Preliminary conclusions

The purpose of reconnaissance exploration is firstly to select metallogenic districts which have a potential for economic mineralisation, and secondly to eliminate with confidence barren areas. The three methods of exploration used in this project, gamma-spectrometry, geochemistry and geological exploration have been used to augment and complement each other. It is possible even at this preliminary stage of evaluation to select two areas which will warrant further work where the methods have supported each other. These are the Igaliko complex and the adjacent Narssaq–Narssarssuaq area, and the supracrustal unit (Tasermiut quartzite) in the Folded Migmatite Zone, The areas that can already be eliminated with some confidence are the Archaean and adjacent supracrustal unit in the Border Zone and the Nunarssuit complex in the Granite Zone.

The rest of the area including the Grønnedal–Ika complex and the Flat-lying Migmatite Complex in the south will be ranked in importance on the basis of further evaluation of the analyses of the stream sediment and rock samples and the gamma-spectrometry.

References

Allaart, J. A. 1976: Ketilidian mobile belt in South Greenland. *In* Escher, A. & Watt, W. S. (edit.) *Geology of Greenland*, 121–151. Copenhagen: Geol. Surv. Greenland.

Berthelsen, A. & Henriksen, N. 1975: Descriptive text to Geological map of Greenland 1:100 000, Ivigtut, 61 V 1 Syd. Copenhagen: *Grønlands geol. Unders.* (also *Meddr Grønland* **185**(1), 210 pp.).

Buchwald, V., Sørensen, H., Breval, E. & Hansen, J. 1960: Autoradiografisk undersøgelse af grønlandske bjergartsprøver III. Unpubl. report Min. Geol. Inst., Copenhagen University.

Emeleus, C. H. & Upton, B. G. J. 1976: The Gardar period in southern Greenland. *In* Escher, A. & Watt, W. S. (edit.) *Geology of Greenland,* 154–181. Copenhagen: Geol. Surv. Greenland.

Hansen, J. 1968: A study of radioactive veins containing rare earth minerals in the area surrounding the Ilímaussaq alkaline intrusion in South Greenland. *Bull. Grønlands geol. Unders.* **76** (also *Meddr Grønland* **181**,8) 47 pp.

Persoz, F., Larsen, E. & Singer, K. 1972: Helium in the thermal springs of Unartoq, South Greenland. *Rapp. Grønlands geol. Unders.* **44**, 21 pp.

Mapping of Archaean, Mesozoic and Tertiary rocks between Watkins Bjerge and Angmagssalik (69°–65°50′N)

John S. Myers, David Bridgwater and Robin C. O. Gill

A light aircraft and helicopter were used between the 23rd and 29th July to complete the mapping of the 1:500 000 geological map sheet 13 (fig. 2).

Two reconnaissance flights were made from Iceland in a Piper Navajo aircraft on the 23rd and 24th July over the inland nunataks between Watkins Bjerge and Angmagssalik (fig. 30).

The aim was to map the structure and distribution of Precambrian, Mesozoic and Tertiary rocks between Nansen Fjord and Watkins Bjerge, where there is no coverage by aerial photographs, and the structure and lithologies within the Precambrian gneiss complex on the inland nunataks to the south.

On the 25th July a G204 helicopter was used to complete mapping of the Tertiary centres of Kialineq and Nualik (Bridgwater *et al.*, 1978; Myers *et al.*, 1979) and flown to Nordre Aputitêq which was used as a base for the next four days. From there the region between Nansen Fjord and Watkins Bjerge was mapped, mapping of the Igdlitarajik plutonic centre was completed (Bridgwater *et al.*, 1978), and a portion of the Tertiary dyke swarm was mapped and sampled on nearby Fladø. A major layered gabbro intrusion was mapped west of the Nualik plutonic centre during the return flight to Angmagssalik on the 29th July.

Archaean gneiss complex

Archaean gneisses were examined and sampled at two localities north of Nansen Fjord (fig. 30). They were derived from medium-grained granodiorites with veins of pegmatite. The gneisses are strongly deformed with a marked *L-S* fabric and the pegmatite veins show a flaser structure with augen of potash feldspar. At locality A (fig. 30) the main foliation is crossed by minor sinistral shear zones which pre-date regional granulite facies metamorphism. At B the gneisses are in amphibolite facies but show textural evidence of having been retrogressed from earlier granulites. Some have marked cataclastic textures.

