Emerging Hot Topics for Eastern North America in EarthScope Seismology Research

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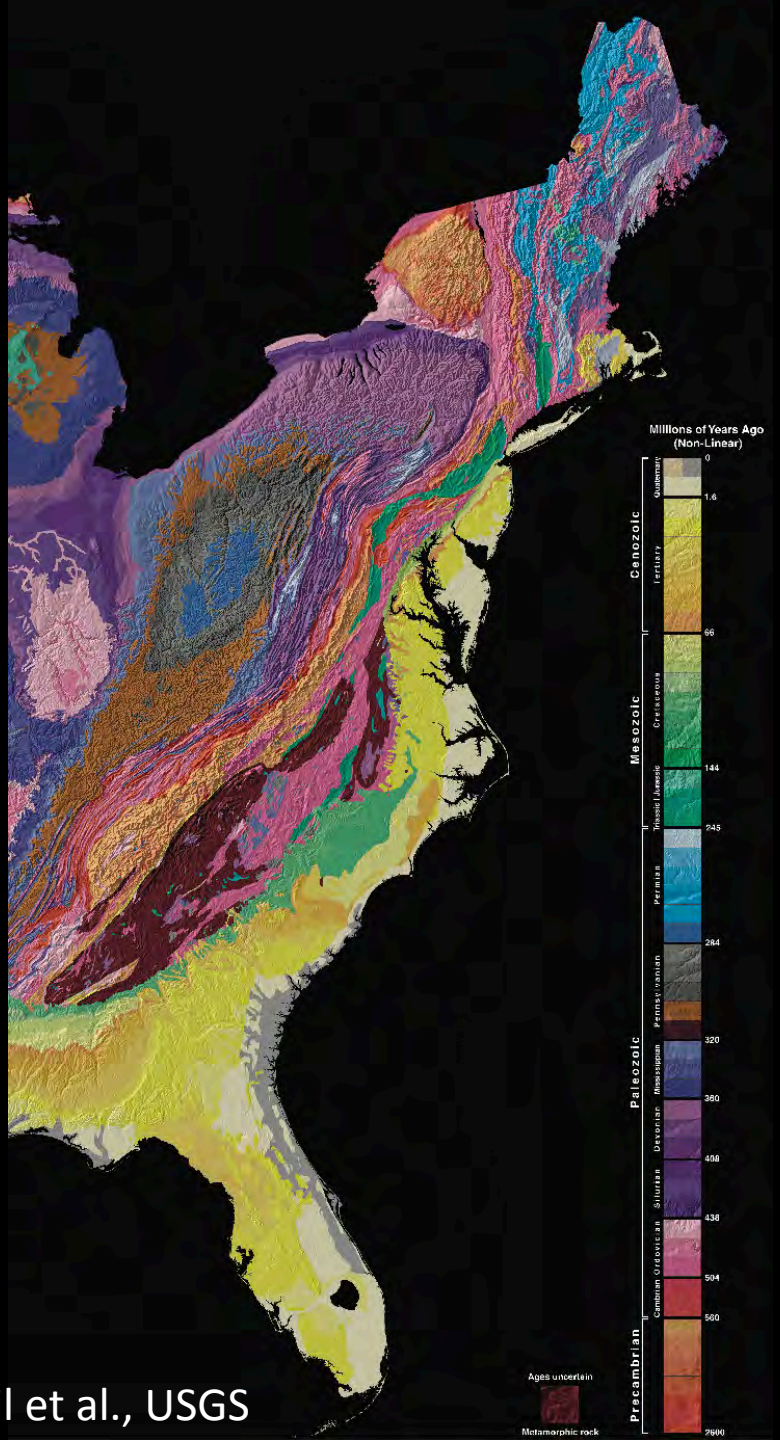
Scientific Targets from the EarthScope Science Plan for 2010-2020

- 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

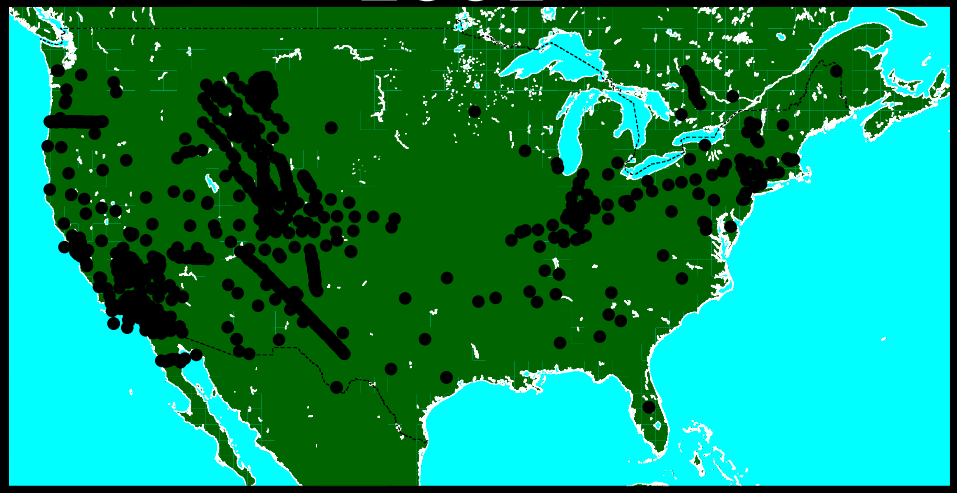


Vigil et al., USGS

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?

2001



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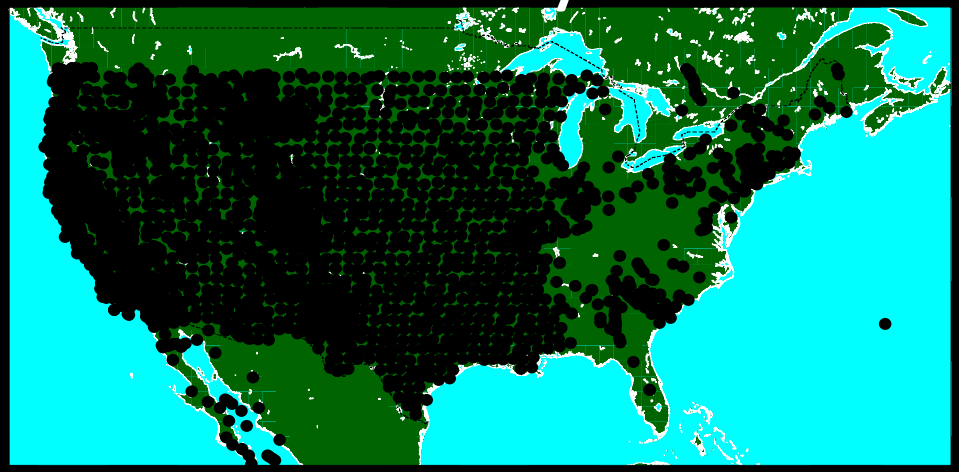
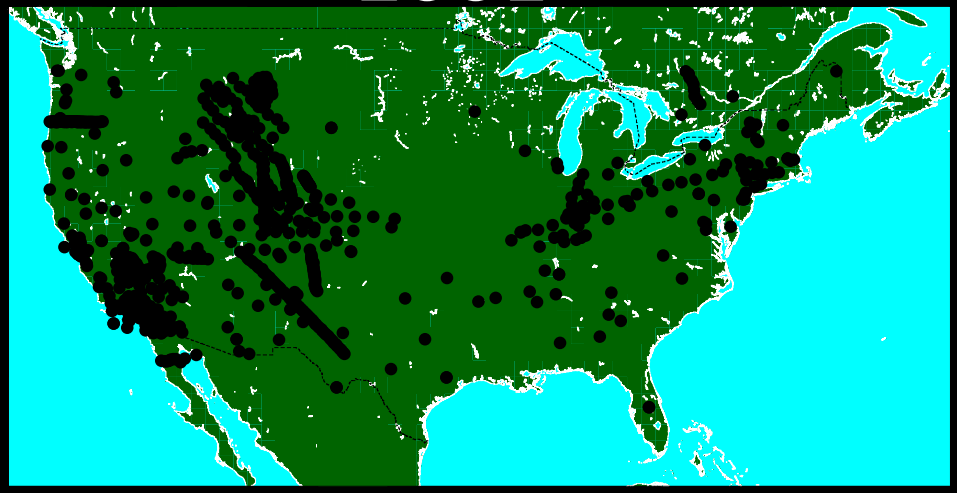


A Pictorial History of Sparse Broadband Data

- MOMA (Missouri to Massachusetts Array)
- FLED (Florida to Edmonton)
- SESAME
- Regional Arrays
  LDEO, ABBA, SC, NC, Penn State, TEENA, etc

