

An outline of juvenile crust formation and recycling history in the Archaean Western Dharwar craton, from zircon *in situ* U-Pb dating and Hf-isotopic compositions

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The Western Dharwar Craton (WDC), southern India is a classic Archaean granite-greenstone terrain. The existing geochronological and isotopic data bearing upon multiple events of magmatism, greenstone belt development, deformation and metamorphism indicate an evolution between ca. 3.36 and 2.5 Ga, but preclude a clear resolution of crust forming and crustal recycling episodes. Zircon *in situ* analysis was aided by electron microprobe BSE/CL imaging and comprised U-Pb ages, estimation of U, Th, Zr, Hf, Y and Yb abundances and Hf isotopic compositions by a combination of Electron microprobe, LAM-ICPMS and LAM-MC-ICPMS (for methodology, Griffin *et al.* [1]). A large number of zircon grains from samples of: 1) fluvial quartz-arenite from the basal quartz-pebble-conglomerate unit of the Dharwar Supergroup, depositional age ca. 2.9 Ga, 2) low-Al₂O₃ tonalite gneiss from Gorur, dated previously at ca. 3.3 Ga and 3) sands from rivers draining central part of WDC at two locations.

Considering the concordant or nearly-concordant zircon ages, the combined dataset represents a range of protoliths between ca 3.63 and 2.5 Ga. The oldest age of 3634±10 Ma (2σ) corresponds to the mean of two detrital grains from the basal quartzite while rocks of this antiquity are yet unrecognised in the WDC. Initial ¹⁷⁶Hf/¹⁷⁷Hf ratios of these and few other zircons of marginally younger (upto ca. 3.5 Ga) ages approach chondritic composition (ε_{Hf} between +3 and +0.5) suggesting their protoliths may have incorporated older juvenile material with some crustal pre-history. Significant addition of juvenile magmas into the Dharwar crust between ca. 3.36 and 3.2 Ga is emphasized, a direct example being the Gorur tonalite gneiss, which was revisited and dated here at ca. 3346±10 Ma (2σ, ε_{Hf} between +4 and +7). Explanations for the apparent non-involvement of older crust in the genesis of these juvenile magmas remain ambiguous, possible scenarios are discussed in the light of constraints from previous geochronological data. Younger zircons (ca. ≤ 3.1 Ga) suggest protoliths that represent an essentially recycled crust.