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PETROLOGY OF THE BASIC GRANULITES AROUND BARAMBA TOWN CUTTACK DISTRICT, ORISSA

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Introduction: The area around Baramba town (20°27'30" to 20°25'N and 85°20' to 85°23'E) forms a part of the Eastern Ghats. The lithological units of the area comprise of bands of khondalite, calc-silicate rock, basic granulite, quartzo-feldspathic gneiss and leptynite intruded by pegmatite, quartz and pseudo-tachylite veins. The basic granulites form bands of varying thickness and, in general, occur as sill-like bodies in the khondalites. They are considerably weathered at many places and exfoliated locally forming big rounded to sub-rounded boulders. Occurrence of blastoporphyritic varieties is a notable feature at some places.

Petrography: The basic granulite is a melanocratic rock of variable grain size. It displays characteristic granulitic structure. It consists essentially of bluish-grey plagioclases and ortho- and clinopyroxenes. Common hornblende, garnet, biotite, opaque minerals and apatite are accessories.

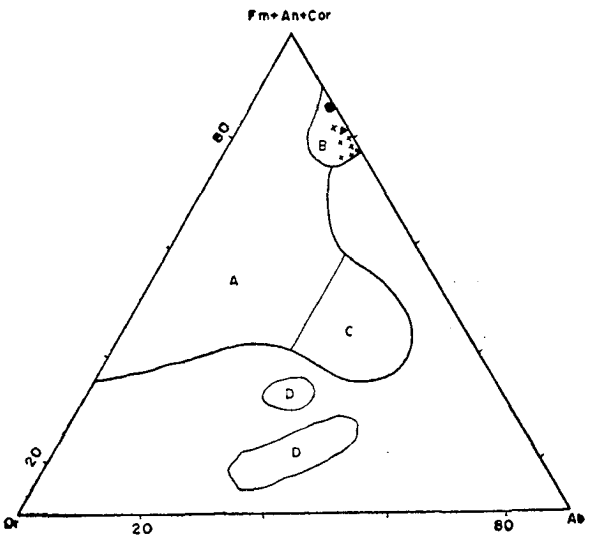
Plagioclase ranges in composition from andesine to labradorite ($Z \wedge c = 25°$ to 37°) and forms 20 to 50% of the rock (mode). Most of the grains of plagioclase have undergone distortion and strain effects are revealed by bent cleavage lines, undulose extinction and bent twin lamellae. Lamellar and complex twinning are common and the twin lamellae are wedge shaped. Orthoclase is found in much less quantity (<3%).

The orthopyroxene (hypersthene) comprises 12 to 35% (mode) of the rock. It exhibits pleochroism: X-pink, Y-yellow, Z-light green. It displays straight extinction having $2V_x$ ranging from 53° to 56°. The clino-pyroxene (augite) forms 8 to 35% (mode) of the rock. It shows extinction angle $Z \wedge c$ ranging from 38° to 45°; $2V_z = 52°$ to 56°.

Hornblende, replacing pyroxenes, occurs in varying proportions from 8% to 16% (mode). It is anhedral to subhedral and strongly pleochroic (X-yellowish green, Y-green, Z-greenish brown). $Z \wedge c = 16°$ to 18°; $2V_x$ varies from 78° to 84°. Biotite is secondary after pyroxene or hornblende, and exhibits strong dichroism from straw yellow to deep brown; Y = Z = dark brown, X—straw yellow. Garnet is found only

in the blastoporphyritic varieties forming nearly 18% of the rock. It is later than hypersthene.

Petrochemistry: The results of the chemical analyses of the major elements indicate that the basic granulites of this area are poor in their silica content (49.195% on an average), rich in Al_2O_3 (average 14.33%), CaO (10.89% average) and FeO (10.98% average). They are closely similar in chemical composition to the charnockitic rocks of Chipurupalli (Rao, *et al.*, 1969) and norite of Madras (Howie, 1955). The data obtained from the chemical analyses are plotted in diagrams after Wilson (1958), Evans and Leake (1960) and Becke (1925) along with the porphyritic pyroxene granulite from Chipurupalli area and norite of Nagarmalai, Salem.



+ Basic Granulites from Baramba, Orissa.
● Porphyritic Pyroxene granulite from Chipurupalli, A.P.
▲ Norite from Nagarmalai, Madras.

Figure 1. Or-Ab-(Fm+An+Cor) diagram (after Wilson, 1958).

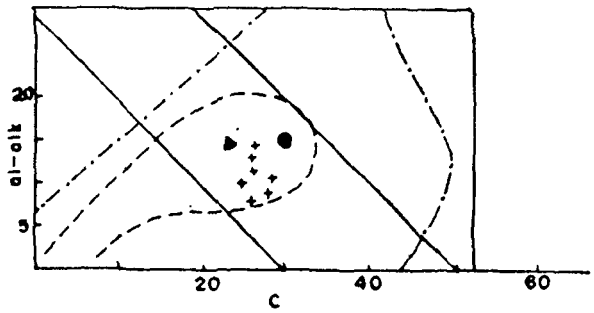
A. Field of argillites. B. Field of Basic igneous rocks.
C. Field of greywakes. D. Field of granites.

