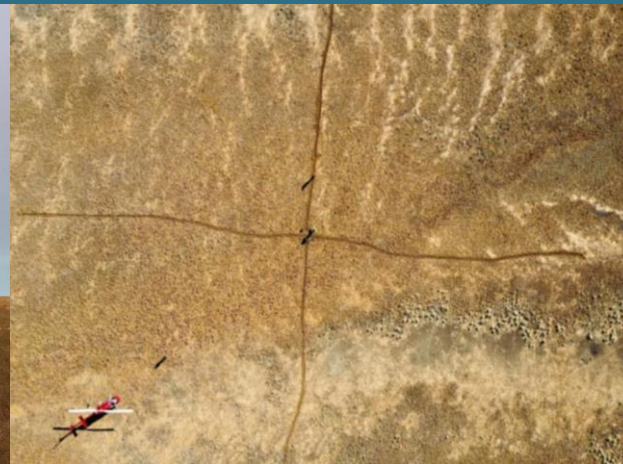


Multi-scale magnetotelluric surveys - mapping from the deep lithosphere to near surface for geological interpretation and mineral prospectivity

Wenping Jiang, Jingming Duan, Darren Kyi, Peter Maher, Adrian Hitchman

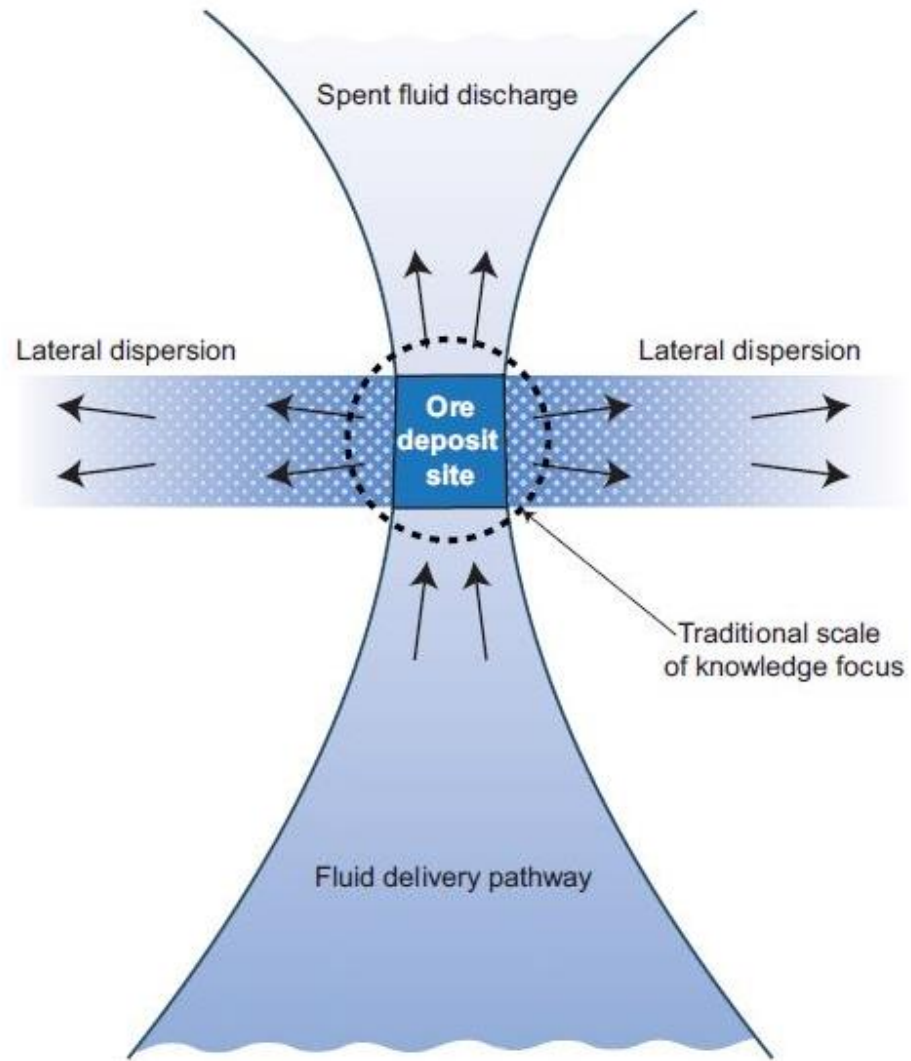


We acknowledge the Traditional Owners of the lands on which our work is undertaken and pay our respects to Elders past and present. We extend that respect to any Aboriginal and Torres Strait Islander people.



Photo taken in Western South Australia (courtesy of Mark Pawley)

Mineral exploration – a whole lithosphere architectural framework



Hronsky, 2012

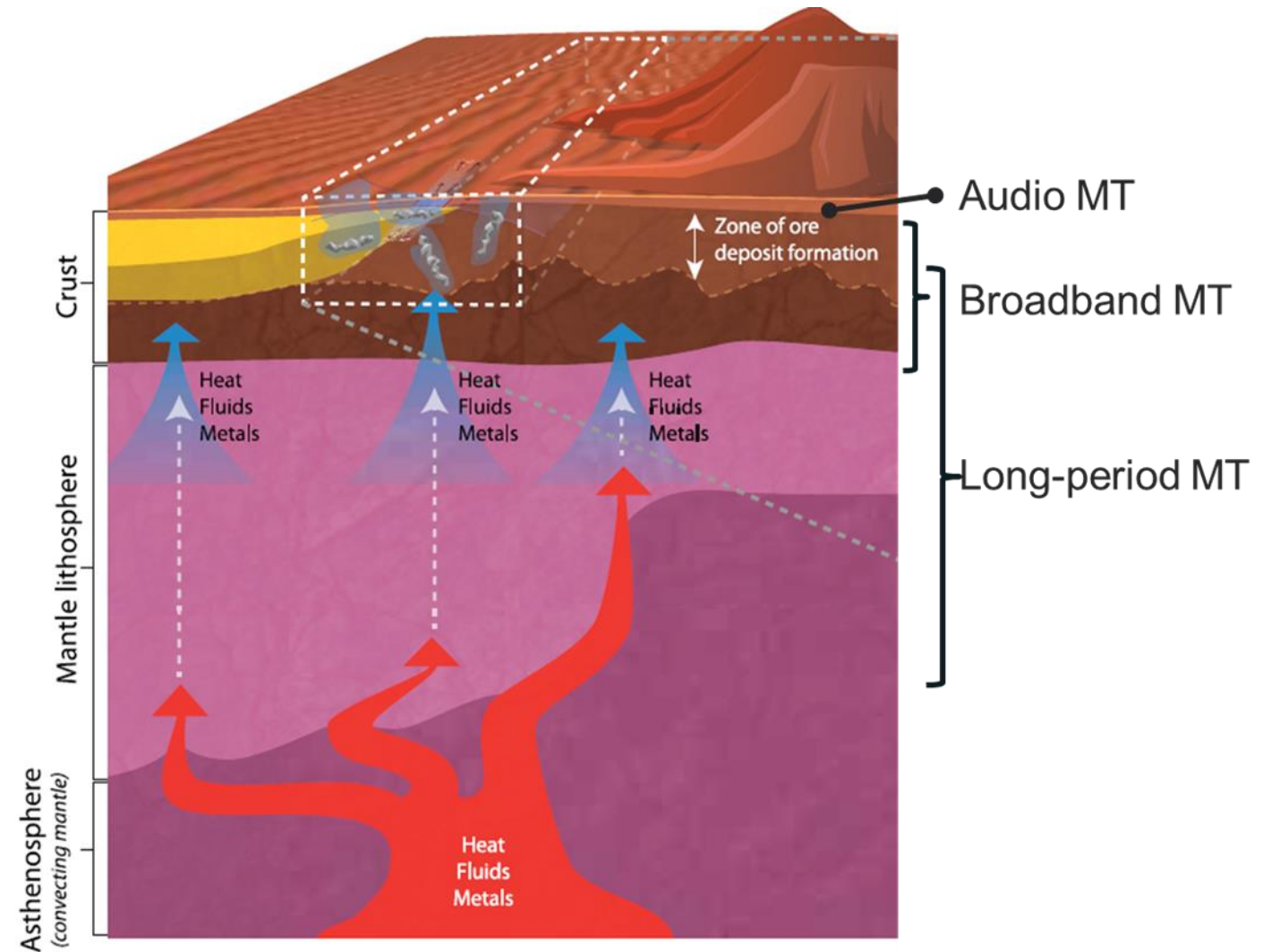
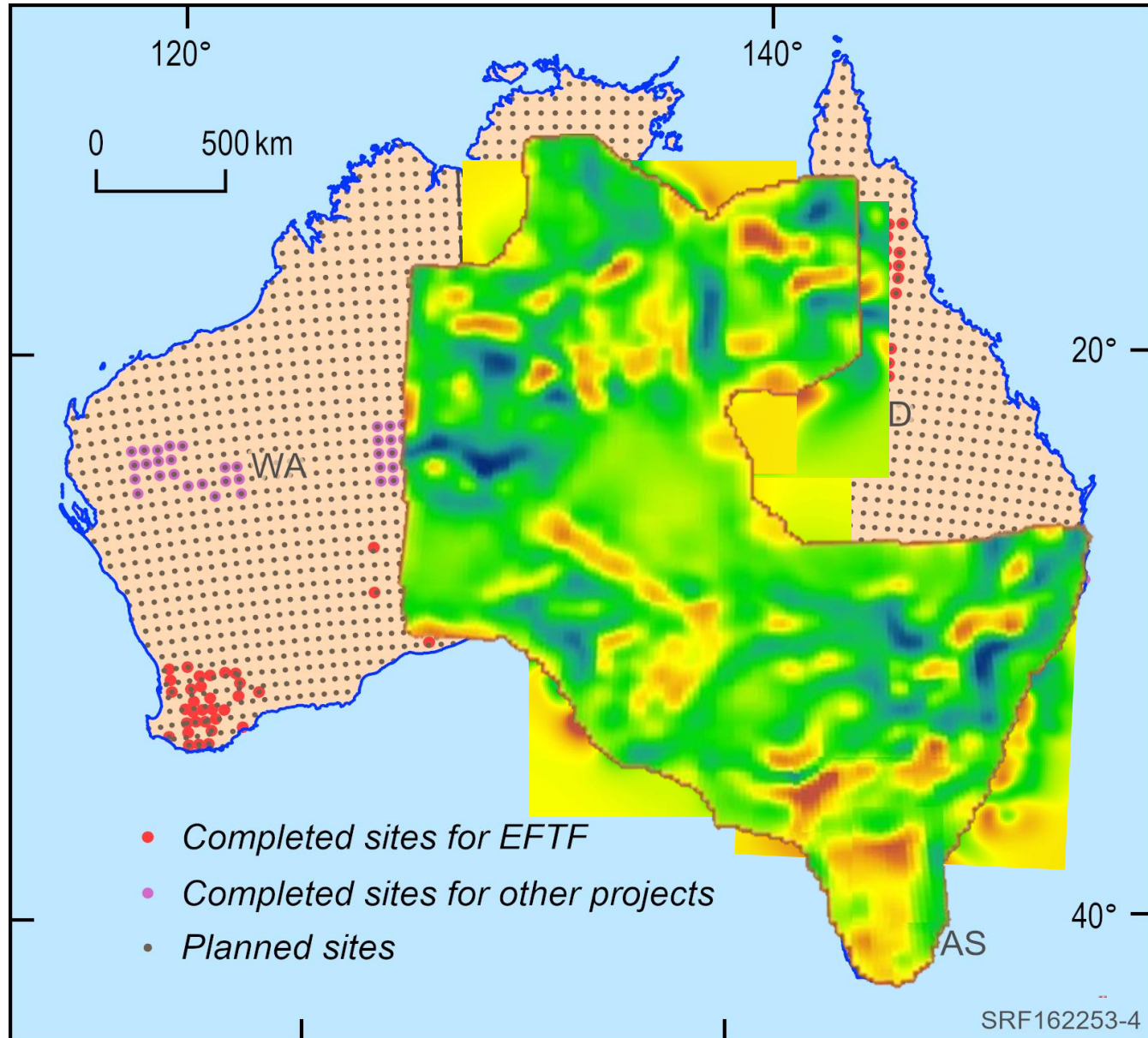
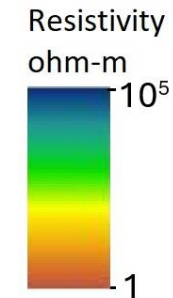


