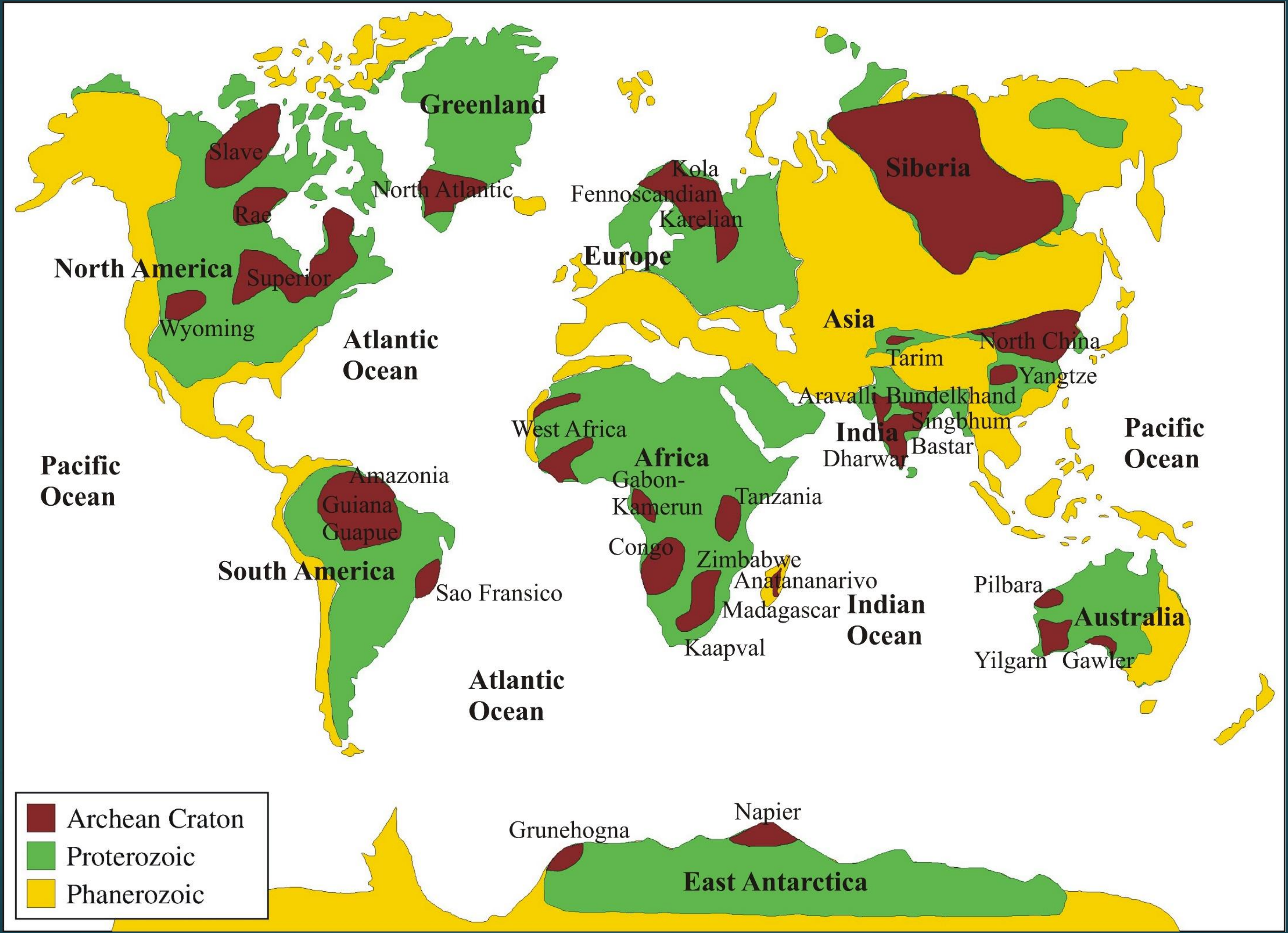
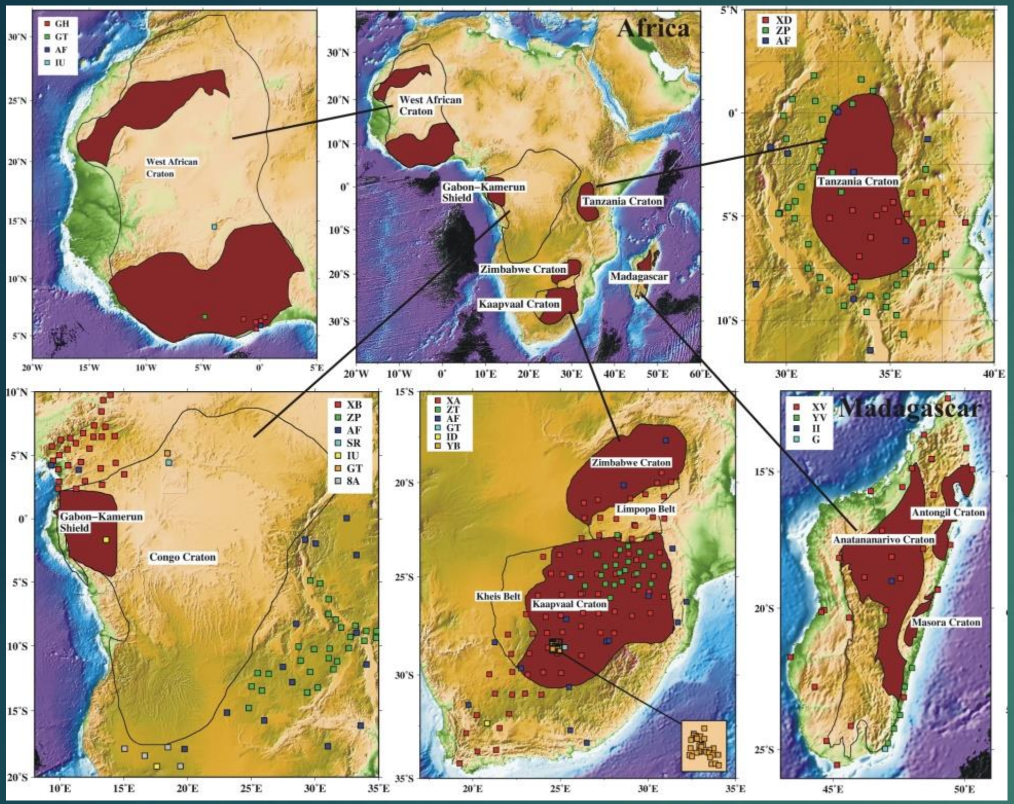
Seismic P wave Receiver Function Modelling of Archean Cratonic Crust: A Global Perspective

