A review of Greenland activities, 1998

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Field activities in Greenland by the Geological Survey of Denmark and Greenland (GEUS) were at a high level in 1998, involving 122 persons including 23 from the Danish Lithosphere Centre (DLC); these figures include guest researchers within and outside Denmark. This year, the Survey's normal total staff, in terms of man-years, amounted to 362; of these, 98 were focused on Greenland-related activities. DLC, whose activities up to now have largely been concerned with research in Greenland, has a normal staff of 21 persons.

GEUS activities are primarily funded by the Danish state through a Finance Law grant, of which 35 million DKK were ear-marked for Greenland activities in 1998. In addition funding for resource-related activities is provided by the Government of Greenland (18 million DKK) via the Bureau of Minerals and Petroleum (BMP) in Nuuk, which took over administrative responsibility for energy and mineral resources on the 1st of July 1998.

General scientific activities are made possible by funding from a variety of sources, national, as well as international: the Danish Natural Science Research Council, the Commission for Scientific Research in Greenland, the Carlsberg Foundation, the European Union, the Government of Greenland (through the BMP), and others. Scientific funding agencies contribute significantly to earth science activities in Greenland. Total funding for Greenland activities in 1998 thus amounted to 84 million DKK. The Danish Lithosphere Centre, funded by a grant from the Danish National Research Foundation (Grundforskningsfonden), is administratively linked to the Survey but housed in the buildings of the University of Copenhagen.

General scientific activities are often co-operative ventures between GEUS and national as well as international universities and research establishments. Co-operation with institutions in Greenland are particularly important. In 1998, the Greenland National Museum and Greenland Field Investigations (Asiaq) participated in the Survey's scientific activities.

Through its representative on the Board of GEUS, the Government of Greenland is directly involved in setting priorities for the Survey's activities. GEUS had two geologists seconded to the BMP in Nuuk throughout 1998 to assist in its work concerning mineral and petroleum exploration. BMP and GEUS jointly supported initiatives to inform the international oil and mineral industries about opportunities in Greenland through publication of the newsletters *Ghexis Newsletter* and *Greenland MINEX News*, and through participation in conferences in Europe and North America with publicity stands, lectures and posters.

Geological mapping

The Survey's mapping project in North-East Greenland between latitudes 72°N and 75°N was initiated in 1997 with the emphasis on compilation of a 1:500 000 scale map (sheet 11, Kong Oscar Fjord; Fig. 1, **1**) and the field activities by an expedition group totalling 43 persons were completed in 1998. The 29 geologists and ten student assistants included a DLC party of two working with Paleogene basalts, several teams studying post-Caledonian basins (Tupolar project), and mineral resource investigations (see also below). This now classic area of North-East Greenland was originally mapped during Lauge Koch's expeditions before and after the Second World War. Developments in geological techniques, notably the advent of absolute dating methods, have necessitated a systematic re-mapping, with the focus on interrelationships between reworked basement complexes and Neoproterozoic and Early Palaeozoic sediments. The timing of granite formation and emplacement has also been the subject of reassessment. During the 1998 field work logistic support was given to a Cambridge University field party which visited some of the classic Devonian vertebrate localities,

