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GEOLOGICAL SURVEY OF CANADA

DEPARTMENT OF ENERGY, MINES AND RESOURCES

PAPER 66-47

GEOLOGICAL RECONNAISSANCE, SOUTHERN BAFFIN ISLAND, DISTRICT OF FRANKLIN

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R. G. Blackadar

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Illustrations

ABSTRACT

Operation Amadjuak, a helicopter-supported project, completed the geological reconnaissance of that part of Baffin Island that lies south of latitude 66° N and southwest of Cumberland Sound, an area of about 50,000 square miles.

Southern Baffin Island is composed primarily of a wide variety of metamorphic rocks, which on the basis of the few currently available isotopic age determinations, are all part of the Churchill Structural Province.

Palaeozoic carbonate and argillaceous carbonate rocks outcrop to the south and northwest of Amadjuak Lake. Several small outliers including Silliman's Fossil Mount occur between the main outcrop area and Frobisher Bay. A Middle Ordovician age has tentatively been assigned to the Palaeozoic rocks.

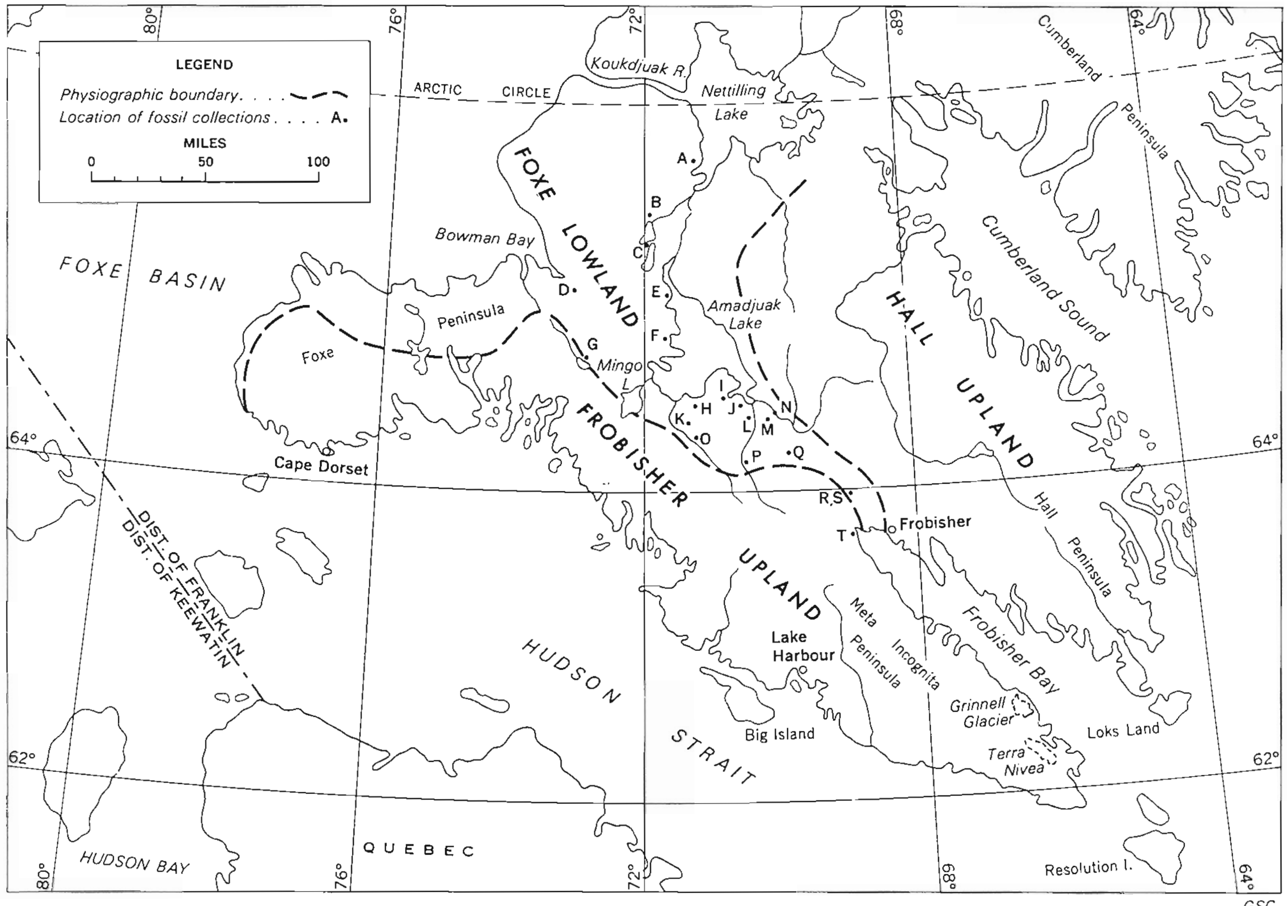

Figure 1. Physiographic divisions and locations of fossil collections, southern Baffin Island, District of Franklin

GEOLOGICAL RECONNAISSANCE, SOUTHERN BAFFIN ISLAND, DISTRICT OF FRANKLIN

INTRODUCTION

METHODS OF FIELD OPERATION

The reconnaissance geological investigation of Baffin Island south of latitude 66° N, initiated in 1949 by Y. O. Fortier and W. L. Davison, was completed in 1965 by "Operation Amadjuak", an aircraft-supported project. Bedrock mapping was carried out in eighteen 1:250,000 NTS map-areas and the data so obtained, together with that derived from published and unpublished Geological Survey maps, have been compiled and are presented on the three maps that accompany this report.

"Operation Amadjuak" was planned in 1963; in 1964 aviation fuel was shipped to Frobisher, Lake Harbour, and Cape Dorset. The writer considered that the commonly rugged terrain of southern Baffin Island precluded extensive use of aircraft equipped with low pressure, over-sized tires so widely and successfully used elsewhere in the arctic, and for this reason it was decided that support would be provided by float-equipped aircraft.

A reconnaissance trip in August 1964 disclosed that an operation using float-equipped aircraft and dependent on Frobisher as a central supply point was impractical. No facilities existed there for aircraft to land on fresh water and landing on the sea appeared practicable only under very favourable weather conditions. The tidal range at Frobisher Bay varies from 24 to 37 feet, and at low tide muddy tide flats, more than a mile wide, are exposed in front of the settlement. Loading and refueling would be impossible during such periods and would be practicable for only a few hours on either side of the twice daily high tides. The harbour is fully exposed to southeast gales and except on the calmest days it is unwise to anchor an aircraft at sea.

It was considered essential that Frobisher should be accessible to the party at all times. It is the administrative centre for southern Baffin Island and is serviced from Montreal by a commercial airline, the obvious route for fresh food, spare parts, mail etc. required by the project. In order to make use of the facilities at Frobisher and yet to offer service to a field-based camp an amphibious Cessna 180 was used as the supporting aircraft, supplemented by casual charter of Otter and Canso aircraft based from time to time at Frobisher.

The need to maintain regular contact with Frobisher, the fact that ski-equipped aircraft could not be used after late May, and the decision to use an amphibious aircraft meant that the first campsite had to be situated where open water would occur early in the season, yet where there would be an expanse of water large enough to allow a Canso aircraft to operate when the time came to move camp. In addition the site had to be in a place to which personnel could be flown by ski-equipped aircraft at the start of the field program.

These requirements drastically limited the possible sites and indeed seemed impossible of fulfillment, but a site at the mouth of Soper River, 4 miles north of Lake Harbour settlement was selected and proved satisfactory.

Gas caches were set out in early April 1965 south and west of Frobisher Bay and $2\frac{1}{2}$ tons of camp gear were flown to the Soper River campsite. About 2,500 gallons of fuel were moved by the Eskimos of Lake Harbour during May from the settlement to the campsite. It had been decided to select and stock only the first campsite because succeeding camps would have to be situated on large ice-free lakes and from past experience it was known that there can be a variation of several weeks between the time a given lake opens one year and the next.

Two helicopters under contract from Universal Helicopters Ltd. proceeded from Carp by way of the east coast of Hudson Bay and Cape Dorset and reached Lake Harbour on June 1. The geological party arrived at Frobisher June 2 and by June 8, having proceeded to Lake Harbour by ski-equipped Otter, had established camp. On June 15 the amphibious Cessna was able to land on the waters of Soper Lake and regular communications were established.

