Passive Seismic Studies of the Capricorn Orogen

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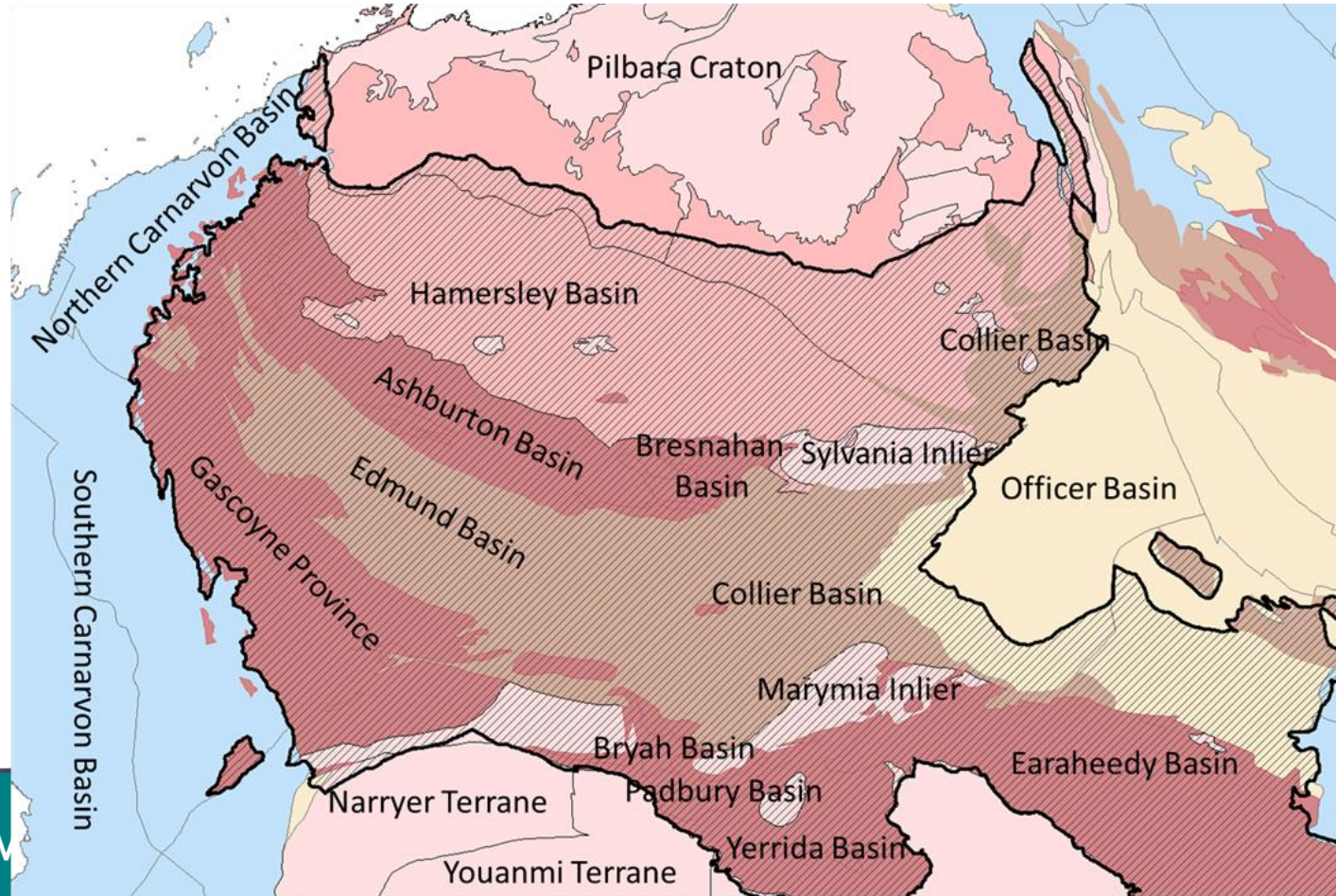
Capricorn Orogen – tectonic setting

2215–2145 Ma Ophthalmian Orogeny: collision between Pilbara Craton and Glenburgh Terrane

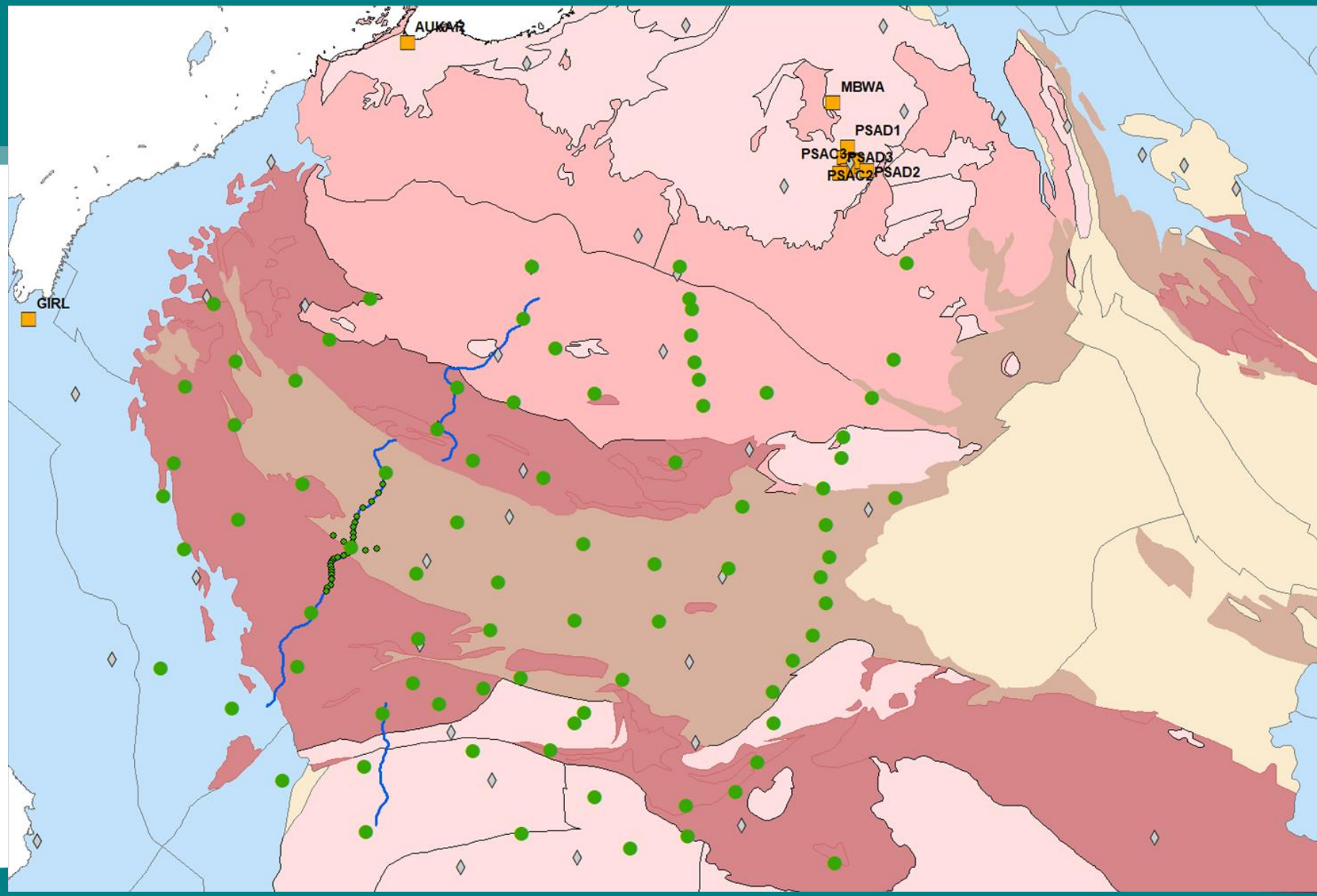
2005–1950 Ma Glenburgh Orogeny: collision between the Pilbara–Glenburgh Terrane and Yilgarn Craton

1820–1770 Ma Capricorn Orogeny: intracratonic reworking

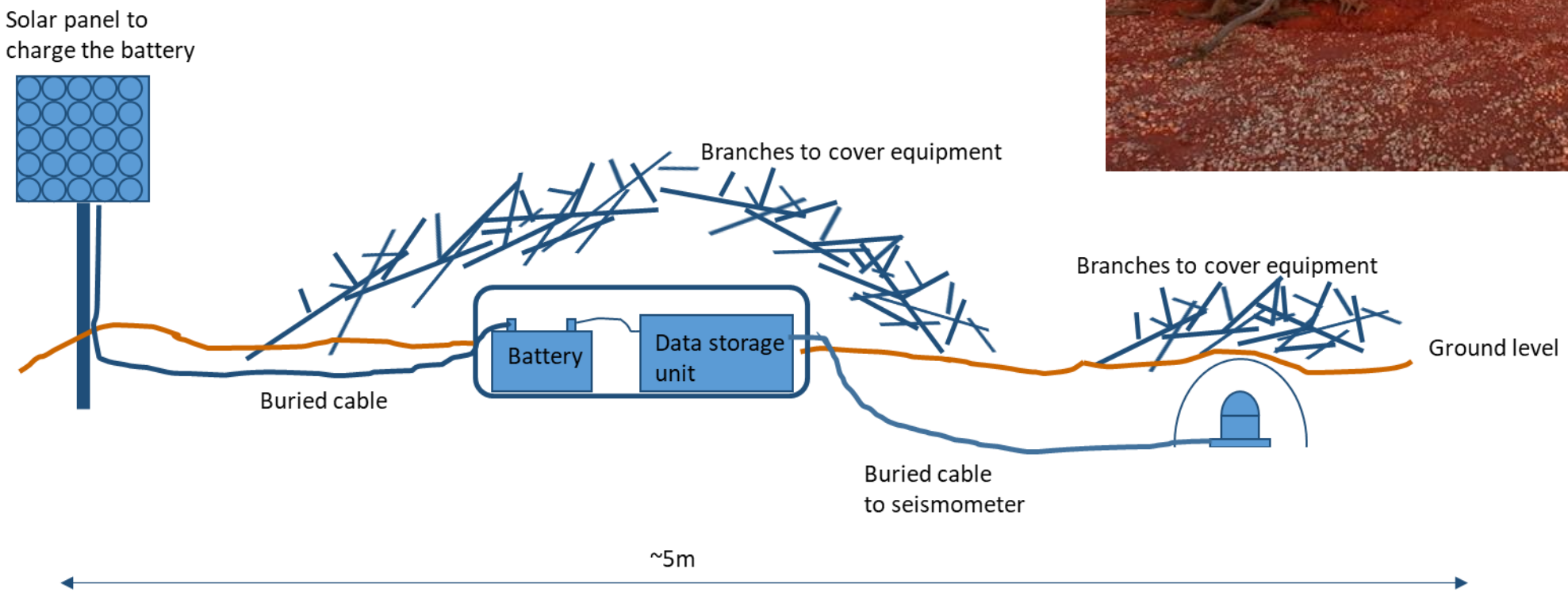


Passive seismic project

- 13GA-CP lines
- Passive Seismic Station
- Detailed study of PS
- Regional stations
- Other temporary PS

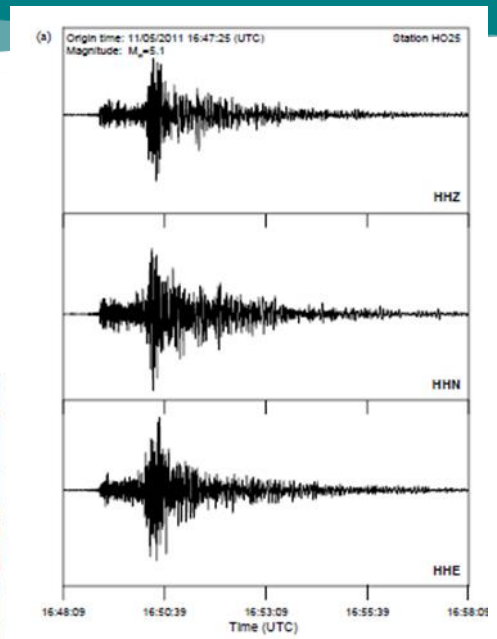


What is a seismic station?

