

# A review of Greenland activities, 1997

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Field activities undertaken by the Geological Survey of Denmark and Greenland (GEUS) in and around Greenland were at a relatively high level in 1997. A total of 115 scientific and technical personnel took part in GEUS expeditions, including 13 from the Danish Lithosphere Centre. The Survey's total full-time staff numbers 360, of which 95 are concerned with projects in relation to Greenland. In addition the 20 staff of the Danish Lithosphere Centre, a research centre funded by the Danish National Research Foundation and administratively linked to GEUS, are mainly involved in research activities centred on Greenland.

The Greenland Home Rule Government has a representative on the Survey's Board of Management, and thus has direct influence on setting priorities for the institution's varied projects. The Greenland Government Minerals Office (from January 1998, the Bureau of Minerals and Petroleum) has also directly financed joint projects with GEUS, in particular airborne geophysical surveys, with a budget in 1997 of 18 million kroner. This supplements the grant of 35 million kroner provided by the Finance Law for Denmark dedicated to Greenland projects. Together with other sources of income, the total Survey budget expended on Greenland activities in 1997 amounted to 70 million kroner.

As part of the agreement dated 14 November 1994 between the Prime Minister of Denmark and the Premier of the Greenland Home Rule Government, concerning strengthening of the mineral resources sector in Greenland, two GEUS geologists were seconded to the Greenland Government Minerals Office in Nuuk throughout 1997. This arrangement covers both the oil resources and mineral resources sectors, and involves two-way communication of geological information of particular relevance to the non-living resource sector.

GEUS, in cooperation with the Mineral Resources Administration for Greenland, Danish Ministry of Environment and Energy, and the Minerals Office in Nuuk, has continued the joint information service directed at the

international oil and mining industries. This activity concentrates on the presentation of geological results and information relevant to resource prospecting on land and offshore at meetings, symposia and exhibitions, in addition to the distribution of publications, newsletters and reports. In the field of mineral resources, particular efforts have been directed at Canadian companies, and in respect of oil resources to companies in both North America and Europe.

GEUS has assisted the Mineral Resources Administration for Greenland in geological questions concerning the activities of companies with concessions in Greenland, including monitoring of grøNArctic's activities on Nuussuaq, the work of the Statoil group on the Fylla Banke, and with respect to new mineral concessions in West Greenland the area calculation of mineral licences. In the summer of 1997 GEUS monitored Rio Tinto's drilling activity on iron ore deposits east of Nuuk on behalf of the Mineral Resources Administration for Greenland (Fig. 1, **A**).

The Danish National Research Foundation has announced that funding for the Danish Lithosphere Centre is to be extended for a further five-year period (1999–2004) with a grant of 85 million kroner.

## Geological mapping

Systematic geological mapping for the 1:500 000 map series has been continued, and in 1997 as the Survey's largest single activity a two-year project with significant international participation was initiated in North-East Greenland (72°–75°N: sheet 11, Kong Oscar Fjord; Fig. 1, **B**). Field work in 1997 was concentrated in the southern part of the map sheet, with investigations of the composition, structure and age of the lithological units making up the Caledonian fold belt, and studies of the post-Caledonian strata to the east. During the summer the expedition was visited by the Danish Minister

