Emerging Hot Topics for Eastern North America in EarthScope Seismology Research

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Scientific Targets from the EarthScope Science Plan for 2010-2020

• Imaging the Crust and Lithosphere
• Active Deformation of the North American Continent
• Continental Evolution through Geologic Time
• Deep Earth Structure and Dynamics
  – Subducted Slabs and Mantle Drips
  – Lithosphere-Asthenosphere Boundary
  – 410 and 660
• Earthquakes, Faults, and the Rheology of the Lithosphere
• Magmas and Volatiles in the Crust and Mantle
• Topography and Tectonics: Elucidating Time-Space Patterns of Lithospheric Deformation
Focus Questions:

- What are the effects of Multiple Episodes of Collision and Rifting on the Crust and Lithosphere?

- What active processes are occurring in the mantle that are related to continental evolution and active deformation?
A Pictorial History of Sparse Broadband Data

- MOMA (Missouri to Massachusetts Array)
- FLED (Florida to Edmonton)
- SESAME
- Regional Arrays: LDEO, ABBA, SC, NC, Penn State, TEENA, etc.
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What are the effects of Multiple Episodes of Collision and Rifting on the Crust and Lithosphere?

Whitmeyer and Karlstrom, 2007;

After Withjack et al., 1998
Imaging the Crust and Lithosphere

We can address first order questions related to tectonic inheritance by investigating crustal and lithospheric thickness.

- Are sutures visible in the mantle?
- Can we resolve shear zones in the mantle?
- How was the lithosphere altered by magmatism?
- Results so far from various groups suggest that crustal thickness (and possibly lithospheric thickness) does correlate with Precambrian structures and domain boundaries
We see evidence for thinned crust in the piedmont and modeled 7.x layer.
Lithospheric Thickness and Structure

Abt et al. 2010

Complex Lithospheric Structure

Yuan and Romanowicz, Nature, 2010

Yuan et al., GJI, 2010
What active processes are occurring in the mantle that are related to continental evolution and active deformation?

Recent unsteadiness in the erosion record
Variability in Mantle Velocity Structure

van der Lee and Frederiksen (2005)

Nettles and Dziewonski (2008)
Vertical mantle flow beneath the Southeast?

Whitmeyer and Karlstrom, 2007;

Yuan and Romanowicz, Nature, 2010

Forte et al., 2007

van der Lee et al., 2008

King, 2007
How do internal boundaries respond to dynamics?

Simmons et al., GJI

Long, Benoit, Chapman, & King, 2010

Unpublished Images from A. Forte and R. Moucha
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