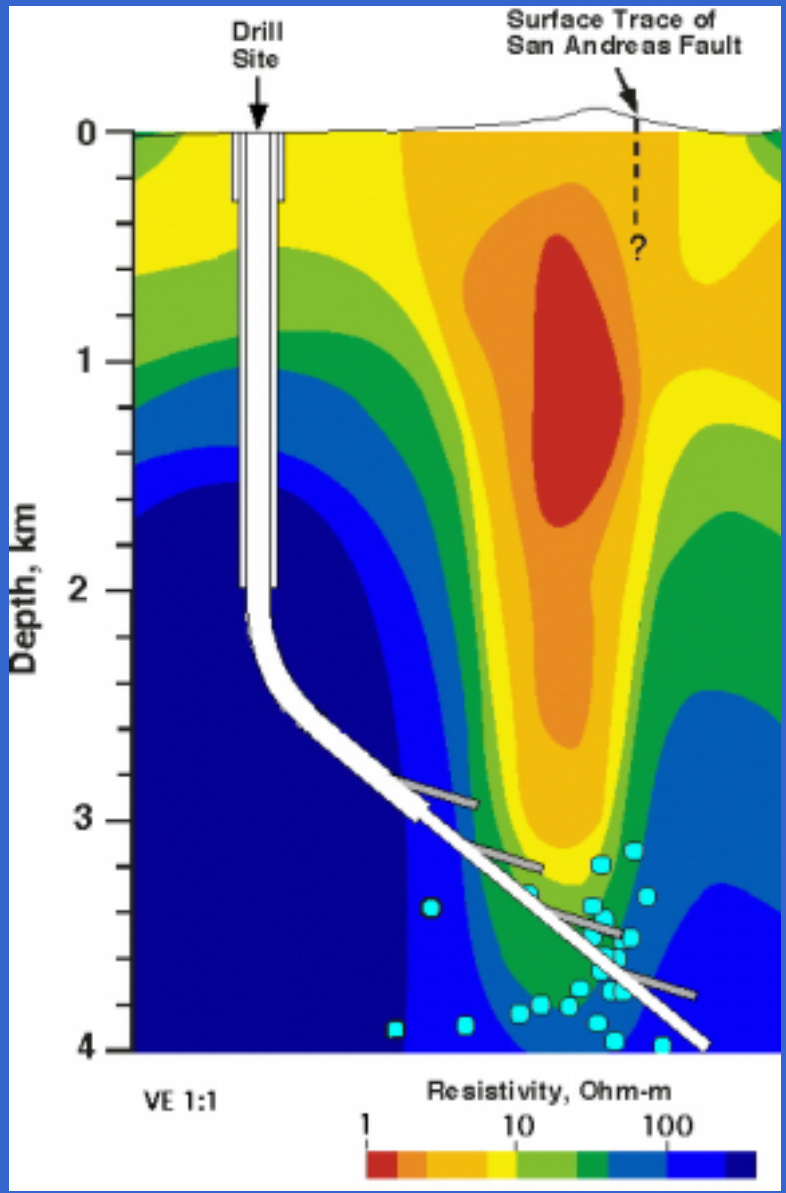


Recent Work on Gases Near the San Andreas Fault

- High 3He/4He ratios at two sites (Kennedy et al., 1997)
- High conductance for biogenic CO2 in fault zone (Lewicki and Brantley, 2000)