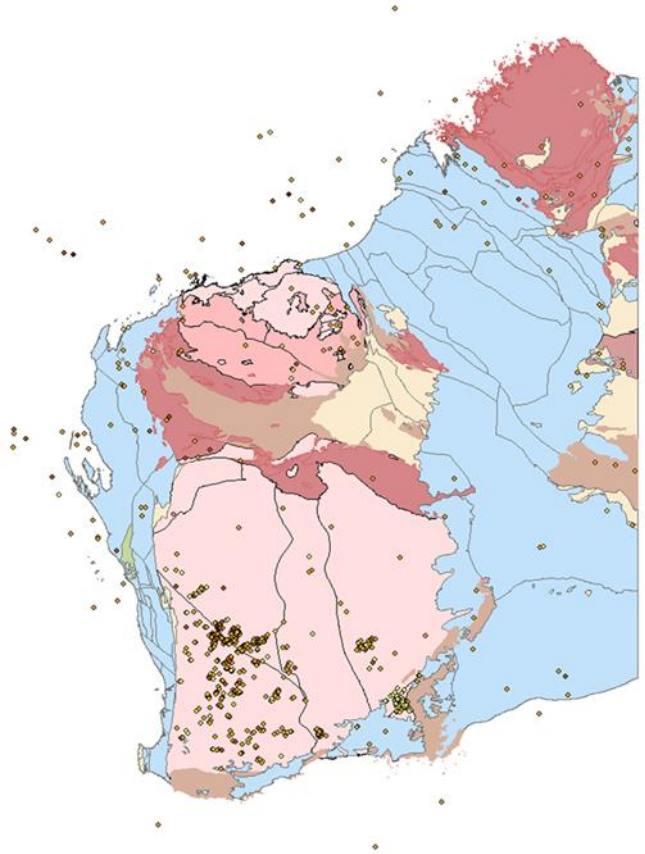


What do we record?

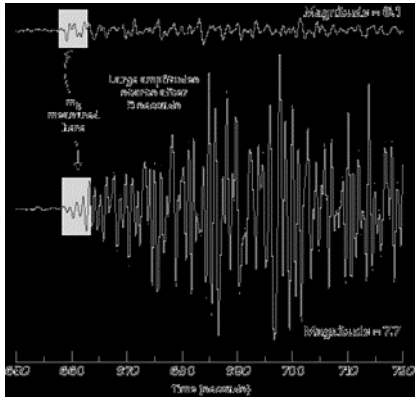
Local earthquakes



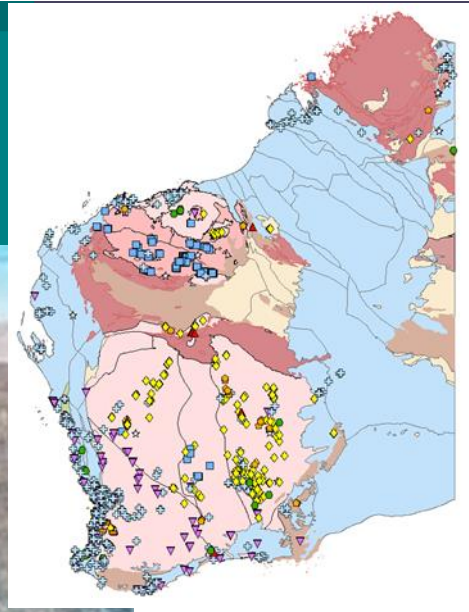
Earthquakes



Teleseism



Mine blasts

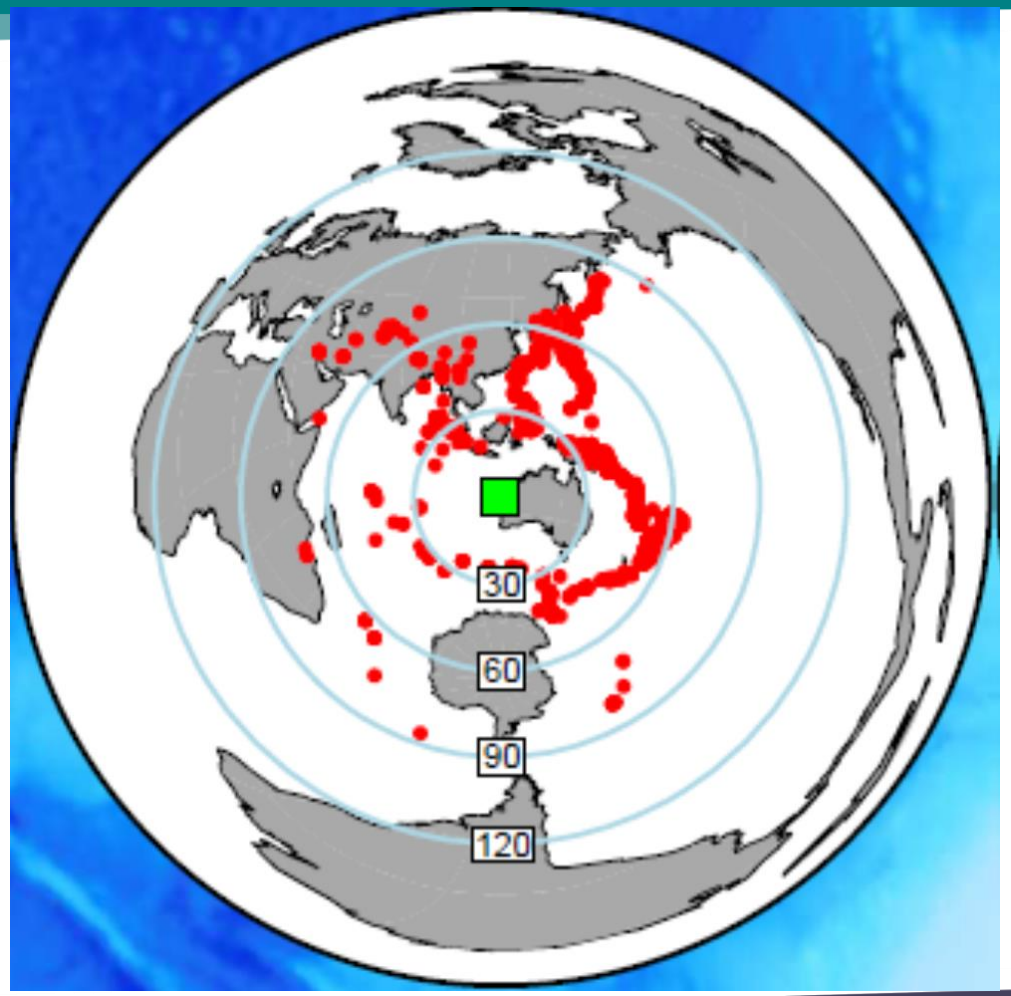


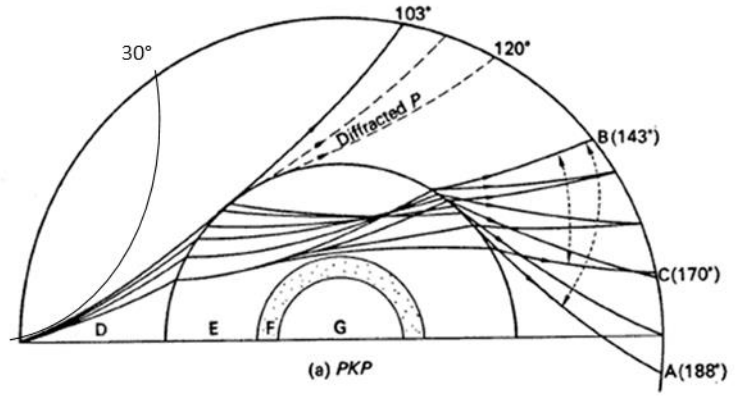
Noise – Ocean waves, trucks

Earthquakes

Teleseismic events
> 40°
> Ms 5.8

Regional events
20–40°
> Ms 5.2





Array statistics

4 years recording

8 “permanent stations” for 3 years

36 mobile stations – 1.5 years each

Total of 83 stations

70% recovery

3 terrabytes of data!!!!!!!!!