Image: <https://www.science.org.au/files/usertiles/support/reports-and-plans/2015/uncover-report.pdf>

Australian Lithospheric Architecture Magnetotelluric Project (AusLAMP)



- Collaboration between Geoscience Australia, state/territory geological surveys and academia.
- Acquire long-period MT data on a 0.5° spacing.
- About 50% of ~3000 sites completed.
- Aim to resolve large-scale lithospheric architecture beneath the Australian continent.

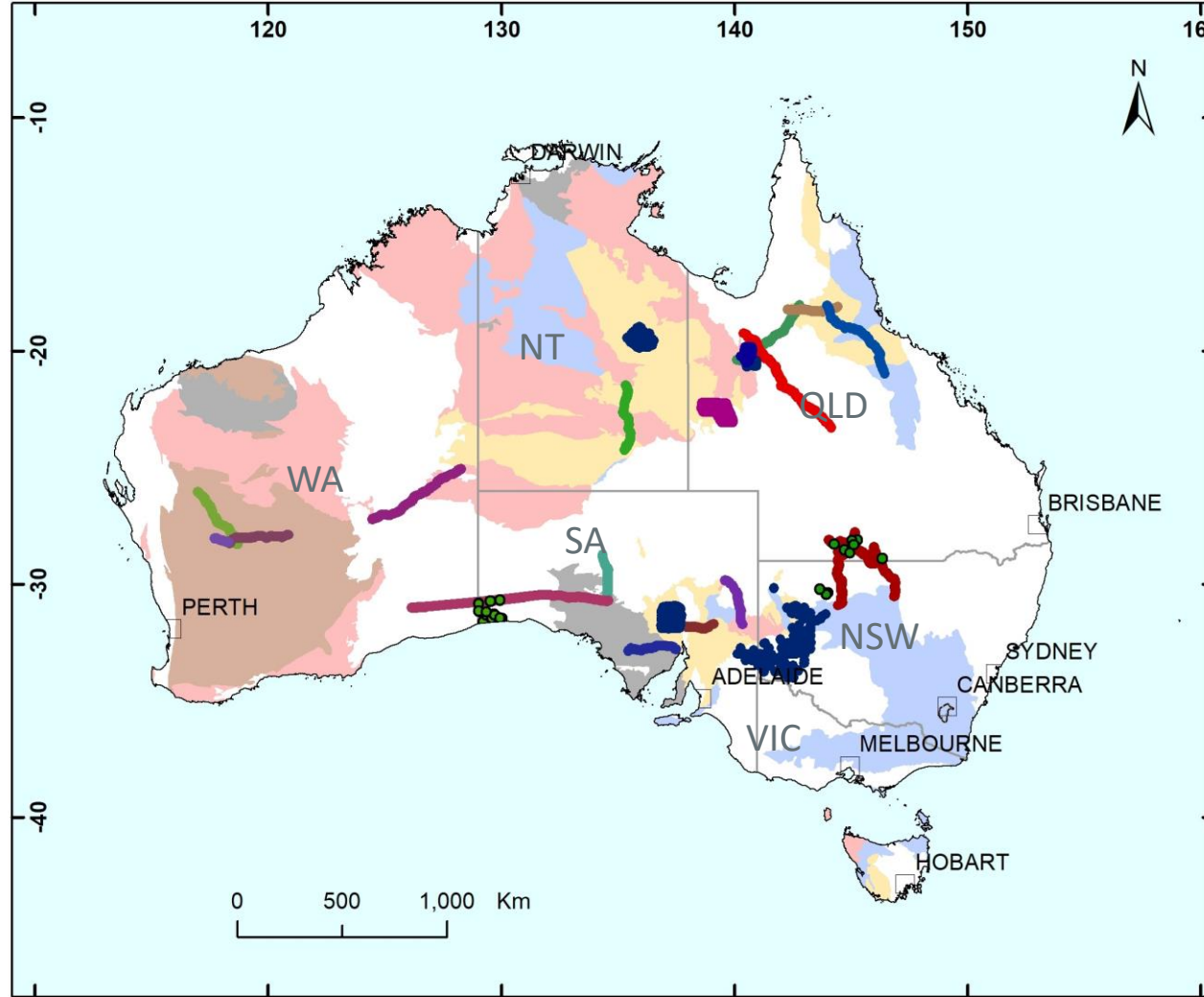


Kirkby et al., 2020

Robertson et al., 2020

