CANADA

DEPARTMENT OF MINES AND TECHNICAL SURVEYS

GEOLOGICAL SURVEY OF CANADA

PAPER 55-6

GEOLOGICAL RECONNAISSANCE OF ADMIRALTY INLET, BAFFIN ISLAND, ARCTIC ARCHIPELAGO, NORTHWEST TERRITORIES

(Report, Map, and Stratigraphic Sections)

By

R. G. Blackadar

OTTAWA
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Price 50 cents

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GEOLOGICAL RECONNAISSANCE OF ADMIRALTY INLET, BAFFIN ISLAND NORTHWEST TERRITORIES

INTRODUCTION

Location

Baffin Island, the largest of the Canadian Arctic islands and third largest island in the world, extends from a little below latitude 62° north to just south of latitude 74° north. This report is concerned with the coasts adjacent to Admiralty Inlet and the long sounds that break the east coast of that inlet; a region bounded by latitudes 71°30' and 73°30' north and longitudes 83° and 87° west. The region is included in the district of Franklin for the purpose of civil administration and in the Pond Inlet district, E-5, for the administration of native affairs.

Present Investigation and Acknowledgments

The geological investigation upon which this report is based was carried out between May and August 1954. Early in May the author and his assistant, R. R. H. Lemon, were landed on the sea ice at Arctic Bay by a ski-equipped DC-3 aircraft chartered from Arctic Wings Limited.

During May and June the writer and his assistant, travelling separately and each accompanied by two Eskimos, covered about 1,000 miles by means of dog teams. Reconnaissance geology was carried out during this period and detailed sections were made in formations of post-Archaean age. The balance of the season was spent in a more detailed examination of the geology in the immediate vicinity of Arctic Bay settlement. This included the study of the late Proterozoic and/or Early Cambrian sediments, an examination of the metallic mineral occurrences of the district, and a study of the basic dykes that are characteristic of the peninsula lying between Strathcona Sound and Adams Sound.

Several short journeys were made by trap boat near the close of the field season.

The party returned south aboard the C. G. S. C. D. Howe and C. G. S. D'Iberville.

Four men from Arctic Bay, Attagoocheah, Kakaseak, Levi, and Neuterajuk assisted the party and capably carried out their duties as dog drivers.

The Hudson's Bay Company and the Meteorological Division of the Department of Transport, in true northern fashion,

accorded a warm welcome to the party whenever they were in the settlement.

The writer was ably assisted in the field by R. R. H. Lemon, without whose help much of the work, resulting in this report, could not have been accomplished.

History of Discovery

Lancaster Sound, the eastern gateway of the Northwest Passage, was penetrated by Sir Edward Parry in 1819. During this voyage he named and entered Admiralty Inlet but did not proceed any distance into it.

Captain Adams of the whaling ship Arctic explored the inlet in 1872. Adams Sound is named after him and the harbour on which the settlement of Arctic Bay stands, known to the Eskimos by the descriptive name of "the pocket", was named after his ship.

In 1906 a Canadian Government Expedition (Bernier, 1909, pp. 24-25)[1] traversed Admiralty Inlet to its southern extremity but did not proceed beyond the narrows at Shimik that lead into Berlinguet Inlet. During the winter of 1910-11, Captain Bernier, again commanding a Dominion Government expedition, wintered with his ship at Arctic Bay. A description of this expedition will be found in Bernier (1911). Sled trips were made along the length of Admiralty Inlet and a considerable amount of general information was obtained.

There are no further published reports of investigations in the area until 1922-24 when Mathiassen and Freuchen, members of the Fifth Thule Expedition, made several trips into the district (Mathiassen, 1933, pp. 35-43; 1945, pp. 48-49, 80-82).

In 1927 the Hudson's Bay Company established a trading post at Arctic Bay. This was closed the next year but was reopened in 1936 following the abandonment of the post at Dundas Harbour. Since that time the settlement has been increased by the building of a Roman Catholic mission and a Department of Transport meteorological station. A Church of England mission was established at Moffet Inlet but has been vacant since 1947.

Previous Geological Investigation

A prospector, A. English, accompanied the Dominion Government expedition of 1910. Copper, iron, nickel, platinum, silver, antimony, gold, and lead discoveries were reported (Bernier, 1911, pp. 147-153).

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[1] Dates, etc., in parentheses refer to References, page 6.

The geological results of the Fifth Thule Expedition are contained in the reports of Mathiassen (1933, pp. 35-43) and Teichert (1937, pp. 21-33, 28-47).

A report on the geology in the immediate vicinity of the settlement at Arctic Bay is found in Weeks (1927, p. 95C).

Prospecting in the vicinity of Arctic Bay was carried out in 1937 by J. F. Tibbitt and J. W. McInnes. Two claims were staked but these were allowed to lapse the following year. No published report resulted from this work.

Accessibility and Method of Travel

Arctic Bay, the only white settlement in the area, is a regular port of call for the annual supply ship of the Eastern Arctic Patrol. The district can also be reached by air. Sea ice is generally sufficiently thick by December to support large aircraft but the absence of daylight during the winter months renders landings quite hazardous. However, in emergencies such landings have been made. From April until mid June aircraft can land almost anywhere on the sea ice in the Admiralty Inlet district. The ice is relatively smooth, and except in sheltered bays the surface is firm. The ice usually clears from the inlets in late July or early August and float-equipped aircraft can be used during August and September.

Travel within the area during the winter is entirely by means of dog teams. This is possible from late October until mid July. Travel by small boats is confined to the months of August and September. Mechanical transport along the main inlets would probably be feasible during the winter owing to the hard snow surface developed by the wind.

Population

Admiralty Inlet district appears to have been inhabited by Eskimos for many years. Ancient dwellings, now tens of feet above sea-level, are found at many localities. Currently (1954) there are about two hundred natives trading into the Arctic Bay post. Six white persons at present live at the settlement, five being attached to the Department of Transport's meteorological station and the sixth being the manager of the Hudson's Bay Company post.

