ABSTRACT

The North Singhbhum Mobile Belt (NSMB) is an arcuate zone of multiply-deformed greenschist-amphibolite facies schists and gneisses of Mesoproterozoic age. The NSMB is sandwiched between the Archean Singhbhum Craton to the south and the suite of granulite-amphibolite facies gneisses and foliated granites of the Chotangapur Gneissic Complex to the north. The three tectono-stratigraphic units are separated by north dipping ductile shear zones. In the past, several attempts were made to understand the tectonic evolution of the belt based on sedimentation history, chronological information and petrogenesis of mafic volcanics, but the input of metamorphic P-T evolutionary history was lacking. The present study attempts to reconstruct the pressure – temperature – deformation – time history in different segments of the NSMB schists based on a corridor study in the western part of the belt.

Three fabric-forming (S_{1S}, S_{2S}, and S_{3S}) diastrophic events and three metamorphic stages (M_{1S} – pre-S_{2S}; M_{2S} – syn-S_{2S}; and M_{3S} – syn/post-S_{3S}) were identified in the southern part of the NSMB. Reverse sense transport along north-dipping imbricate thrusts (S_{3S}-M_{3S}) emplaced the high-grade garnet-kyanite-staurolite schists centrally located in the orogen over low-grade muscovite-biotite-chlorite schists in the foreland. The M_{1S} stage (~1.5Ga EPMA monazite date) in the high-grade gneisses characterized by high P/T prograde metamorphism (P>10kbar, T_{max} ~ 650°C) was followed post-loading prograde heating and slow exhumation (1mm/yr) - cooling at amphibolite facies (M_{2S}) and greenschist facies (M_{3S}: ~1.3Ga EPMA) monazite date) conditions along a clockwise P-T path.

In the northern part of the NSMB, mica schists fringing the CGC document a northward increase in strain (sequential cleavage formation) and temperature (greenschist to amphibolite facies). The strain-temperature spatial gradient is correlated with crustal shortening and prograde clockwise heating-loading (T ~ 620°C, P ~ 7kbar) synchronous with reverse-sense transport of schists along hinterland dipping thrust planes.

The structural framework and thermal structure across the mobile belt is correlated with collision thickening of the orogen, followed by convective removal of the lithospheric root resulting in post-burial heating and exhumation of the orogen by outward-directed extrusion of the crustal slices along imbricate foreland-vergent thrusts dipping towards the centre of the orogen.