CHAPTER VII

D Y K E R O C K S

It has already been mentioned in the earlier pages that the amphibolitic and the granitic rocks have been intruded by numerous basic dykes, and these dykes are encountered in all parts of the area. In fact, there is hardly any exposure, which does not contain one of these basic intrusions.

Most of these dykes are rather small, ranging in size from 100 to 200 m in length and 10 to 50 m in width. However, there are quite a few large dykes also, extending for about 5 to 6 km and at present these occur as discontinuous patches. On the other hand, tiny dykes measuring a

metre or two in length and a few cm in width, are fairly common. As it was not possible to map and record all the dykes - big and small - the author has shown only the more conspicuous ones on a separate map (Fig.11).

On account of widespread lateritisation, the exposures of the various dykes have become fragmentary and form isolated outcrops. This gives an impression of a haphazard occurrence of these dykes. But on a careful regional scrutiny, it is found that these intrusive bodies show following two trends:

(1) NW-SE to WNW-ESE (some are even E-W)

(2) NE-SW to NNE-SSW.

Though most of the dykes cutting the amphibolitic rocks show fairly distinct and sharp junction, at a few places, a little mixing up at the contacts is recorded, and such occurrences are quite misleading. The intrusions, cutting the granitic rocks, are more conspicuous.

The various basic intrusions have been classified by the author into two main groups:

1. Altered dykes: These are somewhat epidioritic rocks, almost wholly or partially altered dolerites.

2. Unaltered dykes: These consist of fresh and unaltered basic dykes, showing a wide range of textural variation from coarse gabbroic to fine basaltic (some of the finer grained varieties are suspected to be sill like bodies).

At first glance, it appears that these two varieties - altered and unaltered - might belong to two distinct basic igneous activities. But on a detailed and careful scrutiny of the field and petrographic criteria, it becomes clear that all these dykes are of the same age and show various stages of alteration. At a few places, it is seen that a single dyke at one end is fresh and unaltered while it is completely changed over to the epidiorite at the other end.

The scope of the present study has prevented the author from going into the various problems connected with the emplacement, origin and alteration of these basic dykes. It was not possible for him to conduct a detailed study of these rocks, as this itself would have been a separate problem for investigation. He has therefore given in the following pages, only a brief descriptive account of these basic dykes.

I. ALTERED DYKE (EPIDIORITES)

These rocks form bouldary and fragmentary outcrops, and are seen to be dirty green to dark greyish green in colour. Fine grained and massive hand specimens do not reveal much. The specific gravity ranges between 2.979 to 3.059.

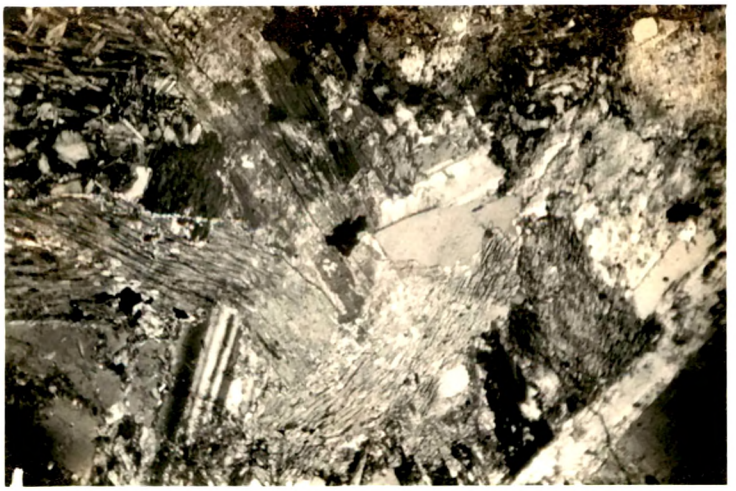
Texturally these rocks are difficult to describe in detail. Varying in grain size from medium to fine grained, these are seen to consist of a confused aggregate of altered felspars and uralitic amphibole. In most cases, traces of original ophitic relationship are well preserved (Plate 24).