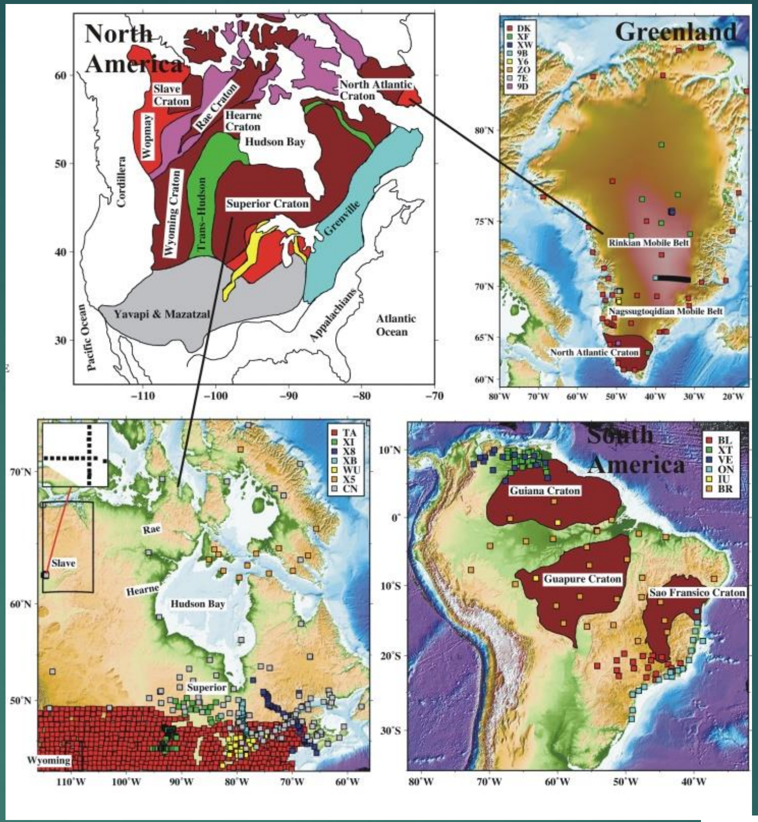
POULAMI ROY, KAJALJYOTI BORAH

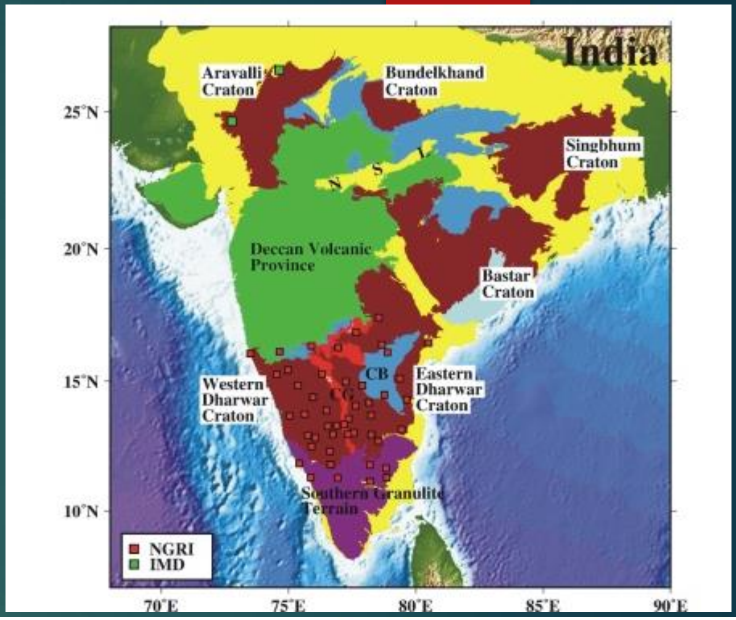
Global Cratons

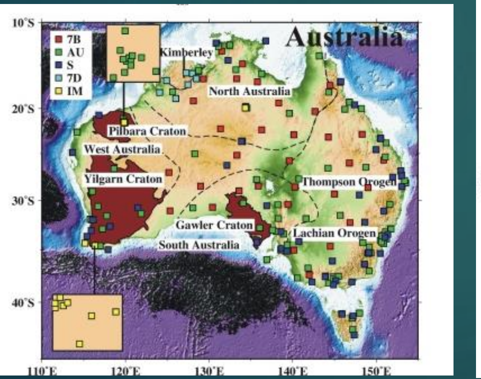


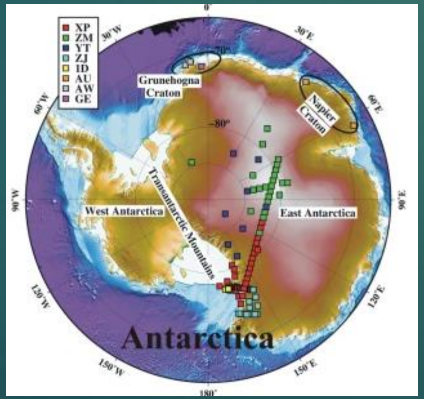
Global Seismic Stations (IRIS)