2001



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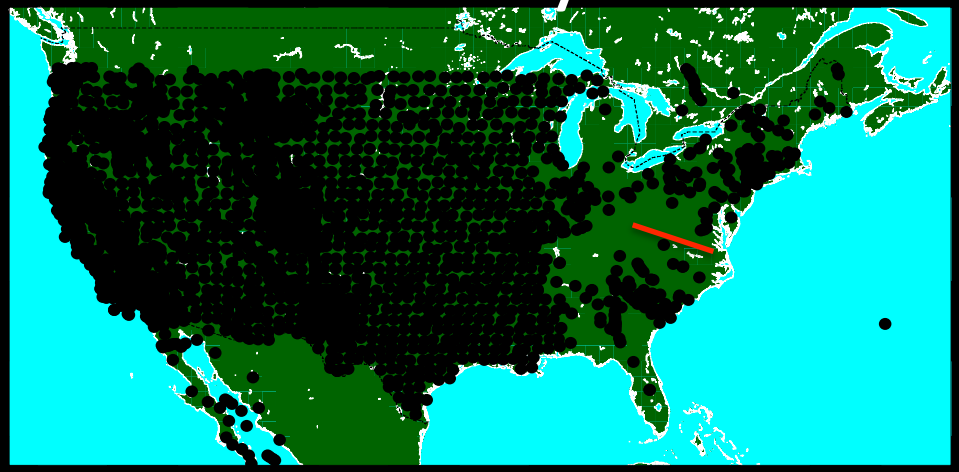

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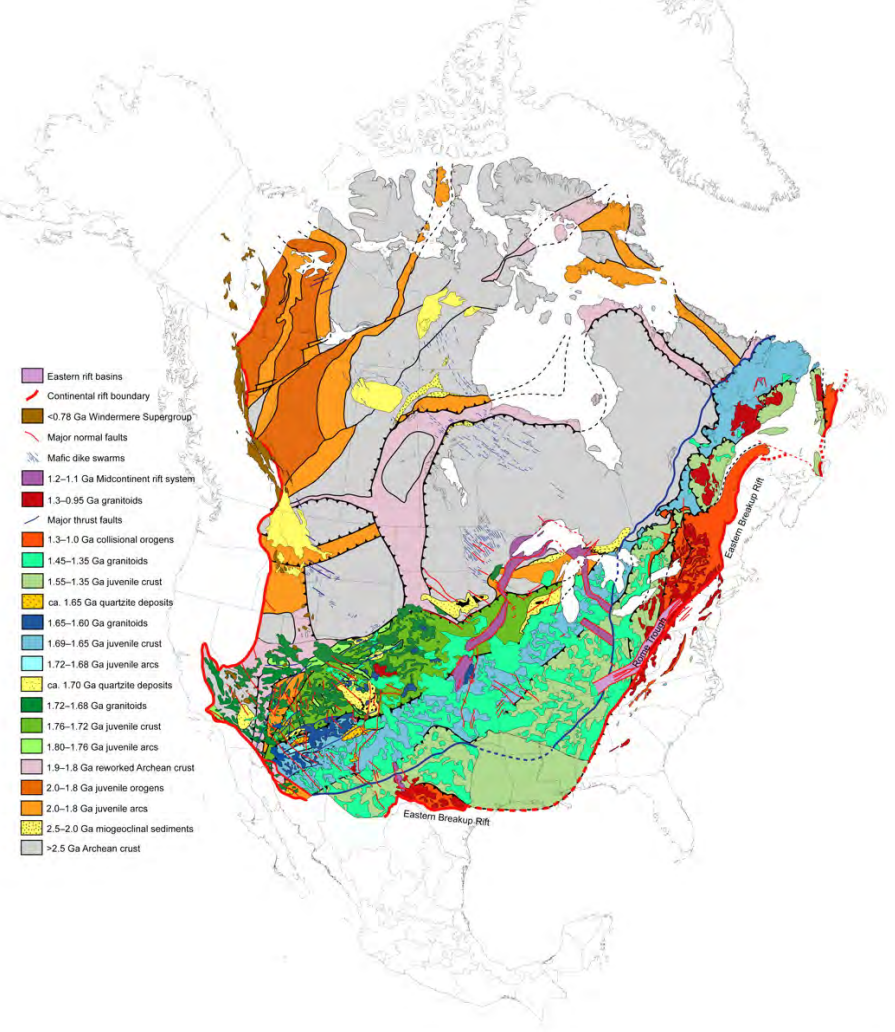
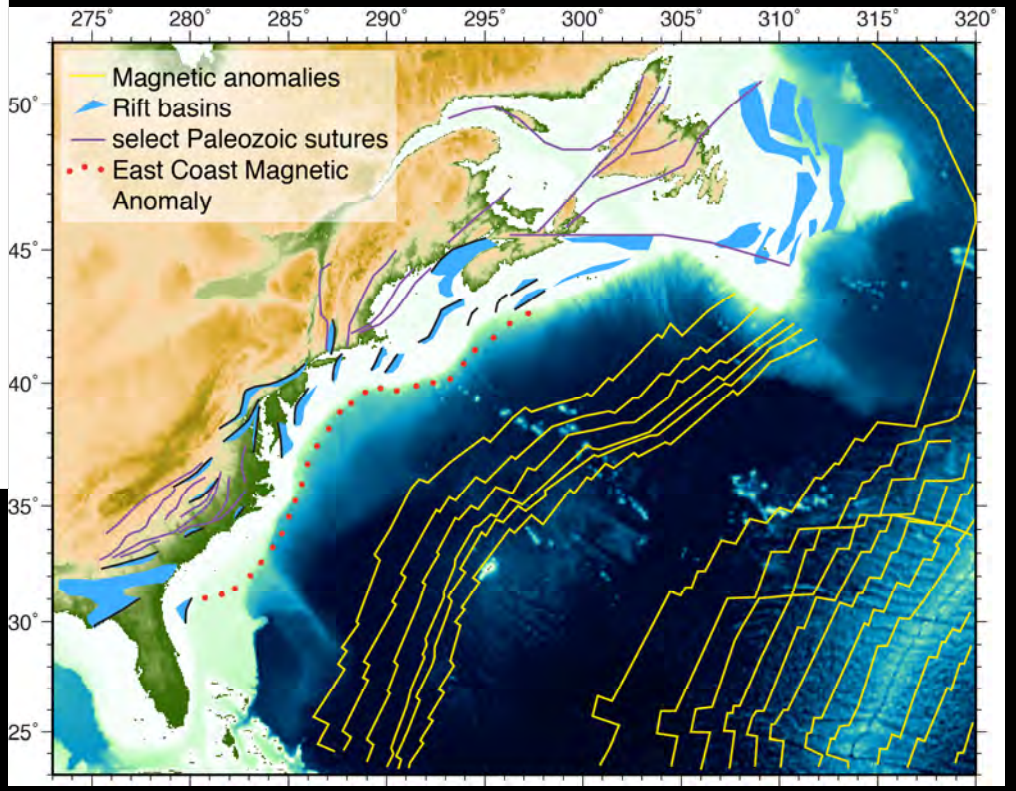
What are the effects of Multiple Episodes of Collision and Rifting on the Crust and Lithosphere?



Whitmeyer and Karlstrom, 2007;