The remainder of the operation was similar to other projects carried out previously by the Geological Survey. A second camp was established on July 26 on a small island in the southeast corner of Amadjuak Lake and the final camp, on a large unnamed lake 65 miles northeast of Frobisher settlement, was occupied between August 17 and 31. On the latter date the entire operation returned to Frobisher. The helicopters returned south by way of Fort Chimo and Schefferville on September 2, the main party followed the next day on a commercial flight.

Southern Baffin Island is known for unpleasant summer weather and 1965 was no exception. Except for a few warm sunny days June was overcast much of the time with rain and snowshowers. July was a mixture of sun and storm. Rain fell for some part of every day between July 31 and August 17 and from that date until the completion of the field work snow squalls and fog continued the unsettled weather.

Despite generally unfavourable weather and an accident that rendered one helicopter unserviceable for 2 weeks, about 550 hours of helicopter flying were accomplished and, with the exception of Resolution Island and a small area north of Nettilling Lake, all of the area included in the original plans was covered at reconnaissance scale.

GEOLOGICAL PRECIS

With the exception of the flat-lying Palaeozoic rocks that outcrop mainly south and west of Amadjuak Lake, southern Baffin Island is composed of medium to high grade gneisses.

Southwest of Frobisher Bay and a line extending northwest from the head of the bay to Bowman Bay, Foxe Basin, the gneissic rocks are of diverse types and the structure is very complex, although an overall northwesterly trend predominates. Quartz-feldspar gneiss, garnet-quartz-feldspar gneiss, granite gneiss, and migmatite are the most common rock types in this region. The presence of thick bands of crystalline limestone in the succession, the diversity of rock types, and the complex structure led early geologists to compare this terrane with the Grenville rocks of Ontario and Quebec, but the K-Ar age determinations now available indicate that the rocks of southern Baffin Island are part of the Churchill Province.

North of Frobisher Bay and the imaginary line extending to the northwest, lithologies are less diverse and the region includes large expanses of biotite granite and hypersthene granite. Structural trends appear less complex and the general trend is north-northwest rather than north as is the case south of Frobisher Bay.

PHYSIOGRAPHY

Southern Baffin Island is dominated by two southwesterly inclined uplands, commonly referred to as Hall Upland and Frobisher Upland, which form part of the Baffin Upland physiographic province. It is bordered on the west by the southeastern part of Foxe Lowland (Fig. 1).

Hall Upland approximates the boundaries of Hall Peninsula but extends farther to the west. The northern coasts of Hall Peninsula (south of about Irvine Inlet) are precipitous and elevations exceeding 2,000 feet are common within a mile of the coast. Throughout most of this peninsula elevations exceed 2,000 feet and only near its southern coast does the altitude of the land begin to drop. Near the mouth of Frobisher Bay the change is abrupt and sheer cliffs more than 1,000 feet high are not uncommon, but towards the head of the bay a more gradual change prevails. Northwest of Frobisher Bay Hall Upland merges with various subdivisions of the Foxe Lowlands.

Frobisher Upland is similar in many respects to Hall Upland. The south coast of Frobisher Bay, especially south of latitude 63° N, is precipitous; the highest points, the Grinnell and Terra Nivea glaciers are slightly less than 3,000 feet above sea-level. The surface elevation decreases gradually towards Hudson Strait and also towards the west. Near the south coast of Baffin Island elevations do not exceed 1,000 feet, and west of about longitude 73° W no part of the Upland reaches that height except for a few ridges in the Kingnait Range northwest of Cape Dorset.

The Foxe Lowlands, although primarily developed on carbonates and shales of Palaeozoic age, also include terrains developed on crystalline rocks such as northern Foxe Peninsula or the region between Nettilling and Amadjuak Lakes east of Amadjuak River.

Baffin Upland

Hall Upland

The central part of Hall Peninsula comprises a gently undulating, broadly dome-shaped, barren, relatively lake-free area capped near the east coast by numerous small snowfields. Here and there drift and felsenmeer are widespread. Several relatively large rivers, notably McKeand River, have their sources on this upland. These rivers flow in broad valleys 200 or 300 feet below the upland surface. Near the coast deeply incised valleys dissect the Upland surface; many of these are flooded in their lower reaches, and arms of the sea as much as 40 miles long penetrate the landmass. South of latitude 64° N many of the larger rivers flow in vertical-walled gorges for 50 miles or more before entering the flooded, fiord-like coastal area.

Northwest of Chidliak Bay the Upland surface, although lower, is more rugged than in the interior. Rivers are deeply entrenched and erosion has resulted in a rectilinear pattern wherein innumerable small lakes and ponds have formed. The valleys are commonly filled with outwash sands and gravels, and delta terraces are common near their mouths; a fine example of the latter is at the western head of Robert Peel Inlet.

The coasts of Hall Peninsula south of Chidliak Bay are spectacular and depending on bedrock and bedrock structures are marked by vertical or near vertical cliffs. In the coastal area small streams flowing more or less at right angles to the principal drainage, itself structurally controlled, break the coastal area into many, more or less rectangular blocks.

A belt of low islands margins most parts of the coast. These islands rarely exceed 500 feet altitude, but those that do probably reflect the persistence of the upland surface. The Lady Franklin group, about 30 miles east of Cape Haven rises to 780 feet and together with Monumental Island, 510 feet high, stand isolated in Davis Strait and form the easternmost exposures of Baffin Upland in the southern part of the island.

The west and south shores of Blunt Peninsula and Loks Land, together with the off-shore islands, are in marked contrast to most other parts of the coastline. For as much as 4 miles inland from the seashore the land does not rise above 200 feet. The surface is relatively free from drift and consequently vegetation is sparse. Raised beaches are common, especially on Sharkok Peninsula.

The altitude of Hall Peninsula decreases towards the southwest; near Frobisher settlement it is less than 1,000 feet, and merges with a southeastward extension of the lowlands that surround Amadjuak Lake. Similarly east of Amadjuak River, Hall Upland merges with Foxe Lowland and rivers are less deeply incised, valleys broader, and drift deposits much more extensive.

Frobisher Upland

Baffin Island south of Frobisher Bay is physiographically similar to Hall Peninsula, and Frobisher Upland is separated from Hall Upland by the probably fault controlled, southeastern extension of Foxe Lowlands. The south shore of Frobisher Bay, especially south of Cape Vanderbilt is precipitous, and razor-like ridges rise almost vertically from sea level to altitudes exceeding 2,000 feet. The general level of the land surface exceeds 2,200 feet and here and there gently sloping domes reach as much as 2,600 feet above sea level. Two glaciers cap this part of Frobisher Upland and are the highest points south of Frobisher Bay.

Most rivers on Meta Incognita Peninsula head within a few miles of Frobisher Bay and flow south. In their upper reaches they occupy ill-defined courses in valleys only a few tens of feet below the general Upland surface, but as they approach Hudson Strait their valleys become better defined and more deeply incised and in their lower reaches, rivers such as Soper River or the rivers that flow into Barrier and Shaftesbury Inlets, flow in valleys more than 1,000 feet deep.

On a map of southern Baffin Island a northwest-trending line more or less equally dividing Meta Incognita Peninsula will approximate the 2,000 foot contour line. South of this line a rugged relatively drift-free terrain predominates. Hills are dome-shaped and are separated by steep-sided valleys. The peninsula presents a rugged appearance to its eastern extremity, East Bluff, where near vertical cliffs rise to more than 800 feet above sea level. The south coast, with the exception of Big Island, is lower, although elevations in excess of 500 feet occur within a few miles of the coast. The northeastern shore of Big Island is precipitous, and near this coast elevations exceed 1,200 feet, but the altitude decreases towards the southwest and the southern third of the island is less than 500 feet above sea level.

Between Beaumont Harbour and Markham Bay the coastal region is rugged with a maximum elevation of just over 1,400 feet. Several large inlets indent the coast; one of these, Crooks Inlet, completely traverses the rugged coastal region and heads in a low, often drift-covered belt about 10 miles wide that extends from near Lake Harbour to Markham Bay.

Between Markham Bay and Cape Dorset settlement the coast is rugged, but elevations seldom exceed 500 feet, although some hills near Mingo Lake slightly exceed 1,000 feet. This part of the coast is fringed by innumerable islands both large and small and is reef-strewn and subject to very strong tidal currents. Long inlets penetrate this part of the coast. The longest of these, Chorkbak Inlet, reaches to within 30 miles of the north coast of Foxe Peninsula.

