GEOLOGICAL RECONNAISSANCE

SOUTHAMPTON, COATS AND MANSEL ISLANDS

AUGUST, 1963

for

SOGEPET LIMITED

by

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GEOLOGICAL RECONNAISSANCE

SOUTHAMPTON, COATS AND MANSEL ISLANDS

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This report is written by R. D. Johnson as a formal presentation of the findings of the party. A separate report is being prepared by Dr. Nelson covering the paleontological aspects of the work.

PART I

PURPOSE

In the present investigation by Sogepet Limited of the petroleum potential of the Hudson Bay Lowlands with particular reference to the Cape Tatnam area of Manitoba, it became apparent that the Lowlands are probably the southwestern area of a basin (or basins) whose centre is further eastward under the waters of Hudson Bay. Knowledge of this flank is provided by the literature and by surface litho-logical data collected along the Churchill and Nelson rivers and by airborne magnetometer work along the coast between Churchill and the Manitoba-Ontario boundary. Considerable published data is available regarding the James Bay Lowlands. However, this data has not been overly stressed because of this author's contention that the James Bay basin while related, is probably differentiated from and secondary to, a greater Hudson Bay basin.

Reliable stratigraphic data for the Paleozoic area between the Nelson River and Cape Henrietta Maria is very scarce. A canoe traverse was made through the Paleozoic area cut by the Severn River in order to provide stratigraphic data bracketing the Cape Tatnam area between the Nelson and Severn rivers. This traverse is reported upon separately.