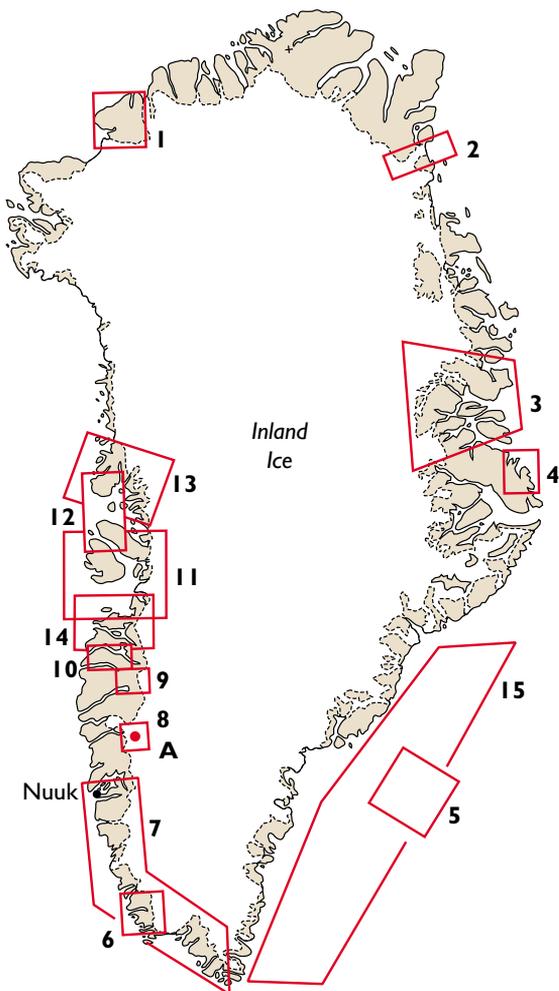


Fig. 1. Survey activities in Greenland in 1997. **A**: Commercial drilling activity, north-east of Nuuk; **1**: Ore geological studies, Washington Land; **2**: Nioghalvfjerdingsfjorden glaciological studies; **3**: Regional geological mapping, North-East Greenland; **4**: Geophysical survey south of Mestersvig; **5**: Marine geological survey offshore South-East Greenland; **6**: Plate tectonic studies north of Ivittuut; **7**: Lake sediment investigations, West Greenland; **8**: Ancient life studies, Isua; **9**: Lake sediment studies, Kangerlussuaq; **10**: Hydrological and glaciological reconnaissance, north-east of Sisimiut; **11**: Aeromagnetic survey, West Greenland; **12**: Hydrocarbon studies, Nuussuaq Basin; **13**: Ore geochemical studies, West Greenland; **14**: Danish Lithosphere Centre, geological studies, West Greenland; **15**: Danish Lithosphere Centre seismic survey, offshore South-East Greenland.

for Research, Jytte Hilden, and the Greenland Home Rule Government Minister for Research, Marianne Jensen.

East of Nuuk in West Greenland, a major research project coordinated by GEUS, focused on the search for traces of life in some of the oldest known rocks on Earth in the Isua area (Fig. 1, **8**). In addition to detailed geological mapping a series of specialised studies will be undertaken by a group of scientists from the United Kingdom, France, Germany, USA and Australia.

In the northern border zone of the Ketilidian orogen north-east of Ivittuut (Fig. 1, **6**) in South-West Greenland, studies undertaken in cooperation with a British geologist are aimed at elucidation of plate tectonic processes 1800 Ma years ago.

A programme to digitalise the Survey's 1:500 000 geological map sheets, undertaken in cooperation with the Minerals Office in Nuuk, has been completed; CD-ROM products will be released in 1998.

Work by the Danish Lithosphere Centre in 1997 was limited to onshore studies in the region between Sisimiut and Aasiaat (Fig. 1, **14**), and a seismic survey offshore South-East Greenland (Fig. 1, **15**).

## Mineral resource investigations

As part of the continuing emphasis on promotion for the exploration of Greenland's natural resources, airborne geophysical surveys were flown in 1997 over areas in both East and West Greenland. The surveys were managed by GEUS, and carried out by international geophysical contractors; they were financed by special grants from the Greenland Home Rule Government. A magnetic survey was flown over the land and sea areas between Aasiaat and Uummannaq (Fig. 1, **11**) in West Greenland, and a magnetic and electromagnetic survey was flown over a particularly prospective area south of Mestersvig (Fig. 1, **4**) in East Greenland. The data acquired are included in geoscientific databases at the Survey, where they can be consulted by industry.

As part of the regional 1:500 000 geological mapping project in North-East Greenland (Fig. 1, **3**), geological and geochemical investigations were carried out with particular interest in possible gold mineralisation.