Climate

In general the climate of the Admiralty Inlet district is dry and cool. The following data are taken from Rae (1951). Between 1938 and 1950 the temperature extremes at Arctic Bay were

-48°F. and 62°F. The average annual precipitation over the same period was 5.91 inches, 2.44 inches being in the form of rain and 34.7 inches as snow. Snow fell during every month of the year; rain from May to September only. The average wind speed, 1938-50, was 5.6 miles per hour. The writer was informed that during the past summer (1954) a maximum temperature of 68°F. was recorded at Arctic Bay.

From the data given above, it would appear that the winds were light. However, in Admiralty Inlet winds of considerable force and duration are encountered. Visibility is generally good. Rae (1951) reported that on between 25 and 30 days a month the visibility exceeded 6 miles. Foggy weather may occur following break-up. Drifting snow frequently limits the visibility from the ground up for 100 feet, above which visibility may be unlimited.

Vegetation and Game

The land surface is quite barren except in sheltered valleys where there is a relatively prolific flora. The author collected several dozen varieties of wild flowers as well as various grasses in the vicinity of Arctic Bay. The flowers bloom from early June, when the purple saxifrage flowers in the first snow-free areas, until late in August. Mosses are also quite common and are abundant in some localities. Low willows, rarely exceeding 6 inches in height, are also found. A fuller description of the botany of the region is contained in Polunin (1948, pp. 64-83).

Caribou were formerly abundant but in 1954 the closest caribou were 1 day's travel by dog team south of Admiralty Inlet. This is an improvement over the recent past when it was necessary to travel 5 days south from the inlet to obtain these animals.

Seals are plentiful in most of the bays and inlets during much of the year. Walrus, narwhal, and white whales are obtained each year by the natives. Polar bears are also found but they are not numerous.

Snow geese are abundant during the summer months as are many varieties of non-game birds.

Among the other animals inhabiting the Admiralty Inlet district the white fox is probably the most important economically. Arctic char are abundant in certain rivers and are speared by the natives for food.

Topography

Admiralty Inlet district is part of a dissected plateau that includes much of northern Baffin Island. Spectacular cliffs of

multicoloured strata are developed in the relatively flat-lying sedimentary rocks that outcrop over much of the area. The west side of Admiralty Inlet, from Cape Crawford southward for 100 miles, is composed of castellated cliffs 1,200 to 1,800 feet in height. This coast is unbroken by inlets but the cliffs are separated into units by numerous valleys. The surface of the plateau, which has an elevation of about 1,800 feet, is relatively flat and monotonous and is strewn with angular rock fragments. In places this surface is reminiscent of the classic "felsenmeer" or rock desert. Poor drainage gives rise to many soft, wet patches of ground in which the soil approaches a gumbo in consistency.

Four small ice-fields cap the plateau west of Admiralty Inlet. The most southerly of these is in the latitude of Arctic Bay and is inland from the north end of Turner Cliffs. Two larger ice-caps are present on the high land east of Elwin Inlet and several small snowfields are found south of Adams Sound.

South of latitude 72°30' north, the elevation of the plateau decreases until at Kingarut Hill on the west side of the inlet it is at 850 feet. This hill and several others form mesas that rise several hundreds of feet above the surrounding land. The general elevation of the land increases gradually inland from the west coast of the inlet, until at a distance of about 10 miles, the general land level appears to merge with the mesas; presumably, the plateau was more intensely eroded near the coast giving rise to the flat-topped, table-like hills. A similar situation exists on the southeast side of Admiralty Inlet, for example at Tadlukotit Hills. Here the plateau is composed of Palaeozoic strata whereas the lowlands are Archaean gneisses. The south end of Admiralty Inlet, Bell Bay, and Berlinguet Inlet are reported to be surrounded by a low, featureless plain. A study of air photographs discloses the presence of many small lakes in this plain.

The northern part of the east coast of Admiralty Inlet, unlike the west side, is broken by many long sounds and inlets. As in the main inlet, these are margined by nearly vertical cliffs and there are few places where it is possible to reach the plateau from the sea. Soundings near these cliffs indicate depths of 300 fathoms in places; thus there is a vertical range of nearly 4,000 feet from the sea floor to the plateau surface.

The St. Georges Society Cliffs near Arctic Bay rise vertically from Adams Sound to a height of 850 feet, and at Eqalulik a river has cut a canyon 1,200 feet in depth, the walls of which are nearly vertical.

There are no large lakes in the district. The rivers carry a large volume of water during June, but by late July they have dropped in level and most can be forded on foot.

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GENERAL GEOLOGY

General Statement

Gently undulating clastic and chemically precipitated sedimentary rocks, in part fossiliferous, indicative of shallow to deep water deposition, volcanic flows, highly contorted gneisses, basic dyke rocks, and granitic and pegmatitic dyke rocks outcrop in the map-area. Traces of mineralized rock are widespread in certain parts of the district. With the exception of widespread block faulting and periods of gentle warping of the land surface, no orogenic deformation has taken place since Archaean time.

Table of Formations

Period	Group and approximate thickness (feet)	Formation and approximate thickness (feet)	Lithology
Quaternary			Silts, gravels, clays
Disconformity			
Late Ordovician or possibly in part older	Admiralty group + 2,580	Baillargé formation + 460	Limestone, fossiliferous
		Ship Point formation 920	Flaggy dolomite, fossiliferous
		Turner Cliffs formation ± 350	Sandstone, siltstone, mudstone, shale
		Gallery formation ± 600	Sandstone
Slight angular unconformity			
			Gabbro dykes
Intrusive contact			
Proterozoic and/or Early Cambrian	Uluksan group + 6,850	Elwin formation + 2,500	Sandstone, siltstone, shale
		Strathcona Sound formation ± 2,500	Mudstone, siltstone
		Victor Bay formation + 600	Dolomite, minor limestone, mudstone, edgewise conglomerate
		Society Cliffs formation + 900	Dolomite
		Arctic Bay formation + 350	Calcareous shale
Erosional disconformity ?			
Proterozoic and/or Early Cambrian	Eqalulik group + 5,500	Upper Quartzite + 4,000	Quartzite; minor shale
		Volcanic member ± 1,000	Andesite and basalt flows, tuff
		Lower Quartzite ± 50	Quartzite

Angular unconformity

Archaean			Biotite gneiss, granitic gneiss, biotite garnet gneiss; granitic and pegmatitic dyke rocks

Small, reportedly stagnant ice-caps are present in the northern part of the map-area but there is widespread evidence that formerly ice covered much of the area. Marine deposits above present sea-level indicate a recent emergence of the land.