The southwestern extremity of Baffin Island is considerably more rugged than the area between Markham Bay and Cape Dorset; Kingnait Hill behind the settlement exceeds 500 feet, and to the northwest elevations in excess of 1,200 feet occur in Kingnait Range.

Foxe Lowlands

This physiographic division includes several subdivisions in part reflecting the nature of the bedrock on which the landform has developed.

A remarkably level feature, the Great Plain of the Koukdjuak characterizes the area north of "Aukpar" River on the east shore of Foxe Basin. This feature, in places 20 miles or more wide, extends from Bowman Bay to Taverner Bay, the latter being more than 100 miles north of the northern limits of the mapping carried out on "Operation Amadjuak". Limestone outcrops in the intertidal zone, and it is probable that the entire plain is underlain by gently westward-dipping Palaeozoic strata, although outcrop is seldom visible. The intertidal zone is as much as 4 miles wide, and spring tides reportedly extend a mile farther inland than do the neaps. Innumerable anastomosing streams cross the plain, but the absence of good drainage is emphasized by countless shallow, almost circular lakes that spangle the surface. East of Bowman Bay crystalline rocks outcrop in a low, eastfacing scarp named Bluegoose Prairie, which is somewhat better drained.

The flat and featureless north coast of Foxe Peninsula is underlain by crystalline rocks, but drift is common. There are many lakes of all sizes and shapes and although many are margined by bedrock others are surrounded in part at least, by bouldery shores. South of Cory Bay this plain is margined by a low scarp in the Precambrian rocks that is intersected to the east by a presumed fault parallel to "Aukpar" River. To the west the scarp merges with the low ground that extends north from the upper reaches of the various branches of Chorkbak Inlet. West of Kommanik River the plain merges imperceptibly towards the south with the Upland topography that is characteristic of Cape Dorset region. Although a canoe route appears to exist between Chorkbak Inlet and Foxe Basin, much of the way lies through boulder-filled lakes which in places are only ankle deep, and a canoe traverse of the region requires innumerable portages.

The Foxe Lowlands are characterized by several limestone plateaux, the best known being Putnam Highland, which from the west presents a fairly impressive appearance rising as it does 400 feet above the featureless Bluegoose Prairie. The plateau surface increases eastward reaching a maximum of slightly over 600 feet above sea-level, but the contrast with surrounding terrain is less marked although a scarp up to 200 feet high is characteristic. The northeast- and northwest-facing scarps of Putnam Highland are in part scree-covered and cut by gorges. The surface of this plateau is drift-covered and gently undulating.

Southeast and east of Putnam Highland the region underlain by Palaeozoic rocks is characterized by much the same sort of plateau topography. Low scarps of limestone outcrop along "Aukpar" River and the two large lakes lying between it and Mingo Lake, on the north shore of Mingo Lake and in a few stream valleys between "Aukpar" River and Amadjuak Lake. Elsewhere the surface is drift-covered, but has a plateau-like appearance.

South of Amadjuak Lake Palaeozoic rocks underlie a triangular area more or less bisected by Hone River. Outcrops are scattered and for the most part the surface is covered by clay till.

Palaeozoic strata outcrop along the west shore of Amadjuak Lake in a scarp 50 to 100 feet high. Inland, drift is abundant, but there are scattered outcrops. This region is bordered on the west by an extensive system of raised beaches, and is thus separated from the Great Plain of the Koukdjuak.

East and north of Amadjuak Lake the Palaeozoic lowlands are separated from Hall Upland by a wide expanse of low-lying, lake-studded granitic rocks. Linear features are common in the bedrock and as a result there are many long, narrow lakes Bouldery drift covers much of the surface, but is extremely thin, and bedrock can be found without difficulty almost anywhere. It is probable that this part of the lowlands is a recently exhumed surface once covered by limestone. A Palaeozoic outlier north of North Bay, Amadjuak Lake, supports this interpretation.

Extending northwest from Frobisher Bay is a lowland area that separates Hall Upland and Frobisher Upland. On the southwest this area is bordered by a fault-line scarp whose steep faces rise as much as 1,000 feet above the lowland. The northern margin slopes more gradually, and no obvious features indicative of faulting were seen.

This lowland is underlain by both Precambrian and Palaeozoic strata and merges with the similar terrains south and east of Amadjuak Lake. Small, poorly exposed erosional remnants of Palaeozoic strata similar to those that comprise much of Foxe Lowland, are present and suggest that the lowland may at one time have been completely filled with similar rocks. The best known of the outliers is Sillimans Fossil Mount (loc. T, Fig. 1), at the head of Frobisher Bay, a downfaulted block about 300 feet high, above which Precambrian rocks rise to more than 1,000 feet.

PREVIOUS GEOLOGICAL INVESTIGATIONS

Although Frobisher's second and third voyages (1577, 1578), directed as they were to the search for gold, had a geological connotation, geological investigation of southern Baffin Island properly began with the small fossil collection made at Sillimans Fossil Mount by C. F. Hall in 1861, a collection that indicated the existence of Ordovician strata and the affinities of these strata to North American sections. Robert Bell, Geological Survey of Canada, made a brief examination of the area around Amadjuak Bay in 1885, and in 1897 carried out a coastal reconnaissance between Big Island and Chorkbak Inlet (Bell, 1885, 1901).

During the next 50 years the exploration of southern Baffin Island was directed primarily towards natural history and geographical exploration; the story of this period is admirably covered by Millward (1930). Among the most significant geological studies made during this time were those by Weeks and Haycock, who spent the winter of 1926-27 at Pangnirtung and carried out studies around the head of Cumberland Sound and west from Nettilling Fiord to Nettilling Lake (Weeks, 1928). In 1927 the Putnam Baffin Island Expedition explored the north coast of Foxe Peninsula and traversed inland from Bowman Bay to Putnam Highland, part of the extensive Palaeozoic cover between Amadjuak Lake and Foxe Basin. This group made collections that were valuable in understanding early Palaeozoic history.

Reconnaissance geological investigations of southern Baffin Island by the Geological Survey of Canada continued in 1949 when Y. O. Fortier and W. L. Davison examined the coastal area of Meta Incognita Peninsula between Frobisher Bay and Lake Harbour and in addition made four traverses across the peninsula. Davison continued the coastal studies in 1950 and 1951 and in addition carried out detailed mapping on a scale of 1 inch to 1 mile near Lake Harbour in map-sheet 25 K/13 (Davison, 1958). In 1950 he mapped the north shore of Frobisher Bay and the eastern coasts of Hall

Peninsula as far north as Cape St. David; the following season he continued coastal mapping west from Lake Harbour to Chorkbak Inlet (Davison, 1959). During the same year G. C. Riley carried out geological investigations along the shores of Cumberland Sound and connected with Davison's mapping at Cape St. David (Riley, 1960).

Studies of the north shore of Hudson Strait were continued in 1952 under the direction of Y. O. Fortier and the shoreline was mapped between Chorkbak Inlet and Nuwata, western Foxe Peninsula.

In 1953 Davison made a study of low-grade iron deposits discovered during preceding work. These deposits and their extensions were staked in 1956 and 1957, mainly by Ultra Shawkey Mines Ltd. This interest in the economic possibilities of southern Baffin Island led the Geological Survey to undertake more detailed work, and in 1958 R. G. Blackadar commenced mapping on a scale of 1 inch to 4 miles. He completed Mingo Lake (36A) and Macdonald Island (35P) map-areas between 1958 and 1960 (Blackadar, 1959, 1960, 1961, in press) and Andrew Gordon Bay and Cory Bay (36B, 36G) in 1961 and 1964 (Blackadar, 1962).

ACKNOWLEDGMENTS

The writer was in charge of "Operation Amadjuak" and was assisted in pre-field planning and organization as well as field investigations by F. C. Taylor of the Geological Survey staff; P. H. Smith and R. N. McNeely, two graduate students, acted as assistants. W. Blake Jr. of the Geological Survey staff, assisted by F. M. Synge of the University of Leicester, examined the surficial deposits, the subject of a separate report (Blake, 1966). R. Senneville served admirably as cook, capably assisted by V. Pigeon, and J. Fox acted as radio operator.

Both helicopters were supplied by Universal Helicopters Ltd., whose capable crew comprised J. Murphy, M. Wongkee, and E. Hogan. The Cessna 180, chartered from Bradley Air Services, was piloted by E. Gates.

