GEOLOGY OF PART OF STONINGTON ISLAND, MARGUERITE BAY*

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THE field work on which the following short note is based was carried out in late February and early March 1961, after the completion of the season's main field work and prior to the arrival of the relief ship, R.R.S. *John Biscoe*.

The object of the mapping was to investigate in detail the structure and petrology of the small outcrops on Stonington Island with a view to correlating the geology of the island with the general geology of Neny Fjord and northern Marguerite Bay.

Mapping was commenced at a scale of 1 : 300 on the outcrops around Mast Hill, Stonington Island (Fig. 1), but owing to the arrival of the relief ship only a small area was completed.

GENERAL FIELD RELATIONS AND PETROLOGY

The apparent order of intrusion of the igneous rocks is as follows:

Pegmatite dykes	*Youngest*
Basic dykes	
Xenolithic basic dykes	
Aplite dykes	
Leucocratic gneiss	
Biotite-hornblende-gneiss	
? "Injection gneiss"	*Oldest*

No thin-section studies were carried out and consequently the names assigned to the rock types are only tentative.

"*Injection gneiss*"

The field term "injection gneiss" was given to a band of fine-grained rocks with a pronounced planar structure strongly resembling flow. The rock is light grey in colour and has a low percentage of mafic minerals. Elongated xenoliths are common and emphasize the flow structure. Rare xenoliths of leucocratic gneiss and biotite-hornblende-gneiss were observed. One of the most interesting types of xenolith present in the injection gneiss, and in none other on the outcrop, is composed of fine-grained epidote and a reddish brown mineral provisionally identified as garnet.

The contact between the injection gneiss and the biotite-hornblende-gneiss is comparatively sharp but it is irregular with tongues of injection gneiss penetrating the host rock. An unusual feature of the contact is the apparent concentration of biotite schlieren in the biotite-hornblende-gneiss.

The origin of the injection gneiss is obscure. When first examined, it was believed to be a "flaser gneiss" occurring in a wide shear zone, the planar structure being due to mechanical shear rather than to flow. The tongues of injection gneiss in the host rock could be explained in at least one instance by the presence of minute shears at an acute angle to the contact. However, the presence of comparatively fresh wall rocks, although rare, and the unsheared state of the epidote-garnet xenoliths suggest that the banding is a flow structure.

Rocks of similar character were observed on Horseshoe Island in association with an "andesitic breccia".

Copper staining (malachite with a little azurite) occurs in the gneiss at the north-western corner of the outcrop, due to the oxidation of minute amounts of chalcopyrite.

Biotite-hornblende-gneiss

Biotite-hornblende-gneiss accounts for about one-third of the exposed rock on the Mast Hill outcrop. The grain-size is smaller than that of the leucocratic gneiss and mafic minerals

* A detailed account of the petrology of Stonington Island is given in *British Antarctic Survey Scientific Reports*, No. 52—*Ed.*