Precambrian

Archaean

Gneissic rocks, presumed to be of Archaean age, outcrop at many localities in the map-area. Extensive outcrops are found on Steensby Peninsula and east of Moffet Inlet. Smaller outcrops are present along Adams Sound, where block faulting has raised the Archaean rocks at least 600 feet above sea-level, along the east coast of Admiralty Inlet between Eqalulik River and Cape Cunningham, and on the low coasts bordering Jungersen Bay. The Archaean rocks are unconformably overlain by the Eqalulik group. They include biotite gneiss, banded biotite and granitic gneiss, biotite garnet gneiss, biotite granite, and granitic and pegmatitic dyke rocks.

The biotite gneiss is composed of alternating bands of fine-grained biotite and coarser bands of quartz and feldspar usually in a ratio of 1:1. The bands average 1/4 inch in width. A thin section examination shows that biotite, oligoclase, and quartz are the main constituents of the rock. Garnet, carbonate, micropegmatite, chlorite, and pyrite are of minor importance.

Granitic gneiss results from an increase in the amount of quartz and feldspar in biotite gneiss, gradations from one to the other being common. The alternation of granitic gneiss and biotite gneiss gives rise to the broadly banded granitic and biotite gneiss.

Lenses of amphibolite are present in the granitic gneiss. These rarely exceed 2 feet in length and are composed mainly of hornblende.

The biotite garnet gneiss is a fine-grained, banded rock, composed of feldspar, biotite, and scattered reddish brown garnets. In thin section oligoclase, quartz, microcline, and perthite are seen to be the most abundant minerals present. Garnet and biotite are less abundant and a few grains of zircon are also present in each specimen.

Irregular masses of granite, rarely exceeding 100 feet in length, cut the gneissic rocks at some localities. This granite is an equigranular rock composed of crystals of pink feldspar, clear quartz, and biotite, averaging 1 mm. in diameter.

Vein-like lenses of granite ramifying from these masses show crosscutting relationships to the gneisses and are also present along the planes of gneissosity.

Pegmatite dykes are seen in numerous places on the Archaean terrain. They are composed of reddish feldspar and quartz, minor amounts of biotite, and rarely red garnet. These dykes have considerable lateral extent, commonly in excess of 1,000 feet, but rarely exceed 10 feet in width. The Archaean rocks are highly folded and vertical dips are common.

Proterozoic and/or Early Cambrian

Eqalulik Group

Sandstone cliffs, towering above dark, close-grained rocks along the shores of Adams Sound were reported by English (Bernier, 1911, p. 152). Mathiassen (1933, pp. 35-43) mentions numerous outcrops of non-fossiliferous red sandstones in the Admiralty Inlet district, and in the delta of Eqalulik River he noted the presence of basaltic and amygdaloidal rocks in addition to sandstone.

These sedimentary and volcanic rocks constitute a group that the author has called the Eqalulik group. Outcrops of this group extend from Nauyat Cliff north to an imaginary line running southeast from King George V Mountain. The group includes three members, lower and upper quartzite members, and a volcanic member.

Lower Quartzite

The lower member is a buff-coloured massive quartzite with a thickness varying from nearly 100 feet at Nauyat Cliff to 10 feet along Adams Sound. For purposes of mapping the member is included with the volcanic member.

Volcanic Member

The lower quartzite is overlain with apparent conformity by the Eqalulik volcanic rocks. This member is composed of relatively unaltered basaltic flows with well-formed pillow structure, massive basaltic rocks, amygdaloidal basalts, andesites, and thin tuffaceous beds. The volcanic member is about 1,000 feet thick

and is overlain with apparent conformity by the upper quartzite. A microscopic examination of the plagioclase in Eqalulik group volcanic rocks indicates that both andesites and basalts are included in the group. In the coarse-grained rocks of this group, plagioclase and pyroxene, the predominant minerals, form a doleritic to sub-doleritic texture. Vein-like masses of magnetite and red iron oxides are found in small amounts. Most of the volcanic rocks contain less than 1 per cent quartz. Many are considerably altered, carbonate, chlorite, and white mica being the main products. Siliceous tuffaceous bands have been extensively replaced by carbonate. Amygdules in certain basalts were found to contain carbonate, stilbite, or both of these minerals.

Northeast of Peter Richards Islands interbedded sedimentary and volcanic rocks mark the change from the thick volcanic sequence to the upper quartzite, although along Adams Sound only the thick volcanic member is present.

The division between the volcanic member and the upper quartzite member is arbitrarily placed at the top of the thick volcanic succession. The effusive rocks at the base of the upper quartzite member are composed of massive basalt, amygdaloidal volcanic rocks, medium-grained basic rocks that may be sills but are more probably the centres of slowly cooled flows, tuffs, and pillowed flows of basalt.

Upper Quartzite

The upper Eqalulik member is essentially a uniform succession of pure quartzites. Conglomerate beds are not common in the succession but where present are composed mainly of pebbles of quartzite cemented by silica. Near the top of the succession, beds of argillaceous quartzite are present.

Variations in colour, white to deep red, and in degree of induration exist throughout the succession. Crossbedding is common and grain gradation is frequent. Ripple-marks are encountered in places. The upper quartzite member forms immense castellated cliffs, in places rising 1,000 feet from the sea. Thin section study of these quartzites shows that they are essentially composed of silica-cemented sub-rounded grains of quartz averaging 0.2 mm. in diameter, with a few rounded biotite and zircon grains and flakes of biotite. Red iron oxides stain the cement in many sections and in places magnetite also occurs along the grain boundaries.

The Eqalulik quartzites appear to be first cycle quartzites probably resulting from the intense chemical weathering of the Archaean rocks. All but the most resistant minerals in the Archaean formations were destroyed before deposition of the Eqalulik quartzites.

