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GNEISSES IN THE VICINITY OF FISKENÆSSET; SOME PRELIMINARY OBSERVATIONS

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This report describes some preliminary observations, arising out of detailed work, that pertain to one of the major problems of the Fiskenæsset region: the relationship between granulite-grade pyroxene-bearing gneisses and biotite gneisses that appear to be almost entirely of amphibolite grade. Previously little detailed work has been done on the gneisses in the vicinity of Fiskenæsset where most attention has been focused on the meta-anorthosite complex. Impressions gained by Windley (1969, 1972) from reconnaissance mapping not only around Fiskenæsset but also in areas to the north and south have become firmly entrenched in the literature. In an unpublished thesis, Herd (1972) provided a brief summary of the gneisses based on study of a limited number of thin sections of samples from the Fiskenæsset area.

The area mapped on a 1:20 000 scale by the author in 1970 and 1971 includes Qeqertarssuatsiaq, the island on which Fiskenæsset is situated. Mánisât and the smaller islands to the west and the immediate east and south of the two larger islands (fig. 21).

The author has divided the gneisses into just two groups: those with pyroxene (or pseudomorphs thereof) and those without pyroxene and with biotite as the chief mafic mineral. Within each group there are a number of varieties of gneiss but it was not found practical to map these. The other major rock types in the area are pyroxene±garnet amphibolites, amphibolites without pyroxene or garnet, (orthopyroxene)-hornblende-biotite quartz diorite and the meta-anorthosite complex with its associated amphibolites of apparently supracrustal origin (Windley, Herd & Bowden, 1973). The distribution of these rock types (excluding the garnet- and pyroxene-free amphibolites, which are lumped with their host gneisses) is outlined in fig. 21.

Pyroxene-bearing gneisses

The pyroxene-bearing gneisses and altered varieties of them can be recognised by their reddish or yellowish weathering colour on lichen-free outcrops and their greenish colour on fresh surfaces. The most common assemblage in these gneisses is orthopyroxene–hornblende–biotite–quartz–plagioclase. The orthopyroxene is strongly pleochroic in pink and green; amphibole has α = pale greenish, β = greenish brown and γ = brownish green; biotite is pale yellowish to deep reddish brown; and plagioclase is antiperthitic. Other characteristic features of these rocks are granoblastic-polygonal texture with numerous equiangular triple-junctions (Spry, 1969) and the apparent equilibrium coexistence of both amphibole and biotite with orthopyroxene. Pale green clinopyroxene may join the above-named assemblage, in which case it is commonly partly replaced by the hornblende (which does not, however, replace the orthopyroxene). Rarely, clinopyroxene is the only