*Duan et al., 2021,
2023, 2024*

Regional-scale MT surveys



Queensland
Government
Australia



Tasmanian
Government



Department of
Mines, Industry Regulation
and Safety



Northern Territory
Government



THE UNIVERSITY
of ADELAIDE



UNIVERSITY of
TASMANIA

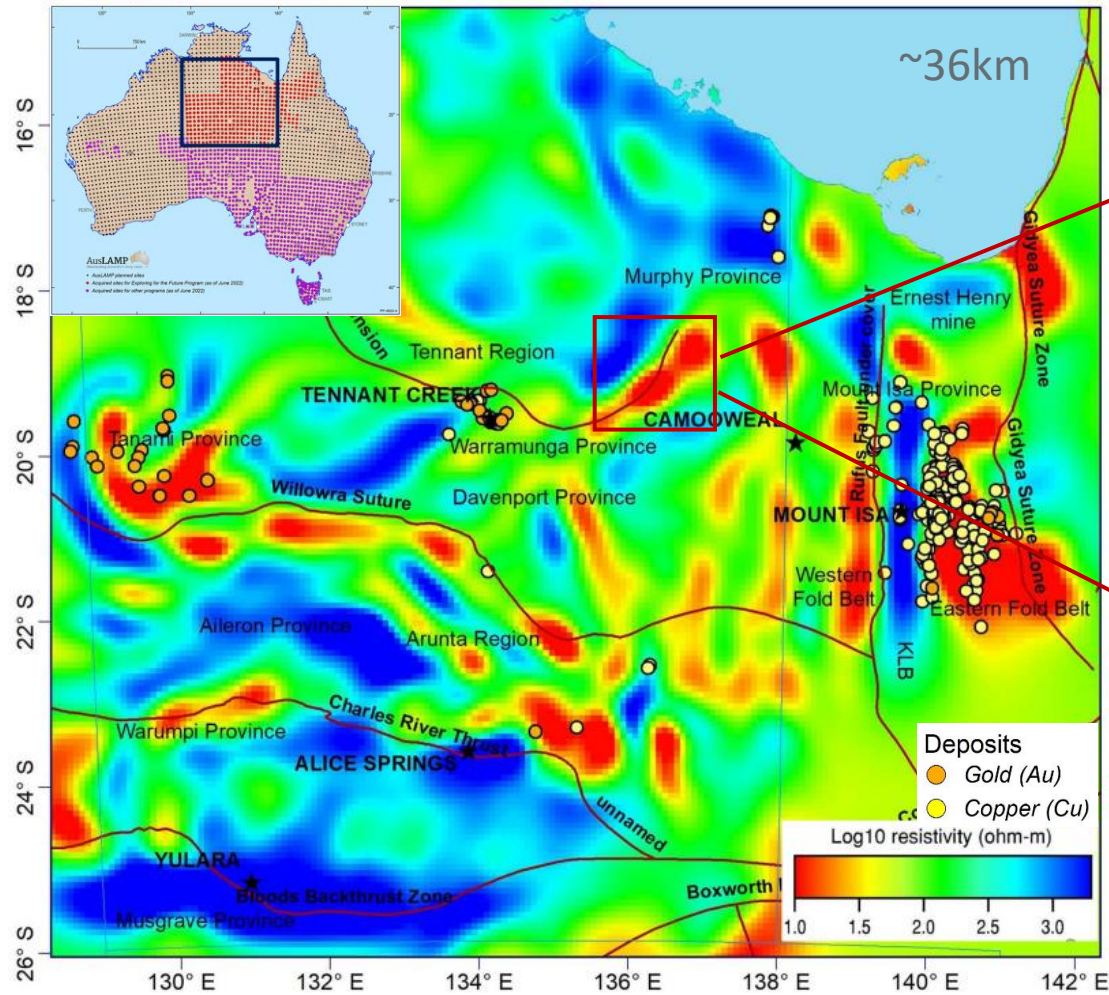


THE UNIVERSITY OF
WESTERN AUSTRALIA



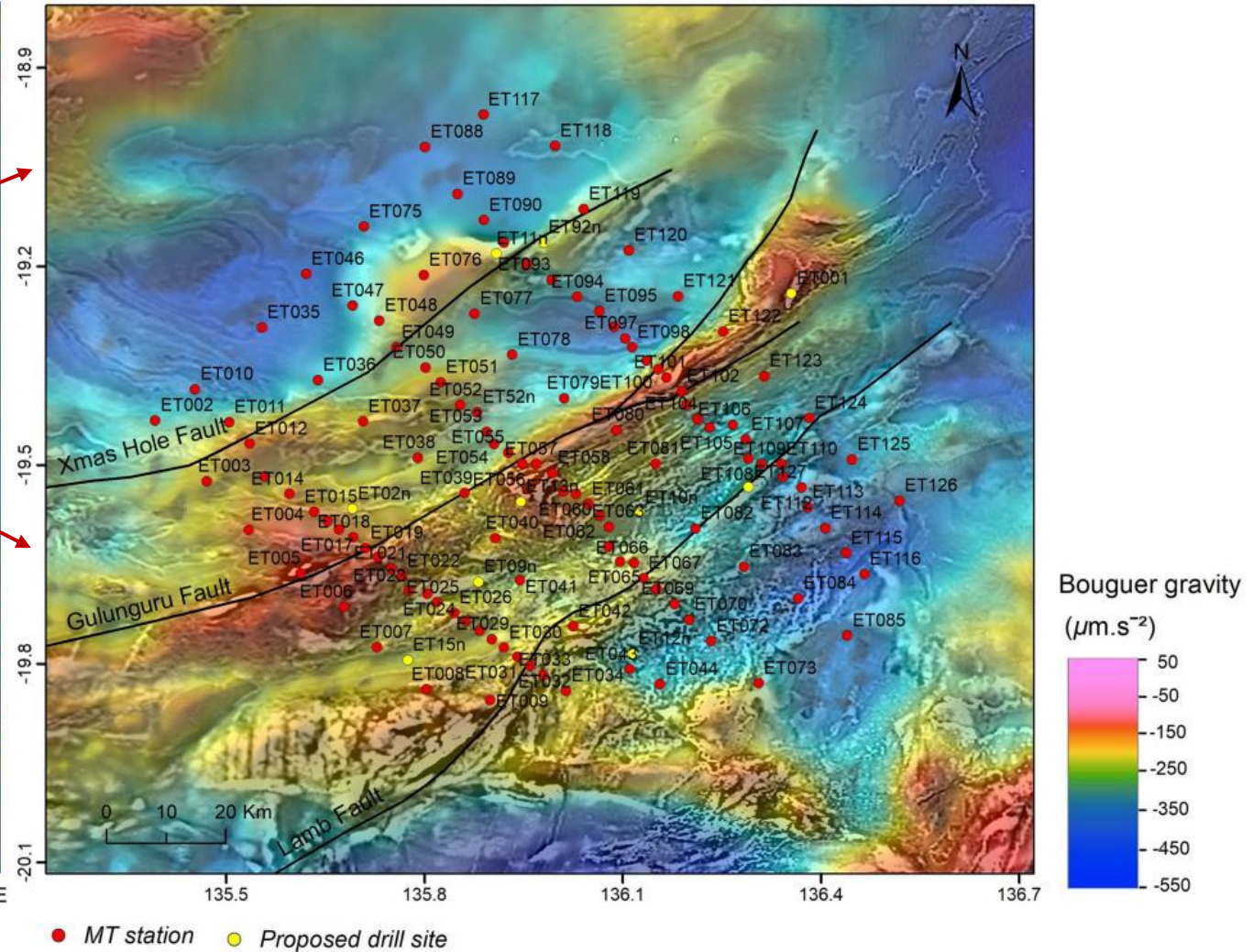
AuScope

Scale-reduction infill survey in East Tennant



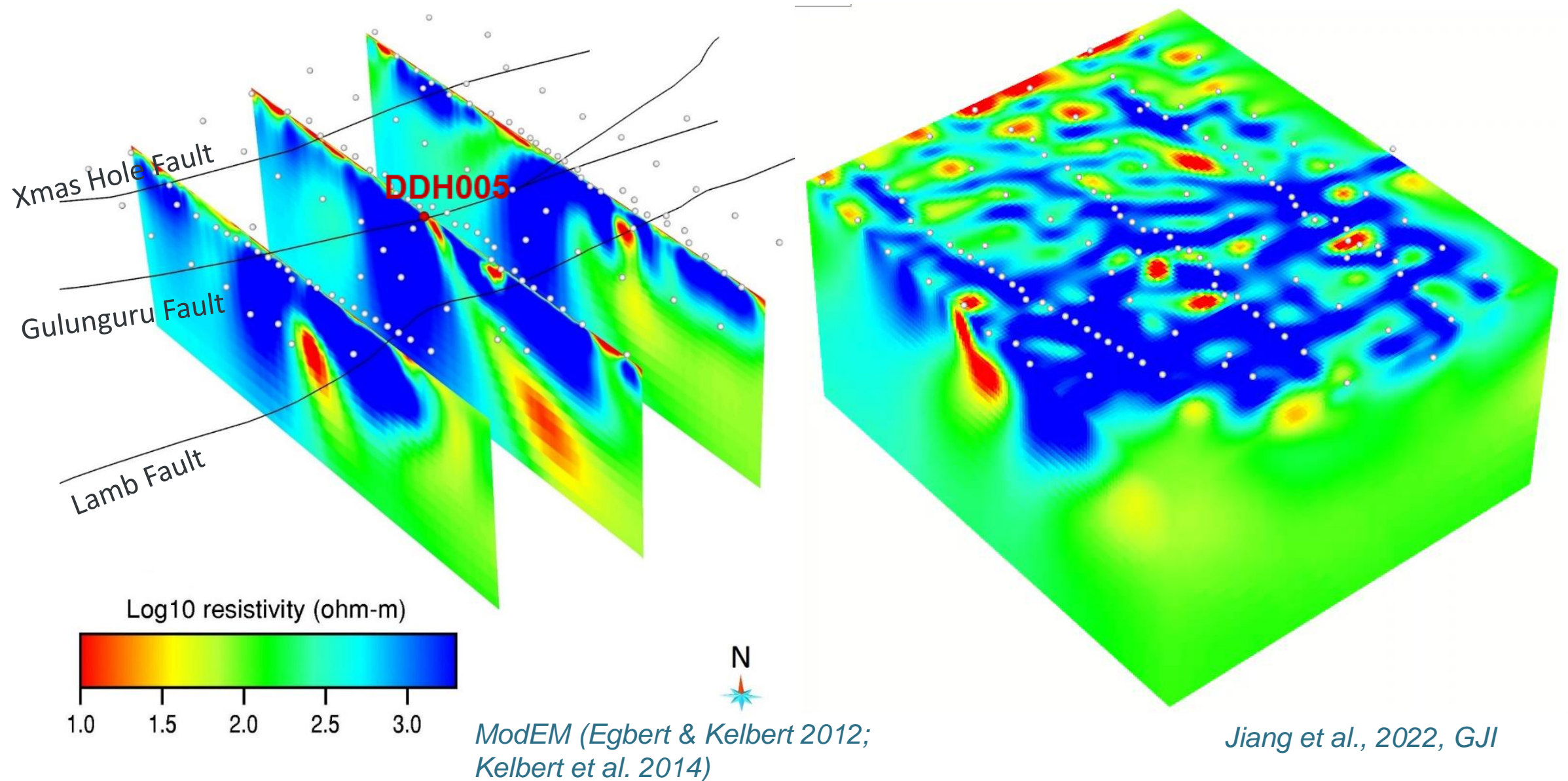
Duan et al., 2021

(Korsch and Doublier, 2016)

