



Disko Bugt Project, central West Greenland

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One of GGU's major field activities in 1989 took place in July and August in the north-eastern part of the Disko Bugt region, mainly north of Ilulissat (Jakobshavn) (fig. 1). This was the second year of the 'Disko Bugt Project', planned for 1988–1991, with one summer's break in 1990. The project spreads over various activities and over two very different geological provinces: the Archaean–Proterozoic basement east and north-east of Disko Bugt and in the eastern part of Nûgssuaq, and the Cretaceous–Tertiary basin in the west, on Disko and the western part of Nûgssuaq. The main aim of the project is to provide a background for the evaluation of the economic potential of the region – mineral resources in the Precambrian basement, and the hydrocarbon potential of the basin.

Prior to the project the Precambrian basement was very poorly known. The geology shown on GGU's 1:500 000 map (sheet 3, Søndre Strømfjord – Nûgssuaq) is imprecise at many places, being only based on reconnaissance mapping along the coasts and on the interpretation of aerial photographs. This area is of special interest because it contains important greenstone belts and has therefore a potential for precious metals. Indeed, investigations by Kryolitselskabet Øresund A/S have shown the presence of copper and gold-bearing sulphide mineralisations, and study of stream sediment samples has also indicated the occurrence of gold-bearing rocks in the area (Steenfelt, 1987).

The western part of the study area is of importance because it represents the onshore part of the West



Strongly deformed, Archaean banded gneisses on the north side of Nûgssuaq. Photo: A. A. Garde.

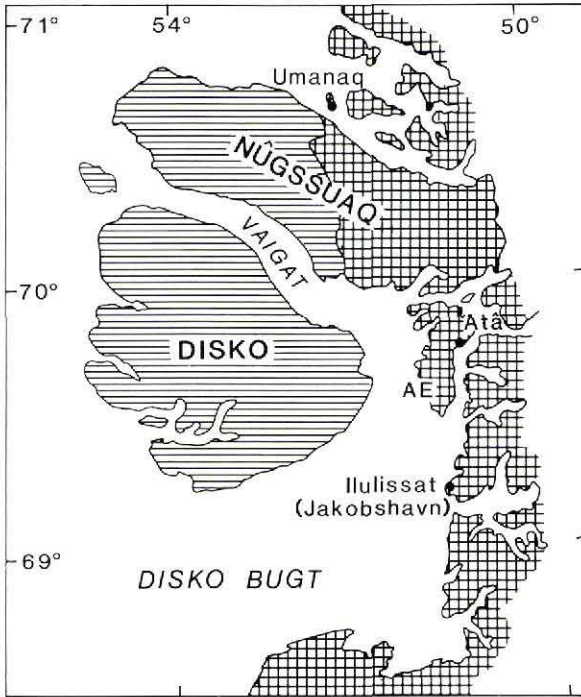


Fig. 1. The Disko Bugt region with the Precambrian basement in the east and the onshore part of the West Greenland basin in the west. AE = Arveprinsen Ejland.

Greenland basin, and the study of this area is essential to obtain a better insight into the hydrocarbon potential of the basin offshore (Stemmerik *et al.*, 1990). The basin consists of Cretaceous and early Tertiary sediments which are overlain by a thick sequence of Tertiary basalts.

During the first summer of the Disko Bugt Project (1988) field work was carried out both in the eastern and western terrains (Kalsbeek, 1989); in 1989 the work was concentrated in the eastern terrain. In both years a base camp was established at the abandoned settlement Atå on the eastern side of Arveprinsen Ejland. The base camp was manned by GGU personnel, and a Bell 206 B 'Jet Ranger' helicopter was chartered for two months from Greenlandair Charter A/S for transport of personnel and equipment as well as for geological reconnaissance. The Disko Bugt Project is carried out in close cooperation with staff and students from the University of Copenhagen who took part in the field work on a par with GGU geologists, and some of the teams were partly or wholly funded by the Danish Natural Science Research Council (SNF) and by the Carlsberg Foundation, Copenhagen.

