Investigation of satellite images

Niels Henriksen

The National Aeronautics and Space Administration (NASA) of the United States on 23rd July 1972 launched a satellite with the purpose of investigating the Earth's natural resources and their potential use. The satellite, named ERTS–1 (Earth Resources Technology Satellite), circles the globe 14 times a day in a near-polar, sun-synchronous orbit at a height of 912 km and produces images in 4 spectral bands. Each image covers an area of 185 × 185 km. The image data is stored at the Eros Data Center in the U.S.A. and from there made available for scientific investigation in all countries.

GGU has systematically collected information on available ERTS–1 images covering the ice-free areas of Greenland and has evaluated a number of ERTS-pictures for geological, hydrological, glaciological and cartographic purposes.

Together with officers from the Geodetic Institute (J.K.W. Ekholm, personal communication) some examples of pictures from the Scoresby Sund region in East Greenland have been evaluated cartographically (fig. 1). It was found that the variation in image scale of an 1:250 000 enlargement was less than 0.25 %, confirming the near-orthophotographic character of the images. The geological and glaciological information in the images was compared with the results from the recently finished systematic mapping project of the Scoresby Sund region (*Rapp. Grønlands geol. Unders.* 58, 1973).

A second ERTS satellite is planned to be launched early in 1975 and, in relation to this, a special study of the hydrology and geology of the fjord region of East Greenland has been suggested as a joint venture between GGU and the United States Geological Survey.

The development of the ERTS-project and other aspects of Remote Sensing are being closely followed by GGU, in order to make best possible use of these study methods in future survey work.

Developments in petroleum exploration in and around Greenland 1969–1974

Gilroy Henderson

The rapidly increasing interest that has been shown in the petroleum potential of the Arctic during the last decade has caused attention to be focussed on the sedimentary basins of Greenland and its offshore areas.

During the period up to 1966 sporadic interest was shown in the petroleum

potential of onshore West Greenland. In 1966 parties from two oil companies visited Nûgssuaq and Disko. None of this work was followed up by geophysical surveys or drilling.

In the late 1960s interest was shown for the first time in the potential of the West Greenland continental shelf. Geophysical surveys by the oil industry and by government institutes over the Labrador shelf. (e.g. Hood *et al.*, 1967) had already shown the presence there of thick sedimentary sequences.

Systematic field mapping in the onshore sedimentary area of central West Greenland was started in 1938 and by the late 1960s the Geological Survey of Greenland had accumulated a considerable amount of information on the Cretaceous–Tertiary sediments and overlying Tertiary basalts. The stratigraphy and structure of these rocks were reviewed by Rosenkrantz & Pulvertaft (1969). In 1968 the marine shales were sampled for source rock analysis. The analyses, which were carried out for GGU by Olexcon International B.V., The Hague, showed the presence of commercial source rocks. Combining the work already done in this area and the analytical results, Henderson (1969) reviewed the oil and gas prospects of this part of West Greenland.

During 1969–1972 21 companies and groups interested in petroleum held prospecting licences covering parts of West Greenland and the West Greenland continental shelf. Most of our present knowledge of the rocks underlying the shelf south of Egedesminde stems from geophysical work carried out in this period under these licences and to a small extent under permits granted directly to geophysical contractors. This work encompassed more than 20 000 line kilometres of deep seismic profiling and some sparker profiling, aeromagnetic surveys, shipborne magnetometer surveys and gravity surveys.

The data resulting from these surveys were submitted to the Ministry for Greenland who in turn passed them on to GGU, the Ministry's adviser on any mineral exploration and exploitation undertaken by private companies in onshore and offshore Greenland. The data were interpreted with the help of GGU's consultants Negem N.V. in London and Olexcon International B.V. This interpretation provided background knowledge that was available during the preparation of terms for forthcoming petroleum concessions in the area.

During 1947–1967 the Royal Danish Hydrographic Office carried out detailed bathymetric surveys of the West Greenland continental margin between 59° and 69°30'N. The data were used to prepare charts at 1:400 000 and 1:80 000 in the coastal waters. The basic data were made available to GGU and used to prepare a series of 86 bathymetric maps at scale 1:100 000 with 10 m contour interval. The maps can be purchased from GGU and give a very detailed picture of the entire continental margin of this part of Greenland.

A prerequisite for the granting of petroleum concessions in offshore West Greenland was the establishment of a dividing line in the area between Greenland and the Canadian Arctic Islands. An agreement between the two governments was signed in Ottawa on 17th December 1973 and ratified by the Danish parliament on 25th February 1974 covering the marine area from 61°00'N in the southern part of Davis Strait to 82°13'N in Nares Strait.