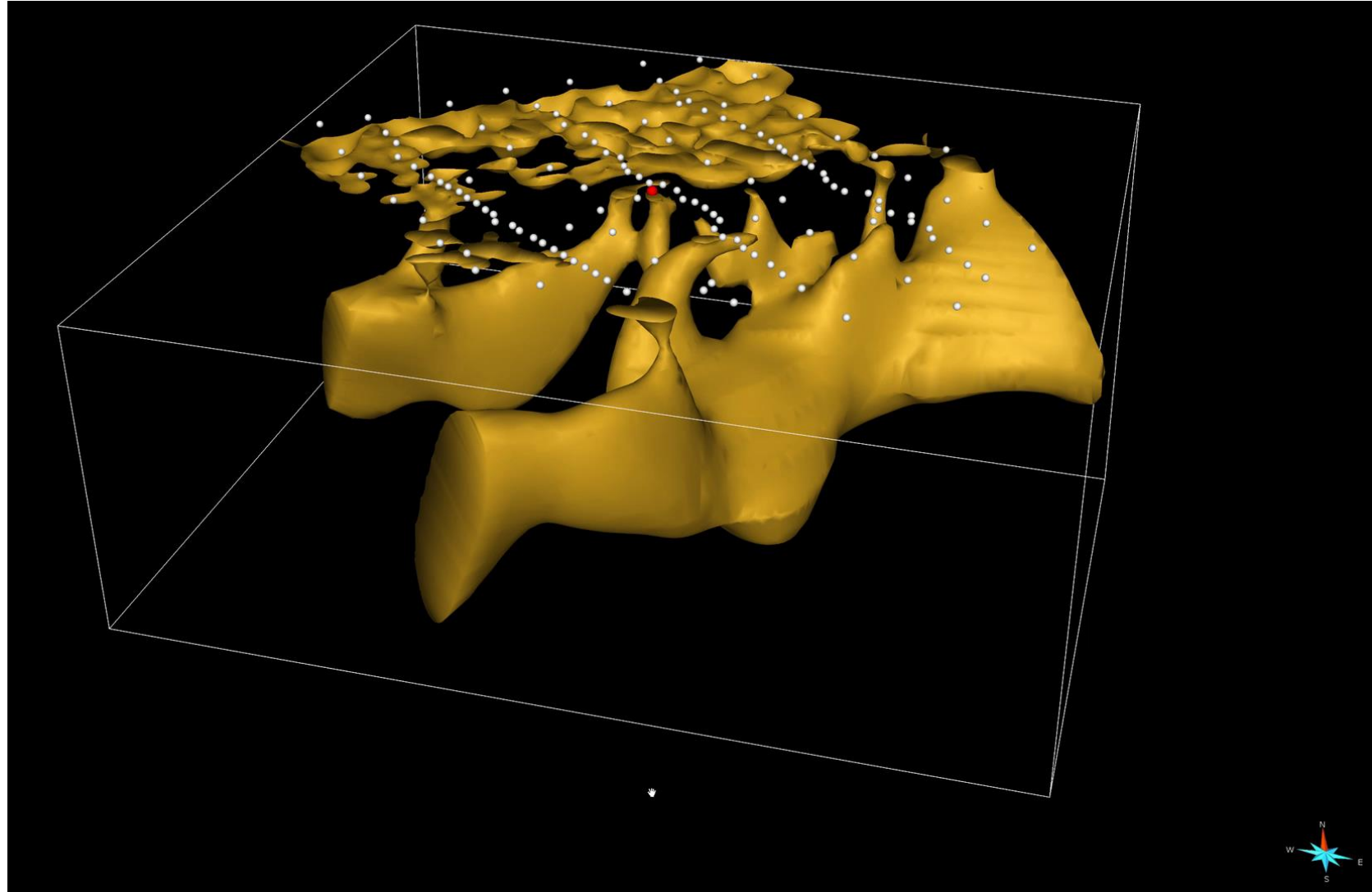


Jiang et al., 2022

Mapping crustal structures in East Tennant



Mapping crustal structures



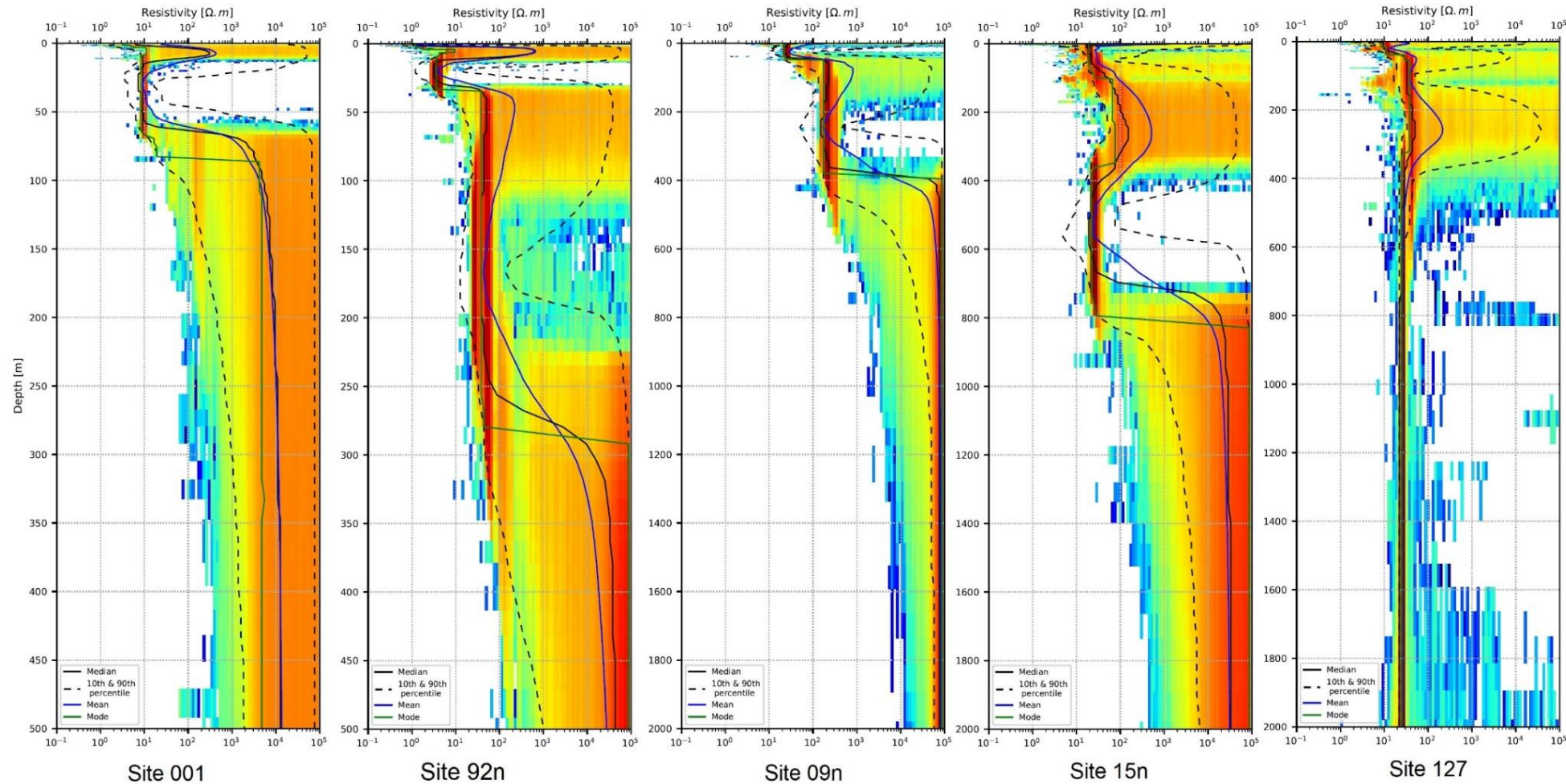
● DDH005

Cover thickness estimation – drill targeting

