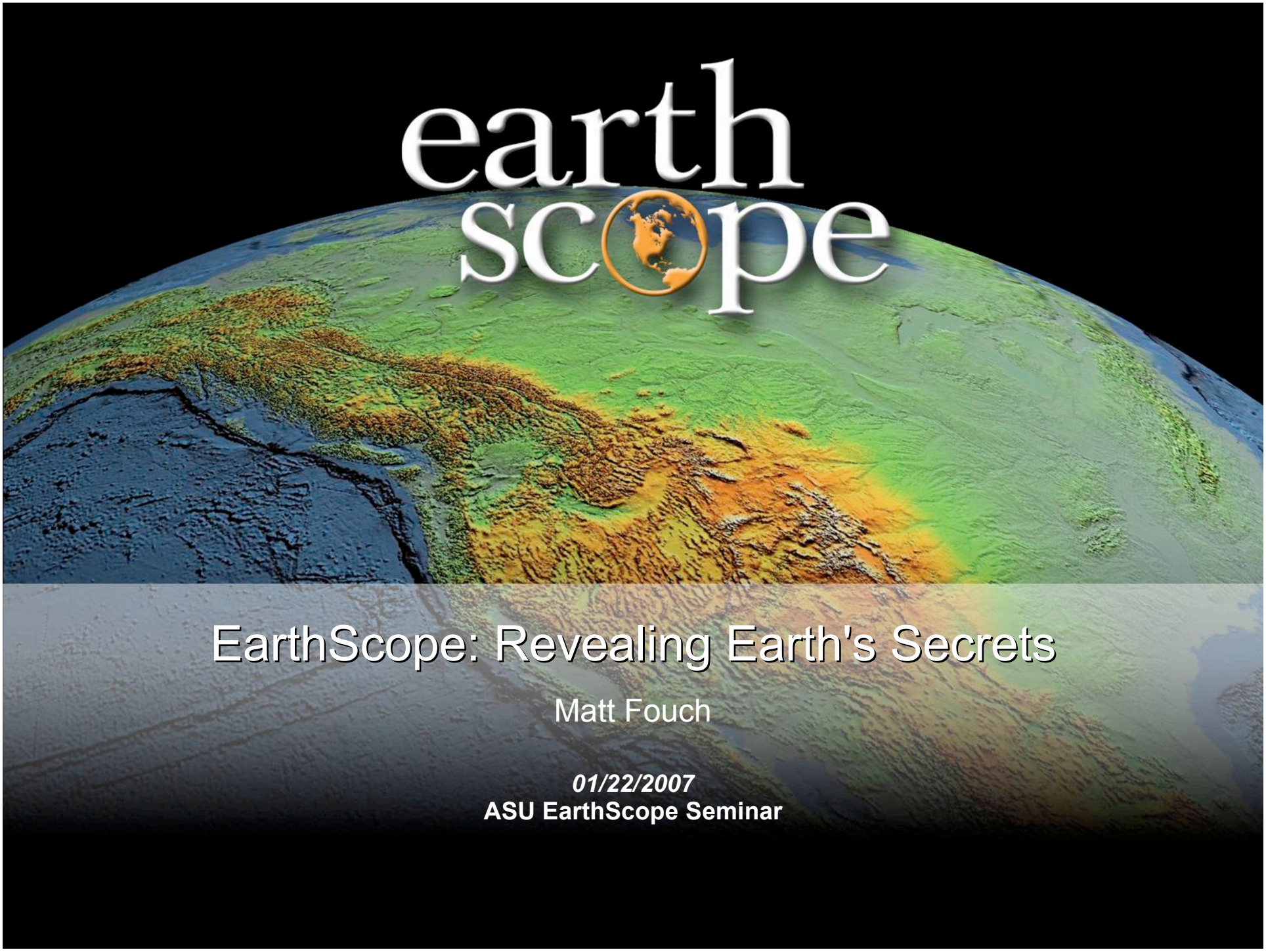


EarthScope: Revealing Earth's Secrets

Matt Fouch

01/22/2007
ASU EarthScope Seminar

Acknowledgements

EarthScope is funded by the National Science Foundation and conducted in partnership with the US Geological Survey.

EarthScope is being constructed, operated, and maintained as a collaborative effort with UNAVCO, Inc., IRIS, and Stanford University, with contributions from NASA and several other national and international organizations.