The rest of the gneiss complex was only observed from the air. Major horizons of amphibolite, mica schist and pegmatite occur in the quartzo-feldspathic gneisses north-east of Kangerdlugssuaq where regional structures are steep and trend NNE–SSW.

Between inner Kangerdlugssuaq and 67°30′N both amphibolite facies and granulite facies rocks are widespread. Major horizons of amphibolite and mica schist are intruded by sheets of granite and pegmatite but are not abundant and cannot be traced very far among the scattered nunataks. The abundance of steep structures and amphibolite facies gneisses in the inland part of this area was not expected from coastal observations (Bridgwater *et al.*, 1978) from which it appeared that the inland area consisted largely of granulite facies gneisses with flat-lying structures.

South of 67°30′N all the gneisses are in granulite facies except in a narrow belt along the outer coast and in scattered zones of Nagssugtoqidian shearing and basic dyke injection. Major lenticular zones of intense Nagssugtoqidian deformation and dyke intrusion were discovered between 40 and 80 km north of the mobile belt, similar to those found closer to the margin of the Nagssugtoqidian mobile belt in 1978 (Myers *et al.*, 1979). Nagssugtoqidian dykes are scattered throughout the Archaean gneiss complex but are locally concentrated in narrow swarms. Most dykes trend east–west and dip steeply southwards, and where they cut granulite facies gneisses many dykes are associated with narrow zones of retrogression to amphibolite facies.

An expedition which crossed the nunatak zone between latitudes 67°–68°N on foot in 1978 (Matthews & Wright, 1979) collected a sample from these dykes which gave a K-Ar age of 2120±100 Ma (D. C. Rex analyst, D. W. Matthews, personal communication, 1979). Oriented samples of similar dykes collected from the coast show a palaeomagnetic pole consistent with a Proterozoic age (Beksgaard Jensen, personal communication, 1977).