Trans-dimensional (reversible jump) Markov chain Monte Carlo - rj-McMCMT

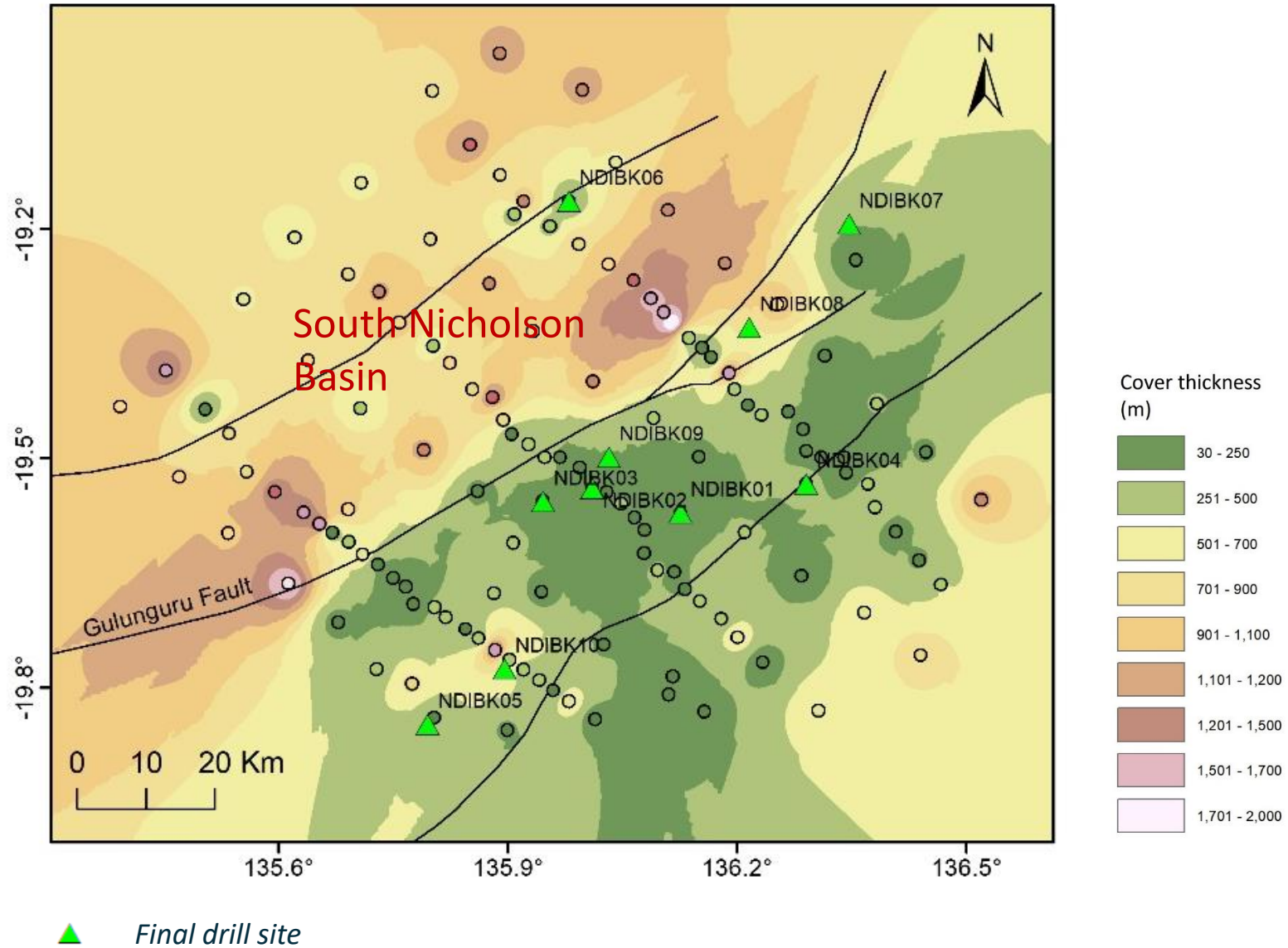
<https://github.com/GeoscienceAustralia/rjmcmcmt>

(Brodie and Jiang 2018)

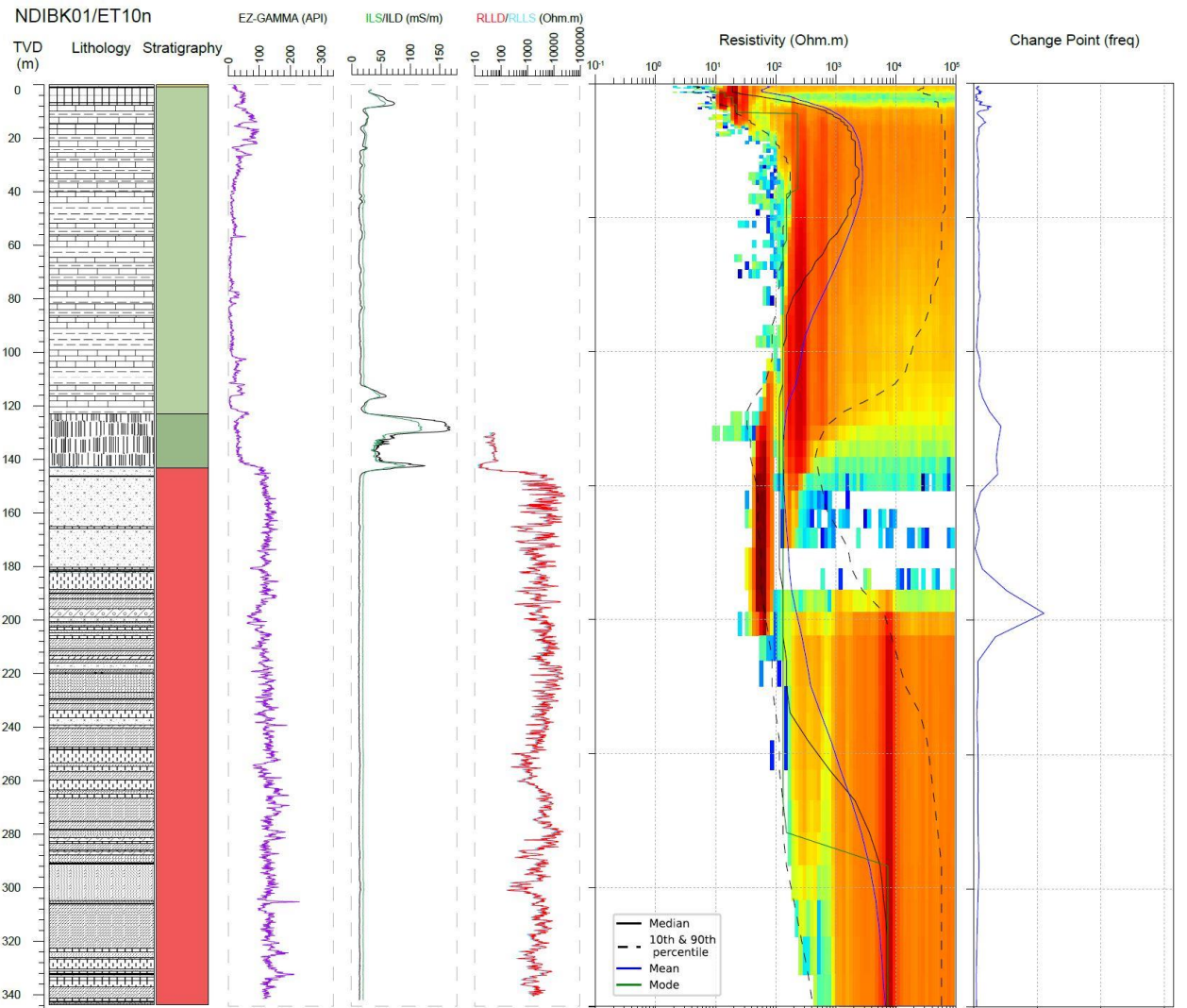
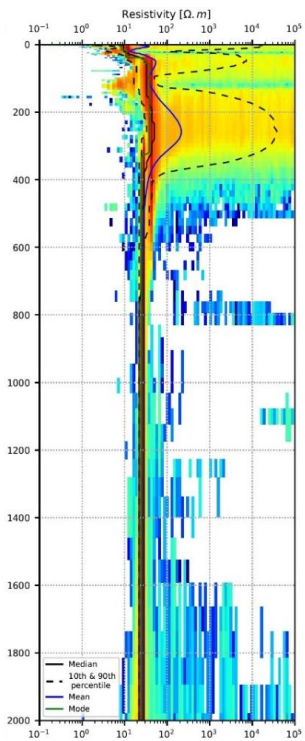


