

## Basic igneous intrusives in Pernem Taluk, Goa

BIJOY K. JENA

### Abstract

Describes discordant gabbroic intrusives traversing the Dharwar group of rocks. The main body occurs as a central ellipsoidal mass and the smaller ones as narrow linear dyke-like bodies disposed radially. Mela-gabbro and gabbro-norite are the rocktypes. They are emplaced into the country rocks late in the tectonic regime.

### Introduction

Some of the basic igneous rocks occurring in the eastern parts of Pernem Taluk, Goa have been considered by the earlier workers as Precambrian schistose metabasalts underlying the 'Pink phyllite and metagreywacke' formations (Gopalakrishnan, 1966). Recent work by the author has brought out that they are gabbroic intrusives

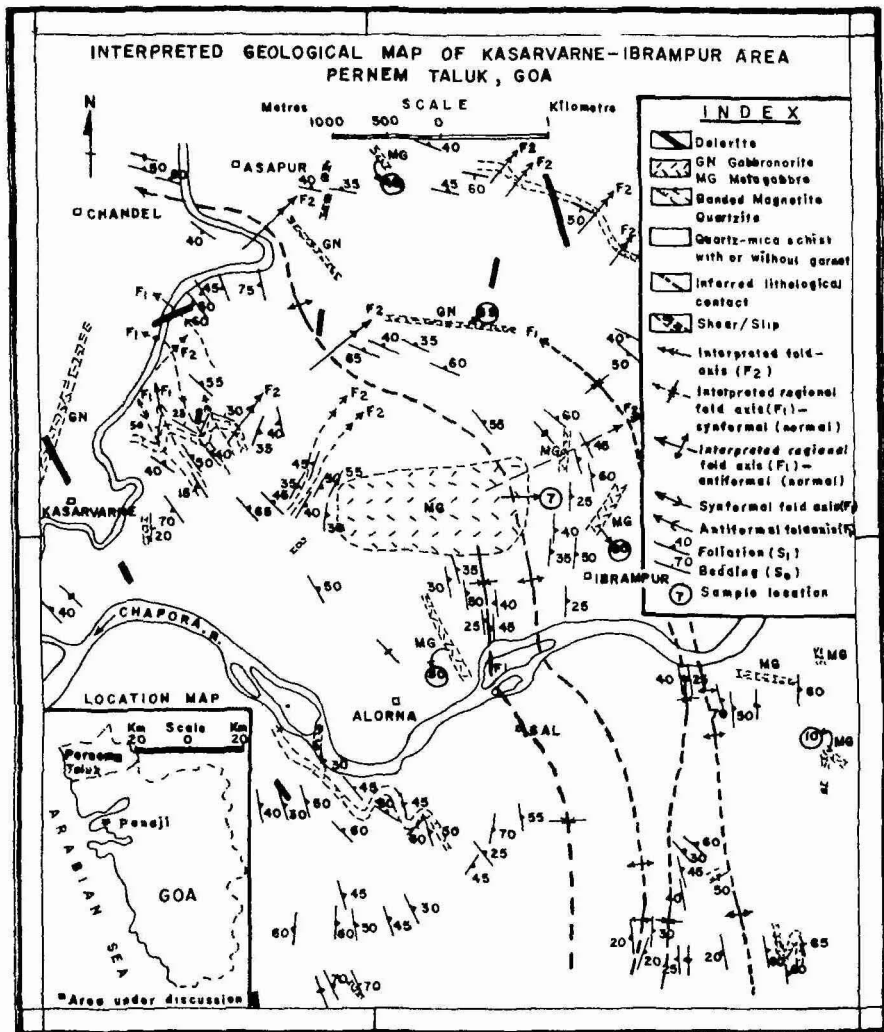


Figure 1.

into the schistose country rocks of Upper Dharwar age. The aim of this note is to record in brief the mode of occurrence and petrography of these rocks.

### General geology and structure

The area of about 60 sq km under study, comprises the Dharwar Group of Precambrian schistose rocks and falls close to the axial portion of a major NW-SE trending syncline. The litho units of the area are represented by garnetiferous quartz-mica schist with interbeds of banded iron formations and are traversed by a number of basic intrusives. The study of the foliation trends of the schistose rocks and the mesoscopic folds developed in the banded magnetite quartzites indicate that the litho units of the area have been thrown into regional open and tight, normal antiformal and synformal folds ( $F_1$ ), the axial traces of which trend NW-SE and show in general, a northwesterly plunge. Swerving of the axial traces of these early folds and local reversal of plunges have been observed (Fig. 1). This may be due to the superposition of a later fold movement of minor intensity that led to the development of open folds and broad warps around a NE-SW axis with a northeasterly plunge ( $F_2$ ). Dykes of dolerite are post-tectonic and are younger to the gabbroic intrusives under discussion.