Precambrian rocks

Most of the terrain bordering north-eastern Disko Bugt consists of Archaean gneisses and granitoid rocks (fig. 2). The 'Atå granite' (in reality largely composed of tonalitic rocks) is about 2800 Ma old (Kalsbeek *et al.*, 1988). Some of the regional gneisses have been formed by deformation of Atå granite, whereas others are older than the granite. The area contains an important Archaean greenstone belt, consisting of basic and acid metavolcanic rocks as well as metasediments, which is cut by the Atå granite. A few Sm-Nd isotope determinations on acid metavolcanics have yielded model ages which are indistinguishable from the Atå granite, and it is possible that the acid volcanic activity and the intrusion of the Atå granite belong to the same igneous event.

The Archaean supracrustal rocks are discordantly overlain by a sequence of Proterozoic sediments which are of a much lower metamorphic grade and much less deformed than the Archaean supracrustals. The lower part of this sequence consists of local beds of marble and orthoquartzite, overlain by thick shallow-water siltstones. Upwards the sequence changes into more deep-water sediments of turbiditic aspect. The age of these

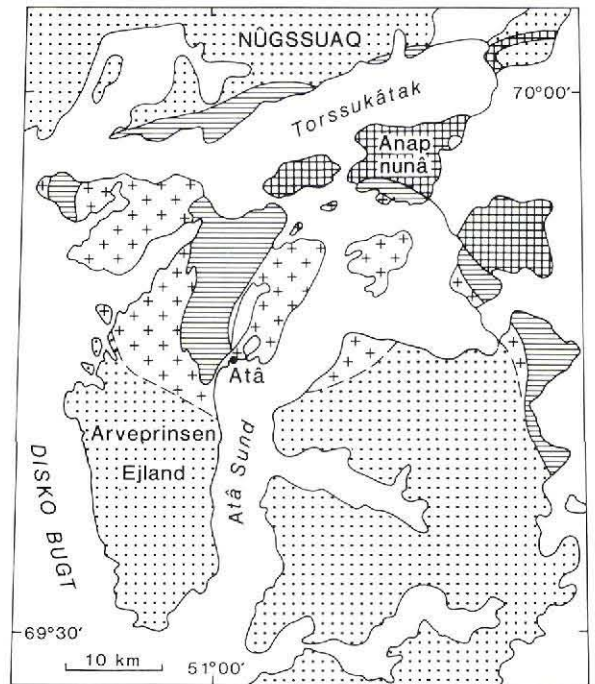


Fig. 2. Geological sketch of the Precambrian area north-east of Disko Bugt. Stipple: regional gneisses (Archaean). Crosses: Atå granite (Archaean). Horizontal ruling: Archaean supracrustal rocks. Cross-hatched: Proterozoic supracrustal rocks.

rocks is not well known, but it is possible that the sediments are of the same general age as the Proterozoic sediments in the Umanaq region (Henderson & Pulvertaft, 1987) that host the 'Black Angel' lead-zinc deposit at Maarmorilik.

The most interesting (gold-bearing) mineral showings occur in the Archaean supracrustal rocks; mineral showings also occur in the Proterozoic sequence, but these appear to be of less interest. No mineral occurrences have yet been located in the gneisses and granitoid rocks.

The Precambrian gneisses and granitoid rocks contain a number of thin lamprophyric dykes, locally associated with carbonatitic material (Marker & Knudsen, 1989). The age of these is not known, but they may be more or less contemporaneous with *c.* 1650 Ma alkaline dolerite dykes in the area.

The Precambrian rocks to the north and the south of the area shown in fig. 2 are being studied in a reconnaissance manner. One of the aims of this study is to obtain an understanding of the Proterozoic tectonic activity in this area, which mainly consists of Archaean rocks. In the central part of Nûgssuaq large outcrops of Proterozoic marble with lead-zinc mineralisation are tectonically emplaced within Archaean gneisses. An insight into the tectonic style of the area is of paramount importance for a prediction of the shape and size of these occurrences.

Cretaceous and Tertiary rocks

The West Greenland basin occupies much of the continental shelf off northern West Greenland and may have hydrocarbon potential (Schiener & Leythaeuser, 1978). The onshore part of the basin is exposed on Disko and Nûgssuaq and in coastal areas to the north (Henderson *et al.*, 1976). The lower, sedimentary part of the sequence consists of shales and sandstones which on Disko and Nûgssuaq are largely of fluvial to deltaic origin and contain numerous coal seams. On Nûgssuaq the total thickness of sediments is in the order of 3 km, most of which lies below sea level.