Many courtesies were extended to members of the project by residents of the area. Special thanks are extended to Mr. A. Miller of the Department of Transport, Frobisher, whose suggestions and personal attention did much to facilitate radio communications; to Mr. and Mrs. G. Sim, Hudson's Bay Company, Lake Harbour, and Mr. and Mrs. W. H. Hall, Hudson's Bay Company, Cape Dorset, who extended hospitality from time to time to various members of the operation; and to Mr. John Hughes, Department of Northern Affairs and National Resources, who in early July arranged accommodation and facilitated the work of members of the party during a one week subcamp at Cape Dorset.

GENERAL GEOLOGY

PROTEROZOIC

The Precambrian rocks of southern Baffin Island comprise a heterogeneous, complexly folded succession of granite, migmatite, and quartz-feldspar gneissic rocks.

Here and there, especially southwest of Frobisher Bay, belts and bands of crystalline limestone, graphitic schist, quartzite, and mafic schists and gneisses are interbedded with these rocks.

Age determinations made on specimens from southern Baffin Island all indicate an Aphebian age for the metamorphism of the gneissic complex and are consistent with placing the region in the Churchill Structural Province. A specimen from near Cape Dorset settlement gave an age of 1,685 m. y. (GSC 59-36); two determinations from Ptarmigan Fiord, southwestern shore of Cumberland Sound, gave ages of 1,605 and 1,700 m. y. (GSC 59-37, 59-38); and a specimen from near Soper Lake, just north of Lake Harbour, gave an age of 1,740 m. y. (GSC 61-52). A specimen of mafic-rich rock from map-unit 13 collected at 65° 06'N, 68° 02'W gave an age of 1,555 ± 50 m. y. (K-Ar 1294) and a specimen from the same map-unit but from Foxe Peninsula (lat. 65° 34'N, 73° 37'W) gave an age of 1,540 ± 50 m. y. (K-Ar 1308).

Volcanic rocks (1)

An assemblage of dark, well-cleaved, biotite-hornblende schists of probable volcanic origin, interbedded with bands of crystalline limestone, underlies the West Foxe Islands. Although this area was not examined during "Operation Amadjuak" it was visited by the writer in 1961 and 1964 and the following description is derived from published and unpublished information (Blackadar, 1962).

Innuksuk Island is composed of interbedded grey-black schist and grey-green schist, which in a few places are highly garnetiferous. Bands of breccia (?) occur throughout the schist, the fragments of which are more siliceous than the matrix. In many places calcite lenses parallel the schistosity and the outcrops where these occur are commonly deeply pitted, owing to surface leaching.

In thin section the green-grey schists consist of diopside, quartz, and carbonate, with minor amounts of sphene and hornblende. The dark schists are mainly hornblende with lesser amounts of biotite, quartz, and magnetite.

Similar rocks are characteristic of the other islands in the West Foxe group. On Putaguk Island a crystalline limestone band 10 feet wide occurs in the succession. There too calcite veins, breccia, and possible pillow structures can be seen.

Hornblende schist (2)

Several bands of dark schist interbedded with gneissic rocks, and here and there intruded by granite, outcrop on Foxe Peninsula. The most prominent of these extends east from Schooner Harbour to Shartowitok Bay. Smaller masses are found north of Lonebutte Bay and northwest of Cape Dorset, and similar rocks outcrop along the south shore of Andrew Gordon Bay east of Alareak Island.

North of Schooner Harbour and near Shartowitok Bay the mafic schistose rocks are commonly associated with quartzite, but between these two localities they are more homogeneous. Most commonly they are biotite-quartz-andesine-hornblende schists, but in many places biotite is lacking. Garnet or sillimanite may be present. These rocks are fine grained and thinly laminated, and in thin section are seen to be equigranular and granoblastic.

Here and there metatuffs have been recognized. These are fine grained, dark green, well-laminated beds about 1/4 inch thick, which contain minor amounts of pyrite. In hand specimen only plagioclase and actinolite can be recognized.

West of Alareak Island hornblende-rich rocks are interbedded with crystalline limestone and are locally intruded by tourmaline-bearing pegmatite. To the west and south this succession grades into very rusty graphitic schists (unit 6).

The association of these rocks with known metasediments, the possible presence of tuffs, and the mineral composition, indicate that the assemblage, in part at least, is volcanic in origin and indeed may represent a slightly more varied succession than the volcanic rocks (unit 1) found on West Foxe Islands.

Quartz-feldspar gneiss (3)

Large areas of southern Baffin Island are underlain by buff-weathering, granular quartz-feldspar gneiss. Mafic minerals are of minor importance, although biotite-hornblende lenses occur in places and with an increase in this component the unit grades into either migmatite (unit 11) or granitic gneiss (unit 12). The most common mafic mineral present as a rock constituent is pyroxene, commonly hypersthene, and the rocks could therefore be called charnockites, a nomenclature followed by Riley (1960) for the south coast of Cumberland Sound. Other writers have referred to these rocks as granulites, but this term, having as it does a textural connotation, is open to confusion.

The rocks have a characteristically buff colour, due apparently to the weathering of biotite. Quartz is commonly bluish or smoky. Plagioclase, the most typical feldspar, is commonly yellowish green and often shows a greasy lustre. Trace amounts of apatite are visible in most thin sections.

The average composition of a suite of specimens selected from widely separated points in southern Baffin Island is as follows: quartz 44 per cent, plagioclase An_{30-48} 32 per cent, potash feldspar 16 per cent, pyroxene 4 per cent, biotite 2 per cent. The texture of most of these rocks is interlocking and inequigranular.

Grey granite gneiss (4)

A distinctive light grey, thinly banded to massive, inequigranular biotite granite outcrops extensively on the eastern half of Hall Peninsula. In this unit the writer includes the Chidliak, Finger Land, and Misty Island gneisses described by Riley (1960), because diagnostic criteria for the separation of these subdivisions previously proposed could not be recognized. In some places, especially west of Cornelius Grinnell Bay, rocks of this unit grade imperceptibly into banded grey or pink granite gneiss of unit 12. The unit is well exposed on Blunt Peninsula and Loks Land where, although migmatite is exposed along the shore of the former, much of the area is underlain by light grey granite.

Amphibolite bands, boudins, and schlieren are locally abundant in the grey granite gneiss and some of these are very rich in garnet.

The average composition of specimens from widely separated areas is: quartz 66 per cent, plagioclase 23 per cent, biotite 5 per cent, hornblende 5 per cent. The composition of the plagioclase varies between An_{20} and An_{25}. A few specimens examined contained disseminated microcline and in such rocks quartz rather than plagioclase decreases in abundance.

In the grey granitic gneisses and granites plagioclase is but little altered, sericite being the principal alteration mineral. There is a considerable variation in the colour of biotite. Dark greenish brown biotite is frequently intergrown with hornblende whereas pale yellowish brown to dark brown biotite is more common in sections lacking hornblende. Amphibole, apparently mainly hornblende, is olive-green to dark blue-green in thin section. Some forms discrete grains, but in other sections alteration of pyroxene to hornblende and biotite can be discerned. Clinopyroxene is present in a few specimens examined and is seldom free from the alterations described above.

Sillimanite schist (5)

Rusty, sillimanite-bearing biotite-(microcline)-quartz schist bands occur here and there interbedded with grey biotite granitic gneiss (unit 4). Bands, commonly a few inches thick, include light grey quartzose layers and layers rich in porphyritic feldspar. Sillimanite is most abundant in quartz-rich layers and occurs in lens-shaped masses, often with a fibrolite texture impregnated with quartz. It is commonly closely associated with biotite and is derived at least in part at the expense of biotite. In fibrolite-rich zones muscovite is associated with biotite.

Garnet, generally anhedral and locally poikilitic, is a common although not invariable constituent of unit 5. Cordierite was seen in one thin section and in a few hand specimens. Quartz is colourless and inclusion free. Microcline is the most common feldspar and occurs in anhedral, poikilitic grains that commonly enclose biotite, partly altered plagioclase, and quartz. Plagioclase, commonly present in amounts not exceeding 5 per cent, is partly altered oligoclase.

Rusty paragneiss (6)

Rusty bands are encountered in almost all map-units, but are commonly associated with garnetiferous biotite-quartz feldspar gneiss (unit 7) and crystalline limestone (unit 9). Such rocks outcrop at many places between Lake Harbour and Markham Bay.