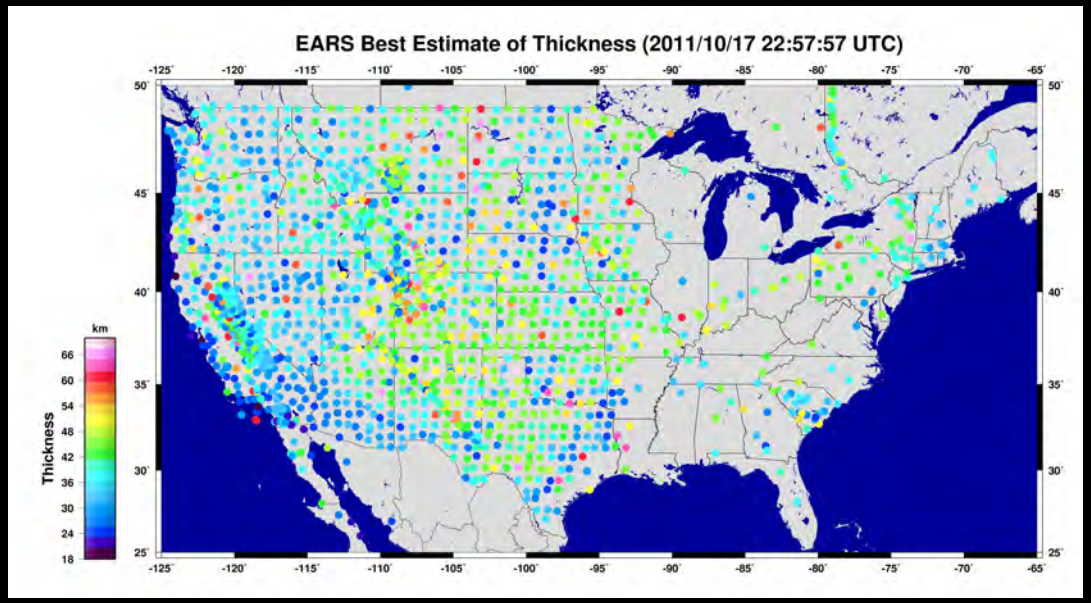


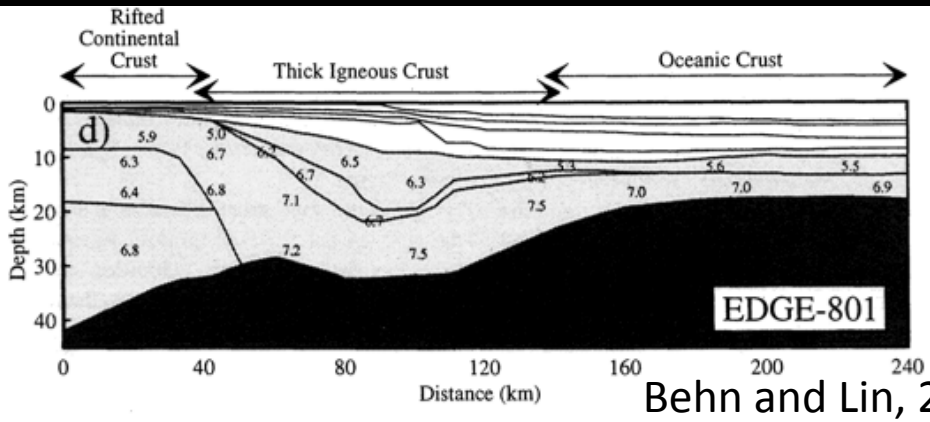
After Withjack et al., 1998

Imaging the Crust and Lithosphere

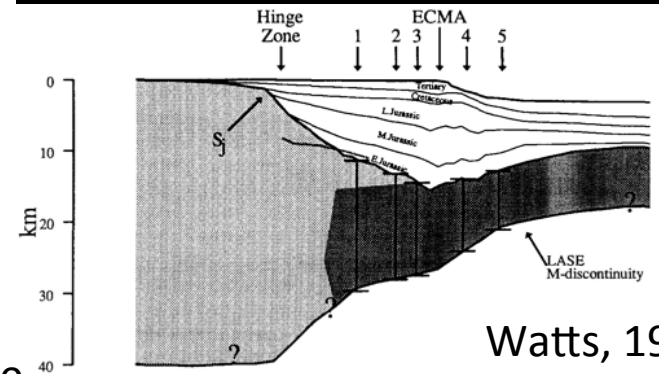
We can address first order questions related to tectonic inheritance by Investigating crustal and lithospheric thickness.

- 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



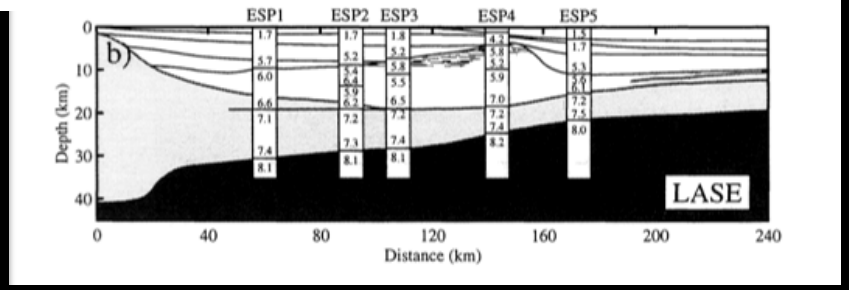


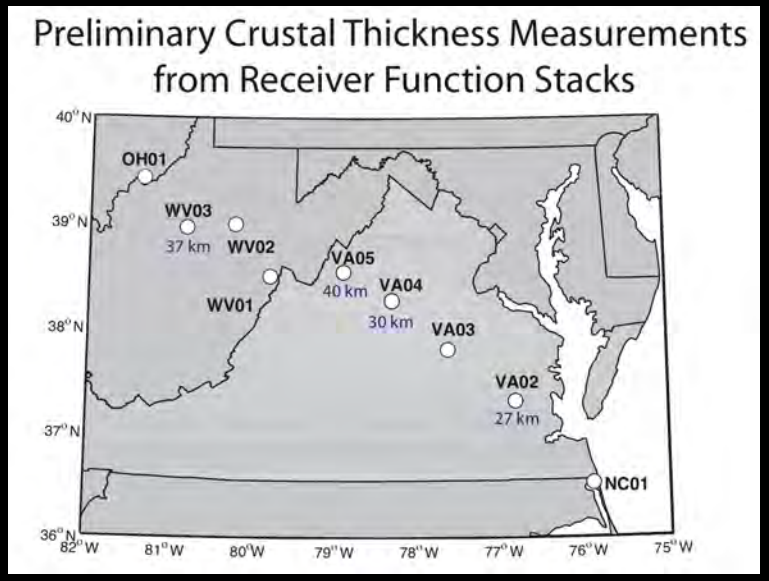
Behn and Lin, 2000

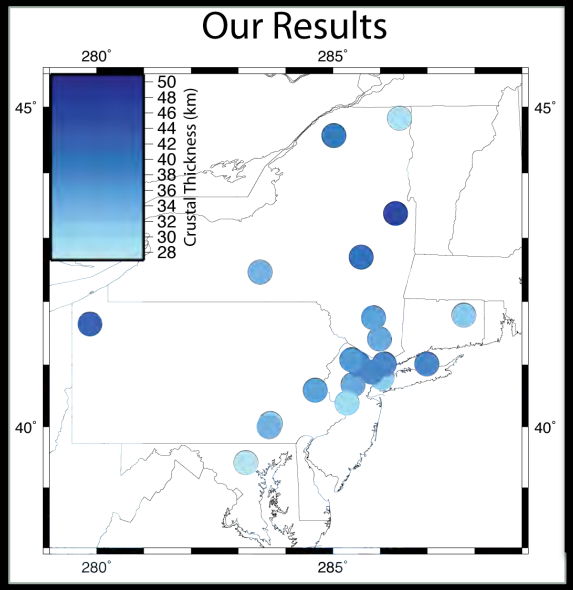


Watts, 1998

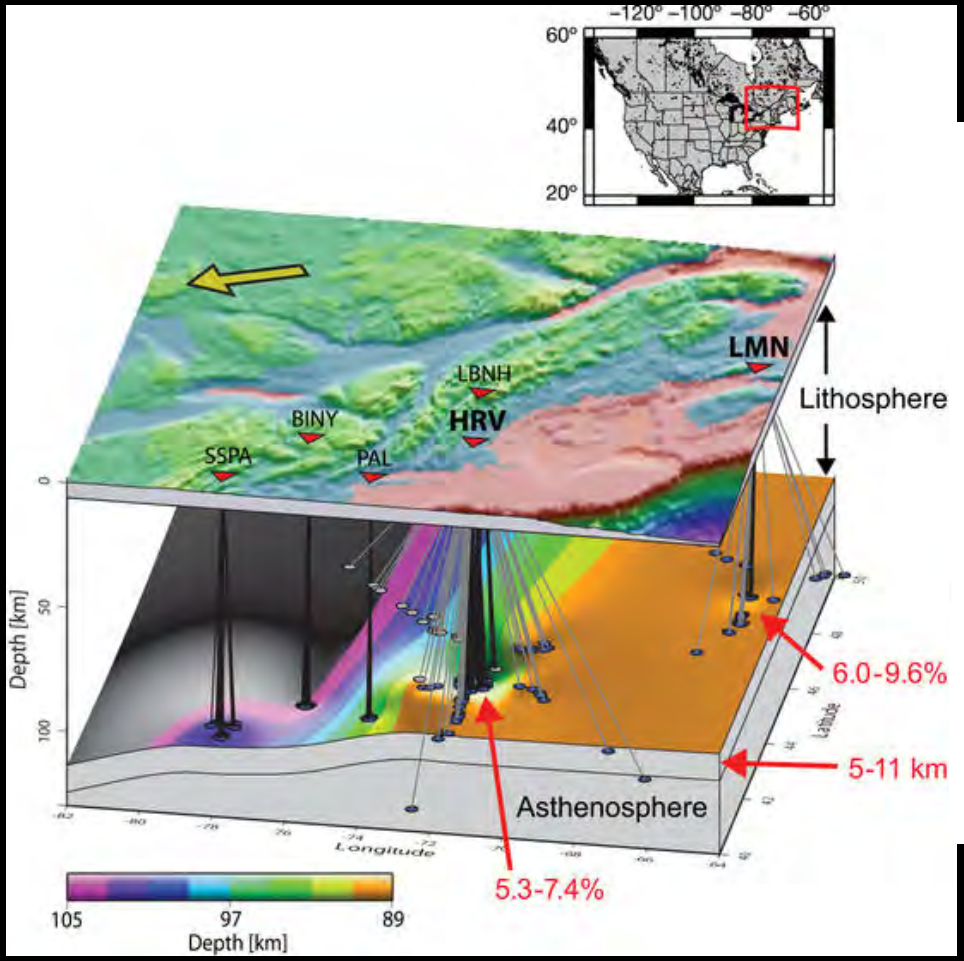
We see evidence for thinned crust in the piedmont and modeled 7.x layer



