Proterozoic rejuvenation of the Archean Crust tracked by U–Pb and Hf-isotopes in Detrital Zircon

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The TerraneChron® methodology (Griffin et al., 2006) was applied to zircons in drainage samples collected from 24 defined catchments across the Gawler Craton, South Australia to define the relative contribution of juvenile sources and recycled crust to the continental crust as a function of time and to constrain the role of mantle inputs during the Proterozoic rejuvenation of the Archean Gawler Craton.

Modelling of the composite age spectrum derived from the detrital zircons allows definition of six major geological events in the Gawler Craton, spanning the period 2550–1550 Ma (1595 ± 40, 1743 ± 37, 1853 ± 25, 2021 ± 30, 2450 ± 37, and 2540 ± 32 Ma). A major peak at 1165 ± 48 Ma is also present, and may represent zircons transported from the Musgrave Province. A minor age peak at 3152 Ma probably represents an inherited population in the igneous rocks of the Craton. Widespread Hf model ages (by in situ LAM-MC-ICPMS) of about 3.5 Ga, and the presence of inherited zircon grains with comparable U–Pb ages (3.2–3.5 Ga), indicate the existence of Archean crust as old as ca 3.5 Ga in the Gawler Craton. This component may now reside largely in the lower crust, where it has provided a source of crustal magmas throughout the Proterozoic.

The combination of the Hf-isotope and trace-element data with the U–Pb age spectra provides a detailed 'Event Signature' for the Gawler Craton:

- Crustal evolution was dominated by long periods of crustal reworking. Crust generated in the Archean (3.2–3.5 Ga) was largely reworked during Proterozoic time.
- Three periods of juvenile mantle input occurred at ca 2540, 1850, and 1595 Ma. A significant juvenile input at ca 1165 ± 48 Ma is probably not relevant to the evolution of the Gawler Craton as the source of these zircons is likely to be the Musgrave Province.
- There is a trend of increasing juvenile contribution from the north-west toward the south-eastern parts of the Gawler Craton throughout Proterozoic.

Reference

Griffin, W.L., Belousova, E.A., Walters, S.G., O'Reilly, S.Y., 2006. *J. Petrol.* **47**, 239–353.