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ZIRCON U-Pb-Hf ISOTOPIC EVIDENCE FOR TRANSITION IN GRANITOID SOURCE AT THE PALEOARCHEAN-MESOARCHEAN BOUNDARY IN THE WESTERN DHARWAR CRATON, SOUTHERN INDIA

SAMEER RANJAN AND DEWASHISH UPADHYAY

Indian Institute of Technology Kharagpur

Presenting Author: sameerranjan.18@gmail.com

Considerable debate exists on when a persistent depleted mantle reservoir came into existence and whether the Hadean and Eoarchean mantle were depleted. The U-Pb-Hf isotope composition of zircon can be used to track the record of continental crust extraction and resulting mantle depletion. Detrital zircon grains from the Western Dharwar Craton define notable clusters at 3685–3638 Ma, 3573–3524 Ma, 3471–3411 Ma, 3373–3341 Ma, 3277–3249 Ma, 3172–3148 Ma, 3084–2996 Ma, and 2659–2647 Ma which correspond to major episodes of granitoid crust formation in the craton. These zircon grains therefore preserve a continuous record of crust building from Eoarchean to the Neoarchean. The zircon suites furnish both radiogenic (positive) and crust-like (negative) Hf isotopic compositions. Noteworthy is the fact that the $\varepsilon Hf_{(t)}$ of zircon older than 3.6 Ga, i.e., those derived from Eoarchean granitoids generally scatter around chondritic composition (-2.8 to +2.2). At the Eoarchean-Paleoarchean boundary, there is a shift in the $\varepsilon Hf_{(t)}$ of the detrital zircon to strongly positive as well as negative values. This transition can be explained by a distinct change in the source of the granitoids at ca. 3.6 Ga. The Eoarchean granitoids were either derived from juvenile sources extracted from a primitive mantle, or their protoliths had long crustal residence times. In contrast, the Paleoarchean and younger granitoids appear to have been sourced both from strongly depleted mantle-derived sources as well as crustal components that incubated for a long period prior to granitoid extraction. The mantle depletion event must have happened in the Hadean/Eoarchean to allow sufficient time for the depleted mantle reservoir to acquire the strongly radiogenic isotopic compositions by the beginning of the Paleoarchean.