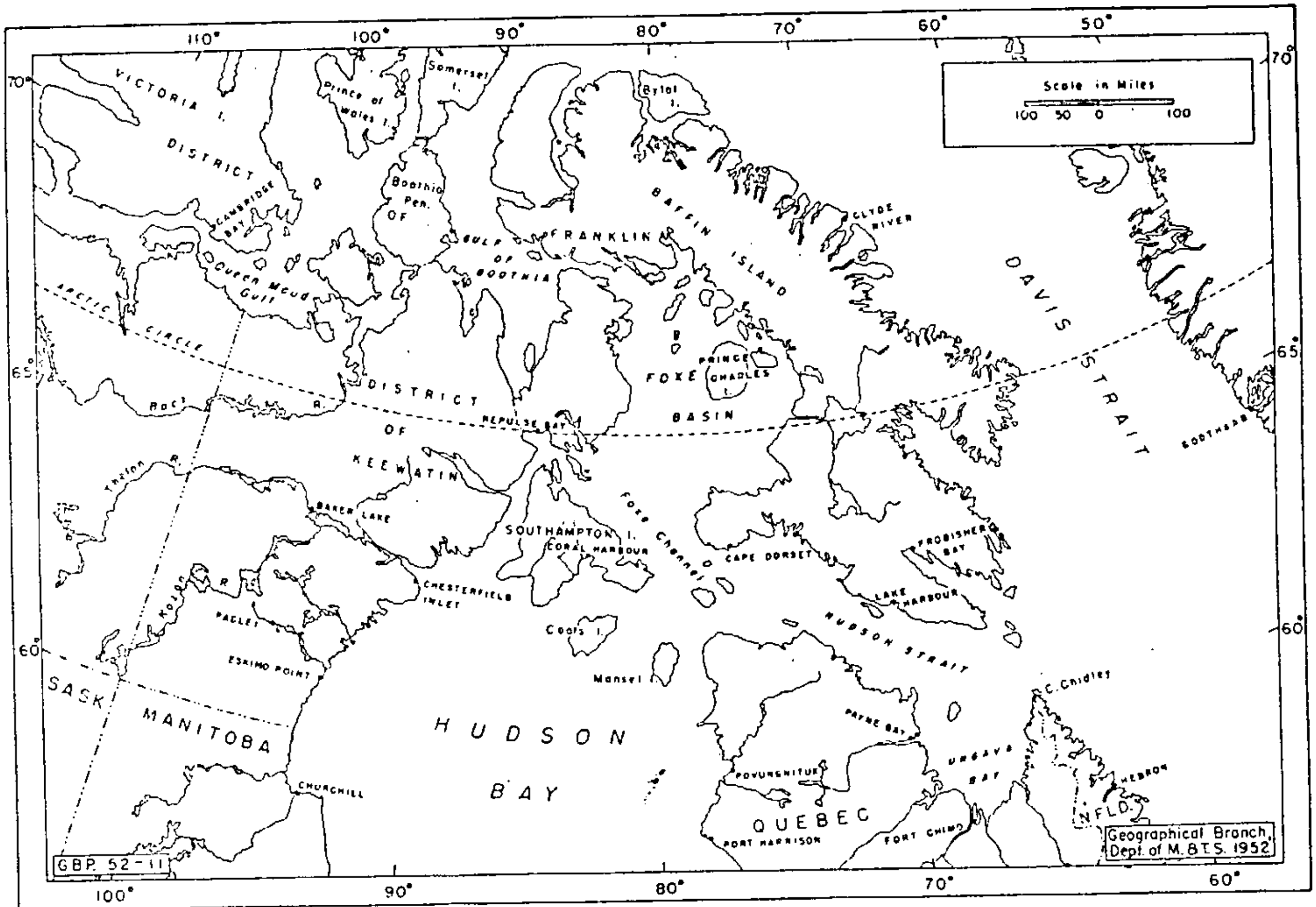


Figure 1. Index Map*

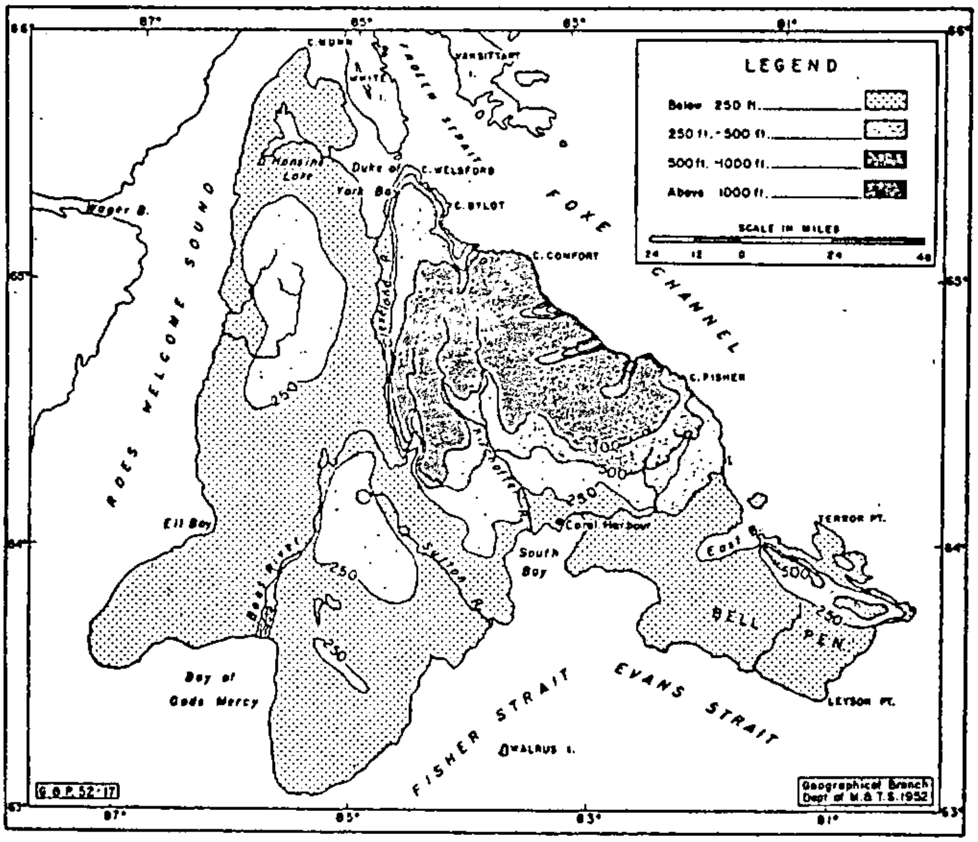


Figure 2. Southampton Island - Generalized Relief *

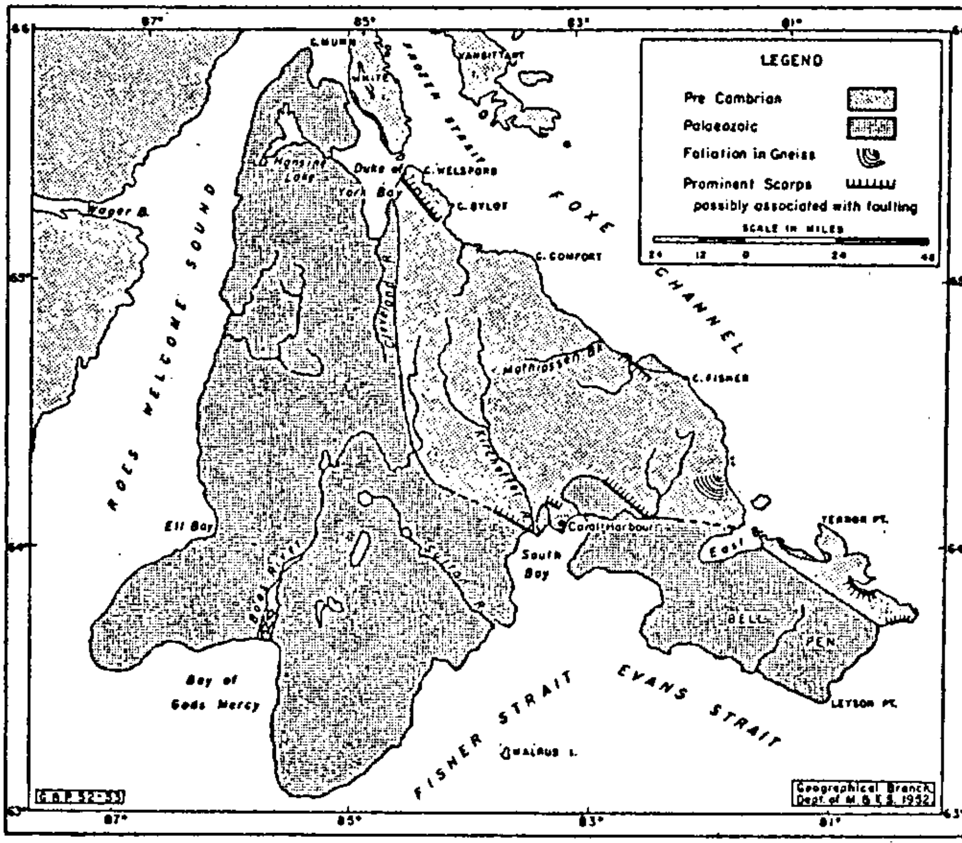


Figure 3. Southampton Island - Generalized Geology*

* After Savage and Van Tuyl (1919)

With such little information available along the southwest flank of the basin, it was desirable to gather what data might be readily available from other areas. The only other known location of Paleozoic rocks in the Hudson Bay area is Southampton, Coats and Mansel islands. These islands, which presumably represent the northern flank of the Hudson Bay basin, are largely unmapped geologically, with the sedimentary areas generally shown as "Paleozoic Undivided" on government maps. The purpose of this traverse then, was to gather stratigraphic and structural data from the northern flank of the basin which might aid in the understanding and exploration of the basin, and particularly give guidance to initial exploration of the Cape Tatnam area. An equally important function was to gain an insight into the petroleum possibilities of the northern flank.

Some of the questions to which answers were sought are as follows:

(1) Are the sedimentary areas of Southampton Island entirely composed of Ordovician and Silurian rocks or are other ages represented; in particular, Cretaceous, Devonian, Cambrian or Proterozoic rocks?

(2) What is the age of the "Paleozoic Undivided" rocks of Coats and Mansel islands?

(3) What is the gross lithological character of the major rock groups and what are their economic implications in terms of source and reservoir beds?

(4) What is the relationship of the sedimentary rocks to the "basement" rocks of Southampton and Coats islands?

(5) What are the gross structural conditions observed and do they offer particularly favorable accumulation situations?

