PETROGRAPHY OF GNEISSES SOUTH OF BJØRNESUND IN THE FISKENÆSSET REGION

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Introduction

The mapping of the area south of Bjørnesund, begun in 1970, was completed during the summer field season of 1971. During the routine mapping special attention was paid to the gneiss complex. The detailed petrography and chemistry of the gneisses will be the topic of a further paper, but this report gives a brief description of the distinguishing petrographical characters of the gneiss types. Several types and sub-types of gneisses have been distinguished according to their varying mineral composition, structure, texture and grade of migmatisation. Only those gneiss types and sub-types that occur in units which can be followed for more than 200-500 m are described; xenoliths and small patches of different rock types, however lithologically different, are not.

The gneisses

The area south of Bjørnesund is made up mostly of migmatised light coloured gneisses which are called granodioritic gneisses, according to their mineral composition and small content of dark minerals (see table 5). The gneisses have undergone several phases of intensive migmatisation; M-1, giving rise to plagioclase-rich neosomes, M-2, giving rise to potash feldspar rich neosomes and potash feldspar metasomatism. The neosomes vary in size from bands, a few centimetres thick, in arteritic types, through thicker pegmatite dykes (M-2), to nebulites and agmatites in which M-2 neosome is the dominant portion of the rock.

The main types and sub-types of gneisses in the area south of Bjørnesund are as follows:

1) Migmatised medium-grained, light coloured, biotite gneiss (streaky gneiss) with a planar fabric, is the prevalent rock type of the area mapped. In places it contains thin (0.5-1m) layers of amphibolite, adjacent to which there is local enrichment of hornblende in the gneisses. This gneiss type is light coloured in the field and possesses a foliation marked by the alternation of light coloured quartzo-

feldspathic and darker biotite-rich layers in the order of a centimetre thick. Generally the rock exhibits a planar foliation although in places of intensive migmatisation the foliation is sometimes very weakly marked. Sometimes the rock contains relatively large amounts of epidote and allanite.

The texture of the rock is largely granoblastic and subordinately lepidogranoblastic; the latter only occurs if biotite is present in large amounts. The mineral assemblage of this gneiss type is quartz, plagioclase (An_{28}-An_{40}), potash feldspar (microcline), biotite, occasionally hornblende and epidote, with accessory, calcite, muscovite, allanite, apatite, zircon and garnet.

The following sub-types 1a and 1b have the same mineral composition as the type described above and differ only in their structure.

1 a) Medium grained, small folded, biotite gneiss occurs as zones, patches and layers in the gneisses of type 1. It chiefly occurs on both sides of the complex of supracrustals which runs in an E-W direction across the whole area. There is a complete gradation between these small folded gneisses (1a) and the gneisses with agmatitic structure (1b) described below.

1b) This type forms patches and lenses in both the medium grained planar foliated and small folded biotite gneisses. Xenoliths in it are chiefly amphibolites which possess a banding which is oblique to the general strike of the gneiss banding. In several places wider zones of this rock occur which can be followed for a great distance across the whole area. Metre thick amphibolitic layers are usually present in these zones together with layers of garnet amphibolite and concordant pegmatitic veins containing magnetite and allanite.

2) Medium grained biotite pearly gneiss with feldspar porphyroblasts. This gneiss type forms a lithological horizon parallel with the general foliation in the southern and central part of the area. It is a medium grained plagioclase biotite gneiss with epidote, often displaying a cataclastic structure. The rock has clearly been migmatised twice. The first phase of migmatisation formed centimetre thick quartzofeldspathic streaks emphasised by a blastesis of plagioclases. The second phase appears as coarse grained, thicker (1 cm to 50 cm) bands and veins. Potash feldspar either replaced plagioclase or occurs as porphyroblasts concentrated chiefly in the migmatitic veins of the second phase. These veins also contain plagioclase porphyroblasts (3-5 mm) similar to those of the pearly gneisses. A gradual transition from the pearly gneiss to a light coloured, homogeneous granite gneiss has been observed on the shore of Ikatoq. Zones of pearly gneiss also occur on a small scale between the planar foliated biotite gneiss and layers of homogeneous, more quartz dioritic, granite gneiss (fig. 5).