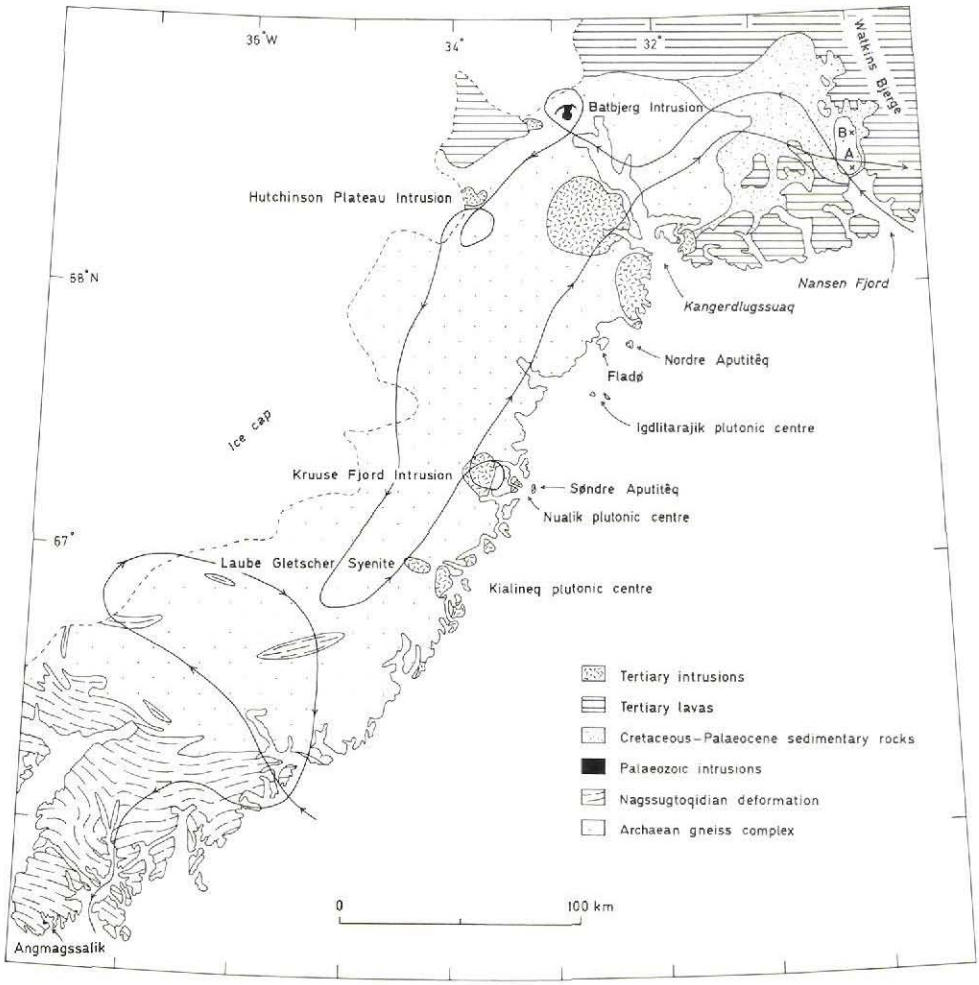

Fig. 30. Map showing the main geological units between Watkins Bjerge and Angmagssalik, and routes flown in a Piper Navajo aircraft (continuous thick lines with arrows). Crosses A and B mark localities mentioned in the text.

Palaeozoic intrusion

The Batbjerg Intrusion (Brooks *et al.*, 1975, 1976) at the head of Kangerdlugssuaq was examined from the air (fig. 30). It consists of two circular plug-like bodies, a grey diorite to the north, and a black pyroxenite to the south, 5 km in diameter, at the centre of a swarm of grey ring dykes, 8 km in diameter and up to 1 km thick. This differs from the only published map by Brooks *et al.* (1975), and further field work is clearly necessary in this area to delimit the complex.

Upper Cretaceous – Palaeocene sedimentary and volcanic rocks

The eastern outcrops of the Kangerdlugssuaq Sedimentary Series and lower part of the Plateau Basalt Series of Wager (1947) were mapped between Nansen Fjord and Watkins Bjerge with the aid of a helicopter. Further south-west similar rocks have been divided into a number of formations by Soper *et al.* (1976), but such subdivision was not possible in the region described here because of the reconnaissance nature of the work. A thick sill occurs along most of the unconformity between the Archaean gneiss and base of the Kangerdlugssuaq Sedimentary Series. The latter consists of shale, siltstone, sandstone, coal and locally abundant tuff and agglomerate. Fossil plant fragments are abundant in the shale and siltstone. Sills with well developed columnar jointing occur throughout the sedimentary series and in the lowermost part of the main plateau basalts. The main plateau basalts are a fairly uniform series of subaerial tholeiitic lava flows. Most individual flows are between 10 m and 50 m thick and grade from a lower, medium-grained, orange-brown weathering, non-vesicular portion to an upper, fine-grained, grey to black weathering vesicular portion. The few flows examined were only slightly porphyritic or non-porphyritic. In some places the main plateau basalts are unconformable on the sedimentary rocks and tuffs, suggesting that the latter were locally tilted eastwards and eroded before the eruption of the main plateau basalts.

Tertiary intrusions

A major layered basic intrusion was discovered during the reconnaissance flight from Iceland, on the eastern part of Hutchinson Plateau at the edge of the inland ice cap, east of the head of Kangerdlugssuaq (fig. 30). Layering in the eastern part of the intrusion dips steeply westwards (inwards). This intrusion should be visited whenever helicopter transport is available in the area.