(6) Is there any direct evidence of hydrocarbons in the area?

(7) Are there any particularly obvious structures which appear prospective for petroleum?

(8) Which are the areas of greatest interest?

It was with these questions in mind that the survey was planned and a series of airborne traverses made. The enclosed map (in pocket) illustrates the traverse paths and the positions of geological field stations, as well as other pertinent observations. The actual observations at the field stations are presented in Part II of this report. Considerable numbers of lithological and faunal samples were collected at the stations. An extensive photographic record was made and the more pertinent photographs included as Part III.

CONCLUSIONS

These conclusions are based on very sketchy information and as such are only tentative. They do, however, represent the considered opinion of the author at this date.

(1) No evidence of Cambrian or Proterozoic sediments was noted in outcrop, or as float.

No evidence of sediments younger than Silurian was found. Paleontologically, some outcrop presents a possible Siluro-Devonian countenance. If there is, in fact, some Devonian present, it would appear in a general sedimentary sense to belong to the Ordovician-Silurian carbonate sequence. The areal distribution of the sediments appears to be dominated by Silurian carbonates with lesser areas of Ordovician carbonates. No large bodies of sandstone or shale were noted.

(2) The "Paleozoic Undivided" rocks so marked on most regional geological maps for Coats and Mansel islands appear to be probably all Silurian. No Ordovician outcrop was found on these islands, although some minor suggestions of its presence were found on Coats Island. It seems probable, however, that the Ordovician is present in the subsurface.