The pearly gneiss contains the following mineral assemblage: quartz, plagioclase (An_{30}-An_{46}) sericitised, potash feldspar (microcline), biotite and epidote with accessories allanite, apatite, muscovite and zircon.

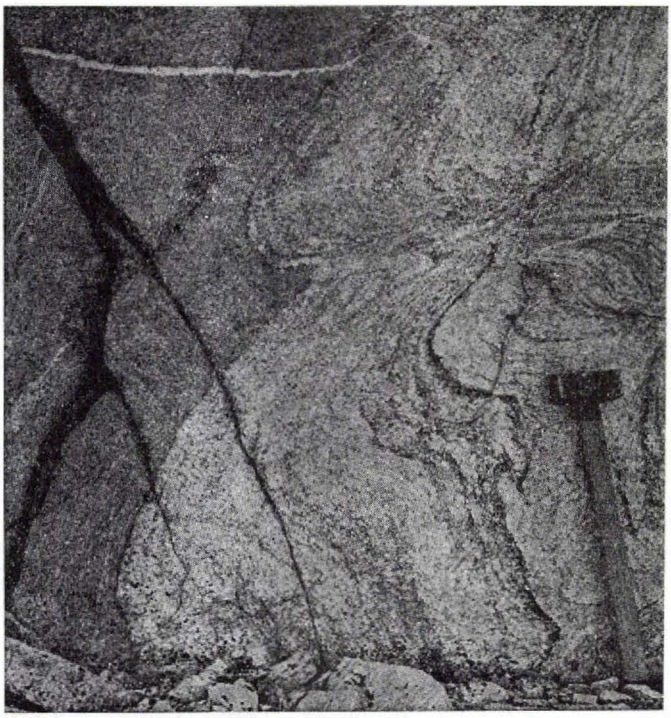

Fig. 5 Pearly gneiss between planar foliated gneiss (above the hammer head) and homogeneous quartz dioritic gneiss (to the left). On the mountain ridge 2 km north of Ikâtoq.

3) Medium grained, mainly homogeneous, biotite granite gneiss usually occurs as thick (1-20 m) concordant layers in the gneisses of types 1 or 1 b, but in several places, especially in the central part of the area, the rock occurs in large outcrops. Usually a slight foliation can be observed in the rock but in many places the rock is quite homogeneous.

This gneiss type mainly occurs in the close vicinity of the pearly gneisses, which suggests that the effect of plagioclase blastesis had a direct connection with a probably igneous origin of the granite gneisses.

The granite gneiss contains the following assemblage: quartz, plagioclase, potash feldspar (more than 15 %), biotite and muscovite, with accessories epidote, apatite, allanite and zircon.

4) Medium grained hornblende-banded gneiss forms a zone which occurs on the shore of Bjørnesund and on the mountain ridge parallel to Bjørnesund about 6 km north-east of Eqaluit. This rock type alternates with 10-20 cm thick bands of light

