ABSTRACT

The study addresses the geodynamic significance of the oldest known crustal domain in the Eastern India Precambrian Shield, e.g. the Paleo/Mesoarchean Singhbhum Craton, and it's environ. The thesis embodies the results of (i) litho-structural mapping and kinematics of shear zones in a 150 km long, ~40 km wide E-W corridor across the Craton, (ii) petrographic analyses of 400 thin sections emphasizing reaction textures and deformation microstructures, (iii) Th-U-total Pb age dating of monazites in 40 rocks, and (iv) phase equilibrium analyses of critical metamorphic rocks highlighting the role of fluids affecting corona formation and mineral stability. Mesoscopic structures and deformation micro-structures are combined to reconstruct (a) the Paleo/Mesoarchean tectonism that led to the present architecture of the lithodemic units in the western part of the Craton, and (b) the setting and relevance of the hitherto-undiscovered Grenvillian-age tectonic zone along the eastern fringe of the Craton.

The western margin of the Craton evolved by two-stage partial convective overturn involving ~3.4 Ga accretion of supracrustals to the gneissic basement followed by collapse (3.2-3.3 Ga) of the thickened crustal domain leading to supracrustal-down sense of movement and broadly synchronous ascent, albeit episodic, of the Singhbhum granitoid pluton along structurally-controlled exhumation zones. The bulk of the pluton was deformed at low-T ($\leq$ 500°C), but granitoids along the western margin experienced syn-emplacement deformation. By contrast metamorphism and granitoid emplacement in the eastern part of the Craton are younger (~3.1 Ga) suggesting that the western and eastern parts of the Craton may not have represents a coherently-evolved crustal domain.

The Bangriposi Shear Zone along the eastern margin of the Craton is a Grenvillian-age tectonic zone that juxtaposed ultra high-pressure spinel-wehrlites, sub-greenschist facies syn-accretion ensialic basin sediments, and amphibolite facies schists in the Craton. The juxtaposition is correlated with accretion of the South India and the North India Blocks as Greater India approached landmass of the Rodinia Supercontinent between 0.95-1.0 Ga.

At the mid-crustal P-T conditions of shearing, advection transport of elements and coupled dissolution-reprecipitation are inferred to be the causal mechanisms that chemically modified spinel in UHP-wehrlites and stabilized coronal chloritoid-mica aggregates replacing staurolite-kyanite in schists. (350 words)

KEY WORDS (6):
Singhbhum Craton; partial convective overturn; element advection, dissolution-reprecipitation; Bangriposi Shear Zone; U–Th–total Pb monazite dating