

SHORTER COMMUNICATIONS

BASIC INTRUSIVE ROCKS OF BHARTI MUNDIA HILL, NEAR BHUBAN, DHENKANAL DISTRICT, ORISSA

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Bharti Mundia hill (180 metres high) and the surrounding area is situated at a distance of 2 km. to the northwest of Bhuban in the Dhenkanal district of Orissa. The area is underlain by garnetiferous granite gneiss which is again intruded by basic igneous rocks of various composition (Fig. 1). The garnetiferous granite gneiss trends ENE-WSW and is equivalent to the leptynites of the Eastern Ghats orogenic belt.

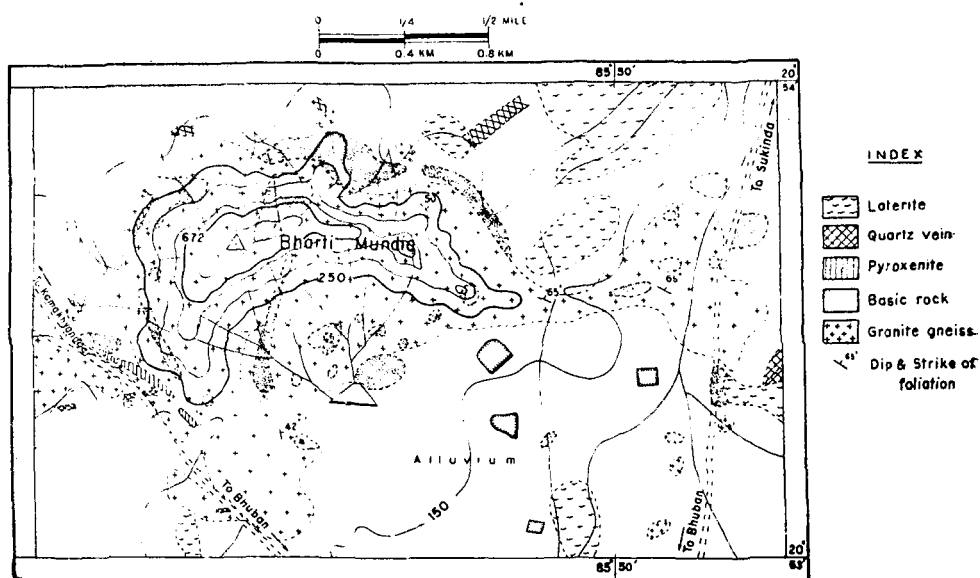


Figure 1. Geology of the area around Bharti Mundia hill. Dhenkanal District, Orissa.

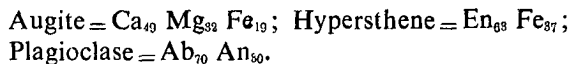
The basic igneous rocks are exposed as dykes and small isolated stock like bodies within the granite gneiss. Small xenoliths of granite gneiss within the basic rocks and its recrystallization at the contact of the latter are common. Effect of post crystallization deformation is completely absent in the basic rocks.

Petrography of the basic igneous rocks: On the basis of mineralogical composition and textural relationship, the basic igneous rocks around Bharti Mundia hill have been classified into four types, which represent the critical stages of fractional crystallization of the magma. Compositions of the minerals were determined from their optical properties and the volume percentage was calculated by a swift automatic Point Counter.

Pyroxenite: Pyroxenite is present as a solitary intrusive dyke in granite gneiss at the south-western corner of the Bharti Mundia hill. It is a fairly coarse grained,

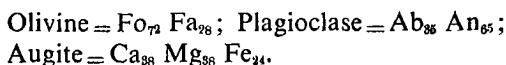
dark coloured rock consisting predominantly of augite, hypersthene, and a little amount of interstitial plagioclase. Magnetite and apatite occur as accessories, and brown hornblende and biotite are secondary after pyroxene. Augite occurs as equidimensional grains and makes up 77-82 per cent of the total volume of the rock. Hypersthene occurs as stout prismatic grains measuring even up to 3 cm in length and poikilitically encloses the earlier formed minerals, viz., augite and plagioclase.

Composition of the minerals



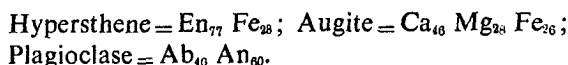
Olivine gabbro: The essential minerals are olivine, plagioclase and augite with secondary green to bluish green hornblende and chlorite. Olivine has developed kelyphitic rims of ortho pyroxene and actinolite around the grains. Plagioclase and augite are present as coarse grains in nearly equal proportion (40-45 per cent by volume) with mutually co-existing grain boundaries.

