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Reconnaissance mapping of the Precambrian rocks between Uîvaq (63°03′N) and Bernstorffs Isfjord (63°38′N), South-East Greenland

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A programme for the mapping of the Archaean and Nagssugtoqidian rocks between 62°30′ and 67°00′ on the south-east coast of Greenland was initiated in August 1981(fig. 25). The aim of the programme is the production of a 1:500 000 geological map sheet (sheet no. 14) covering the Tingmiarmiut-Angmagssalik region. Due to the late retreat of the pack ice in South-West and South-East Greenland in 1981, the field season was limited to 17 working days. Logistic support for the two mapping parties was provided by two inflatable dingies with outboard motors and by the GGU motor cutter *K. J. V. Steenstrup*. This summer's investigations only covered the areas accessible from the fjords, but at a later stage of the programme it is planned to visit the more remote inland areas by helicopter.

There has been little previous geological investigation of the region. R. Bøgvad sailed along the coast in 1932 during the seventh Thule expedition and reconnaissance mapping for the 1:2 500 000 tectonic geological map of Greenland (Escher, 1970) was carried out by D. Bridgwater and K. Gormsen during the summers of 1967 and 1968 (Bridgwater & Gormsen, 1968, 1969). Bridgwater kindly placed all available data collected during these two expeditions at our disposal.

Although no radiometric measurements have yet been made on the rocks collected, there is little doubt that most of the rocks are of Archaean age, because of their very close resemblance to the Archaean of West Greenland.

No mineralisation of possible economic value was observed.

Metamorphism and deformation

Field evidence shows that the rocks north-east of Kangerdlikajik are of amphibolite facies, and those to the south-east are of granulite facies. The metamorphic boundary is gradual and has a NW–SE trend. The agmatitic gneisses of the amphibolite facies terrain are grey, biotite and hornblende-bearing, and contain many well-preserved inclusions. The same

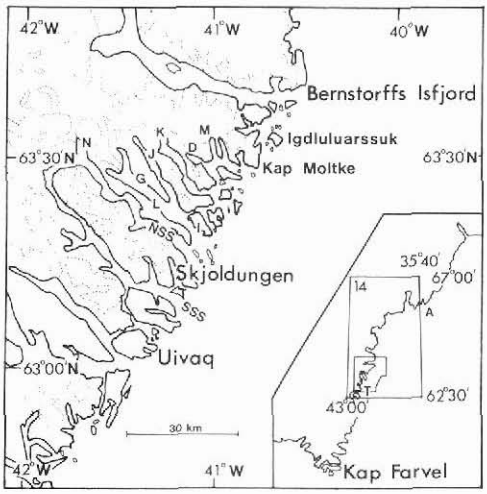

Fig 25. Locality map of investigated area. Insert: The SE part of Greenland, Sheet 14 of the 1:500 000 series indicated. a: Angmagssalik, d: Dragsfjord, g: Graahs Fjord, i: Imaersivik, J: Jættefjorden, k: Kangerdlikajik, l: Langenæs, m: Magnes Fjord, n: Nørrevig, nss: Nørre Skjoldungensund and sss: Søndre Skjoldungensund.

gneisses under granulite facies conditions are garnet- and orthopyroxene-bearing, and typically brownish weathered with only ghosts of inclusions in a more homogeneous matrix. The granulite facies metamorphism seems to be related to the intrusion of a suite of younger hypersthene-bearing granites, occurring in the region of Skjoldungen.

The rocks of the region have been strongly deformed during several phases of deformation. The overall trend of foliation is NW–SE and many of the inclusions in the gneisses are strongly flattened parallel to the foliation. The dip varies from near vertical at Skjoldungen to 30°–40° to the south-west at Igluluarssuk. Other trend and dip directions have been measured only at the hinges of a few major isoclinal folds. Late dominant features of the area, especially well observed at Langenæs, are two sets of shear zones trending NNW–SSE and E–W respectively. The shear zones cut all the observed rock types of the region, and lead to local greenschist facies metamorphism.

Main rock types

The following rock types have been mapped in the region:

(a) Agmatitic gneiss. Agmatitic gneisses have been observed throughout the entire region and are the most common rock type. As mentioned above, they contain well preserved inclusions in the amphibolite facies terrain, while in granulite facies terrain the rocks are more homogeneous and the inclusions reduced to ghosts. The distribution of the inclusions varies, but the amount is estimated to average 20 per cent. In the amphibolite facies gneisses the matrix is clearly intrusive and composed of several sets of granitic and granodioritic veins. The inclusions, which are clearly discordant to the foliation of the matrix, mainly consist of ultramafic rocks, amphibolite, diorite and gneiss. The origin of the agmatitic gneiss is still uncertain. The agmatitic character can be explained either by anatexis, or by emplacement of new granitic material, or a combination of both.

