



Contrasting crustal evolution processes in the Dharwar craton

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Archaean cratons provide a critical window into early Earth dynamics, preserving a record of crustal evolution processes that include the start of 'modern' plate tectonics and the development of supercontinents. However, these same processes can also destroy or rework substantial volumes of crust, and the oldest extant Archaean terrane is only ~ 3.9 Ga. Where Archaean rocks are exposed, bulk techniques such as Pb and Nd isotopes can provide considerable information about continental formation, but these may have been altered by later metamorphic events. Another method is to examine sedimentary units, which can preserve fragments of the crust that are no longer exposed at the Earth's surface. Resistant detrital minerals such as zircon have particular use in these studies, as they incorporate a range of isotopic and geochemical tracers and can survive multiple crystallisation and/or sedimentary events. In this manner, a more complete record of a craton's evolution may be obtained, with the benefit of contributions from contrasting isotopic systems.

The Dharwar craton of southern India is one such Archaean block, comprising >2.7 Ga trondjemite-tonalite-granodiorite (TTG) gneisses, volcano-sedimentary belts (>3.0 and $2.9\text{--}2.6$ Ga) and $2.7\text{--}2.5$ Ga calc-alkaline to potassic granitoids. These rocks preserve evidence for several cycles of supracrustal formation, deformation, metamorphism and granitic activity during the Precambrian. New *in situ* U–Pb–Hf analyses of detrital zircons from across the craton indicate significant juvenile crustal extraction events at ~ 3.3 and 2.7 Ga, and continuous extraction from $3.7\text{--}3.3$ Ga. Reworking in the older western block at ~ 3.0 Ga marks the onset of cratonisation, most likely due to 'modern' plate tectonic processes, while reworking in both the western and younger eastern block at $2.55\text{--}2.50$ Ga indicates accretion of the two terranes and final cratonisation much later than in most other Archaean terranes (~ 2.7 Ga). Different patterns of disturbance to the zircon U–Pb systematics reflect variations in both the U content of parent rocks and later metamorphic conditions. Tectonic links are observed between the Kaapvaal and western Dharwar cratons, and between the north China and eastern Dharwar cratons, though none of these links necessarily requires a consanguineous origin.