Metamorphic evolution of the western Gawler Craton

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ABSTRACT

The tectonothermal evolution of the western Gawler Craton, including the Fowler Domain, during Proterozoic Australia is currently poorly understood. *In-situ* U-Pb ages obtained in this study from the Fowler Domian yielded ages of metamorphism at c. 1732–1701 Ma attributed to the Kimban Orogeny, and at c. 1599 Ma attributed to Kararan/Hiltiba events. Quantitative phase equilibria modelling, i.e. pressure-temperature pseudosections, provide the first modern metamorphic constraints on pressure–temperature conditions for two areas within the Fowler Domain and are ~2.6–7.4 kbar and 550– 700°C for the Barton Block, and 8.2–8.7 kbar and 450– 475°C for the Nundroo Block which equate to apparent thermal gradients of approximately ~116–135°C /kbar and ~50–60 °C/kbar respectively. These thermal gradients occur within the hotter part of the 'high *T*/*P* or Barrovian' (Barton Block) and 'colder than normal' (or eclogite–high-pressure granulite, Nundroo Block) subdivisions of *P*–*T* space. This is suggestive of extension in the Barton Block and later convergence in the Nundroo Block. Kimban-aged tectonism in other parts of the Gawler Craton records thermal gradients ranging between ~150–133 °C/kbar. These differences in thermal gradients are appreciably, and in some cases different from previous studies on the Fowler Domain. The Curnamona Province (north-north eastern South Australian Craton) possesses sedimentation and thermal gradients consistent with divergence within this time period. This has prompted many scientific debates surrounding tectonic regime of the Proterozoic time line, which are yet to include any metamorphic quantitative pressure-temperature considerations. Apparent thermal gradients presented in this study are consistent with both divergence within the Kimban Orogenisis time line 1730–1690 Ma, and convergence within Kararn-/Hiltiba time line 1600–1550Ma. These processes are interpreted to record Tasmanide type tectonic regimes.

KEYWORDS
U–Pb geochronology, P–T pseudosection, geothermal gradients, Proterozoic Australia, Tectonics

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