Typically these rocks are grey, medium grained, and schistose. The rusty alteration is due to oxidation of pyrite and less commonly other iron-rich minerals. Quartz is the most abundant constituent, followed by feldspar (usually plagioclase), biotite, and garnet. Graphite is ubiquitous and many outcrops not exhibiting a rusty appearance due to lack of iron-rich minerals, are spangled with graphite and are therefore grouped with unit 7.

Rocks of unit 6 are intimately associated with crystalline limestone and quartzite, and in some outcrops the alternation of the various rock types is measurable in tens of inches.

The variety of composition and the field associations of this unit strongly suggest a sedimentary origin.

Garnet-biotite-quartz-feldspar gneiss (7)

A light grey weathering, commonly garnetiferous, massive to foliated granular (biotite)-quartz feldspar gneiss (unit 7) outcrops extensively along the south coast of Baffin Island and is present here and there in the more massive rocks on Hall Peninsula and northwest of Frobisher Bay.

The most typical exposures of this unit outcrop near Markham Bay where the unit is closely associated with rusty paragneiss (unit 6) and crystalline limestone (unit 9). Fine examples of this association are found west of Big Island near Crooks Inlet and on Glencoe Island. The intermixture of the components is too complex to illustrate on the accompanying maps in any but the most generalized manner.

The principal constituent, quartz-feldspar gneiss with varying garnet and biotite content, is commonly spangled with graphite. Sillimanite is present in a few places. Crystalline limestone commonly forms distinctive bands, but the former existence of a carbonate component in the succession may be recognizable only by the presence of concentrations of scapolite and diopside.

Map-unit 7 is well laminated, the appearance of the structure being accentuated by innumerable rusty streaks that faithfully reproduce each change of attitude. Locally biotite becomes abundant and in such cases quartz and feldspar tend to become concentrated in knots and lenses along the foliation.

The rocks of this unit are cut by white pegmatite and by dykes and sills of white granite, in places garnetiferous. With increasing content of white and pink granitic material the rocks grade into migmatites.

Hornblende-pyroxene gneiss (8)

A variety of mafic-rich rocks is included in this unit, the most common being hornblende-pyroxene-quartz-plagioclase gneiss and amphibolite.

Mafic gneisses rarely form masses large enough to map on a reconnaissance scale, but are an important constituent of the migmatite and granitic gneiss map-units and also form discrete masses in the granulitic quartz-feldspar gneisses and grey granitic gneisses. Schlieren are most common in migmatites; discrete bands, some of which are many tens of feet in length are the characteristic form of occurrence of mafic-rich gneiss in granitic gneisses, whereas in quartz-feldspar gneiss and grey granitic gneiss a lens-shaped form is more typical.

Extensive mafic gneiss occurrences have been mapped in several places along the north shore of Hudson Strait, the area of greatest lithological diversity. Such occurrences are particularly abundant north of Keltie Inlet. There the outcrops are commonly more or less circular and appear to lie above felsic gneisses. Davison (1959) considered that the contact between mafic gneiss and quartz-feldspar gneiss is disconformable, but the author has been unable to substantiate this. Magnetite is associated with some of the larger mafic gneiss occurrences (Blackadar, in press) in southern Baffin Island. Several private companies conducted extensive prospecting and staking programs between 1956 and 1958, but apparently the tonnages outlined and the grades encountered were not sufficiently high to warrant exploitation.

A thin section study discloses that several associations are included in unit 8, the commonest being:

1. pyroxene-amphibolite. The two minerals are about the only constituents. Orthopyroxene is commonly more abundant than clinopyroxene. In some specimens hornblende appears in part at least, to be an alteration of pyroxene, but in others it appears to be primary.

2. pyroxene-hornblende-quartz-plagioclase. A typical composition of rocks with this association is plagioclase An_{34-40}, pyroxene (both orthopyroxene and clinopyroxene are present) 23 per cent, dark brown hornblende, 20 per cent, quartz, 10 per cent, dark red-brown biotite, 5 per cent.

Crystalline limestone (9)

Crystalline limestone is an important lithologic constituent of southernmost Baffin Island and is especially abundant between Lake Harbour and Keltie Inlet.

First described by Bell (1901), who reported 10 bands of carbonate having a total thickness of 30,000 feet, crystalline limestone has now been shown to comprise many discrete bands that vary greatly in thickness and lateral extent.

In order adequately to show the carbonate outcrop pattern it has been necessary to generalize and many bands in fact comprise diverse lithologies. Rusty graphitic schists and gneisses (unit 6) and quartzite (unit 10) are commonly associated. At some time the carbonate appears to have become plastic, for in places the various rock types are intricately mixed and the structure highly convoluted.

Crystalline limestone is composed of medium- to coarse-grained, white, grey, or orange calcite crystals. Owing to the impure nature of the original sediments, metamorphism has produced a great diversity of minerals. Diopside, muscovite, biotite, graphite, pyrite, pyrrhotite, serpentine, and scapolite are commonly encountered. Indeed in places only highly contorted masses of pale green diopside in the gneisses attest to the former existence of carbonate rocks.

Typical mineral compositions of the impure limestones are: calcite, 65 per cent; antigorite, 25 per cent; muscovite, 10 per cent; diopside, 45 per cent; scapolite, 44 per cent; quartz, 10 per cent; chondrodite, 1 per cent; diopside, 87 per cent; scapolite, 10 per cent; and hornblende, 3 per cent.

Quartzite (10)

Quartzite is commonly associated with crystalline limestone and rusty graphitic paragneiss and in most instances has been grouped with the former for mapping purposes. There are, however, several mappable quartzite outcrops and these are described in the following paragraphs.

On southwesternmost Foxe Peninsula a broad band of quartzite extends east from Schooner Harbour to Pudla Inlet. On the west side of Schooner Harbour the quartzite is interbedded with volcanic rocks, but on the east shore the succession comprises very pure crossbedded quartzite. The rock becomes less pure inland. A few miles east of Schooner Harbour the white, thick-bedded to massive quartzitic succession includes thin beds of brown weathering sillimanite-biotite-quartz schist. Elsewhere biotite and chlorite occur randomly throughout the outcrop. A typical specimen of the "impure" quartzites of map-unit 10 consists of 50 per cent microcline, 20 per cent quartz, 15 per cent sillimanite, 12 per cent biotite and 2 per cent muscovite. Quartz grains commonly contain sillimanite inclusions. Microcline forms large, anhedral, spongy grains that poikilitically enclose quartz, biotite, muscovite, and sillimanite.

East of Lona Bay the appearance of the rock becomes less and less sedimentary. Pink feldspar becomes prominent and the outcrop is cut by many pinkish quartz-feldspar pegmatite veins and dykes. So complete has been this feldspathization that north of Ikalukpiuk Lake the original sedimentary characteristics are no longer visible and the rock is mapped as granitic gneiss. About 10 miles west of Pudla Inlet sedimentary features again become recognizable although feldspar remains an important constituent; thin beds of biotite, muscovite, and sillimanite commonly parallel the bedding. These rocks consist of 85 per cent quartz, 10 per cent microcline, 5 per cent muscovite, and trace amounts of sillimanite. Microcline forms small grains interstitial to quartz and is equally distributed throughout the rock.

Two small islands of quartzite west of West Foxe Islands are thought to be the easternmost recognizable exposures of unit 10, although separated from the Pudla Inlet outcrops by several islands of granitic gneiss.

Quartzitic bands associated with crystalline limestone do not show cross-bedding, but are commonly well bedded, medium-grained, grey, granular rocks. Many are derived from impure sediments and may contain considerable amounts of biotite, graphite, and garnet. Chalcopyrite and pyrite are locally present. The rusty weathering surface of these quartzites is in marked contrast to the large, white outcrops east of Schooner Harbour.

Quartzite forms a recognizable unit 12 miles southwest of Cape Rammelsberg on the south shore of Frobisher Bay. There it is interbedded with garnet-biotite gneiss and biotite gneiss. The metasediments are cut by coarse-grained, white to pink granite dykes.