*Jiang et al., 2023,
Applied Geophysics*

Cover mapping and drill targeting



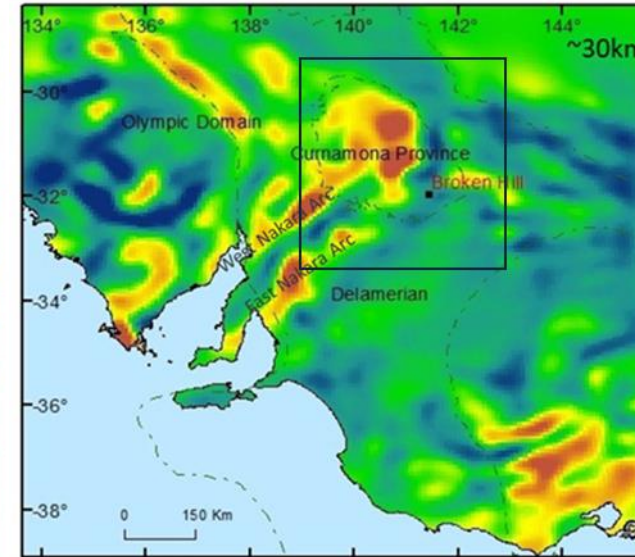
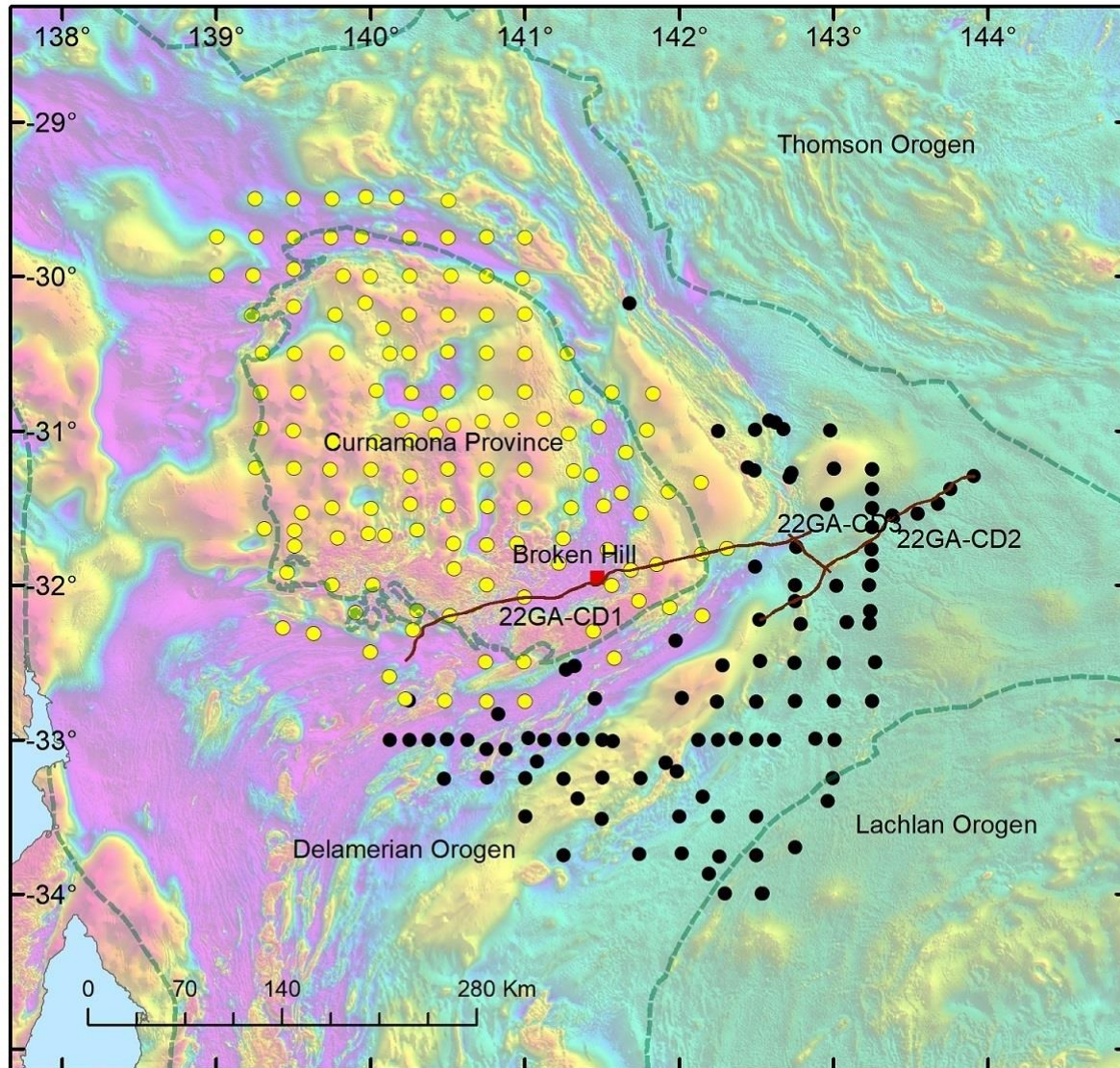
Validation against drill results



- | Lithology | | Stratigraphy | |
|-----------|----------------------|--------------|---------------------------|
| | Acid intrusive rock | | Cenozoic |
| | Basalt | | Georgina Basin |
| | Biosparite | | Helen Springs Volcanics |
| | Breccia | | Paleoproterozoic basement |
| | Granodiorite | | |
| | Micrite | | |
| | Mudstone, calcareous | | |
| | Pegmatite | | |
| | Pelite | | |
| | Psammite | | |
| | Saproolith | | |
| | Schist | | |
| | Vein quartz | | |

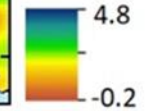
Jiang et al., 2023,
Exploration Geophysics

Delamerian Orogen



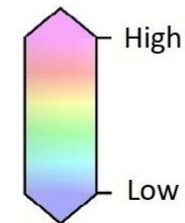
Robertson et al., 2020

Log resistivity (ohm-m)

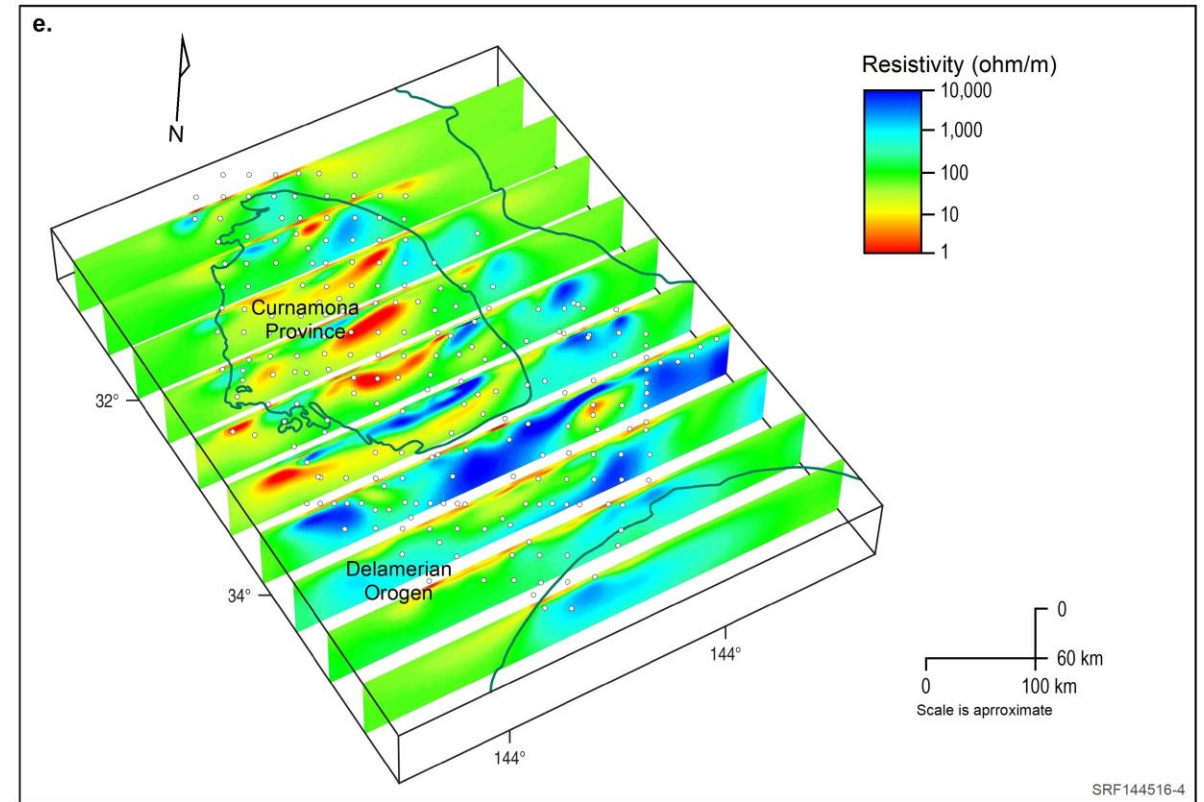
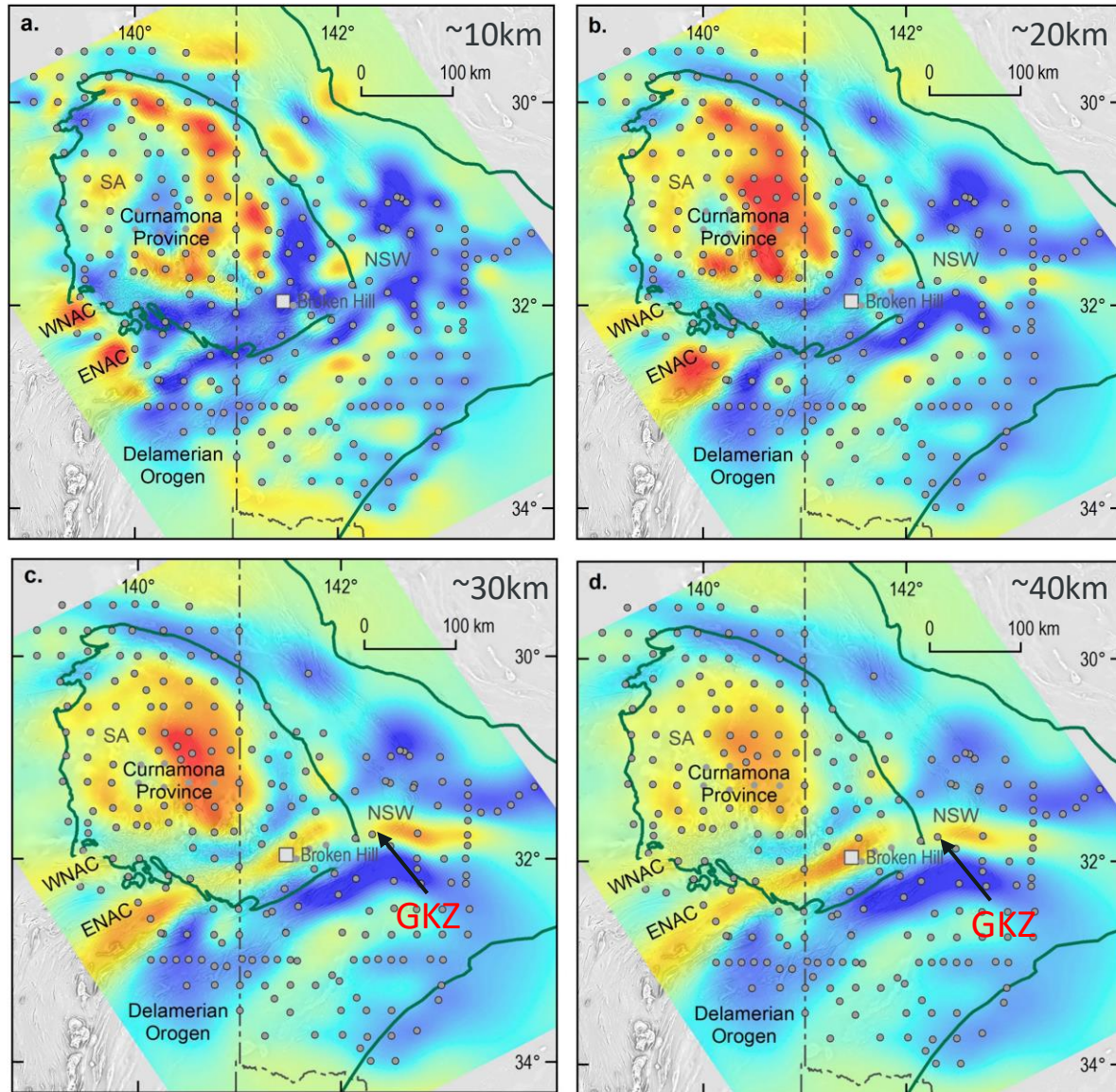


