

REVIEW OF THE SURVEY'S ACTIVITIES IN 1971

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Director

In 1971 the Geological Survey of Greenland (GGU) celebrated its 25th year of geological research in Greenland. During this period the Survey has developed into the official government department of the Ministry for Greenland dealing with geological aspects. The interest shown by mining and oil companies in both onshore and offshore areas of Greenland during the last decade has continued to grow and as a result the Survey has set up an economic section to deal with matters concerning mineral and hydrocarbon exploration. This work forms an important part of the Survey's tasks which are to investigate, map and explain, in as much detail as is practicable, the geology of Greenland. Systematic geological mapping, detailed investigations of selected mineral deposits and the publication of results of research carried out during the first 25 years of the Survey's existence provide the basic data for the realisation of the economic potential of Greenland.

Personnel

In 1971 the Survey was served by a permanent scientific staff of 17 geologists and 1 chemist, supported by 39 permanent non-scientific personnel, 2 of whom were permanently resident in Greenland. As in previous years a large number of geologists and supporting personnel were attached to the Survey for the summer field work in Greenland from June to September. A total of 128 people travelled to Greenland of which 33 were geologists and 8 were senior geological students. In addition 40 Greenlanders were employed during the summer, as either field assistants or crew members on boats.

Operations in Greenland

The main areas of operation in 1971 are indicated on fig. 1. The field projects undertaken can be assigned to six main groups concerned with:

- (a) systematic geological mapping for the production of map sheets at the scale 1:100 000,
- (b) reconnaissance mapping for compilation of regional map sheets on the scale 1:500 000,
- (c) geophysical investigations,
- (d) Quaternary investigations,

- (e) economic investigations,
- (f) specialised projects.

(a) The penultimate year of the five-year mapping project in the Scoresby Sund region, East Greenland, was completed successfully.

In southern West Greenland the systematic mapping in the Fiskenæsset region, started in 1969, was continued and in addition, one team completed the mapping in the Frederikshåb area to the south which was the site of the main west coast mapping between 1964 and 1968.

In central West Greenland geological mapping was undertaken by parties on Disko, Hareøen, Nûgssuaq and Ubekendt Ejland.

(b) Reconnaissance investigations carried out sporadically during the last few years in North Greenland, were continued along the coast north and south of Thule, using local boat transport and assistance.

(c) Geophysical investigations formed a larger part of GGU's total field programme than hitherto, a trend which is likely to continue in the coming years.

In the Scoresby Sund region, East Greenland, various magnetic profiles across land and sea areas were investigated and an aeromagnetic survey was carried out using a fixed-wing aircraft equipped with a gamma ray spectrometer.

In central West Greenland one party made seismic refraction measurements in northern Nûgssuaq, and another collected samples for palaeomagnetic investigations. A further station for measurement of ground temperatures was erected at Christianshåb.

In South Greenland a detailed programme of magnetic and electromagnetic measurements was carried out over ultramafic plutons in the Nanortalik area.

(d) Quaternary investigations in 1971 were restricted to Jameson Land, East Greenland, where one two-man party mapped moraine deposits and collected material for radiometric measurements.

(e) In the course of basic geological mapping much information on economic aspects is assembled; geiger-counter readings are registered and any mineralisations and deposits of economic potential are investigated.

The prospecting programme started in 1970 on nickel, copper, platinum and other mineralisations in ultramafic rocks of the Nanortalik area, South Greenland, was continued.

The geological and geophysical work in the Disko-Nûgssuaq region of central West Greenland contributed to the assessment of the hydrocarbon potential of the West Greenland sedimentary basin, in connection with which a preliminary shallow-core drilling programme was carried out.

(f) Specialised projects included: 1) detailed mapping in the Klokken and Ilímaussaq intrusions in South Greenland; 2) a combined water balance study in the Narssaq river valley, South Greenland; 3) sampling of rocks in West Greenland for isotopic age determination in the Godthåb area, where rocks as old as 4000

