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Mesoproterozoic suture between India and Madagascar

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The understanding of position of southern India in various supercontinent assemblies, its amalgamation and rifting with various continental fragments have significant implication in understanding the tectonic processes through geological time-scale. The southern India is a mosaic of various crustal domains, which are divided by shear/suture zones, but several controversies exist regarding the tectonic framework, shear zones and crustal blocks of southern India. The detailed structural lineament mapping of southern India along with new and compiled of geological and geochronological datasets help in delineating new shear zones and redefining the Precambrian crustal blocks of southern India. Especially, in a Madagascar- India correlation point of view, recent studies have reconstructed plate margins of India and Madagascar based on flexural isostasy along the Western Continental Margin of India (WCMI) and the Eastern Continental Margin of Madagascar. In this context, the newly proposed Mesoproterozoic Kumta and Mercara suture zones (1400-1000 Ma) welding Archean crustal blocks in western India offer critical insights into Precambrian continental juxtapositions and the crustal evolution of Gondwana. The textural evidences, mineral chemistry and thermodynamic modeling of quartz-phengite schist, garnet-biotite schist from the Kumta suture suggest peak metamorphic P-T conditions of c. 18 kbar, 550^{o}C and c. 11 kbar, 790^{o}C respectively and garnet-biotite-kyanite-gedrite-cordierite gneiss from the Mercara suture suggests peak metamorphic P-T conditions of c. 12.5 kbar, 825^{o}C. The calc-silicate granulite and mafic granulite were re-equilibrated under high-pressure conditions of 15-20 kbar at a temperature of 800-900^o C. The Bondla-ultramafic complex in the northwest of Kumta suture contains shale, basalt, dolerite, gabbro, chromite bearing serpentinite, chromitite and peridotite. The chromite chemistry from ultramafics suggests the evolution in a supra-subduction zone arc setting. Towards the east of the Kumta suture, the Sirsi shelf contains weakly deformed sedimentary rocks (limestone, shale, banded iron formations, greywacke, sandstone and quartzite) unconformable on high-grade ca.2571 Ma gneisses of the Dharwar craton. The Karwar block to the west of the Kumta suture is mainly composed of weakly deformed tonalite-trondhjemite-granodiorite (TTG) with enclaves of amphibolite. Whole-rock major and trace element data suggest that the TTGs (Type I, low K2O, high Na2O, Sr) were derived from a volcanic arc, and that the TTGs (Type II, high K_2O, low Na_2O, Sr) have within-plate signatures. Amphibolites have a chemical composition comparable to basalts to basaltic andesites with MORB signatures. The Karwar block TTGs (Type I) are ca. 3200 Ma with ?Hf range of -0.7 to 4.4. The whole-rock ?Nd ranges from -2.4-2.1 representing juvenile crustal origin. The Coorg block, about 100 km south of Karwar block mainly consists of highly metamorphosed lower-crustal rocks yielding 3200 Ma age with positive to negative ?Hf spread (3.3. to -3.2) indicating their source as mixture of juvenile and recycled crustal materials. Metasedimentary rocks from the Kumta suture have ?Hf (t) values that range from -9.2-5.6, and TDM ages that range from 2747-3546 Ma; comparable values in metasedimentary rocks from the Mercara suture range are from -18.9-4.2 and from 3214-3647 Ma respectively. Synthesis of the above results suggests that the Kumta and Mercara suture zones incorporate sediments, which range in age from Paleoarchean to Mesoproterozoic, and were subjected to high-pressure metamorphism in the late Mesoproterozoic. The protolith sediments were mainly derived from juvenile crust that was mixed with products of recycled older continental crust. Integration of the results indicates the Mesoproterozoic Kumta-Mercara suture in western Peninsular India interpreted as eastern extension of the Betsimisaraka suture of Madagascar.

Keywords: Gondwana Supercontinent, Continental Correlation, Crustal evolution, Mesoproterozoic suture