An outcrop of quartzite, more or less elliptical in shape, and 2 miles in greatest dimension, occurs about 10 miles northeast of Sylvia Grinnell Lake. Banding is faint in this quartzite, but mullion structure is locally well developed. Interbedded with the quartzites are thin, highly schistose, buff-weathering sillimanite-quartz-feldspar beds. The sequence of metasediments appears to be interbedded with typical granitic rocks, although extensive drift masks most contacts.

Migmatite (11)

The intergradation of quartz-feldspar gneiss (granulite), migmatite, granitic gneiss, and granite has been noted above. No clear criteria to separate them can be established, and commonly the placement of an outcrop into one or other of the groups is most subjective. This is especially true for migmatites, for here are grouped diverse rocks of possibly widely differing origins and now exhibiting a wide range of structural forms.

The most common structural form in the migmatites is layer or stromatic structure. A newly formed leucocratic component, usually either quartz or feldspar or both, has developed parallel to pre-existing structure in the country rock. The presence of these beds, often lens-like when viewed in section, distinguishes these rocks from the granulites.

Agmatitic structures, fragments of country rock embedded in leucocratic material and showing little evidence for rotational movement, are not uncommon, but most migmatites exhibit evidence of more intense metamorphism and schlieren textures have resulted. In such rocks the original components have been torn apart and have undergone partial assimilation, and once adjacent parts can no longer be recognized. The end result of these processes is nebulitic structure and there migmatite and granulites are easily confused.

Many migmatites are cut by younger white or pink coloured quartz-feldspar pegmatite.

These rocks show a wide variation in composition. Some are granodiorite or quartz diorite and comprise quartz, oligoclase andesine, and less than 20 per cent mafic minerals. Others are similar in composition to quartz monzonite and contain about equal amounts of quartz and microcline; plagioclase and mafic minerals make up less than 10 per cent of the total mineral content. A few migmatite specimens examined are granitic in composition and consist mainly of microcline with minor quartz and only trace amounts of plagioclase and mafic minerals.

Schlieren, bands, and other forms of inclusions are comparable in composition to the variety of mafic rocks included in unit 8.

Granite gneiss (12)

Pink or grey, well foliated granitic rocks outcrop widely throughout southern Baffin Island, but may grade imperceptibly into closely related map-units.

In composition these rocks commonly approximate quartz monzonite, although quartz diorites and granodiorites are also encountered. They are essentially quartz, plagioclase, and microcline; mafic minerals seldom exceed 5 per cent, but may include several varieties. Unlike the quartz in the buff quartz-feldspar gneisses (granulites), the quartz in these rocks is clear or milky rather than smoky.

The rocks of unit 12 commonly exhibit a wide range of grain size within a single specimen, resulting in an uneven texture best described as interlocking and inequigranular.

Biotite granite (13)

Red or reddish pink granite is particularly abundant north and east of Amadjuak Lake and between Mingo Lake and Cory Bay. Although slightly foliated in places it is generally massive; north of Amadjuak Lake it has a highly developed fracture pattern.

These rocks vary from fine grained to very coarse grained. In thin section they exhibit a granulitic or interlocking texture and are seen to comprise, in decreasing order of abundance, quartz, microcline, and plagioclase. Biotite is commonly the only mafic mineral present and rarely exceeds 10 per cent of the total mineral content.

Quartz is clear or milky and in thin section is seen to be clear and inclusion-free, although in several specimens small, acicular, reddish inclusions are abundant and in others trains of bubble-like, parallel-oriented inclusions occur. Microcline, commonly perthitic, contains a variety of forms, finely laminated anastomosing rods being most common. Myrmekitic intergrowths are common along the potash feldspar grain margins. Plagioclase varies slightly in composition, but most is within the oligoclase range. In some sections plagioclase contains inclusions of quartz, in others the mineral is extensively sericitized.

Biotite, the principal mafic mineral, is pleochroic in shades of dark brown to golden yellow. Some grains are chloritized. Hypersthene and/or hornblende are less common.

One specimen of medium-grained, greyish pink granite collected about 10 miles west of Nettilling Fiord and megascopically similar to the rather monotonous assemblage described above contains cordierite. The composition of this specimen is quartz 61 per cent, labradorite 12 per cent, cordierite 10 per cent, biotite 10 per cent, microcline 7 per cent, and trace amounts of garnet, zircon, and chlorite. Zircon is enclosed by cordierite, which displays well-developed pleochroic haloes.

Hypersthene granite (14)

Deeply weathered hypersthene granite outcrops in a band as much as 40 miles wide that extends south from Irvine Inlet to Ward Inlet on the north side of Frobisher Bay. Similar rocks outcrop an unknown distance north beyond the limits of the area mapped. Along Cumberland Sound the outcrop boundaries of this unit approximate those shown by Riley (1960) for a zone of charnockite and the two units are considered comparable.

This hypersthene granite is distinguished by a massive texture and general lack of lineation and foliation. It is commonly brownish in colour and may include garnet and contain bluish quartz rather than the clear or milky varieties that are more characteristic of map-unit 13. It is in many respects similar to the quartz-feldspar gneiss (unit 3) and the eastern boundary of the main belt is gradational.

In thin section these rocks are seen to comprise potash feldspar (most commonly with perthitic structure), quartz, plagioclase (commonly oligoclase, some andesine), hypersthene and/or diopside, biotite, and garnet; minerals present in trace amounts include apatite and ore minerals. Here and there myrmekite has formed at the boundaries between plagioclase and potash feldspar grains.

Perthite is commonly unaltered and contains minute, aligned blebs, which in some grains form short stubby rods (0.001 mm long). Quartz commonly contains a few needle-like inclusions; in some sections there are also brownish, non-isotropic rectangular inclusions scattered throughout the quartz grains.

An interlocking inequigranular texture is most common. In some specimens a textural and compositional banding is evident and in such rocks the mafic minerals are mostly concentrated in the finer-grained bands. Quartz also is commonly more abundant in such bands.

Ultramafic rocks (15)

Irregularly shaped, chocolate-brown weathering rocks of ultramafic composition occur in the gneissic succession in a few places throughout southern Baffin Island. One such intrusion outcrops a mile south of Lonebutte Bay, along the Foxe Channel coast of Foxe Peninsula; several long, narrow, sill-like ultramafic masses occur about 10 miles south of Chidliak Bay, smaller patches are found east of that bay, and similar rocks are found a few miles east of Soper River near Mount Joy.

In general these rocks appear conformable with the enclosing rocks and have been folded with them.

As seen in thin section these rocks are mainly pyroxene and hornblende. Pyroxene comprises as much as 90 per cent of the rock and except in the case of altered specimens is never less than 50 per cent. Several specimens contain both orthopyroxene and clinopyroxene; indeed, the presence of two pyroxenes can be seen readily in hand specimens. Alteration of the pyroxenes to chlorite, tremolite, and serpentine is common. Hornblende is medium to light green in colour and like pyroxene shows extensive alteration in places. Magnetite and spinel are common accessory minerals.

Diabase (16)

Several northwest-trending diabase dykes intrude the gneissic rocks of southern Baffin Island. The largest and most continuous is a group of two parallel intrusions that extend from north of Markham Bay to the head of Chorkbak Inlet. In some places in this distance the dykes anastomose, elsewhere they are margined by dykelets that vary in width from a few inches to tens of feet. Several considerably shorter dykes near Soper River are more or less on strike with the larger group, but no outcrops of diabase were found in the intervening area.

Diabase outcrops along a line extending from north of Popham Bay almost to the head of Ptarmigan Fiord and comprises several en échelon intrusions.

A brown-weathered surface, and the rectangular joint pattern of the larger intrusions are characteristic of these rocks. In thin section, plagioclase, pyroxene, and hornblende are seen to be the principal mineral components. Plagioclase is andesine or labradorite, commonly partly altered to white mica. Some crystals are zoned, the core being more calcic than the margins. Both clinopyroxene and orthopyroxene are present, although the former is more abundant. Opaque minerals including magnetite rarely exceed 5 per cent of the mineral content.

PALAEOZOIC

Sedimentary rocks of Palaeozoic age outcrop widely on Foxe Plain physiographic region. These rocks are flat-lying to gently dipping and are mainly light grey limestone with minor argillaceous limestone and calcareous shale. Outcrops are mainly confined to cliff sections along rivers and lakeshores and on the reconnaissance scale of mapping used during "Operation Amadjuak" it was not possible to subdivide the Palaeozoic.

Twenty fossil collections were made from the Palaeozoic strata and the locations of these are given on Figure 1.