In the region between Jættefjorden and Kangerdlikajik (visited only by T. F. D. N.), the inclusions seem rather undeformed and the migmatitic matrix is composed of pink and grey granitic veins. From Dragsfjord to Kap Moltke the gneiss changes character. The inclusions occur in more or less diffuse bands, which are concordant with the general trend of the gneisses. At the head of Magnes Fjord the original relationships between the rock types seem to be best preserved. Amphibolite inclusions occur in well defined bands which are cut by numerous thin granitic veins. The surrounding gneiss is composed of an older grey inclusion free migmatite, an intrusive rather homogeneous red granitic gneiss, and folded discordant amphibolite dykes. The dykes intrude both gneiss types and the amphibolite bands. The second author suggests that the grey agmatitic gneiss in the remainder of the region was developed by agmatisation and mobilisation of rock types identical to those now exposed in Magnes Fjord.

(b) Amphibolite horizons. Continuous layers of amphibolite up to 100 m in width have been folded together with the gneisses, and some can be followed several tens of kilometres. They are for the most part rather massive, dark amphibolites with no clear extrusive textures, and finely layered leucocratic amphibolites which are possibly volcanogenic sediments.

We suspect that diffuse bands of amphibolite inclusions, observed at several localities north of Graahs Fjord, represent an earlier generation than the continuous amphibolite layers. On the island of Imaersivik the two types are exposed within 4 km distance from each other.

(c) Metasediments. Brown weathering garnet-sillimanite gneiss layers occur at the margins of some amphibolite horizons, or are interbedded with them. A gradual transition from finely layered leucocratic amphibolites (b) to garnet-bearing metasediments has been observed at several localities. In general the metasedimentary layers are no more than a few metres wide but seem continuous over long distances. Thin layers of calc-silicate rocks, carbonates and green quartzites were found at two localities.

(d) Ultramafic lenses. Brown weathering ultramafic rocks form concordant lenses up to 100 m long in some of the amphibolite-metasediment horizons (b) and (c).

(e) Deformed intrusions. A number of deformed ultramafic to noritic layers and bodies occur along Søndre Skjoldungensund. They are concordant with the foliation of the gneiss and often have well preserved magmatic layering. They range from ten to several hundred metres in length and it is suggested they were emplaced prior to the granulite facies event (see below, g).

(f) Tonalite sheets. Intrusive and folded sheets of granodiorite, tonalite and granite are exposed in the Kangerdlikajik and Dragsfjord areas. No contacts with the igneous granites described below were observed.

(g) The Skjoldungen igneous complex. A suite of igneous rocks, ranging from leuco-gabbros to granites, is exposed on and around Skjoldungen. The rocks are weakly foliated or

lineated and have nearly everywhere a concordant contact relationship with the surrounding agmatitic gneiss. The following types have been observed:

(1) Brown weathering hypersthene-bearing granites. This magmatic rock of charnockitic affinity is the dominant rock type. It is found in the south-east part of Skjoldungen and in the Graahs Fjord and Jættefjorden areas as plug or sheet-like intrusions. They intrude both the agmatitic gneiss and the amphibolite-metasediment horizons (b) and (c).

(2) Leucocratic granites. A few large sheets of white granite and granodiorite occur together with the brown granites.

(3) Leuco-gabbro. A leuco-gabbro body occurs on the south side of Nørrevig at the head of Nørre Skjoldungensund.

(h) Dolerite dykes. Three sets of dolerite dykes up to 100 m wide and trending N–S, WSW–ENE and NW–SE, cut all the other rock formations of the region. No relative chronology for these dykes can yet be suggested.

Discussion

After the first field season it is clear that a good start with the mapping and interpretation of the geology has been made. It is, however, too early for a meaningful comparison with the Archaean rocks of West Greenland. The Uîvaq–Igdluluarssuk region has suffered intense migmatisation resulting in disruption and modification of the original rock types. The identification of these original rock types and the precursors of the migmatite matrix is of primary importance for the understanding of the geological history of the region and for the study of the early crust. Radiometric age investigations of the amphibolites and more detailed field observations will be necessary to determine whether there are two different generations of amphibolites.

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