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Reconnaissance mapping for the 1:500 000 map sheet in the Godthåb–Isua region, southern West Greenland

J. H. Allaart, S. B. Jensen, V. R. McGregor and B. J. Walton

A two summer reconnaissance mapping programme covering the region east of Godthåb and Sukkertoppen was started in 1976 in order to complete the field work for the 1:500 000 map sheet Frederikshåb Isblink – Søndre Strømfjord (62° 30′–66° 45′N). Most of the coastal areas have been visited previously and the earliest results were published as a reconnaissance map (Noe-Nygaard & Ramberg, 1961). The area immediately north of Itivnera was mapped by Walton in 1975 (Walton, 1976), and the area around Isukasia was mapped by Allaart in 1974 and 1975 (Allaart, 1975, 1976).

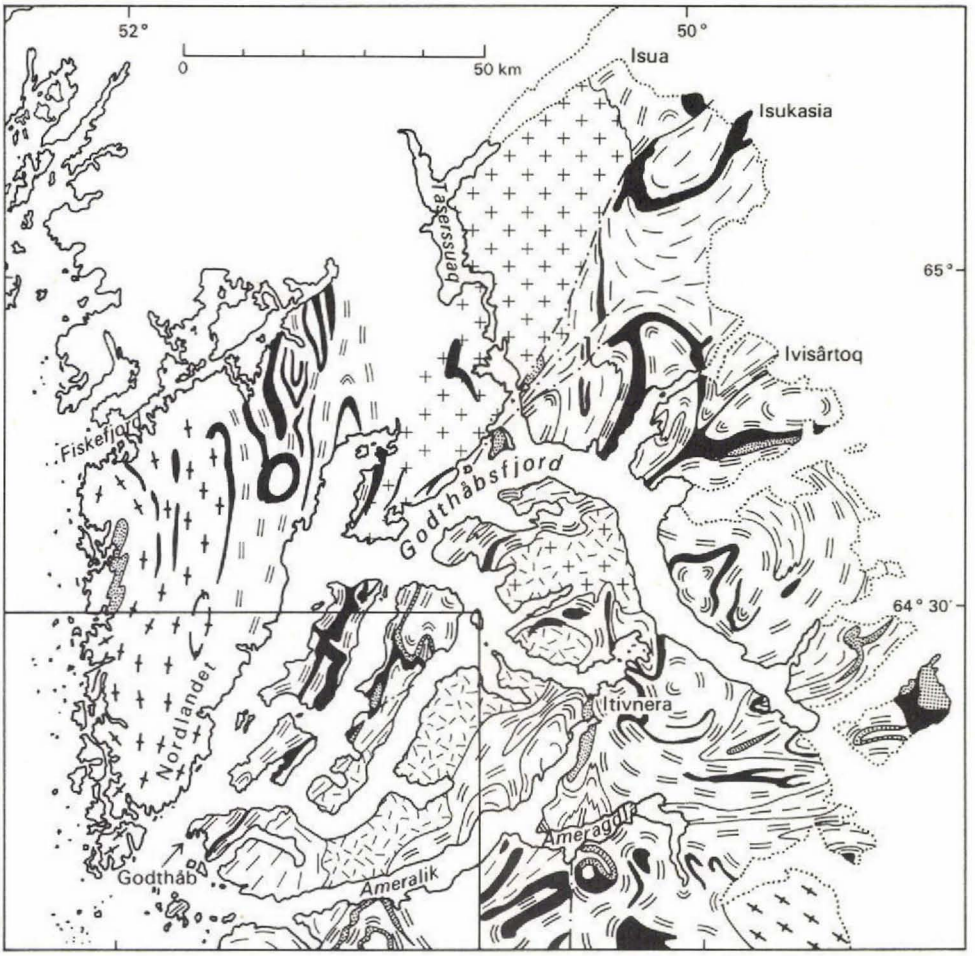
During the 1976 summer the following areas were covered: south of the fjord Ameragdla, around the inner parts of Godthåbsfjord and to the north along the edge of the Inland Ice to Isua, and between Godthåbsfjord and Fiskefjord (fig. 14). At the same time C. R. L. Friend & R. P. Hall (see this report) carried out more detailed mapping of the Ivisârtoq area.