Analysis products

Receiver function analysis

1a) Moho depth (Hk technique)

1b) Crustal composition by Vp/Vs ratio (Hk technique)

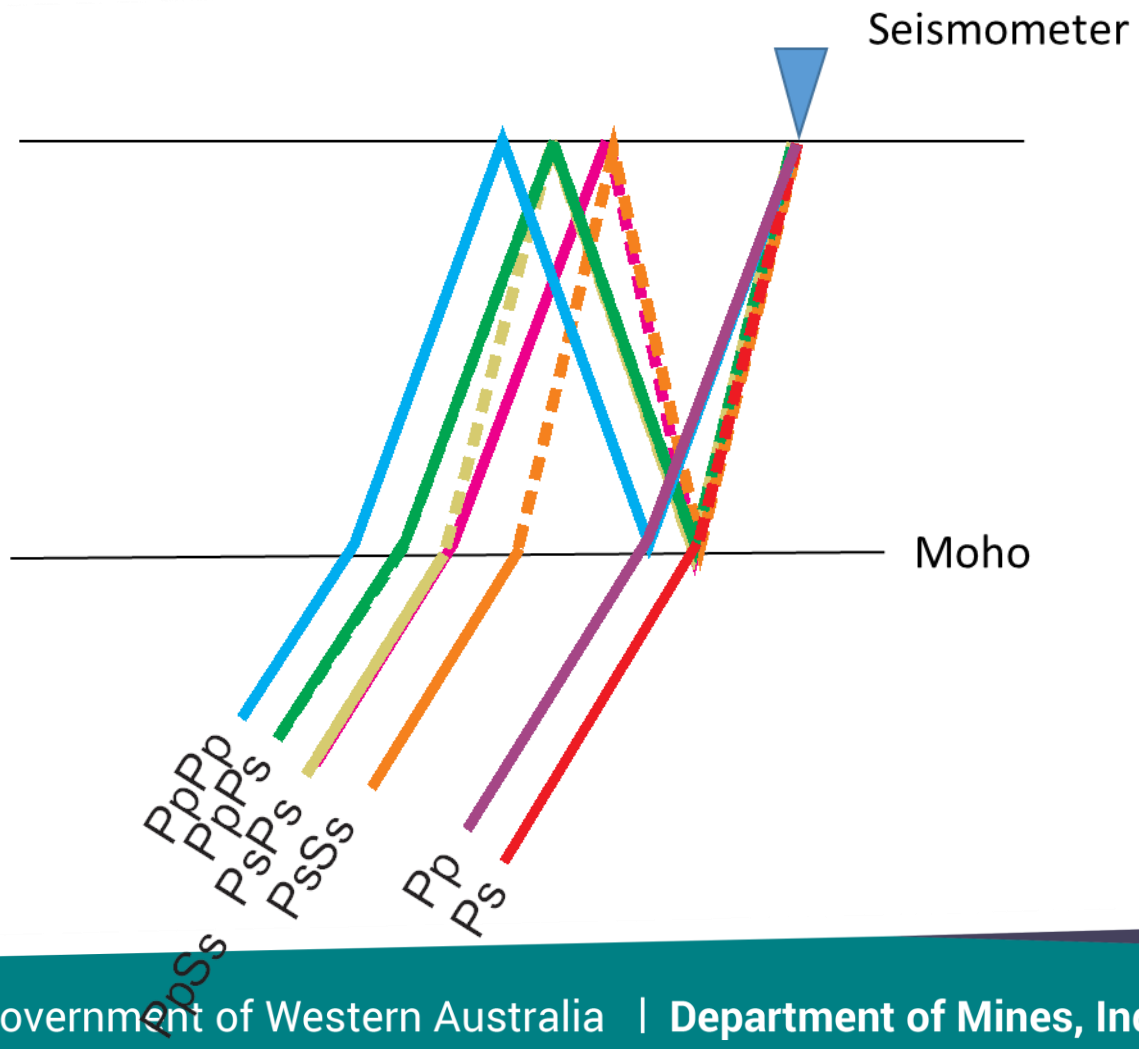
2) Common Conversion Point

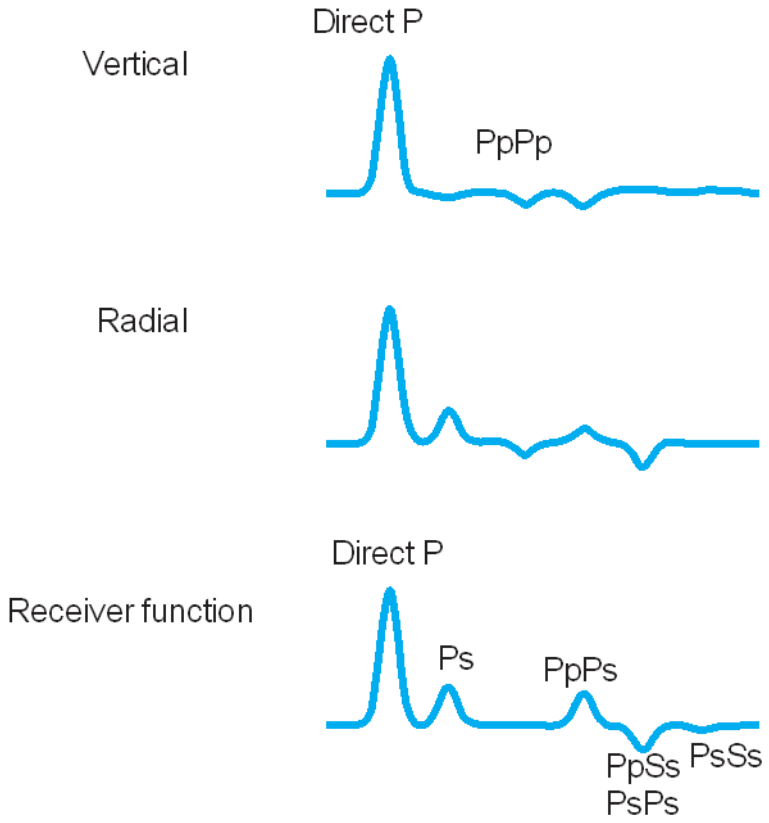
Tomography

3) Ambient noise – crustal scale tomography

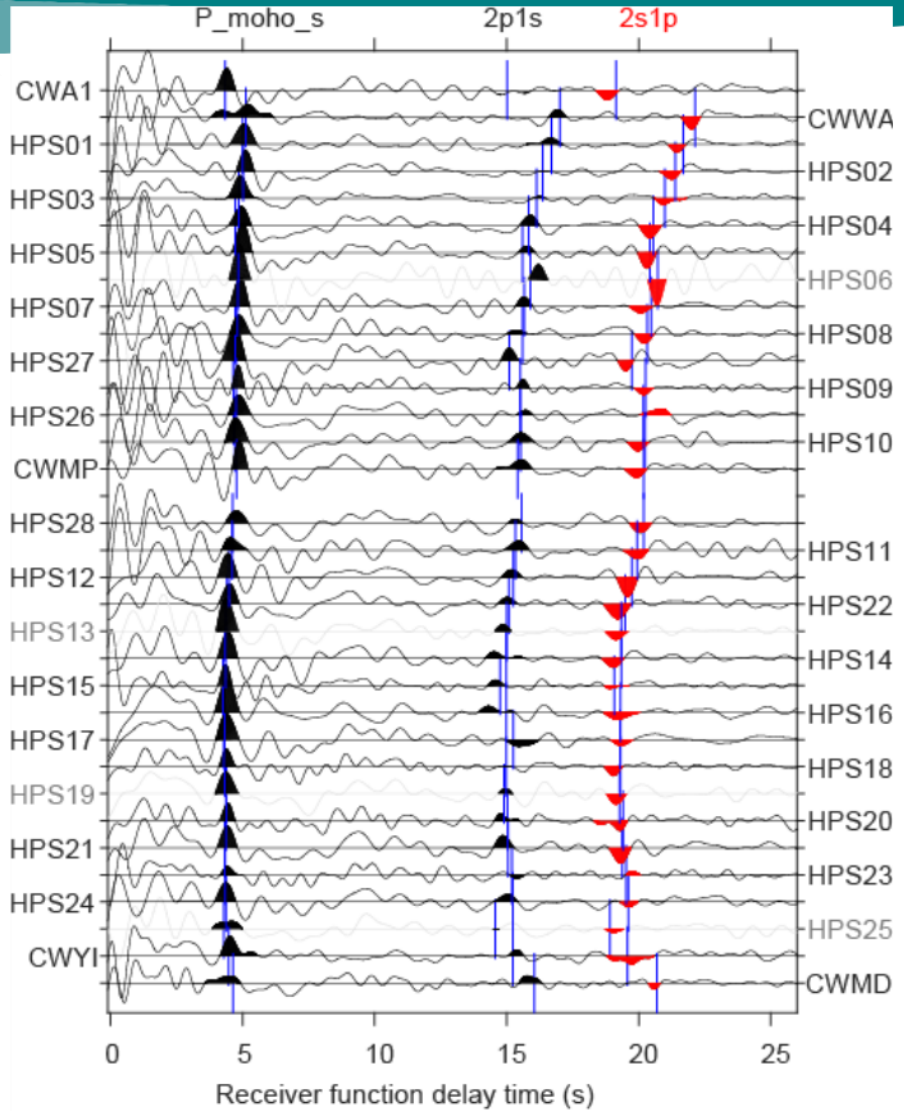
4) Body-wave tomography – lithospheric scale

