Radially Anisotropic Models of Shear Wave Velocity Beneath the Wyoming Craton and Other Places from the USArray Data

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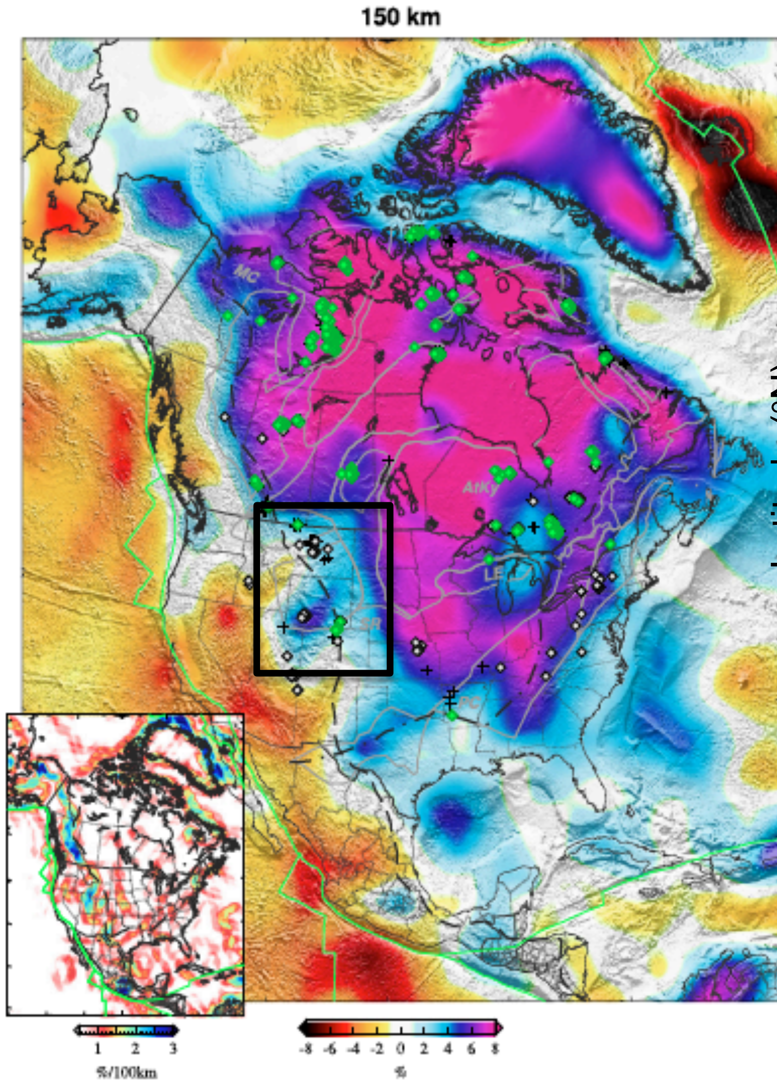
earthscope

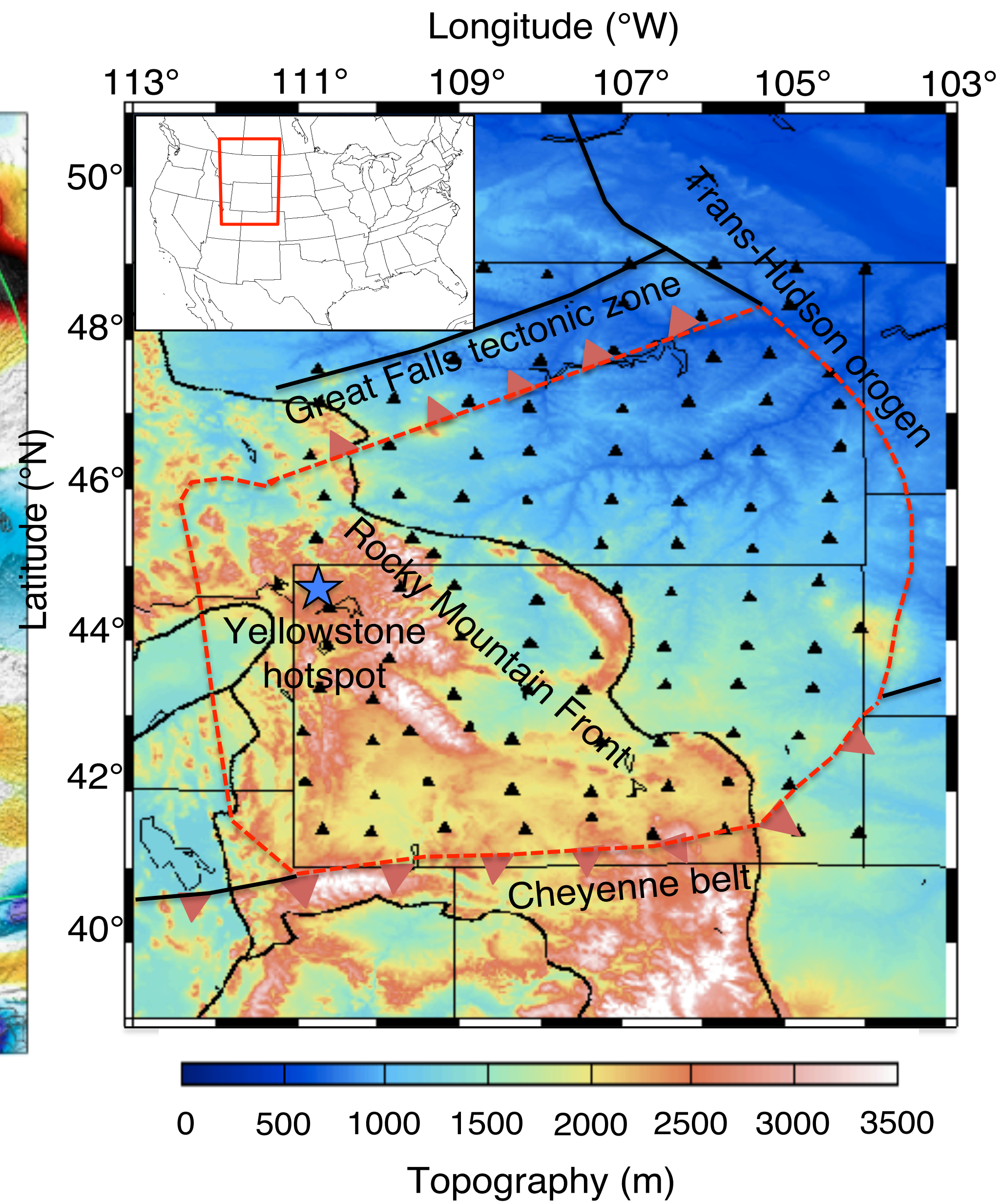
Anchorage, 2017

North American Craton

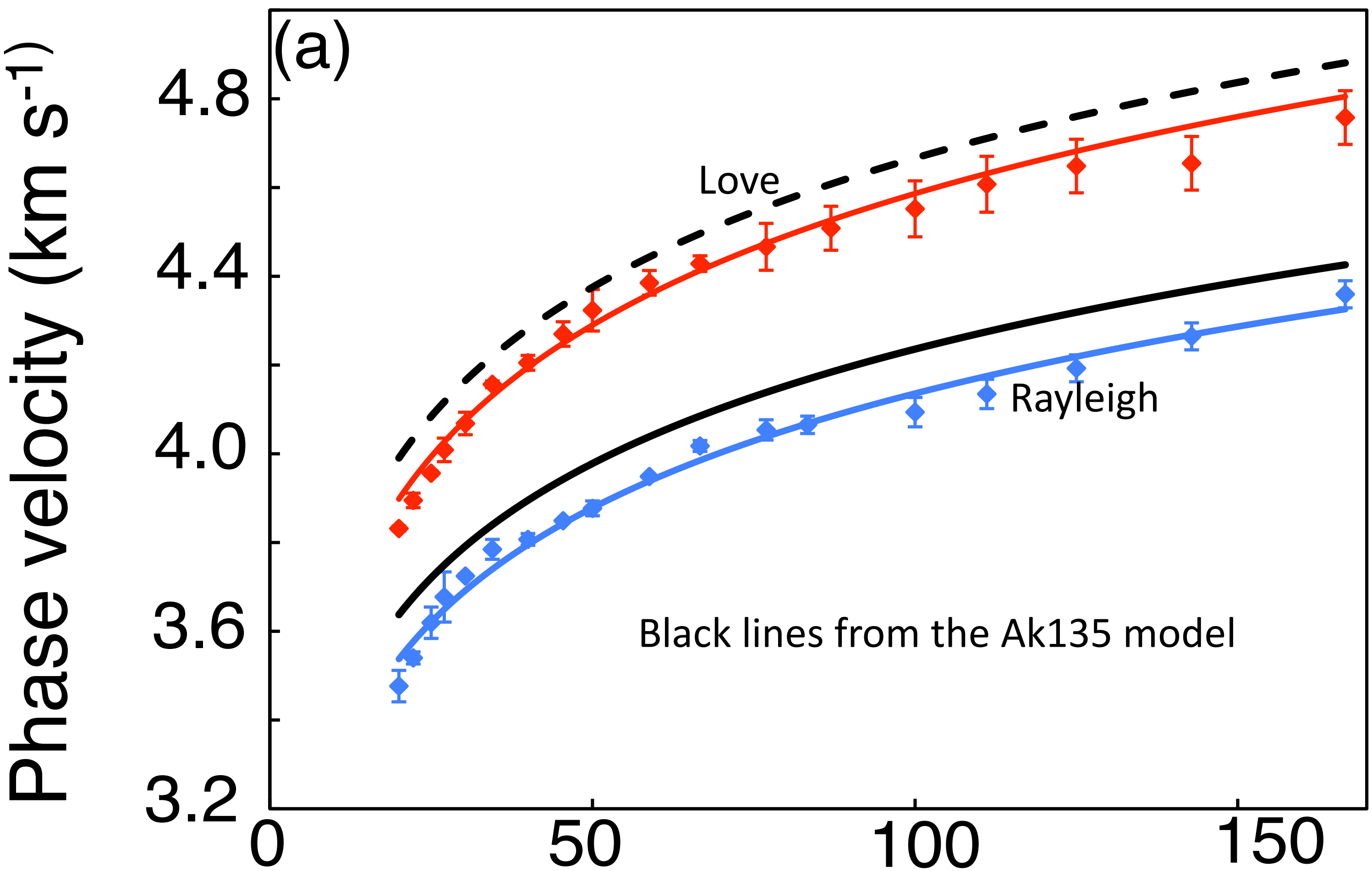


(Schaeffer and Lebedev, 2014)

