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Zircon U–Pb–Lu–Hf systematics of Charnockite from Gondpipri, south-western Bastar Craton and its tectonic implications

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The tectonic affinity of Gondpipri Charnockite, previously considered as part of the Bhopalpatnam Granulite Belt (BGB) from the south-western margin of Bastar Craton remains contentious and is commonly attributed to the Bastar Craton largely because the belt lies along the Pranhita–Godavari rift/basin margin. Here, we reassess this assignment using zircon Lu–Hf isotopes coupled with U–Pb geochronology from granulite-facies rocks.

Magmatic zircon cores from the Gondpipri Charnockite yield concordant U–Pb ages of 2536 ± 14 Ma and 2502 ± 8.8 Ma, which overlap Neoarchean ages reported from the Karimnagar Granulite Belt (KGB), located at the southwestern side of the Pranhita–Godavari basin. The same zircon domains record εHf(t) values ranging from +0.6 to −4.4, indicating derivation from an evolved crustal reservoir that includes components not older than ~3.0 Ga. The close correspondence in U–Pb ages and Lu–Hf isotopic signatures between the Gondpipri Charnockite and KGB is best explained by derivation from a shared late Meso-Neoarchean crustal source and participation in a broadly similar tectono-thermal evolution, rather than by independent development as marginal granulite belts attached to different cratons. Collectively, these similar isotopic and geochronological data support the interpretation that the Gondpipri Charnockite possibly was not a part of BGB and evolved as single, coherent granulite terrane prior to development of the Pranhita–Godavari basin.