

Geochronological constraints from the Coompana Province, with implications for geological relationships with the Gawler Craton, Musgrave Province and Madura Province

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The Coompana Province is one of the most poorly understood pieces of crystalline basement geology in the Australian continent. It lies entirely concealed beneath a variable thickness of Neoproterozoic to Cenozoic sedimentary rocks, and is situated between the Gawler Craton to the east, the Musgrave Province to the north, and the Madura and Albany-Fraser Provinces to the west. A recently-acquired reflection seismic transect (13GA-EG1) provides an east-west cross-section through the southern part of the Coompana Province, and yields new insights into the thickness, seismic character and gross structural geometry within the Coompana Province. To assist geological interpretation of the 13GA-EG1 seismic line, new SHRIMP U-Pb zircon ages have been acquired from samples from the limited drill-holes that intersect the Coompana Province.

New results from several granitic and gneissic rocks from the Coompana Province yield magmatic and/or high-grade metamorphic ages in the interval 1100 – 1200 Ma. Magmatic or high-grade metamorphic ages in this interval have not been identified in the Gawler Craton, in which the last major magmatic and metamorphic event took place at ~1590 – 1570 Ma. The Gawler Craton was largely unaffected by ~1100 – 1200 Ma events, as evidenced by the preservation of pre-1400 Ma $^{40}\text{Ar}/^{39}\text{Ar}$ cooling ages. In contrast, magmatic and metamorphic ages of 1100 – 1200 Ma are characteristic of the Musgrave Province (Pitjantjatjara Supersuite) and Madura Province (Moodini Supersuite).

The new results from the Coompana Province have also yielded magmatic or inherited zircon ages at ~1500 Ma and ~1640 Ma. Once again, these ages are not characteristic of the Gawler Craton and no pre-1700 Ma inherited zircon has been identified in Coompana Province magmatic rocks, as might be expected if the province was underlain by older, Gawler Craton-like crust.

The emerging picture from this study and recent work from the Madura Province and the Forrest Zone of the western Coompana Province is that the Coompana Province has a geological history that is quite distinct from, and generally younger than, the Gawler Craton to its east, but that is very similar to the Musgrave and Madura Provinces to the north and west.

The contact between the Coompana Province and the Gawler Craton is interpreted in the 13GA-EG1 seismic line as a prominent west-dipping crustal-scale structure, termed the Jindarnga Shear Zone. The nature and timing of this boundary remain relatively poorly constrained, but the seismic and geochronological evidence suggests that it represents the western edge of the Gawler Craton, marking the western limit of an older, more isotopically evolved and multiply re-worked craton to the east, from a younger, more isotopically primitive crust that separates the South Australian Craton from the West Australian Craton.