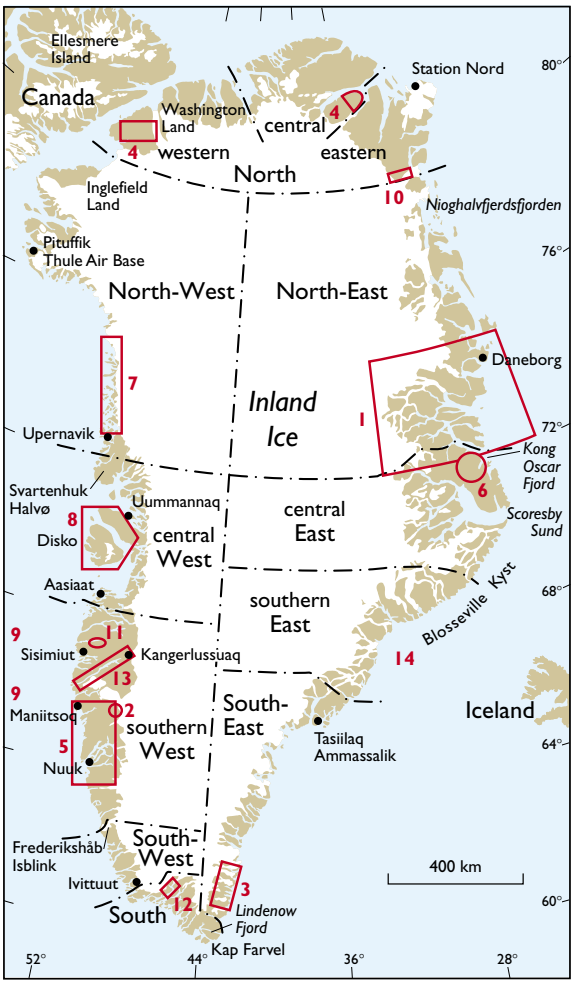

Fig. 1. Survey activities in Greenland in 1998. **1**: Regional geological mapping, North-East Greenland. **2**: Studies of the early crust of the Earth at Isua. **3**: Plate tectonics and the Julianehåb batholith. **4**: Aeromagnetic survey, Washington Land and J.C. Christensen Land. **5**: Aeromagnetic survey, Nuuk to Maniitsoq. **6**: Ore geological studies, Mestersvig. **7**: Ore geological studies, Upernavik. **8**: Hydrocarbon studies, Nuussuaq Basin. **9**: Marine seismic reinterpretation, offshore West Greenland. **10**: Glaciological and palaeoclimatic studies, Nioghalvfjerdsfjorden. **11**: Snow hydrological investigations, Sisimiut. **12**: Palaeoclimatic data acquision. **13**: Palaeoclimatic data acquision, Kangerlussuaq (Søndre Strømfjord). **14**: Danish Lithosphere Centre drilling operations, offshore East Greenland.

and to four groups of geologists from the University of Oslo with whom co-operation has been established.

Field activities in the Isua region north-east of Nuuk, West Greenland (Fig. 1, **2**) continued, with the second field season of a three-year programme aimed at sampling and mapping of the very early Archaean Isua supracrustal belt. This work is undertaken in co-operation with a number of institutions within and outside Denmark, and is primarily funded by the Danish Natural Science Research Council.

In South-East Greenland work continued on the elucidation of the plate tectonic processes during the Palaeoproterozoic Ketilidian orogeny. Studies in 1998 concentrated on the margins of the Julianehåb batholith (Fig. 1, **3**) with the purpose of improving models of its emergence. The project was carried out as a joint project with Kingston University, England, and the Danish contribution was funded by grants from the Carlsberg Foundation and the Danish Natural Science Research Council.

Mineral resource investigations

The Survey's ongoing airborne geophysical programme, financially supported by the BMP, was continued at a high level in 1998. The main aim of the project is to acquire data of interest to the mining industry and thus encourage commercial prospecting.

The final survey of a planned five-year programme 'AEM Greenland' was completed in 1998, and comprised magnetic and electromagnetic data acquisition over Washington Land and J.C. Christensen Land in respectively western and eastern North Greenland (Fig. 1, **4**). In addition, an aeromagnetic survey, 'Aeromag 98', was flown over the region between Nuuk and Maniitsoq in West Greenland (Fig. 1, **5**).

As part of the North-East Greenland mapping project field parties investigated mineralisation showings, in particular along fault zones, as well as carrying out follow-up studies of anomalies detected by the 1997 magnetic and electromagnetic survey flown south of Mestersvig, in the sediments of the Jameson Land Basin (Fig. 1, **6**).

A mineral resource investigation carried out in the Upernavik district of North-West Greenland (Fig. 1, **7**) encompassed collection of stream sediments and visits to, and sampling of, mineralisation localities. This work was undertaken in co-operation with, and was funded by, the Bureau of Minerals and Petroleum.