Wyoming Craton



Average Phase Velocities

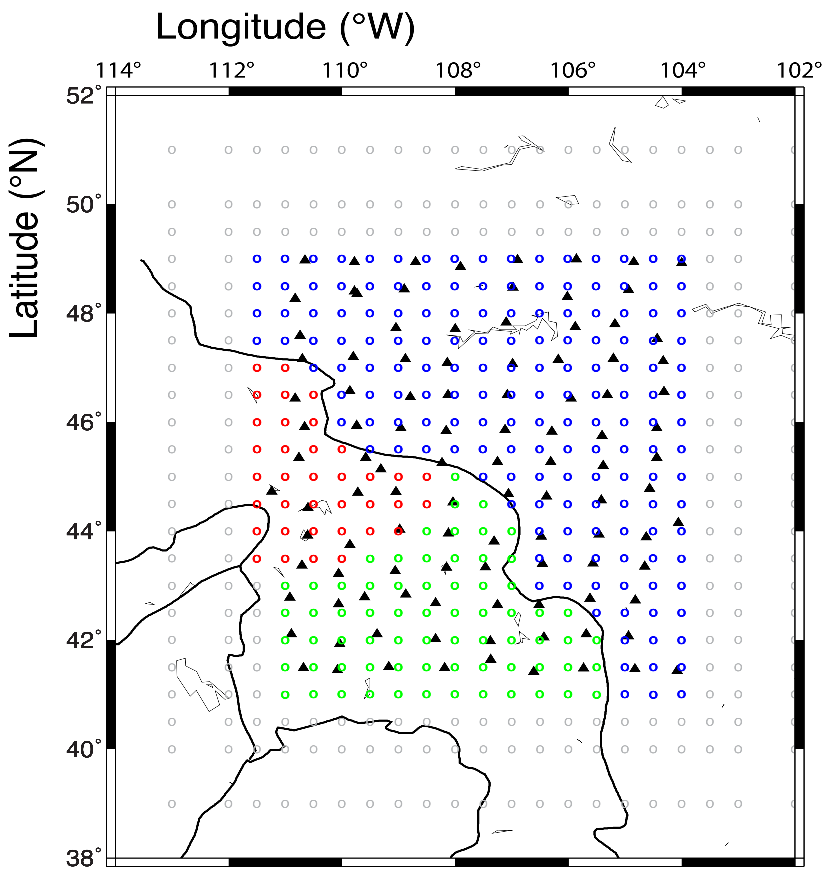


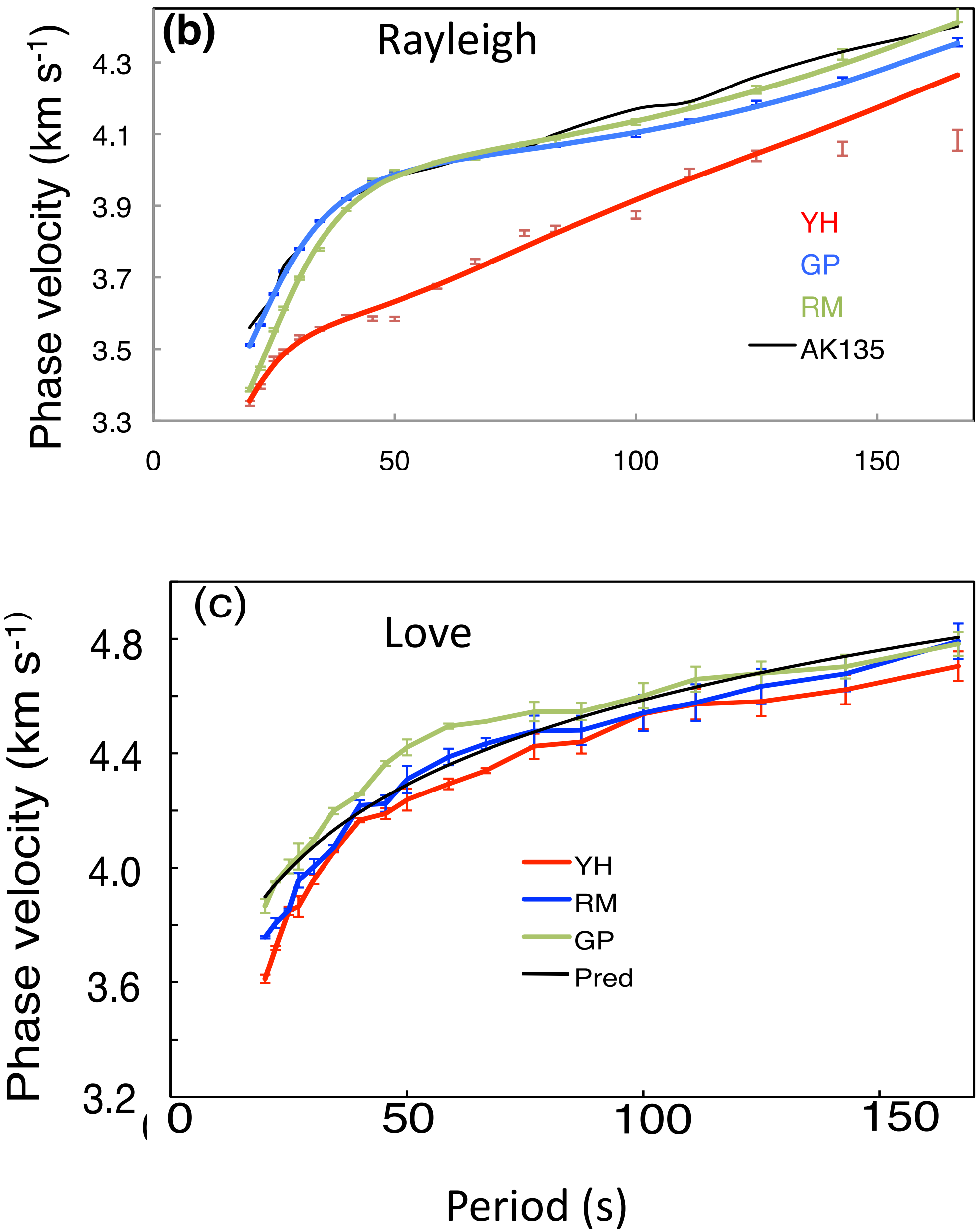
Three sub-regions:

