



Regional geological investigations and 1:500 000 mapping in North-East Greenland

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North-East Greenland is the last major area that remains to be geologically mapped in the programme of regional mapping at a scale of 1:500 000. In 1988 a three-year field mapping programme was initiated aimed at regional geological studies and geological mapping in the area between 75°N and 78°N. The southern third of this region (75°–76°N) is included on the map at a scale of 1:250 000 by Koch & Haller (1971), and the northern part forms part of a map at a scale of 1:1 000 000 (Haller, 1983). However, the region as a whole has previously only been studied on a reconnaissance basis with limited ground control, and the published maps make extensive use of aerial photograph interpretation.

Geologically North-East Greenland is part of the East Greenland Caledonian fold belt which can be traced as a continuous coast-parallel belt for more than 1200 km. In the inner nunatak zone to the west, foreland rocks belonging to the Precambrian Greenland shield are exposed beneath westwards directed Caledonian thrust units. Post-Caledonian sequences of Upper Palaeozoic to Mesozoic sediments are found in the coastal regions as block-faulted remnants of coast-parallel basins. Tertiary basalts cover parts of the easternmost land areas bordering the North Atlantic. The Caledonian fold belt between 75°N and 78°N is made up of crystalline complexes with rocks of probably a polyorogenic Precambrian basement and a sequence of only moderately folded Proterozoic sediments. Late to post-orogenic granitic intrusions cut both the crystalline rocks and the folded sediments.

The geological work in 1988 was carried out with seven two-man field teams, of which three worked in the crystalline complexes (Henriksen *et al.*, 1989). One team studied the sedimentology of the Upper Proterozoic Eleonore Bay Group sediments in the region between 75°N and 76°N as well as an area around 74°N (Sønderholm *et al.*, 1989). Stratigraphical and palaeontological investigations of the Cambro-Ordovician sequence around 74°N were undertaken by a three-man team for one month (Hambrey *et al.*, 1989). A geochemical reconnaissance exploration was undertaken by a two-man team, also for one month. The studies of the Devonian sequence between 73°N and 74°N in rela-

tion to ongoing investigations of the onshore hydrocarbon potential north of 73°N (Marcussen *et al.*, 1988) were continued by two two-man teams (Larsen *et al.*, 1989). The working areas of the various teams are shown on fig. 1.

Logistic background

The expedition in 1988 was carried out in cooperation with a surveying group from the Geodetic Institute, Copenhagen (GI), which worked in the region between Bessel Fjord (76°N) in the north and Hjørnedal (70°N) in the south.

The GGU and GI groups chartered two small helicopters (a Hughes 500 D and an Ecureuil AS 350 B) via Greenlandair Charter from Uni-Fly, Svendborg, and a Twin Otter from Flugfélag Norðurlands, Akureyri. The helicopters provided transport and camp moves in the field, while the Twin Otter was used for transport from various stations in the region to the expedition's base camp at Fligely Fjord. Danish C-130 transport aircraft of the Royal Danish Air Force carried the expedition between Denmark and Mestersvig.

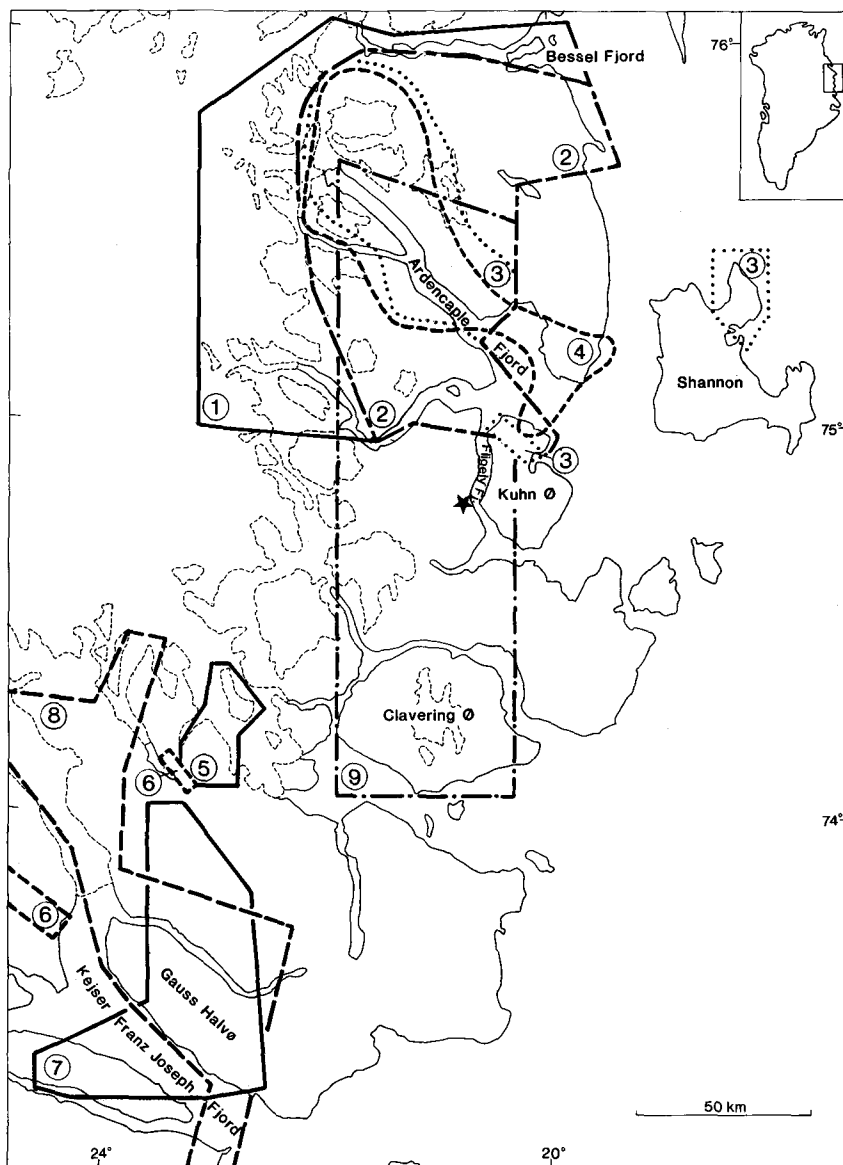
A tent base camp was established on the west side of Fligely Fjord (at 74° 49'N, 20° 46'W) where landing strips for the Twin Otter were prepared. The base camp served as an operation centre for the expedition and the support personnel and the helicopters were stationed there. Regular radio communication was maintained between the base and field parties and aircraft during the season. After the season the base camp was dismantled and most of it transported to the 1989 base camp site at Hvalrosodden (76° 57'N, 20° 07'W) on the north side of Dove Bugt.

