Abstract

The Eastern Ghats Province (EGP) of India was contiguous with East Antarctica in the Neoproterozoic supercontinents of Rodinia and Gondwana. In the northern part of the granulite facies EGP, regional-scale lineaments and strikes of structural fabrics show a regional swing, from NNE-SSW in the south, through E-W, to WNW-ESE to the north of a major intra-province lineament called the Mahanadi Shear Zone (MSZ). This study investigates the role of the MSZ in this regional-scale transposition of fabrics and lineaments. The earliest planar fabric (S_1) that formed during the D_1 deformation in the area was associated with partial melting under granulite facies conditions that peaked at ultra-high temperatures (UHT) at moderate to low pressures (3.5-5.5 Kb). Tight to isoclinal folding and thrusting associated with D_2 was synchronous with loading (to 7-8 Kb) and coronal garnet formation on orthopyroxene and cordierite in charnockites and aluminous granulites, respectively. After D_2, terrane-wide hydrous fluid infiltration led to biotite formation under upper amphibolite facies conditions, followed by decompression to 5.5-6 Kb. Subsequently, sinistral strike-slip shearing during D_3 transposed earlier fabrics consistently into a N-S striking, westerly dipping orientation, with the formation of a late penetrative foliation (S_3) defined by a segregation of quartz-rich and feldspathic layers. D_3 was followed by extensional shearing (D_4) that caused transposition of the earlier fabrics to an E-W striking, northerly or southerly dipping orientation and formed the pervasive S_4 foliation in the vicinity and north of the MSZ. Both D_3 and D_4 operated under lower to middle amphibolite facies conditions. A final dextral strike-slip shearing event (D_5), operating at greenschist facies conditions, was mainly localized along the MSZ. Structural studies show that in late, lower temperature shears that nucleate within an earlier shear zone, kinematic interpretation is complicated, and the evolution of the later stretching lineation is strongly influenced by the temperature, strain rate and orientation of the pre-existing stretching lineation.

Monazite chemical dating constrains the sequence of deformation events (D_1-D_5) to between 1100 and 510 Ma, similar to ages reported from East-Antarctica. This is compatible with an initial back arc-setting of EGP-East Antarctica during D_1 deformation and UHT metamorphism, followed by back-arc closure during D_2 loading and thrusting. Subsequent fluid infiltration and decompression followed this loading. Thereafter, sinistral strike-slip shearing during D_3 may have detached the back-arc from its arc. Rodinia break-up relates to the D_3 strike-slip and the D_4 extensional shearing, while D_5 dextral strike-slip shearing indicates intracontinental readjustments during Gondwana assembly.

(**Keywords:** *Eastern Ghats Province, Mahanadi Shear Zone, strike-slip, extensional, transposition, strain rate, pre-existing stretching lineation, Rodinia, Gondwana*)