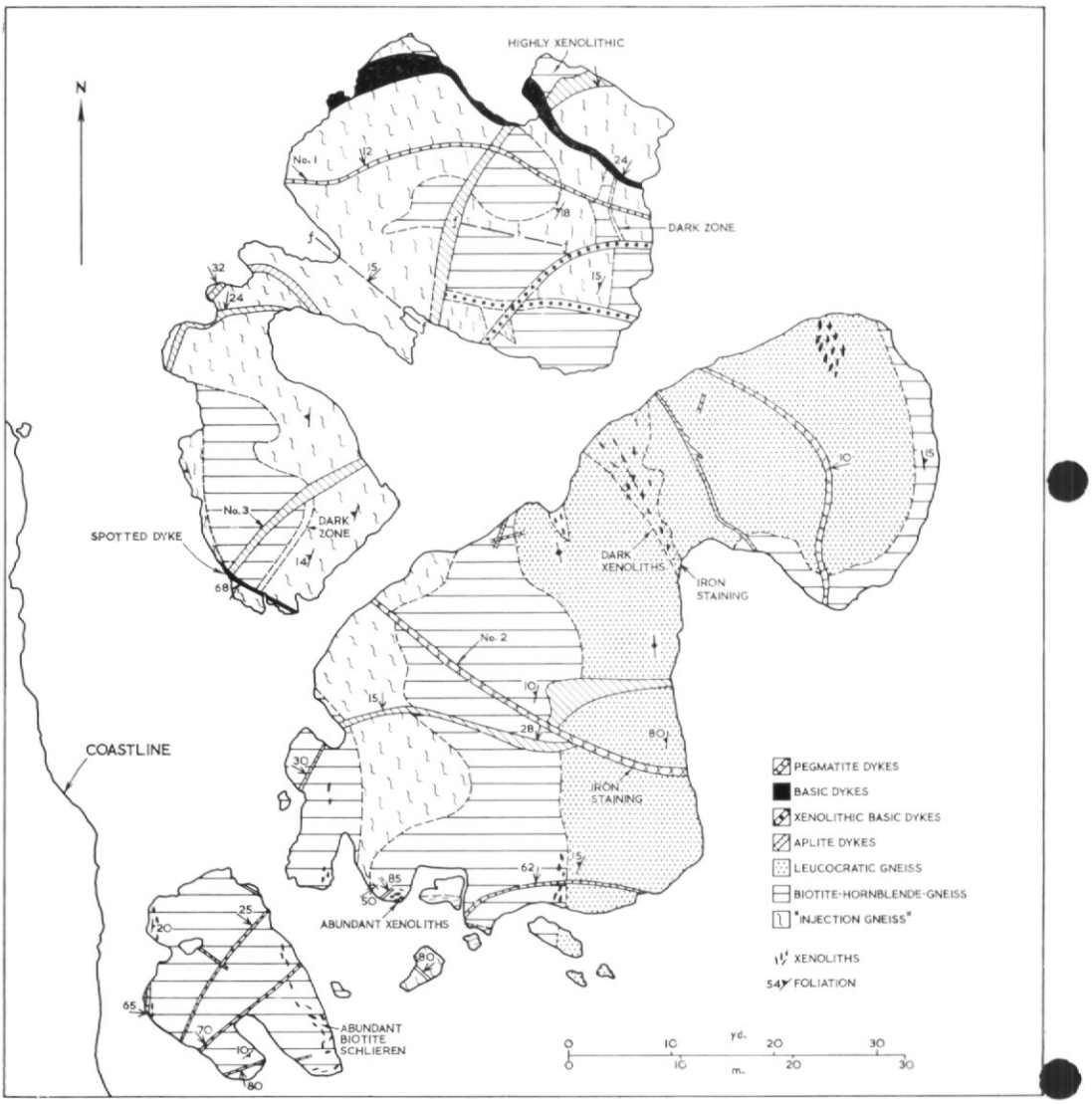

Fig. 1. Geological map of Mast Hill, Stonington Island, Marguerite Bay.

are more abundant. Parallelism of biotite and hornblende is more pronounced and xenoliths and schlieren are more common. The majority of the xenoliths are partially assimilated and are represented by local concentrations of biotite.

Leucocratic gneiss

This medium- to coarse-grained gneiss with apparently equal percentages of quartz and plagioclase feldspar also occupies about one-third of the outcrop. Orientation of the mafic minerals (principally hornblende with some biotite) imparts a poorly developed planar structure to the gneiss. Xenoliths appear to be concentrated along certain bands in the gneiss, but on the whole they are rare. Sphene is common both close to and away from the xenoliths and the presence of garnet was suspected but not proved.

Aplite dykes

Fine-grained aplitic dykes, varying in width from 1 in. (2·5 cm.) up to 1 ft. (30 cm.) or more, are common over the outcrop. A low percentage of biotite and magnetite imparts a pepper-and-salt appearance to the rock. The distribution of the aplites appears to be controlled at least partly by joints or by the stresses which produced the joints. The contacts of the aplitic dykes are sharp and in one dyke (Fig. 1, No. 3) a lighter band of aplite almost devoid of mafic minerals occurs at the margin of the dyke.