Along the lower reaches of the large river on the south coast of Adams Sound, opposite Johnson Harbour, a lateral facies variation is present in the quartzite. The rock changes from buff-coloured quartzite to finely laminated rocks composed of narrow bands of purple shale 3 inches or less in thickness, bands of chloritic shale of comparable thickness, chlorite-bearing quartzite, and relatively pure quartzite. This assemblage continues to the shore of Adams Sound and extends easterly along the sound for about 6 miles. To the west the lithology changes to interbedded red shale and buff quartzites and within 2 miles to typical buff-coloured quartzite. The quartzites are less perfectly sorted where the interbeds of shale are encountered, the grain size varying from 0.2 to 0.5 mm. Up to 5 per cent biotite and chlorite are present in the quartzite units. The texture and composition suggest that the rocks in this area are a near-shore facies of the Eqalulik quartzite.

A considerable amount of block faulting has taken place in the Eqalulik group with vertical displacements apparently exceeding 3,000 feet. Prominent fault blocks are present along Adams Sound where Archaean gneisses have been elevated 600 feet above sea-level. The dip in the Eqalulik group does not exceed 20 degrees and is generally less than 10 degrees. A gentle warping characterizes the strata but much of this may be an effect of the faulting. The strike is northwest and the dip is generally north in both sedimentary and volcanic rocks.

The Eqalulik group unconformably overlies the Archaean gneisses and is overlain, possibly disconformably, by the Uluksan group of Late Proterozoic and/or Early Cambrian age. The writer considers the Eqalulik group to be Proterozoic in age.

The only place near Admiralty Inlet where detailed geological studies have been made is Dundas Harbour, Devon Island (Kurtz et al., 1952, pp. 636-655). No group of rocks similar to the Eqalulik group was found there and fossiliferous Lower Cambrian strata unconformably overlie a Precambrian complex of pinkish grey, coarse-grained granites, garnetiferous gneisses, and dull red, thinly banded, gneissoid quartzites (op. cit., pp. 639, 652).

Rocks similar to the Eqalulik group were reported by Parry (1824) (See Mathiassen, 1933, p. 32) in the vicinity of Fury and Hecla Strait. These may be a southern outlier of Proterozoic sedimentary rocks similar to the Eqalulik group.

The Etah and Thule formations in northern Greenland are similar in some respects to the Eqalulik group (Koch, 1929, pp. 15-17). These formations comprise sandstone and limestone strata. Both formations were intruded by sills and dykes of diabase.

Uluksan Group

This group, named for the type locality on Uluksan Peninsula west of Arctic Bay, is composed of five sedimentary units, the Arctic Bay, Society Cliffs, Victor Bay, Strathcona Sound, and Elwin formations. Shallow dips to the north-northwest characterize the group. This regional dip is modified by broad flexures with axes trending north or north-northeast, which are responsible for the appearance and disappearance of the various formations of the group as one proceeds from west to east.

The Uluksan group exceeds 6,850 feet in thickness. Stratigraphic section No. 1 (See Figure 2, Section 1), based on work by R. R. H. Lemon, and found in the back pocket of this report, illustrates the details of the lithology of the group.

Arctic Bay Formation

This formation is composed of black fissile shale, and is commonly pyritiferous and contains rusty weathering concretions, bands, and nodules. It is named from the type locality at the settlement of Arctic Bay, to the east of which it outcrops extensively. It is about 350 feet thick, although variations occur, and is unfossiliferous. The contact of this formation with the underlying Eqalulik group was not seen.

Society Cliffs Formation

The name of this formation is derived from the spectacular cliffs at the entrance to Arctic Bay.

Twenty feet of black argillaceous dolomite marks the base of the Society Cliffs formation, the remainder being composed of vaguely bedded to massive, medium- to coarse-grained, grey or pale grey dolomite. The formation is 900 feet thick and conformably overlies the Arctic Bay shale. It is mainly exposed at St. Georges Society Cliffs, on the south side of Strathcona Sound, and at the head of Adams Sound. It is unfossiliferous.

Victor Bay Formation

A varied series of dark to pale grey, medium- to coarse-grained dolomites, often with flecks of chert and edgewise conglomerate, conformably overlies the Society Cliffs dolomite. This has been called the Victor Bay formation. Interbedded with the dolomite are minor amounts of dark grey limestone and black, fine-grained, brittle mudstones. The top of the formation is marked by coarse, breccia-like dolomite conglomerates, and by silty flagstones and mudstones that are transitional to the succeeding formation.

The formation is exposed at the head of Victor Bay, on Uluksan Peninsula, east of King George V Mountain, and at English Bay. It is 600 feet thick, is unfossiliferous, and in structure is comparable to other members of the Uluksan group.

Strathcona Sound Formation

A monotonous succession of fine-grained, laminated, dark grey to green or red mudstones and siltstones outcrops along both sides of Strathcona Sound. The upper boundary of this formation cannot, at present, be delineated, and it is probable that the contact is gradational.

Elwin Formation

This formation is best exposed along Elwin Inlet and elsewhere in the northeastern part of the map-area. The contact between the Strathcona Sound formation and the Elwin formation has not been defined but it is fairly certain that the contact is conformable. The Elwin formation has not been subdivided into lithologic units and further field work may show that it embraces more than one formation.

The succession is characterized by a rapid alternation of reddish or bright orange weathering sandstones and red weathering siltstones and shales. The sandstones are commonly 200 feet thick, and alternating with these are irregularly bedded micaceous siltstones and shales of comparable thickness. The entire succession presents a distinctive banded appearance.

The formation appears to be more than 2,500 feet thick and together with the Strathcona Sound formation forms a conformable succession possibly exceeding 5,000 or 6,000 feet in thickness.

Low angles of dip, never exceeding 10 degrees, characterize the formation, although in a small monocline 1/2 mile southwest of Ship Point dips locally increase to 20 degrees.

Gabbro Dykes

A belt of anastomosing basic dykes, outcropping mainly on the peninsula between Strathcona Sound and Adams Sound, cuts all formations so far described. The belt extends more than 100 miles to the east-southeast from Admiralty Inlet, but only one dyke has been found on the west side of the inlet. The general trend of the dykes is west-northwest, but all dykes locally diverge from this direction. The dip of most is vertical. The long point at the entrance to Arctic Bay and the dangerous reef in Victor Bay are formed by basic dykes. The intrusions vary from 10 feet to more than 400

feet in width. Many individual dykes have considerable lateral extent; one was traced by the writer for 50 miles. In general, the dykes are resistant to erosion and project hundreds of feet above the invaded sedimentary rocks.