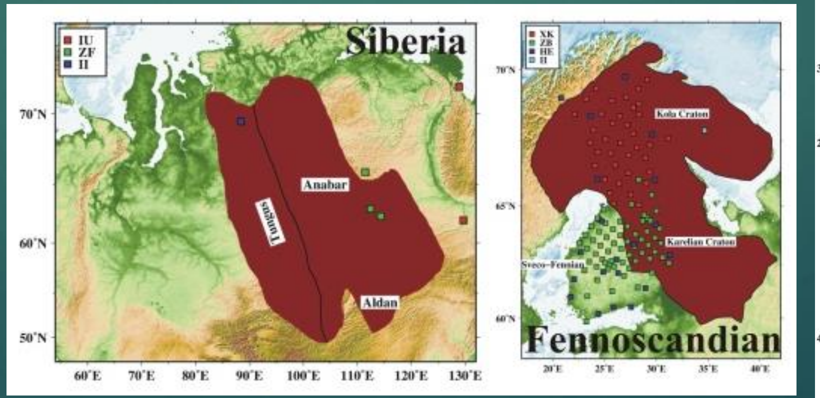


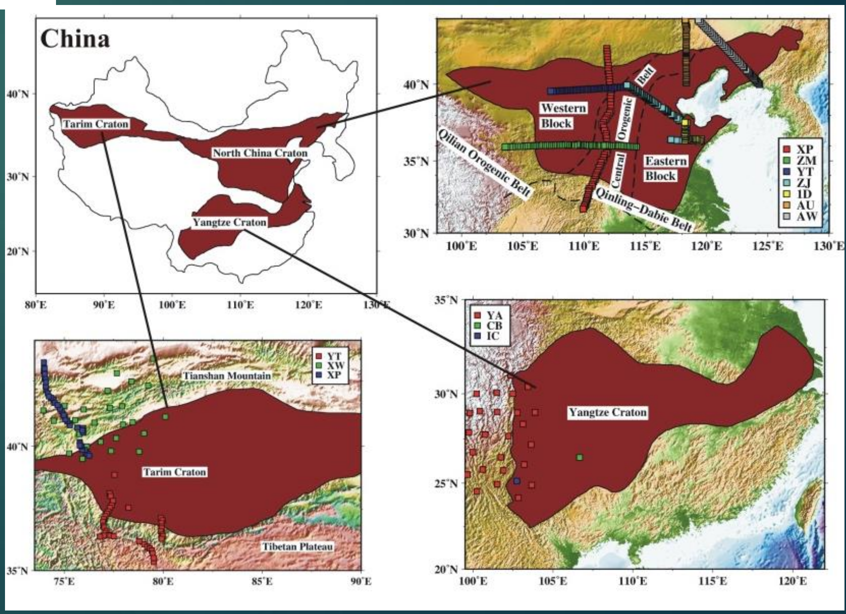








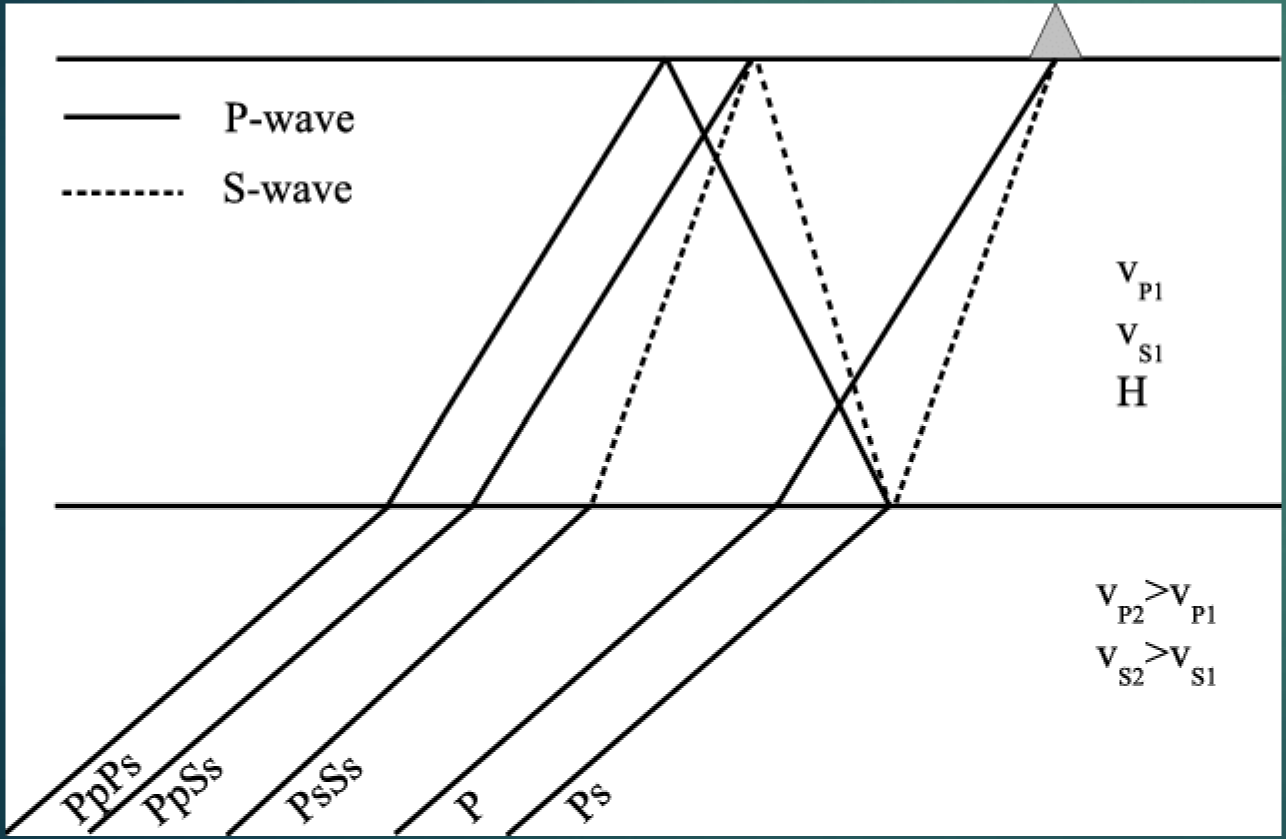


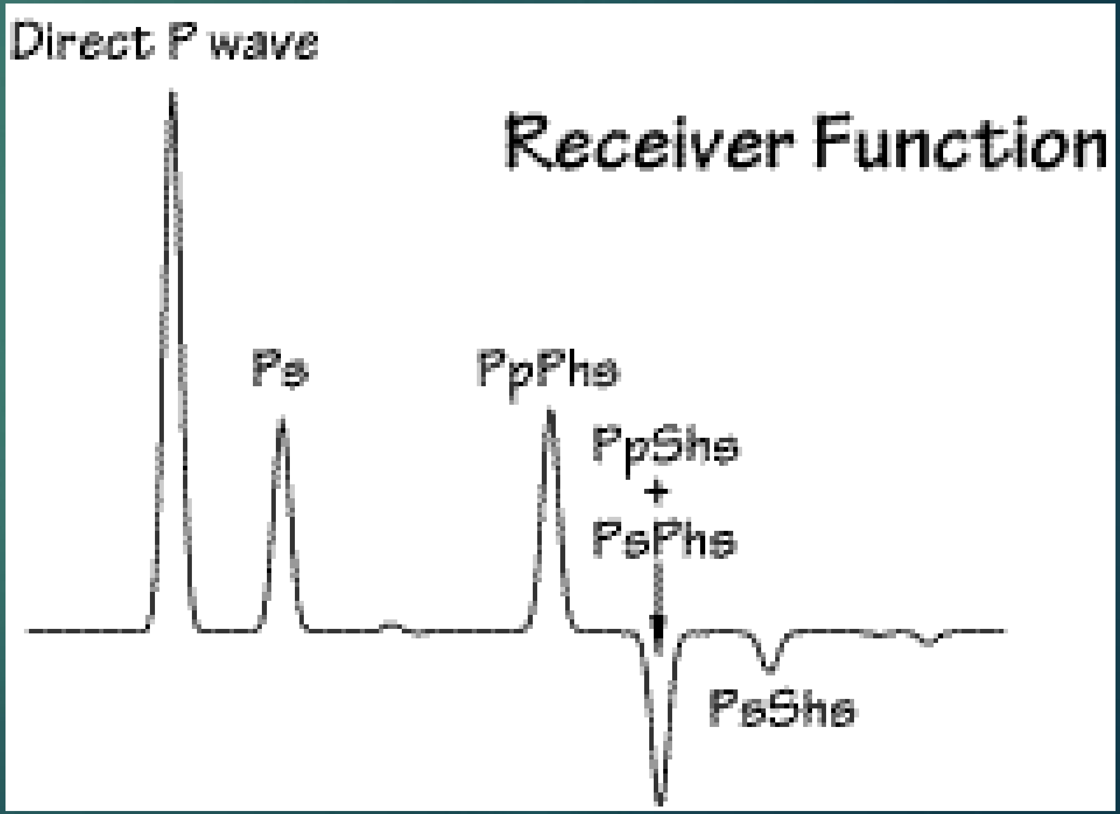


Receiver Function

- Receiver functions are time series, computed from three-component seismograms, which show the relative response of Earth structure near the receiver.
- The waveform is a composite of P-to-S converted waves that reverberate in the structure beneath the seismometer.

1. Layer thickness
2.Seismic wave velocity





Objective

- 1.Structure and composition of Archean cratonic crust.
- 2. Depth of Moho.
- 3.Globally consistent evolutionary model of Archean cratons.

H-k Stacking

$$s(H,k) = w_1 r(t_1) + w_2 r(t_2) - w_3 r(t_3)$$

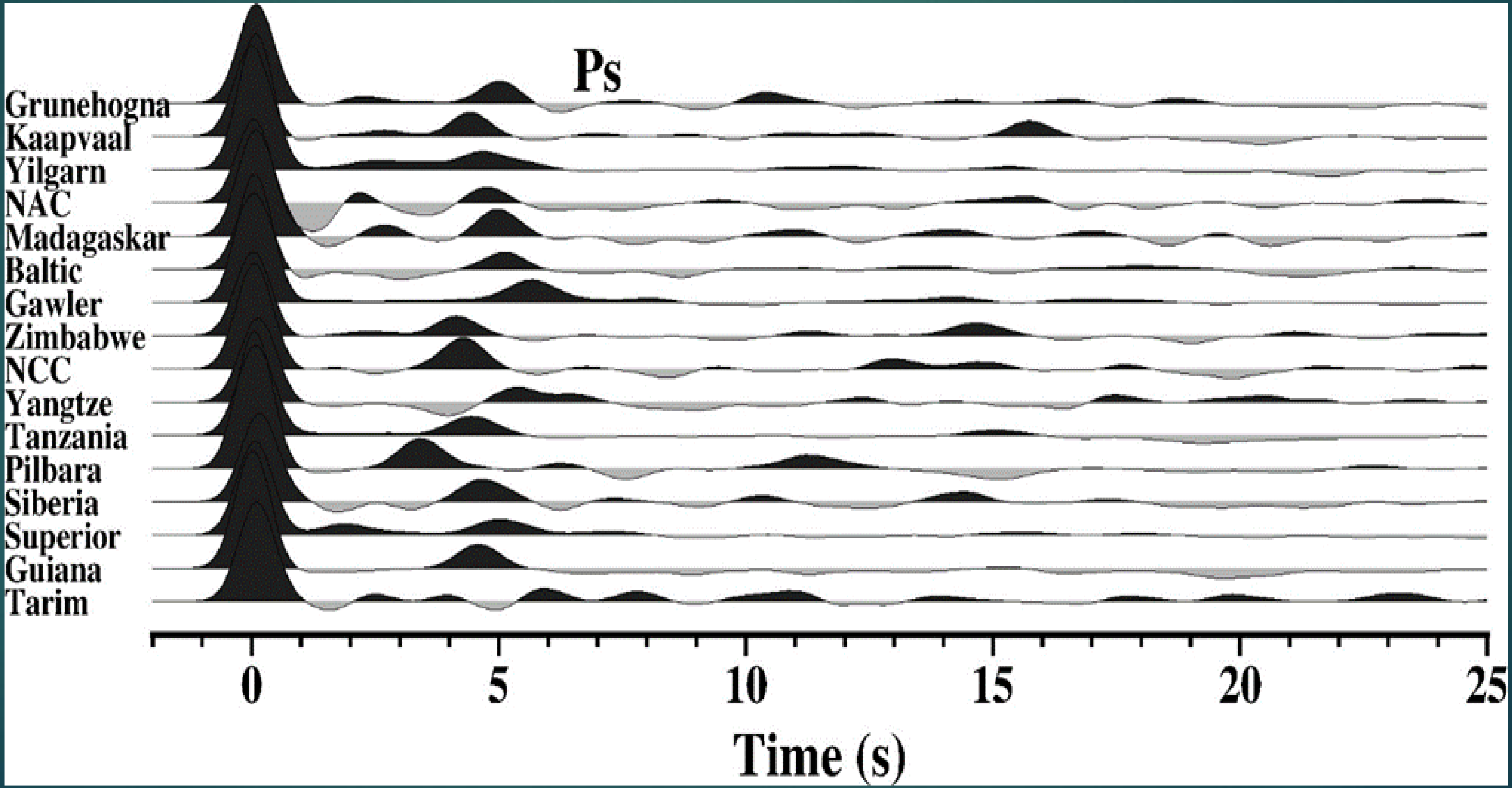
- where r(t) is the radial receiver function,

$$\sum w_i = 1$$

- The w_i are weighting factors.
- The $s(H,k)$ reaches maximum when all three phases are stacked coherently with the correct H and k.