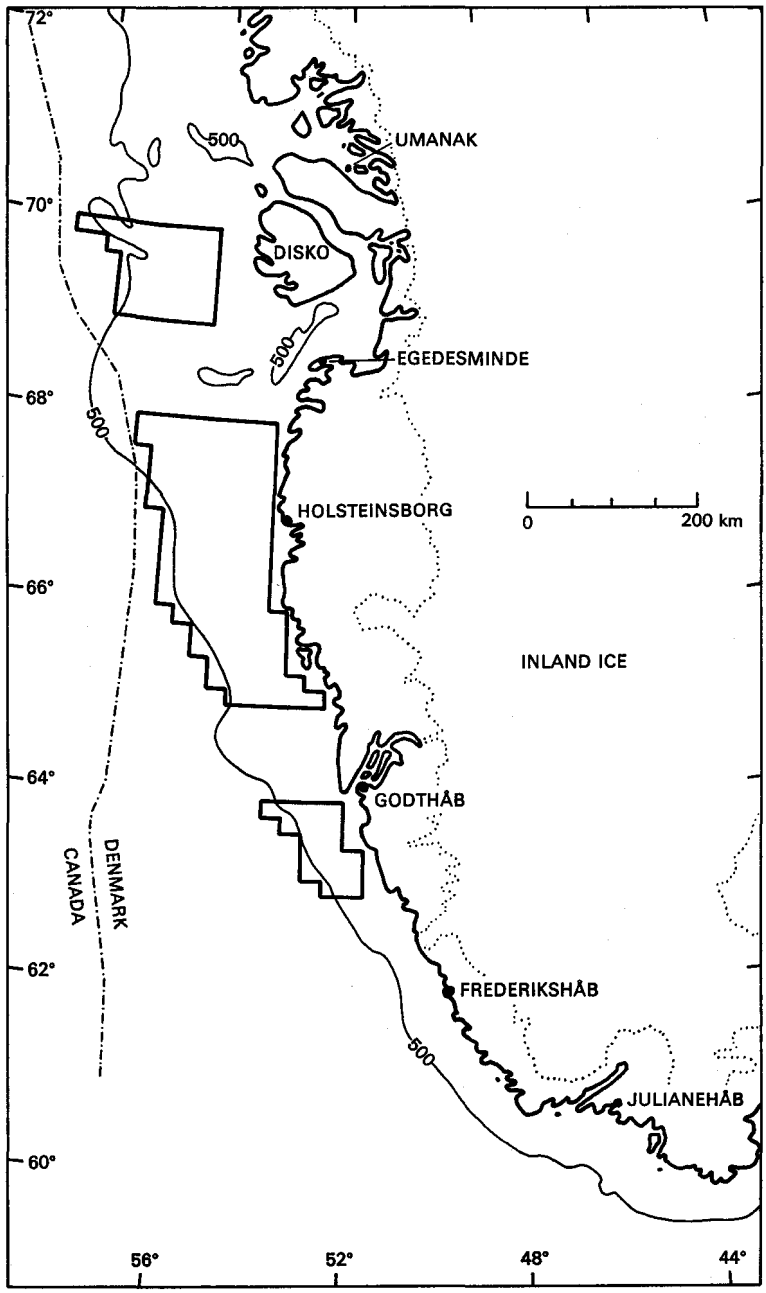

Fig. 4. Map of West Greenland south of 72°N showing the three areas open for concession applications. The 500 m bathymetric contour is indicated.

On 15th July 1974 the Ministry for Greenland invited applications for petroleum concessions within three areas offshore West Greenland (fig. 4). On the closing date of 15th October 22 companies had responded to the invitation, which is a firm indication of continuing interest in the potential of this area. GGU has assisted the Ministry in assessing the concession applications received.

Although interest has been concentrated on West Greenland, in particular the West Greenland shelf, other areas have also attracted attention. Until late 1973 three companies held prospecting licences for petroleum on land in North Greenland. One of these undertook extensive airborne magnetometer surveys, aerial photography and field work. Numerous oil companies have expressed interest in the sedimentary basin of central East Greenland and the continental shelf off East Greenland. One mining company holds an exclusive concession over the sedimentary area on land in this area. The concession includes petroleum rights. No licences or concessions have yet been granted over the East Greenland shelf.

The Survey is represented in the working group drawing up regulations to govern the activities of companies undertaking mineral exploration on land in Greenland and in adjacent marine areas. In this connection the writer has participated in discussions with the Norwegian Petroleum Directorate in Stavanger, the Department of Indian and Northern Affairs in Ottawa and the Department of Energy, Mines and Resources in Ottawa.

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X-ray fluorescence spectrometry at GGU

Ib Sørensen

In 1971 GGU started to establish a modern laboratory for rock analysis based on X-ray fluorescence spectrometry and a manual Siemens SRS sequence spectrometer, prepared for automation, was bought. It is difficult to imagine a modern X-ray spectrometer without automatic preselection of measuring parameters but the automation can be present in varying degrees and can follow different paths. For various reasons GGU chose an on-line computer control connected via interface to a Digital PDP-8E mini-computer. By this selection we have obtained an almost fully automatic instrument which has so far proved to be excellent both in terms of measuring accuracy and technical reliability.

The so-called LINQUA programme chooses the detector, collimator, crystal, gonio-