As part of the Polar Research Programme of the Danish Natural Science Research Council, ore geological investigations were carried out in Washington Land (Fig. 1, **1**), western North Greenland, and revealed hitherto unknown indications of zinc, lead and silver mineralisation.

In the Uummannaq and Upernavik kommuner (Fig. 1, **13**) in cooperation with the Minerals Office in Nuuk, ore geological investigations were carried out, partly

using Greenland-trained prospectors. Systematic sand sampling was undertaken from rivers in the region which, after treatment and chemical analysis, will provide the mining industry with the possibility of evaluating the presence of possible mineral resources.

## **Petroleum geology**

In the Nuussuaq–Svartenhuk area (Fig. 1, **12**) field investigations were carried out with the objective of evaluating the hydrocarbon prospects of the Nuussuaq Basin and the adjacent offshore region. Both the sedimentary and volcanic sequences in the region have been investigated, and led to finds of widespread oil seeps. Rock cores from drilling by the Survey and the commercial company grønArctic Energy Inc. have been the subject of detailed laboratory analysis. The GEUS investigations were supported by special grants from the Danish State and the Greenland Home Rule Government (until end 1997), from the Danish National Energy Research Programme, from the Greenland Home Rule Government, and from the Carlsberg Foundation. The results of the GEUS investigations are of fundamental importance in strengthening the interest of the international oil industry in West Greenland.

The Survey's regional mapping project in North-East Greenland (Fig. 1, **3**) included, as part of the Danish Natural Science Research Council's Polar Research Programme, petroleum geological investigations of the post-Caledonian sedimentary basins. Within the scope of the same programme, studies were undertaken in Washington Land (Fig. 1, **1**) of the source and reservoir properties of selected sedimentary rocks and bitumen residues.

## **Climate research and marine geology**

The floating glacier which fills the interior of Nioghalvfjordsfjorden in North-East Greenland (Fig. 1, **2**) was again the focus of international glaciological investigations. Studies of mass balance, glacier movement and melting on the underside of the glacier in contact with sea water were carried out. Among other results, melting at the underside of the glacier was found to be considerably greater than previous estimates.

Investigations of lake sediments and their microfossil and pollen contents around Kangerlussuaq in West Greenland (Fig. 1, **9**) have provided data on environmental and climatic developments since the last ice

age. Studies of variation in lake sediments along the West Greenland coast (Fig. 1, **7**) have also provided information on climatic changes.

Marine geological surveys offshore South-East Greenland (Fig. 1, **5**), including seismic surveys and recovery of shallow seabed cores, were carried out as part of a project to map former ocean current systems between Greenland and Iceland. In the same general region (Fig. 1, **15**) the Danish Lithosphere Centre completed a seismic survey in preparation for planned drilling in 1998.

North-east of Sisimiut (Fig. 1, **10**) in West Greenland, GEUS in cooperation with ASIAQ (Greenland Field Investigations) carried out hydrological and glaciological reconnaissance. Field work is aimed at the modelling of drainage basins and contributes to general models designed to evaluate future utilisation of Greenland's water resources.

The climatic research activities of the Survey are an integral part of international climate research carried out in close cooperation with institutes in Canada, Germany, Norway, Russia, Sweden, Switzerland, The Netherlands and USA.

## **Publications**

In 1997 GEUS published five numbers in the new Bulletin series, *Geology of Greenland Survey Bulletin* (nos 173, 174, 176, 177, 178). Number 176, *Review of Greenland activities 1996*, provided an overview of the year's activities in 18 articles (see p. 172, this volume). One sheet in the Geological map of Greenland 1:500 000 series was issued (sheet 10, Dove Bugt), together with two sets of geophysical maps from respectively South-West Greenland (Aeromag 1996) and an area around Ivittuut (AEM Greenland 96). In the Survey's open file type series *Danmarks og Grønlands Geologiske Undersøgelse Rapport*, 26 geological reports were issued which have relevance to Greenland. Three issues of *Greenland MINEX News* (nos 11, 12, 13) and two issues of *GHEXIS* (nos 11, 12), the Survey's international newsletters to respectively the mining and oil industries, were released in 1997.