Xenolithic basic dykes

Two narrow xenolithic dykes occur near the centre of the outcrop. Unfortunately the relationships between each other and between the aplitic dyke phase could not be established. The dykes are xenolithic in the sense that angular fragments of basic material occur in a lighter-coloured groundmass. The reverse relationship has been noted elsewhere on Stonington Island. The margins of the fragments are often blurred and along one of the dykes there is a gradual transition along the strike from a leucocratic phase almost devoid of inclusions, through a xenolithic phase, to a mesocratic basic rock.

It is tentatively suggested that the dykes were intruded along lines of maximum tension. Relaxation of confining pressure caused fracturing of the original basic dyke and later leucocratic material cemented the fragments, i.e. the dykes are "breccia dykes" rather than xenolithic. A similar mechanism is suggested for the "igneous breccias" which are commonly found at the margins of the Andean intrusions in northern Marguerite Bay.

Basic dykes

A dark, fine- to medium-grained basic dyke with an average width of about 4·5 ft. (1·4 m.) cuts across the north-western corner of the outcrop. The margins are sharp with little or no chilling, and fragments of wall rock incorporated in the dyke are apparently unaltered. The texture of the dyke is ophitic with small local concentrations of hornblende. Two thin dykes of the same type occur at the southern end of the outcrop.

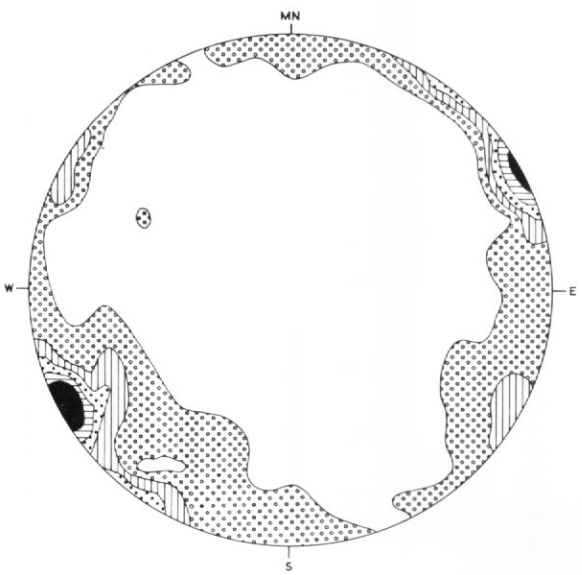

Fig. 2. Poles of joints plotted on the lower hemisphere of an equal area net (250 observations; maximum of 10 per cent per 1 per cent area; contour interval of 2 per cent).

Pegmatite dykes

Simple pegmatites a few inches to 2–3 ft. (0·6–0·9 m.) in width are apparently the youngest of the intrusions. Although the margins are invariably sharp, chilling is uncommon. The grain-size varies, often within the same dyke, from fine-grained (<1 mm.) to coarse-grained patches where individual crystals may be as much as 5 cm. in length. Graphic intergrowths of quartz and feldspar were observed in some specimens. Small amounts of red garnet (?) and a dark dravitic tourmaline were found in dyke No. 2 (Fig. 1). Magnetite is common in most of the dykes together with minor amounts of pyrite.

Structure

Foliation. The strike of the gneissosity in all rock types varies between about 110° and 150° mag. In the western half of the outcrop dips are shallow to the west and the apparently complicated structure shown in Fig. 1 is a reflection of small changes in the topography. Towards the eastern half of the outcrops, dips steepen until they become vertical near the top of the hill. The general form of the outcrop is that of a monocline or overturned anticline, whose axis lies in the region of the top of the hill and whose strike corresponds to that of the gneissosity.

Joint patterns. Between 200 and 300 joint planes were measured across the outcrop. A plot of the joint poles (Fig. 2) shows a well-defined maximum which represents vertical or steeply dipping joints with a strike of 330° mag. Steep joints with a strike of 210° mag. give a large but less pronounced maximum, and small subsidiary maxima corresponding to sets of joints of strike 125° and 270° mag., respectively, also occur.

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