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Lithospheric structure in the vicinity of the Eucla-Gawler reflection profile

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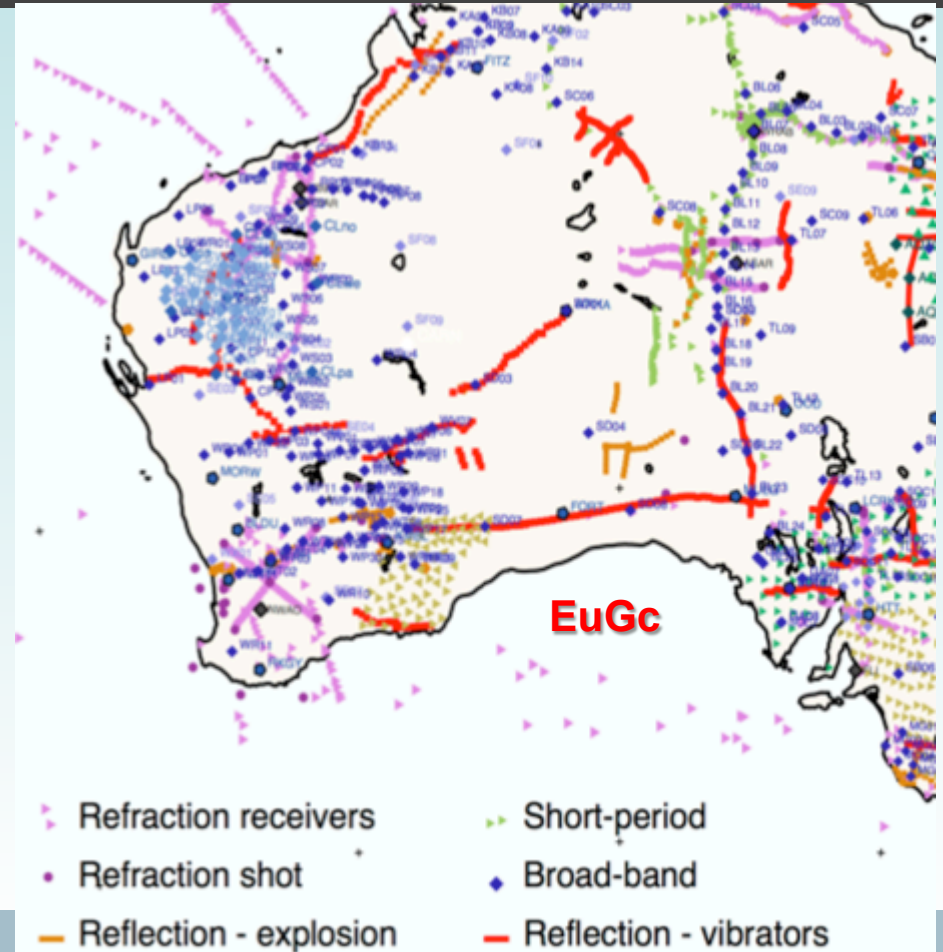
Research School of Earth Sciences, The Australian National University

R. Chopping

Geoscience Australia

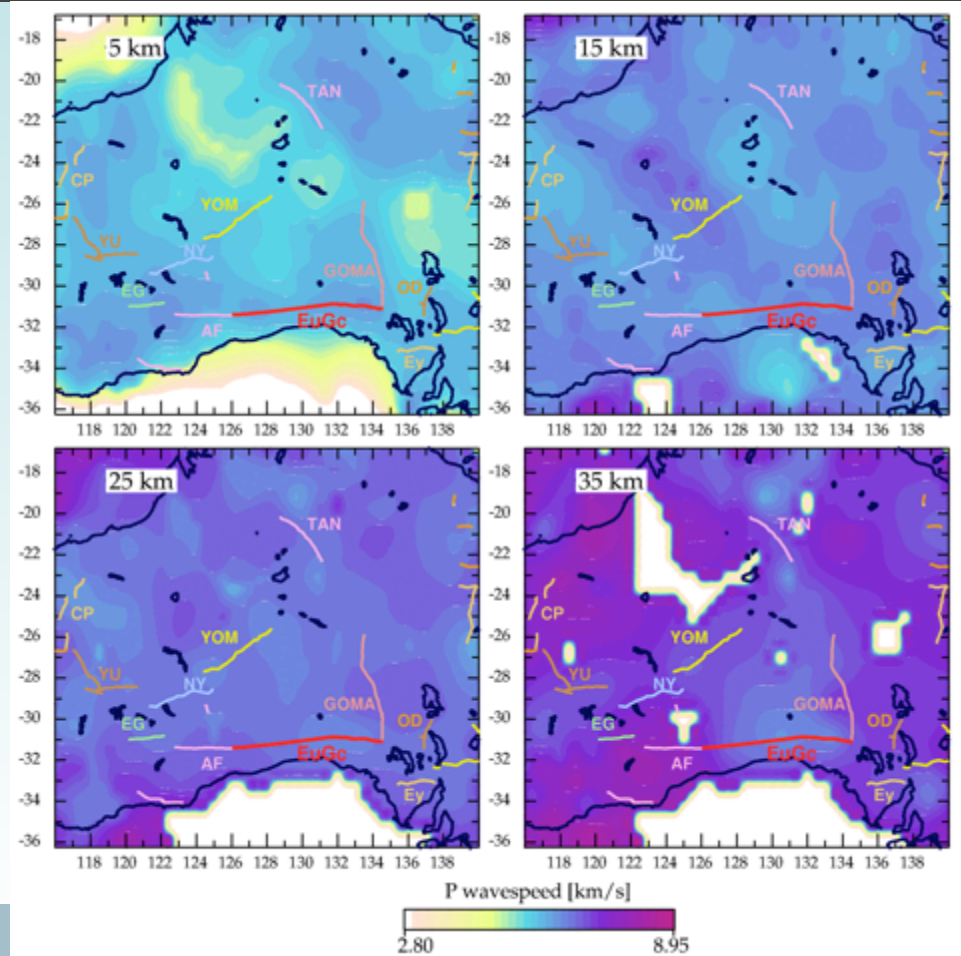
Seismic coverage for west-central Australia

