are more heterogeneous and pyroclastic and thin sandstone horizons with lignite products are more frequent. Sagging of the crust probably became appreciable at this time with local erosion.

The topmost four flows of the total succession are of a type not recognised with certainty elsewhere in the region, either because they never existed or because they were removed by subsequent erosion.

The magmatic activity was followed by rapid uplift and subsequent foundering of the coastal zone with the formation of large fault scarps. The faulting produced a marked shoreline with conditions for rapid erosion and the deposition of beach conglomerates which gradually gave way to coarse sandstone with a nearshore fauna and finally to marly siltstones with concretions of hard calcareous siltstone sometimes with crabs, and occasional basalt pebbles, forming the Kap Dalton Formation.

The Kap Brewster Formation represents a repeat of the process after renewed activity on the same fault line with large boulders at the base of the fault scarp and coarse sandstones, interpreted by Birkenmajer (1972) as a river-lag deposit further away from the fault scarp.

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Source rock sampling, stratigraphical and sedimentological studies in the Upper Palaeozoic of the Jameson Land basin, East Greenland

F. Surlyk

A drilling programme was initiated in Jameson Land in 1982 with the objective of obtaining fresh cores of possible hydrocarbon source rocks. The area was chosen (1) because it exposes a thick, easily accessible and well studied Late Palaeozoic – Mesozoic sequence which is also supposed to extend eastwards to the off-shore shelf area of northern East Greenland; (2) because together with North Greenland it represents the only possible target for on-shore oil exploration in Greenland; and (3) because a petroleum concession to the area is at present being negotiated between ARCO/Nordisk Mineselskab and the authorities.

Thus there are very good short-term as well as long-term reasons to obtain a better knowledge of the nature and distribution of possible source rocks in the Jameson Land basin. The drilling programme was supplemented by studies of the Late Palaeozoic basin configuration and facies. In particular the Upper Permian basin was selected for detailed

work as it is considered to contain the most promising part of the Jameson Land sequence with respect to content of source rocks and to some extent also reservoir rocks.

The expedition included a total of 13 participants plus a helicopter pilot and engineer.

The drilling programme

The drilling programme used a new drilling unit which was assembled by A. Clausen and J. Boserup with a Hagby 600 as a basic fully hydraulic unit (fig. 31). The drill is constructed so that the heaviest part can be carried by two persons and the whole unit can be moved with helicopter sling in two flights. The total weight is about 600 kg.

J. Boserup, A. Clausen and K. Villadsen worked as technical personnel on the drilling team, while E. Thomsen functioned as a well-site geologist in July, and S. Piasecki and F. Rolle alternated in August. Although all technical work was carried out by GGU, parts of the later analytical work will be made as a joint project between GGU and Kernforschungsanlage (KFA), Jülich, West Germany. Accordingly D. Leythaeuser succeeded by U. Mann, both of KFA, participated in the work of the drilling team.

A total of 10 holes were drilled, mainly to a depth of about 20 m. One hole was drilled to a depth of 60.6 m. The core recovery was approximately 94 per cent and a total of 265 cumulative metres were drilled. The core diameter is 32 mm. Preliminary temperature surveys were carried out in some of the holes in order to evaluate the problems which may be encountered in permafrost-drilling.

Drilling work was concentrated in the two main outcrop areas of the Permian sequence, along the Schuchert Flod valley and on Wegener Halvø (fig. 32). The majority of the cores were obtained from the Upper Permian *Posidonia* Shale. Two drill holes were made in the western carbonate platform sequence and several of the other cores include parts of the evaporitic sediments, which underlie the *Posidonia* Shale. Finally one drill hole was made through the Triassic Gråklint Beds ('*Martinia* Limestone'). The cores are at present being subjected to detailed studies in the laboratory and a large number of samples have been selected for organic geochemical analyses, thin sections, vitrinite reflection analyses and

Fig. 31. Drill, mounted on its water-filled transport container, used in shallow core drilling in Jameson Land.