EarthScope's Landscape

- Largest undertaking in NSF-EAR
- 1st MREFC project for Earth Science
- Only NSF-requested MREFC funded in 4 yrs.
- Full partnership w/USGS
- Distributed, multi-use, dynamic facility

Test-case for the management and execution of NSF-funded large science projects

Management Objectives

- Enfranchising broad Geoscience community
- Promoting interdisciplinary research
- Integrating education with research
- EarthScope as a model of a well-managed MREFC
- Maintaining strong support for federal investment in Geoscience among policy-makers and public.

★ Creating a sustainable resource for the Geoscience community

Scientific Mission

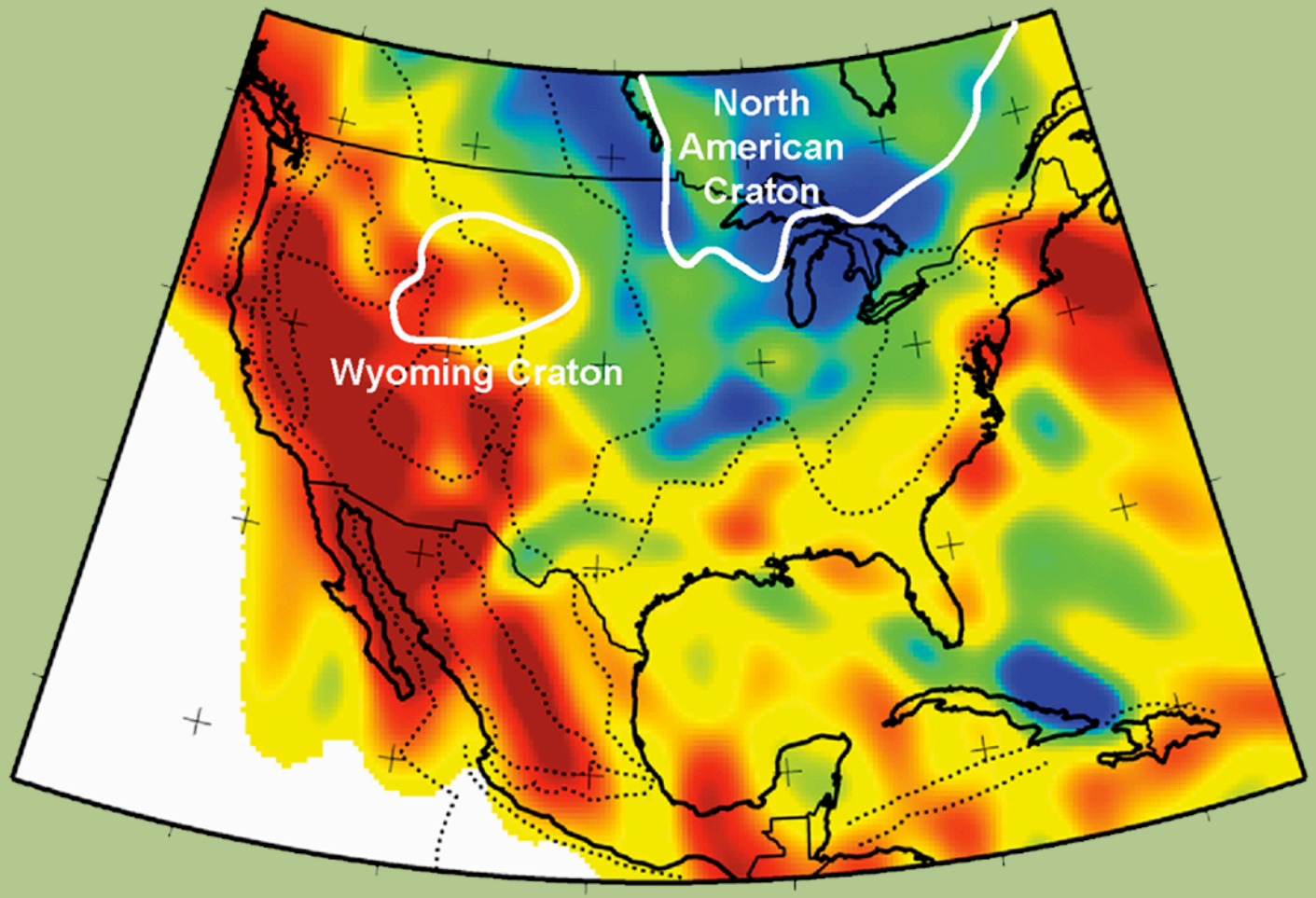
Explore the structure and evolution of the North American Continent, and the physical properties that control earthquakes and volcanoes.

