

Systematic 1:500 000 mapping in the Peary Land region, North Greenland

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A three year systematic field mapping programme in the Peary Land region, north of *c.* lat. 81°N and east of *c.* long 40°W, was initiated in the summer of 1978 with the aim of producing a 1:500 000 map sheet of eastern North Greenland and investigating the geological framework of the region. The expedition was carried out in cooperation with a seven-man group from the Geodetic Institute, Copenhagen, who undertook a general surveying programme establishing ground control points for a new topographic map of North Greenland.

A tent base camp was established at the mouth of Jørgen Brønlund Fjord and served as operation centre for two small helicopters and a small STOL aircraft. The expedition numbered 30, comprising 10 geological two-man parties and supporting personnel. The geological teams were divided into several working groups. Three parties mapped the Precambrian platform area mainly between Independence Fjord and Danmark Fjord (fig. 3) and five

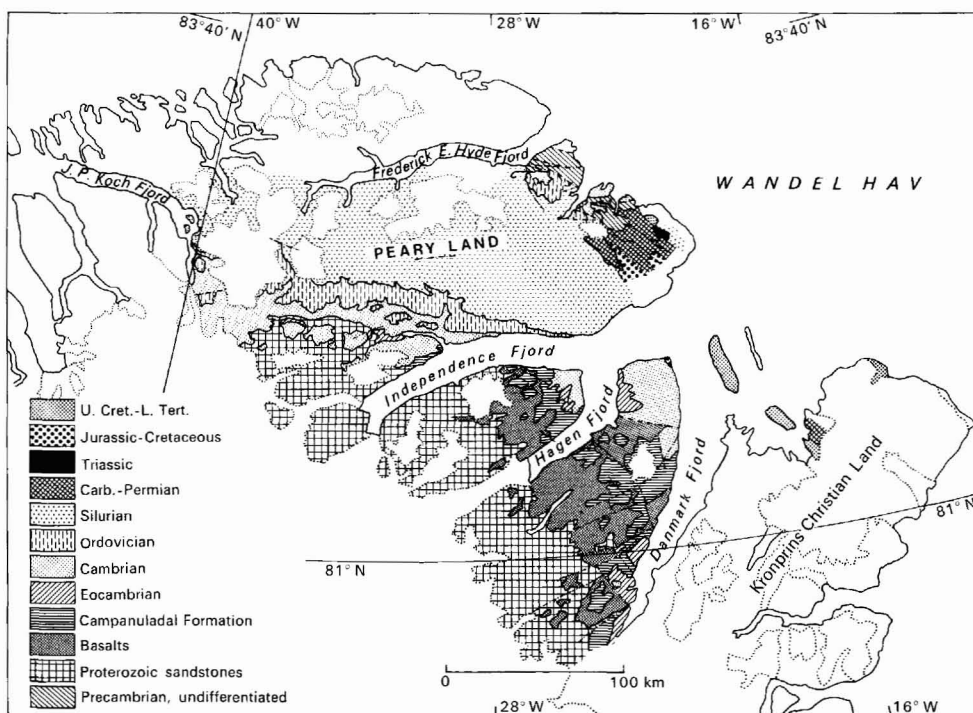


Fig. 3. Geological sketch map of the Peary Land region, eastern North Greenland, showing results of mapping in 1978.

parties mapped the Lower Palaeozoic sequence in southern Peary Land. One party mapped the Upper Palaeozoic – Tertiary rocks of the Wandel Sea Basin in eastern Peary Land and south-east thereof. Approximately 15 000 km² and 10 000 km² were covered in respectively the Phanerozoic and Precambrian part of the area, although many areas need revisiting in future years.

In addition to the production of a geological map over a large area, the first year's systematic mapping in the Peary Land region supplied a large amount of both general and more specialized geological information. Aspects of this work will be reported upon by the individual geologists, who will present their preliminary results in a special report, accompanied by a tentative compilation of the 1:500 000 map ('Report on the 1978 geological expedition to the Peary Land region, North Greenland.' *Rapp. Grønlands geol. Unders.* no. 88). The present report is based on an internal GGU report ('Express report, GGU Peary Land 1978') to which all participating geologists contributed immediately after the end of the field season.

Geological investigations

The Peary Land region contains a more than 8000 m thick succession of flat-lying Precambrian and Lower Palaeozoic platform sediments. These grade northward into equivalent basinal deposits which are folded and metamorphosed by the (Devonian?) east–west trending North Greenland fold belt. Upper Palaeozoic to Lower Tertiary sediments forming the Wandel Sea Basin rest with a major unconformity on folded Silurian flysch deposits (Dawes, 1976a).

Recent investigations of part of the Precambrian by Jepsen (1971), and establishment of a geological reference section through the Lower Palaeozoic sequence in central Peary Land by Christie & Peel (1977) formed a useful base for this year's mapping. In preparation for the field work a photogeological interpretation was carried out covering a large part of southern Peary Land.