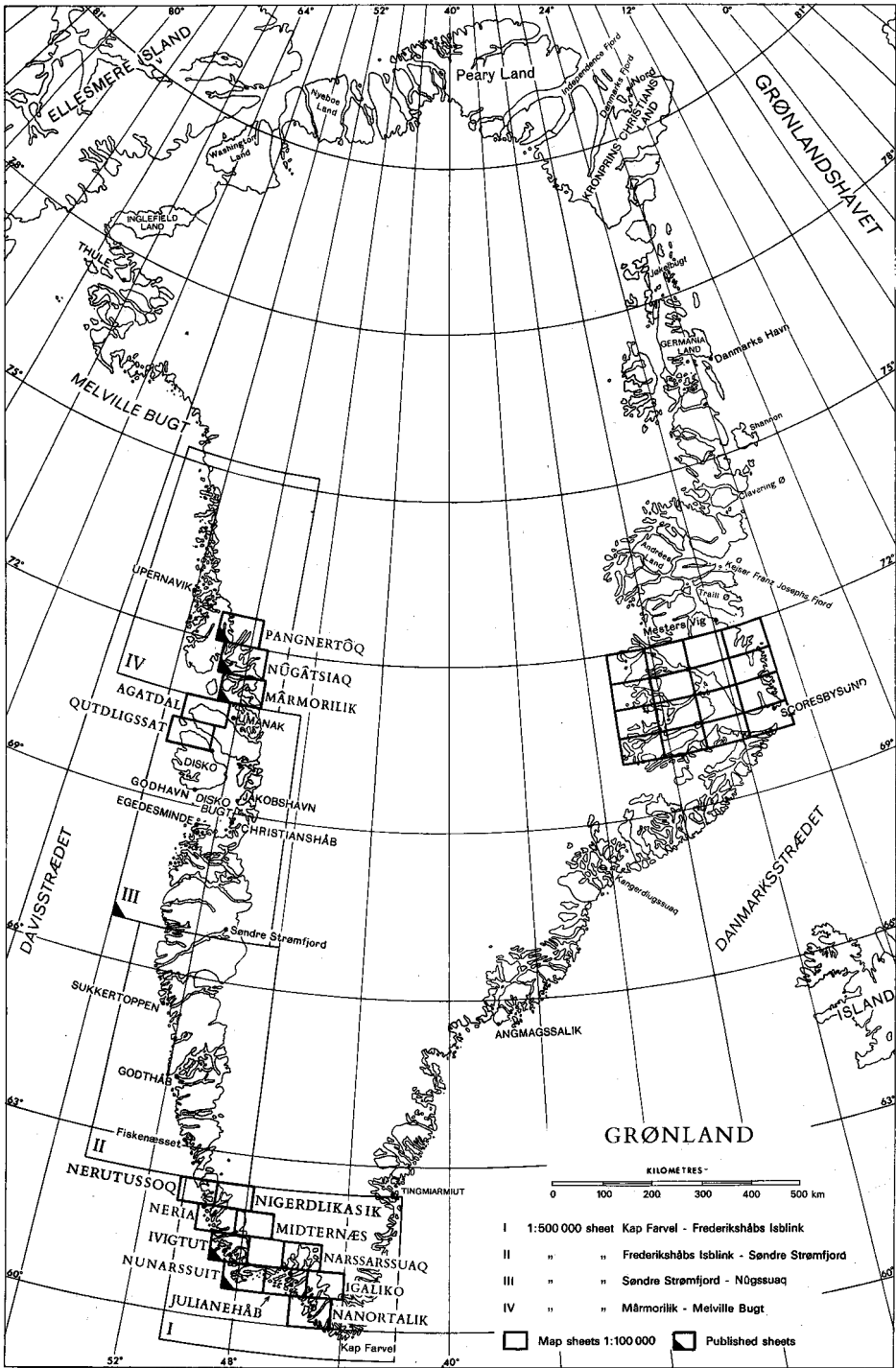


Fig. 2. Greenland showing map sheets issued and in preparation by the Survey.

m.y. were dated in 1971, and in the Fiskenæsset area where it is possible that similar very ancient rocks exist; 4) measurement of Na^+ activity in naturally occurring substances in the Fiskenæsset area, West Greenland.

Collaboration with other institutes

By employing summer contract geologists, geophysicists and other personnel, both Danish and foreign, the Survey enjoys a fruitful collaboration with many geological institutes. The material collected in Greenland under GGU auspices forms the basis of numerous research projects. Contact is encouraged and maintained with other institutions interested in Greenland so that maximum benefit can be obtained from the sharing of resources and exchange of ideas.

In Denmark close cooperation with the Mineralogical Museum and the Mineralogical-Geological Institutes of the University of Copenhagen, the Geological Institute of the University of Aarhus, the Danish Atomic Energy Commission and the Geotechnical and Mineralogical Institutes of the Technical University in Copenhagen, has continued, and a sharing of laboratory equipment and personnel with the University of Copenhagen has proved most beneficial.

In 1971 the Survey's staff were joined in the field by geologists from the universities of Aberdeen, Alberta, Dalhousie, Durham, Edinburgh, Exeter, Liverpool, London, Modena, Oxford and St. Andrews, and from the Central Geological Survey in Prague, Portsmouth College of Technology, the Polish Academy of Science at Krakow, Eidg. Technische Hochschule in Zurich, Centre de Recherches Faculté des Sciences in Montpellier, the Scottish Research Reactor Centre at East Kilbride and Olexon International N.V., The Hague.

The Survey also participated in marine geophysical investigations undertaken by the Bedford Institute, Dartmouth, Nova Scotia, in Umanak Fjord.

The Survey's capacity for geochemical work is relatively limited compared to the number of geologists actively working in Greenland. This deficiency was remedied in 1971 by collaboration with the universities of Birmingham, Durham and Leeds to raise the output of chemical analyses. Likewise, the universities of Alberta, Copenhagen, Leeds, Newcastle and Oxford, the Eidg. Tech. Hoch. in Zurich, the Geophysical Laboratory of the Carnegie Institution, Washington and the Scottish Research Reactor Centre have provided K/Ar, Rb/Sr and zircon isotopic age determinations on Survey rock material. Shells and driftwood have been dated through cooperation with the National Museum of Copenhagen, University of Washington and Isotopes Inc., New Jersey. Analyses of water and gas samples from warm springs have been made by the Geological Survey of Denmark (DGU) and the Atomic Energy Commission's Research Establishment at Risø, Denmark.