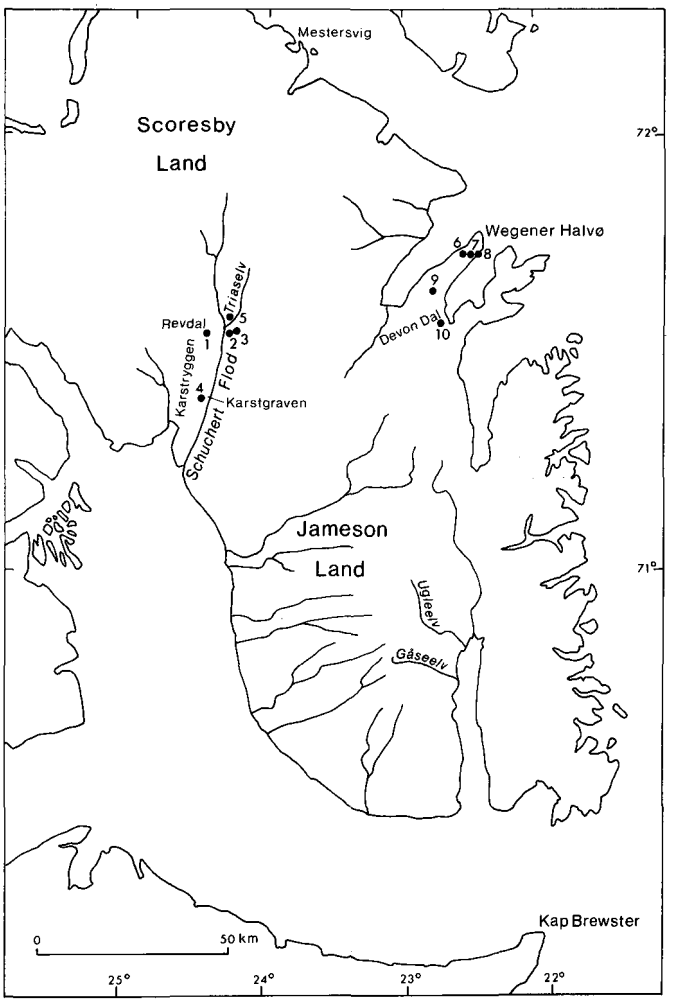

Fig. 32. Core hole drill sites in Jameson Land and on Wegener Halvø.

palynology. The core descriptions and the preliminary analytical results will be presented as a separate report.

Lower Permian

The oldest post-Caledonian sediments exposed in the Jameson Land basin is a thick sequence of Carboniferous – Early Permian age (Perch-Nielsen *et al.*, 1972; Bierther, 1941; Kempter, 1961; Collinson, 1972). The rocks are poorly dated and have previously only been studied in the Karstryggen area west of Schuchert Flod (Kempter, 1961; Collinson, 1972). The Carboniferous part of the sequence was briefly visited in the area south of Mesters Vig (fig. 32), while the Lower Permian part received more attention. The latter includes towards

the west coarse pebbly sandstones and subordinate shales of alluvial fan origin. Transport direction was mainly towards the east, away from the main fault zones controlling the western basin margin. The alluvial fan sediments pass distally into floodplain, braid plain and meanderbelt sequences in the environs of Schuchert Flod. Here palaeocurrents become deflected towards the north and the axis of the Jameson Land basin was orientated north–south with a palaeoslope towards the north.

Lower Permian mudstones mainly of floodplain origin were closely sampled for palynological studies by S. Piasecki assisted by H. Nøhr Hansen.

Mid-Permian block-faulting

The Carboniferous – Lower Permian sequences were subjected to intense block-faulting and -tilting before deposition of the overlying Upper Permian sequence (Kempter, 1961).

Upper Permian

The Upper Permian sequence rests with marked angular unconformity of up to 15 degrees on block-faulted Lower Permian or older sediments.

The main Upper Permian outcrop area is Karstryggen west of Schuchert Flod, a narrow N–S belt east of Schuchert Flod, and Wegener Halvø (fig. 32). The sequence is poorly dated, but an early late Permian Kazanian age is generally accepted (see review by Teichert & Kummel, 1976).

The sediments, which include carbonates, evaporites, mudstone, and a basal conglomerate, are generally included in the extremely poorly defined Foldvik Creek Formation, which is overlain by the equally poorly defined Lower Triassic Wordie Creek Formation (Teichert & Kummel, 1976). Kempter (1961) erected the Karstryggen Group for the Upper Permian sequence west of Schuchert Flod. It is thus considered necessary to prepare a revised lithostratigraphic scheme which covers the whole basin. A first attempt at this was done by Stemmerik in an unpublished thesis (1982).