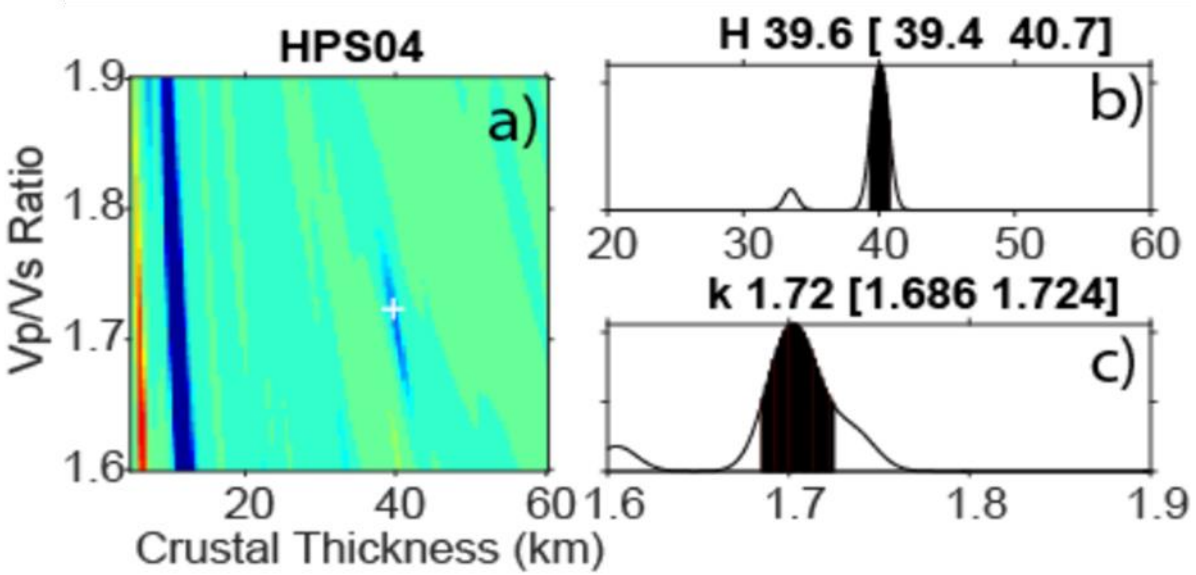
Receiver function fundamentals



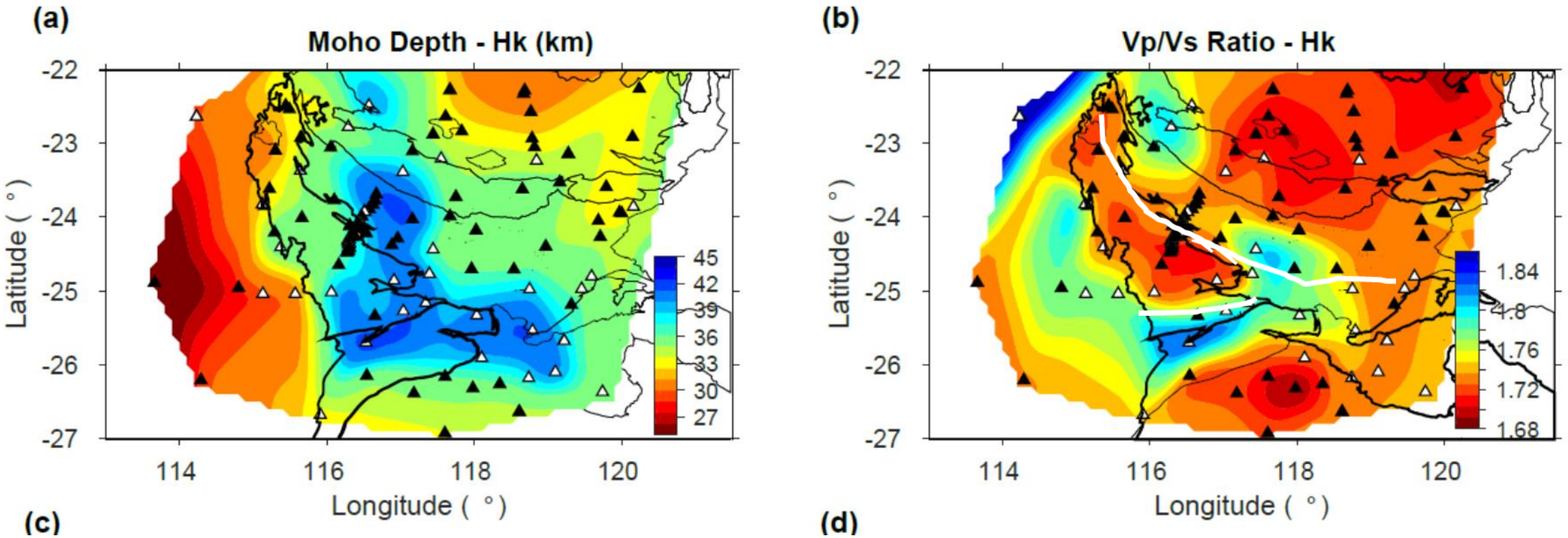


1) Moho depth and crustal composition

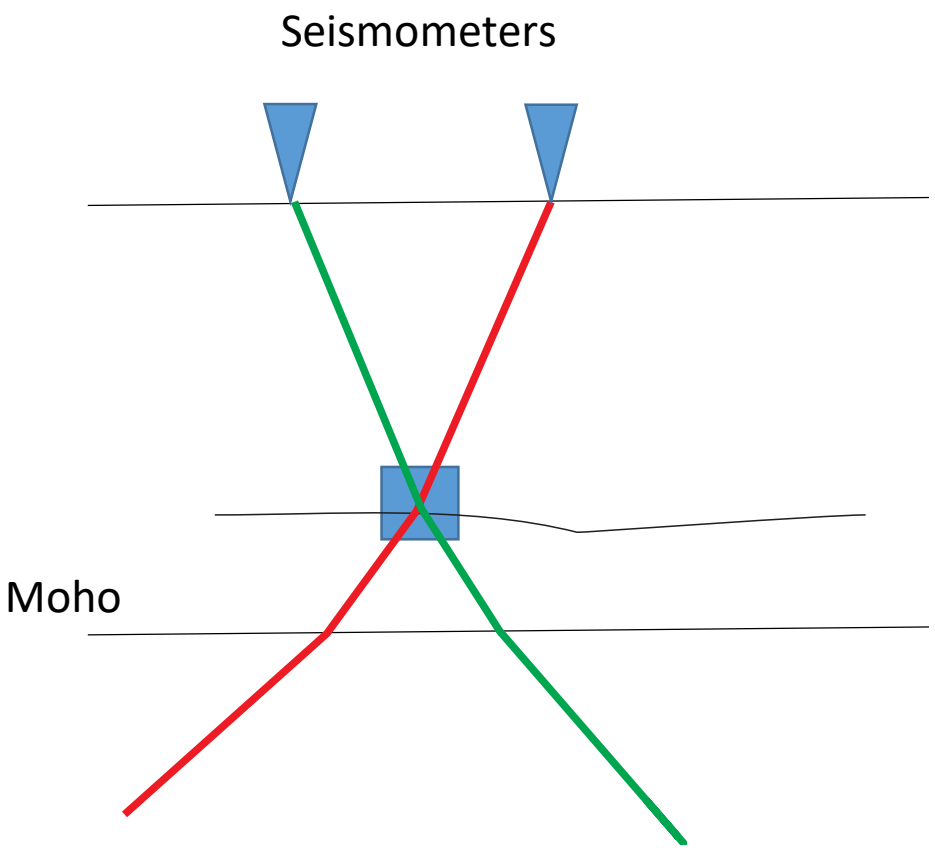


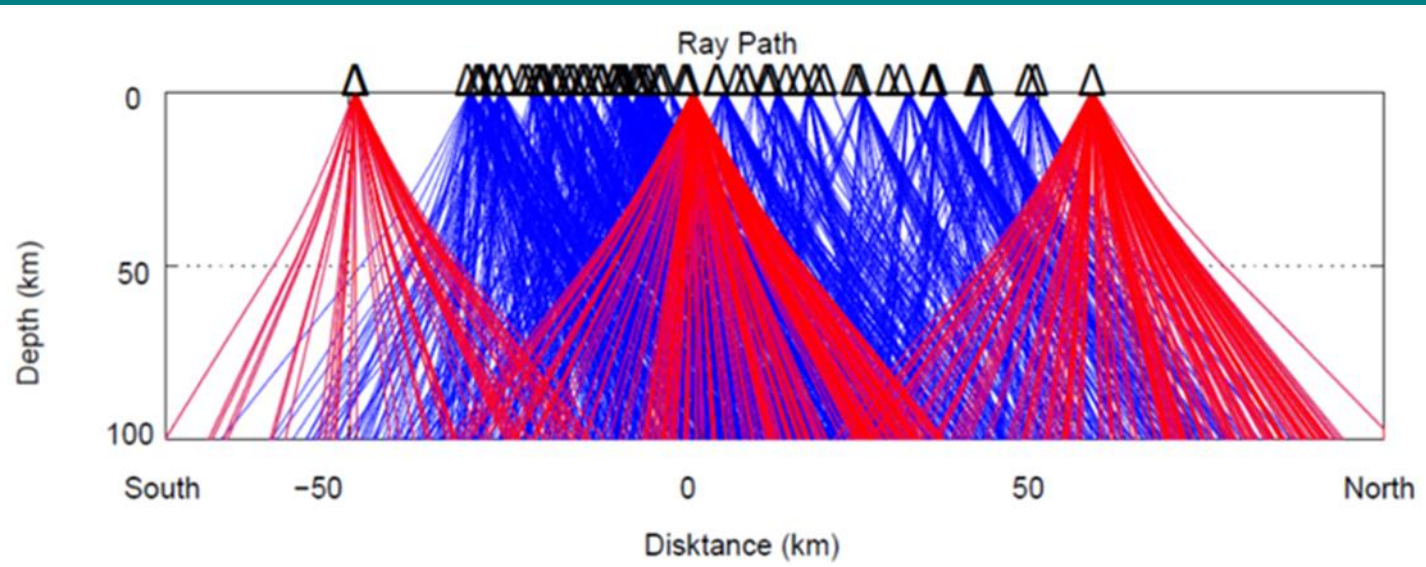


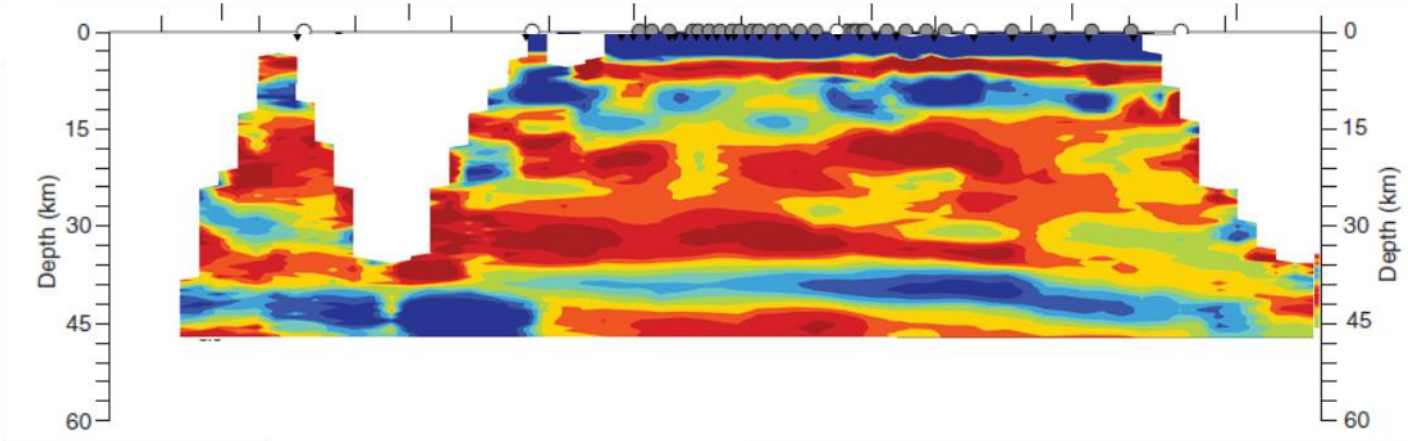
1) Moho depth and crustal composition results