Exploring the Structure, Evolution and Dynamics of the North American Continent

- **All scales**
  - Fault (within earthquake zone)
  - Plate boundary
  - Continent
- **Interdisciplinary**
  - Core samples, fluids
  - Seismic
  - GPS
  - Strainmeters
  - MT, etc.
- **Broad community participation**
  - Built upon existing consortia (IRIS and UNAVCO)
  - 3,000 geographical locations
  - Open data
  - Integrated E&O Program
  - Seamless single-point access, integrative tools

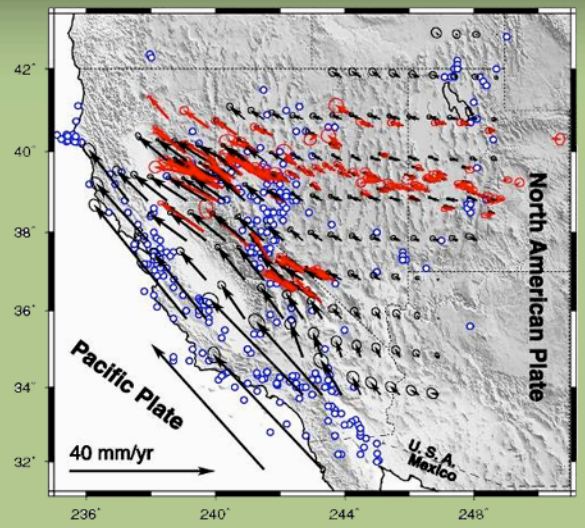
What is a Continent?

Archean crust relative to S-wave tomography

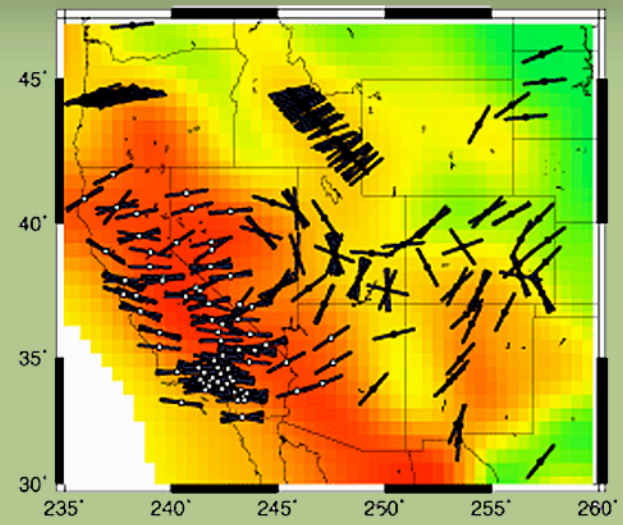


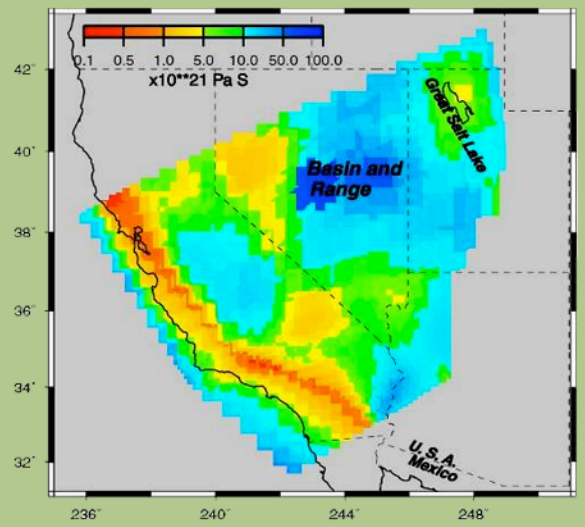
Goes and van der Lee (2001), van der Lee et al. (2002)