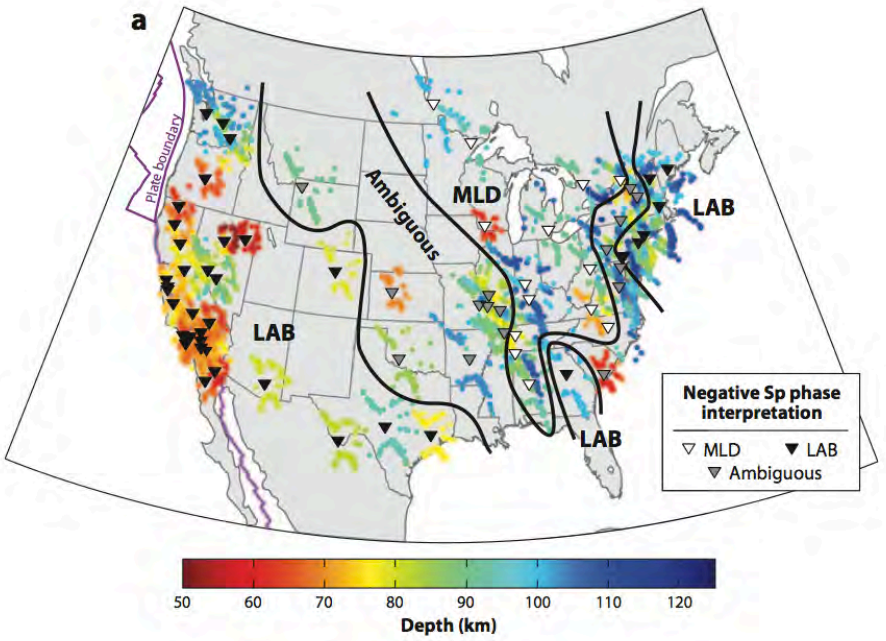




Lithospheric Thickness and Structure

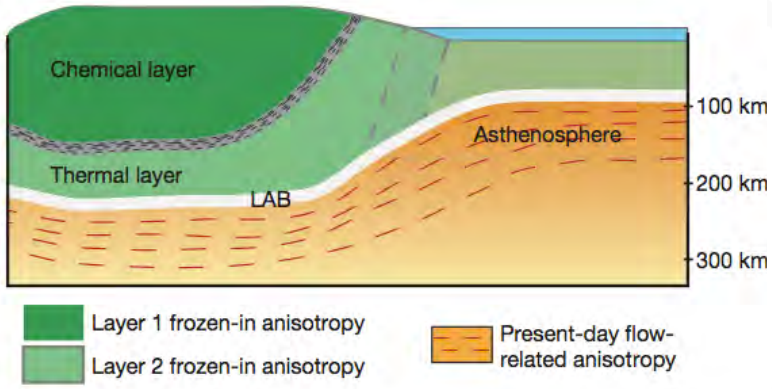


C.A. Rychert, S. Rondenay, and K.M. Fischer, 2007

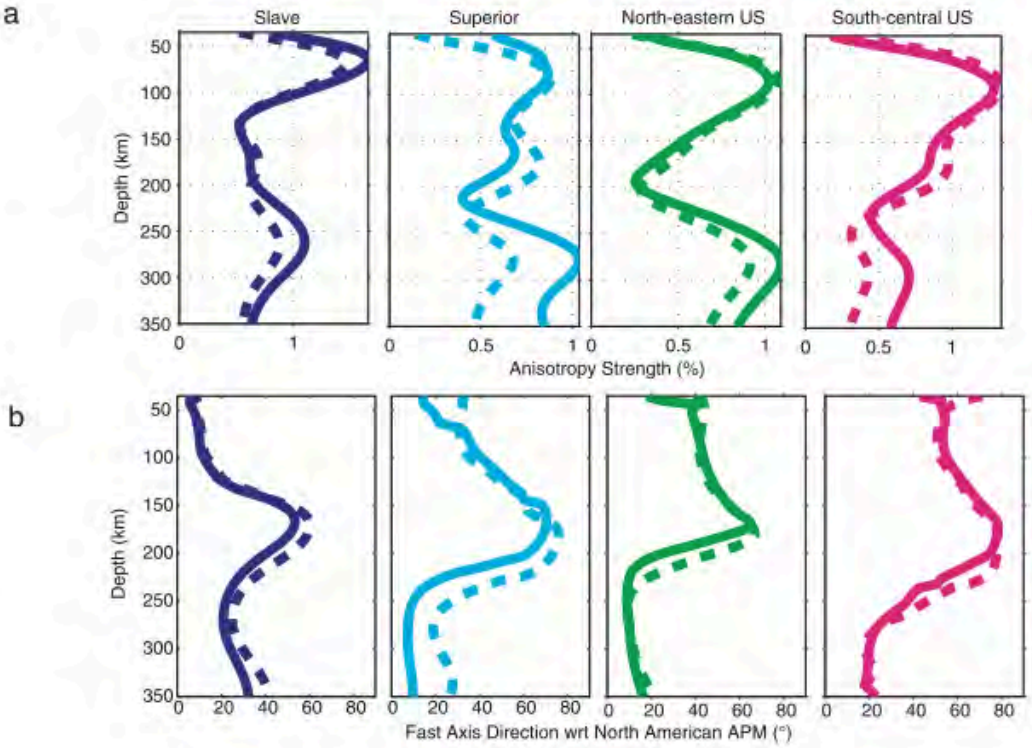


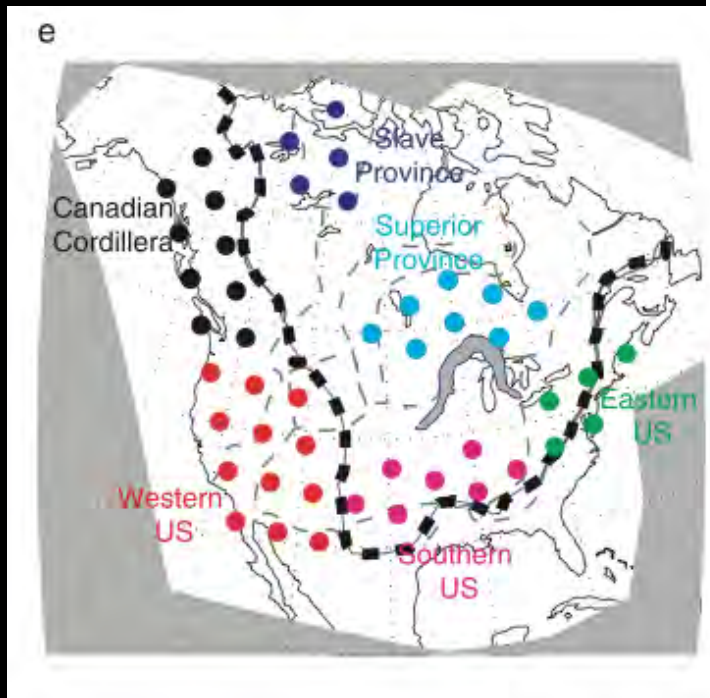
Abt et al. 2010

Complex Lithospheric Structure

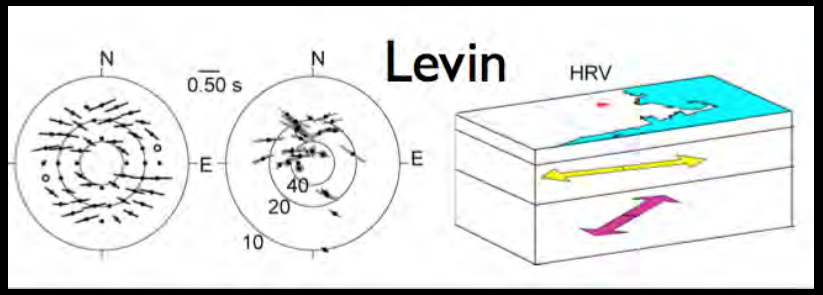


Yuan and Romanowicz, Nature, 2010