San Andreas Fault Observatory at Depth: Project Overview and Science Goals



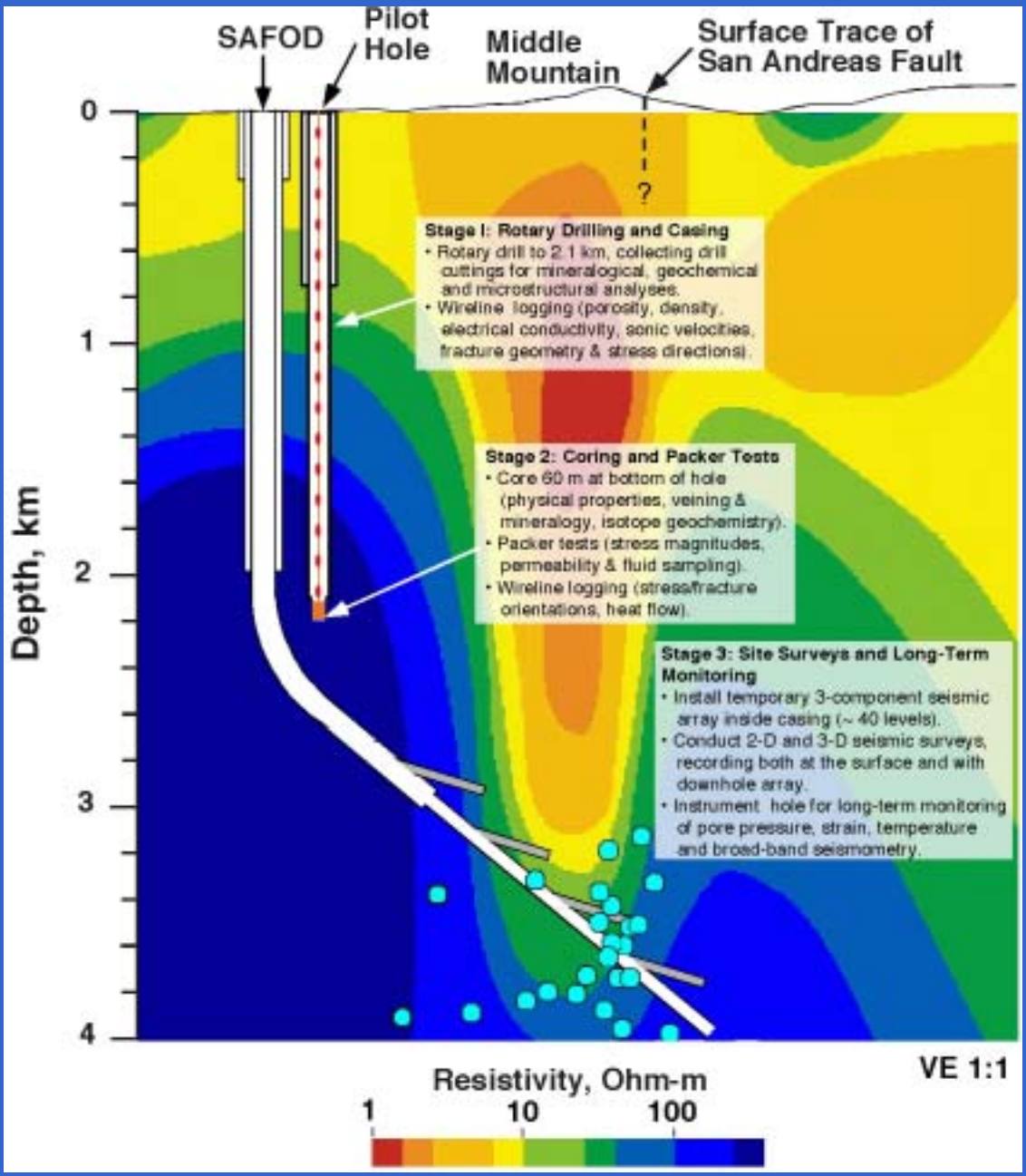
Test fundamental theories of earthquake mechanics:

- Determine structure and composition of the fault zone.
- Measure stress, permeability and pore pressure conditions in situ.
- Determine frictional behavior, physical properties and chemical processes controlling faulting through laboratory analyses of fault rocks and fluids.

Establish a long-term observatory in the fault zone:

- Characterize 3-D volume of crust containing the fault.
- Monitor strain, pore pressure and temperature during the cycle of repeating microearthquakes.
- Observe earthquake nucleation and rupture processes in the near field.
- Determine the nature and strength of the asperities that generate repeating microearthquakes.

SAFOD Pilot Hole: Objectives



- Provide technical information about drilling conditions prior to SAFOD drilling
- Measure stress, fluid pressure and heat flow adjacent to the fault zone
- Record surface seismic sources during calibration seismic experiment in Oct. 2002
- Facilitate precise location of target earthquakes for SAFOD
- Test seismic, pore pressure, and strain monitoring instrumentation for SAFOD
- “Calibrate” physical properties inferred from surface geophysical surveys with downhole measurements.
- Reveal nature and extent of fluid/rock interaction adjacent to fault zone

Pilot Hole Summary

- Depth 2170 m
- 5.5 m uncased at bottom
- Only 9 cm core from bottom
- Bottom hole temperature 90C
- Water level 580 m below land surface, rising slowly
- No fluid measurements yet