The basalts of Disko and Nûgssuaq are well known for the occurrence of flows that carry native iron and they have been studied for more than 150 years (Giesecke, 1823; Pedersen, 1985). Picritic lavas and pillow breccias are very common, and contamination of the magmas with sedimentary material gives rise to a range of hybrid rocks, among which the above mentioned native-iron bearing lavas.

Investigations under the auspices of the Disko Bugt Project include a detailed sedimentological and stratigraphical study of the sediments, the detailed mapping

and stratigraphical study of the basalts, and a study of the interrelationship between sedimentation and volcanic activity during the formation of the West Greenland basin. Most of this work is carried out by teams from the Geological Institutes and the Geological Museum of Copenhagen University.

Field work in 1989

As mentioned earlier, the field work in 1989 was concentrated in the Precambrian basement. Main aspects were as follows:

(1) Regional geological and geochemical reconnaissance of the area between 69° and 70° 30'N by one GGU team.

(2) Detailed mapping of the supracrustal sequences and the surrounding gneisses shown in fig. 2. This mapping was carried out by three student teams, one GGU geologist and one geologist funded by the Carlsberg Foundation. One of the aims of this mapping is the location and study of mineral occurrences in these rocks.

(3) One team of GGU geologists made a detailed investigation of different kinds of mineral showings in the area covered by fig. 2 with the aim of establishing their geological setting and origin.

(4) A team from the University of Copenhagen, funded by SNF, studied the Atâ granite and its relation to the surrounding gneisses.

(5) One GGU team made a systematic gravimetric survey of the area with supracrustal rocks shown in fig. 2, and along the south coast of Nûgssuaq to locate faults in the basement underneath the sediments there.

(6) Finally, a team of GGU geologists studied the stratigraphy and structure of the Cretaceous and Tertiary sediments at selected localities along the south coast of Nûgssuaq (Pulvertaft & Chalmers, 1990). The information obtained will be used during the interpretation of seismic data acquired for the offshore parts of the West Greenland basin.

Results of the investigations in the Precambrian basement will be reported in a separate volume of GGU's Rapport series.

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F. K., Geological Survey of Greenland, Copenhagen.



GGU has two principal functions in the field of hydrocarbon geology: (1) to identify and investigate sedimentary basins with hydrocarbon potential, in order to obtain information that can attract and guide industry in its choice of target areas for exploration, and (2) on the basis of the insight gained from (1), to advise the Mineral Resources Administration for Greenland in technical matters concerning the administration of licences and concessions.

Areas of interest for hydrocarbon exploration in Greenland can be grouped under four headings: onshore areas accessible to present or near future technology; onshore areas accessible only to distant future technology; offshore areas accessible to present technology; and offshore areas accessible only to distant future technology (fig. 1). In recent years GGU has concentrated its activities in onshore areas, but in 1987 a re-evaluation of the western Greenland continental shelf was initiated, and new seismic acquisition projects both to the west and east of Greenland are planned for the 1990s.

Current activities in the field of hydrocarbon geology

Lars Stemmerik, T. C. R. Pulvertaft and Hans Christian Larsen

Onshore East Greenland

Jameson Land

Jameson Land in central East Greenland is the only area in Greenland where hydrocarbon exploration is currently being carried out. The concessionaire is ARCO, in partnership with AGIP, Arktisk Minekompagni A/S and the joint Greenland Home Rule/Danish State-owned company Nunaoil A/S. The first seismic programme in the area was completed in 1989, and a total of 1800 km of data has now been acquired and will form an important part of the basis for a decision as to whether and where drilling will be carried out.* The main play is Upper Permian carbonate reefs sourced and capped by Upper Permian organic-rich shales.

GGU's responsibilities in Jameson Land include in-

* Since this report went to press, ARCO announced its decision not to proceed to a drilling phase. In consequence, ARCO relinquishes its concession at the end of 1990.