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Tectonothermal and palaeogeographic significance of orthopyroxene-plagioclase bi-phase corona around garnet in the Proterozoic anorthosite complex, Eastern Ghats Province, India

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Development of structural elements and subsequent metamorphic reactions are evidences of tectono-thermal events that continuously change the mutual positions of the cratonic blocks in the Earth. In the Proterozoic era, the structural evolution of the crust is governed by the assembly and disintegration of two supercontinent: a) Columbia and b) Rodinia. The assembly and breakup of these two supercontinent is marked by the extremely high heat flow and emplacement of massif type anorthosite. Although, the palaeo-position of the continents in the northern hemisphere is well constrained to explain the anorthosite magmatism, even after five decades of research ambiguity still exists on the origin of anorthosite in the Gondwana supercontinent. Central to the controversy of Gondwana reconstruction is the position of proto-India in the Proterozoic time. In this contribution, the interrelationship between structural elements and the metamorphic reaction is discussed.

At Bolangir, Eastern Ghats Province, massif type anorthosite is characterized by a margin parallel foliation defined by recrystallized biotite and magmatic orthopyroxene. The margin parallel foliation is parallel to the parallel alignment of magmatic plagioclase. At the margin of the pluton, 2-3 mm long garnet porphyroblasts are observed. The garnet porphyroblasts are mantled by bi-phase corona of orthopyroxene and plagioclase and overgrow the orthopyroxene- defined margin parallel foliation.

In a core to rim traverse, the garnet shows a decrease in the Ca content. In the bi-phase corona, the plagioclase shows a strong zonation of anorthite component that gradually decrease away from the bi-phase corona. The metamorphic orthopyroxene don't show any compositional variation. Classical thermo barometry obtained from the compositions of the garnet-plagioclase-orthopyroxene indicates a decompression path from 750 °C, 10 Kbar to 650 °C, 6.5 kbar for the origin of bi-phase corona.

Available radiometric ages and structural data indicate that the massif type anorthosites were placed during the Grenvillian orogeny, and the decompression path was interpreted as the result of thrusting of Eastern Ghats Province over the Bastar craton during the assembly of Gondwana. However, without any evidence of thrusting in the Eastern Ghats Province, the mechanism for the breakdown of garnet needs to be re-examined. Based on the occurrence of similar garnet breakdown texture due to Pan-African heating in the East Antarctica, it is proposed that the garnet breakdown texture in anorthosite developed due to heating in the Eastern Ghats Province during the Pan-African orogeny.