### Gabbroic intrusives

A major occurrence of these basic rocks is recorded about 1 km northwest of Ibrampur and is exposed over an area of about 1 sq km, simulating a major ellipsoidal plug. Dykes of similar composition occur radially around the central body with general trends NNE-SSW, N-S, NNW-SSE, NW-SE and WNW-ESE (Fig. 1). These are exposed amidst garnetiferous quartz-mica schist with interbanded iron formation and show an apparent discordant relationship. Dykes and sills of similar rock occur around Valpoy ( $15^{\circ}31'50''$ ;  $74^{\circ}05'15''$ ) where one of the sills is traceable for a distance of 3 km in a NW-SE direction. From the study of petrography and modal analyses, the basic igneous rocks can be classified into – (i) mela-gabbro and (ii) gabbro-norite, based upon Streckeisen's (1973) classification (Table I).

TABLE I. Modal composition of rock samples (In volume percentage)

* Sample Numbers	7	10	**16	30	48	59	60	**70A
Olivine	23.8	34.4	—	15.2	14.6	0.1	13.2	—
Orthopyroxene	16.5	22.0	21.4	2.8	27.0	32.2	24.5	23.1
Clinopyroxene	34.3	23.7	18.3	48.6	14.9	—	42.7	14.1
Plagioclase	24.4	17.1	53.1	30.8	25.7	49.9	18.9	55.4
Biotite	1.2	2.1	2.8	—	5.0	13.7	0.8	3.3
Secondary amphibole	—	—	4.0	2.6	12.0	—	—	3.3
Opaques	—	0.8	0.3	—	0.8	0.8	—	0.9
Quartzo-feldspathic intergrowth	—	—	—	—	—	3.3	—	—
Total	100.2	100.1	99.9	100.0	100.0	100.0	100.1	100.1

\* Location of samples are shown in the map (Figure 1).

7 – Melagabbro, from the central body, about 1 km northwest of Ibrampur.

10 – Melagabbro, about 2.5 km east of Sal.

30 – Melagabbro, about 1 km northeast of Alorna.

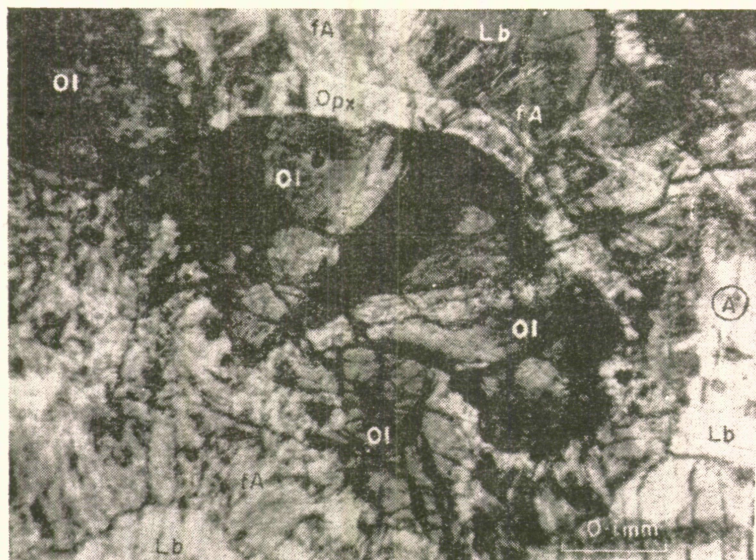
48 – Melagabbro, about 1.5 km east of Asapur.

59 – Gabbro-norite, about 2.5 km north-northwest of Ibrampur.