(3) The gross lithological character of the Silurian rocks is that of a limestone sequence, often bioclastic to varying degrees, sometimes argillaceous and sometimes silty, containing reefoid biohermal and biostromal developments. The presence of excellent oolite and calcarenite beds is known. These textures are sufficiently common to indicate in a regional exploration sense, that the Silurian can be considered as having a high probability for reservoir rocks including reefs, bioclastic banks, oolite banks and dolomite porosity.

Insufficient data is available for the Ordovician rocks to draw any tenable conclusions as to their economic potential. The Ordovician has been examined at only two localities and the nature of the upper part of the section is largely unknown. In general, the Ordovician of the area appears to be limestone which is sometimes silty and generally poorly fossiliferous. It is not characterized by bioclastic rocks in the manner of the Silurian. There is a sandy tendency at the base which may be related to local poddy basal sandstones in some localities. While the first impressions are not highly encouraging, it would be positively incorrect to condemn the reservoir potential of the Ordovician for the basin on the present observations.

Nothing is known of the reservoir potential of the rest of the section. No potential source shales have been observed. No evidence of the presence of a basal sandstone of regional dimensions has been found. It is reasonable to assume that a sandstone exists down-dip in at least parts of the basin.

(4) The Paleozoic-Precambrian contact on southern Southampton Island, including Bell Peninsula, and on Coats Island is unconformable where observed, with the Precambrian surface plunging under gently-dipping to nearly flat-lying Paleozoic carbonate strata. Along the north shore of Southampton Island, the probable presence of both fault and unconformity contacts were noted.

(5) The general structural situation of the sedimentary areas is one of flat-lying and nearly flat-lying beds with apparent dips generally seaward. Dips from one to three degrees are common, while dips above five degrees are rare. No obvious faulting was noted in the sedimentary areas, however such may well exist. The general impression is that no sharp folding occurs but very broad gentle folds with flanks dipping up to three degrees may be common.

Only two areas with dips over five degrees were noted. On Southampton Island the Ordovician dips seven degrees westward along the Precambrian-Paleozoic contact (at S3) on the east fork of the Sutton River. On the south end of Coats Island east of Cape Southampton (S18), a long linear zone strikes N25°E and dips thirty to forty degrees southeastward. The strike of this zone ties into the lineament direction of the Precambrian at the north end of Coats Island and to one vector of the regional rectilinear pattern of the area. It is suggested, therefore, that this zone of high dips is related to basement faulting.

The economic aspect of the structure of the islands would seem to depend on the gentle dips actually forming closed structures of large dimensions. This could well be the case and Mansel Island may prove to be an example. However, to establish the presence of such structure detailed work, both by photogeology and by field mapping, will be necessary.

(6) The only direct evidence of the presence of hydrocarbons was the gassy odor noted from freshly broken Silurian rock at several localities. Reports of "rock that burns" have been noted from the eastern part of the north shore to Junction Bay at the south end of Bell Peninsula. However, it proved

impractical to follow up these rumors under the conditions of the present survey. It seems possible that the rumors are true, and that the burnable material is possibly pyrobitumen related either to a fault zone or to some unknown geological horizon. Efforts to recover some of the material are continuing.

(7) No obvious location for a wildcat test was noted. At this time it appears that careful geological mapping and geophysical work would be needed to choose a tentative drill site. At the present time it would appear that the southern tip of Cape Low is the most logical location. However, both Coats and Mansel islands offer interesting possibilities.

(8) In my opinion, the areas of greatest interest remain the Cape Low and Cape Kendall areas, the southern end of Coats Island and all of Mansel Island. Originally, Coats Island received the least emphasis because it was theorized that the sedimentary cover might be thinnest here. However, the zone of high dips at Cape Southampton necessitates more attention being given this area.

DISCUSSION

This traverse was far too brief and the observations far too scattered to result in complete and sound evaluation of the geological conditions. However, many impressions were gained on various aspects, and these are reported herein as a collection of notes.

Itinerary

The itinerary of the reconnaissance is given below. In the thirteen days spent north of Churchill, some fifty flying hours were logged of which forty hours provided some 4,000 miles of actual reconnaissance. Most of this flying was done at altitudes of 200 to 1,000 feet above ground level. Four days were lost because of poor flying conditions.