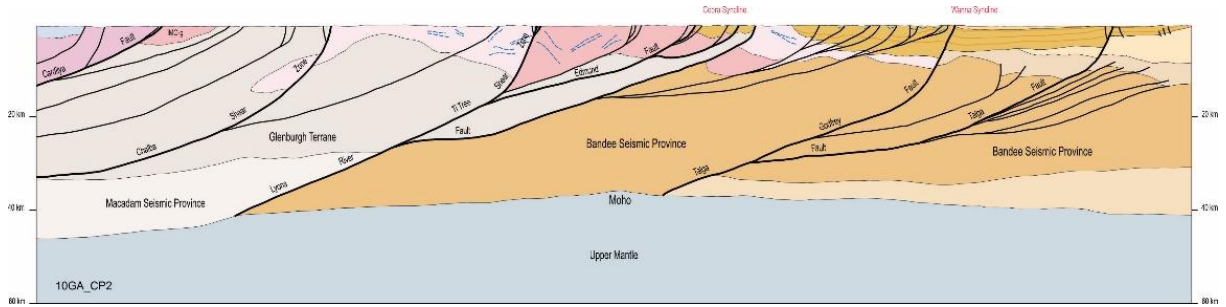
2) Common Conversion Point – CCP

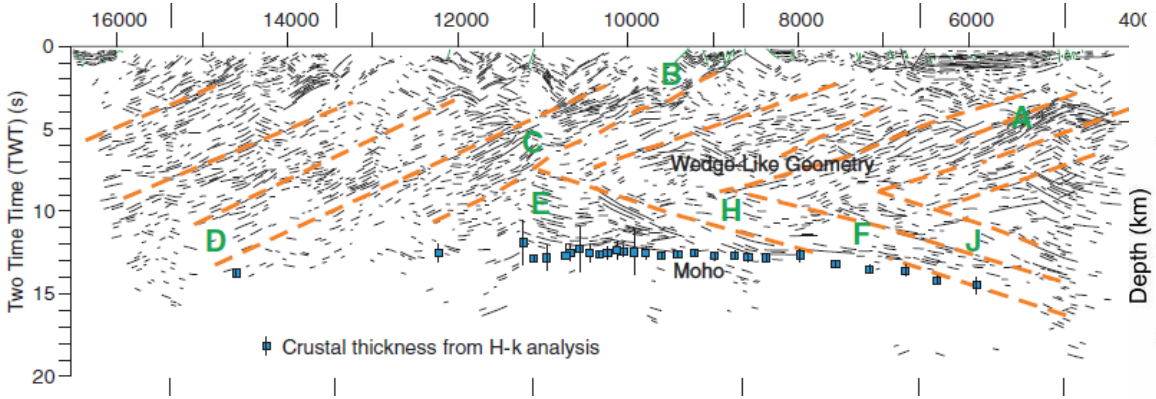


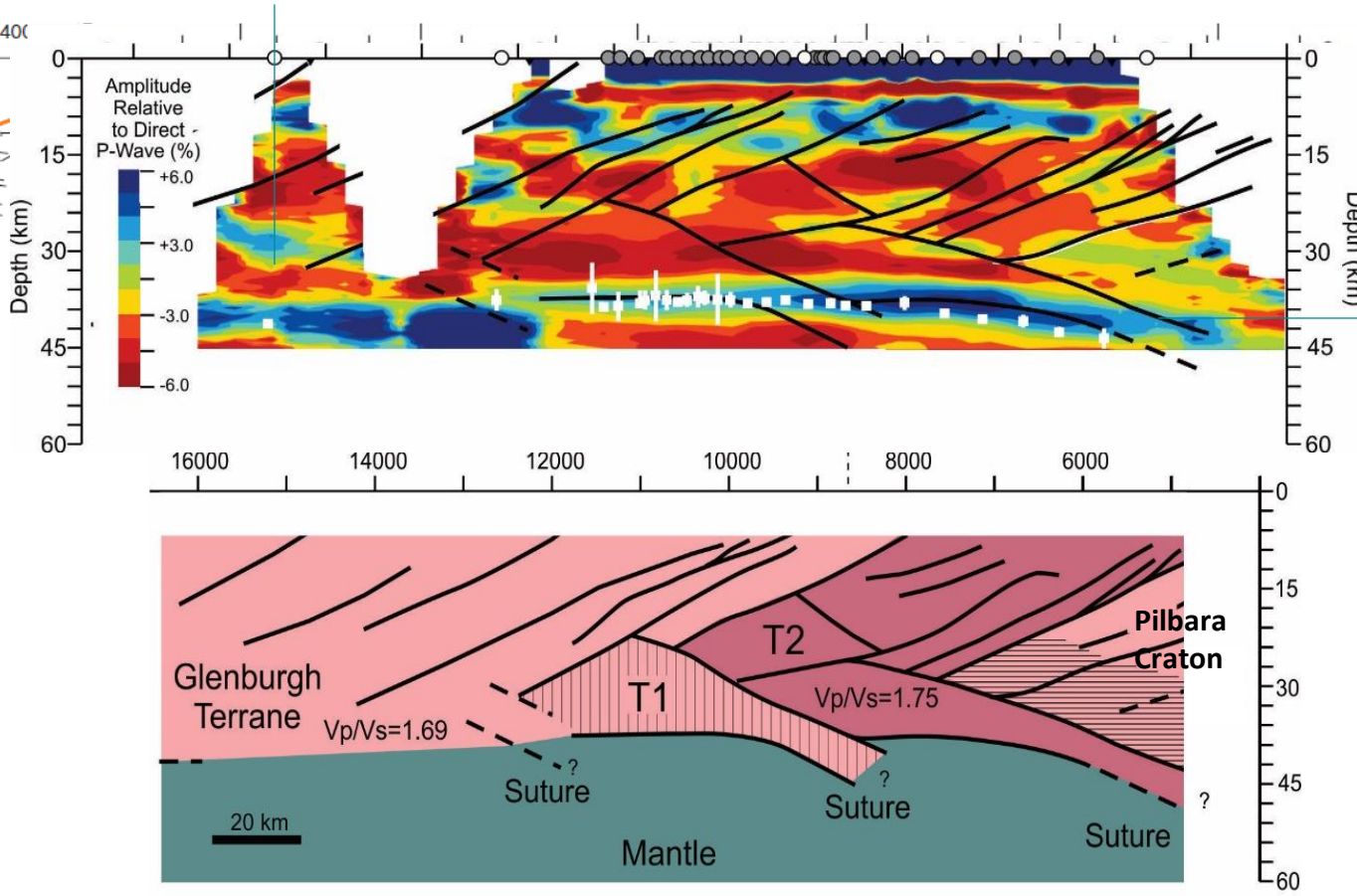




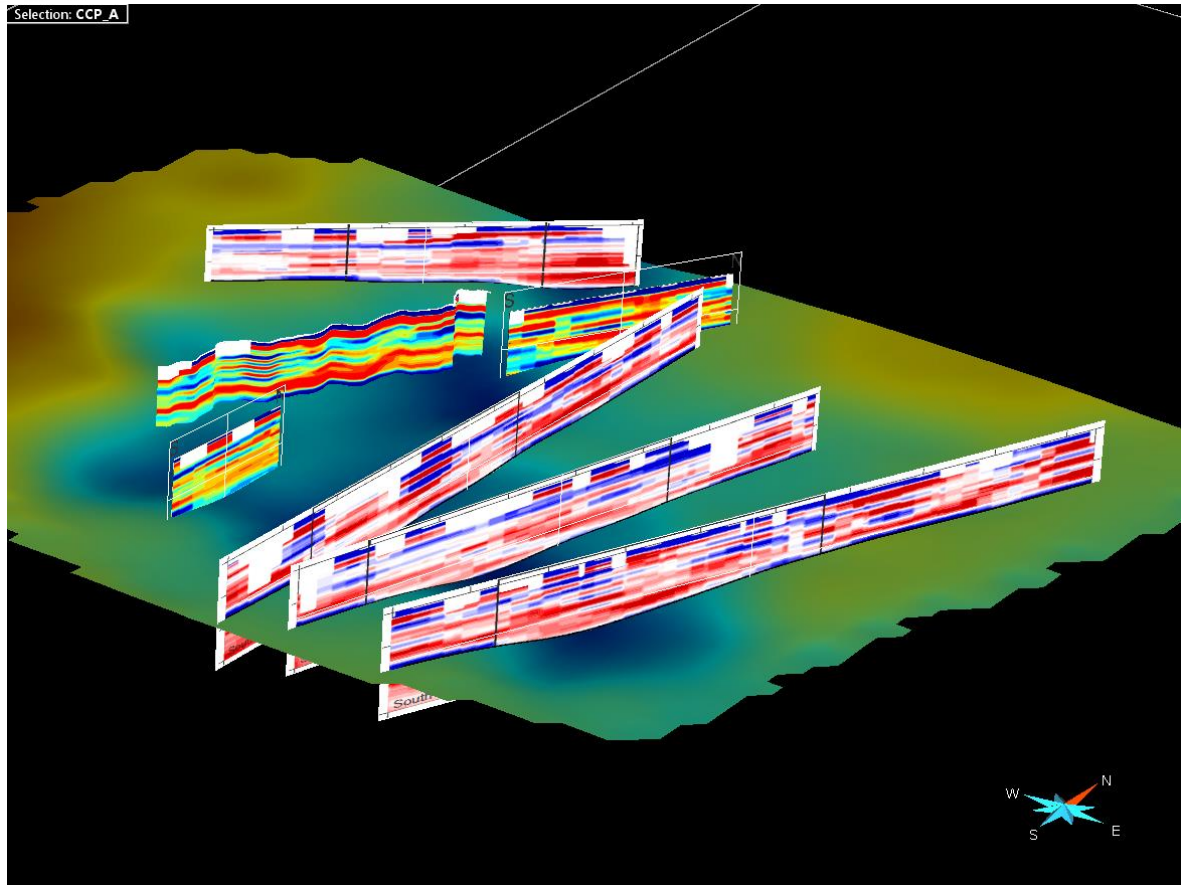
2) CCP and CP2 reinterpretation

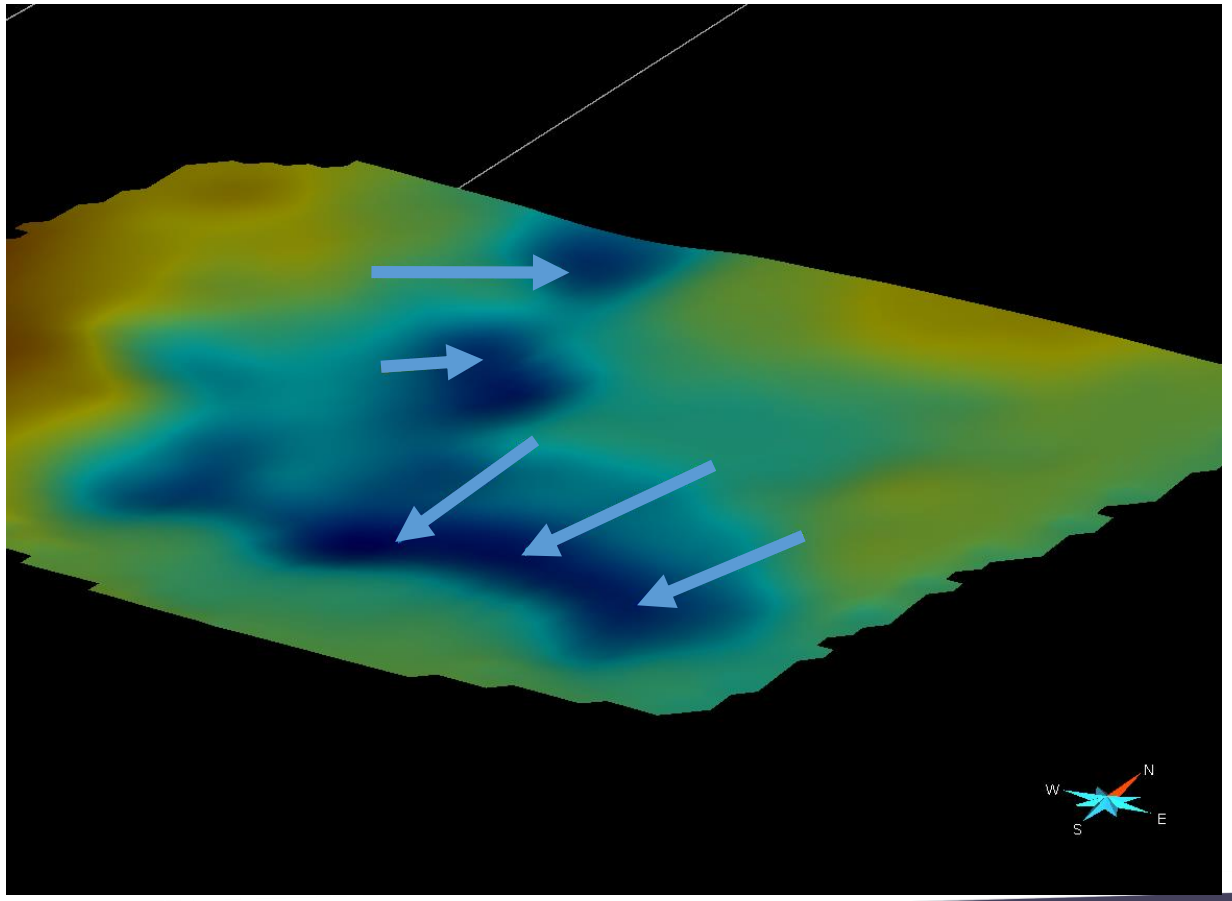




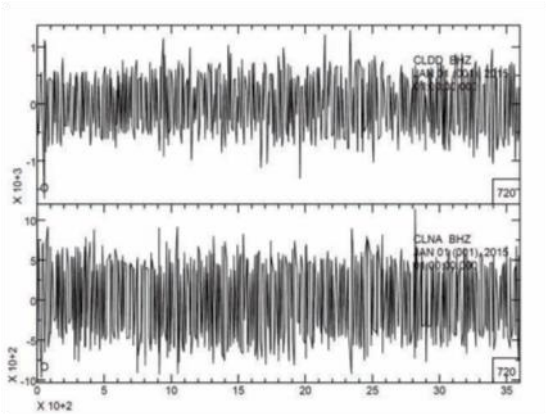


2) 3D CCP results

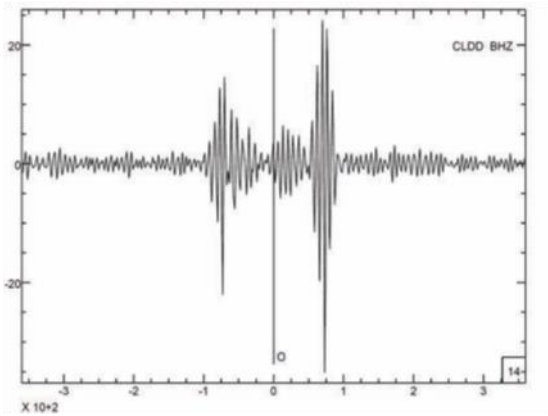




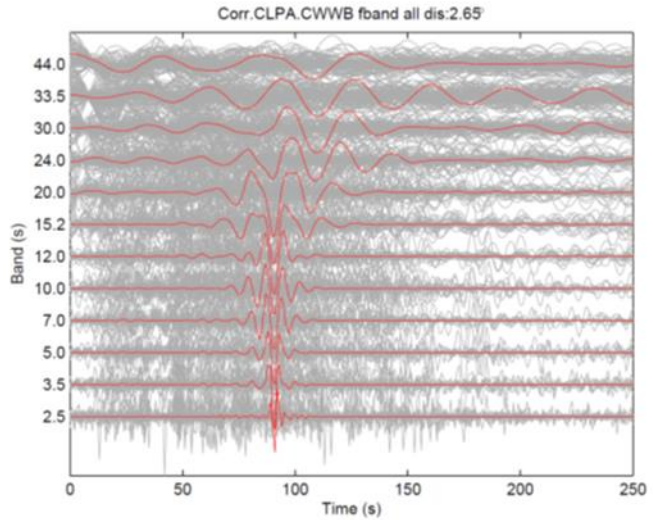
3) Ambient noise tomography