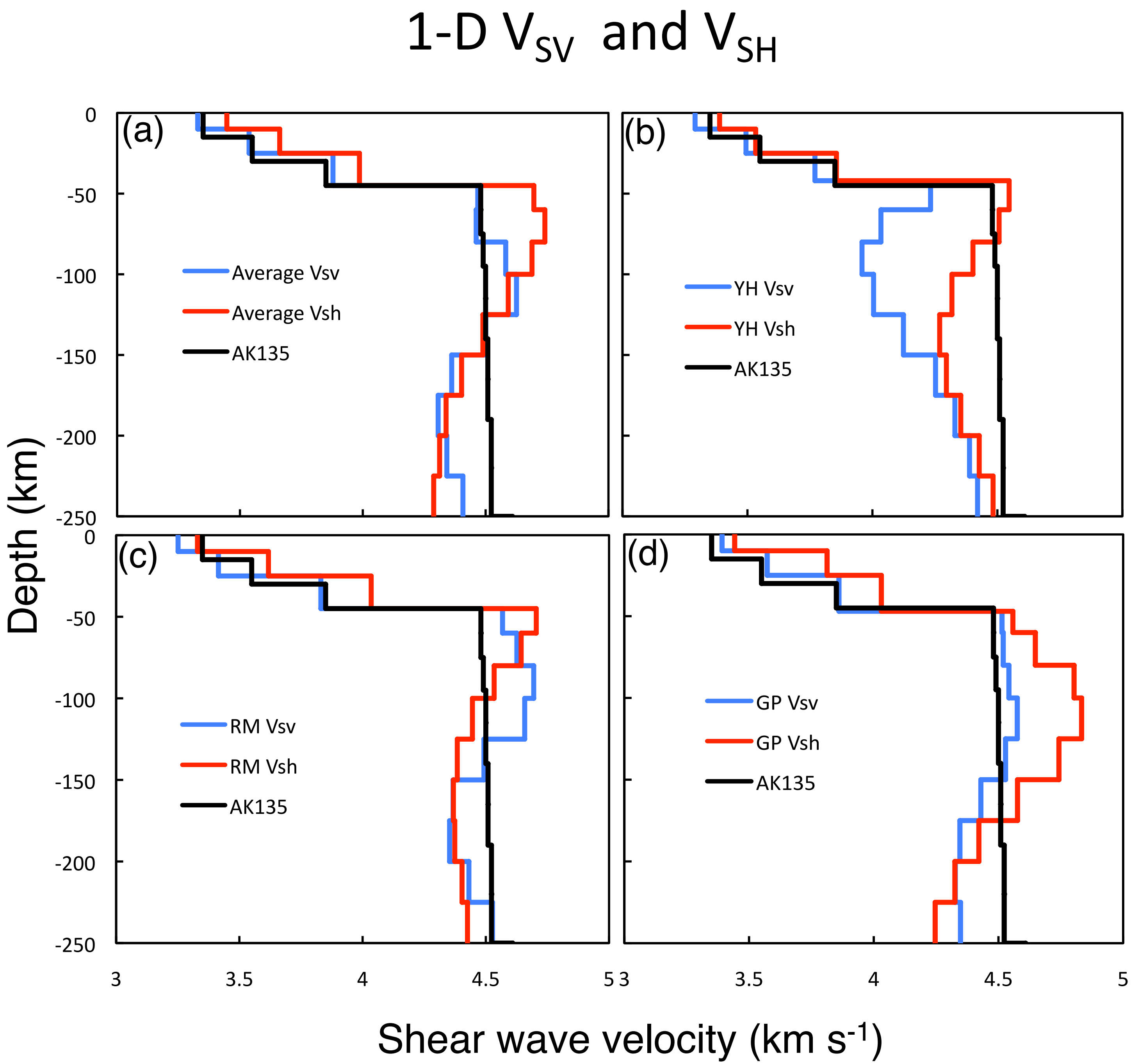
Yellowstone hotspot

Rocky Mountains

Great Plains

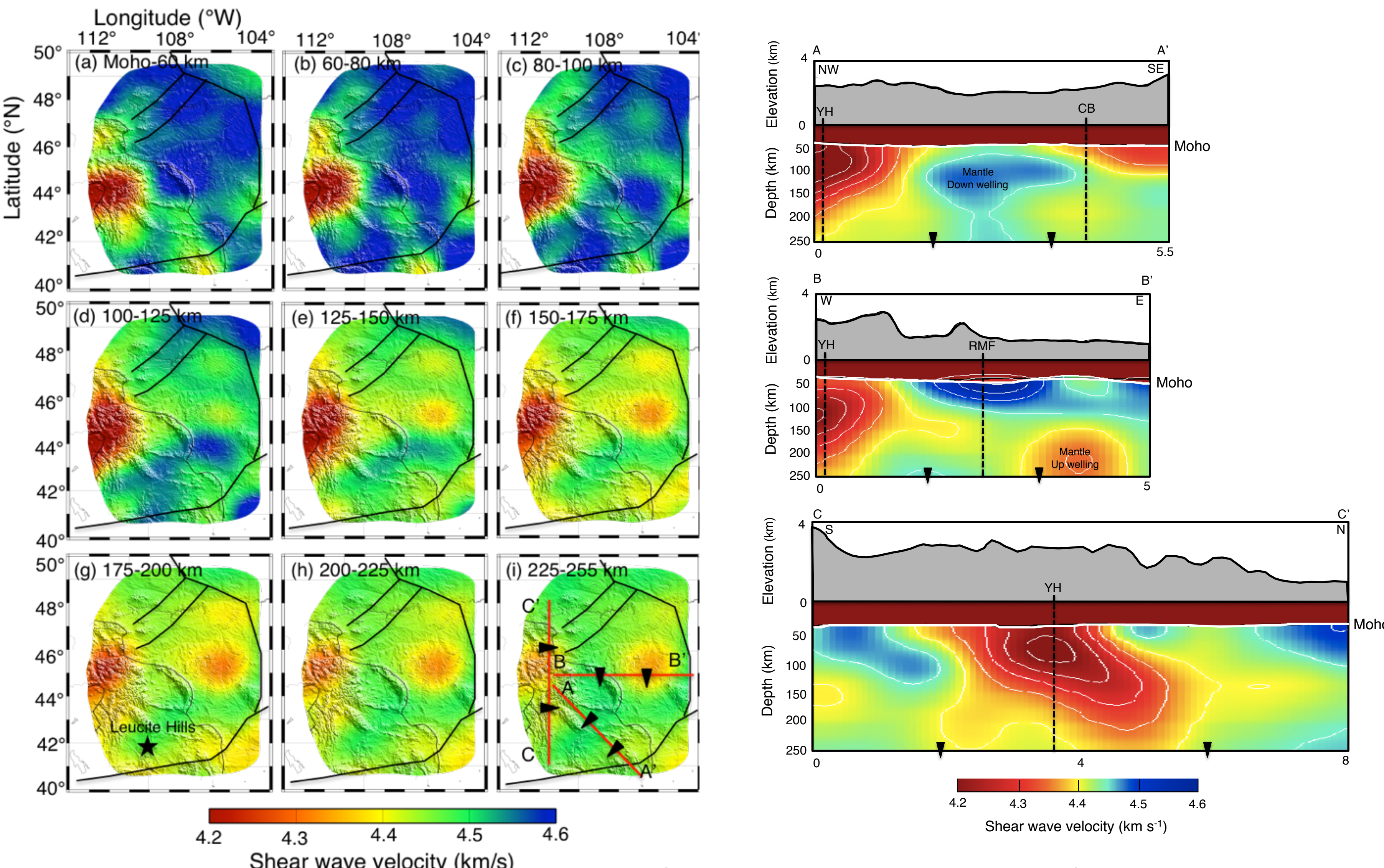






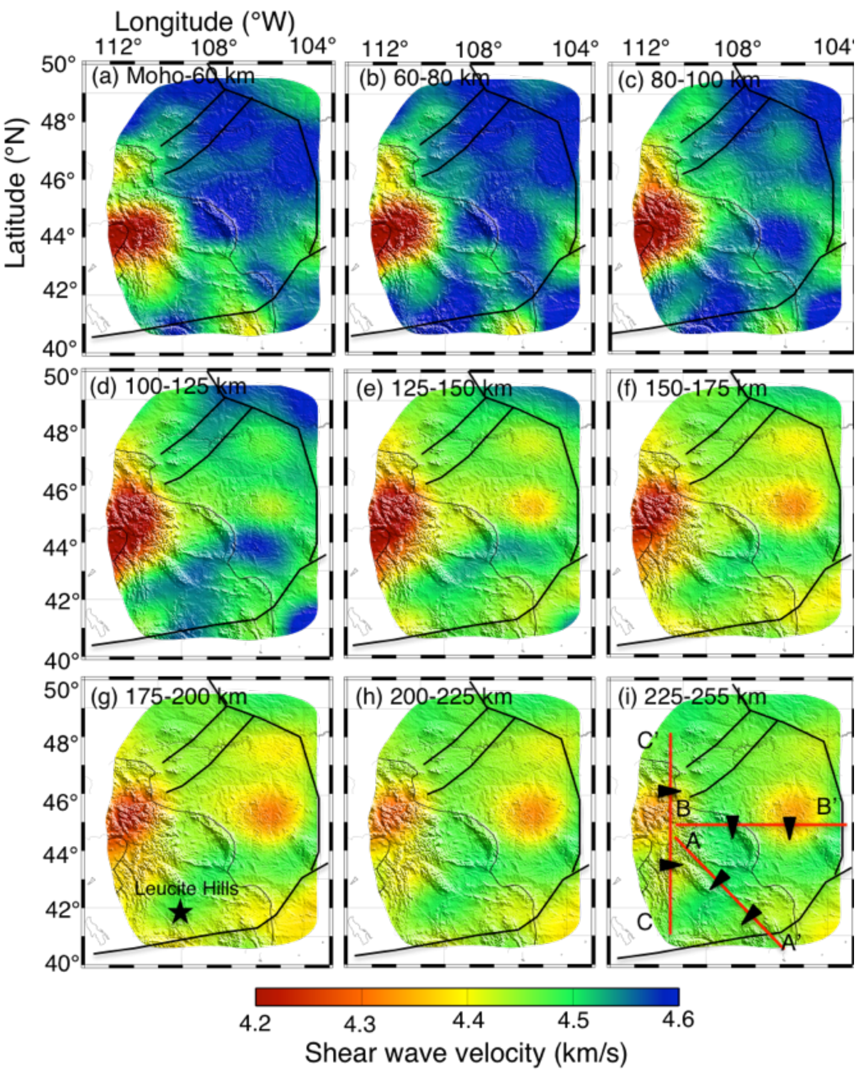
1-D V_{SV} and V_{SH}
(a)
Average Vsv
Average Vsh
AK135
(b)
YH Vsv
YH Vsh
AK135
(c)
RM Vsv
RM Vsh
AK135
(d)
GP Vsv
GP Vsh
AK135
0
-50
-100
-150
-200
-250
Depth (km)
3
3.5
4
4.5
5
Shear wave velocity (km s^{-1})