Putting it together for new scientific discoveries



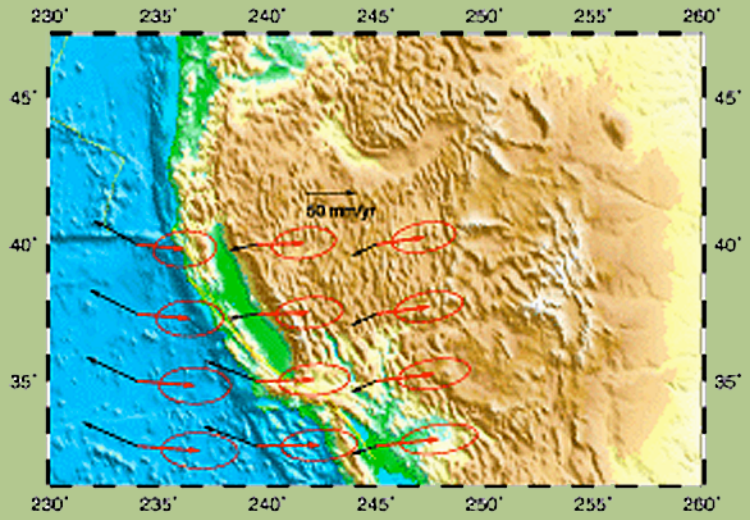
Left: Inverting for <u>lithospheric viscosity</u> through a force-balance model of surface deformation





Flesch et al., 2000

Right: Inverting for <u>mantle flow velocity</u> using mantle deformation from seismic anisotropy.



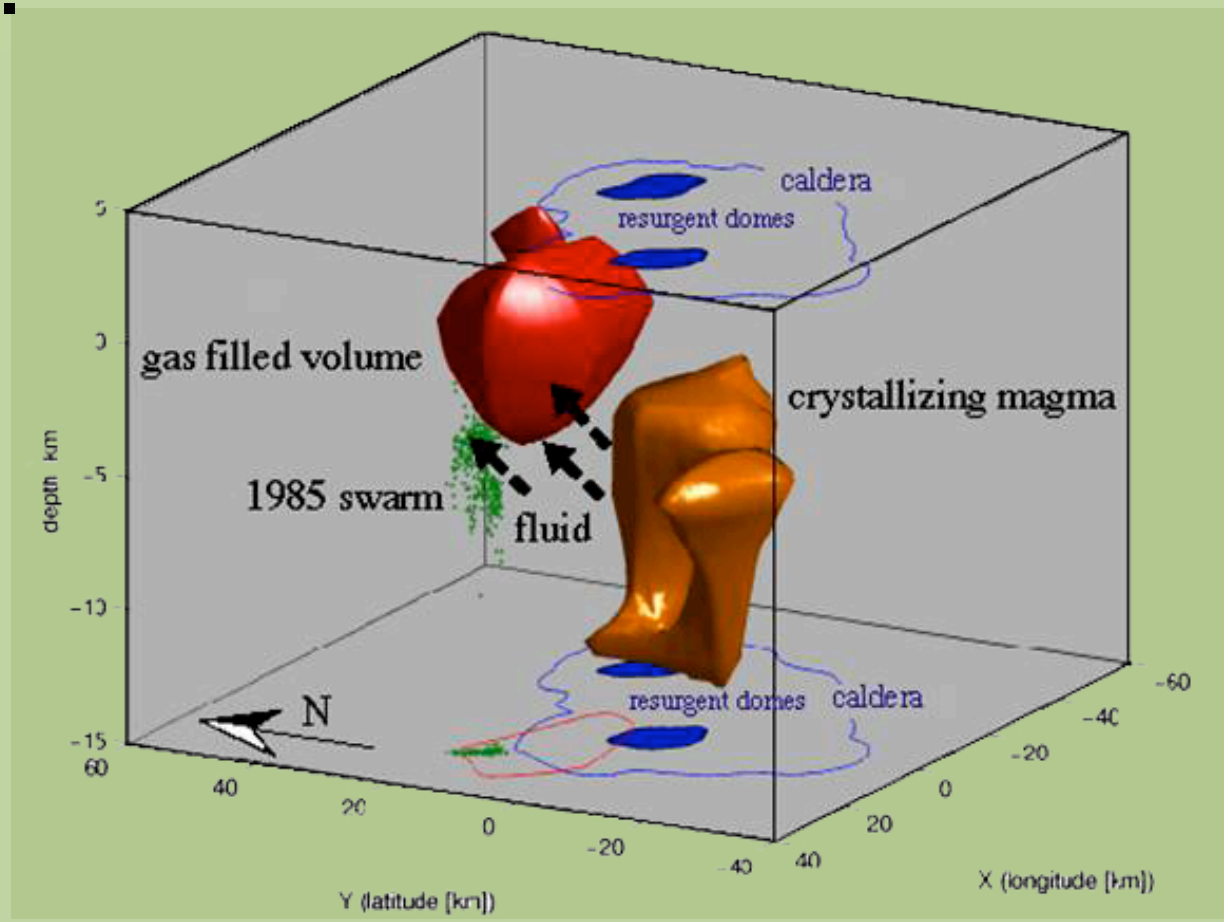
Silver and Holt, 2001

Yellowstone

Seismic tomographic image of Yellowstone magma system.