- Curnamona Cube (UoA)
- Curnamona Cube Extension (GA)
- Seismic Line
- - - Delamerian Orogen

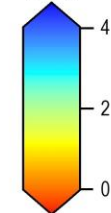
Magnetic intensity



Curnamona Cube and Extension



Log Resistivity (Ωm)

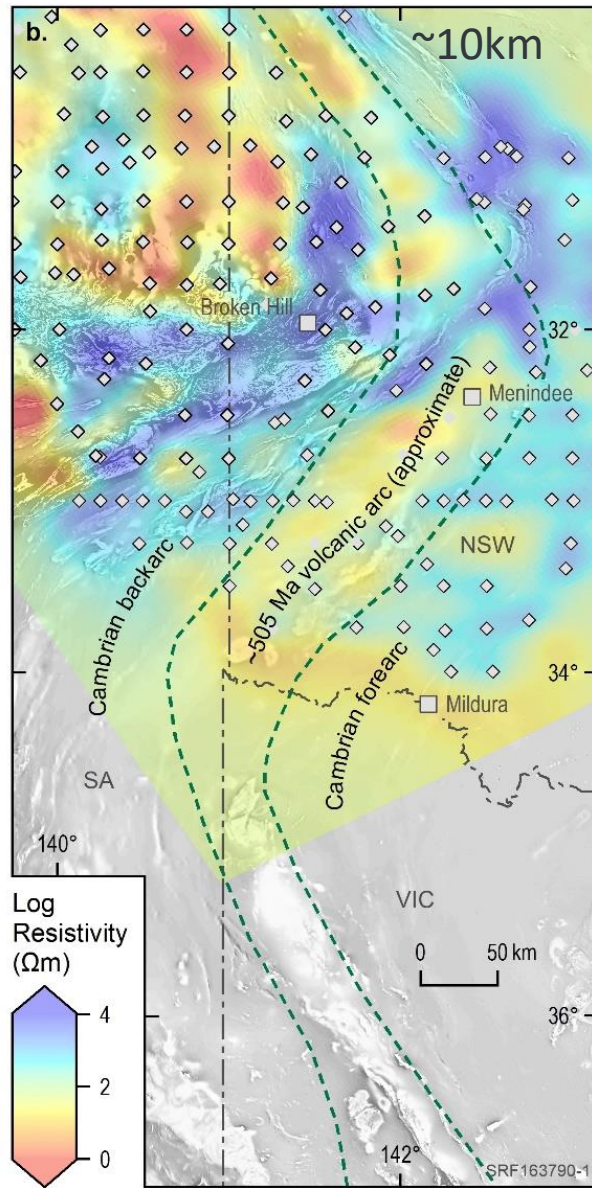


- Delamerian Orogen outline
- MT station
- City/town

WNAC = West Nakara Arc Conductor
 ENAC = East Nakara Arc Conductor
 GKZ = Grasmere Knee Zone

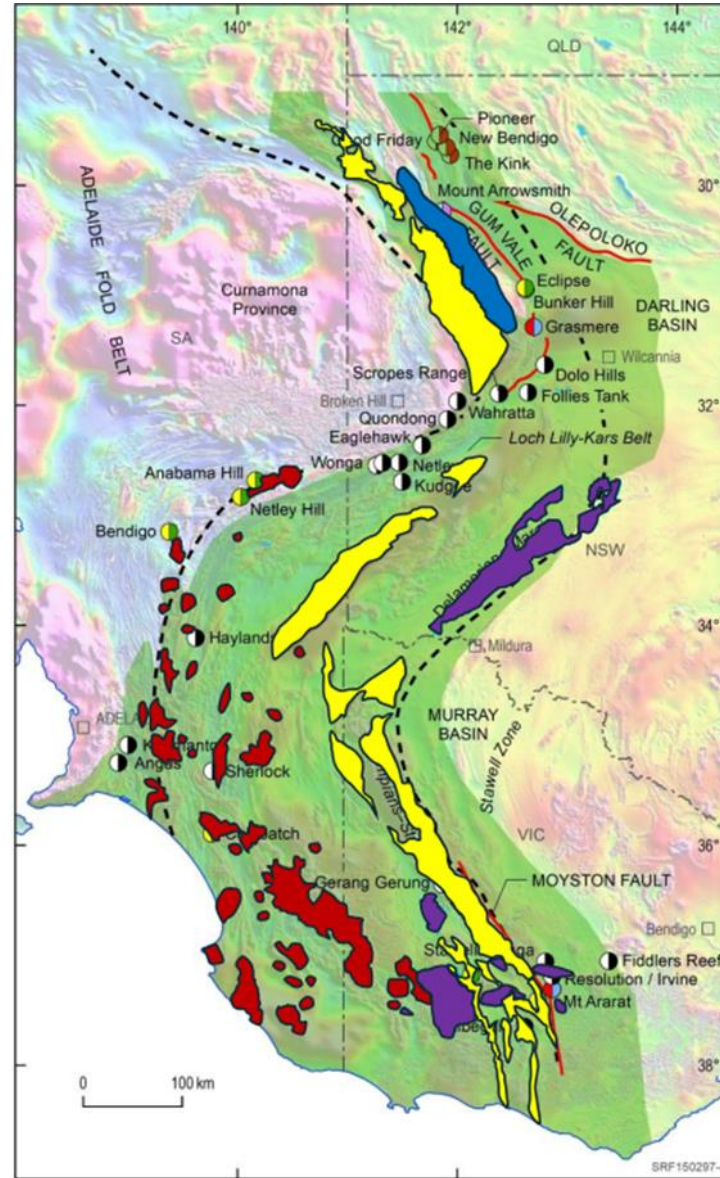
Jiang et al., 2024

Geological interpretation and mineral prospectivity



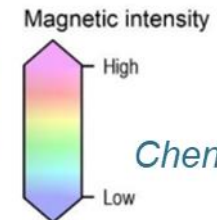
- Geological boundary
- Seismic line
- New MinEx CRC NDI borehole
- ◇ MT station
- Legacy sample location
- Town/location

Clark et al., 2024
Jiang et al., 2024



- 425-400 Ma magmatic rocks
- 490-460 Ma magmatic rocks
- 515-495 Ma magmatic rocks
- 515-495 Ma convergent margin
- 590-580 Ma magmatic rocks

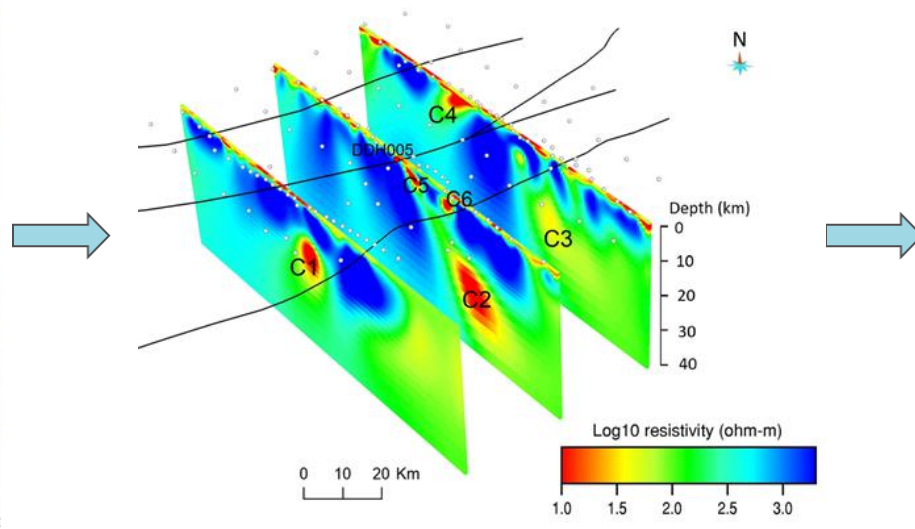
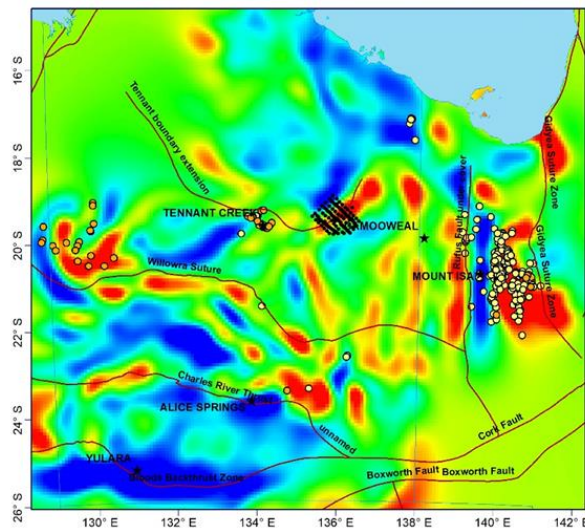
- Orogenic Au
- Orthomagmatic Ni-Cu-PGE
- VHMS
- Porphyry-epithermal
- Unspecified magmatic-hydrothermal
- Delamerian Margin
- Town/locality