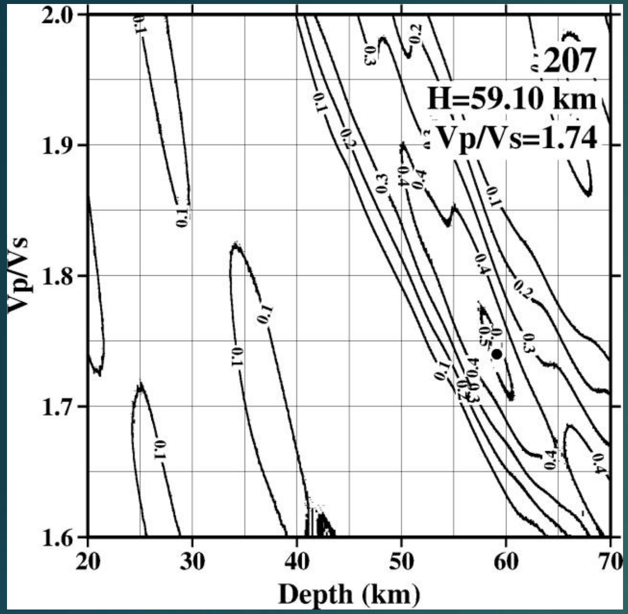
Zhu and Kanamori 2000

Receiver Functions of Global Cratons

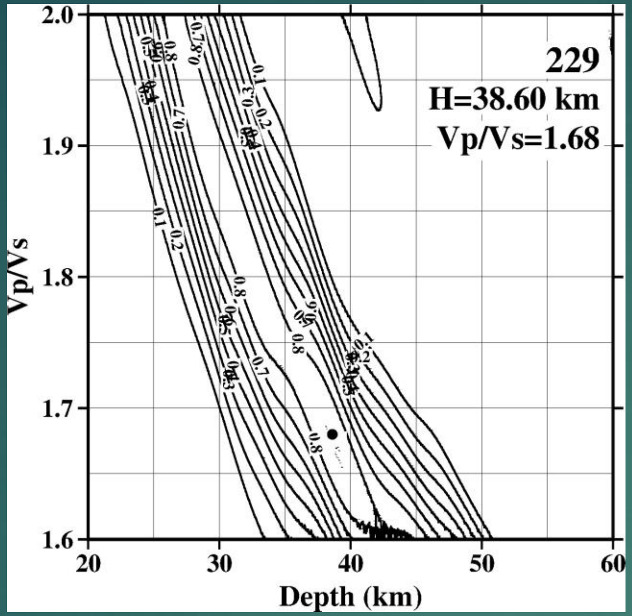


Results from H-k stacking

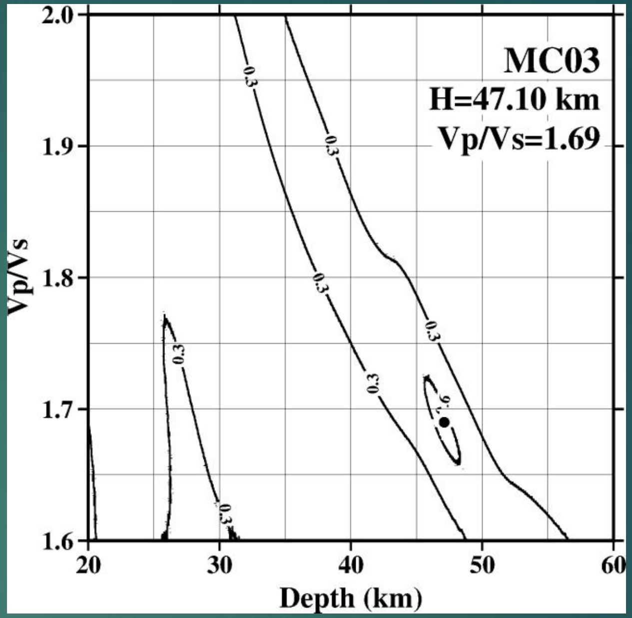
Tarim



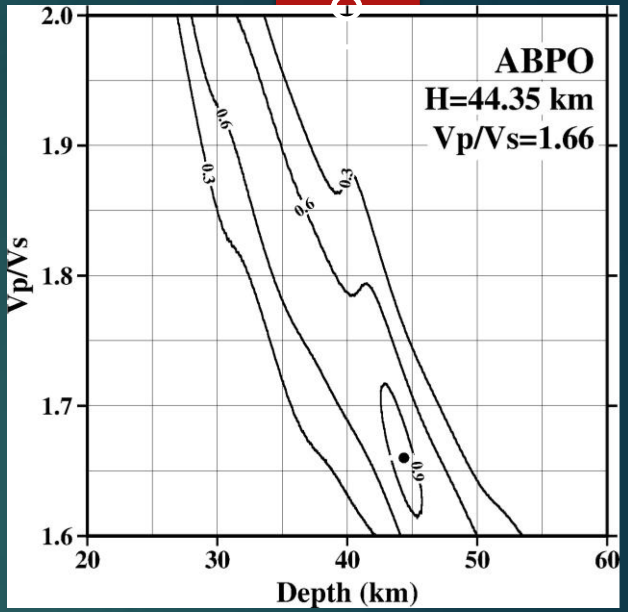
NCC



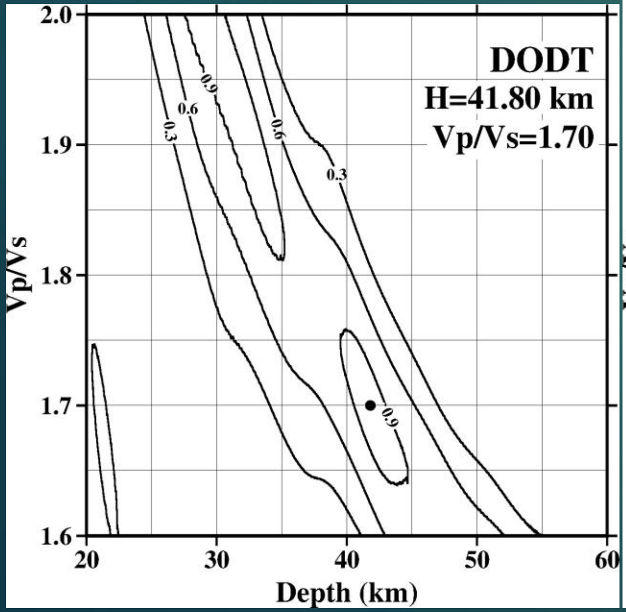
Yangtzee



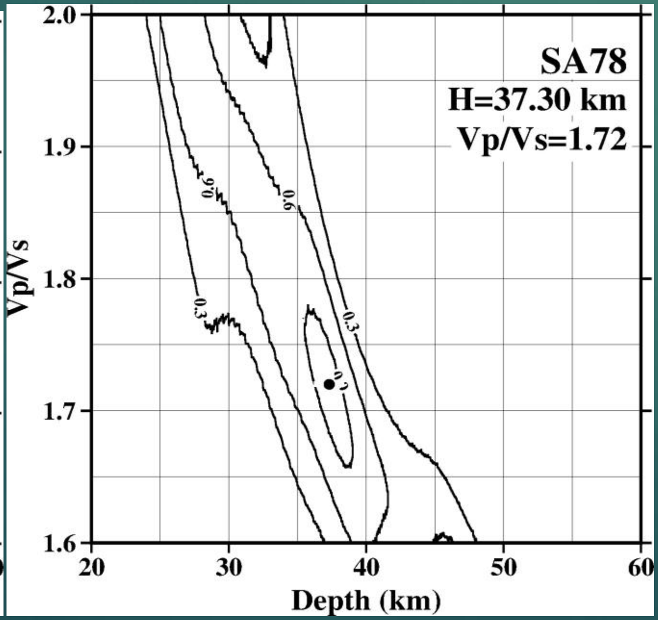
Antananarivo



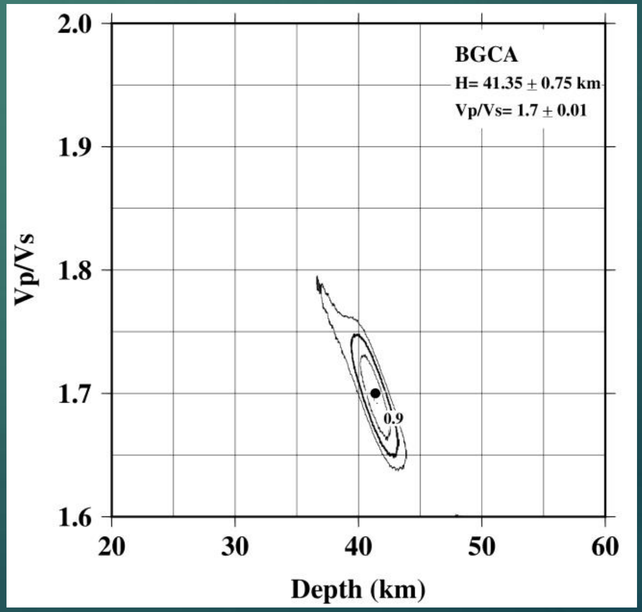
Tanzania



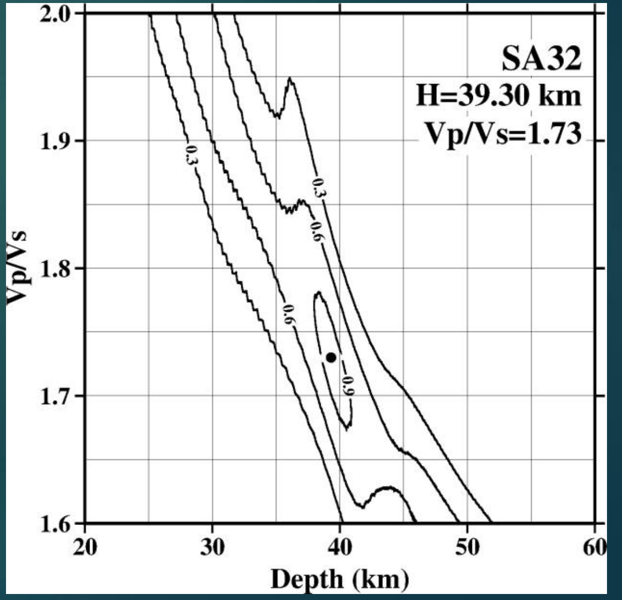
Zimbabwe



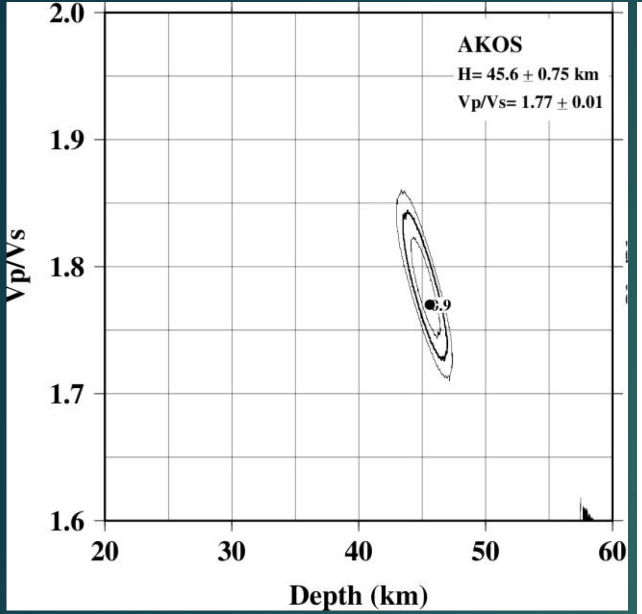
Congo



