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Mesoproterozoic metamorphic evolution of the Indian Craton – Studies from the Gneissic Complex of the West Khasi Hills, Meghalaya, North East India.

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Metamorphic events of the Gneissic complex of Meghalaya (MGC), located at the north-eastern fringe of peninsular India are significant to build up the metamorphic evolution of the Indian craton during Mesoproterozoic time[1]. Despite its preservation of the different stages of metamorphism little is

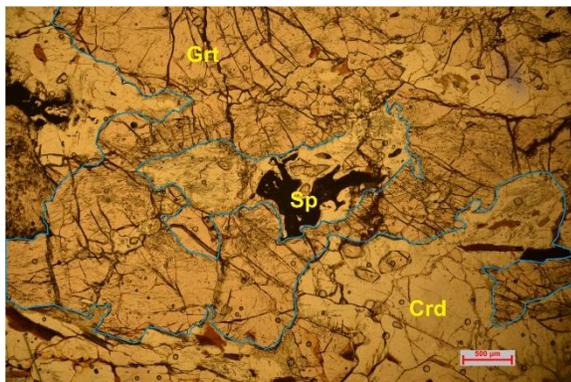


Figure 1: Photomicrograph of cordierite gneiss showing growth of garnet (Grt) at the expense of cordierite (Crd) and spinel (Sp)

plagioclase and quartz (M_1). In the second stage cordierite and spinel appeared at the expense of garnet and sillimanite (M_2). In the same PT field another type of garnet grew from cordierite and spinel (M_2) at $>750^\circ\text{C}$ and >5 kbar (Fig. 1). In the P-field M_3 stage is characterised by isobaric cooling which second type of cordierite produced from spinel and quartz. Again an early spinel–cordierite assemblage converted to garnet and sillimanite in the same PT regime. The remnant garnet and sillimanite broke down to form cordierite and spinel at $750\text{--}720^\circ\text{C}$, 4.2–4.5 kbar. M_4 is metamorphism marked by decompression in which garnet, sillimanite, quartz reacted to form cordierite at $715\text{--}670^\circ\text{C}$ and 2.5 kbar. Biotite, sillimanite, quartz, plagioclase stabilised as a final retrograde product during the M_5 stage of metamorphism through three reactions, viz. a) garnet, K-feldspar reacted to produce plagioclase, biotite and quartz (Fig. 2), b) garnet, K-feldspar and H_2O reacted to form biotite, sillimanite, quartz and c) cordierite, K-feldspar, H_2O formed biotite, sillimanite and quartz at $>500^\circ\text{C}$ and >2 kbar. By contrast, the metamorphic history of the granite gneiss is different from the cordierite gneiss. The textural features show that growth of garnet and K-feldspar from biotite, plagioclase and quartz occurred along a prograde path and breakdown of garnet to biotite occurred along a retrograde path, which corresponds to the M_4 and M_5 stages respectively recorded by the cordierite gneiss.

known about the granulite-amphibolite terrain of this part of Indian craton. Detailed study including mapping of an area of 300 sq km in the West of Khasi Hills, Meghalaya shows enclaves of high-grade metasediments (cordierite gneiss, sillimanite schist), basic granulite, charnockite within granite gneiss of amphibolite grade. The cordierite gneiss preserves five stages of metamorphism with two prograde (M_1 & M_2) and three retrograded paths (M_3 , M_4 & M_5). In the first stage garnet grew at the expense of biotite,

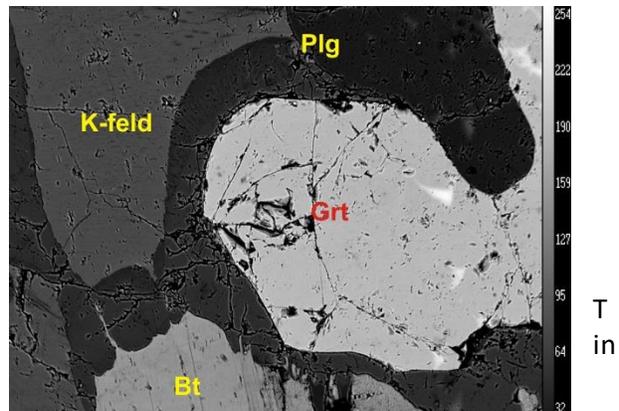


Figure 2: BSE showing M_5 plagioclase (Plg) + biotite (Bt) due to garnet breakdown

The PT estimates and textural features show that the reactions of M₃ stage are linked with isobaric cooling and M₄ stage is isothermal decompression. The study therefore is a significant step in building up the metamorphic evolution of MGC and forms the basis of future endeavour for correlation with the Chottanagpur Gneissic Complex of the eastern part of peninsular India and with the global context with the Grenvillian orogeny.

References:

[1] Lal, R.K (1978) Contrib. Mineral. Petrol. 67:169-187