Cheng et al., 2024

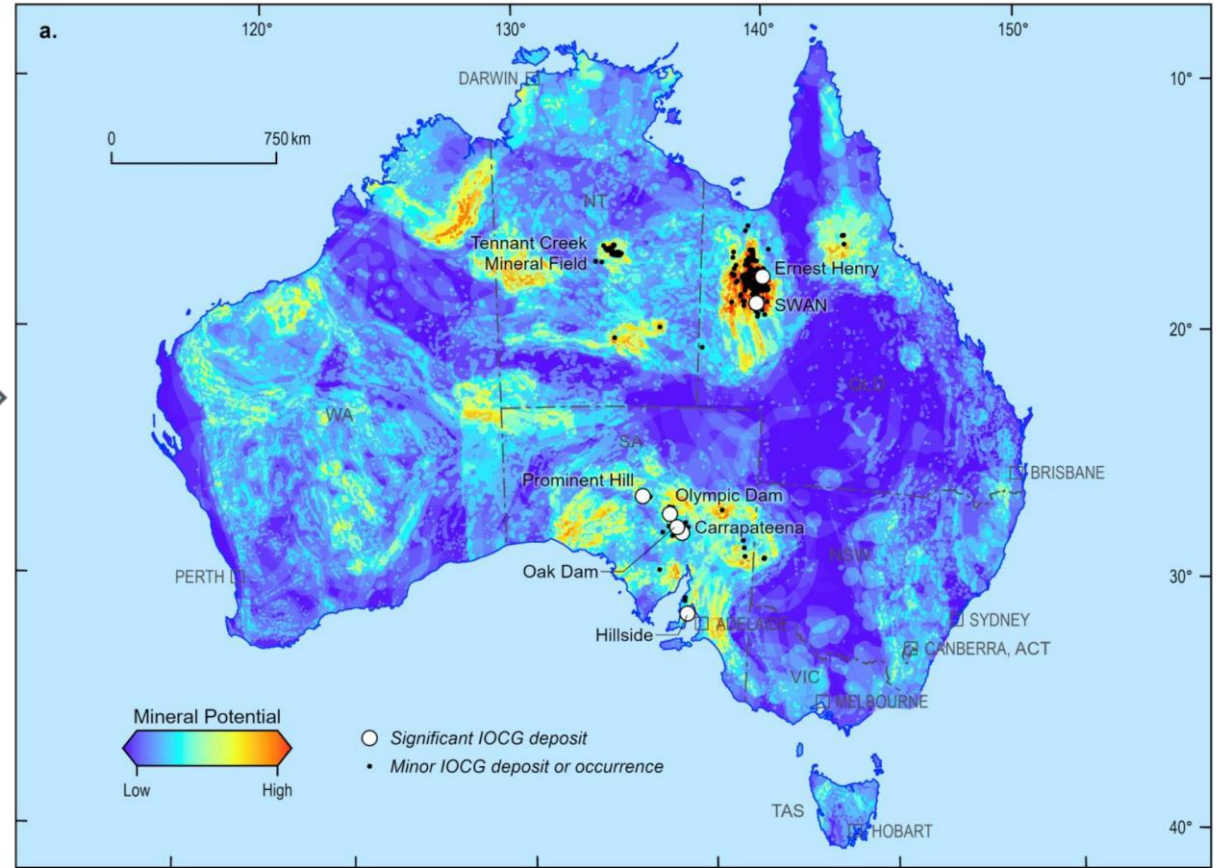
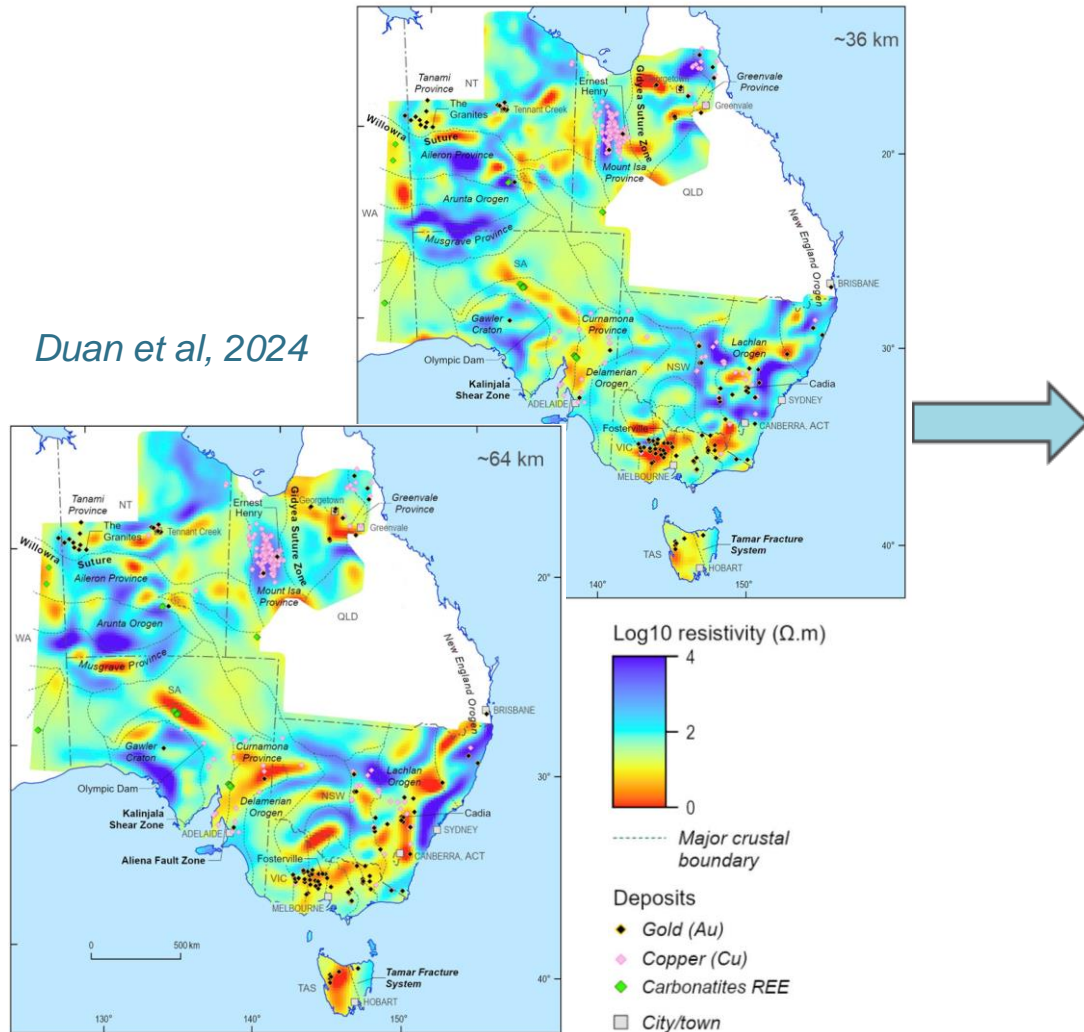
Summary

- Magnetotelluric data provides new insights into geodynamics and prospective mineralisation in covered terranes.
- Large-scale surveys help narrow the search space and in-fill surveys help identify 'targets' of mineral potential.
- Integration of geophysical data from multiscale surveys is an effective approach to scale reduction during mineral exploration in covered terranes.



Ongoing work

Duan et al, 2024



Cloutier et al., 2024

Acknowledgements



[2024 Showcase | Exploring for the Future](https://www.eftf.ga.gov.au/2024-showcase)
<https://www.eftf.ga.gov.au/2024-showcase>



and many other collaborators...

Future – Resourcing Australia’s Prosperity

Australian Government’s 35-year, \$3.4 billion precompetitive geoscience initiative, led by Geoscience Australia, to accelerate the discovery of critical minerals and other resources, to support Australia’s net zero transition and enable responsible management of all resources.

<https://www.ga.gov.au/scientific-topics/resourcing-australias-prosperity>

Data and model release: <https://dx.doi.org/10.26186/149630>

Web: www.ga.gov.au

Email: clientservices@ga.gov.au

Postal Address: GPO Box 378, Canberra ACT 2601