

## Linking Western and South Australia – insights from magnetotelluric profiling

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The Proterozoic basement under the Nullarbor Region of Western and South Australia links the Archean Yilgarn Craton with the Archean-Proterozoic Gawler Craton, and is one of the largest under-explored regions of the Australian continent. Its tectonic history and mineral endowment is currently being investigated and the recent 13GA-EG1 seismic and magnetotelluric (MT) transect across this region is designed to complement this work by imaging the crustal architecture, augmented by dense gravity profiling and numerical modelling.

We report on the continuous magnetotelluric (MT) profile, from west to east, imaging the edge of the Yilgarn Craton, the Albany-Fraser Orogen, (~300 km 12GA-AF3 MT profile), the Madura and Coompana Provinces, to the northern part of the Fowler Domain and western margin of the Gawler Craton (~830 km 13GA-EG1 broadband MT profile). Electrical resistivity profiles derived from rigorous 2D inversions of the MT impedance tensor have the ability to highlight areas of low resistivity which are typically a proxy for shear zones, and fossil fluid pathways.

The MT data shows varying complexity along the >1100 km profile, with pronounced three-dimensionality across the western end in the Albany–Fraser Orogen and in the Gawler Craton to the east. The Madura and Coompana Provinces between these regions generally show a 1D resistivity distribution (layered structure) in the near surface sedimentary cover, and predominantly 2D resistivity distribution (one predominant lateral strike) in the basement.

There exists a good correlation between narrow (~10 km wide) crustal zones of low resistivity and the location of shear zones from surface mapping and potential field data across the Fowler Domain and the Albany–Fraser Orogen. The Gawler Craton bounding Karari Shear Zone is imaged as a ~10 km wide deformation zone in the upper and lower crust, supporting its significance as a crustal-scale shear zone. The Colona and Coorabie Shear Zones bounding the Proterozoic Fowler Belt to the east show similar crustal-scale fossil fluid pathways and deformation zones, as does the Rodona Shear Zone separating the Albany–Fraser Orogen from the Madura Province. Separating the Madura and Coompana Provinces, the Mundrabilla Shear Zone is visible in the data to periods of close to 1000 s, indicative of a near-vertical crustal-scale shear zone.

The preferred current flow and associated geoelectric strike of the lower crust and upper mantle along the entire profile follows the main subregions of the Gawler Craton (NNE orientation) changing to due north for the Nullarbor Region. This suggests that the lower crust and mantle lithosphere records different tectonic domains with a contrasting history.