Detailed studies of the evaporitic sequences were made by L. Stemmerik assisted by P. H. Larsen. The western platform carbonates were drilled south of Revdal and at Karstgraven, and the evaporites at Triaselv.

The black mudstone (*Posidonia* Shale), which was the main object of the source rock sampling project, was drilled at a number of localities at Triaselv and on Wegener Halvø and was studied in the field by F. Rolle.

Special attention was paid to the transition from carbonate bioherms to black mudstone in Wegener Halvø. Cores drilled through this junction were sampled by KFA participants with the objective to study migration of light hydrocarbons.

Triassic

The Upper Permian sediments are overlain by the Lower Triassic Wordie Creek Formation. The boundary is difficult to place where the dark mudstones of the latter formation overlie the *Posidonia* Shale.

The Wordie Creek mudstones are, however, lighter, more bioturbated, and generally somewhat coarser grained.

Palynostratigraphic sampling of the boundary sequence was carried out at several localities by S. Piasecki, and one hole was drilled across the boundary at Triaselv. Selected intervals of the Wordie Creek mudstone were studied in the field by F. Rolle.

A thick sequence of yellow coarse-grained, pebbly sandstones occurs a few tens of metres above the base of the Wordie Creek Formation along the eastern side of Schuchert Flod. These were studied by F. Surlyk assisted by P. H. Larsen.

Other parts of the Triassic sequence were not subject to special studies, but one hole was drilled through the Triassic Gråklint Beds (Clemmensen, 1980) (= *Martinia* Limestone of earlier authors) at Devon Dal, NE Jameson Land. The grey limestone of this unit was known from earlier analyses to constitute possible hydrocarbon source rocks.

Jurassic

The Upper Jurassic Hareelv Formation was studied and sampled from two camps in Ugleelv and Gåseelv by F. Surlyk, S. Piasecki and H. Nøhr Hansen. The formation consists of black mudstone with thick channel sandstones (e.g. Surlyk *et al.*, 1981).

The mudstones were sampled for source rock analyses and palynology. They constitute an East Greenland analogue to the Kimmeridge Clay of the North Sea region and several levels qualify as possible source rocks for oil or gas.

In connection with the sampling and sedimentological studies of the Hareelv Formation reconnaissance work was done to locate good drill sites for planned shallow core drilling in 1983.

Cretaceous

A sequence of late Cretaceous mudstones underlying the Tertiary plateau basalts and Tertiary mud- and sandstones at Kap Brewster (Birkenmajer, 1972) was sampled for palynology by S. Piasecki assisted by K. Villadsen.

Other activities

Apart from the geological work the expedition was obliged to inspect the seismic test programme undertaken by ARCO in July and August in three test areas in central Jameson Land. This work was undertaken by F. Surlyk, and in shorter periods by S. Piasecki and F. Rolle. Another obligation was to inspect the remains of exploration and mining activities of Nordisk Mineselskab, especially in Scoresby Land.

Special reports on these two subjects are being prepared for the Mineral Resources Administration.

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Marine geophysical investigations offshore East Greenland

H. C. Larsen

During August and September 1982 a marine geophysical survey was conducted on the East Greenland Shelf. The survey was part of the ongoing regional project NAD (Larsen & Andersen, 1982; Andersen *et al.*, 1981; Risum, 1980; Larsen & Thorning, 1980). In all 2794 km of 30-fold multi-channel seismic data and marine gravity and magnetic data were acquired (fig. 33).

The object of the NAD programme is to acquire regional coverage of aeromagnetic, multi-channel seismic reflection, seismic refraction (sonobuoy), marine gravity and magnetic data of the East Greenland Shelf between latitudes 60°N and 78°N. Aeromagnetic data comprising 63 000 line kilometres were acquired in 1979 (Larsen & Thorning, 1980) and 5000 km of marine geophysical data were acquired in 1980 and 1981 (Larsen & Andersen, 1982; Andersen *et al.*, 1981).

This year the final data for the project were collected. Thus, a total of 7800 km of multi-channel reflection seismic data and 50 sonobuoy refraction seismic profiles of 20 to 70 km length have been acquired (fig. 33). In addition, marine gravity and magnetics were run at most lines.