II. UNALTERED (AND PARTLY ALTERED) DYKES

To this group belong the various occurrences of fresh basic rocks. In the rocks of this group, the felspars are unaltered, and the pyroxenes for the most part, are free from uralitisation. Taking into consideration the texture and mineralogy, these rocks have been classified into following three varieties.

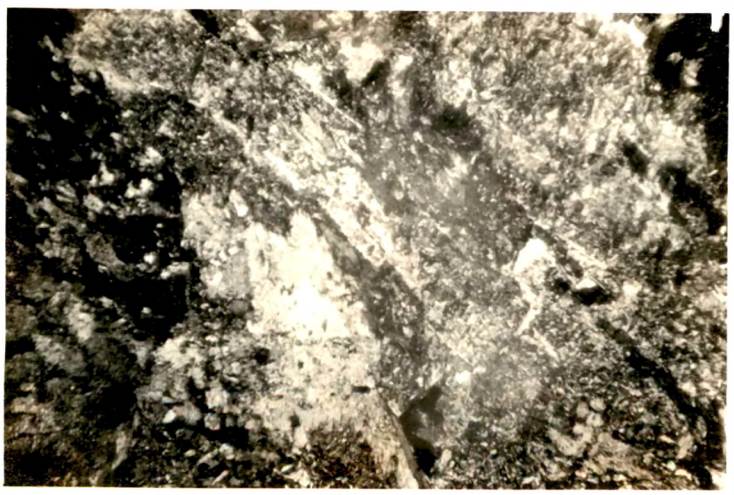
1. Coarse gabbroic
2. Medium grained doleritic
3. Fine grained basaltic.

PLATE 24



A

A. Epidiorite showing coarse doleritic structure with somewhat unaltered plagioclase. (X 40) (Sp.D. 188, Hosgadde area).



B

B. Epidiorite showing complete alteration of pyroxene and plagioclase. (X 40) (Sp.D. 33; 19th M.St., Ankola area).

(1) Gabbros

These are coarse grained, dark grey compact and fresh looking rocks with granular texture. In the hypersthene bearing variety, it has a typical resinous lustre. Under the microscope, these show a typical coarse gabbroic texture tending to be somewhat poikilitic (Plate 25). Mostly, these rocks contain either

(1) plagioclase, hypersthene and augite or

(2) plagioclase, augite and olivine.

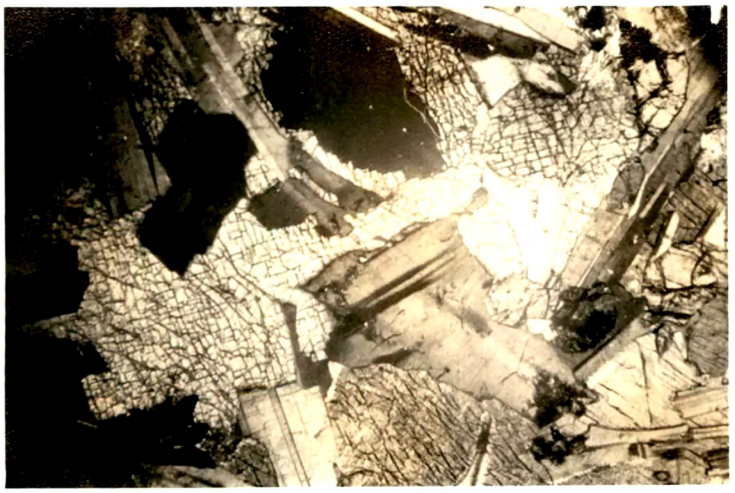
(2) Dolerites

These are medium grained, dark grey compact and hard rocks. Thin sections of these rocks show an ophitic or coarse basaltic texture (Plate 26). Mostly, the dolerites are made up of plagioclase and augite with or without olivine.