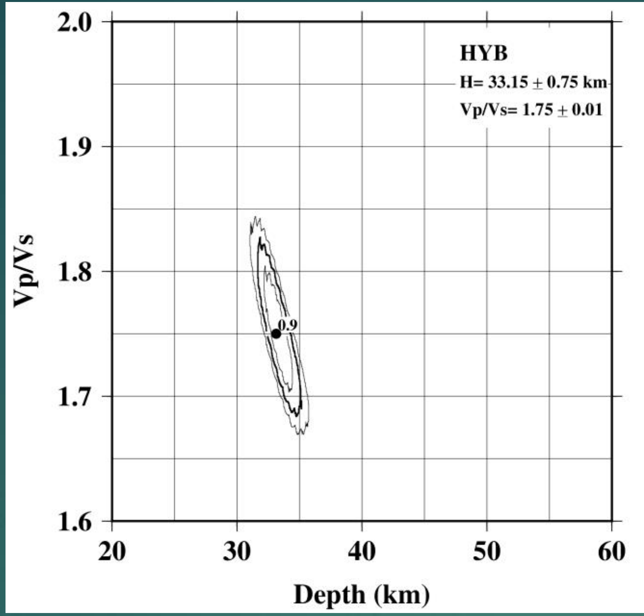
Kaapvaal



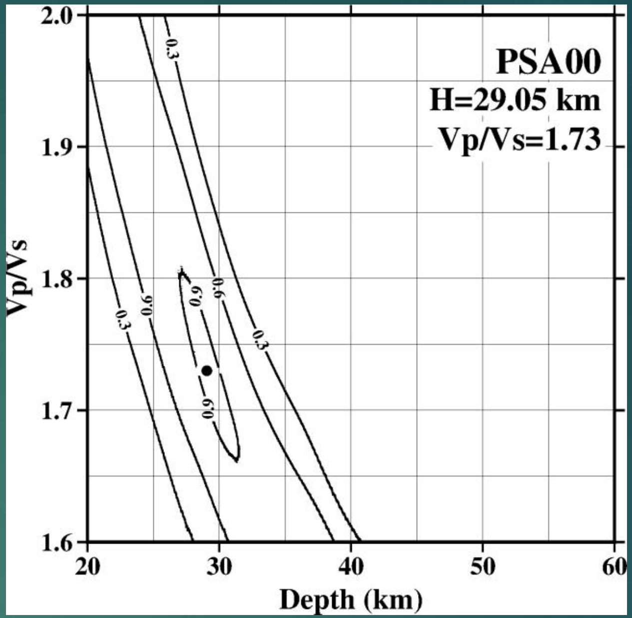
WAC



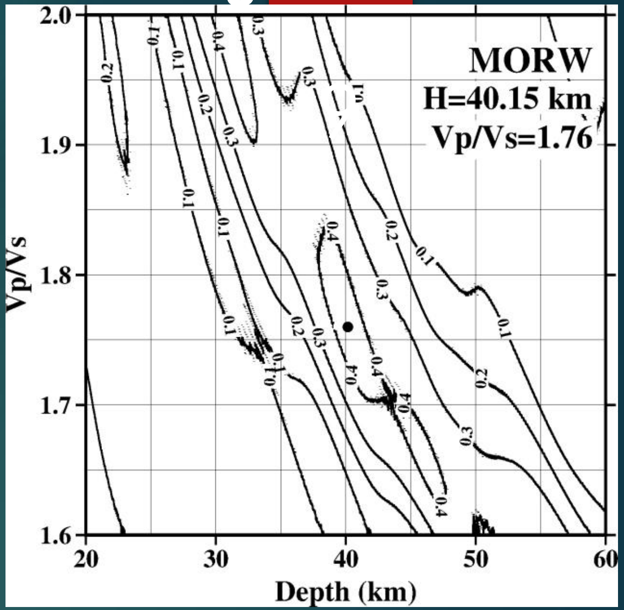
Dharwar



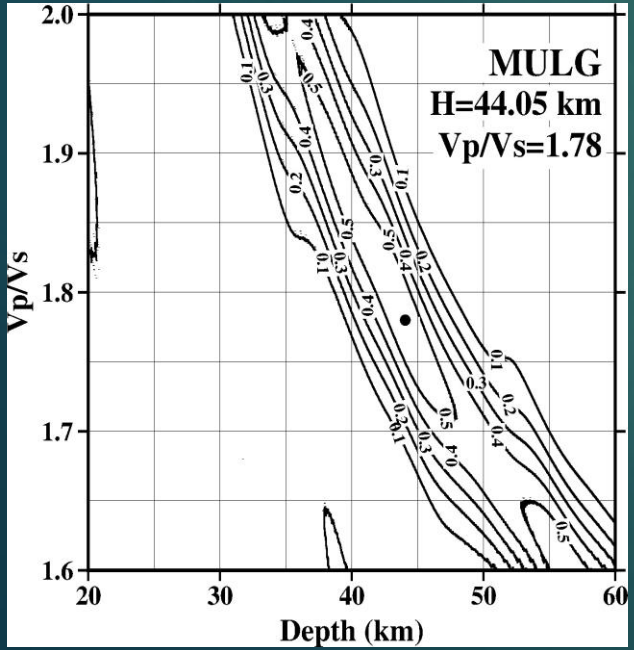
Pilbara



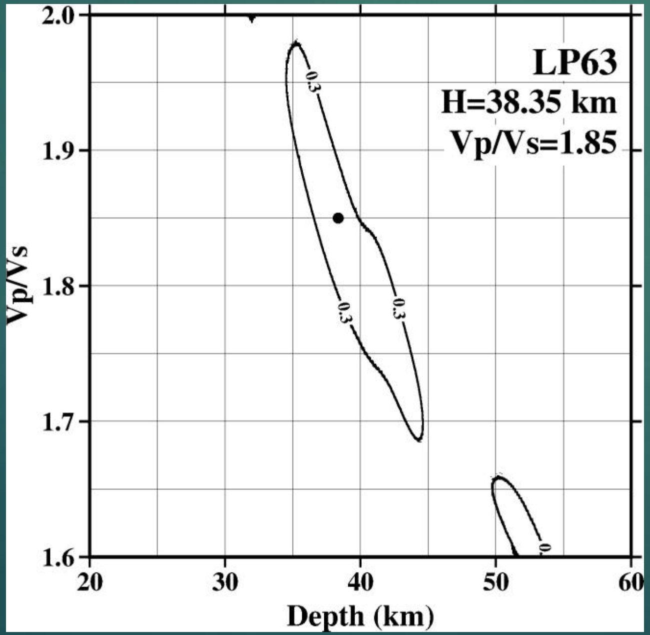
Yilgarn



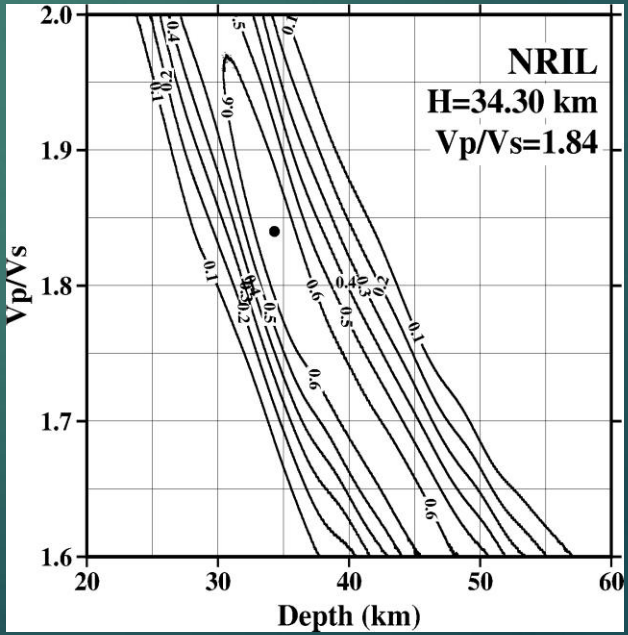
Gawler



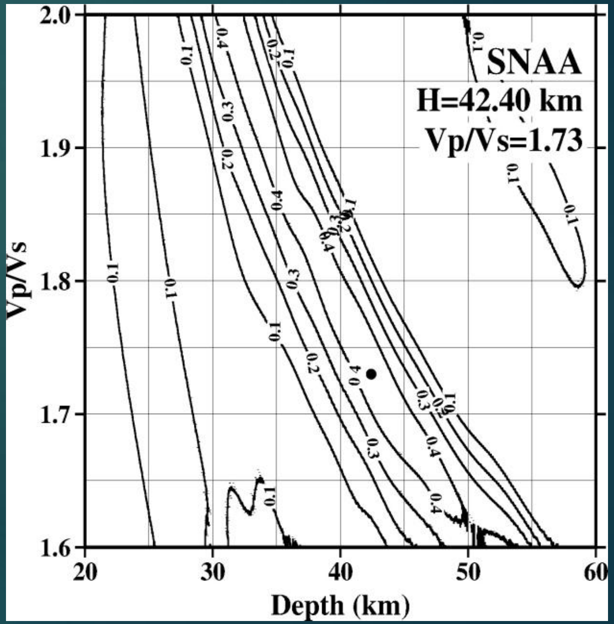
Baltic



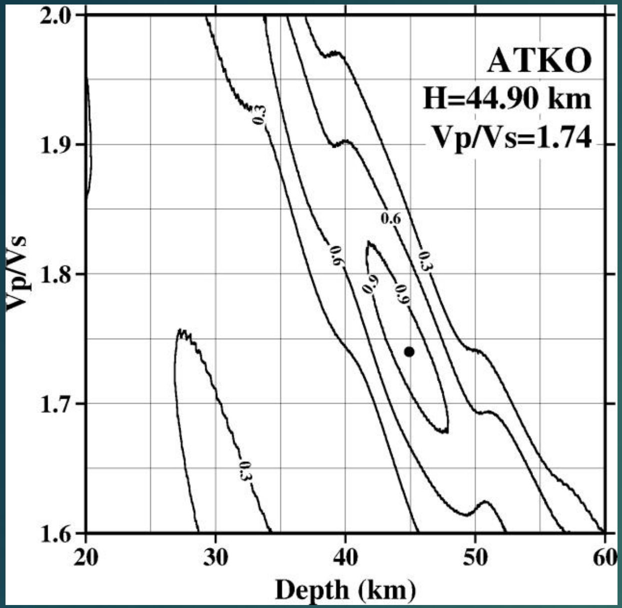
Tungus



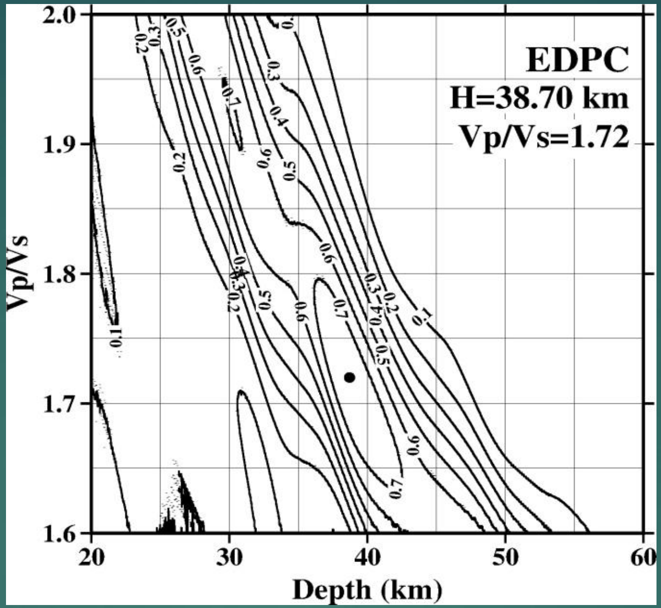
Grunehogna



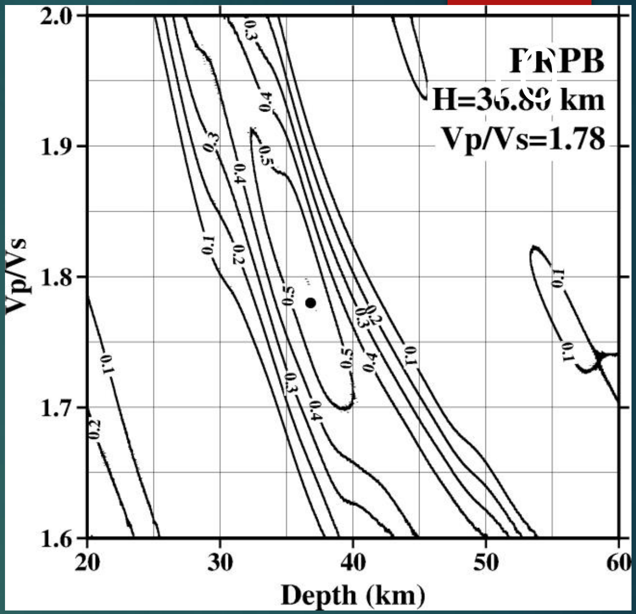
Superior



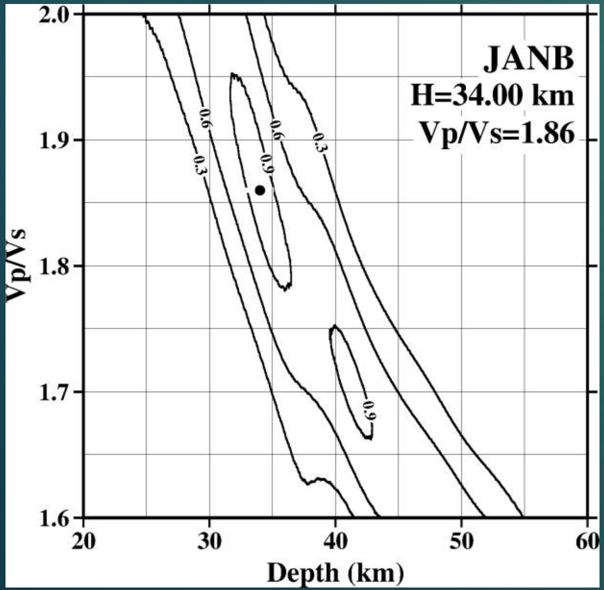