The values of the analyses of the basic rocks of the present area fall within the field of basic igneous rocks in Wilson's diagram. The values of the porphyritic pyroxene granulite of Chipurupalli area and the norite of Nagarmalai also lie within the field of basic igneous rocks (Fig. 1). Hence it is concluded that the basic granulites of Baramba area are derived from igneous rocks.

Graphical representation of al and alk/c (Fig. 2) shows that all the points lie within the field of Karroo dolerites and ortho-amphibolites, thereby indicating a magmatic origin for the basic rocks of the area under discussion.

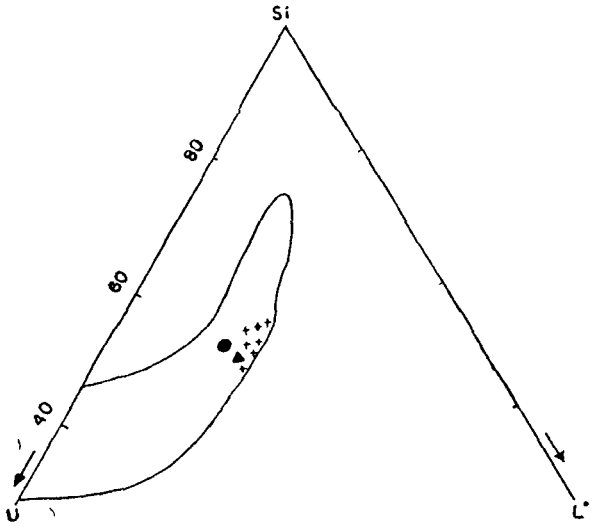
The igneous trend of the rocks under consideration is further revealed by plotting the Becke values (Si, U, L) in the triangular diagram (Fig. 3)

Genesis: The basic granulites of Baramba occur as sill-like bodies and show sharp contacts with the khondalites. The uniformity in their mineral composition and the complex twinning of some plagioclases are indications of their igneous parentage. Their igneous nature is further revealed by the plots (Figs. 1, 2 & 3) of the data



–·–·– Field of igneous rocks.
— — — Field of Karroo dolerites.
\+ Basic granulites from Baramba, Orissa.
● Porphyritic pyroxene granulite from Chipurupalli, A.P.
▲ Norite from Nagarmalai, Madras.

Figure 2. al – alk/C plot for the mafic rocks (after Niggli, 1954 modified by Evans and Leake, 1960).



\+ Basic granulites from Baramba, Orissa.
● Porphyritic pyroxene granulite from Chipurupalli, A.p.
▲ Norite from Nagarmalai, Madras.

Figure 3. Si – U – L diagram (after Becke, 1925)

obtained by the chemical analyses. The blastoporphyritic varieties of basic granulites resemble porphyritic charnockites of Chipurapalli described to have been derived from tholeiitic magma (Rao, *et al*, 1959). In addition, the granulites under discussion are chemically similar with basic charnockites for which igneous parentage has been

suggested by many workers, e.g. Howie (1956); Subramaniam (1959); Rao, *et al.* (1969).

Bent twin lamellae, wedge shaped twinning of some plagioclases, undulose extinction and elongation of feldspar grains are evidences of subsequent stress on the rock. The mineral assemblage, viz., pyroxene (hypersthene and augite)-plagioclase-hornblende belongs to the granulite facies of Eskola. The ACF values further indicate that the rocks belong to the granulite facies (Fig. 4). Local development of coarse granularity is possibly due to recrystallization.

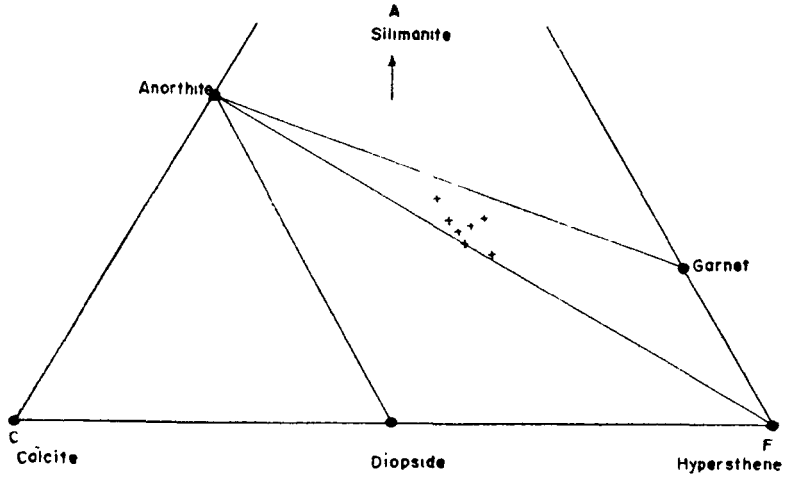


Figure 4. A C F diagram (after Turner)

Thus the basic granulites around Baramba town are intensely metamorphosed representatives of original igneous rocks.

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