(3) Basaltic

These are fine grained rocks, hard and compact and dark grey in colour. Texturally, these are very fine grained, and mostly made up of an equigranular aggregate of tiny grains of pyroxene and small needles of plagioclase. Occasionally, porphyritic structure is developed on account of the presence of the phenocrysts of the two above-named minerals (Plate 27).

PLATE 25



A

A. Gabbro showing poikilitic texture. Minerals are fresh and unaltered. (X 30) (Sp. D. 293, Andle area).

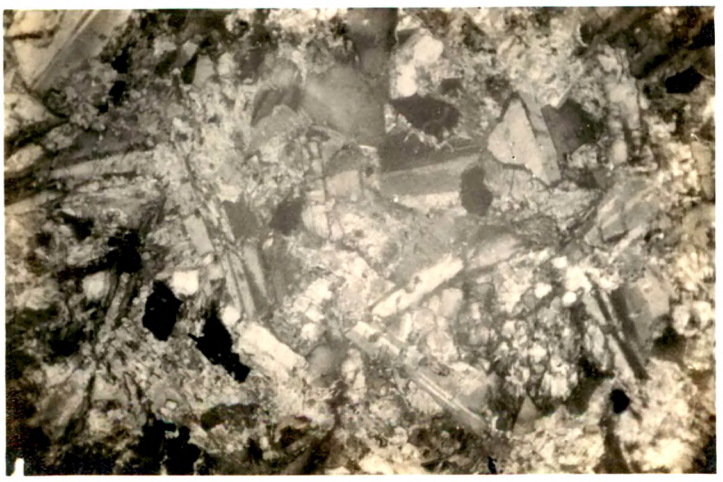
B

B. Gabbro showing some alteration of pyroxene to hornblende (X 30) (Sp. D. 61, Vadibogri area).

PLATE 26

A

A. Fresh dolerite showing coarse ophitic texture. (X 30) (Sp. D. 196; Hosgadde area)



B

B. Partly altered diolerite (X 30) (Sp. D. 8; Vadibogri area).

PLATE 27

Basalt showing an equigranular aggregate of pyroxene and plagioclase. (X30)
(Sp. D. 63; Andle area)

MICROSCOPIC DETAILS OF MINERALS

The plagioclase felspar occurs as (1) subhedral to anhedral prismatic crystals in the case of gabbros, (2) elongated narrow laths in dolerites, and (3) tiny needles and microlites in basalts. It shows varying degree of alteration. It is seen to occur as very fresh grains, partly altered grains and as completely turbid and saussuritised grains (in epidiorites). The plagioclase, on the whole is fairly calcic-approximating to labradorite, tending to be a little more calcic in olivine bearing varieties (Table 6).

Twinning is seen mostly on Albite law, and is of repeated type. Pericline twinning is also fairly common, while combined Albite and Carlsbad twins are only occasionally recorded (Table 7).

Pyroxenes as already stated, are both monoclinic and orthoroombic, the former being more common and of augite variety. The orthopyroxene is hypersthene.

In coarser varieties, the augite forms irregular plates and laths of various sizes, showing pale brown or yellowish brown colour. There is no appreciable pleochroism. Prismatic (110) and (010) cleavages are also

TABLE 6

Table showing An contents and 2V of plagioclase felspar in various types of dykes

Rock type	An content	No. of grains studied	2V
1. Olivine gabbro	55-70	16	+80° to +82°
2. Hypersthene gabbro	52-60	8	+74° to +80°
3. Gabbro (normal) (including quartz bearing)	50-66	13	+82° to +86°
4. Dolerite	49-55	21	+72° to +78°
			-86° to -89°
5. Baslat	51-65	2	--

TABLE 7

Table showing frequency of Twin laws in plagioclase

Method used	No. of grains studied	Albite law	Carlsbad law	Pericline (in addition to Albite law)
1. Reinhard's	8	6	2	(3)
2. Rittmann's	30	22	8	(10)

met with in suitable sections. Twinning is commonly seen in medium and fine grained rocks, and is mostly of orthopinacoidal type. Zoning is seen only in a few section. The mineral is biaxial positive with optic axial angle varying between 40° and 54°. Extinction angle (C:Z) is between 38° and 44°. Birefringence is high. All this optical data points out that the mineral is a sub-calcic augite. This mineral shows alteration to uralite in varying degree, and in epidiorites, it is completely uralitised.

