Liebig-aged (c. 1640 Ma) magmatism and metamorphism in c. 1760 Ma crust in the Warumpi and southern Aileron Province, central Australia: a case for revising the tectonic framework of Proterozoic Australia

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ABSTRACT

The southern margin of the North Australian Craton (NAC) has been suggested to represent a long-lived (c. 1860 to 1600 Ma) active margin that preserves a cryptic record of the growth and assembly of the Australian continent. The Warumpi Province is juxtaposed against the southern Aileron Province, and has been interpreted as exotic to the NAC, though the timing of collision between the Warumpi Province and the southern Aileron Province is contentious. U-Pb zircon and monazite LA-ICP-MS geochronology from granulite facies metapelites and granitic gneisses along the southern margin of the Aileron Province and northern margin of the Warumpi Province, has shown it is characterised by c. 1780-1740 Ma magmatic rocks and c. 1640-1615 Ma magmatic and metamorphic rocks. The evidence for these events is preserved in kilometre-scale migmatitic boudins and low-strain zones enveloped by pervasive E-W trending higher strain belts. The overprinting high strain fabrics are Grenvillian age and constrained to c. 1175-1070 Ma. Phase equilibria modelling on a garnet-sillimanite-cordierite metapelite dated at c.1616 Ma, from a low-strain domain within the southern Aileron Province, indicates that peak metamorphic conditions were ~7-8 kbar and between 740-900 °C, and were associated with a down-pressure or decompressional P-T history. A metamorphic monazite age of c.1620 Ma was also preserved in a granitic gneiss located in an older, low-strain domain. The presence of the c. 1760 Ma and c. 1640 Ma timelines in both the Warumpi and Aileron Provinces calls into question the proposed exotic nature of the Warumpi Province. A speculative interpretation is that the Liebig-aged metamorphism and magmatism, seemingly associated with relatively shallow orientated, low strain fabrics, represents a period of extension rather than collision.

KEYWORDS

Proterozoic Australia, Aileron Province, Warumpi Province, southern Arunta region, North Australian Craton, U-Pb zircon geochronology, U-Pb monazite geochronology
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Table 2 Summary of samples analysed in this study; including grid reference, lithological unit, rock type and structural setting.

Table 3 Summary of U-Pb monazite and zircon geochronology, listed in order of increasing age.

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