- The Eucla-Gawler profile is part of an extensive network of seismic information
- Prior refraction work and extensive broad-band deployments (receiver functions) provide control additional to the recent reflection work, supplemented by ambient noise tomography

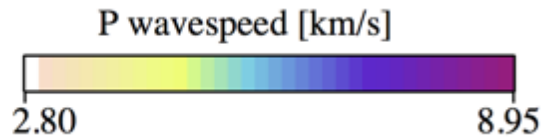
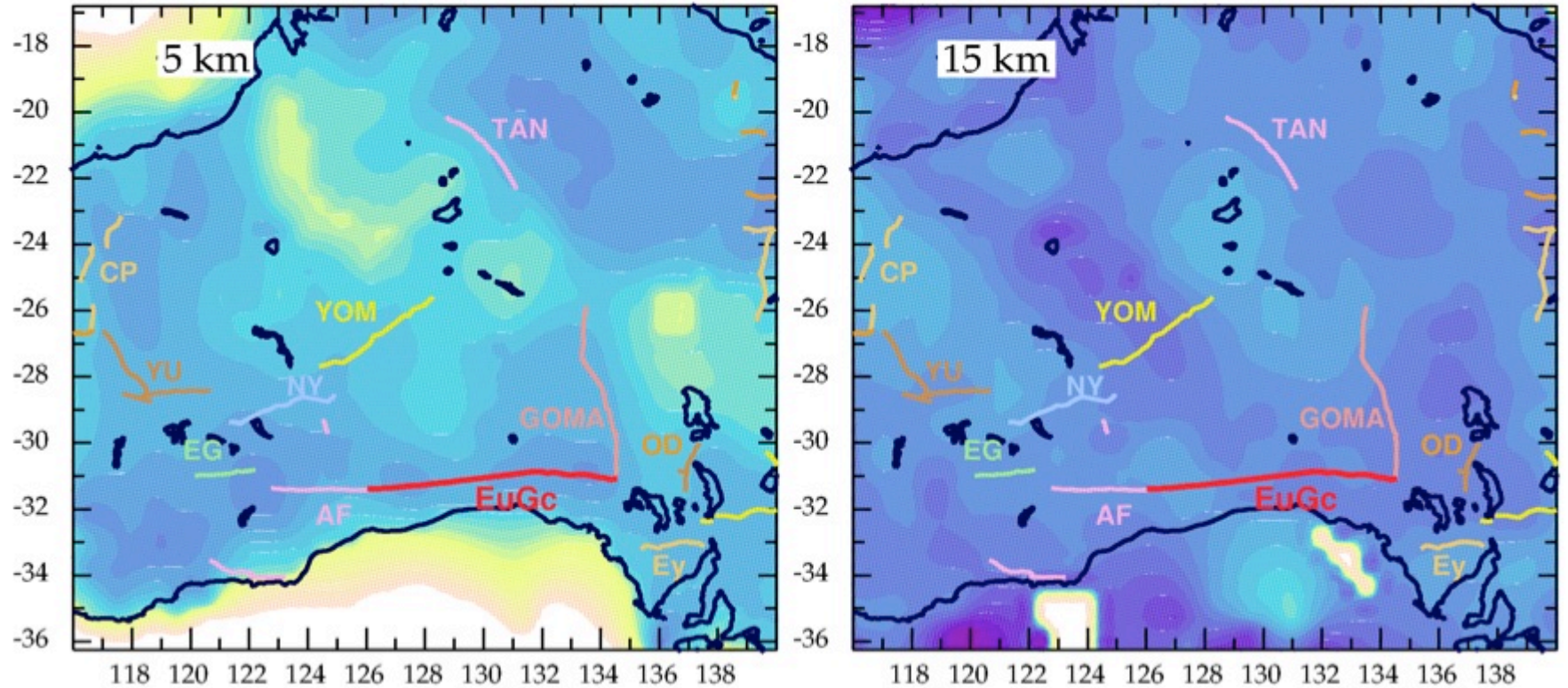