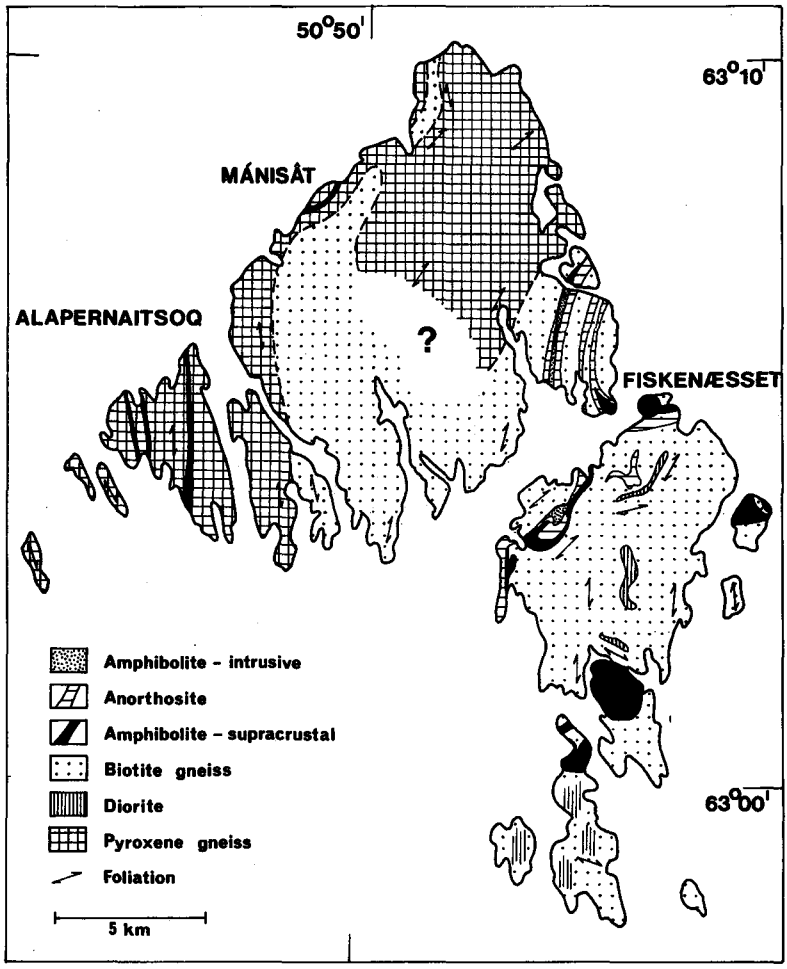

Fig. 21. Geological sketch-map of the area around Fiskenæsset. The blank area with a question mark is underlain by pyroxene-bearing and biotite gneisses whose mutual relations are uncertain. The islands south of the island on which Fiskenæsset lies are made up largely of interlayered diorite and gneissic diorite and biotite gneiss.

pyroxene in the rock but the accompanying minerals appear optically identical to those listed above.

The amounts of hornblende and biotite vary considerably but no rock has been found that does not contain one or the other. In general, the rocks of the outer isles west of Alapernaitsoq are poorer in hydrous minerals than those to the east.

Excluding antiperthite, the general dearth of K-feldspar in this group of rocks is striking. However, small amounts of microcline appear in crush zones of cataclastically deformed rocks, along with finely recrystallised plagioclase and quartz. There is no evidence of the production of K-feldspar by breakdown of biotite and it seems probable that the source of microcline lay in the antiperthite component of the plagioclase.

Alteration and retrogressive metamorphic features are minor in this group of gneisses. Orthopyroxene is commonly partly altered along cracks to an indeterminate material, probably a mixture of chlorite and serpentine. In a few rocks, this alteration has gone to completion. Effects of retrogressive metamorphism are generally limited to thin, ragged fringes of slightly bluish green amphibole on orthopyroxene, occasionally with an intervening zone of colourless (presumably Ca-poor) amphibole. Neither corona structures nor major amounts of bluish green hornblende, the usual indicators of significant retrogressive metamorphism, have been seen.

Although plagioclase-rich, the pyroxene-bearing gneisses should not be called enderbites (cf. Tectonic/Geological Map of Greenland), as amphibole and biotite in apparently stable association with pyroxene are far too prevalent.

Biotite gneisses

In this group are included rocks with the following assemblages: biotite–microcline–plagioclase–quartz, hornblende–biotite–plagioclase–quartz and garnet–biotite–microcline–plagioclase–quartz. The latter assemblage has been found at only one locality, south of Fiskenæsset island. Altered rocks may show small amounts of muscovite and epidote.

The hornblende has the pleochroic scheme α = yellowish green, β = green and γ = bluish green. The γ colour of biotite is dark brown without the reddish tinge so common in the pyroxene-bearing gneisses. Texture is granoblastic with fair to good foliation and no sign of the equilibrium features of the pyroxene-bearing gneisses.