The megascopic appearance of the dykes varies with the width of the intrusion. The narrower dykes show little contact metamorphism and are uniformly fine grained. These rocks are basaltic in texture and little can be determined in the hand specimen.

The wider intrusions in part exhibit definite contact effects. In places where the gabbro intruded the Society Cliffs dolomite, the dolomite for 20 feet on each side of the dyke has been altered to white crystalline limestone. In places magnetite is associated with this alteration. Pyrite is not uncommonly present in shales near the contact of these larger dykes. An outstanding example of this is mentioned by Bernier (1911, p. 148). For the most part contact effects are remarkably few in view of the abundance and size of the intrusive rocks. A microscopic examination of the dykes shows that where least altered the rock consists of andesine or labradorite and clinopyroxene with minor amounts of magnetite, biotite, apatite, and sphene. Alteration of the clinopyroxene to hornblende and biotite has occurred in many of the rocks. The most common texture is sub-doleritic. On the basis of composition of plagioclase, these dyke rocks are diorite and gabbro.

Within an individual dyke marked variations may exist. A definite change in grain size is observed as the centre of a large intrusion is approached. At the contact the rock is too fine grained for the mineral content to be determined. Within a few inches of the contact, feldspar and pyroxene can be distinguished, forming an equigranular texture. The grain size increases until, at the centre of the largest intrusion, phenocrysts of pyroxene a foot or more in length are present. The coarse-grained rocks are mostly deeply weathered and crumble to a coarse sand. At latitude 72°55' north, longitude 84°25' west, the result of considerable differentiation was observed in a dyke. The margins of the intrusion are typical grey-green, medium-grained gabbro but at the centre of the dyke is a zone of siliceous "red-rock" 100 feet in width. The mineralogical composition of this differentiate is 65 per cent quartz and 15 per cent albite with lesser amounts of chlorite, biotite, carbonate, apatite, and sphene. A lesser degree of differentiation has taken place in other dykes. In the dyke near mineral locality B, east of Arctic Bay, a change in the mineralogical composition takes place 250 feet from the southwest margin. There the rock, classified as a quartz gabbro, contains over 10 per cent quartz, 50 per cent mafic minerals, and minor amounts of magnetite, apatite, pyrite, sphene, and carbonate. Extensive alteration of clinopyroxene has resulted in the formation of hornblende and biotite. Changes in texture from equigranular to sub-doleritic occur in many places in this dyke. At the contacts the rock is a very fine-grained, almost glassy basalt. The maximum mineral grain size is 2.0 mm.

The presence of patches of metallic minerals in some of the dykes is treated more fully in the section on Economic Geology.

The dykes are well jointed, one set being parallel with the strike of the dyke and the other perpendicular to this direction.

The source of the magma that formed these dykes is unknown. They cut all formations of the Eqalulik group and, therefore, cannot be connected with its volcanic formation.

The unconformity between the Uluksan group and the overlying Admiralty group is easily recognized when these dykes are present. An example is seen near Arctic Bay where a dyke, traversing the Society Cliffs formation, passes under red sandstones of the Admiralty group capping King George V Mountain and reappears southeast of the mountain cutting Eqalulik quartzite. Several small basaltic dykes were observed in Archaean gneisses south of latitude 72°30' north. The strike of these dykes is more easterly than that of the main group of intrusions and the dykes may be related to the Eqalulik volcanic member and not a part of the main group. A small basaltic dyke on Saneruarsuk Island is a multiple intrusion and carries minor amounts of chalcopyrite.

Narrow basic dykes, striking northwest, cut the Strathcona formation north of Strathcona Sound. The relationship between these dykes and the larger west-northwest striking gabbro intrusives is unknown but they are of comparable age.

Late Ordovician, Possibly in Part Older

Admiralty Group

The name of the most prominent feature in the map-area is given to this, the youngest group of consolidated rocks in the district. The group consists of a series of flat-lying or gently inclined sediments with a regional dip towards the north-northwest. The group outcrops along the west coast of Admiralty Inlet for at least 100 miles and on the east coast from Adams Sound north to the limits of investigation. The group is at least 2,580 feet thick and carries a sparse Richmond fauna in the upper formations. It is composed of four units; the Gallery, Turner Cliffs, Ship Point, and Baillargé formations.

Detailed stratigraphic sections, prepared by R. R. H. Lemon, will be found in the back pocket of this report (See Figure 2, Sections 3-9).

Gallery Formation

This formation is named for the type locality, a remarkable series of cliffs on the west coast of Admiralty Inlet some 100 miles south of Cape Crawford.

This basal member of the Admiralty group is composed of thick, fine- to coarse-grained, dark red, purple, pale grey, or white sandstones. Large cross-laminated structures are common and indicate deposition from torrential currents.

The Gallery formation in outcrop gives rise to steep cliffs and spectacular stacks and pinnacles have resulted from differential erosion along joint planes.

The contact between the Uluksan and Admiralty groups is marked by an erosional unconformity and the Gallery formation varies in thickness in conformity with the undulating relief of the old land surface below the unconformity.

Indeterminate markings, which if organic may represent worm borings, are found in this formation.

The thickness of the Gallery formation varies from 400 to 800 feet. The formation is overlain conformably by the Turner Cliffs formation. The Gallery formation is not seen in outcrop at Yellow Valley and a possible explanation for this is shown in Figure 1. Progressively younger formations are seen to overlap the older ones south from the Gallery until, in the southern part of the Admiralty Inlet district, limestone carrying a Richmond fauna is found overlying the Archaean gneisses. Thus there is evidence of progressively widespread marine transgression during early Palaeozoic time in northwestern Baffin Island.

Turner Cliffs Formation

A succession of alternating sandstones, siltstones, mudstones, and shales overlies the Gallery formation and is typically exposed in the Turner Cliffs due west of Adams Sound on the west coast of Admiralty Inlet. The alternations are extremely regular and single sandstone bands, perhaps 10-15 feet thick, may be traced 20 miles without difficulty. It has, therefore, been possible to subdivide the Turner Cliffs formation into three members, the Upper and Lower sandstone members and, separating these, the shale member. The cross-sections along the west coast of Admiralty Inlet, figured on the map, illustrate the relationships of these members.