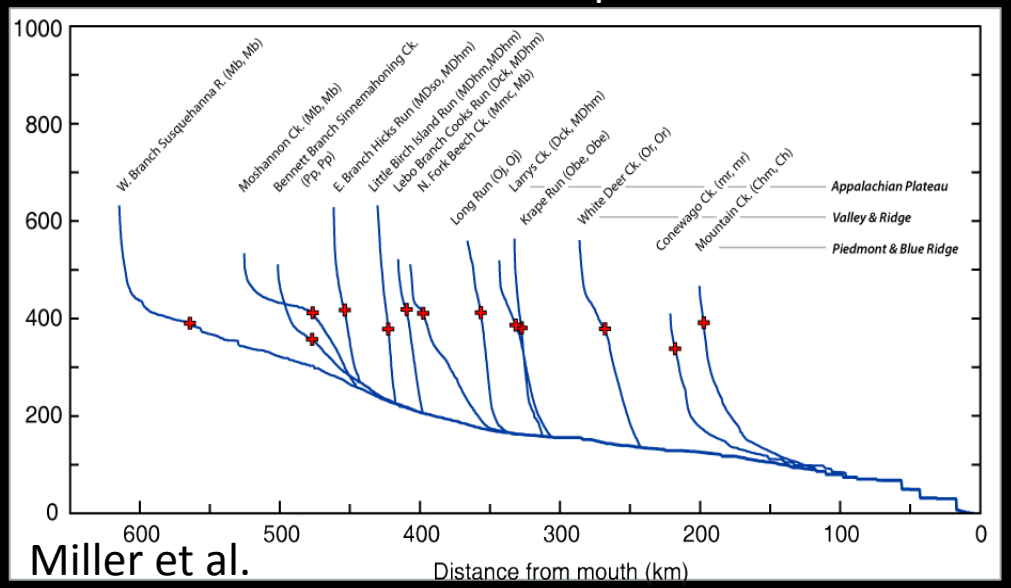




Yuan et al., GJI, 2010



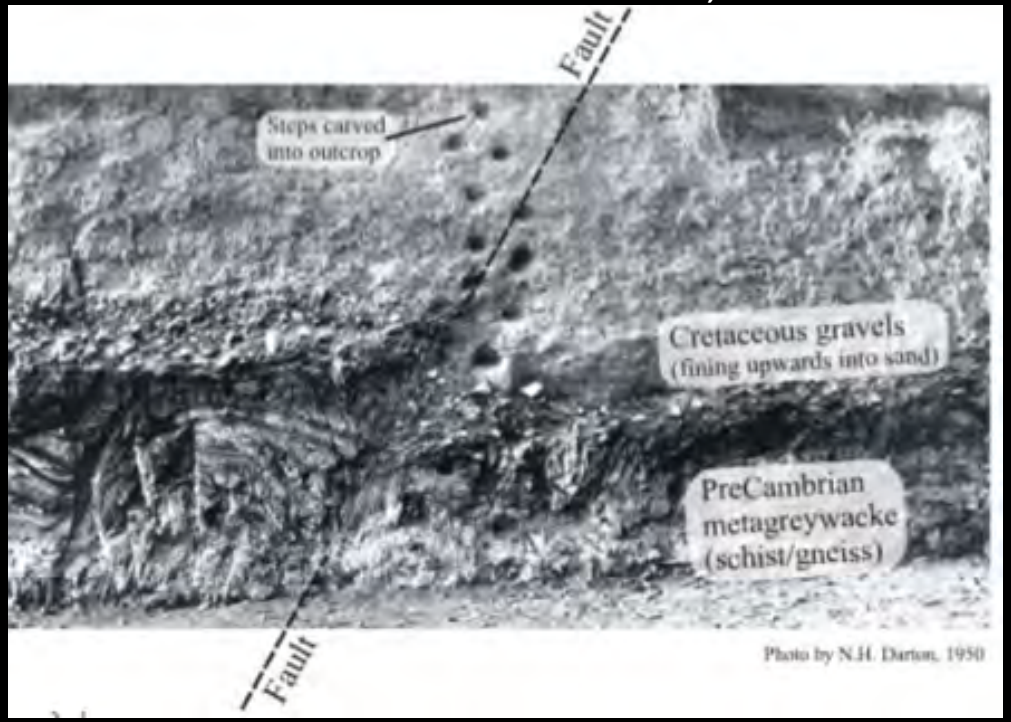
Late Cenozoic Geomorphic Transients



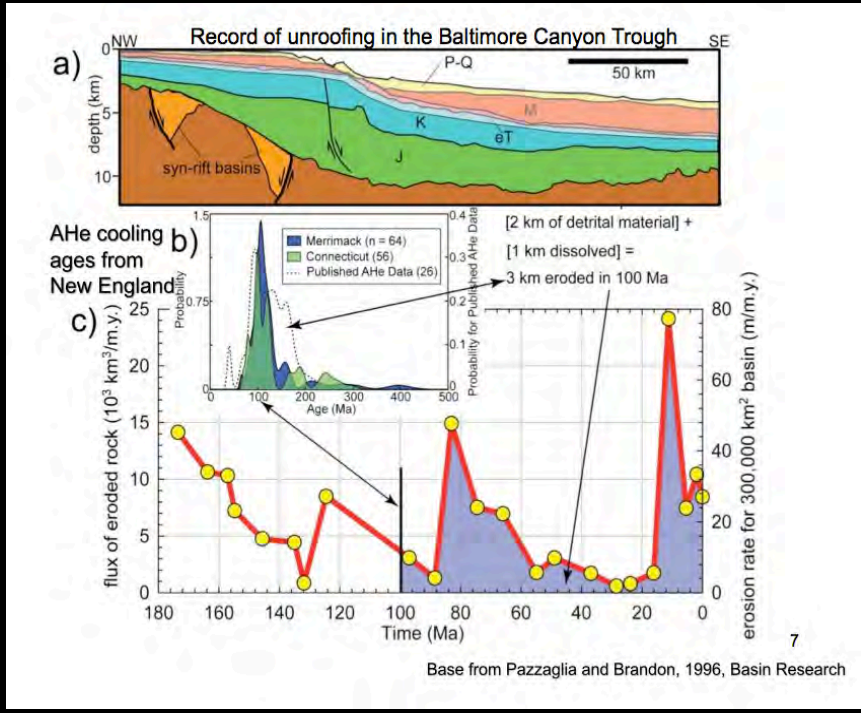
Miller et al.

- What active processes are occurring in the mantle that are related to continental evolution and active deformation?

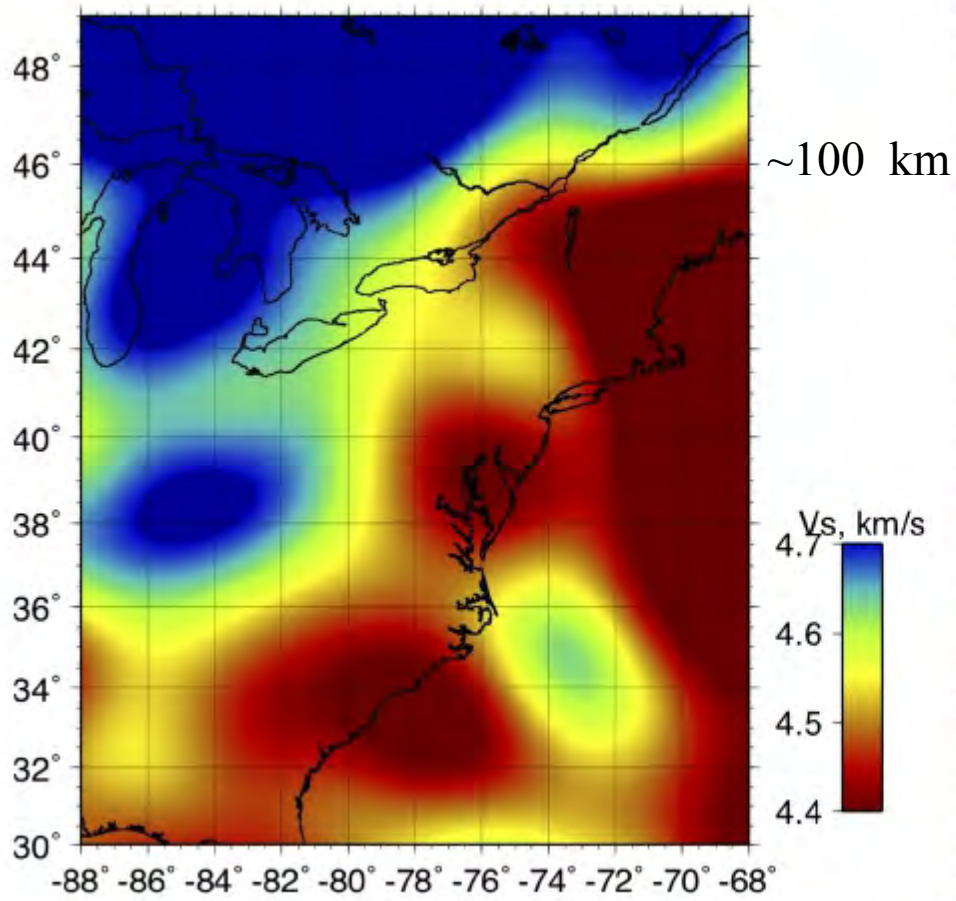
Cenozoic Fault in Rock Creek Park, Wash. DC