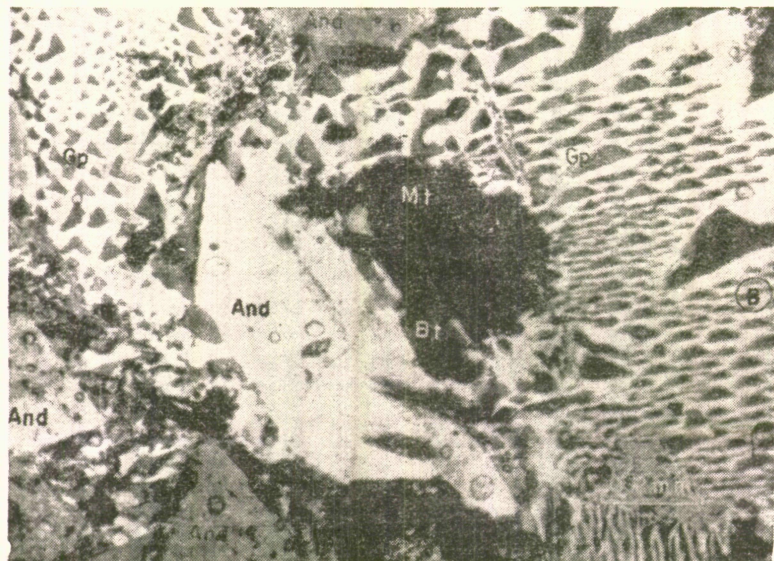
60 – Melagabbro, about 0.5 km north of Ibrampur.

\*\* Samples 16 and 70A were collected from Torse occurrence (not shown in the map) (See text).

*Mela-gabbro*: The central plug and six other narrow dykes occurring to the east of the central mass are constituted of melagabbro. It is very coarse-grained, dark grey and massive, and is mainly composed of enstatite, hypersthene, augite labradorite and olivine. Biotite and opaques form the accessories. Olivine is usually fresh and spindle shaped. Reaction rims of orthopyroxene and fibrous amphibole have developed successively around the olivine grains in the occurrence located east of Asapur (Photomicrograph-A). Granules of olivine occur enclosed in plates of



A. Successive coronas of colourless orthopyroxene (Opx) and fibrous amphibole (fA) around olivine (Ol) in mela-gabbro. Few grains of labradorite (Lb) are also seen. (Crossed nicols)



B. Quartzo-feldspathic intergrowth (Gp) in the interstitial spaces of gabbro-norite. Other minerals are andesine (And), magnetite (Mt) and biotite (Bt). (Crossed nicols).

pyroxene and in some cases magmatically corroded olivine is partially engulfed by twinned pyroxenes. Some of the hypersthene grains are idiomorphic. Imperfect development of lamellar and herringbone patterns due to exsolution of orthopyroxene from clinopyroxene is noticed. Labradorite, probably the last to form envelops olivine and pyroxenes. Brown hornblende is developed around olivine and orthopyroxene grains.

*Gabbro-norite*: This rock occurs mostly to the west of the main central mass near Ibrampur as narrow, linear discordant bodies. An isolated 400 m long dyke of this rock was also recorded near Torse ( $15^{\circ}46'15''$ ;  $73^{\circ}50'45''$ ) located about 7 km north-west of the main body. The rock is coarse-grained, massive and is composed of andesine, augite and hypersthene showing sub-ophitic relationship. Olivine is present in minor proportions only in the intrusives closest to the main central mass. Relic sub-ophitic texture is preserved though the plagioclases are thoroughly saussuritised and the pyroxenes are altered to hornblende and actinolite with pseudomorphous outline of the original mineral. Quartzo-feldspathic intergrowths are noticed in the interstitial spaces in some of the occurrences of gabbro-norite (Photomicrograph-B).

### Discussion

The basic igneous rocks under report viz. the mela-gabbro and the gabbro-norite occur as isolated bodies with discordant disposition in the garnetiferous quartz-mica schists. Exact contact relationship is mostly obscured due to extensive laterite cover, but where exposed the discordant relationship is clear and contact effects are also discernible. In the adjoining area coming under Ratnagiri District of Maharashtra, Ghodke *et al.*, (1971) have reported the occurrence of peridotite-serpentinite-pyroxenite-gabbro intrusives traversing the Dharwarian schistose formations. Petrographic study coupled with the available field data, leads to the inference that these basic igneous intrusive bodies were emplaced into the Dharwar group of rocks, late in the tectonic regime. The gabbroic rocks do not show any sort of foliation nor do the straight linear dyke-like bodies show any swerves comparable to the patterns produced by the  $F_2$  deformation in the country rocks. Therefore, it is inferred that these bodies are perhaps emplaced during post- $F_2$  period.

The mineralogical evidences such as the development of corona of Ca-poor pyroxenes around unzoned olivine, exsolution features in the pyroxenes and quartzo-feldspathic intergrowths in the interstitial residuum are indicative of a tholeiitic parentage (Wilkinson, 1967) for these basic bodies.

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*Address of the Author*

BIJOY K. JENA, Geologist (Jr.), DORIS, GSI, SR, 4-3-542, Tilak Road, Hyderabad 500001.

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