A composite schematic section presented here (fig. 4) reflects the general outline of the investigated sequence which comprises in total c. 8000 m of Proterozoic – Lower Palaeozoic platform sediments and c. 3000 m of Upper Palaeozoic – Lower Tertiary sediments reflecting the younger Wandel Sea Basin deposits.

The oldest part of the Proterozoic sequence was investigated by John Collinson (Keele Univ.). It comprises a c. 1700 m thick succession of sandstones which can be divided into 3 units divided by two mappable thin marker bands of siltstones. Below the lower siltstone band occurs an unconformity. The whole sequence is transected by abundant basic sills and dykes and occasional acid hypabyssal intrusions.

The overlying up to 1300 m of Proterozoic plateau basalts were investigated by Hans Jepsen and Feiko Kalsbeek (GGU) who mapped this extensive series over a large part of the area south of Independence Fjord. A total of approximately 50 flow units were recognised – the thickest being up to c. 100 m. The basalts are generally fine-grained massive rocks with columnar jointing in the lower part of the flow unit and grade into strongly vesicular rocks in the top. The total thickness of the basalt unit decreases both towards north-east and south-west.

The sandstone sequence below the basalts is dissected by a large number of intrusions

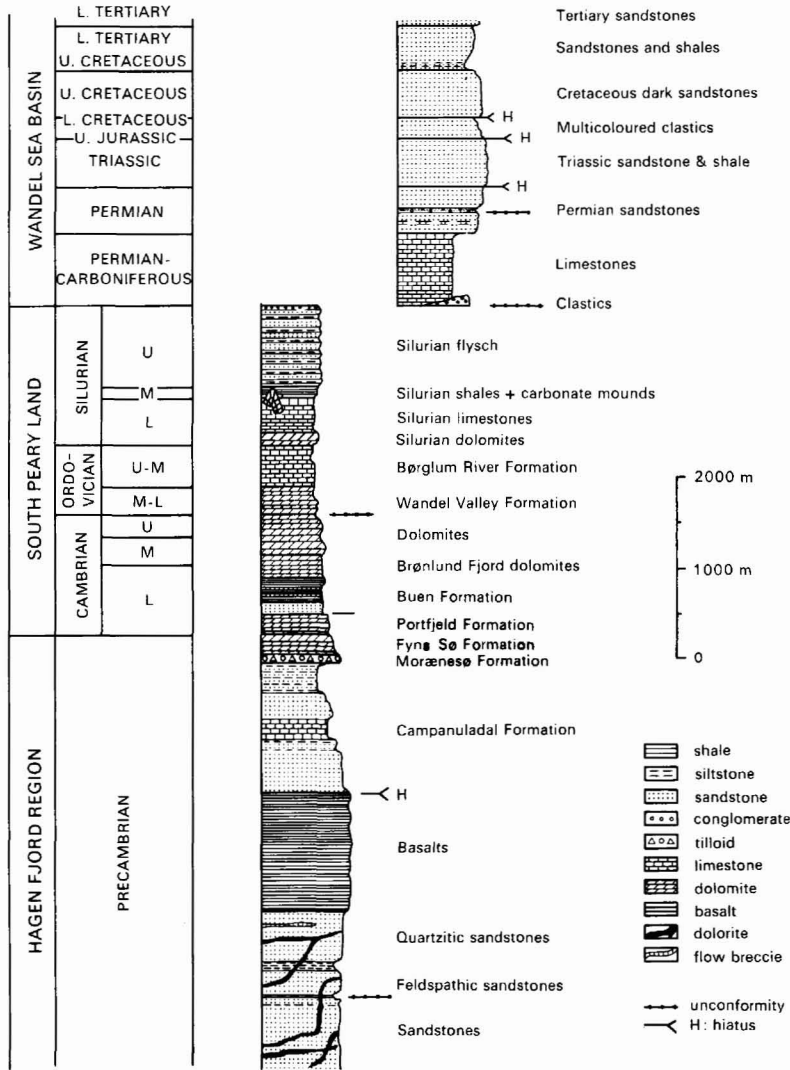


Fig. 4. Composite schematic litho-stratigraphical section showing general outline of investigated sequence.

(Jepsen, 1971), which might correspond to the basalts. The vast majority of the intrusions are dark doleritic sills and dykes, but some acid sills and dykes (granophyres and 'flow breccias') accompany the basic intrusions.

South of Independence Fjord the basalts are followed by a more than 1000 m thick sequence of mainly sandstones. This, and overlying non-fossiliferous formations have been mapped and investigated by Lars B. Clemmensen (Copenhagen Univ.) and Bernard O'Con-

nor (Melbourne Univ.). The sequence following the basalts is referred to as the Campanuladal Formation and is considered partly equivalent to the Campanuladal Sandstones and Limestones of Adams & Cowie (1953). It comprises 4 units of sandstones and limestones showing dissimilar facies development and large lateral variations in thickness. The sandstones above the basalts do not contain the abundance of intrusions characteristic of the sandstones below the basalts.