Another major layered intrusion, named the Kruuse Fjord Intrusion, was delineated and mapped by helicopter west of the Nualik Plutonic Centre (fig. 30). This intrusion was discovered in 1977 at sea level at the head of the fjord Agtertia, but the well layered rocks on the 1500 m peaks above were then thought to be basalt lava flows (Bridgwater *et al.*, 1978). Field work in 1979 showed however that this whole mountain massif is part of an oval gabbro intrusion 20 km long and 13 km wide, exposed through a vertical height of nearly 2 km. Igneous layering is prominent throughout the intrusion and dips steeply inwards. The north-eastern part of the intrusion is cut by a dense swarm of microdiorite dykes, and small sheets of syenite and granite containing pillowed microdiorite dykes occur throughout the eastern half of the intrusion. Access to the Kruuse Fjord Intrusion is difficult by any means as it mainly outcrops on steep mountain sides which rise from crevasses and are capped by sharp ridges or snow cornices, and although it outcrops at the head of Agtertia and Kruuse Fjords, these fjords are usually blocked by ice.

Additional mapping and sampling were carried out at the Igdlitarajik, Nualik and Kialineq plutonic centres. The Igdlitarajik Plutonic Centre consists of two layered gabbro intrusions, one with mainly tabular plagioclase froms an oval body with inward dipping layering exposed on Pâtûlajivit, the eastern island (fig. 30), and skerries to the north, and the other with mainly equant plagioclase outcrops on Igdlitarajik, the western island (fig. 30). The gabbro on Igdlitarajik was intruded into basalt and tuff which forms the western end of the island.

Granite veins occur in the volcanic rocks and locally form spectacular breccias. Steep NE–SW trending dykes cut both intrusions.

The island of Søndre Aputitêq, east of Nualik, mostly consists of layered gabbro. In the middle of the island this is intruded by a complex of diorite and granite similar to that exposed on the island of Ersingerseq to the west. The granite and diorite show complicated contact relations ranging from sharp to diffuse suggesting that they were derived from contemporaneous acid and basic magmas. The main body of diorite is veined by horizontal granite sheets containing pillowed sheets of microdiorite.

A major body of syenite named the Laube Gletscher Syenite, observed from the coastal mountains in 1978, was confirmed and mapped by helicopter, and forms the western part of the Kialineq Plutonic Centre (fig. 30). It is a rectangular pluton 11 km long and 4 km wide with vertical walls, and is composed of massive coarse-grained syenite and a younger phase of medium-grained granite.

Observations were made on the pre-Tertiary erosion surface which is warped by the major post-basalt antiform and coastal flexure (Wager, 1947).

References

Bridgwater, D., Davies, F. B., Gill, R. C. O., Gorman, B. E., Myers, J. S., Pedersen, S & Taylor, P. 1978: Precambrian and Tertiary geology between Kangerdlugssuaq and Angmagssalik, East Greenland. *Rapp. Grønlands geol. Unders.* **83**, 17 pp.

Brooks, C. K., Rønsbo, J. G., & Nielsen, T. F. D. 1975: Leucite from East Greenland: A new petrographic sub-province of the Tertiary North Atlantic province. *Bull. geol. Soc. Denmark* **24**, 93–98.

Brooks, C. K., Fawcett, J. J. & Gittins, J. 1976: Caledonian magmatic activity in south-eastern Greenland. *Nature Lond.* **260**, 694–695.

Matthews, D. W. & Wright, N. J. R. 1979: Reconnaissance geology of the area between Tasîlaq and Kronprins Frederik Bjerge, southern East Greenland. Unpublished report. Copy in GGU.

Myers, J. S., Austrheim, H., Gill, R. C. O., Gorman, B. E. & Rex, D. C. 1979: Field work on the Nagssugtoqidian boundary north of Angmagssalik and Tertiary igneous rocks of Kialineq and Kap Gustav Holm, East Greenland. *Rapp. Grønlands geol. Unders.* **95**, 82–85.

Soper, N. J., Higgins, A. C., Downie, C., Matthews, D. W. & Brown, P. E. 1976: Late Cretaceous – early Tertiary stratigraphy of the Kangerdlugssuaq area, east Greenland, and the age of opening of the north-east Atlantic. *J. geol. Soc. Lond.* **132**, 85–104.

Wager, L. R. 1947: Geological investigations in east Greenland. IV. The stratigraphy and tectonics of Knud Rasmussens Land and the Kangerdlugssuaq region. *Meddr Grønland* **134**(5), 64 pp.

R.C.O.G.,
Department of Geology,
Chelsea College,
271 King Street,
London W6 9LZ,
U.K.