3-D Vsv model

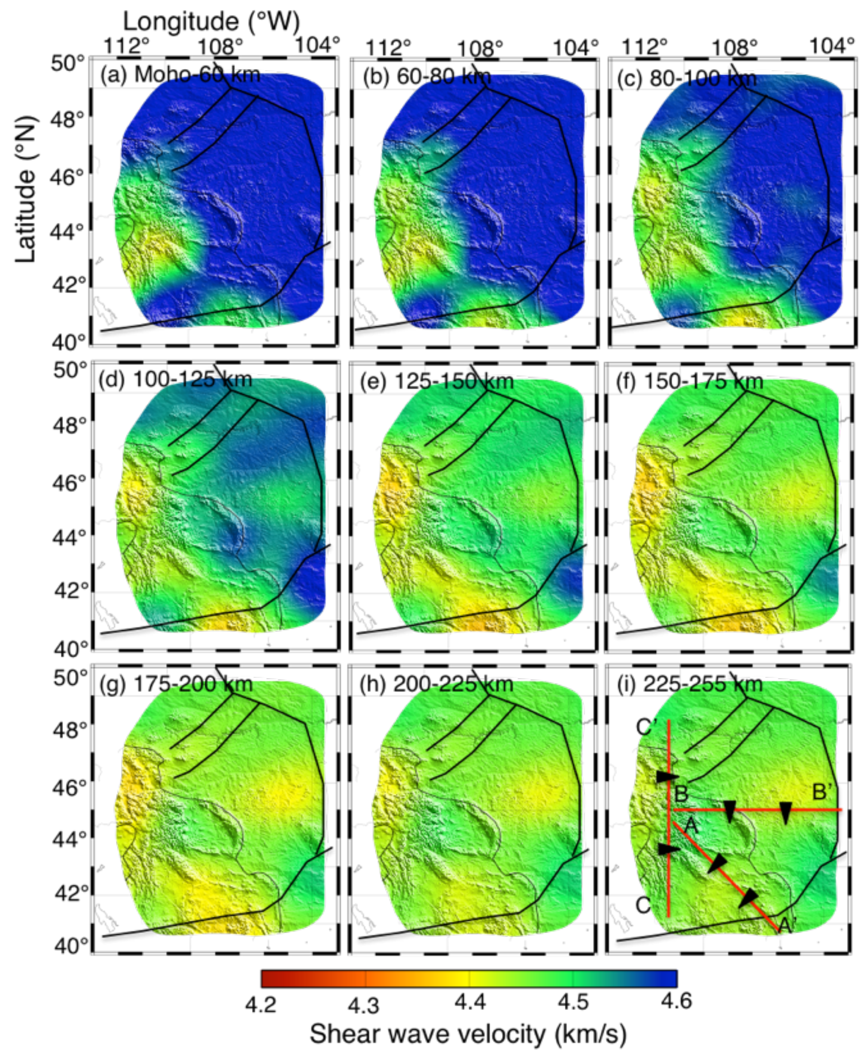


(Dave and Li, Geology, 2016)