August	5	Calgary to Winnipeg
	6	to Churchill
	7	Churchill
	8	to Chesterfield Inlet
	9	to Coral Harbour - Sutton River (S1)
	10	Coral Harbour - bad weather (S2)
	11	Coral Harbour - Sutton River (S3 and S4)
	12	Coral Harbour - Cape Low (S5, S6, S7 and S8)
	13	Coral Harbour - north coast & Bell Peninsula (S9, S10, S11)
	14	to Coats Island (S12, S13, S14)
	15	to Mansel and return to Coats (S15, S16, S17)
	16	Coats Island - bad weather
	17	Coats Island and to Coral Harbour (S18, S19, S20)
	18	Coral Harbour - bad weather
	19	Coral Harbour - bad weather
	20	to Churchill
	21	to Shamattawa - (up Churchill R., over to Ilford, down Nelson R., around Cape Tatnam, up Kaskattama R.)
	22	to Churchill and Calgary

On August 21, a one-day traverse was made in which the type sections for the Ordovician formations on the Churchill River were visited, and the Cape Tatnam area was flown in reconnaissance. At Cape Tatnam and inland to Shamattawa, the Kaskattama River proved too shallow for landing at this time of year and there were virtually no suitable lakes. It was decided that helicopter work in the Cape Tatnam area was impractical this fall because of the impossibility of laying out fuel supply by fixed-wing aircraft.

Landscape

While the Precambrian areas of these islands are rugged (Figure 2), the sedimentary areas are in general low and gently undulating sweeps of land. These large sweeps are in part very reminiscent of the prairies of Alberta, while in other areas they become vast deserts of rock debris. Near the coast in some areas, there are great numbers of very shallow lakes. By and large, the terrain is solid and excellent for walking although the angular frost-wedged limestone rubble is very hard on footwear.

Outcrop is plentiful along the coasts but it is generally well exposed only at low tide. Outcrop is also common along the streams, often in small sharp canyons. Elsewhere outcrop is scattered, generally rare and usually rubbled. Occasionally, good outcrop can be found along old beach features. (See Part III)

Stratigraphy

The details of lithology, etc. are described in Part II of this report and are summarized in table form.

In a general way, the stratigraphic relationships on the northern islands of Hudson Bay are remarkably like the conditions in the Hudson Bay portions of the Lowlands. In both cases, only Ordovician and Silurian strata appear to be present in outcrop. In both cases, the primary rock type is limestone and the gross lithological characteristics appear similar. Also, the areal relationship of strata of the two ages to the Paleozoic-Precambrian contact is similar, with the Silurian making the contact in some areas and the Ordovician in others. As is the case in the Lowlands, no evidence of any extensive shale or sandstone strata has been found.

Accepting the basinal theory for Hudson Bay, one can argue that both the islands and the Lowlands are structurally high on the flanks of the basin in the same relative structural position, and therefore sedimentation was similar in both areas. The general "sameness to present sea level" may be further evidence for this argument, since the area is still actively adjusting to glacial loading.

Evidence of Strata Younger than Silurian

One of the main purposes of the traverse was to investigate the possible presence of strata younger than Silurian age. None had been reported from the area, but regional considerations suggested that such might be present. Our traverse indicates, in a general way, that such strata are not present on the islands. The traverse was sufficiently extensive to assume that any major change in lithology dissimilar to the Precambrian rocks and the Ordovician-Silurian carbonates, should have been encountered and observed.

The area which seemed to offer the greatest likelihood of containing younger sediment was Cape Low, and particularly that area called "The Points". The rocks at the southern tip of Cape Low were established as Silurian in age. The Points, which by their earlier description might possibly have been remnants of a younger formation, proved to be a glacial "moraine" feature.

There is now a fair degree of certainty that rocks younger than Silurian are not present on the island. The tendency of some of the fauna to suggest Silurian-Devonian aspects (as at S5 on Cape Low) will be considered in the paleontological report by Dr. S. J. Nelson. The general conclusion is that no major rock groups younger than Silurian are present on Southampton, Coats or Mansel islands.

Evidence of Strata Older than Ordovician

No evidence was found indicating that strata older than Ordovician, whether Cambrian or Proterozoic, outcrop on the islands. Rocks of these ages may be present in the subsurface but no suggestion was found that such is the case.

Precambrian

No investigations were made of the Precambrian areas. These areas are in general high and rugged compared with the surrounding Paleozoic areas. Steep scarps on faults and lineaments are common. The gross lithology appears to be granitic, from gneisses to pegmatites.

For our purposes, the major observation is that the main Precambrian areas on both Southampton and Coats islands appear as large south-tilting blocks on which the Paleozoic lap.