Petroleum geology

The search for, and sampling of, oil seeps in the volcanic rocks of the Disko – Nuussuaq – Svartenhuk

Halvø region of central West Greenland continued in 1998 (Fig. 1, **8**). General studies of structural geology, sedimentology and biostratigraphy, together with studies of the volcanic sequence, were undertaken as part of the activities in the onshore parts of the Nuussuaq Basin. A major re-interpretation of the basin was concluded, tying together onshore field observations and offshore seismic reflection, magnetic and gravimetric data aiming at an understanding of the pre-basaltic tectonics and basin configuration. A study of the uplift history of the basin, funded by a grant from the Danish Energy Agency (DEA) of the Ministry of Environment and Energy (EFP – Energy Research Programme), was concluded and reported in 1998.

A major re-interpretation of the seismic data offshore southern West Greenland was initiated, incorporating data acquired over the past few years, together with a re-analysis of the biostratigraphy of the offshore wells drilled in the late 1970s (Fig. 1, **9**). After the transfer of the resource administration to Nuuk the formulation of a new oil and gas exploration strategy was initiated in the second half of 1998. This work is undertaken as a joint effort between BMP, GEUS and the DEA.

General scientific activities

A research project studying the dynamics of the floating ice tongue filling Nioghalvfjerdsfjorden in eastern North Greenland was continued in 1998 (Fig. 1, **10**). Through radar and seismic measurements the thickness of the floating glacier front and the bathymetry of the fjord were investigated in co-operation with the Danish Centre for Remote Sensing and the German Alfred Wegener Institute. Submarine melting of the floating ice has been shown to be of particular importance in assessing correctly the mass balance of floating glaciers. Sampling of marine and lake sediments has also been undertaken in order to obtain palaeoclimatic data from the region. Snow hydrological investigations were also carried out north-east of Sisimiut in West Greenland with the purpose of studying the processes leading to discharge from a hydrological basin with hydroelectric potential (Fig. 1, **11**).

In the fjords Tunulliarfik and Igaliku Fjord in South Greenland (Fig. 1, **12**) marine investigations were carried out in order to acquire palaeoclimatic data relevant to the question of the disappearance of former Norse settlements, and to locate, for example, possible shipwrecks and other artifacts of Norse origin.

Lake sediments were sampled for palaeoclimatic studies in several lakes between Kap Farvel and Frederikshåb Isblink in south-western Greenland, as well as in lakes in the Kangerlussuaq (Søndre Strømfjord) area of southern West Greenland (Fig. 1, **13**).

The DLC drilling operation offshore southern East Greenland (Fig. 1, **14**) did not meet its 1998 objectives due to technical problems. DLC researchers also participated in the Survey's activities in North-East Greenland (Fig. 1, **1**) and in the Isua area of southern West Greenland (Fig. 1, **2**).

Publications

In 1998 the Survey published three issues in the *Geology of Greenland Survey Bulletin* series (nos. 175, 179 and 180), of which no. 180 (24 articles) provides a review of the Survey's activities in 1997. In *Geology of Denmark and Greenland Map Series CD*, four CD-ROMs were released of previously published 1:500 000 maps of the national map sheet coverage. The first digitally produced 1:100 000 map sheet (Lindenow Fjord) was also published in 1998. Thematic maps of Inglefield Land, North-West Greenland, previously published in paper form in 1996, were released on CD-ROM. Two series of maps based on airborne geophysically acquired data from two regions were issued during the year: one covers the Disko Bugt – Nuussuaq region central West Greenland (Aeromag 1997) and the other the northern part of Jameson Land, central East Greenland (AEM Greenland 1997).

In the series *Danmarks og Grønlands Geologiske Undersøgelse Rapport,* 18 issues with a 'Greenland content' were published. Two issues of the newsletter directed towards the oil industry (*Ghexis Newsletter* 13 and 14) and two issues of the newsletter directed at the mining industry (*Greenland MINEX News* 14 and 15) were published in 1998. The Survey's activities in Greenland, including those of DLC, have resulted in the publication of 45 papers in international scientific outlets.

A list of publications in English released in 1998 concludes this volume on pages 75–81.