Deep crustal magnetotelluric imaging of continental accretion and intracontinental deformation in central Australia

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SUMMARY

Central Australia preserves a record of micro-continent and craton accretion during assembly of the Paleoproterozoic Nuna supercontinent 2500-1500 Ma, followed by Mesoproterozoic magmatic and orogenic events that formed the Musgrave Province. The Petermann Orogeny (630-520 Ma) and Alice Springs Orogeny (450-300 Ma) resulted in north-south crustal shortening and offsets in Moho of up to 20 km and gravity variations of > 160 mGals.

Three-dimensional inversion of ~500 long-period (10-10,000 s) AusLAMP and legacy MT sites spaced 50 km yielded resistivity estimates to 250 km, covering 1500 km west-east and 1300 km north-south. From 0-5 km, the resistivity maps extent and thickness of Neoproterozoic Officer, Amadeus and Georgina Basins, and Mesozoic Eromanga basin. At all crustal depths the Arunta Inlier and northern Musgrave Province are resistive (> 10,000 Ohm.m), bounded by lower crustal conductive zones (<10 Ohm.m) to the north, east and south that align with suture zones associated with Paleoproterozoic accretion of ribbon continents. Lithospheric scale faults active in the Petermann Orogen (Woodroffe Thrust) and Alice Springs Orogen (Redbank Shear Zone) align with these low-resistivity zones, and we argue that graphite from carbon burial in Paleoproterozoic sediments reduces frictional strength and enable compressive deformation to localise strain.

Keywords: Central Australia, craton accretion, intracontinental orogeny, AusLAMP