Throughout the year Survey geologists continued to contribute to international conferences and symposia, and meetings were attended in Cambridge, Edinburgh, Heidelberg, Keele, London, Munich, Oslo, Ottawa, Oulanka, Paris, Prague, Salisbury and San Francisco.

Much of the field work in Greenland forms part of international projects. This year hydrological and ground temperature studies formed part of the UNESCO International Hydrological Decade programme. Planning of new work has been influenced by UNESCO's International Oceanographic Decade and the International Union of Geological Science's Geodynamics Project.

Publications

Three types of geological maps are published by the Survey: (a) Regional coloured maps at the scale 1:500 000 and 1:2 500 000. In 1971 a coloured Quaternary map at 1:2 500 000 was published as a supplement to the tectonic/geological map issued in 1970. The first 1:500 000 map of a planned series of four covering the whole west coast, was published (see fig. 2) and cartographical work on the others is progressing.

(b) Coloured survey maps at scale 1:100 000. In 1971 the sheets Pangnertôq and Nûgâtsiaq were published, the Julianehåb sheet was in press, the sheets Nanortalik and Narssarssuaq were completed in manuscript form, and the drawing of Neria, Nerutussoq, Midternæs and Nigerdlikasik was begun.

(c) Detailed maps of selected areas at various scales which are mainly issued to accompany written publications.

Written publications are in the form of Bulletins, published also in *Meddelelser om Grønland*, Miscellaneous Papers reprinted from international journals, and Reports. In 1971, 8 Bulletins, 9 Miscellaneous Papers and 10 Reports were issued.

Mining and exploration

The Survey continued to advise the Ministry for Greenland on exploration and mining aspects. 1971 saw 9 additional companies receiving prospecting licences. One company was granted exclusive concession rights for mineral exploration; another was given exclusive rights to survey and exploit minerals except for cryolite, oil and gas. At the end of 1971, 51 companies were operating in Greenland. Out of this total 22 companies and groups of companies hold prospecting licences for petroleum, which gives an indication of the intense interest in the petroleum potential of Greenland. Much geophysical data received from oil companies was interpreted during the year under arrangement with the Survey's geophysical consultants, Negen N. V., Rotterdam.

For the help of companies interested, or planning activities, in Greenland, the Survey reissued in 1971 a 20-page booklet containing practical information about Greenland; it includes data on meteorological, permafrost, ice, navigation, transport and sailing conditions. In addition, a revised edition was issued of a booklet cataloguing the concessions and prospecting licences granted by the Ministry for Greenland up to 1st August 1971.

Survey members have assisted companies holding concession rights with maps and other Survey material as, and when, requested. The Survey's report archives

containing unpublished results and notes of field work undertaken by the Survey are available to companies for reference. Much interest has been shown in the hydrocarbon potential of the sedimentary basin of West Greenland.

In cooperation with the Danish Atomic Energy Commission's Research Establishment at Risø work was continued on the evaluation of the radioactive mineral content of the Ilímaussaq intrusion in South Greenland, where some field work was carried out this year. Other economic investigations are mentioned above under Operations in Greenland.

Note

The following 19 articles report the principal activities of the 1971 field season in Greenland, together with the results of some of the isotopic age determination work carried out during the year. Articles dealing with North Greenland and central West Greenland come first, followed by those from southern West Greenland, South Greenland and East Greenland.

Unless otherwise stated at the end of each article, the authors' address is the Survey's headquarters in Copenhagen.

PRECAMBRIAN CRYSTALLINE ROCKS AND YOUNGER SEDIMENTS OF THE THULE DISTRICT, NORTH GREENLAND

Peter R. Dawes

Field work was carried out from mid-July to mid-September using a 22 foot boat hired from Innuterssuak Uvdloriak of Siorapaluk. Field assistance was given by Kakutsiak, Butdlak, Usakak and Naduk Uvdloriak. A reconnaissance was made along 500 km of coastline between Inglefield Bredning and Inglefield Land (figs 1 and 3). Pack ice stopped northerly progress south of Kap Hatherton (78°25'N).

A review of work carried out by others, including P. Schei, L. Koch, R. Bentham, S. Munck, J. C. Troelsen and J. W. Cowie, is reserved for a later paper.

Basement rock types

In the *Inglefield Bredning area* three main units can be recognised (see fig. 3). These are:

(1) a unit of highly folded, biotite and hornblende gneisses which are commonly garnetiferous. The main type is a veined dark grey to reddish-brown weathering granodioritic gneiss; variations to granitic gneiss, augen gneiss and to pelitic schistose gneiss, rich in biotite, occur. In some areas grey to bluish-grey quartz-rich gneisses are common. The gneisses and associated amphibolite layers and inclu-