How Laramide-Age Hydration of North American Lithosphere by the Farallon Slab Controlled Subsequent Activity in the Western United States

Humphreys, Hessler, Dueker, Farmer, Erslev, and Atwater

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Motivation: western U.S.
tectonics and magmatic activity
North America: Topography
Observations

Seismic velocity
- ~100 km depth
- low resolution: S-wave model of Grand (1997)
- high resolution: P-wave models

Surface heat flow
- High correlation between datasets

Humphreys et al., 2003
Data & Methods

- Travel time data
- Corrected delays used in tomographic inversion
- Regions of slow wave propagation beneath central New Mexico, Colorado, and Yellowstone
- Regions of fast wave propagation in the east and west, and central Wyoming

Humphreys et al., 2003
Results

Low-velocity volumes:
- Jemez volcanic trend
- West-central Colorado (Rocky Mtns)
Implications

- Flattening slab cools and hydrates lithosphere
- Removal of slab exposes hydrated lithosphere to hot asthenosphere
  - Widespread magmatism
  - Uplift due to decreased density from heating and unloading from slab removal

Humphreys et al., 2003
Additional Thoughts

• Why not continue squeeze tests below 200 km?
• What is the mechanism for Farallon slab flattening and detachment?
• Possible impact of proposed Yellowstone plume impingement ~80Ma?