Crustal Structure near EuGc

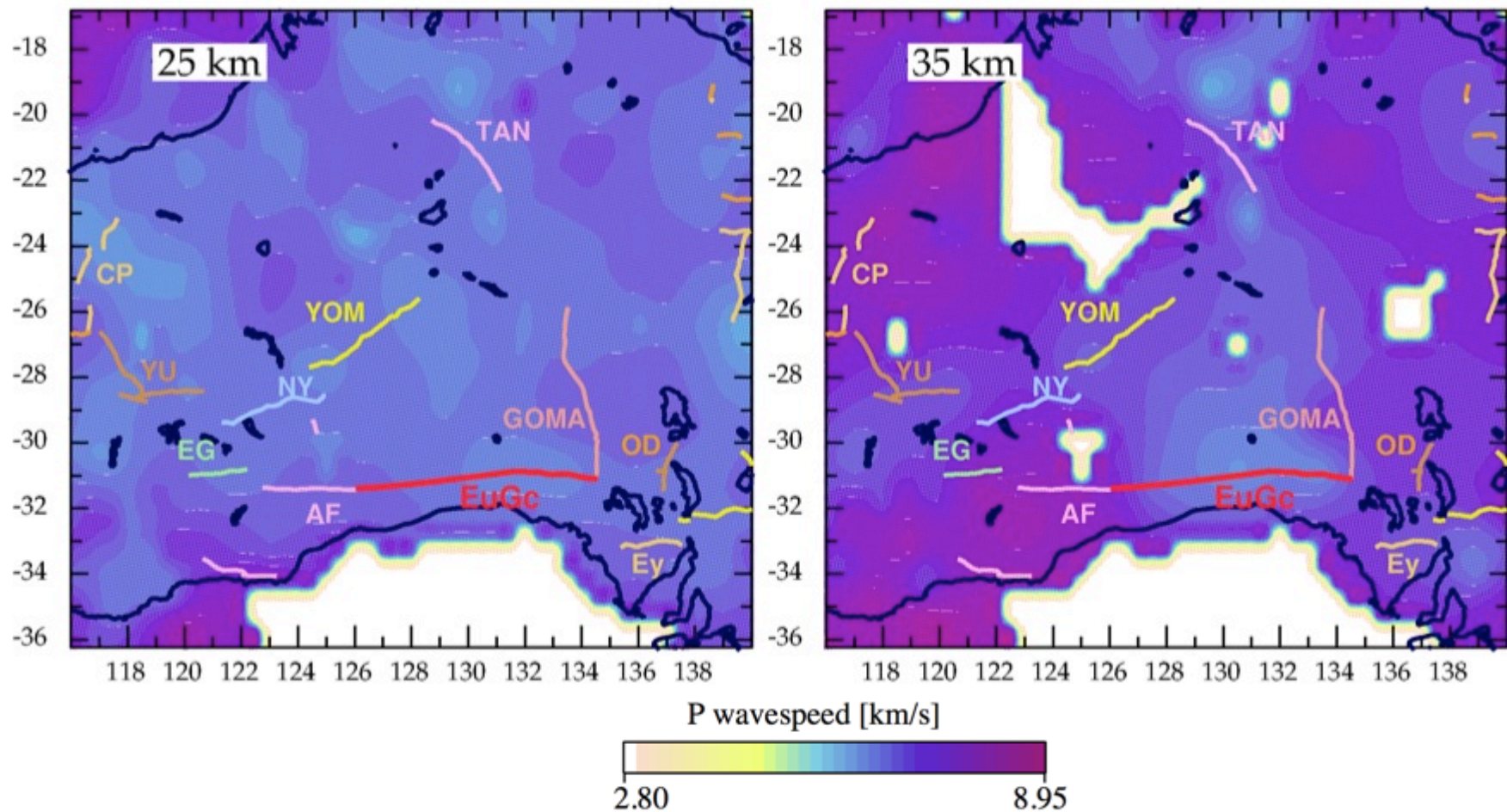
Depth slices through the crustal component of the AuSREM model with a resolution of 0.5 deg, built from all available sources



Crustal Structure near EuGc



Crustal Structure near EuGc



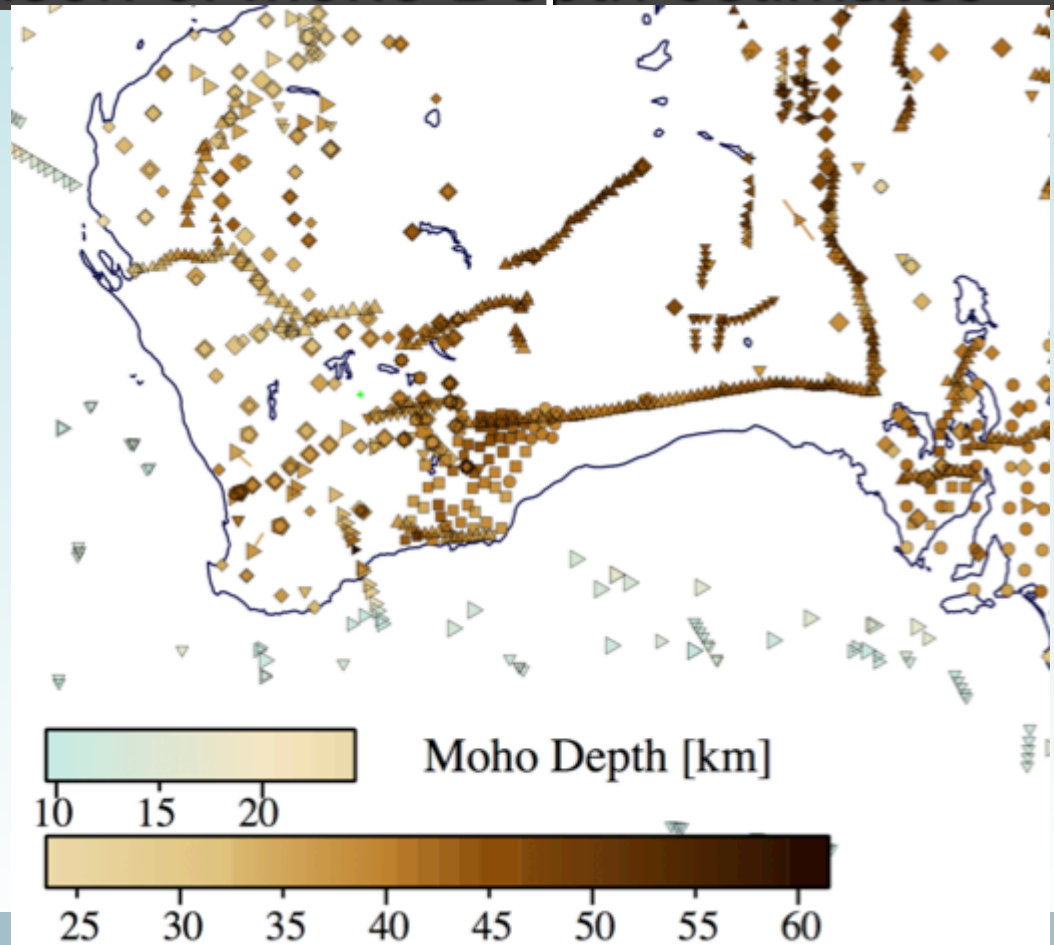


Comparison of Moho Depth estimates

The map summarises all the estimates for Moho depth in the neighbourhood of the Eucla-Gawler line