These collections were examined by G. W. Sinclair, Palaeontology Section, Geological Survey of Canada, whose preliminary report follows. Three faunas may be distinguished in the samples studied:

1. A fauna of Late Wilderness age, which will be referred to as such.

2. A fauna of Barneveld age, and which makes up most of the samples. It will be referred to as Barneveld.

3. A third fauna is not well represented, but seems to be slightly different from 2, the differences suggesting that it is a little younger. It will be referred to as "possibly post-Barneveld".

These faunas will be discussed below, following the determinations.

Determinations

GSC loc. 69486 SR-179 Section A. 71° 37'W, 66° 04'N

Crinoid fragments
Cheirocrinus? sp.
Helopora sp.
Paucicrura sp.
Strophomenid brachiopod
Streptelasma sp.
Holopea sp.
Maclurites sp.
Ostracods
Leperditia sp.
Krausella sp.
Trilobite fragments
Calliops sp.

Indicated age: Barneveld latest Middle Ord.

GSC loc. 69530 SR-149 Section B. 72° 00'W, 65° 50'N, base of 120' section.

Crinoid fragments
Paucicrura sp.
Hesperorthis? sp.
Ceraurus? sp.
Leperditia sp.

Indicated age: Barneveld ?

GSC loc. 69531 SR-149A Section B, 90' level in 120' section.

Crinoid fragments
Bryozoans

Paucicrura sp.
Rhynchotrema sp.
Gastropods
Trilobite fragments
Krausella sp.
Leperditia sp.

Indicated age: Barneveld ?

GSC loc. 69488 SR-148 Section B, 412'

Crinoid fragments
Orthid brachiopod
Trilobite fragments
Ostracods
Krausella sp.

Indicated age: Barneveld ?

GSC loc. 69489 SR-148 Section B, 415'

Crinoid fragments
Strophomenid brachiopod
Trilobite fragments
Ostracods

No age indicated.

GSC loc. 69490 SR-148 Section B, 418'

Crinoid fragments
Orthid brachiopod
Trilobite fragments

No age indicated.

GSC loc. 69487 SR-147 Section B, 510'

Crinoid fragments

No age indicated.

GSC loc. 69491 BE-M-146 Section C, 71°51'W, 65°40'N

Heterospongia sp.
Receptaculites sp.
Protochisolithus sp.
Crinoid fragments

Strophomenid brachiopod
Spyroceras sp.
Actinoceras sp.
Gonioceras sp.
Winnipegoceras? sp.
Richardsonoceras? sp.
Orthoceroconic cephalopod
Trilobite fragments
Encrinurus sp. (s. l.)
Ostracods
Leperditia sp.

Indicated age: Late Wilderness middle Middle Ord.

GSC loc. 69494 SR-165 Section D, 73° 05'W, 65° 20'N, at 50'

Receptaculites sp.
Crinoid fragments
Bryozoans
Gastropods

Indicated age: Barneveld?

GSC loc. 69493 SR-165A Section D, at 90'

Crinoid fragments
Hormotoma cf. _gracilis_
Trilobite fragments

Indicated age: Barneveld?

GSC loc. 69495 SR-166 Section D, at 140'

Receptaculites sp.
Trochonema sp.

Indicated age: Barneveld?

GSC loc. 69492 SR-167 Section D, at 260'

Crinoid fragments
Bryozoans
Helopora sp.
Plasmopora sp.
Rhynchotrema sp.
Dinorthis sp.
Strophomenid brachiopod
Maclurites sp.

<u>Liospira</u> sp.
Orthoceroconic cephalopod
<u>Actinoceras</u> sp.
<u>Hemiarges</u> sp.
<u>Encrinurus</u> sp.
<u>Sphaerocoryphe</u> sp.
<u>Bumastoides</u> sp.
<u>Leperditia</u>
<u>Hallatia</u> sp.
<u>Eurychilina</u> sp.
<u>Krausella</u> sp.

Indicated age: Barneveld

GSC loc. 69527 BE-M Section D, 200-300'

<u>Maclurites</u> operculum

No age indicated.

GSC loc. 69529 SR-168 Section D, 400' (73° 05'W, 65° 25'N)

Crinoid fragments
<u>Catenipora</u> sp.
<u>Sowerbyella</u> sp.
Orthid brachiopod
<u>Zygospira</u> sp.
Gastropods
<u>Lambeoceras</u>? sp.
<u>Cyrtogomphoceras</u> sp.
<u>Kionoceras</u> sp.
<u>Diestoceras</u>? sp.
<u>Maclurites sp.</u>
Ostracods
<u>Anataphrus</u> sp.

Indicated age: Barneveld, or post-Barneveld

GSC loc. 69528 SR-169 Section D, 500' (73° 05'W, 65° 20'N)

Crinoid fragments
<u>Maclurites</u> sp.
Cephalopod
Trilobite fragments

No age indicated.

GSC loc. 69522   BE-M-156 Section E, 71°40'W, 65° 17'N, talus from 40' section

Crinoid fragments
Cheirocrinus sp.
Receptaculites sp.
Plasmopora sp.
Grewingkia sp.
? Tetradium tubifer of Troedsson?
Glyptorthis? sp.
Strophomenid brachiopod
Sowerbyella sp.
Cyclospira sp.
Fusispira sp.
Trochonema sp.
Maclurites sp.
Lophospira cf. L. milleri
Discoceras? sp.
Endoceras sp.
Actinoceroid siphuncle
Diestoceras sp.
Charactoceras sp.
Illaenus sp.
Isotelus sp.
Bumastoides sp.
Ostracods

Indicated age: possibly post-Barneveld

This sample also includes a specimen of blue shale (contrasting with the argillaceous limestone of the other specimens) labelled "20' section below limestone". This shale is crowded with small smooth ostracods, cf. Bythocypris. It should be recorded separately, as it may eventually be separable stratigraphically from the overlying beds. In itself it affords no certain age assignment.

GSC loc. 69526   BE-M-172 Section F, 71°38'W, 65°00'N

Crinoid fragments
Maclurites sp.
Cyrtogomphoceras? sp.
Trilobite fragments
Ostracods

Indicated age: ?possible post-Barneveld

GSC loc. 69523   BE-M-"EA" Section G, 72°58'W, 64°53'N

Receptaculites sp.
Crinoid fragments

Catenipora sp.
Streptelasma sp.
Brachiopod
Maclurites sp.
Hormotoma? sp.
Westonoceras? sp.
Ostracods
Eurychilina sp.

Indicated age: probably Barneveld, just possible post-Barneveld

GSC loc. 69524 TA-T65-190 Section H, 71° 15'W, 64° 35'N

Crinoid fragments
Maclurites sp.

No age indicated

GSC loc. 69516 BE-65-68 Section I, 70° 49'W, 64° 37'N

Receptaculites sp.
Crinoid fragments
Streptelasma sp., small
Cornulites sp.
Helopora sp.
Paucicrura sp.
Rhynchotrema? sp.
Glyptorthis sp.
Sowerbyella sp.
Zygospira sp.
Hesperorthis? sp.
Plectorthis? sp.
Trilobite fragments
Dimeropyge cf. raymondi
Illaenus sp.
Leperditia sp.
Maclurites spp.
Hormotoma sp.

Indicated age: Barneveld

GSC loc. 69517 TA-191C Section J, 10' from base, 70° 37'W, 64° 36'N

Receptaculites sp.

No age indicated

GSC loc. 69518 TA-191B Section J, 15' from top

Maclurites sp.

No age indicated

GSC loc. 69519 TA-191A Section J, 10' from top

Receptaculites sp.

No age indicated

GSC loc. 69520 TA-191D Section J, 10' from top

Cephalopod

No age indicated

GSC loc. 69521 TA-191E Section J, top

Armenoceras sp.
Endoceras? sp.

Indicated age: Barneveld, or possible post-Barneveld

GSC loc. 69515 TA-T46 Section K, 71° 12'W, 64° 30'N

Nothing determinable

GSC loc. 69514 TA-T45 Section L, 6' of limestone overlying granite

Armenoceras? sp.

No age indicated

GSC loc. 69513 TA-T224 Section L, 10' section overlying granite

Receptaculites sp.
Labyrinthites sp.
Echinoderm fragments
Sowerbyella sp.
Maclurites sp.
Gonioceras sp.
Actinoceras sp.
Endoceras sp.
Spyroceras sp.
Illaenus sp.
Leperditia sp.