Precambrian-Paleozoic Contact

The Precambrian-Paleozoic contact was examined at only one location, at S3 on the upper east fork of the Sutton River. Here the actual contact was obscured but there was little doubt that the contact is an unconformity. Ordovician limestone strata, only somewhat sandy towards the base, overlie the Precambrian. There was no suggestion of the presence of any Cambrian at this location. There was no evidence of a basal sandstone and, if one exists, it must be erratic and less than five feet thick.

The conditions found at S3 seemed to satisfy the observations of the contact in other areas. Along the north shore of Southampton, the contact is apparently faulted in some areas such as at Gordon Bay and apparently a rough unconformity as at Cape Donovan. On Coats Island, the actual contact was not examined and the closest station, S20, is some fourteen miles from the contact. The age of the strata at S20 was not established but the lithology was reminiscent of the Silurian section. No outcrop of Ordovician rocks was found on Coats Island, nor on Mansel Island, but possible Ordovician float was noted at S12 near the middle of Coats Island. It must only be assumed, therefore, that the normal Precambrian-Paleozoic contact for the area is an unconformity between crystalline rocks and Ordovician or Silurian strata, usually a carbonate.

Minor Islands

Three small islands which were crossed during the traverses were all noted to be Precambrian. These were Cariboo Island along the north coast of Southampton Island, Walrus Island in Fisher Strait midway between Southampton and Coats islands, and Bencas Island off the northeast coast of Coats Island. Cariboo and Bencas are fairly low masses, while Walrus appears as a rugged rock in the strait.

Intrusion, etc.

No evidence of intrusion was noted in the sedimentary areas. No dikes or veins appear to cut the sediments.

Structure   Southampton Island

The marked dip of the Ordovician seven degrees westward noted at the Precambrian-Paleozoic contact at S3 on the Sutton River is interesting. If this sort of dip continues for any distance, then it suggests a strong possibility of a thick stratigraphic section being present. However, at S1 Ordovician strata dip only a few feet per mile southward. The relatively high dip at S3 does not appear primary. It may indicate an unconformity between the Silurian and the Ordovician or it may simply reflect differential and more speedy reaction of the Precambrian area to glacial unloading. The general attitude of the sediments elsewhere seems to be nearly flat-lying with dips less than three degrees.

Prior to the traverse, Cape Low seemed to offer the most likely combination of adequate sedimentary cover and favorable trapping structure. The general structural suggestion was that the Cape Low peninsula was a broad gentle anticline plunging southward. Further, an anticlinal southeast-trending cross-structure crossing the peninsula on a course through Manico Point was suggested. No evidence to prove or disprove these suggestions was found. The dips are so low that careful leveling is required. The gross attitude however seems to imply dips toward the sea and the attitude at S5, of $N20^{o}E$ dipping westward two to three degrees, supports the gross structural theory.

Structure   Coats Island

The sedimentary areas appear to be composed of flat-lying or nearly flat-lying strata which give a suggestion of dipping very gently seaward.

The high and rugged Precambrian mass at the northern end of the island dips gently and uniformly to the southwest and the Paleozoic strata appear to remain flat-lying as the Precambrian surface plunges beneath. The approximate contact is marked on the accompanying map.

An exception to the general flat-lying strata occurs along the southeast coast on the peninsula leading to Cape Southampton, the extreme southerly tip of the island. For some ten miles along this coast a northwest trending zone of steeply southeast-dipping strata, sub-parallel and in part mark the coast. Station S18 is along this coast. Here the zone strikes N25°E with beds dipping 32°SE, with a minimum 100 feet of exposed section involved. In other adjacent areas the dip appears as high as forty to fifty degrees. Nearby at S19 on Cape Southampton, the rocks are nearly flat-lying with a 2° dip to the west. No direct evidence of faulting was found. However, the zone parallels the structural grain of the Precambrian. This fact together with the combined length and straightness of the zone leads to the supposition that the high dips are probably the result of faulting in the basement, rather than non-tectonic causes such as draping on reef or solution collapse.

Structure Mansel Island

Physiographically, Mansel Island is a low land mass with no elevations in excess of 500 feet. The topography, as in the sedimentary areas of the other islands, is low and gently undulatory. All features have been subdued by marine action, with raised beach features common. The occasional creek or dry gulch cuts the landscape with abrupt banks. The gentle east-west trough along which S15 and S16 are located, and which divides the island into north and south halves, was originally thought to be fault-controlled, and this may be correct. However, the moraine arrangement at S15 leads to speculation of a glacial origin for the feature, such as a lateral spillway.