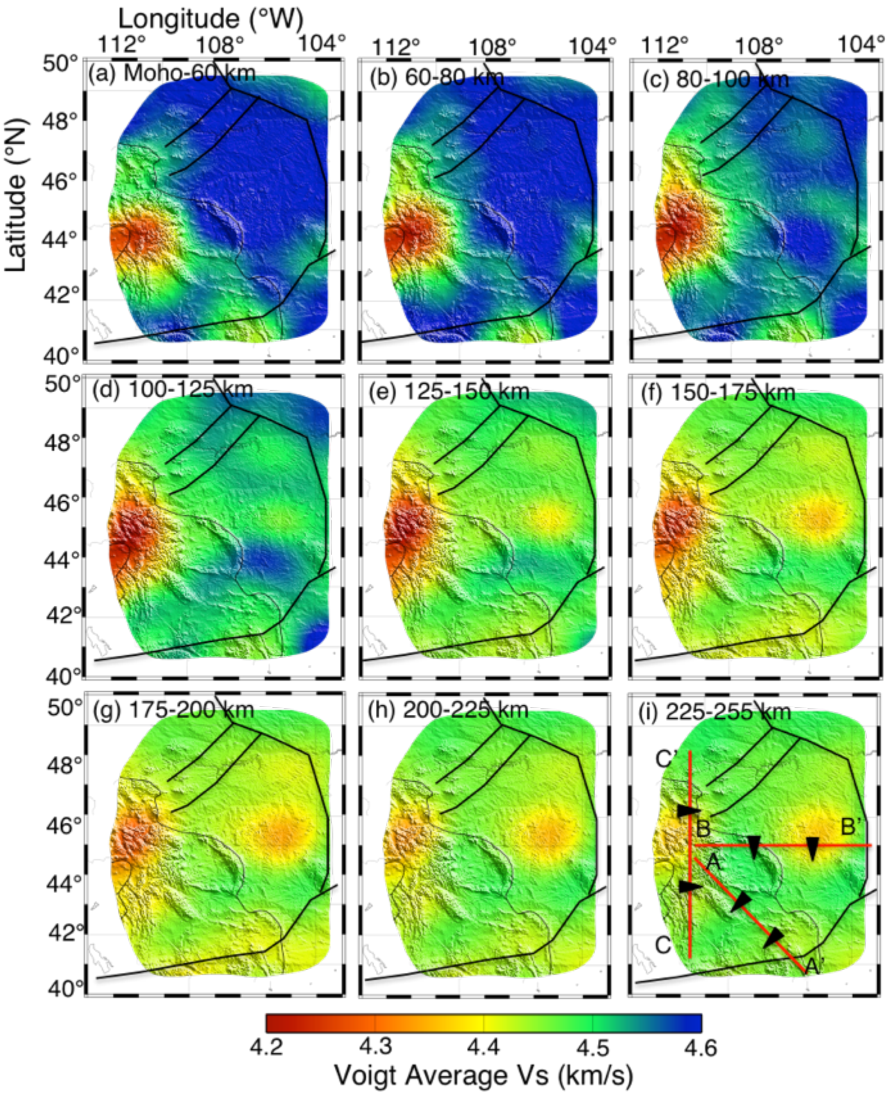
3-D Vsv model



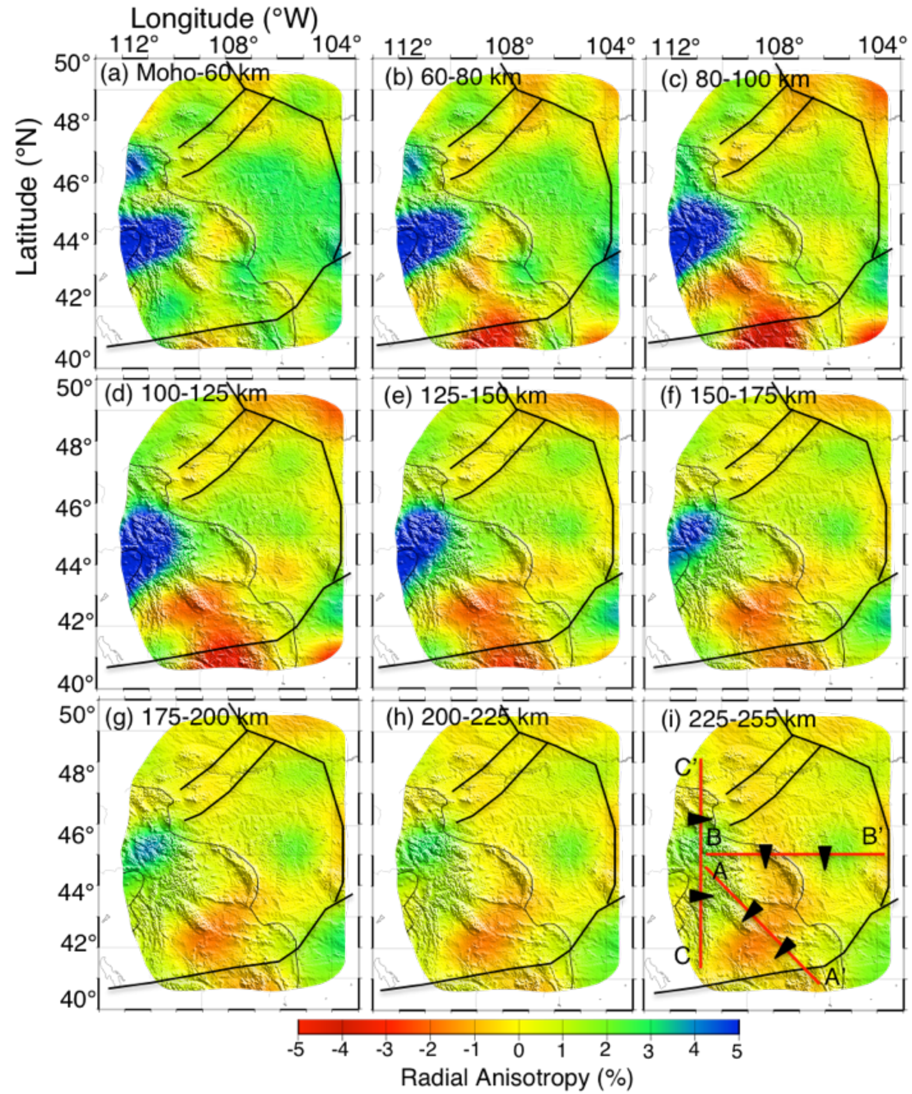
3-D Vsh model



Voigt average Vs

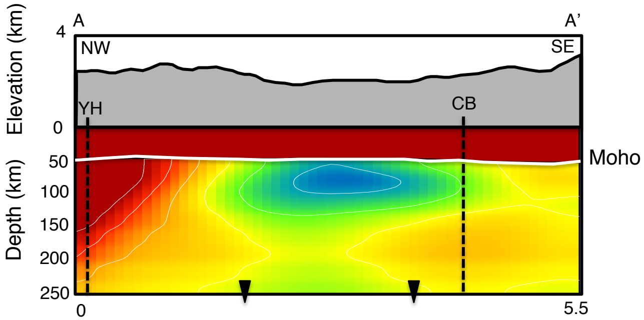


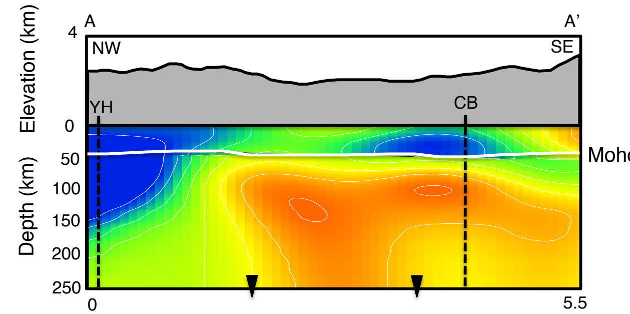
Radial anisotropy



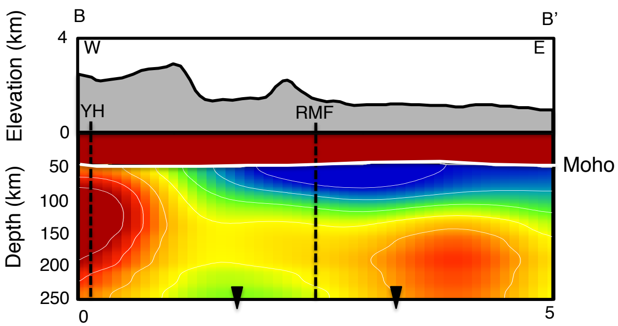
V_S

Radial anisotropy

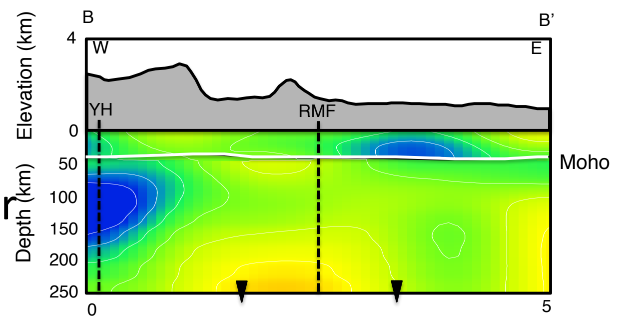


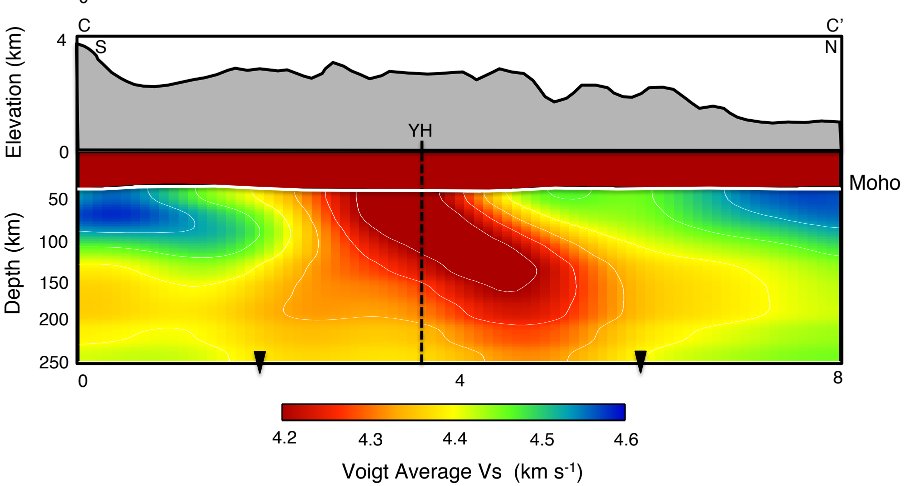


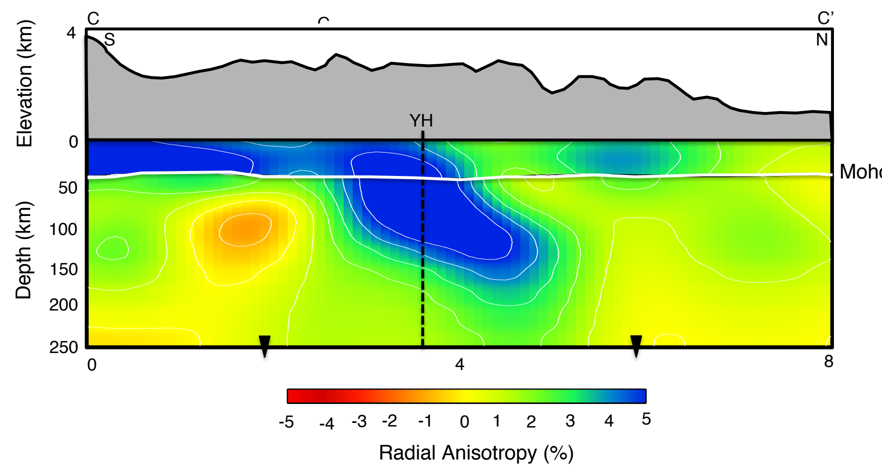
High velocity anomaly associated with Vsv>Vsh, mantle downwelling



Low velocities associated with Vsh>Vsv, dominant shear deformation (weaker upwelling)



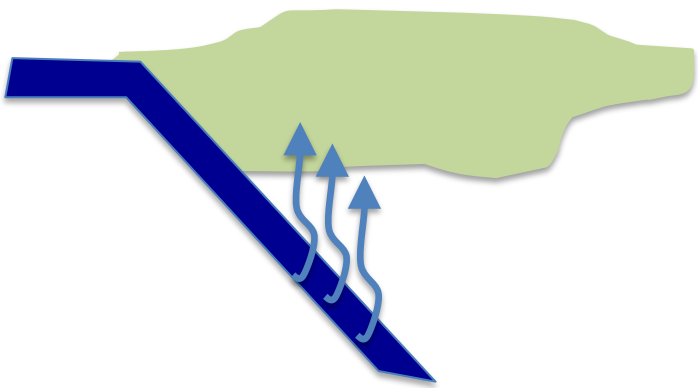




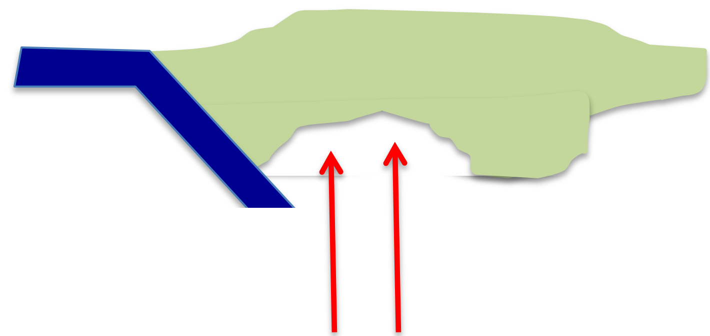
(Dave and Li, in prep)