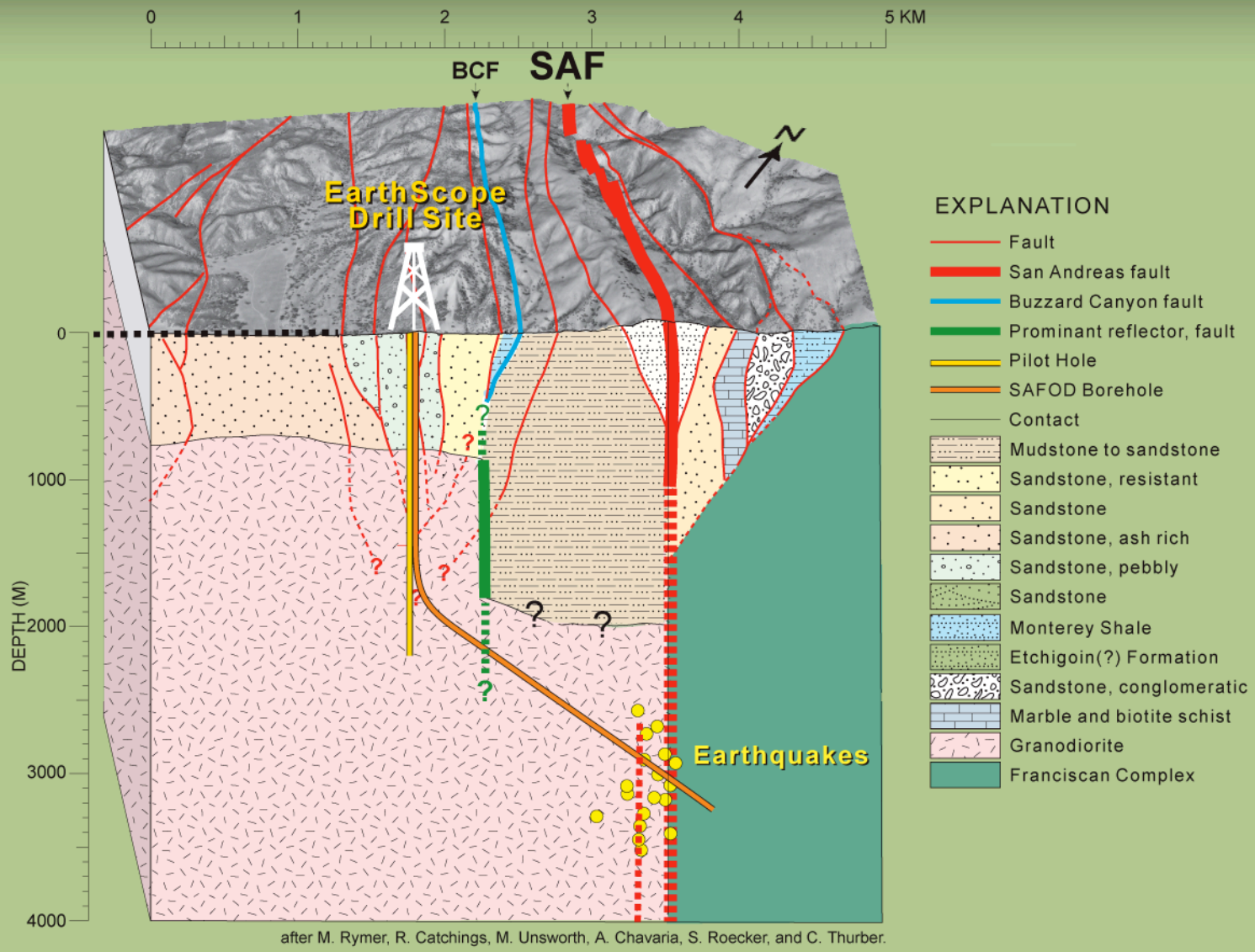
<u>Low</u> seismic-velocity bodies outline magma and hydrothermal bodies that drive Yellowstone's volcanic features.