The Turner Cliffs formation is from 300 to 400 feet thick and is conformably overlain by the Ship Point formation.

Bedding surfaces are commonly ripple-marked and mudcracks and worm trains are abundant. This suggests shallow water deposition. A fossil from an outcrop of Turner Cliffs formation shale at Yellow Valley was identified by G. W. Sinclair of the Geological Survey of Canada as Lingula sp. cf. L. divulgata Sinclair.

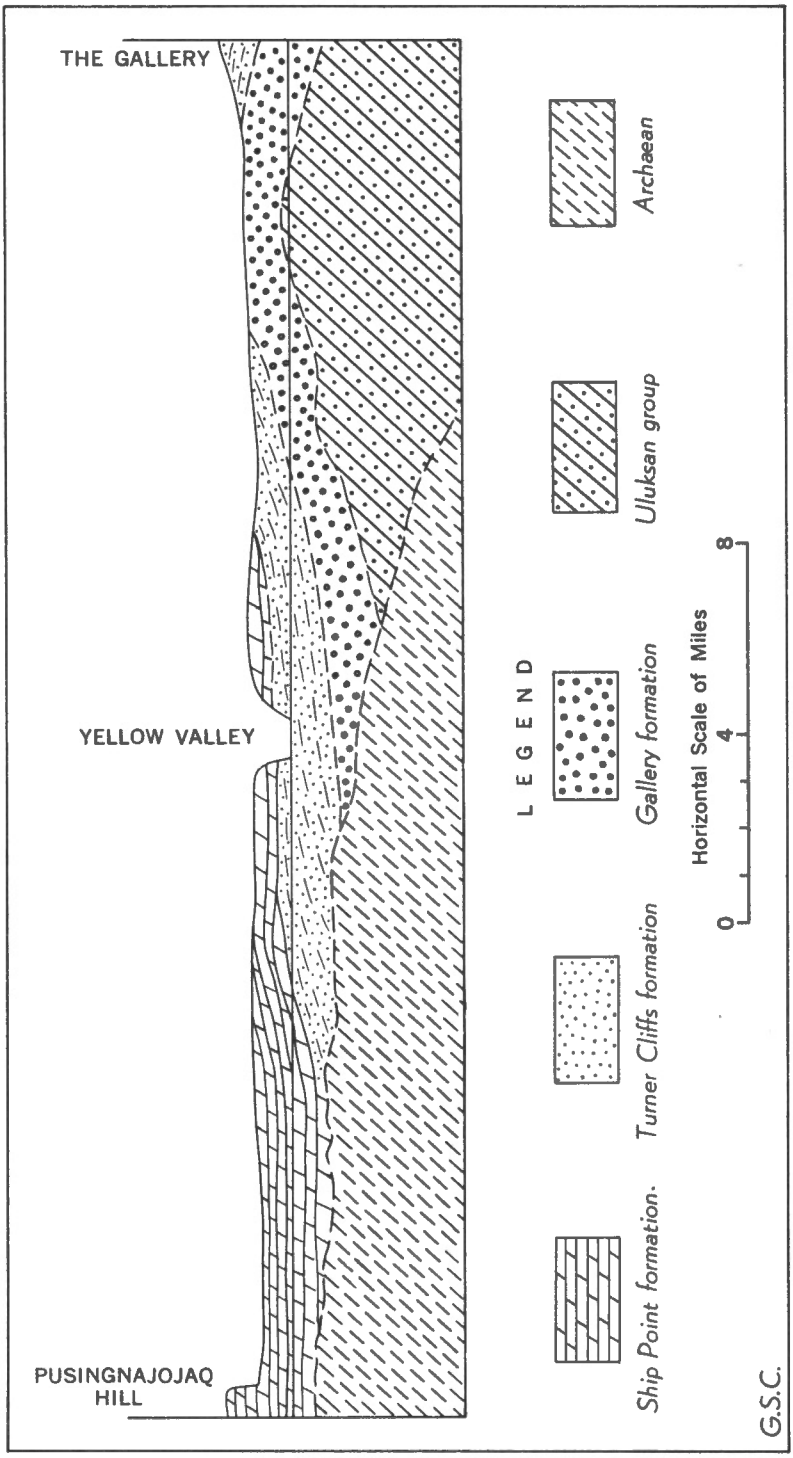

Figure 1. Diagrammatic section "The Gallery" - Pusingnajojaq Hill showing possible explanation for disappearance of lower Admiralty group strata proceeding south from the Gallery.

Ship Point Formation

This formation is named from the very prominent headland at the south entrance to Baillargé Bay. It is composed of grey, grey-brown, or pale brown dolomite that is commonly silty. Cliffs in this dolomite formation are generally very steep and incipient gullying in many places causes the development of a characteristic, 'castellated' appearance with isolated buttresses and pinnacles.

Nautilus Mountain (Teichert, 1937, pp. 29, 41) is composed of Ship Point dolomite with some Baillargé limestone on top.

A detailed stratigraphic section near the north cape of Baillargé Bay showed the Ship Point formation to be 920 feet thick.

Fossils from the formation identified by G. W. Sinclair are:

Maclurites sp.
Metaspyroceras sp.
Zitteloceras sp. ?
Bathyurus sp.
Anisochilina sp.
Lophospira, high-spired sp.
Liospira sp.
worm ? borings

Fossiliferous sedimentary rocks, as mentioned above, are found overlying Archaean rocks in the southern part of the map-area. At Pusingnajojaq Hill the following fossils, identified by G. W. Sinclair, were collected from rocks that may be part of the Ship Point formation:

Endoceras sp.
Maclurites triangularis Teichert
Halysites gracilis Hall
Receptaculites cf. arcticus Etheridge
Umbospira sp.

The Ship Point formation is overlain conformably by the Baillargé Bay formation.

Baillargé Bay Formation

This formation is named from exposures near Baillargé Bay on the east coast of Admiralty Inlet. It is composed of blue-grey, fine-grained, vaguely bedded limestone. It is the youngest formation in the area examined and its total thickness, though unknown, exceeds 460 feet. At a height of 320 feet above the base of this formation is a 30-foot bed of gypsum that appears to have considerable lateral extent.

Outcrops of Baillargé Bay formation limestone are found on either side of Baillargé Bay and on the west side of Admiralty Inlet as far south as a point opposite Cape Strathcona.