Evolution of the Wyoming Craton

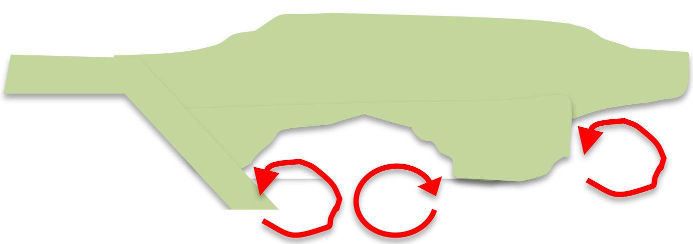
Weakening by hydration



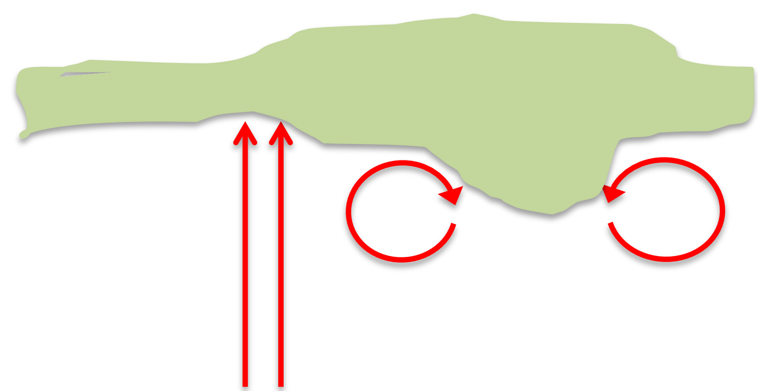
Erosion by mantle upwelling



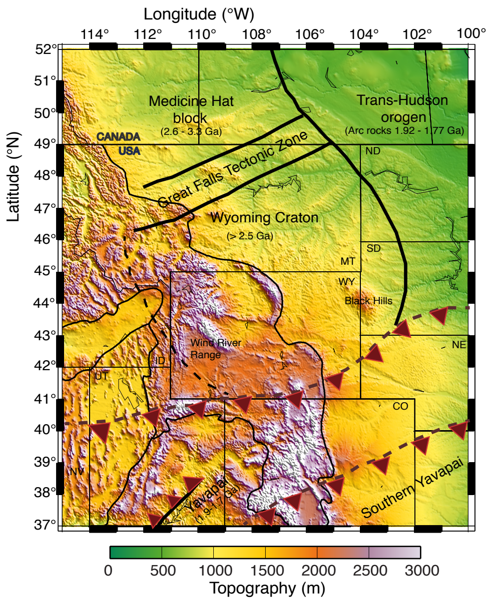
Modification by small-scale convection



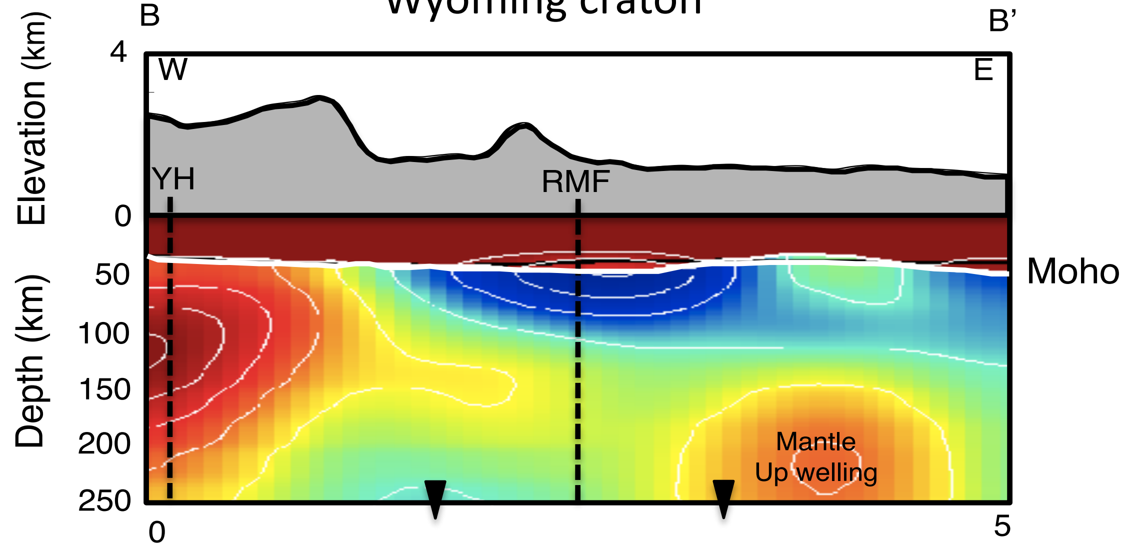
Erosion by plume re-enforced convection

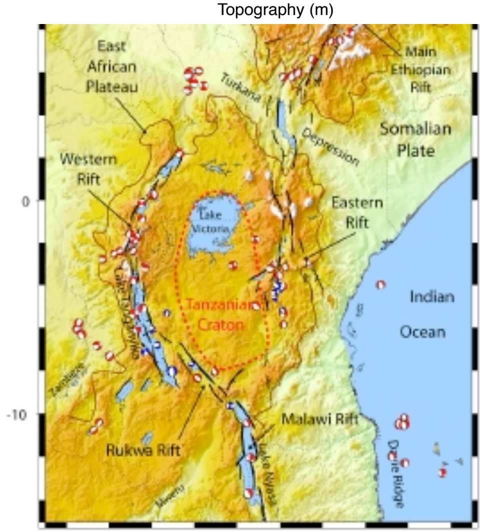


Plume-Craton Interaction

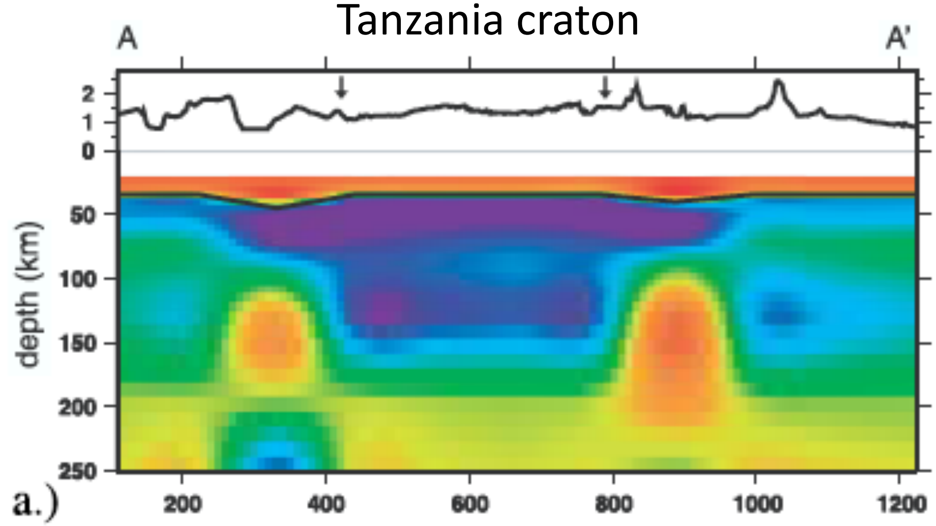


Wyoming craton



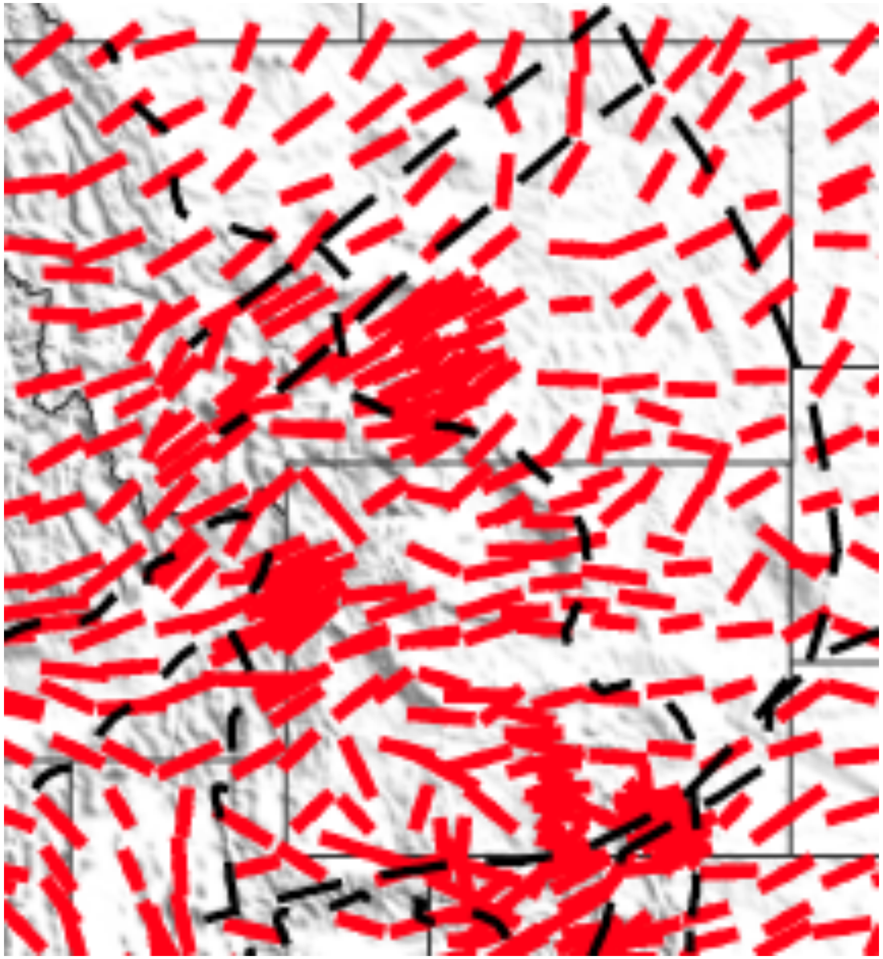


Tanzania craton



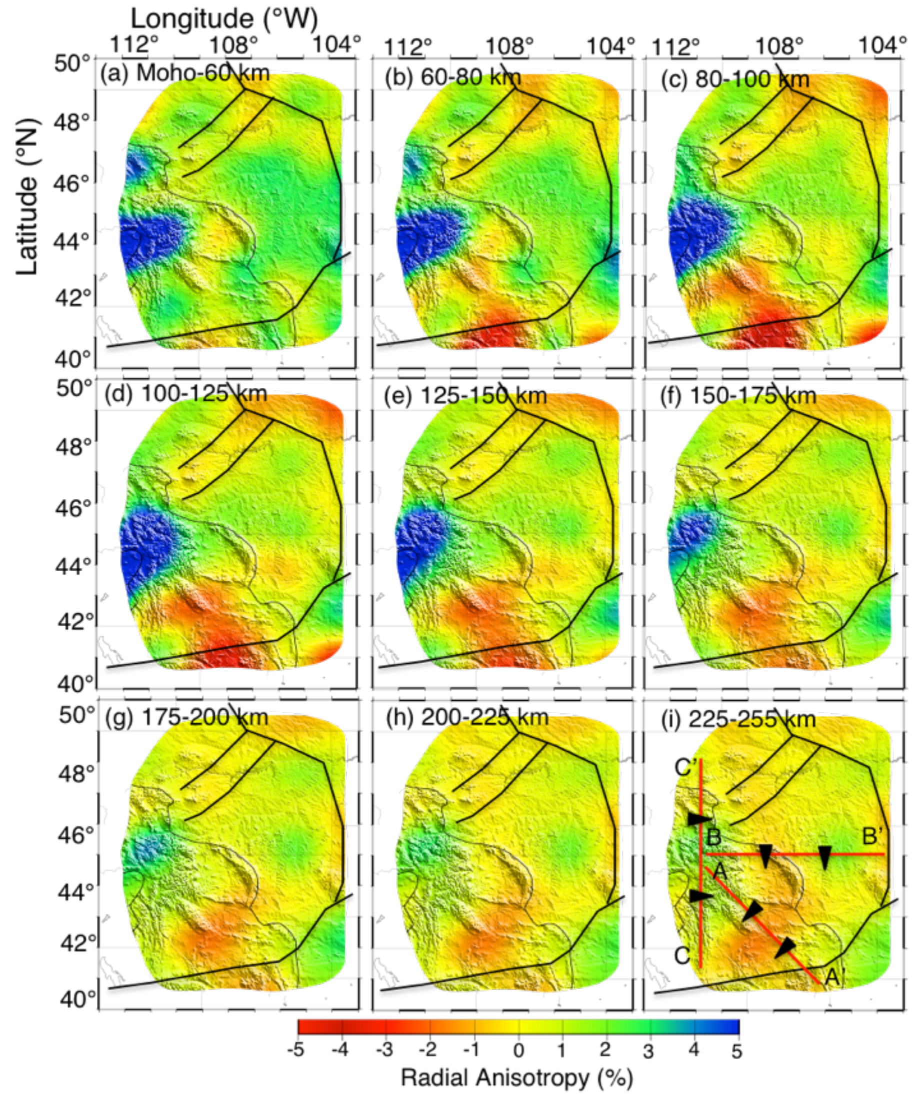
(Weeraratne et al., 2003)