Image from local earthquake tomography at the University of Utah.



Husen and Smith (2004)

Probing the San Andreas Fault



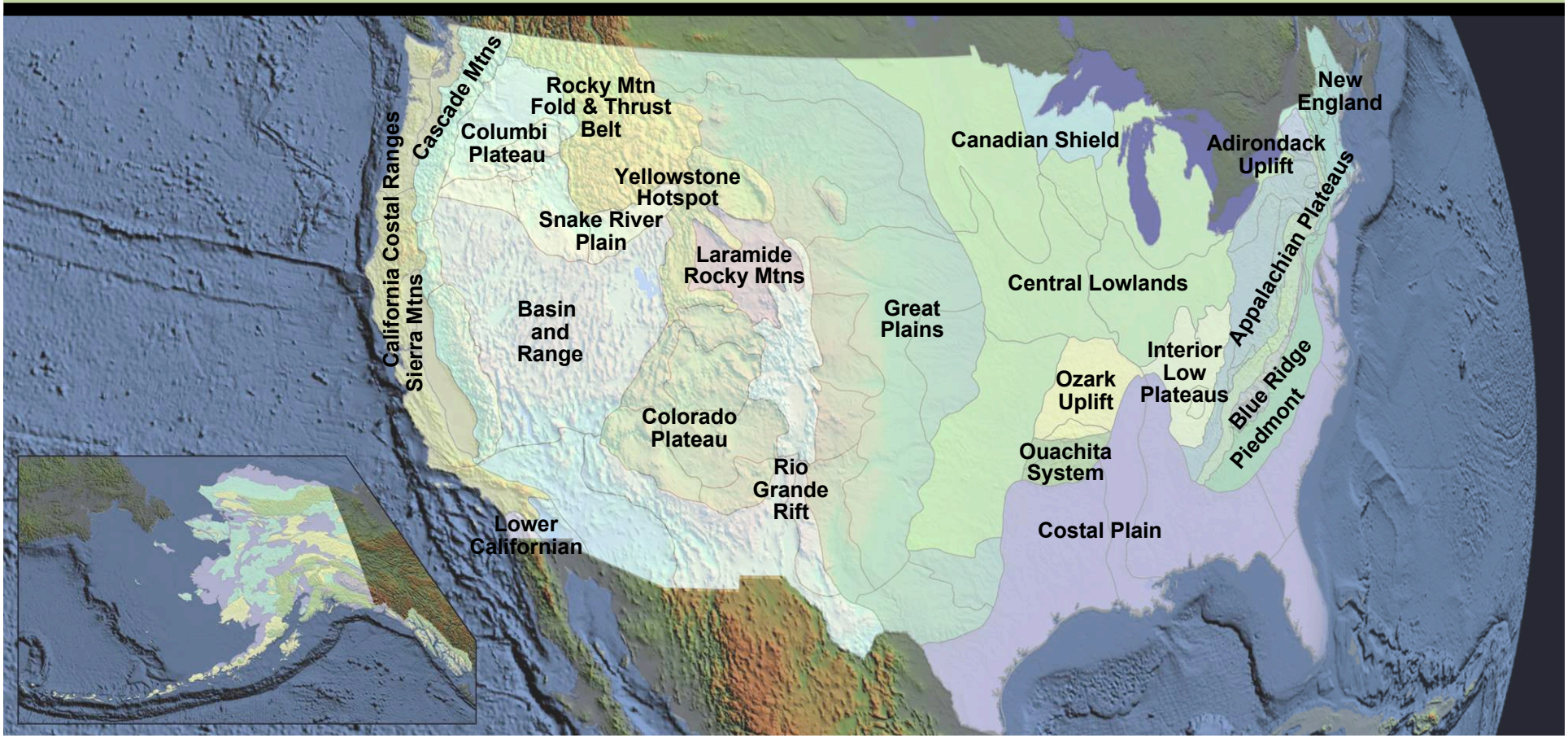
after M. Rymer, R. Catchings, M. Unsworth, A. Chavaria, S. Roecker, and C. Thurber.