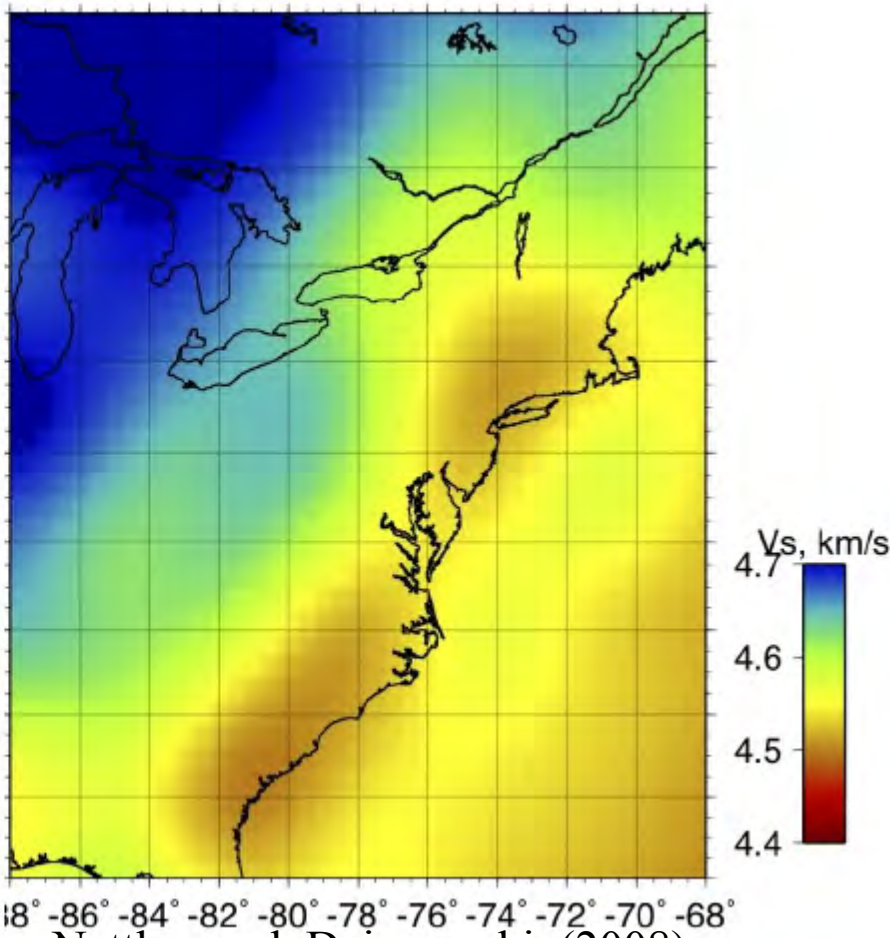
Recent unsteadiness in the erosion record



Variability in Mantle Velocity Structure

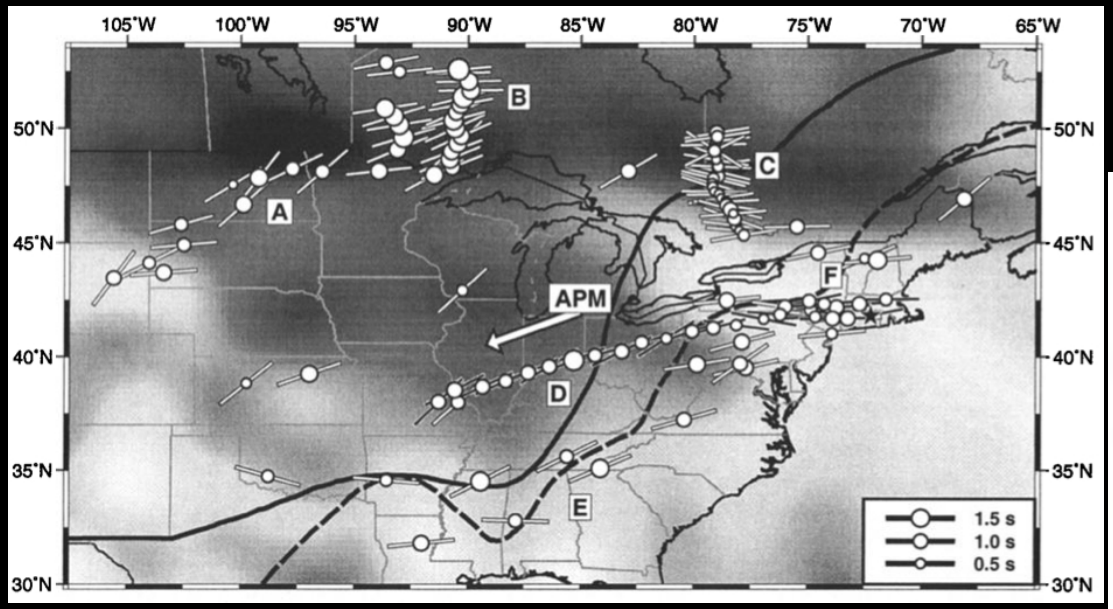


van der Lee and Frederiksen (2005)

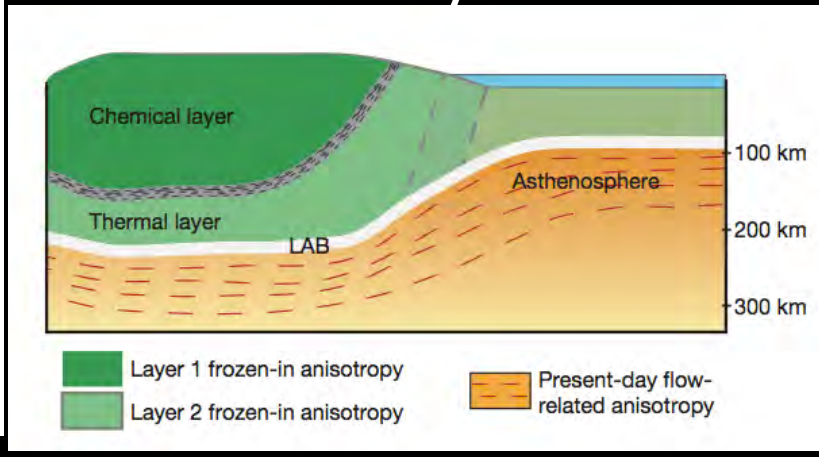


Nettles and Dziewonski (2008)

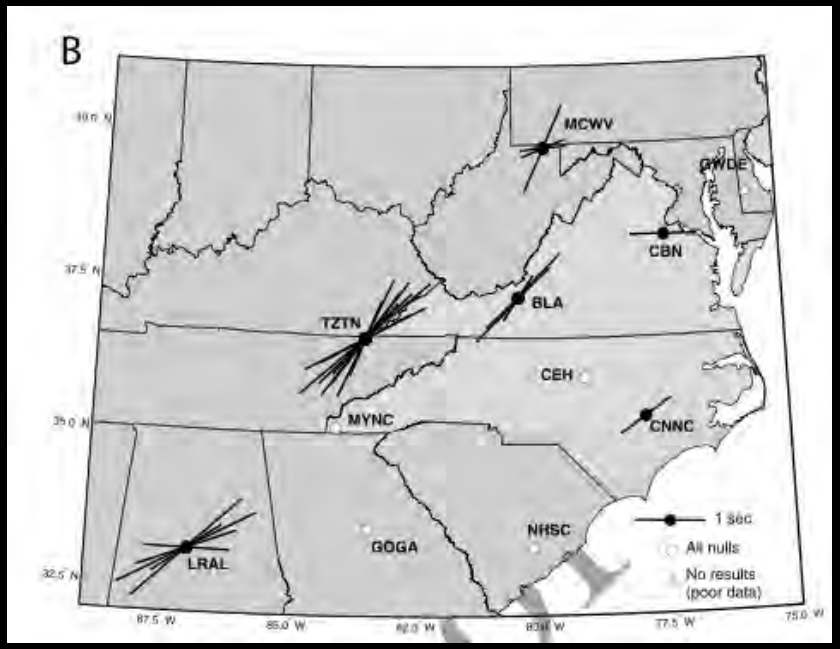
Shear wave splitting and mantle dynamics