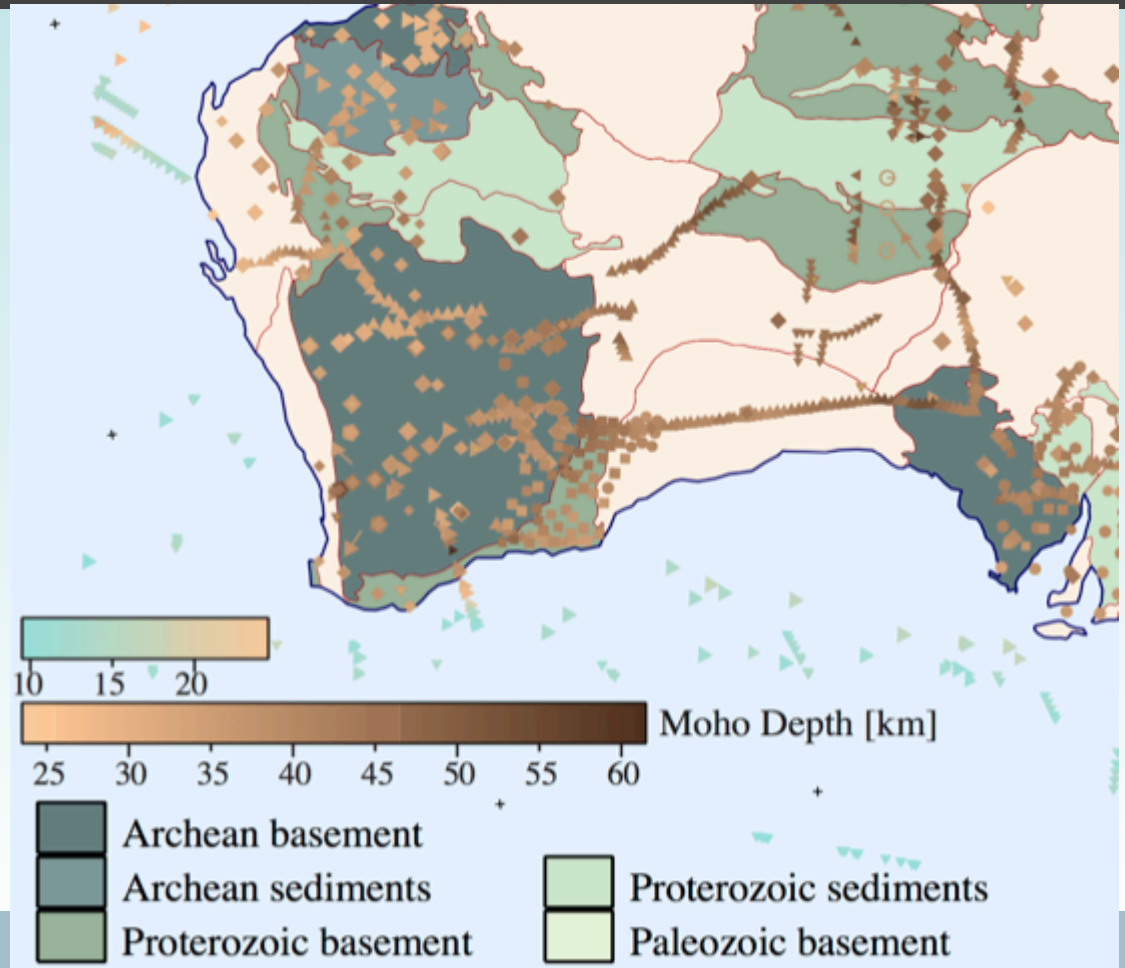
Triangles denote depth estimates from reflection work and refraction. Diamonds, pentagons and squares represent results from Receiver Functions. Circles are from autocorrelograms.

The EuGc results provide important constraints for an undersampled area.

