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# Structural framework for the emplacement of Proterozoic anorthosite massif in the Eastern Ghats Granulite Belts, India: implications for post Rodinia - pre Gondwana tectonics

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This article deals with the origin of massif type anorthosite (950-1000 Ma) at the vicinity of Eastern Ghat Province (EGP), east coast of India - proto-Indian craton contact. The EGP comprises multiply deformed ortho and para gneiss and foliated igneous rocks intrusive into the otho- and para-gneiss.

The earliest deformation is defined by prominent mineral segregation layering ($D_1$) in the host gneiss around Bolangir, EGP, India. The mineral layering is isoclinally folded ($D_2$) with development of pervasive foliation ($S_2$). Asymmetric folds ($F_3$) having short E-W trending and strongly attenuated NNE/NE-trending limbs in the host gneiss characterize $D_3$deformation (950-1000 Ma). $D_4$ deformation is manifested by a set of N/NNE-trending west-vergent folds and coeval shear zones (550 Ma).

The gratitoid is characterized by an asymmetrically mono-phase fabric defined by stretched out K-feldspar + biotite + quartz that gradually disappear into a disjunctive foliation away from the pluton margin. The anorthosite pluton is characterized by outward dipping margin parallel foliation that dies out towards the pluton interior. In the southern part of the massif, N-S trending mm- 50 m wide Fe-Ti-Zr rich melt bands are emplaced transverse to the recrystallized igneous features in anorthosite and granitoids.

Deflection of $S_2$ foliation of the host gneiss around the pluton indicates that pluton was emplaced after $D_2$ deformation. Evidence of a) diffusion creep in plagioclase within anorthosite, b) asymmetrically folded gneissic fabric in the granotoids, c) the similar $\pi$tpole distribution of margin parallel foliation in anorthosite and $\pi$tpole of $S_2$ foliation in the host gneiss indicate that the pluton and granitoid rocks were emplaced during the $D_3$deformation. The orientation of the shear and shear related fractures in anorthosite (N-S) overlaps with the $S_4$ fabric of the host gneiss.

Mean attitude of magnetic foliation (AMS) from the southern and western margin of the pluton confirms that $D_4$ as the last deformation in the complex. In the central part of the pluton, NNE-SSW trending magnetic foliation is similar with the $D_3$-deformation induced mesoscopic fabric. Sub-horizontal deflection of foliation-parallel lineation with increasing magnetic anisotropy ($P^{/}$) and oblate shape parameter ($T>0$) in the complex indicate that AMS fabric was developed during transpressional orogeny. The anorthosite and the granitoids were emplaced post $D_2$, syn $D_3$ and pre $D_4$ deformation.

The observed mesoscopic and AMS data indicate a switch in the stress field from NNE-SSW ($D_3$, 950-1000 Ma) to E-W ($D_4$, around 550 Ma). The switch is significant in the context of tectonic architecture of Bolangir massif. Breakup of Columbia opened a new ocean between India and Antarctica where the sedimentary sequence of EGP was deposited in the Mesoproterozoic. Inversion of the rift basin tectonics occurred around 1000 Ma, that lead to the collision of eastern India-EGP-Antarctica as a part of Rodinia assembly. However recent studies indicate that EGP did not collide with the proto-Indian craton until the Paleozoic (around 550 Ma) after the final break up stage of Rodinia. This study indicate that anorthosite emplacement in EGP needs to be re-evaluated with recent paleo-geographic models coupled with structural studies.