Take 2 stations and cross-correlate the raw waveform from the same time period

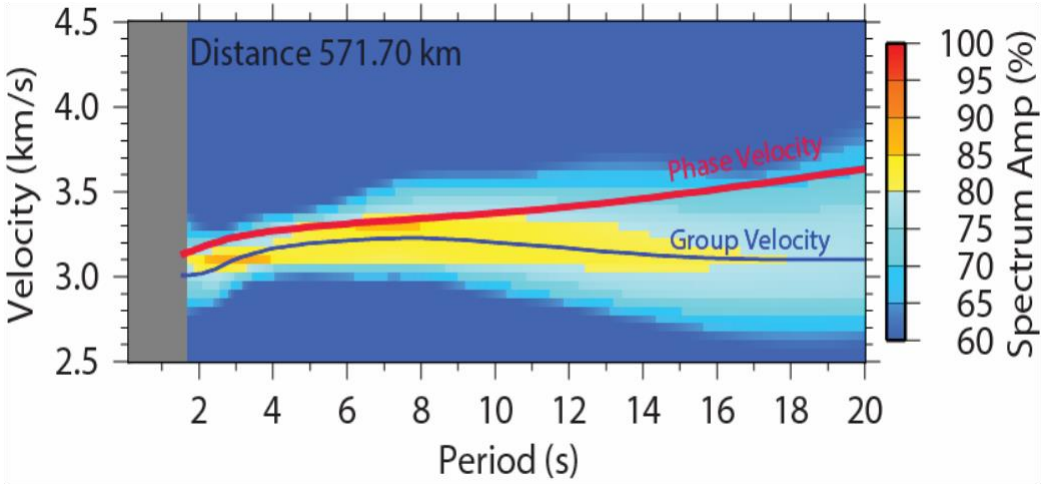


Cross-correlated energy

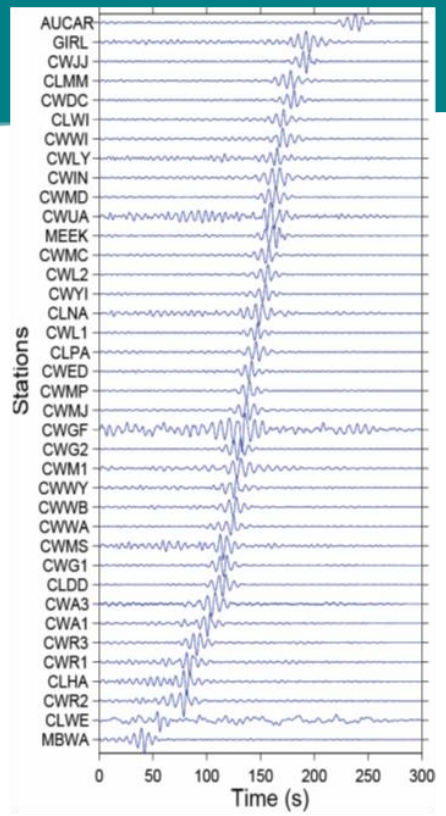


Separate out the energies for each frequency

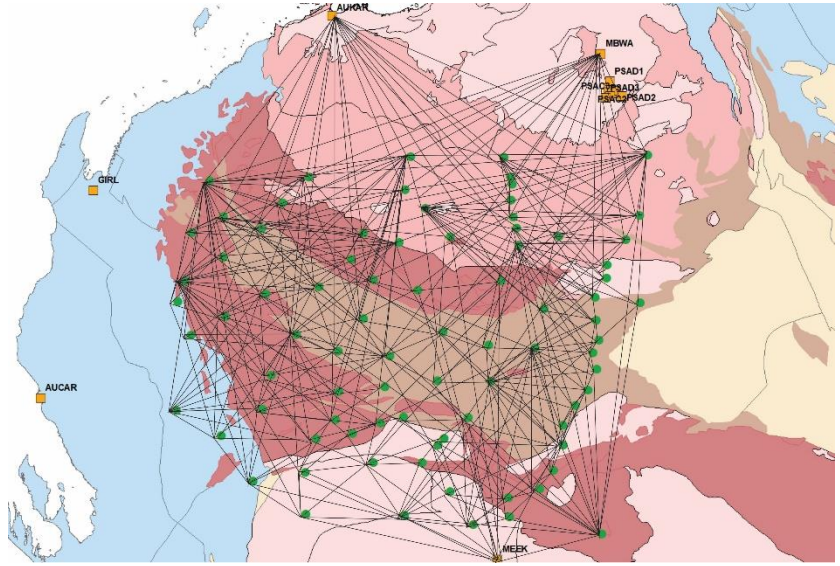
3) Ambient noise tomography



Group and phase velocity dispersion curves for 1 station

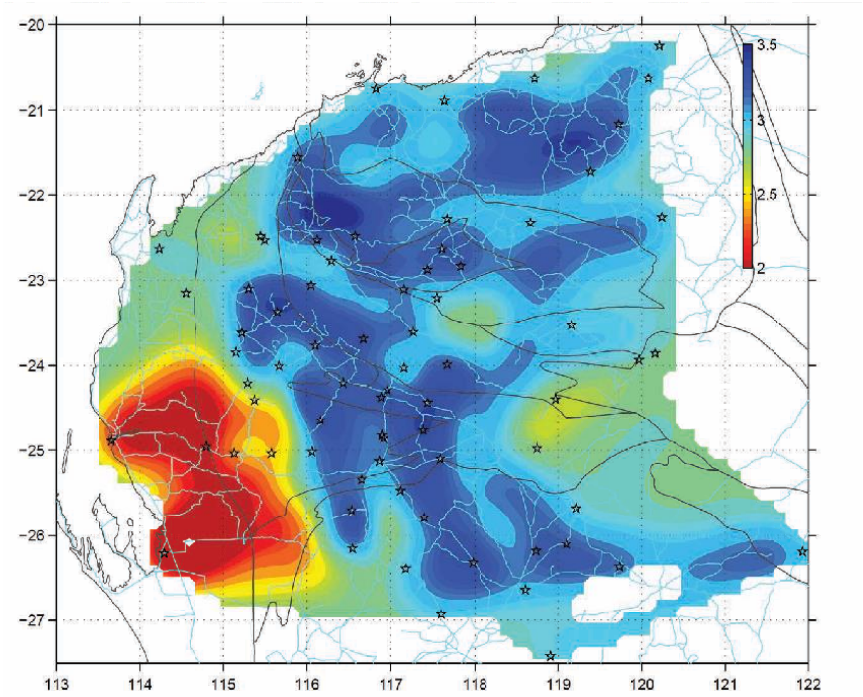


Example of cross-correlation of one station with all other concurrent stations

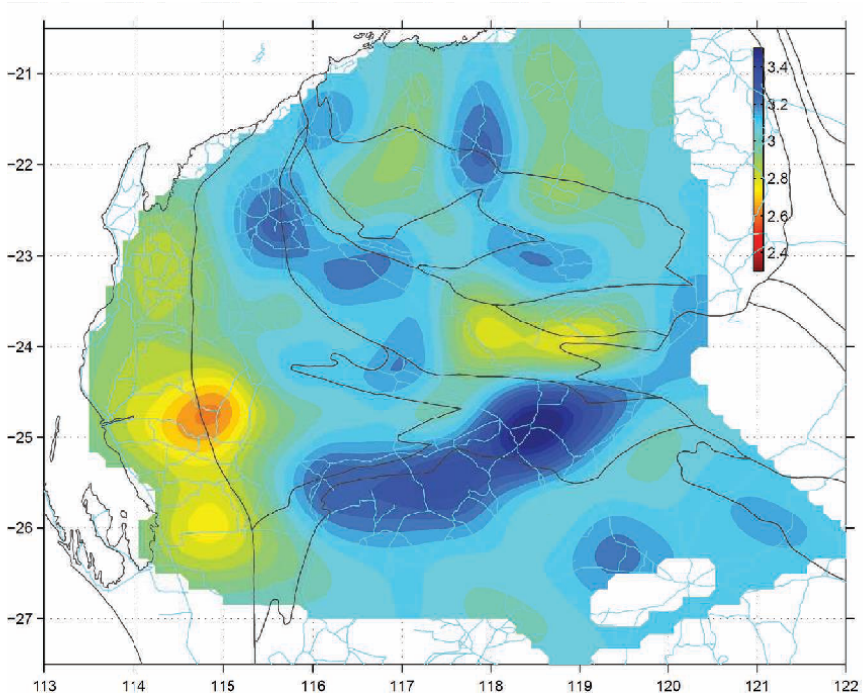