Composition of the minerals



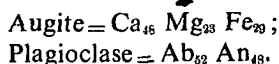
Hypersthene gabbro: This rock type is very limited in outcrop. Augite (23-25 per cent) and plagioclase (44-45 per cent) are the important mineral constituents. Hypersthene makes up nearly 5 per cent by volume of the rock. Green hornblende is a frequent alteration product of the pyroxenes. Coarse grained hypidiomorphic granular texture is characteristic. Both hypersthene and augite appear to have started crystallizing together. Magnetite is present in very minor proportion.

Composition of the minerals



Normal gabbro: This is the most extensive type of basic igneous rock in the area, varying from typical dolerite to gabbro. Normal gabbro is composed of plagioclase (50-55 per cent) and augite (44-48 per cent) as essential minerals, magnetite as accessory, and hornblende as the alteration product of pyroxene. Minor amount of quartz, intergrown with magnetite, is occasionally present in the interstices of the silicates. Magnetite concentration increases up to 3 per cent by volume where it occurs around the grain boundaries of the earlier silicate minerals, viz., augite and plagioclase.

Composition of the minerals



Petrogenesis: Though the different varieties of gabbro occur in detached outcrops and their contact relationship is not very clear in the field, their closeness in space and time suggests that they are cogenetic. The mineralogical and textural variations and the chemical composition (Table I) reveal that the gabbroic rocks represent a partially differentiated basic magma showing compositional variation from olivine gabbro to normal gabbro through intermediate hypersthene gabbro. Pyro-

xenite is also a member of the same suite. From the chemical analysis and normative-mineral composition the basic magma is proved to be a tholeiite.

TABLE I
CHEMICAL ANALYSIS AND NORMATIVE MINERAL
COMPOSITION OF THE BASIC IGNEOUS ROCKS

Sp. No.	Olivine gabbro	Hypersthene gabbro	Normal gabbro	Pyroxene
	Bh. 1-6	Bh. 2-1	Bh. 48	Bh. E
SiO ₂	45.66	48.72	50.84	50.04
Al ₂ O ₃	15.12	13.08	11.31	5.96
TiO ₂	1.82	1.59	0.85	0.89
Fe ₂ O ₃	4.42	4.10	3.66	2.07
FeO	10.06	12.86	14.10	10.83
MnO	0.12	0.03	0.15	0.11
MgO	7.53	6.34	3.01	17.84
CaO	11.14	10.13	12.22	10.51
Na ₂ O	1.92	2.04	2.51	1.28
K ₂ O	1.02	0.73	0.43	0.14
P ₂ O ₅	0.90	0.40	—	—
H ₂ O+	0.16	0.22	0.12	0.08
H ₂ O-	0.44	0.06	0.96	0.68
Total	100.31	100.30	100.16	100.43

Analyst: B. P. Gupta, Calcutta

The plagioclase composition varies from An₆₅ to An₄₈ and the composition of augite ranges from Ca₈₈ Mg₈₈ Fe₂₄ in olivine gabbro to Ca₄₈ Mg₂₈ Fe₂₉ in the normal gabbro. Thus with the progress of fractional crystallization, anorthite content in plagioclase decreases with increase of iron content in augite. Trend of iron enrichment in the rocks from olivine gabbro to normal gabbro has also been established by plotting (FeO + Fe₂O₃), (Na₂O + K₂O) and MgO in a triangular diagram, and also by plotting the different oxides against the mafic index. SiO₂ increases from olivine gabbro (45.66%) to normal gabbro (50.84%). Saturation of silica is also indicated by the presence of both free and normative quartz in the normal gabbro. It is assumed that due to iron enrichment magnetite appears as a separate phase and occurs in appreciable concentration in the normal gabbro. The oxygen partial pressure indicated by the ratio Fe₂O₃/FeO decreases from .43 in olivine gabbro to .25 in normal gabbro, resulting in the enrichment of iron during fractional crystallization of the magma.

The pyroxenite composed essentially of augite, interstitial plagioclase and large grains of poikilitic hypersthene seems to have been formed as crystal accumulate from the same basic magma and later on intruded into the granite gneiss.