Indicated age: Late Wilderness late middle Middle Ord.

GSC loc. 69497 TA-T44 Section M. 70° 14'W, 64° 33'N

Receptaculites sp.
Maclurites cf. *manitobensis*

No age indicated

GSC loc. 69596 TA-T43 Section N. 70° 08'W, 64° 33'N

Maclurites sp.
Crinoid fragments
Spyroceras sp.
Orthoceroconic cephalopod
Sphaerexochus sp.
Ostracods

Indicated age: Barneveld

GSC loc. 69498 TA-52 Section O. 71° 04'W, 64° 27'N

Apsidoceras?? sp.

Indicated age: possible post-Barneveld, but not really determinable

GSC loc. 69511 SR-61 Section Q. 69° 49'W, 64° 16'N

Receptaculites sp.
Grewingkia sp.
Catenipora sp.
Zygospira sp.
Maclurites cf. *M. crassus*
Lambeoceras sp.

Indicated age: possible post-Barneveld

GSC loc. 69512 SR-98A Section R. 69° 17'W, 63° 59'N. Limestone at Precambrian

Crinoid fragments

No age indicated

GSC loc. 69504 SR-242 Section S. 69° 16'W, 64° 04'N

Heterospongia sp.
Echinoderm fragments
Strophomenid brachiopod
Actinoceras sp.
Illaenus sp.
Leperditia sp.

Indicated age: Late Wilderness?

GSC loc. 69509 SR-242 Section S. Horizon 1

Crinoid fragments
Bryozoans
Paucicrura sp.
Sowerbyella "sericea"
Small gastropod
Maclurites sp.
Illaenus sp.
Harpeid trilobite
Remopleurides sp.
Sphaerocoryphe sp.
Leperditia sp.
Krausella sp.

Indicated age: Barneveld

GSC loc. 69506 SR-242 Section S. Horizon 2

Crinoid fragments
Bryozoans
Helopora? sp.
Sowerbyella sp.
Zygospira? sp.
Small gastropod
Small orthocerocone
Trilobite fragments
Ostracods
Leperditia sp.

Indicated age: Barneveld

GSC loc. 69507 SR-242 Section S. Horizon 3

Crinoid fragments
Dinorthis? sp.
Hesperorthis? sp.

No age indicated

GSC loc. 69508 SR-242 Section S. Talus from Horizons 1-3

Receptaculites sp.
Plasmopora sp.
Lambeoceras sp.
Spyroceras sp.

Indicated age: This would seem to be the post-Barneveld assemblage, so far as it goes. It will be noted that these genera were not found in samples from horizons 1-3 in place.

GSC loc. 69599 SR-242 Section S. Horizon 4

Crinoid fragments
Bryozoans
Sowerbyella sp.
Paucicrura sp.
Gastropod indet.
Cephalopod indet.
Trilobite fragments
Isotelus sp.
Illaenus sp.
Krausella sp.
Laccochilina? sp.
Leperditia sp.

Indicated age: Barneveld

GSC loc. 69500 SR-242 Section S. Horizon 5

Crinoid fragments
Zygospira sp.
Salpingostoma sp.
Maclurites sp.
Oncoceras? sp.
Isotelus sp.
Leperditia sp.

Indicated age: Barneveld

GSC loc. 69501 SR-242 Section S. Horizon 6

Crinoid fragments
Brachiopod
Orthoceroconic cephalopod
Ostracods

No age indicated.

GSC loc. 69502 SR-242 Section S. Talus from Horizon 6

Receptaculites sp.
Maclurites sp.
Lambeoceras sp.

Indicated age: Barneveld or post-Barneveld

GSC loc. 69503 SR-242 Section S. Horizon 7

Crinoid fragments
<u>Sowerbyella</u> sp.
<u>Rhynchotrema</u> sp.
Hesperorthis sp. ?
<u>Paucicrura</u> sp.
<u>Maclurites</u> sp.
Trilobite fragments
<u>Krausella</u> sp.
<u>Leperditia</u> sp.

Indicated age: Barneveld

GSC loc. 69504 SR-242 Section S. Horizon 8

Crinoid fragments
Strophomenid brachiopod
<u>Remipyge</u> sp.
Ostracods
<u>Oepikella</u>? sp.
Orthoceroconic cephalopod

Indicated age: Barneveld

GSC loc. 69505 BE-M-239 250' talus slope on Silliman's Fossil Mount, Section T

Echinoderm fragments
<u>Cheirocrinus</u> sp.
<u>Receptaculites</u>
<u>Catenipora</u> sp.
<u>Streptelasma</u>, small sp.
<u>Calapoecia</u> sp.
<u>Sowerbyella</u> sp.
<u>Paucicrura</u> sp.
<u>Maclurites</u> sp.
<u>Trochonema</u> sp.
<u>Oxydiscus</u> sp.
<u>Eotomaria</u>? sp.
<u>Fusispira</u> sp.
<u>Hormotoma</u> cf. <u>H</u>. <u>major</u>
<u>Subulites</u>? sp.
<u>Kionoceras</u> sp.
<u>Cyrtogomphoceras</u> sp.
cf. <u>Wilsonoceras</u> sp.
<u>Lambeoceras</u> sp.
<u>Endoceras</u> sp.
<u>Diestoceras</u> sp.

Indicated age: The sample suggests that there is here a mixing of Barneveld and possible post-Barneveld beds.

Comments

All the samples submitted fall within a very short time range. The oldest fauna is that of the Late Wilderness Stage, and is essentially the same age as the Gonioceras Bay Formation of Washington Land. Most of the samples give a date in the Barneveld Stage, that is, the typical Trenton of earlier usage. The youngest fauna represented is either late in the Barneveld or just a little younger. There is nothing in any of the samples to suggest that they could be as young as Richmond.

The samples that are insufficient for precise dating are all such as could be one of the three horizons found in other samples. None of them suggests a pre-Wilderness or post-Barneveld (or post-Edenian) age.

ECONOMIC GEOLOGY

Interest in 1874 on the part of an American citizen, Lieut. W. A. Mentzer, in the mineral possibilities of the Cumberland Sound area led directly in 1880 to the transfer to Canada by Great Britain of all British possessions on the North American continent and adjacent islands not previously annexed to any colony. Mentzer in 1876 mined 15 tons of mica valued at $120,000 as well as graphite and other industrial minerals.

The Hudson's Bay Company attempted to mine graphite in 1926 on Blacklead Island (southwest shore of Cumberland Sound, east of Chidliak Bay), but discontinued the endeavour the same year (Weeks, 1928, p. 93).

Mica was mined about 12 miles from Lake Harbour settlement during the latter part of the nineteenth century and in 1916 the Hudson's Bay Company commenced the development of a graphite deposit in the same general area. Small tonnages were shipped in the following two years but the operation was discontinued after the close of the First World War when more normal sources became available.

The innumerable gossans that result from the weathering of rocks such as map-units 6 and 7 have over the years aroused considerable interest, but although some of these have been prospected from time to time and although many were examined in the course of "Operation Amadjuak" no deposits of economic interest have been found.

Of greatest economic interest have been the low-grade iron deposits found mainly between Amadjuak Bay and Chorkbak Inlet. The most extensive concentration is contained in a band of hornblende-quartz-feldspar gneiss (amphibolite) that extends in a sinuous course from west of Amadjuak Bay to beyond Keltie Inlet. Magnetite forms as disseminated grains and in coarse-grained bands 1 foot to 15 feet thick. Although the continuity of the 'amphibolite' band is broken by granitic patches, it maintains a more or less constant width of about 400 feet for most of its length.

In addition to the principal magnetite-bearing zone there are many smaller concentrations in the same general area and these as well as the main zone are more fully described elsewhere (Blackadar, in press).

Several deposits of magnetite occur west of Chorkbak Inlet and these are also associated with hornblende-rich rocks. Here and there magnetite may be massive, but more commonly it is associated with garnetiferous hornblende rock. East of a lake 64° 28' N, 74° 50' W, magnetite layers occur in garnetiferous rocks (unit 7) and similar layers are present in quartz-feldspar gneiss northwest of the lake.

Exploration of the iron showings was carried out in 1956-1958, principally by Ultra Shawkey Mines Ltd., but following the 1958 season exploratory work was discontinued, apparently because of the persistent low-grade character of the deposits.

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