In the area west of Independence Fjord a c. 125 m thick unit with dark red sandstones, including tillitic deposits, which has previously been described as the Morænesø Formation, (Jepsen 1971) has this year been subjected to a special study by Lars B. Clemmensen.

The Fyns Sø Formation is a dolomitic unit of variable thickness with stromatolites at the top. It is found between the Campanuladal Formation and the supposed Lower Cambrian? Portfjeld Formation in the Hagen Fjord area, but has not been found in relation to the Morænesø Formation. The succeeding Portfjeld Formation marks the onset of generally similar depositional conditions over a large area. It is a well banded succession of dolomites with oolite-pisolite horizons and beds of stromatolite. The sequence has previously been described by Jepsen (1971) and was this year specially studied by Bernard O'Connor.

The first body fossils (early Cambrian trilobites) occur in the Buen Formation. This, and overlying Cambrian-Ordovician deposits studied by Christie & Peel (1977), were mainly examined by John S. Peel (GGU) and Peter Frykman (Copenhagen). A thick sequence of fossiliferous Lower, Middle and possibly Upper Cambrian carbonates briefly described by Dawes (1976b) was found to be progressively overstepped toward the south-east by the Wandel Valley Formation (Early Ordovician), such that in central Peary Land the latter formation lies directly on the Lower Cambrian Brønlund Fjord Formation.

Philip D. Lane (Keele Univ.) and Alan T. Thomas (Cambridge Univ.) mapped and measured sections in Cambrian-Silurian strata with particular emphasis on sampling for macro- and microfossils. In the latter part of the season their field work was centred around one of the seemingly infrequent carbonate mounds which occur at the transition from the carbonate platform to the clastic basin.

The Silurian succession in the west was studied by John M. Hurst (GGU), who found a new c. 500 m sequence of dolomites and limestones in westernmost Peary Land. These form a southern shelf sequence which stops abruptly northward and abuts against a basinal sequence of turbidites with graptolites in shale units. The Silurian succession in central Peary Land is largely as described by Christie & Peel (1977) and indicated on the composite schematic section (fig. 4). This area was investigated by Stig Schack Pedersen (Copenhagen Univ.), who undertook a special structural study of the transition from the flat lying succession on the platform into the gently folded strata in the area south of Frederick E. Hyde Fjord.

The north-eastern part of Peary Land is structurally complex and the area is affected by folding with south-easterly trends which have later been dissected by numerous major and minor faults. This area was mapped by R. L. Christie (Geol. Surv. Canada) and Jon R. Ineson (Keele Univ.) who established a composite Precambrian succession, and a Lower Palaeozoic sequence grossly correlatable with the one described from central Peary Land. The Precambrian includes three units: (1) a more than 1000 m thick series of quartzites with abundant doleritic sills; (2) a several hundred metres thick series of dark, slightly altered

volcanics (greenstones); and (3) a strongly coloured well-bedded unit including quartzites, dolomites and slates.

A series of Permian–Carboniferous to Lower Tertiary sediments referred to as the Wandel Sea Basin deposits was investigated by E. Håkansson (Copenhagen Univ.). The main outcrops of this sequence occur in eastern Peary Land but also extend in the coastal regions toward south–east. Prior to this season, the Wandel Sea Basin succession has only been sporadically visited by other geologists (Dawes, 1976 a) with the result that an extensive redescription of the strata involved is now in hand. The composite sequence comprises more than 3000 m but the area is strongly affected by late faulting dividing the area into a series of fault blocks. The single units in the succession of sediments – see the composite schematic section in fig. 4 – are laterally variable and each fault block often has a special combination of sedimentary units represented. The succession rests unconformably on folded Silurian flysch and – towards the north–west – on various Precambrian rocks. Triassic sandstones (Håkansson & Heiberg, 1977) occur in an isolated fault block and neither their lower nor upper boundary is known. The Upper Jurassic to Cretaceous multicoloured sands unconformably overly both Silurian flysch and Permo-Carboniferous limestones – the upper boundary is unknown. The dark Cretaceous sandstones were only found at the northern edge of Kronprins Christian Land whereas the Upper Cretaceous – Lower Tertiary sandstones and shales occur in an isolated fault block with bottom and top unknown. The Lower Tertiary sandstones form the islands, south-east of Peary Land.

A geochemical sampling programme was carried out mainly in the Precambrian area south of Independence Fjord and in the Lower Palaeozoic succession in central Peary Land. In all c. 450 sand and silt samples were collected intended for a systematic analysis for trace elements and heavy minerals.

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