Table 5. Mineral content of the gneisses from the area south of Bjørnesund

No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
GGU No.	104331	104330	104324	104326	104327	104335	104345	102036	102030	102033	102029	102057	102004	116652	116685
Modal content %															
Plagioclase	55.1	57.4	52.7	52.4	52.9	46.4	53.8	51.7	60.3	58.2	57.1	45.8	47.0	32.2	50.9
quartz	28.9	29.9	33.9	34.0	37.1	34.2	30.5	37.3	31.1	28.0	28.6	36.2	30.4	34.7	26.0
K-feldspar	0.8	1.5	3.1	7.2	3.8	10.0	–	2.9	–	–	0.6	12.2	17.7	2.7	1.2
biotite	13.2	5.9	6.4	5.3	4.7	6.5	12.8	7.2	3.9	10.9	9.0	2.8	4.1	18.7	19.8
muscovite	0.8	2.4	1.1	–	–	1.8	0.2	0.4	1.2	0.8	1.4	1.2	0.5	0.1	0.2
hornblende	–	–	–	–	0.2	tr	1.1	0.2	0.6	–	1.4	–	–	3.8	–
epidote	0.2	0.1	0.5	tr	1.0	0.6	1.1	tr	2.7	1.6	1.7	1.5	tr	7.6	1.8
allanite	tr	0.1	tr	0.1	–	–	0.2	tr	0.1	0.3	tr	–	–	–	tr
apatite	0.3	0.2	0.3	0.1	0.2	0.5	–	0.2	0.1	0.2	0.2	0.1	0.2	0.2	0.1
zircon	tr	–	–	–	0.1	–	0.1	–	–	tr	tr	–	–	–	tr
ore	0.1	–	–	–	–	–	0.1	0.1	–	tr	–	0.1	0.1	–	–
titanite	–	–	–	–	–	–	0.1	–	–	–	–	–	–	–	–
calcite	0.6	0.1	–	–	–	–	–	–	–	–	–	–	–	–	–
plagioclase	64.9	64.6	58.9	55.9	56.3	51.0	55.2	56.0	63.2	67.3	66.1	48.5	49.4	46.2	65.3
quartz	34.1	33.7	37.6	36.2	39.6	37.9	31.3	40.5	32.5	32.7	33.0	38.5	32.0	50.0	33.2
K-feldspar	1.0	1.7	3.5	7.9	4.1	11.1	13.5	3.5	4.3	–	0.9	13.0	18.6	3.8	1.5
Type of gneiss	1	1a	2	2	2	1a	1	1	1	1	1a	1	5	1a	3

coloured biotite gneiss and dark hornblende gneiss. It forms a zone between the light coloured biotite gneiss complex, which extends further to the south, and the banded or homogeneous biotite (-hornblende) 'brown' gneiss which underlies it further to the north-east.

5) Medium grained, mainly homogeneous but often foliated biotite (-hornblende) 'brown' gneiss occurs only in the eastern end of the area on the shore of Bjørnesund. The brownish weathering of this rock is quite distinct from the white weathering colour of the biotite (-hornblende) planar foliated gneiss. In hand specimens it resembles brown weathering hypersthene gneiss but under the microscope it was not found to contain any hypersthene. It contains only sporadic hornblende and the dominant mafic mineral is biotite, mostly in association with epidote. However, this brown gneiss was found to contain significantly higher amounts of potash feldspar (up to 20 % by volume) than the neigbouring gneisses. The rock is homogeneous and has a granoblastic texture generally without any foliation.

The geological position of this homogeneous rock and its petrographic characters suggest that it may have originated as intrusive synorogenic layers and bodies. Its granoblastic texture could be the result of successive recrystallisation and metasomatism, and in this respect it shows certain similarities with the homogeneous granite gneiss described above.

The brown gneiss has the following assemblage: plagioclase, quartz, potash

Table 5 (cont.). Mineral content of the gneisses from the area south of Bjørnesund

