

The structure and evolution of the North American lithosphere and asthenosphere

What are the big questions and how can EarthScope address them?

New science on a continental scale

Emphasis on what can be achieved with present ES facilities

Resolution will not address all questions discussed

Major Themes:

Cratonic North America: Lots of new opportunities to look at big questions of continental evolution

Anisotropy of lithosphere and asthenosphere

Understanding the lithosphere/asthenosphere boundary

Defining the continental lithosphere (chemical, thermal, physical) and why it is separated from the convective mantle

- Processes that develop stable lithosphere:
- What causes some continental lithosphere to return to the convective mantle?
- What does it take to destroy a craton?
- Boundary between thick and thin lithosphere in Western North America
- Composition and characteristics of Archean, Proterozoic, and Phanerozoic continental crust and mantle lithosphere
- Differences in lithosphere construction through time (4-D evolution)
- multiple stages of development (ie. not simple arc accretion & cooling)
- lateral accretion
- vertical accretion
- What is the fate of mafic lower crust – why lost in some cases
- Cratonic keels – how do they vary with depth MLB, LAB, metasomatism
- Links between magmatism and lithospheric and asthenosphere
- What is the relationship between asthenospheric flow and lithospheric deformation?

How do ancient structures and boundaries control and partition deformation?

- Interaction between the convective mantle and lithosphere – roots and gradients
- Major accretionary boundaries at depth: Continents, arcs, ribbon continents, former ocean plateaus
- Origins of basins and arches in “stable continent”
- Relationship of topography to lithospheric structure
- How variable is the lithospheric mantle in the mid-continent – do the variations we see in the west continue as fossil structures to the east?

What is the role of middle and lower crustal flow in continental dynamics?

- How do the properties (strength etc.) of the mid and lower crust change from orogenic to anorogenic regions?
- What the Moho and when does it form?
- Nature of fluids including magma in the lower crust

***How does rifting modify the crust & lithosphere
and how does this persist through time?***

- How does continental lithosphere rift? – focus on Walker Lane
- What initiates a Wilson Cycle -- initiation of subduction
- Role of LIPS in continental evolution and their preservation – ie. CAMP
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