Guiana



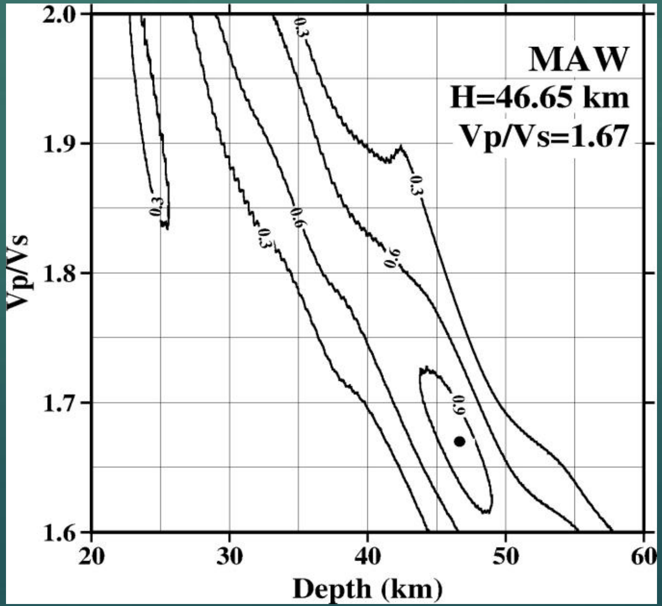
Guapure



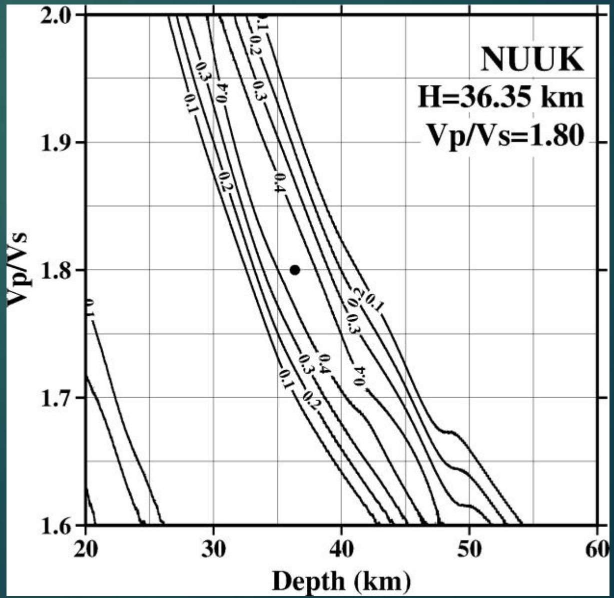
SaoFrancisco



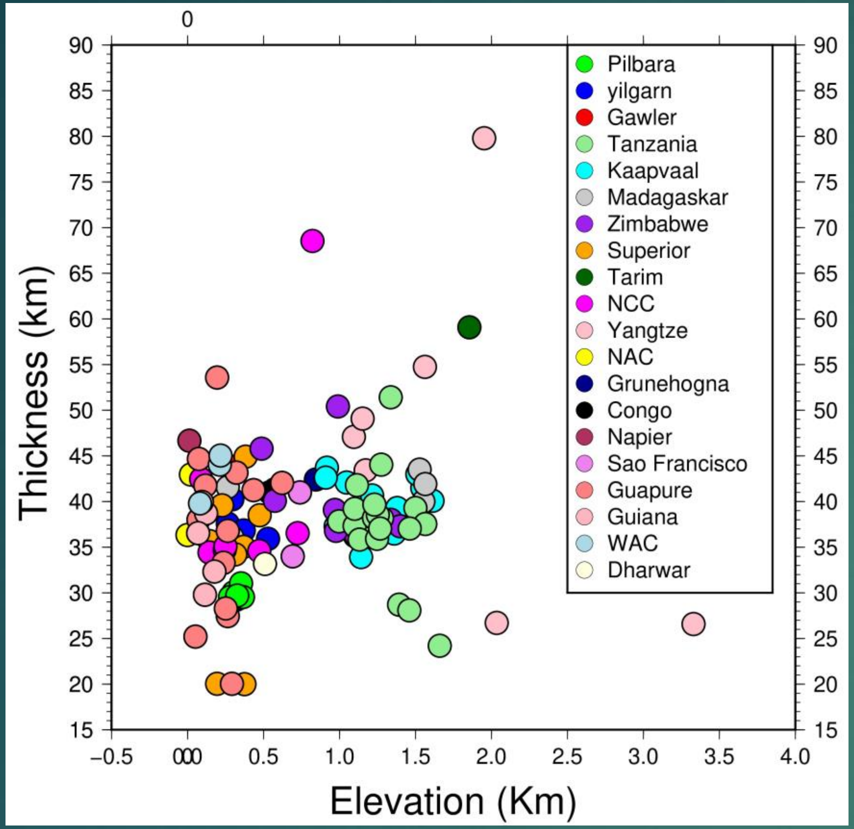
Napier

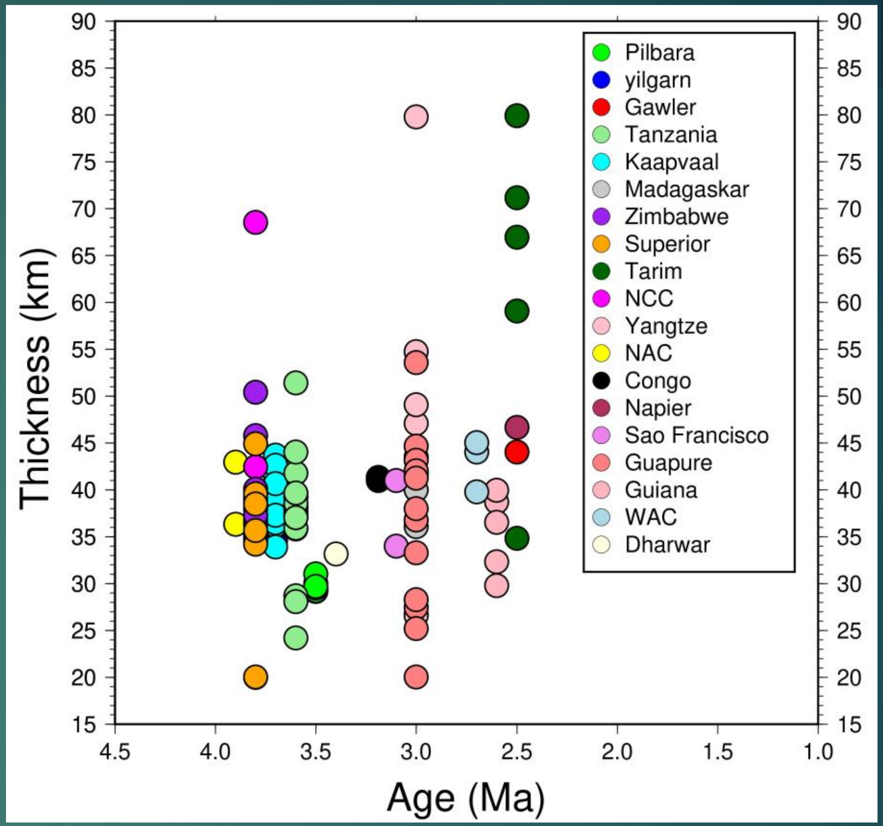


NAC Greenland



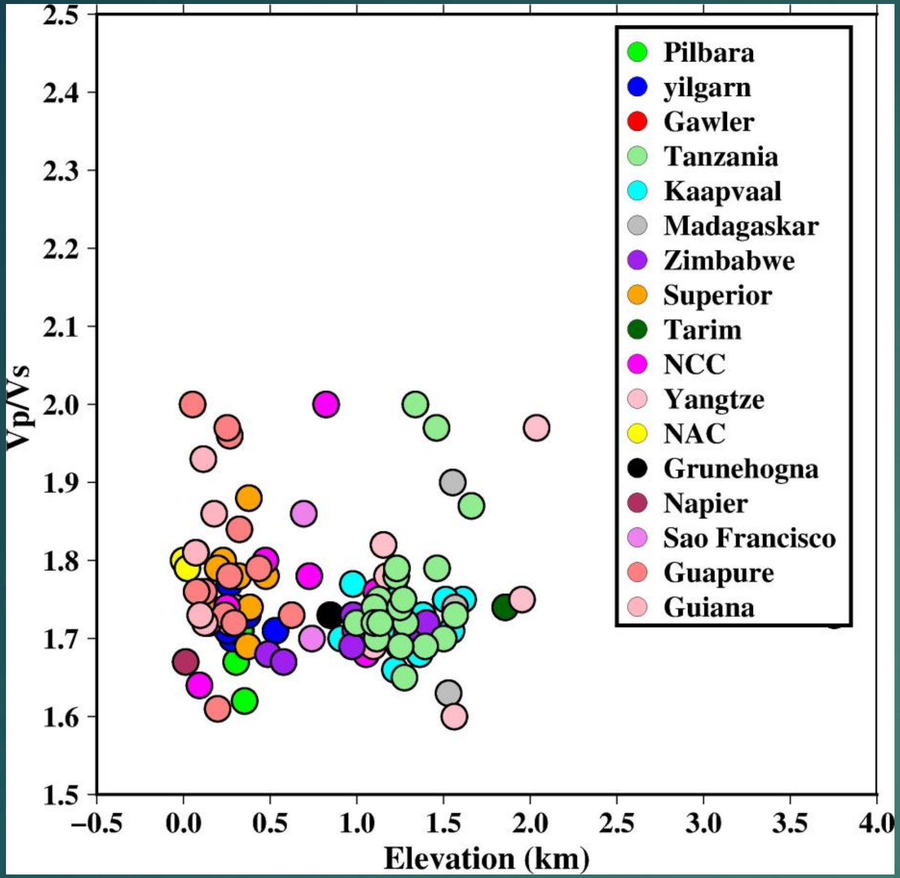
Interpretation

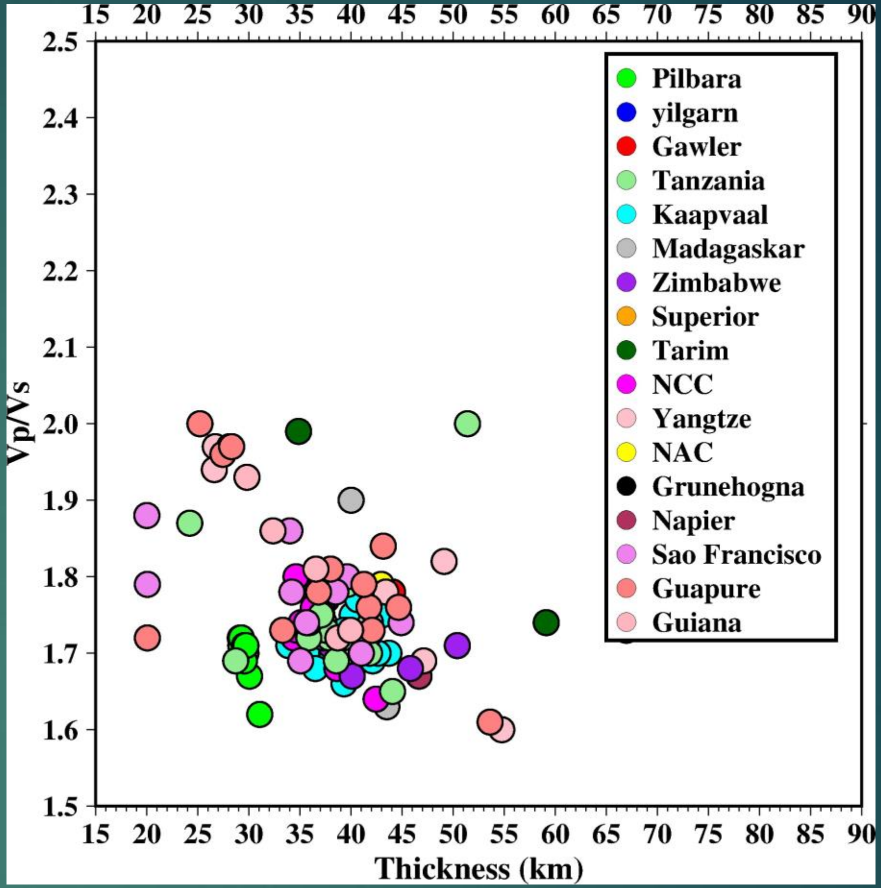




- Higher thickness corresponds to higher elevation.
- Cratonic roots are preserved.

- Older cratons have thinner crusts compared to younger cratons.
- Older cratonic crusts suffered delamination and younger cratons get thickened due to basaltic underplating.





- Global correlations between Vp/Vs vs. elevation and thickness are not very significant as regional variations are predominant than global variations.
- Regional variation occurs due to later tectonic activities. If a craton is in the margin of continent-continent collision zones, the increased crustal thickness would reduce the Vp/Vs ratio and produce felsic crust.
- Whereas, magmatic intrusion in subduction zone increases Vp/Vs ratio and produce mafic crust.

Conclusion

- Most of the Archean crusts have thickness varying from 30Km – 55 Km. But cratons suffering later deformation events may have thickness >55 Km.
- Archean cratons preserved their crustal roots.
- The Vp/Vs ratio ranges between 1.7 to 1.85.
- Older Archean crusts are thinner compared to younger Archean crusts suggesting older crusts have undergone delamination and younger crusts have suffered basaltic underplating.
- Our findings are well correlated with *Durrheim & Mooney's (1994)* craton evolution processes.

References

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