Shear wave splitting measurements



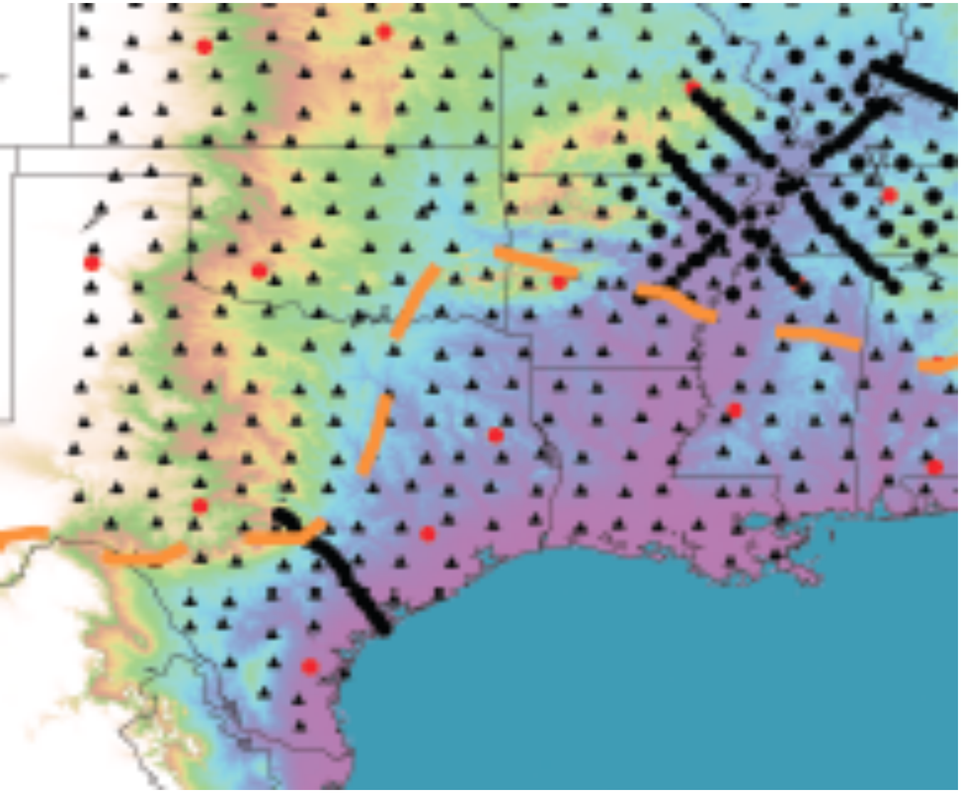
(Liu et al., 2014)

Radial anisotropy

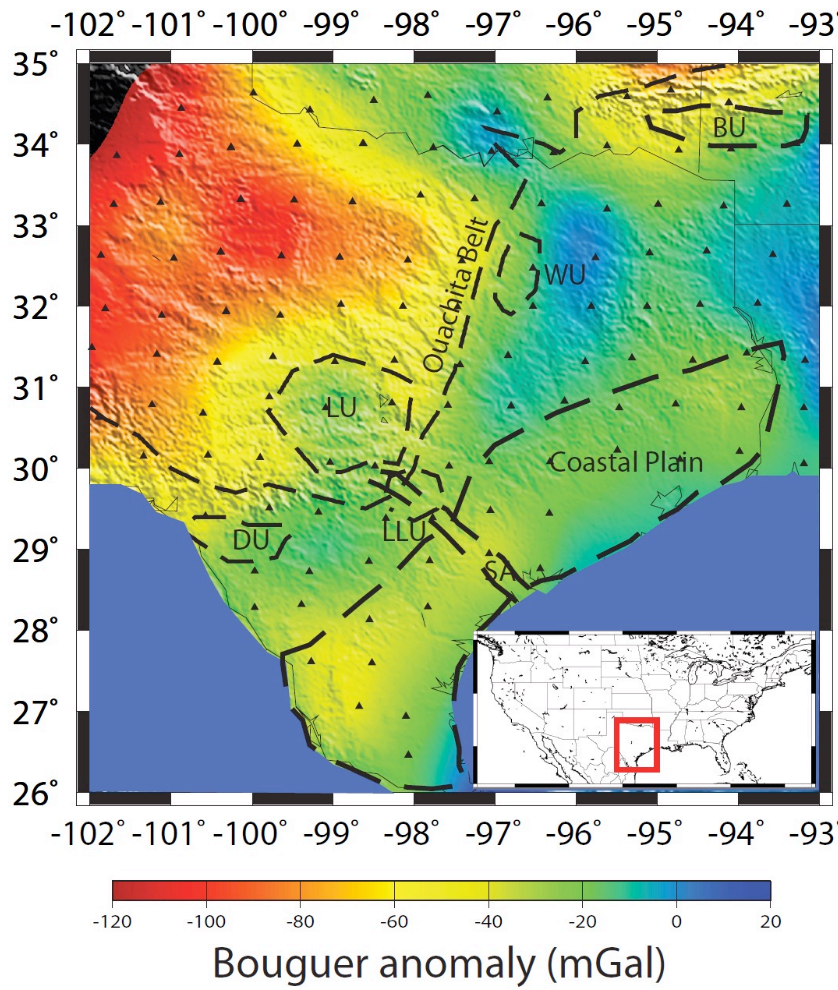


Summary for the Wyoming craton

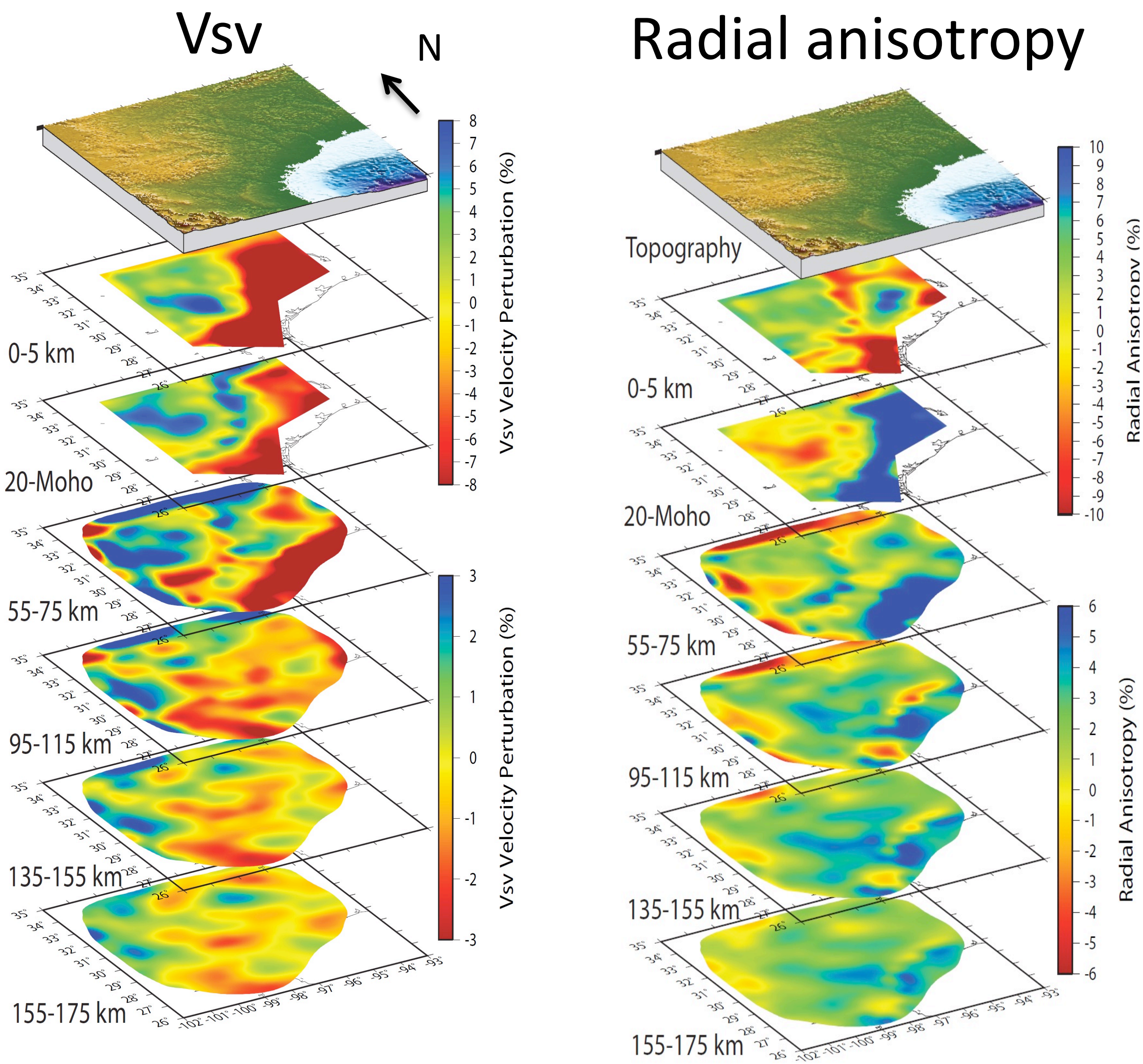
- The Wyoming cratonic lithosphere was weakened by hydration from the Farallon slab, and partially eroded by mantle upwelling and small-scale convection.
- Hot plume materials project into the craton through weak channels at the base of the lithosphere, and upwelling is likely developing at the eastern boundary of the craton.
- Radial anisotropy provides additional constraints for the crustal and mantle structure.