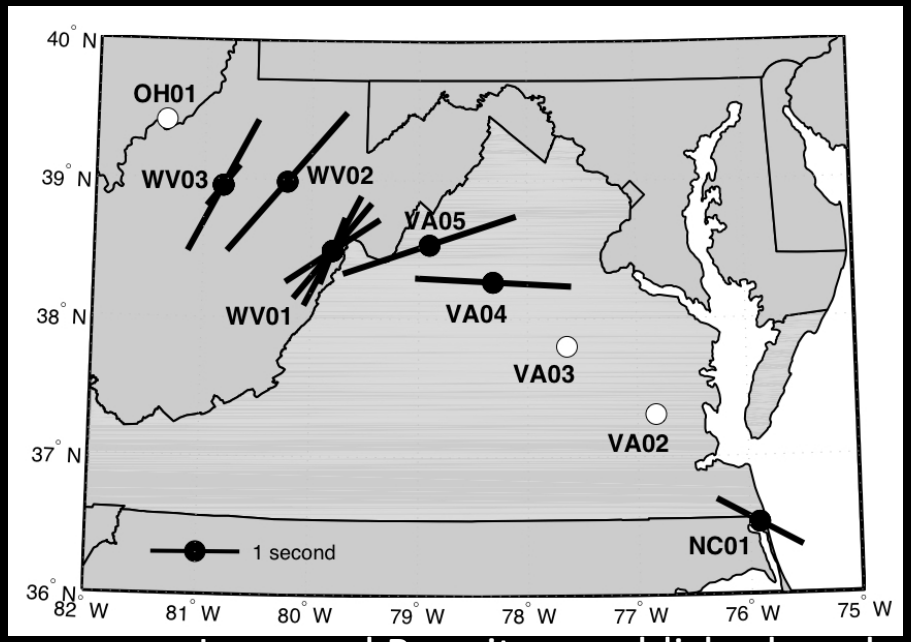
Fouch et al., 2000



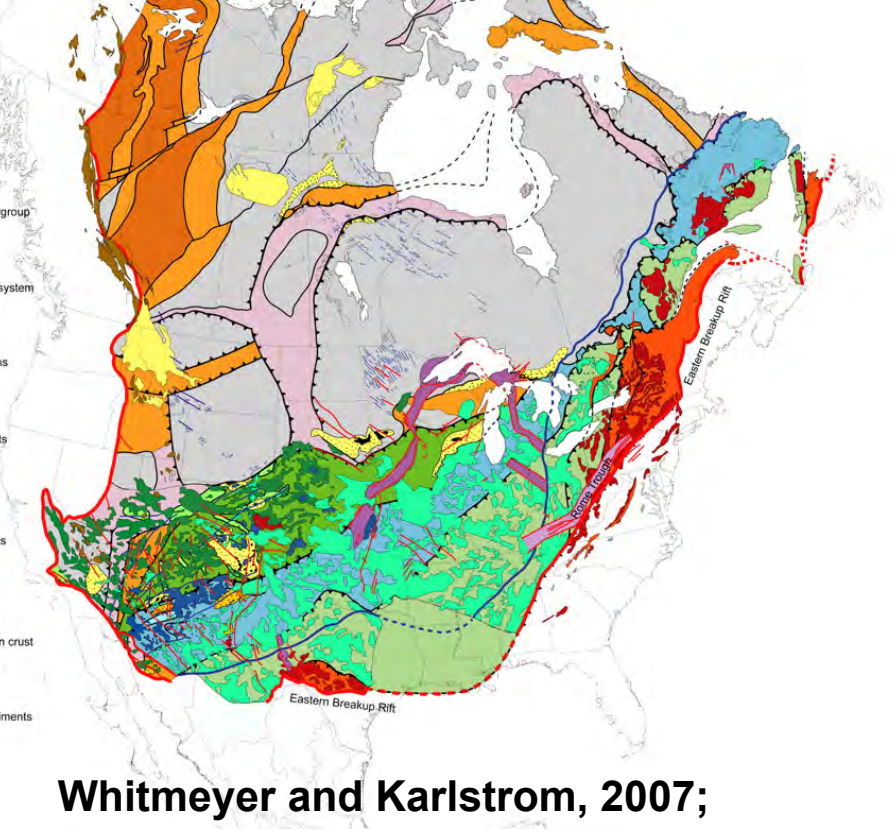
Yuan and Romanowicz, Nature, 2010



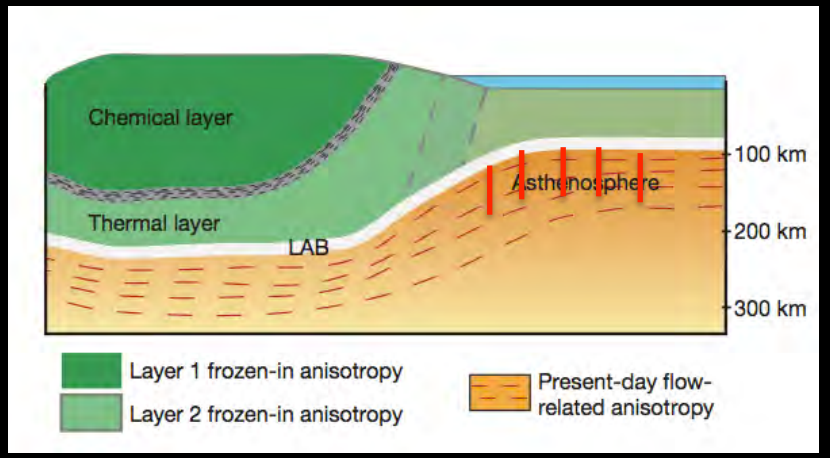
Long et al., 2010



Long and Benoit, unpublished work

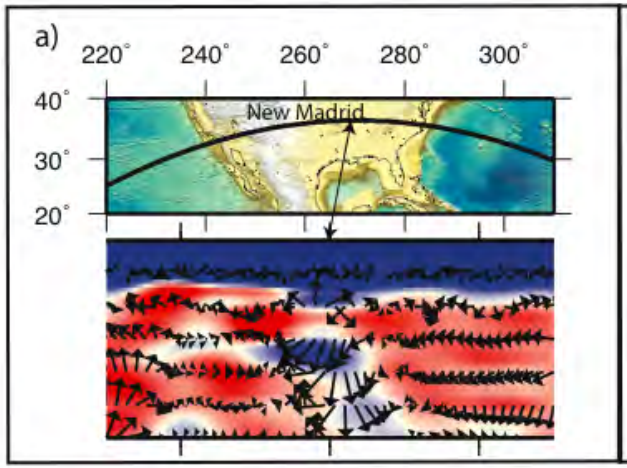


Whitmeyer and Karlstrom, 2007;

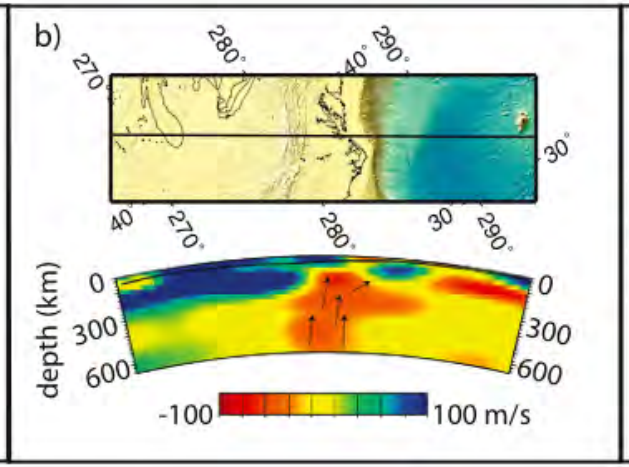


Yuan and Romanowicz, Nature, 2010

Vertical mantle flow beneath the Southeast?