Originally, it was suggested that Mansel Island was essentially a large gentle anticlinal structure. No evidence to disprove or support this suggestion was found. From the aircraft, the island appears smoothly domed when looking along the north-south axis, particularly in the north. However, this appearance could be simply the result of the modern marine features. No reliable attitudes were taken. The impression everywhere is that of flat-lying or nearly flat-lying strata with no evidence of Precambrian topography. A questionable attitude at S17 suggests a very gentle dip eastward in that area. Observations of outcrop along the east-central coast suggest a very slight easterly dip.

The overall impression is that the beds are everywhere nearly flat-lying, with a probable very gentle dip seaward. The conclusion is that

Mansel Island may be a very gentle, relatively simple anticlinal structure. Considerable photo and field work would be necessary to prove or disprove this possibility.

Direct Evidence of Hydrocarbons

Although many queries were made of the local inhabitants of Coral Harbour, no direct information on the presence of oil or gas seeps or tar sands was found. However, it must be noted here that Coats and Mansel islands are uninhabited and the present Eskimos on Southampton Island have been there only since about 1908. Therefore, there is not a long historical background for the present habitation of the islands. While hunting parties visit all areas, the people live almost entirely in the Coral Harbour area. Coats and Mansel islands have no inhabitants and although they are visited by hunting parties, there is probably little travel inland. The result is that even the local people have only passing and seasonal knowledge of most of the area. It seems possible, therefore, that unreported seeps might exist.

One report of the presence of a "black rock which burns" was traced to the Gore Point area of the north shore of Southampton Island. It proved impractical to follow down the report under the limitations of the present work. Arrangements were made to have the eskimo making the report collect and forward a bulk sample of the material, probably when conditions permit travel in the spring.

The only suggestive evidence of hydrocarbons was the gassy odor found in rocks at the following locations: S2, S4, S14 and S20.

Suitability of Aircraft

Prior to the trip, there was considerable conflicting information and advice as to the type of aircraft which would prove most useful. The safety factors of the inter-island hops had to be weighed against the necessity of landing on small lakes. The Canso was considered safest; the Otter was considered the most useful. An Otter was used and proved satisfactory.

In retrospect, it is obvious that the island crossings were somewhat risky since an engine failure would result in being forced down at sea. It is doubtful if the Otter would stay afloat under any sort of rough sea and survival time in the water would be practically nil. Conversely, the Canso could not have carried out the operation. The general roughness of the sea and the nature of the coasts and tides would conspire to make useful sea landings very rare and the Canso could not have made a sufficient number of useful lake landings. Therefore, our purpose was best served by using an Otter, but with an element of risk.

In future work with fixed-wing aircraft, the Otter might again prove the most practical. Two other aircraft which should be considered are the Cessna 180 because of its shallow draft on floats, and the Twin Beech because of the safety-factor of the twin engines.

Ice Conditions

On shore, there was no ice along the beaches and only rare remnants of snow drifts in very shaded areas.

Foxe Channel appeared full of loose pack ice along the north coast of Southampton. This ice continued around Bell Peninsula into the mouth of Evan Strait, and in patches as far south as the north end of Mansel Island. Roes Welcome Sound showed some very minor floe ice. Fisher Strait, the Coats Island area and the west coast of Hudson Bay were completely ice-free.

Further Geological Work

The first step to further work on the islands should be a careful photogeological study. The second step would be detailed stratigraphic work and leveling on all outcrop areas. Our traverse indicates that outcrop is common along the coast and along all stream cuts, but rare to spotty elsewhere. The third step, and the only geological method which might yield a sound structural picture, would be to tie the isolated outcrop areas together by precision survey means, either photogrammetrically or on the ground. The only really satisfactory method of covering the scattered outcrops is by helicopter. Both fixed-wing aircraft and boat are each too limited by a multitude of factors. A poor alternative to the helicopter might be the use of a "Tote Goat" type of vehicle with fixed-wing support.

Bibliographical Reference

There is a lack of published geological data for Southampton Island and practically nothing available for Coats and Mansel islands. The chief reference for the area is by J. Brian Bird (Canada Dept. of Mines and Technical Surveys, Geographical Branch, Memoir 1, Southampton Island, 1953). Bird provides a bibliography of earlier work, including such key references as Low (1903) and Mathiassen (1931). One valuable reference not listed by Bird is the Labrador and Hudson Bay Pilot (1954), published by the Dept. of Mines and Technical Surveys, Canada.

P A R T I I

This part contains both summary and detailed description of the observations made at the geological stations. The ages given are based on tentative field determinations by Dr. S. J. Nelson.