Our Laboratory

Natural Geologic Laboratory

- Plate Boundary Processes
- Diversity of tectonic elements
- 3.5 billion year record of plate evolution

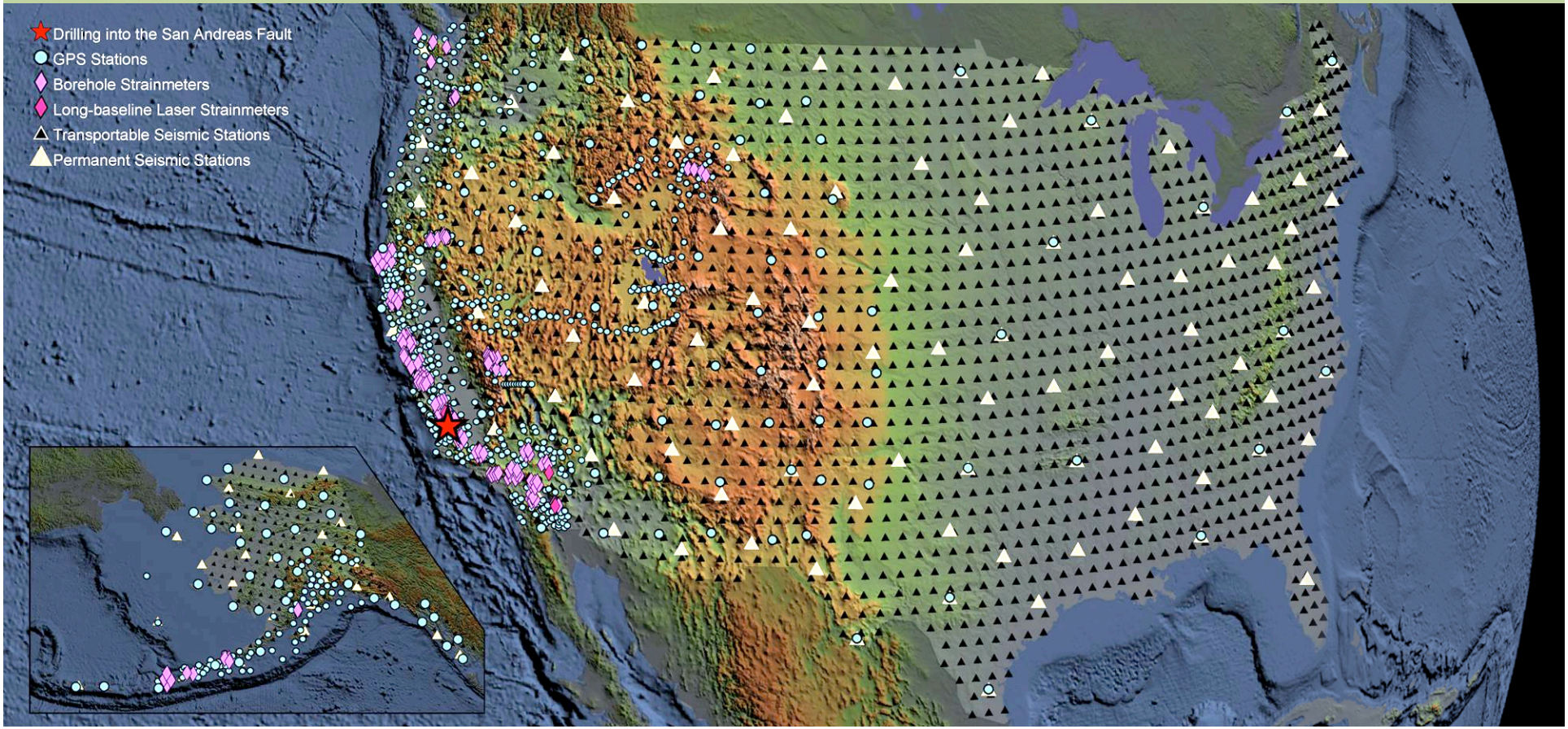
Allows us to study the transition from plate-tectonic interactions to small-scale system level processes such as individual faults and volcanoes.



How do we achieve this?

Instrumentation
Integrated Research
Education and Outreach
Cyberinfrastructure

all contributing to an integrated EarthScope effort



EarthScope Instrumentation

- 3.2 km borehole into the San Andreas Fault
- 875 permanent GPS stations
- 175 borehole strainmeters
- 5 laser strainmeters
- 100 campaign GPS stations
- 400 transportable seismic stations occupying 2000 sites
- 39 Permanent seismic stations
- 2400 campaign seismic stations
- 30 magnetotelluric systems