The mapping team of four geologists was supported by two Bell G 3 helicopters that operated from a base camp established at the reindeer station Itivnera. Transport of equipment, fuel and personnel was by GGU motor cutter *F. Johnstrup*.

Rock units

Except for the Taserssuaq granodiorite (see below) no new rock units were discovered and no changes have been made in the chronology of events put forward for the Godthåb district by McGregor (1973) and Bridgwater *et al.* (1976). The following units have been mapped.

Isua supracrustals and Akilia association (c. 3760 m.y.). These include a variety of lithologies, mainly of supracrustal origin, which occur in many places within the Amîtsoq gneisses; they appear to be older than the gneisses. The Isua supracrustal rocks are a relatively large unit of well-preserved rocks that form a semicircular arc over an area of 10 by 20 km in the Isukasia area. Supracrustals were found south-west of Isukasia in a zone about 15 km long by 500 m wide. These consist mainly of amphibolites, but also include charac-



Supracrustal rocks
Amîtsoq gneiss
Nûk gneiss
Taserssuaq granodiorite and homogeneous Nûk gneiss
Granulite-facies rocks
Anorthosite and leucogabbro
Qôrqut granite
Fault

Fig. 14. Geological sketch map of the Godthåb–Isua region, southern West Greenland. The rectangular area indicates the 1:100 000 geological map sheet (Godthåb 64 V. 1 S) which is under compilation by V. R. McGregor. For more detailed map of the Ivisârtoq area see fig. 15.

teristic carbonate and pelitic sediments. Other occurrences of rocks older than the Amîtsoq gneisses are grouped in the Akilia association (McGregor & Mason, in press). Most bodies of Akilia rocks are relatively small, and consist of amphibolite, ultrabasic rocks, banded ironstones and garnet-biotite schists. It is not always possible to distinguish with confidence between larger units of Akilia association rocks and units of Malene supracrustal rocks.

Amîtsoq gneisses (c. 3750 m.y.). It was possible to map units of these quartzo-feldspathic gneisses in many parts of the area on the basis of the abundant amphibolite fragments derived from basic dykes. In parts of the area it was not possible to distinguish between Amîtsoq and Nûk gneisses. The largest block of Amîtsoq gneiss occurs north of inner Godthåbsfjord enclosing the Isua supracrustal belt.

Ameralik dykes. Basic dykes or amphibolite fragments derived from basic dykes are abundant in all the Amîtsoq gneisses recognised. They are believed to be equivalent to the type Ameralik dykes in the outer part of Ameralik fjord (McGregor, 1973). At Isukasia the dykes are well preserved and occur as two or more sets of metadolerite cross-cutting the Amîtsoq gneisses and the Isua supracrustals. Elsewhere they occur mainly as fragments.

Malene supracrustals (> 3000 m.y.). Strongly folded units of amphibolite intercalated with metasedimentary gneisses and ultrabasic rocks post-dating the Ameralik dykes are common within the Nûk gneisses. Perhaps the most conspicuous lithology is rusty-weathered, garnet-biotite gneiss with cordierite and sillimanite. The Malene supracrustals lack quartz-banded ironstones, which are characteristically developed in the Isua supracrustals and Akilia association. As mentioned above it is difficult, in places impossible, to distinguish between Malene supracrustals and the Akilia association. Occasionally the Malene supracrustals are in direct contact with Amîtsoq gneisses, but these contacts are probably of tectonic origin.

Metamorphosed leucogabbro and anorthosite. Large units of leucogabbroic and anorthositic rocks associated with amphibolites that may be derived from gabbros were mapped in several places. Throughout most of the area Nûk gneisses contain trains of inclusions of leucogabbroic rocks that are believed to represent the same unit as the metamorphosed leucogabbros and anorthosites of the Fiskenæsset complex to the south. However, the bodies of the Godthåb region are usually much more homogeneous than those from the Fiskenæsset area (Myers, 1975).

Nûk gneisses (3000–2800 m.y.). These quartzo-feldspathic rocks can be very similar to Amîtsoq gneisses, but they lack relics of Ameralik dykes and have intrusive relationships to the Amîtsoq gneisses, Malene supracrustals and anorthositic rocks. In the east and south Nûk gneisses and Amîtsoq gneisses occur intimately folded together. Nûk gneisses are the dominant element of the geology in the area between Godthåbsfjord and Fiskefjord.