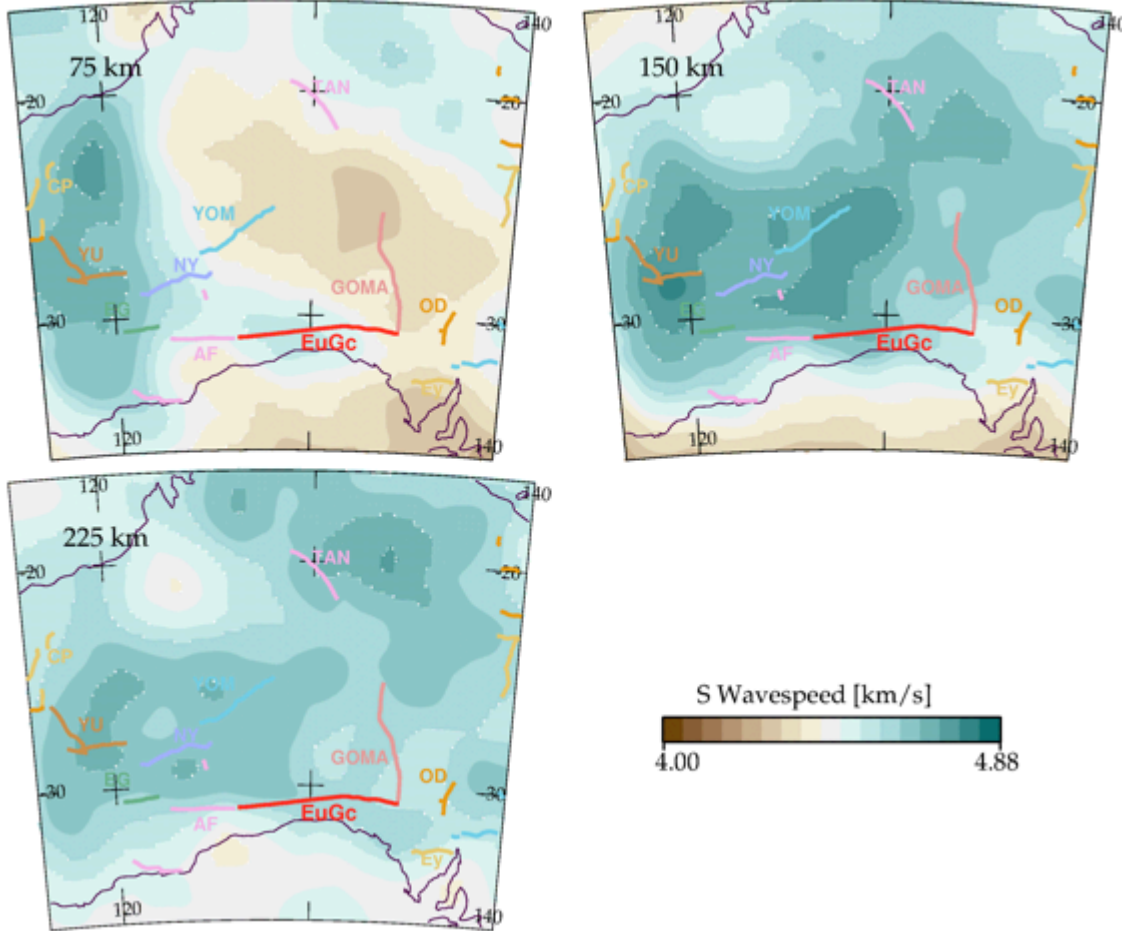


Moho depth superimposed on tectonic framework

The correlation of thinner crust with the ancient Archean blocks is very clear, as also is thickening at the craton margins.

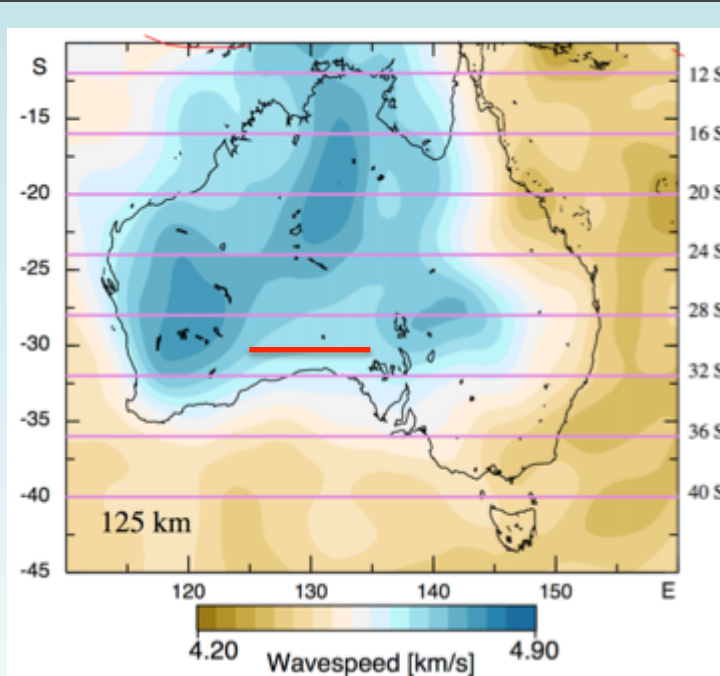


SV wavespeed in mantle



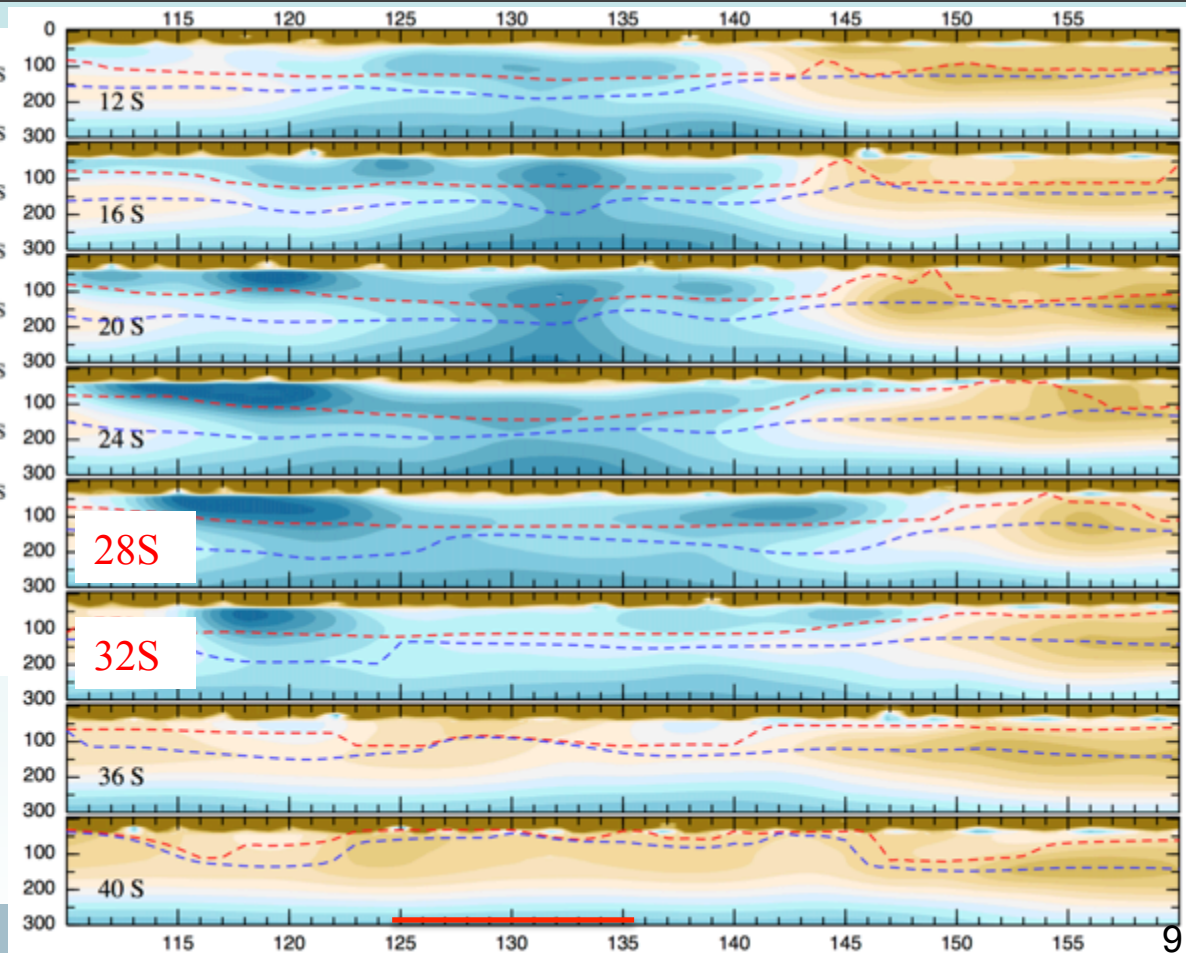
Depth slices
through the
AuSREM mantle
component