Fossils from the formation, identified by G. W. Sinclair, are:

Halysites gracilis Hall
Echinoderm fragments
Receptaculites cf. arcticus Etheridge
Maclurites cf. manitobensis Whiteaves

The faunas present in the Admiralty Inlet district are too sparse and poorly preserved to permit detailed correlation with other localities. However, G. W. Sinclair reports that those species that can be determined suggest an Upper Ordovician age and that those that cannot be determined do not have affinities that would contradict considering them to be Upper Ordovician in age.

Detailed stratigraphic studies made at Dundas Harbour by Kurtz, McNair, and Wales in 1952 disclosed the presence of sedimentary formations ranging in age from Lower Cambrian to Middle or possibly early Upper Ordovician. The oldest formation, the Rabbit Point, composed of 86 feet of sandstone with Olenellus and linguloid brachiopods, rests unconformably on Precambrian rocks. The remaining formations are essentially limestones or dolomites with minor amounts of calcareous sandstone and shale. Thin, flat, pebble conglomerates and clastic zones, indicative of shallower water deposition, characterize the two Cambrian formations that overlie the Rabbit Point sandstone. The total thickness of the post Precambrian succession exceeds 3,660 feet. It is possible that the Ship Point and Baillargé formations at Admiralty Inlet are equivalent to the Nadlo Point (Lower Ordovician) and Crocker Bay (Middle or Upper Ordovician) formations at Dundas Harbour, but whether any part of the Admiralty group is equivalent to the Cambrian formations on Devon Island is a question that cannot be answered, in view of the absence of fossils in the lower formations of the Admiralty group.

The great thickness of sedimentary rocks, exceeding 12,500 feet, included in the Eqalulik and Uluksan groups does not appear to be equivalent to any of the formations present at Dundas Harbour, but may, in part, be comparable to the Etah (1,200 feet thick) and Thule (3,000 feet thick) groups of Greenland (Teichert, 1939, p. 109), although lithologically they are more variable than the Greenland groups and are much thicker.

Quaternary

Glacial Deposits

Small ice-caps, similar to but more active than those found at present, probably developed following the retreat of the postulated continental ice-sheet. Thus in many parts of the map-area the surficial deposits have in all probability been reworked many times. Where soil is present it consists of clay and angular rock fragments. Most of the fragments are from the adjacent country rock.

Glacial striae are rare due to the nature of much of the bedrock, which weathers rapidly, but west-trending striae were observed on several of the Igludjat Islands.

Erratic boulders are not common but in places gneissic fragments are found on the Proterozoic terrain and boulders of sedimentary rock on Archaean areas.

Marine Deposits, Land Submergence and Emergence

Raised beaches are found in places but are not abundant, the highest level observed being 420 feet above sea-level. Marine shells were found at 260 feet above sea-level and skeletons of large whales were seen 110 feet above sea-level at Pusingnajojaq Hill. At present narwhals and white whales are driven into the shallow bay at the base of Pusingnajojaq Hill and there killed by the Eskimos, and the skeletons found are probably the remains of animals killed in a similar manner. It does not appear probable that they were carried far from shore and thus it would appear that the land has emerged at least 110 feet in the historic past.

Perched boulders were observed at an elevation of 430 feet on Yeoman Island, thus suggesting an upper limit to the amount of submergence in the recent past. These figures are lower than those of Mathiassen who reported marine deposits at 754 feet above sea-level on Tadlukotit Hills (1933, p. 96).

Patterned Ground

Patterned ground is not extensively developed in the district but in some places on the plateau surface patches of polygonal patterned ground are present. These polygons are several feet in diameter and appear to be composed of unsorted material. In general, however, the land surface is either bedrock or is strewn with angular rock fragments.

STRUCTURAL GEOLOGY

In the Admiralty Inlet district all strata younger than the Archaean have been only slightly folded. The Archaean gneisses are highly contorted, with fold axes trending west to northwest and with the direction of dip varying from horizontal to vertical. Broad open folds with northeast trending axes several miles apart characterize the Eqalulik group. The strata nowhere dip more than 25 degrees and in places are horizontal for several miles. Similar open folds, pitching gently to the north, are present in the Uluksan and Admiralty groups, but dips rarely exceed 10 degrees.

Block faulting is the dominant structural feature of the Admiralty Inlet area. At least two periods of faulting are discernible, one before the intrusion of the gabbro dykes and one after. The effect of the pre-gabbro dyke faults is particularly well illustrated in places along Adams Sound where Archaean gneisses are now exposed 1,000 feet above sea-level adjacent to blocks in which only the lower Uluksan group rocks are present. The apparent vertical displacement along these faults exceeds 2,000 feet. Where the diabase dykes have been offset, as for example, east of Arctic Bay, a post Uluksan age is indicated. Ordovician strata north of Elwin Inlet have also been affected by block faulting implying that crustal readjustment continued during Lower Palaeozoic time.

Prominent west-northwest trending linears are seen in the Archaean gneisses. This direction is also the trend of the main inlets on the east side of Admiralty Inlet and is the strike direction of the gabbro intrusive rocks.

Field relationships indicate that the Eqalulik group rocks were deposited on the eroded surface of folded Archaean gneisses. The Uluksan group was in part probably derived from the older Eqalulik group and was deposited, possibly disconformably, on it. Deposition of the Uluksan group sedimentary rocks appears to have been in restricted basins, because, as will be seen from the accompanying map and sections, it is completely absent in many places and the Admiralty group overlies the Eqalulik group with slight unconformity although, in general, an erosional unconformity separates the Admiralty and Uluksan groups.

From field relationships it appears that intense deformation occurred following the formation of the Archaean rocks, and that gentle folding followed the deposition of the Eqalulik, Uluksan, and Admiralty groups.

Thus it would appear that during the late Precambrian and early Palaeozoic, northwestern Baffin Island was covered by relatively shallow seas, in which conditions of deposition changed from time to time, and that periods of erosion accompanied uplift. Not since early Precambrian times, however, has it been the site of an orogenic belt.