Forte et al., 2007



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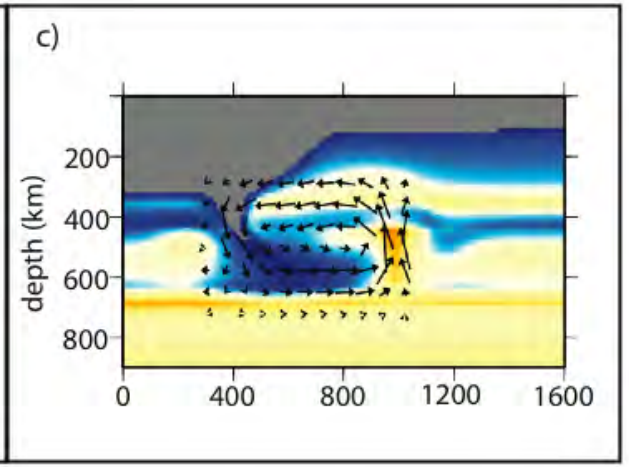
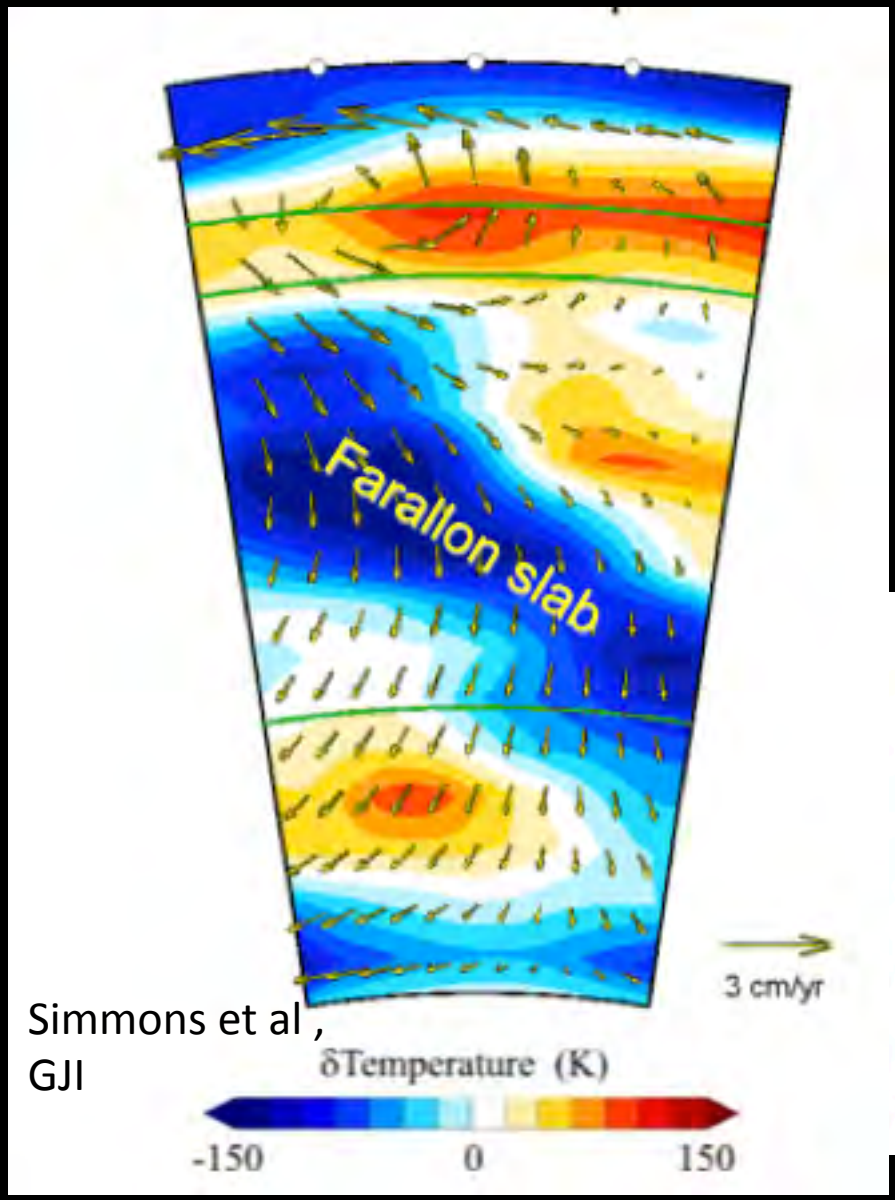
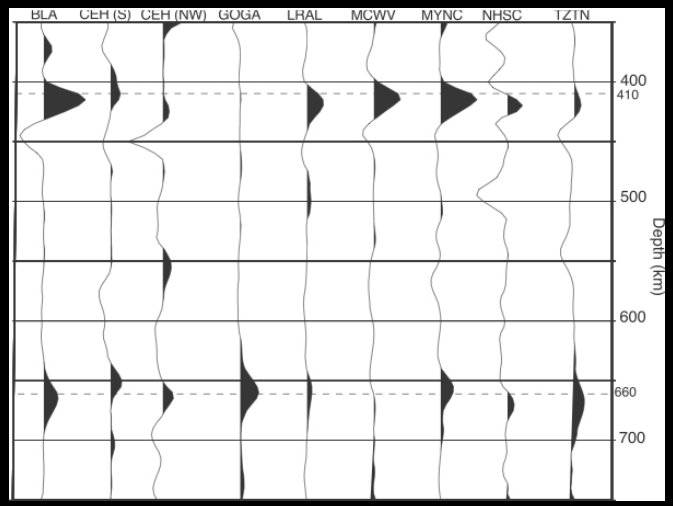


King, 2007

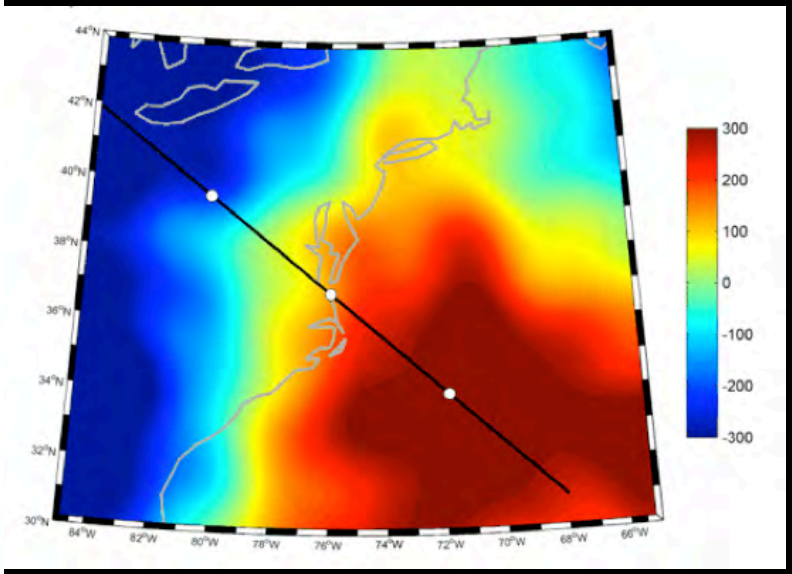
How do internal boundaries respond to dynamics?



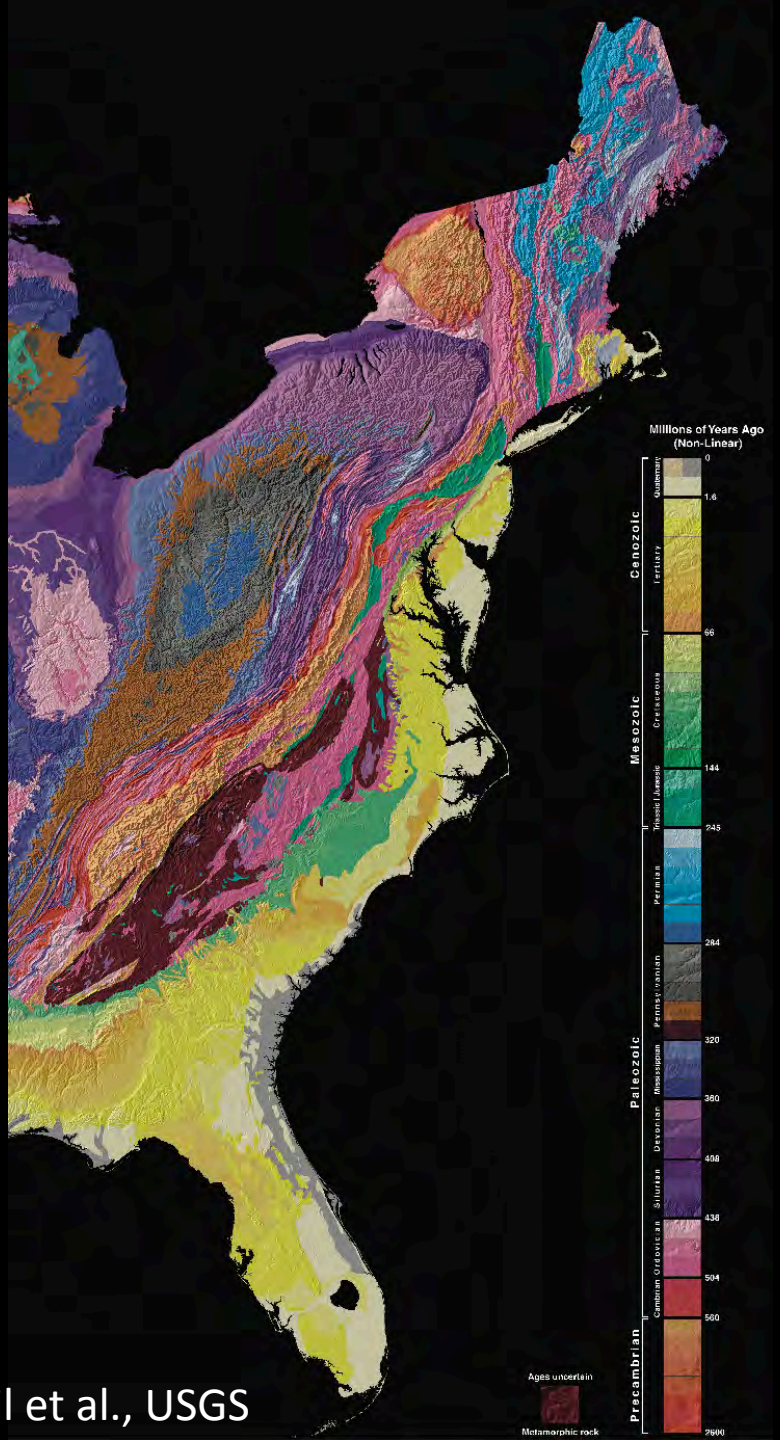
Simmons et al , GJI



Long, Benoit, Chapman, & King, 2010



Unpublished Images from A. Forte and R. Moucha



Vigil et al., USGS

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