Taserssuaq granodiorite. West of the block of Amîtsoq gneiss north of Godthåbsfjord, an area at least 1000 km^2 is made up of granitic rocks that are commonly homogeneous and with weak or no deformational fabric. Most of these rocks appear to be granodioritic in composition, but there are smaller bodies of more basic rocks. To the north-east and south-west the granodiorite grades into Nûk gneisses. Parts of the granodiorite have been affected by granulite-facies metamorphism, presumably of the same age as that which affected the Nordland area to the south-west.

Qôrqut granite (c. 2500 m.y.). The latest main event in the area is the intrusion of a potassium-rich granite (McGregor, 1973). The main body is found west of Itivnera outside

the area mapped. Its north-eastern prolongation occurs north of Itivnera (Walton, 1976).

Discordant dykes of granite and pegmatite are widespread. Most of these are probably associated with the Qôrqut granite.

Metamorphism

Most of the area mapped is in low-pressure amphibolite facies, but in the north-west, north of Nordlandet and to the south-east of the Ameragdla fjord, granulite-facies rocks occur.

Structural development

In the Amîtsoq gneisses surrounded by the Isua supracrustal belt (Isukasia area) the Ameralik dyke relics with the dykes from the Isukasia area is correct. The arcuate form of the therefore pre-date the dykes. Deformation of 2800 m.y. age is here negligible. However, in the outer part of the semicircular arc formed by the Isua supracrustals, the dykes are foliated and further to the south they become progressively stronger deformed and eventually disrupted because of the younger deformation; just north of Godthåbsfjord they show the same relations to the surrounding gneiss as the Ameralik dyke relics in the area farther south. Thus it has become clear that the provisional correlation (e.g. Bridgwater *et al.*, 1976) of the Ameralik dyke relics with the dykes from the Isukasia area is correct. The arcuate form of the supracrustals may at least partly be due to deformation of about 2800 m.y. age.

In the central, eastern part of the area mapped, metamorphism, deformation and granite activity were very intense during the plutonic episode that culminated about 2800 m.y. ago. Amîtsoq gneisses are intimately interfolded with Nûk gneisses and Malene supracrustals. At least two major phases of folding can be recognised.

The Taserssuaq granodiorite which occurs west of the Amîtsoq gneiss block is separated from this block by an important NNE-trending fault.

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Field work in the Ivisârtoq area, inner Godthåbsfjord, southern West Greenland

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The field work reported on here is part of the 1:500 000 scale mapping programme of the Godthåbsfjord region (Allaart *et al.*, this report). Ivisârtoq lies some 110 km north-east of Godthåb *(50°* 00′W, 64° 45′N, map 64 V 2 Kapisigdlit), (fig. 15). The area belongs to the central Archaean block of West Greenland (Pulvertaft, 1968) which in the Godthåbsfjord region has been shown to contain gneisses and associated amphibolites which may be broadly divided into two complexes (McGregor, 1973). The Amîtsoq gneisses and included amphibolites have ages of *c.* 3700 m.y. (Black *et al.*, 1971; Moorbath *et al.*, 1972), and the Nûk gneisses and associated amphibolites and anorthosites of *c.* 3000 m.y. (Pankhurst *et al.*, 1973; Moorbath & Pankhurst, 1976).

There is little previously published information on the Ivisârtoq area. Bridgwater *et al.* (1976) grouped the main belt of supracrustals in the area together with the Malene supracrustal rocks and their equivalents both on petrological grounds and because earlier reconnaissance work did not reveal the presence of demonstrable Ameralik dykes cutting either the supracrustals or the granitic gneisses intrusive into their margins. A single sample of metasediment collected for age determinations during the earlier reconnaissance yielded zircons giving a $^{207}Pb/^{206}Pb$ age of 2580 m.y. and $^{204}Pb/^{238}U$ versus $^{207}Pb/^{235}U$ values very close to a concordia intercept at approximately 2550 m.y. (Baadsgaard, 1976) interpreted as the probable result of metamorphic effects from the Qôrqut granite.

This report describes the field relationships of the rock types and contains the first report of ultramafic pillow lavas from the Godthåbsfjord region.

Rock units of the Ivisârtoq area

The area consists of three main rock types of various generations: quartzo-feldspathic gneisses, amphibolites (with associated ultramafic and meta-sedimentary material) and anorthosites. The gneisses can be divided into two categories, an older complex which