Do this for all station pairs including permanent stations GIRL, WAMB and MEEK

3) Ambient noise results – 2D maps

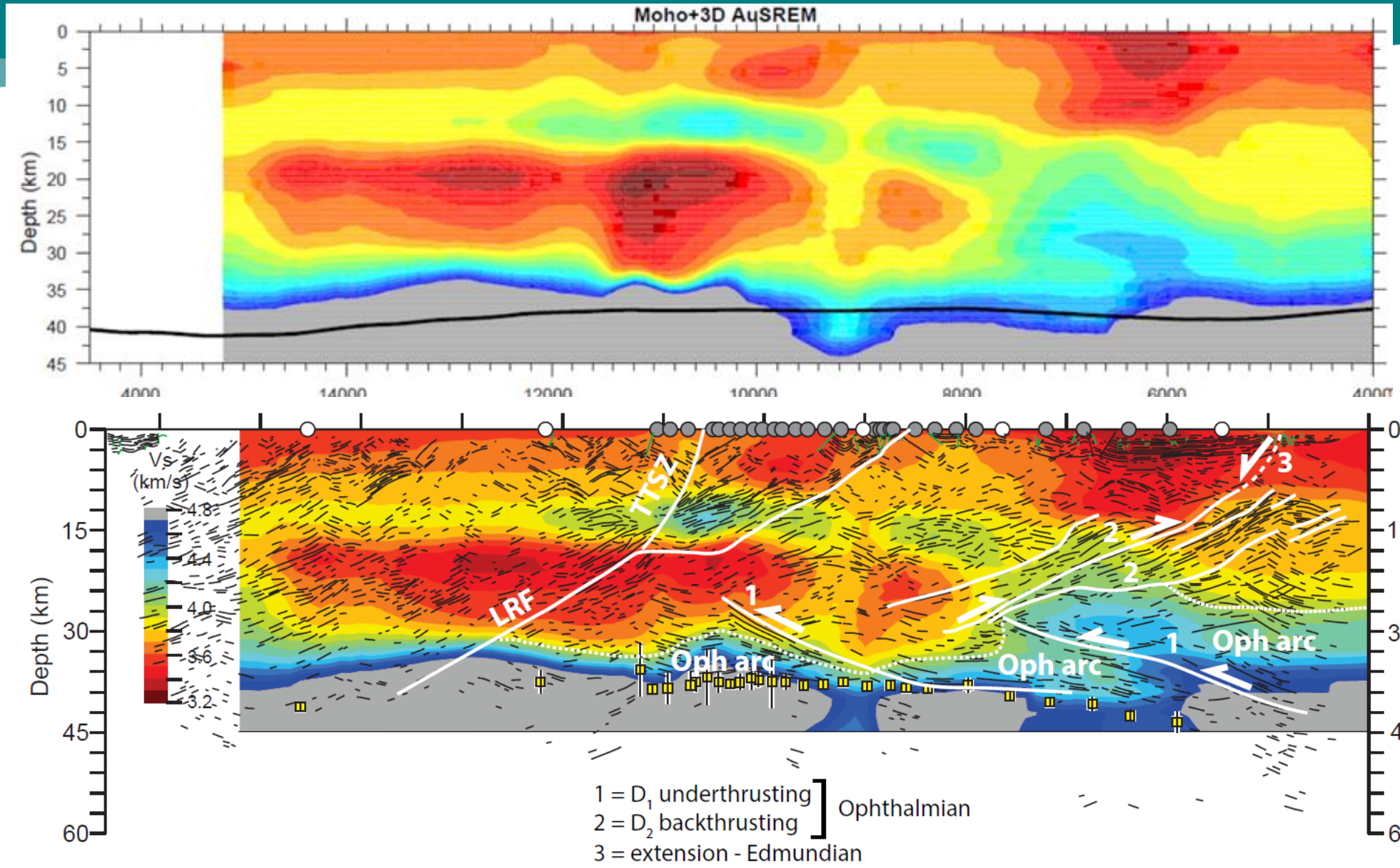


Ambient noise map for 2.5 s
~3km depth

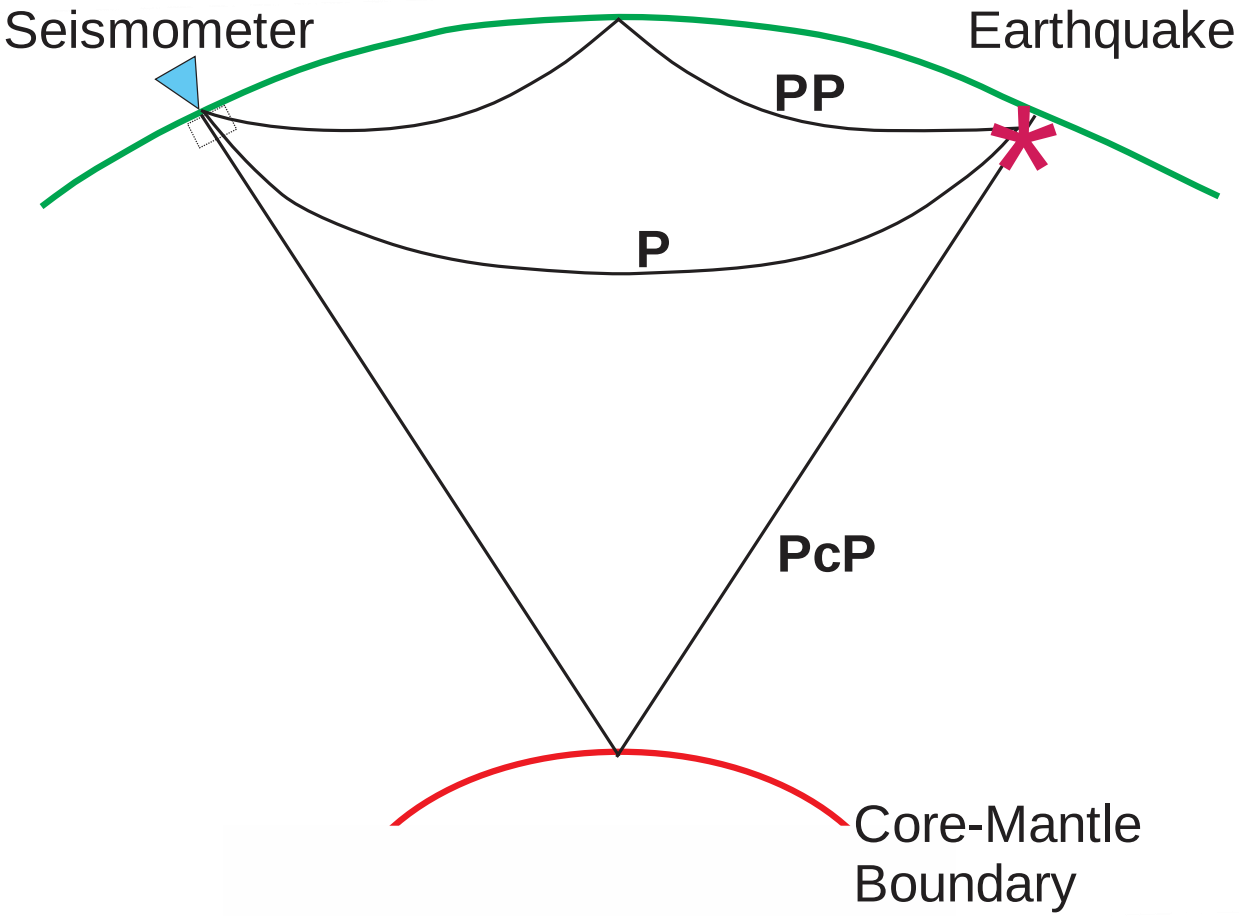


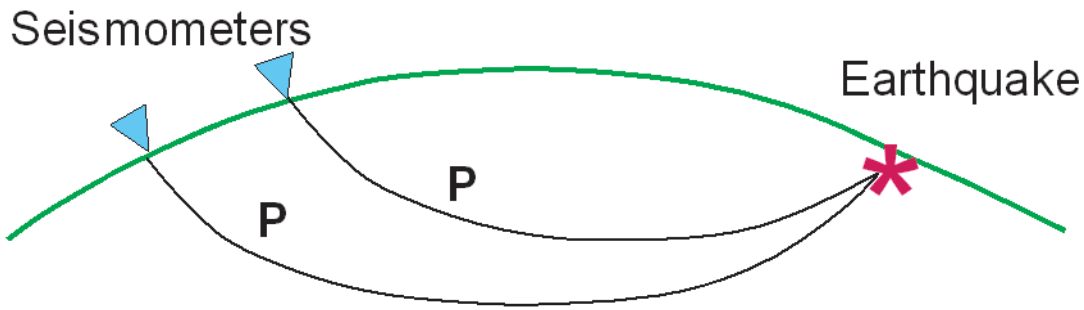
Ambient noise map for 15 s
= mid-crust

3) Ambient noise results – 2D profile on CP2



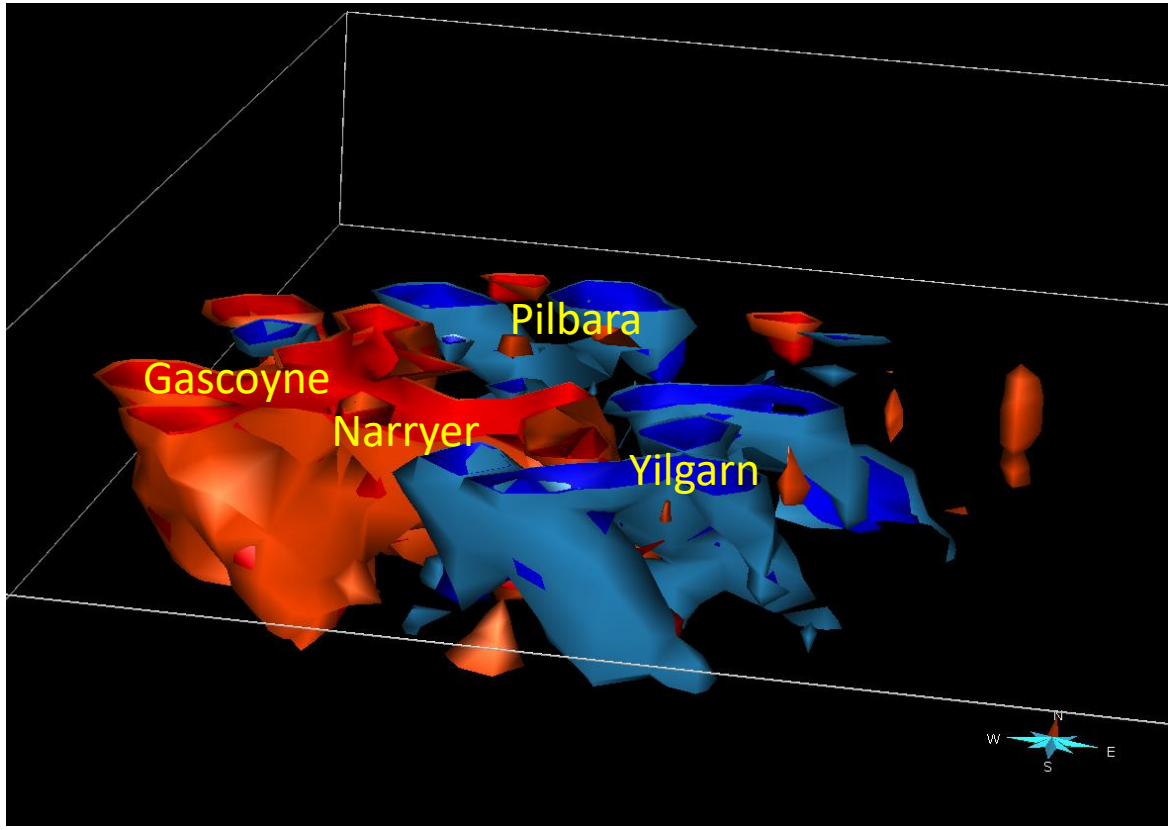
4) Body wave tomography

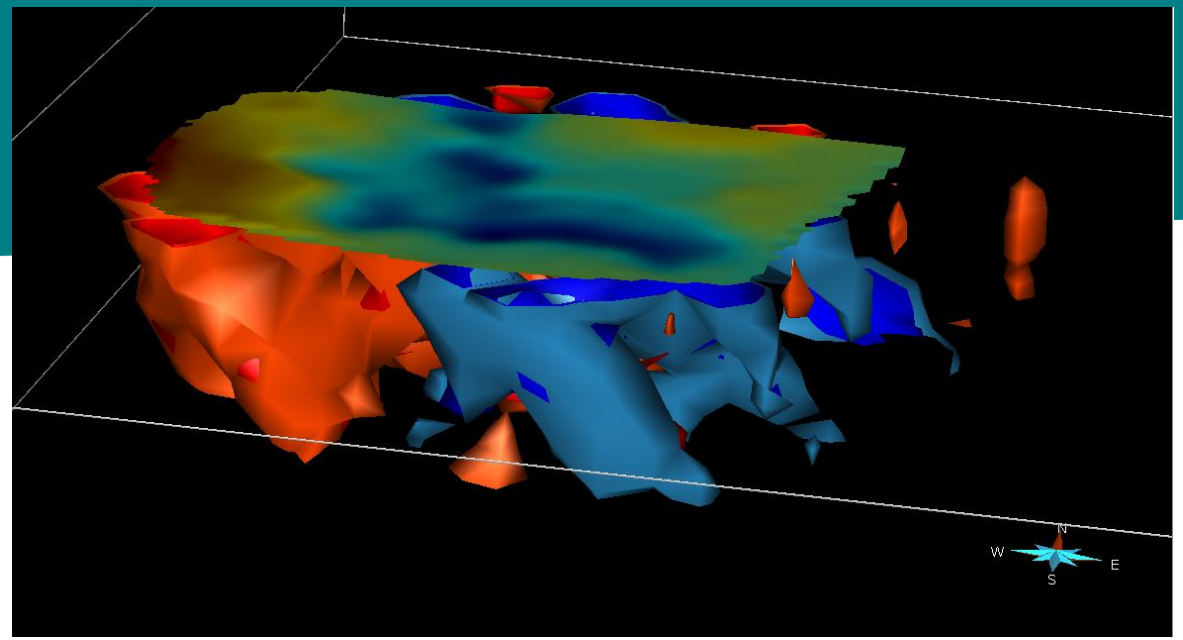


