

ABSTRACT

In this dissertation, the history of magmatism and tectonometamorphism of the Paleoproterozoic Tonalite–Trondhjemite–Granodiorite (TTG) suite and the Neoproterozoic Malayagiri supracrustal belt of the Singhbhum Craton is used to address issues of Archean crustal growth and metamorphism, and the position on proto-India in reconstructions of the supercontinent Rodinia.

The TTG magmas were emplaced in two pulses at 3.45–3.44 Ga and 3.35–3.32 Ga, followed by potassic granitoid activity at ~3.10 Ga. Titanium-in-zircon thermometry gives zircon crystallization temperatures of 938–798 °C. The TTGs belong to the medium to low pressure group with the parental magmas derived from rutile-free, garnet and plagioclase-bearing sources. Strontium–Nd–Hf isotopes indicate that the 3.45–3.44 Ga tonalites and trondhjemites were derived from juvenile mafic crust with little crustal residence time. Granites of this suite were derived by up to 60% recycling of preexisting Eoarchean crust. The 3.35–3.32 Ga TTG suite was produced by partial melting of the same mafic crust with up to 25% recycling of Eoarchean crust. The younger potassic granitoids such as the Mayurbhanj pluton in the eastern part of the craton can be modeled as intracrustal melts of more potassic members of the Paleoproterozoic TTGs. A tectonic setting with relatively high geotherms of 15–20 °C/km such as in a very hot subduction zone, or a collapsed continental collisional zone can account for the magmatism. The TTGs were metamorphosed at 3.30–3.28 Ga and 3.19–3.13 Ga at P-T conditions of 2.4–4.3 kbar, 695–751 °C and ~1.44 kbar and 534–581 °C under high geothermal gradient of 46–115 °C/km.

The Malayagiri supracrustal rocks in the Rengali Province at the southern margin of the craton were deposited in the Neoproterozoic (2.79–2.42 Ga) and affected by three major tectonothermal events at 2.47–2.42 Ga, 0.98–0.94 Ga, and 0.54–0.57 Ga. They share a common geological history with granulites of the Eastern Ghats Province since the early Neoproterozoic. The early Neoproterozoic event shared by the two terranes corresponds to the suturing of the Eastern Ghats Province with the southern margin of the craton, thereby establishing that the Eastern Ghats Province was docked with India during the Grenvillian orogeny, and implying that proto-India was a part of Rodinia.

Key Words (8)

Singhbhum Craton; Tonalite–Trondhjemite–Granodiorite; zircon U–Pb dating; Sr–Nd–Hf isotope; metamorphism; Malayagiri; Grenvillian; Rodinia