There were 31 participants in the expedition, some of whom joined for only part of the season. The participants were distributed as follows: geological field parties 18, GI surveying group 4, aircraft personnel 6 and GGU support group at base camp 3.

Status

With the end of the 1988 season, the field studies of the Devonian strata around Kejser Franz Joseph Fjord

Fig. 1. Map of the region between Kejsler Franz Joseph Fjord and Bessel Fjord showing working areas for the various field teams: 1. Niels Henriksen; 2. J. D. Friderichsen & R. A. Strachan; 3. A. K. Higgins & N. J. Soper; 4. M. Sønnerholm & J. D. Collinson; 5. J. S. Peel, M. P. Smith & M. J. Hambrey; 6. M. Sønnerholm, J. D. Collinson & H. Tirsgaard; 7. H. Olsen; 8. P.-H. Larsen & F. O. Rasmussen; 9. K. Secher.
Star: Base camp position.



(73° 30'N) were concluded and investigations of the Cambro-Ordovician sequence around 74°N aimed at supplying material for correlation with North Greenland were accomplished. Sedimentological investigations of the Eleonore Bay Group sediments initiated in the northern mapping area were later transferred to a less metamorphosed area further south.

In the northern study area (75°–76°N) structural studies of the Eleonore Bay Group were completed, while studies of the gneissic crystalline complexes and pre-Eleonore Bay Group metasedimentary sequences will be extended northwards in the remaining two years of the project. The detail of the mapping was more than

sufficient for representation at a scale of 1:500 000, and about one third of the area of the projected map sheet (75°–78°N) was completed.

A geochemical exploration reconnaissance programme resulted in a collection of stream samples and mineralisation indications in a representative sector of the northern study region.

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Caledonian and pre-Caledonian geology of the region between Grandjean Fjord and Bessel Fjord (75°–76°N), North-East Greenland

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The area between Grandjean Fjord and Bessel Fjord was the focus in 1988 of regional geological investigations and 1:500 000 mapping during the North-East Greenland project (Henriksen, 1989). The greater part of the area forms part of the East Greenland Caledonides and can be divided into three distinct rock groups: infracrustal gneisses and granites of possible Archaean or early Proterozoic origin; a metasedimentary sequence which has probably suffered both mid-Proterozoic and Caledonian migmatization and metamorphism; and the late Proterozoic Eleonore Bay Group, a thick sedimentary sequence which has undergone amphibolite facies Caledonian metamorphism in its lower parts and is intruded by Caledonian granites. Aspects of the stratigraphy and sedimentology of the Eleonore Bay Group are described by Sønderholm *et al.* (1989); only the structures affecting the sequence are described here.

Archaean – early Proterozoic(?) crystalline complex – (N. H.)

The infracrustal crystalline rocks in the region studied occur in an arcuate belt running from the inner part of Grandjean Fjord northwards along the margin of the Inland Ice to inner Bessel Fjord, then curving to follow the north side of Bessel Fjord (fig. 1). The complex is bordered to the east by a thick migmatitic metasedimentary sequence (the Smallefjord sequence) or by the Eleonore Bay Group outcrop.

The previously published geological maps (Koch & Haller, 1971) were based largely on aerial photograph interpretation with only limited ground control; the field work was made during Lauge Koch's geological expeditions up to 1958. On these maps the infracrustal rocks were distinguished as syn-orogenic granite, migmatitic gneiss with amphibolite and mica schist bands, and mica schist/biotite gneiss. In accordance with the then prevailing concept of a pervasive Caledonian orogeny (Haller, 1953, 1955, 1970, 1971), virtually all rock units were considered as of Caledonian age with the mica schists viewed as metamorphic derivatives of the Eleonore Bay Group sequence. They were referred by Haller (1971) to his regional structural unit, the 'Grandjean Fjord Mountain Belt', in which a set of NNE-trending early structures was thought to reflect the main Caledonian orogenic phase (Silurian), and a later set of NW-trending folds was attributed to Lower – Middle Devonian 'late orogenic spasms' centred on Grandjean Fjord where migmatization was rejuvenated (Haller, 1970, 1971).

In southern parts of the East Greenland Caledonides isotopic studies undertaken in association with GGU's mapping since 1968 have shown that substantial parts of the infracrustal gneiss complexes are of Archaean or early Proterozoic development (Steiger *et al.*, 1979; Higgins *et al.*, 1981; Henriksen, 1985), with only limited Caledonian reactivation. By analogy it is suspected that the infracrustal rocks of the study area (75°–76°N) also