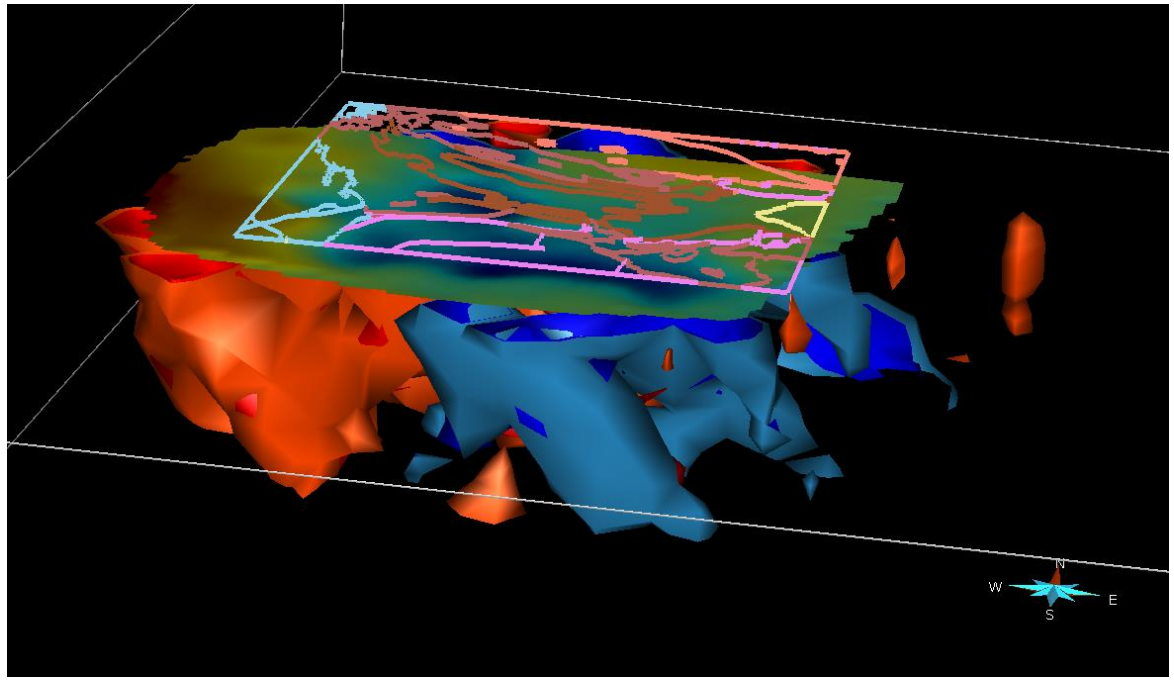


4) Body wave tomography results

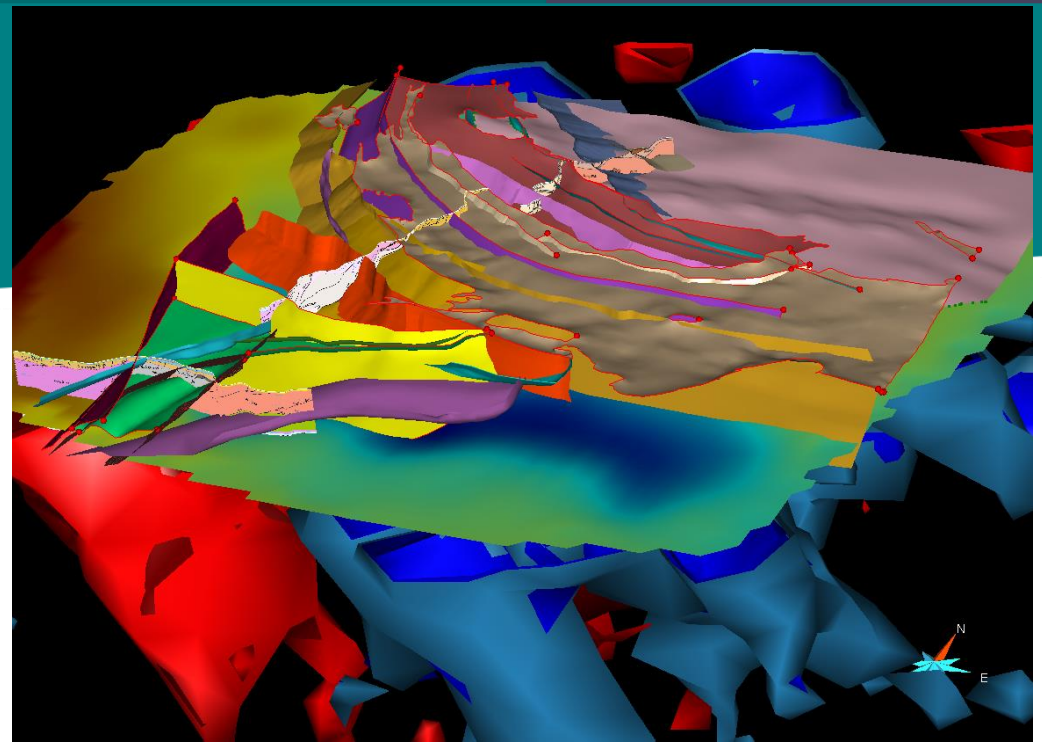
Looking from the Moho to 250 km down







Conclusions



So far we have:

- Moho depth
- Crustal composition
- Crustal layering
- Crustal velocity structure
- Lithospheric velocity structure

Combine this with:

- Geophysical inversions – mag, grav, MT
- Geological mapping

→ Tectonic history
3D model

Prototype 3D model available for viewing at my pc during the break