16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
117763	116101	116620	116699	116638	116666	116673	116636	116683	116689	116621	116696	116631	116637	116630
31.0	40.5	49.6	36.4	41.7	38.6	46.8	39.4	40.9	29.2	32.5	52.8	51.6	42.0	47.2
31.4	32.0	35.2	45.0	44.4	28.2	33.1	41.9	35.5	38.6	35.5	29.3	27.8	37.6	34.6
29.2	17.2	7.2	2.8	1.4	23.2	10.8	3.4	14.7	22.2	22.6	1.2	1.8	1.8	6.8
6.0	9.6	7.6	13.4	12.2	8.2	7.6	14.5	6.6	9.2	9.2	14.8	12.4	16.6	10.2
1.4	0.6	0.2	–	–	0.6	–	0.6	1.4	0.6	–	0.4	–	tr	0.8
–	–	–	–	0.2	–	–	–	–	–	–	–	5.0	1.4	–
0.8	tr	tr	2.4	tr	1.0	1.4	0.1	0.4	tr	tr	1.2	1.0	0.2	0.2
tr	tr	tr	tr	tr	tr	0.1	tr	tr	tr	–	0.1	tr	tr	tr
0.1	tr	0.2	–	0.1	0.1	0.2	0.1	0.3	tr	0.2	0.2	0.4	0.2	tr
0.1	0.1	tr	–	–	0.1	tr	tr	0.1	–	–	–	–	–	–
–	–	–	–	–	–	–	–	0.1	–	–	–	–	0.2	0.2
–	–	–	–	–	–	–	–	–	–	–	–	–	tr	–
–	–	–	–	–	–	–	–	–	0.2	–	–	–	–	tr
33.9	44.7	54.0	43.3	47.7	42.8	51.7	46.4	44.9	32.5	35.9	65.4	63.6	51.6	51.3
34.3	36.2	38.2	53.4	50.7	31.4	36.4	49.4	39.0	42.8	39.2	35.2	34.2	46.2	39.1
31.8	19.1	7.8	3.3	1.6	25.8	11.9	4.2	16.1	24.7	24.9	1.4	2.2	2.2	9.6
1a	3	1	1a	1	1	1	1	1a	3	1	1a	4	1a	2

feldspar, biotite and epidote, with the accessories allanite, apatite, magnetite and zircon.

Modal composition of the gneisses

Modal compositions of 30 gneiss samples from the area south of Bjørnesund and plots of their quartz-plagioclase-potash feldspar ratios are given in table 5 and fig. 6. In spite of the small number of planimetrical analyses, the following features are visible from these modal variations:

1) Plagioclase (An_{28}-An_{40}) in most cases forms about 50 % of the rock, but may form up to 60 % in the plagioclase gneisses. Its amount may be increased by the first phase of migmatisation of arteritic type, which affected all the gneiss types.

2) Potash feldspar varies in abundance from 1-30 % by volume and most of the rocks have a granodioritic composition. Generally the amount of potash feldspar does not exceed 15 % by volume. An abnormal enrichment in potash feldspar in some samples is probably due to the second phase of migmatisation. Furthermore, it is possible that the original composition of the granite gneisses and the homogeneous 'brown' gneisses originally had a higher content of potash feldspar than the other gneisses.

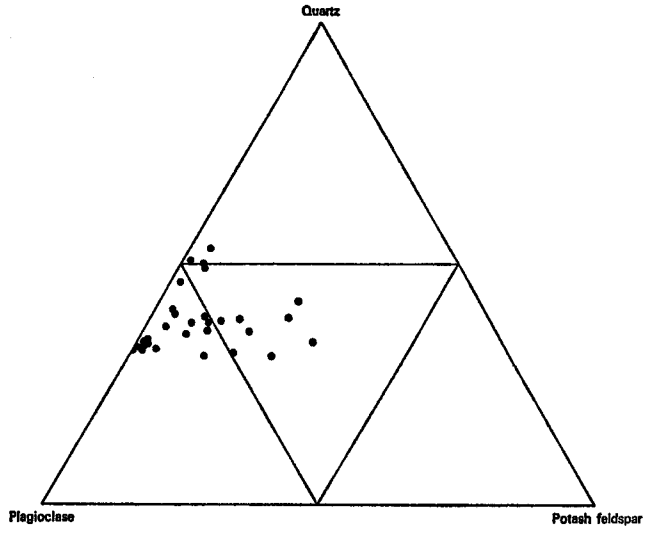

Fig. 6 Plot of the quartz-plagioclase-potash feldspar ratios of 30 gneiss samples from the area south of Bjørnesund.

3) The content of quartz is surprisingly constant (about 35 %) in nearly all the analysed samples regardless of other variations in mineral composition and structure.

From the table of modal analyses it can also be seen that hornblende rarely occurs in the gneisses. It occurs only in the close vicinity of amphibolite layers and in a wider zone along Bjørnesund in hornblende-banded gneiss (type 4). In most places biotite is the only dark mineral in the gneisses, and varies in abundance from 3-20 % by volume.

Epidote is present in nearly all the samples and probably developed as a result of young epidotisation.