(Orthopyroxene)-hornblende-biotite quartz diorite

This is a field term for a relatively mafic rock that constitutes a major unit on Fiskenæsset island and the islets to the south. The rock commonly consists of hornblende (α = pale brown-yellow, β = slightly brownish green, γ = grass green), biotite (γ = deep chestnut brown), plagioclase and quartz with abundant accessory apatite; a little microcline is present in a few specimens. In the field, the rock was thought to contain orthopyroxene but this mineral has been seen only very sporadically in thin section. When orthopyroxene is present, the rock strongly resembles some of the pyroxene-bearing gneisses described above. Garnet is another occasional constituent and has been seen only in outcrop, both in the diorite and what appear to be pegmatitic fractions thereof. Compositions of garnets from both types of occurrence were published by the author (Frisch, 1971) as those of garnets from 'hypersthene gneiss'.

Bodies of the diorite generally are non-foliated and have granoblastic textures (even granoblastic-polygonal with equiangular triple junctions) in their interiors and foliated at their margins. Contacts with gneiss (in all cases biotite gneisses) are generally sharp and, from intrusive relationships, the diorite is undoubtedly the older rock. At one locality, diorite forms two parallel, sill-like layers in biotite gneiss.

The author regards the diorite as a rock, of probable igneous parentage, transitional from the upper amphibolite to the granulite facies.

The biotite gneisses as retrogressed granulite-grade rocks?

Windley (1969, 1972) has suggested that parts of the amphibolite facies terrain of West Greenland (including the Fiskenæsset area) are the result of retrogressive metamorphism of granulite-grade rocks due to the imposition of a later amphibolite facies event. As one

line of evidence he cited the occurrence of layers and inclusions of granulite facies rocks in biotite-hornblende gneisses. Many of these orthopyroxene-bearing relics (e.g. Windley, 1972, p. 21, pt. e) are mafic rocks (amphibolites), which are far more susceptible to characteristic mineralogical changes during metamorphism than granitoid gneisses. For example, in the Adirondack area of New York (Engel & Engel, 1960; Buddington, 1963), quartzo-feldspathic gneiss has the assemblage brown biotite–almandine–quartz–oligoclase–orthoclase? (= K-feldspar with 'microcline domains') in the granulite facies. However, amphibolite layers within the gneiss consist of andesine, hornblende, clinopyroxene and ilmenite in the amphibolite facies, and sodic labradorite, hornblende, clinopyroxene, hypersthene and ilmenite in the granulite facies. The possibility that not all the West Greenland quartzo-feldspathic biotite gneisses with orthopyroxene-bearing mafic interlayers are of amphibolite facies grade, but are actually in the granulite facies, must be borne in mind. Detailed petrographic studies should resolve this question.

The Fiskenæsset area abounds in evidence that the biotite gneisses were locally mobile vis-à-vis mafic rocks, e.g. veining and migmatisation of the borders of the meta-anorthosite complex and the diorite. Inclusions of granulite-grade rocks in biotite gneisses may simply reflect greater mobility of the latter.

The replacement of pyroxene by amphibolite facies amphibole, noted by Windley in many areas, appears to have been insignificant in the gneisses in the vicinity of Fiskenæsset. The breakdown of orthopyroxene described above is more likely to be a consequence of the adjustment of a deep-seated rock to a higher level during exhumation.

The best evidence for large-scale retrogression would be extensive transitional zones across strike showing major retrogressive metamorphic phenomena between granulite and amphibolite grade rocks. These, however, are not present in the Fiskenæsset area. In general, contacts are abrupt and coincide with metamorphic facies boundaries, suggesting that chemical and physical differences between adjacent rocks have exerted the prime influence on the final metamorphic product. It is well to point out here that, while metasedimentary relics have been found in amphibolite facies rocks in the Fiskenæsset region (Kalsbeek & Myers, 1973), the author has found none in the granulite-grade gneisses of his area. The plagioclase-rich, K-feldspar-poor nature of the latter rocks suggests they are meta-igneous and may thus be fundamentally different in origin from the biotite gneisses.

In summary, while not denying that it may have occurred elsewhere in West Greenland, the author has found no evidence of wholesale retrogression of granulite-facies rocks in his area of the Fiskenæsset region. Chemical and mineralogical studies, which should go a long way towards providing more definitive conclusions, are under way.

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