NW Gulf of Mexico Coast



3-D shear wave velocity and radial anisotropy models under Texas



High velocity beneath the Ouachita belt

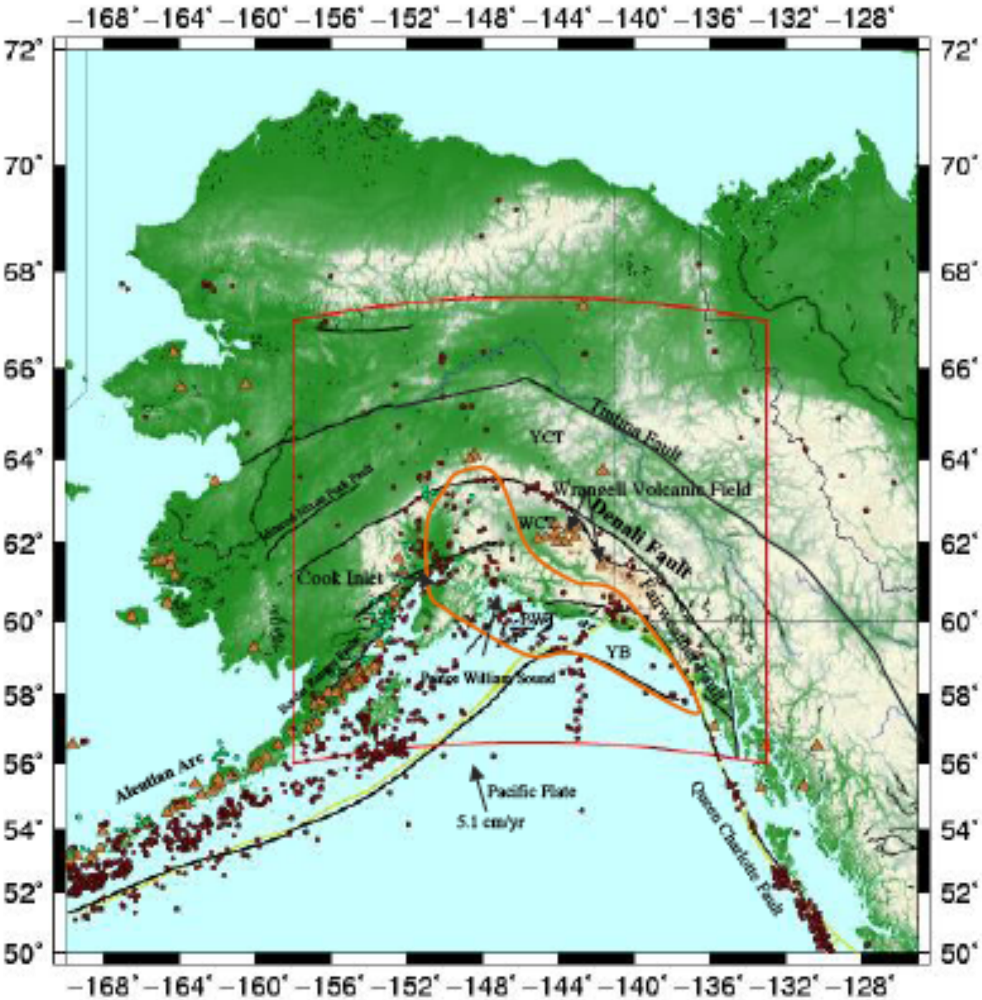
Large +anisotropy (Vsh>Vsv) in the coastal plain

Alternative high and low velocity anomalies in the asthenosphere

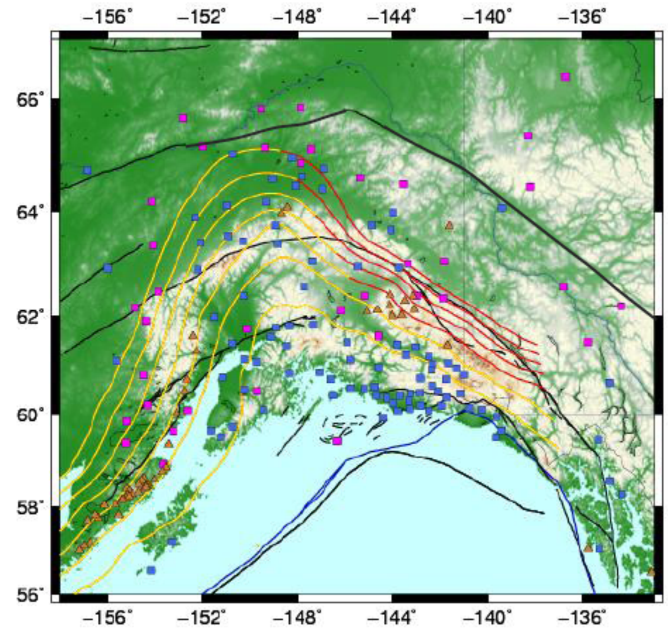
Complex relation between velocity and anisotropy

(Yao and Li, GRL,2016)

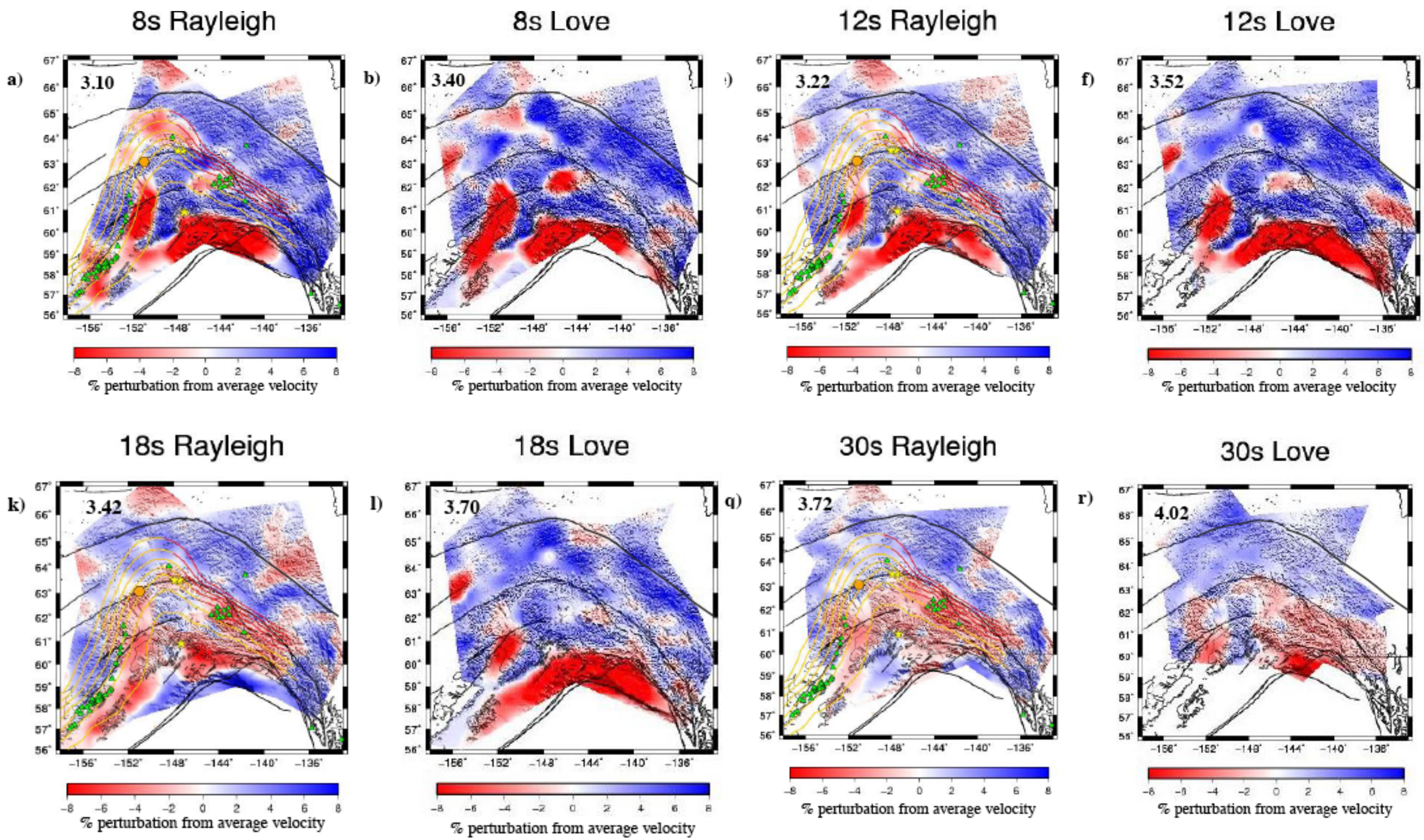
(Yao and LI, in prep)



Station distribution



Rayleigh and Love wave phase velocities in Alaska



(Pepin and Li, in prep)

The Legacy of EarthScope

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Develop anisotropic velocity models

Get into the details

THANK YOU

QUESTIONS?