Hypersthene is seen in a few gabbroic dykes occurring together with augite. It forms subhedral to anhedral prismatic crystals showing the typical pleochroism (X = pale pink, Y = colourless, Z = pale greenish). (110) cleavages are distinct, while (010) and (001) are seen only occasionally. It is biaxial negative with optic axial angle varying between 65° and 85°. The refractive index is Z = 1.68-1.69, elongation positive, extinction parallel to the prismatic cleavages. This mineral is also partly or wholly uralitised.

Olivine is noticed in quite a few rocks and occurs mainly as anhedral grains (0.25 to 0.35 mm). It is colourless, rather fresh and unaltered, showing strong

relief. Cracks are very common, but these are seen filled with iron ore. Alteration to serpentine is noticed in one case only. Under cross nicols, the mineral shows the usual high order colours, is biaxial negative with optic axial angle rather high - 80° to -84°.

In all varieties, the iron ores occur as distinct crystals showing intergrowth of ilmenite and magnetite. It is the most common accessory. In basalts, it also forms, in addition, dusty granules scattered throughout the mass.

CHEMICAL CHARACTER

Detailed chemical study of these basic rocks was found to be beyond the scope of the present investigation. Hence no such study was made. However, in order to get some insight about these rocks, typical samples of dolerite and olivine-gabbro - one each, were chemically analysed. The data obtained is given in Table 8.

AGE OF THE DYKES

It is rather a difficult proposition to fix up the age of the basic igneous activity that gave rise to these dykes. Though it is certain that they are younger than

TABLE 8

Chemical Analyses of Basic rocks

	B Dolerite	D Olivine gabbro
SiO_2	50.25	46.82
TiO_2	0.87	1.90
Al_2O_3	15.08	19.99
Fe_2O_3	3.10	2.20
FeO	9.25	6.48
MgO	5.10	4.94
CaO	12.20	11.65
Na_2O	2.24	3.51
K_2O	0.71	0.67
$+H_2O$	0.934	0.71
$-H_2O$	0.134	0.57
MnO	0.206	traces
Total	100.092	100.00

the amphibolites and granites into which they are intruded, their upper age limit is uncertain.

These basic dykes were emplaced only after the upheavals in the Ankola-Gokarn area had come to a close. This is fairly certain, because these dykes are seen nowhere involved in any folding or faulting. Taking into account the established view (Pascoe, 1950) in Pre-Cambrian formation of the peninsula, completely altered basic rocks (epidiorites) are considered as older, compared to the fresh ones supposed to be of Cuddapah age (Newer Dolerites). The author too was tempted to classify the basic dykes of his area into two main groups - one older and epidoiritic, and the other younger, fresh and unaltered. But as he has already stated earlier, it was found that this classification was untenable, because as individual dyke could show various degree of alteration from one end to the other - from unaltered variety to almost entirely epidioritic. In view of this, it is fairly certain that all dykes belong to the same phase, and are younger than the Dharwars. But how much younger, is a matter still to be decided.

The widespread uralitisation of pyroxenes and alteration of plagioclase, without much shearing or deformation, indicate some hydrothermal action, and it is not unlikely that the basic activity closely followed the last phases of granitisation. If this conjucture is valid, then these dykes would be older than the Newer Dolerites (L. Cuddaph). But in the absence of adequate data, the author would prefer to leave this age problem open for further scrutiny and investigation.