ECONOMIC GEOLOGY

The economic possibilities of the Arctic Bay district have attracted considerable interest from time to time during the past 45 years (Robinson, 1944, p. 70). The reported discovery of gold, silver, platinum, copper, lead, iron, nickel, and antimony by A. English, prospector of the Canadian Government Expedition of 1910-11, was the basis for this interest (Bernier, 1911, pp. 145-147). In many cases the occurrences appear to have been reported without regard for the size of the deposit and assay results were given greater prominence than was justified.

Great difficulty was experience in locating many of the mineral deposits mentioned in the narrative part of Bernier's report. In some cases this was due to the generalized locations given in the earlier accounts, in others only trace amounts of the reported mineral were found.

The writer has divided the mineral occurrences of the district into two groups; firstly, those associated with the gabbroic dykes, and secondly, those with no visible connection with these intrusions.

Group 1

In this group is included most of the reported platinum, nickel, iron, copper, and gold mineralization.

Platinum. No indication of this element was found. (In specimens analysed spectrographically.)

Nickel. Only faint traces of this element were determined in a specimen from the so-called nickel deposits. (See first spectrographic analysis that follows.)

Iron. (Magnetite); stringers of this mineral form a stock-work pattern in dolomite on the south contact of the large gabbro dyke that cuts the Society dolomite, just west of the entrance to Arctic Bay, mineral locality A. This occurrence is limited to a width of 10 feet and was traced for less than 100 feet along the dolomite-gabbro contact. A deposit of magnetite, reported by Bernier (1911, p. 155) between Victor and Arctic Bays was not observed although many trips were made over the area mentioned.

(Hematite); small pods of hematite, rarely exceeding 2 inches in longest dimension, are present in the Society Cliffs formation dolomite, in proximity to the gabbro dykes. This material, known to the Eskimos as "material for making paint", has for many years been used by them

for this purpose. The reddish surface stain that is characteristic of Society Cliffs formation dolomite is derived in part from these pockets. Several larger masses of hematite deposited in the dolomite between Arctic Bay and Victor Bay have been mined out.

Quartz crystals with a length of several inches and stained with hematite occur in vugs in the Society Cliffs formation dolomite. These vugs are most abundant in the vicinity of the basic dyke that cuts the lower strata on King George V Mountain. A few cobbles of black hematite were found on the south side of Strathcona Sound at an elevation of 1,000 feet. The source of these was not seen and whether they are related to the intrusive rocks, or whether they are part of a sedimentary deposit, is unknown.

Copper. Chalcopyrite is the only primary copper mineral present and malachite and azurite are associated with it in many places. Chalcopyrite is widely disseminated in the Eqalulik group quartzites and the Society Cliffs formation dolomites but never in more than trace amounts. Bernier and English, in private conversation many years ago, mentioned an important copper discovery 4 miles east of Arctic Bay. This is possibly mineral locality B. There a zone of dolomite adjacent to a gabbro dyke has been mineralized over a width of 20 feet and for an unknown length. Chalcopyrite is the main metallic mineral present and is disseminated through the dolomite on the northeast side of the dyke.

Malachite forms a surface stain on Eqalulik group quartzite along the narrow point at the eastern entrance to Arctic Bay. The mineralized quartzite is a lens in a gabbro dyke and has been stained along a length of 1 mile.

Chalcopyrite is present in small amounts in many of the gabbro intrusions. On the surface this mineral has been altered, in places, to hydrous copper minerals that tend to give a false impression of the relative importance of the copper minerals in the dyke. Trace amounts of chalcopyrite are associated with a basaltic dyke on Saneruarsuk Island. Small but concentrated pockets of chalcopyrite and pyrrhotite occur in the gabbro dyke that intersects the lower strata on King George V Mountain and forms the south and west margins of Victor Bay. These pockets rarely are greater than 1 cubic foot in volume.

A spectrographic analysis by W. F. White of the Geological Survey of Canada of a specimen of mineralized gabbro from mineral locality C gave the following results:

Element concentration

Major	Si
Minor	Na, Fe, Ca, Al, Mg
Strong trace	Ti
Trace	Mn, V, Ba
Faint trace	Ni, Cu, Co, Zr, Sc, Sr, Cr

Group 2

The only deposit falling into this group is, from the economic aspect, the most interesting in the region.

A zone, composed of pyrite and minor amounts of galena and sphalerite, with a maximum width of 500 feet and traceable for 2 miles, outcrops on the south side of Strathcona Sound (mineral locality D). This zone is exposed on the margin of the plateau lying between Adams Sound and Strathcona Sound. At this locality the country rock is Society Cliffs formation dolomite, the nearest large basic intrusive being 3 miles away. The surface is partly drift covered and partly covered with angular fragments of dolomite. The mineralized zone has been deeply weathered at the surface and consists of 6 inches of gossan followed by grey pyrite sand to a depth of 2 feet. Below that depth the zone is mainly massive pyrite. It was not possible to determine how many veins are included in the zone. At point D-3, one vein is at least 125 feet wide consisting of solid pyrite. At point D-1, solid pyrite is exposed across a width of more than 50 feet. Galena and sphalerite occur with the pyrite at localities D-2 and D-3.

A spectrographic analysis, made by W. F. White, on a specimen from mineral locality D-3, gave the following results:

Element concentration

Major	Fe
Minor	-
Strong trace	Zn, Pb, Al, Ca, Si
Trace	Mg
Faint trace	Mn, V, Cu, Ag, Ba

The depth to which the mineralized zone extends could not be determined. However, east of locality D-1, a large lens of pyrite was seen in a cliff face. This was 7 feet in width and not more than 50 feet in depth. From this evidence the writer is inclined to believe that the large deposit may not extend to any great depth.

The Strathcona deposit was discovered by A. English, 1910-11, who stated in private conversation that four veins outcrop in a deep ravine 400 feet above sea-level. These veins, he stated, were exposed across a width of 300 feet and measured 38 feet, 11 feet,

7 feet, and 2 feet in width. The writer was unable to find a ravine corresponding to this description. The deposit was prospected in 1937 by Tibbitt and McInnes and several shallow trenches testify to their activity.

The source of the specimens of native silver and argentiferous breithauptite collected by Bernier's party could not be found. This material appears to have been collected from the drift, or from a talus slope 5 miles north and 4 miles west of English Bay. No trace of this mineralization was found in the general area indicated and if present in places, it is probably only in minute amounts.