SV wavespeed in mantle

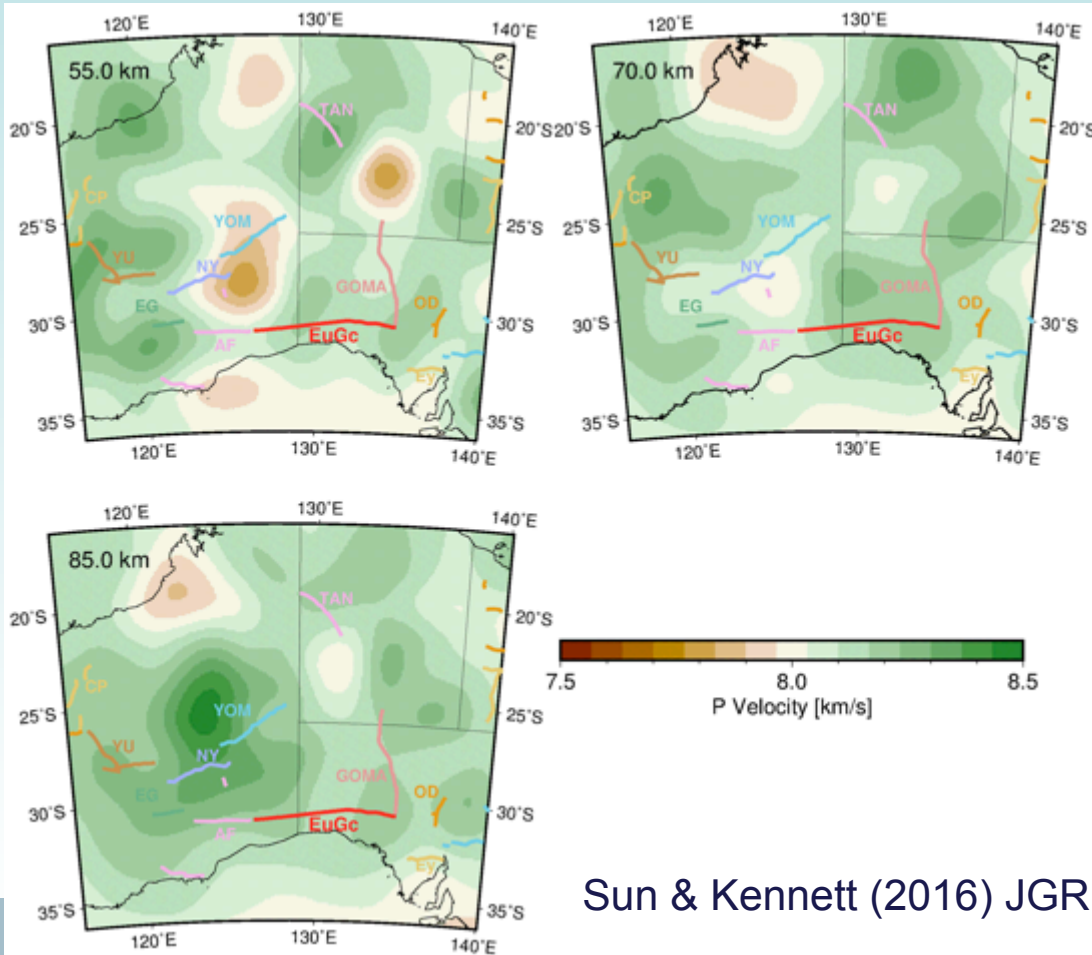


Strong changes in lithosphere thickness along the AF3-EG1 profile

Model: Yoshizawa (2014) PEPI



Pn tomography for mantle



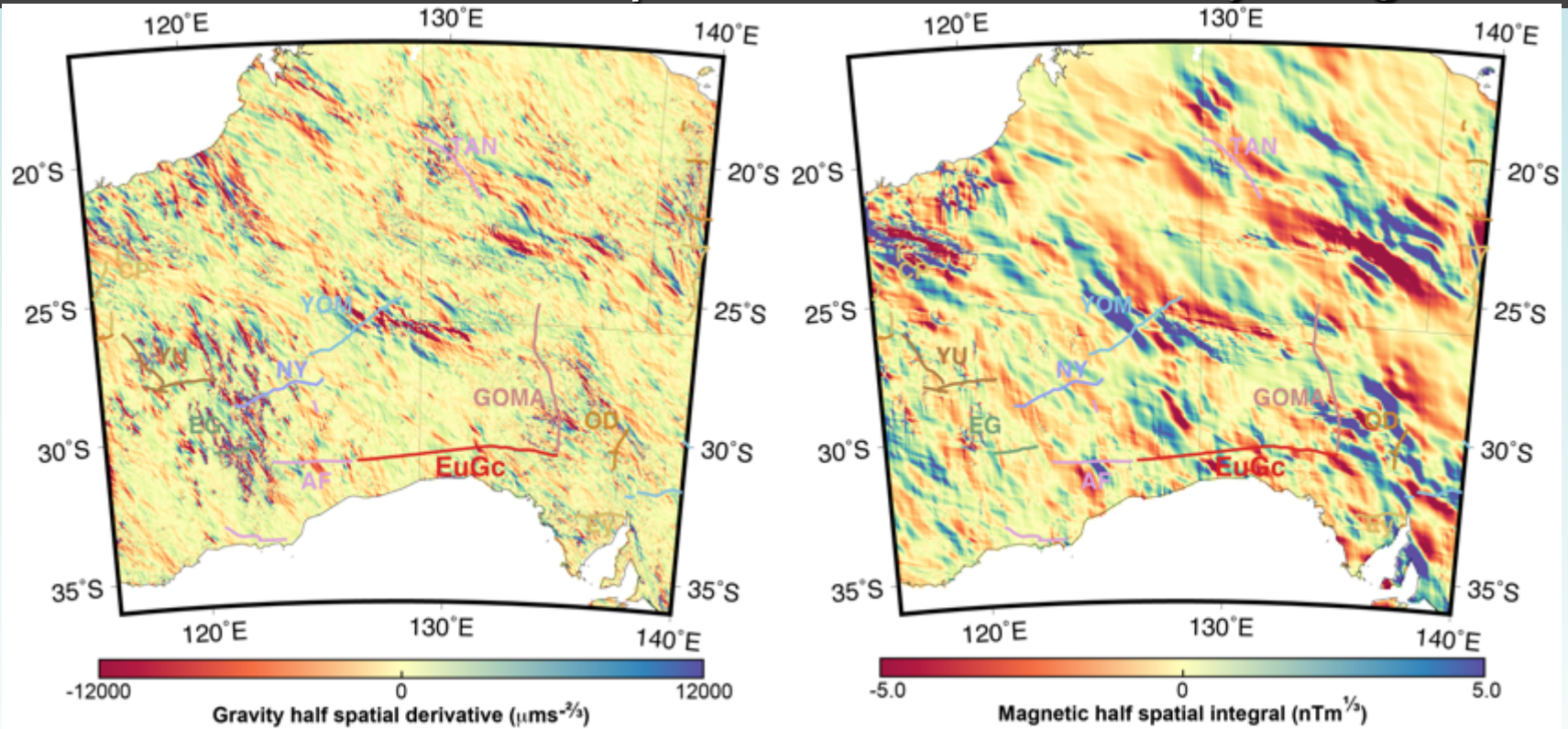
New results
exploiting all
available
earthquake and
explosion records
to examine
structure in
uppermost mantle

Sun & Kennett (2016) JGR

Other lithospheric information

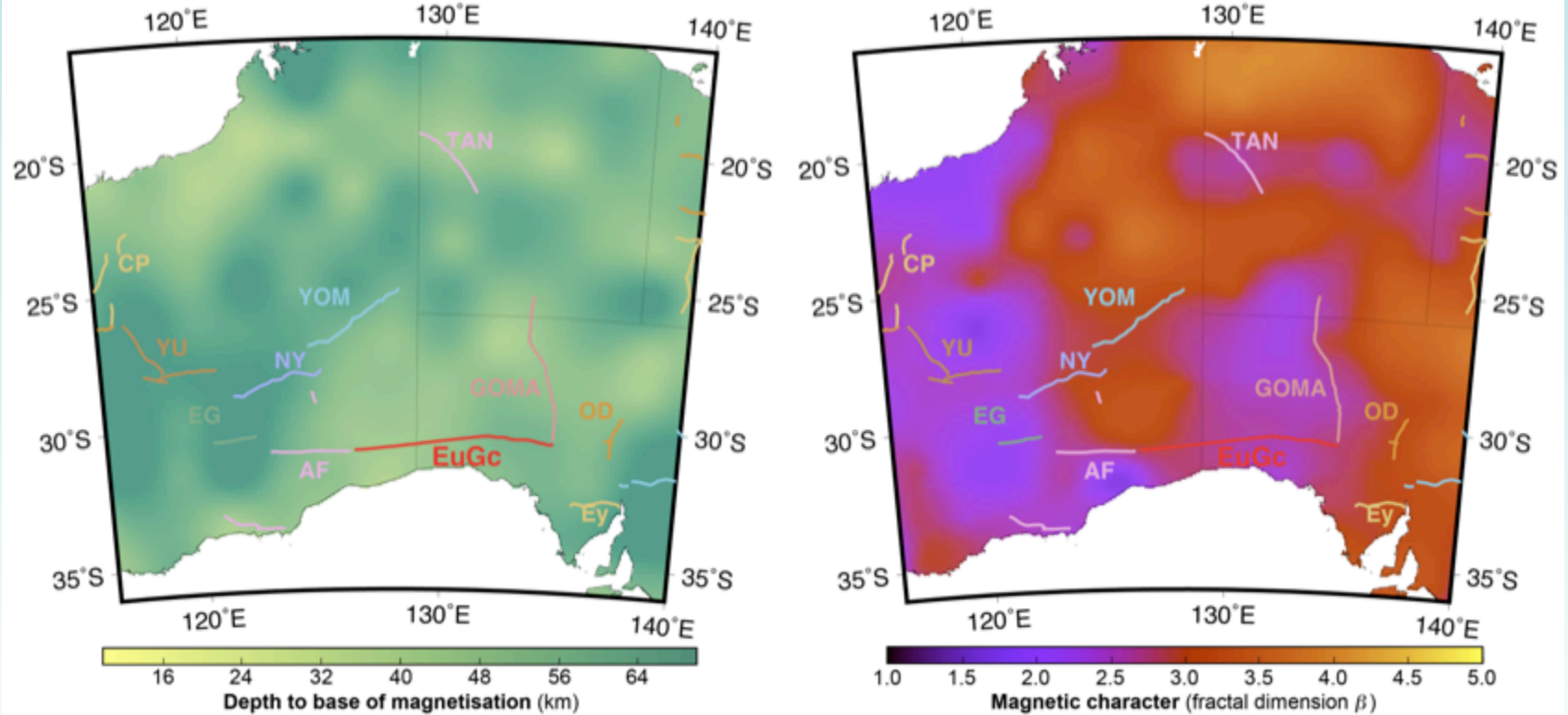
- The comprehensive national gravity and magnetic databases provide a useful starting point for examining other aspects of lithospheric structure, particularly relating to the crust.
- We show the horizontal half-derivative of gravity and half-integral of magnetic anomalies that have nearly the same dependence on structure.
- We also illustrate the depth to base of magnetisation based on a fractal model that also yield information about the magnetic character of different spatial domains.

Lithospheric fabric – Gravity /Magnetic



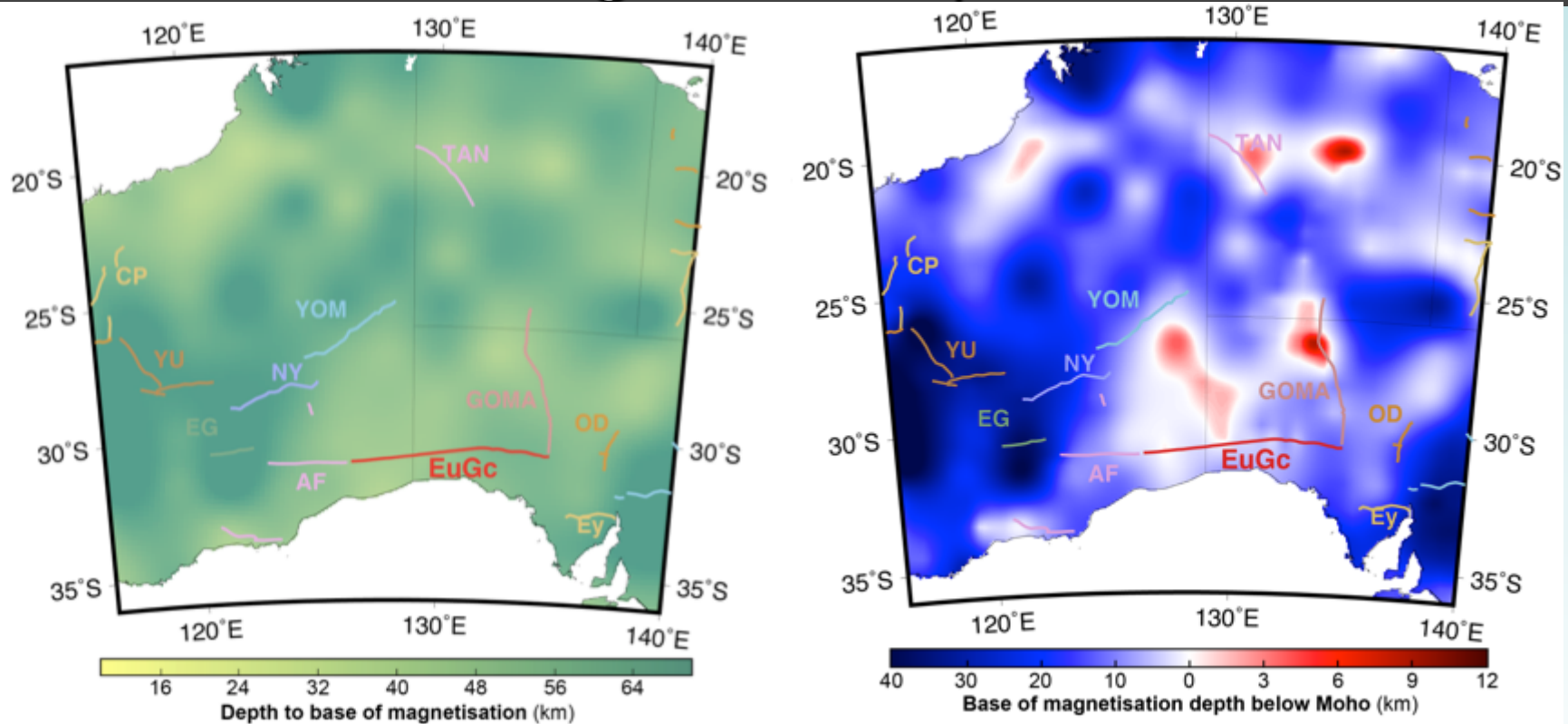
These secondary potential field quantities give a very clear indication of *grain* in the fabric of the continent. There is no simple correlation between density and susceptibility variations.

Magnetic lithospheric domains I



These results are derived from the magnetic anomalies across Australia at 1.2 km spacing, with an inversion for depth of base of magnetisation (Curie depth) and fractal magnetic character.

Magnetic lithospheric domains II



The depth of base of magnetisation (Curie depth) extends in places below the Moho, linking to other evidence for lithospheric domains extending into the mantle.

Summary

- The distinctive crustal domains seen in the reflection sections do not have much contrast in crustal wavespeed.
- Yet the domains appear to have connectivity into the uppermost mantle.
- Strong contrasts in full lithospheric structure are associated with the craton edges.

Acknowledgments

- Surface Wave Tomography: S. Fishwick, K. Yoshizawa, A. Fichtner
- Receiver Functions (WA): A. Reading, C. Sippl
- Ambient Noise Tomography: E. Saygin
- AuSREM Crust & Moho map compilation: M. Salmon
- Pn tomography: Weijia Sun

- All the members of RSES who have helped with the collection of portable seismic data and subsequent data handling.