SUMMARY OF GEOLOGICAL STATIONS

STN.	LOCATION	AGE	STRIKE	DIP	LITHOLOGY	POROSITY	ODOR
S 1	L.Sutton R.	Ord.	-	slight S.	Lm., sl. dol., argillaceous	nil	-
S 2	Coral Hbr.	(glacial)	-	-	Lm., argill.,very fine silty	-	-
S 3	U.Sutton R.	Ord.	N10°W	7°W	Lm., argill.,very fine silty	nil	-
S 4	U.Sutton R.	Sil.?	-	near flat	Lm., f.frag, pt reef,pt platy	nil	gassy
S 5	E.Cape Low	Sil-Dev?	N20°E	2-3°W	Lm., coarse calcarenite	poor	-
S 6	Cape Low	Sil.	-	near flat	Lm., reef	tight?	-
S 7	The Points	(moraine)	-	-	-	-	-
S 8	W.Cape Low	-	-	rubbled	Lm., oolitic	excellent	-
S 9	N.Bell Penn.	Sil?	-	rubbled	Lm., Minor dol.	tight	-
S10	Leyson Pt.	-	-	near flat	Lm. Minor dol.	tight	-
S11	Native Pt.	(No outcrop)		-	-	-	-
S12	E.Coats Is.	Sil?	-	near flat	Lm., fucoidal mottling	-	-
S13	E.Coats Is.	Sil?	-	near flat	Lm., slightly fragmental	tight	-
S14	E.Coats Is.	Sil?	-	near flat	Lm., bioclastic. Minor dol.	tight	gassy
S15	W. Mansel	(Moraine)	-	-	-	-	-
S16	E. Mansel	Sil?	-	near flat	Lm., bioclastic	tight	-
S17	NE Mansel	Sil.	N60°W?	slight NE	Lm., reef	fair	-
S18	S.Coats Is.	Sil?	N25°E	32°SE	Dol., reefoid in part	poor	-
S19	S. Coats Is.	Sil?	N05°W	2-3°W	Dol., fucoidal mottling	tight	-
S20	N. Coats Is.	Sil?	-	rubbled	Lm., argill., part bioclastic	tight to gd.	gassy

DESCRIPTION OF GEOLOGICAL STATIONS

S1 Lower Sutton River, Southampton Island

Approximately twelve miles upstream from the mouth of the Sutton River. Good outcrop for more than one-half mile exposes thirteen feet of section. There is an apparent southward dip of a few feet per mile.

Lithology:
Limestone, medium grey-brown and brown-grey, weathers light medium brown-grey, with slight yellowish cast in part, non to slightly dolomitic, cryptocrystalline, sublithographic texture, argillaceous, poorly fossiliferous, tight. The lower three feet and upper five feet are more thin-bedded and platy and also weather in a more obviously nutty style than the mid-section. The middle five feet weathers in large blocks but disintegrates to small rubbly nuts.

Fauna is suggestive of Upper Ordovician probably equivalent to the Bad Cache Rapids formation.

See Photo 2.

S2 Coral Harbour, Southampton Island

Limestone erratics collected on the south shore of a small lake by the ocean beach immediately east of Coral Harbour. Note the area is Precambrian.

Lithology of a particularly interesting erratic as follows:
Limestone, light brown-cream, slightly dolomitic, microcrystalline, very sugary texture, poor to moderately fossiliferous, slightly chalky, poor to fair intercrystalline chalky porosity, strong gassy odour (in occasional boulder only).

Fauna samples S2A and S2B suggest Silurian while sample S2C looks Ordovician.

S3 Upper Sutton River, Southampton Island

Approximately one and a half miles of limestone outcrop on the east fork of the Sutton River just west of the rise of land coincident with the Precambrian land mass. Approximately 225 feet of section are exposed. The age of the strata is Ordovician.

The actual contact is obscured, however, it is undoubtedly an unconformity at this location with the Precambrian sloping below the Paleozoic cover. The Paleozoic strata strike N 10°W and dip 7° westward. There is no evidence of a basal sandstone other than a sandiness at the base of the Ordovician. If a basal sandstone exists it is less than five feet thick. There is no evidence of any Cambrian and Proterozoic sediments at this location.

The lithology of the Precambrian at this location is predominantly granitic gneiss with minor coarse-grained granitic intrusions.

The gross lithology is as follows:
Limestone, brown and gray, microcrystalline, hard, beds poor and uneven, 2 to 4 inches, cliffs massive, nubbly nutty fracturing, poor to moderately fossiliferous, none to very little obvious porosity.

Detailed lithology of the basal 60 feet (N.B. the remainder of the section was unsampled because of a medical emergency):

S3-1 Basal 15 feet
Limestone, medium grey-brown and brown-grey, microcrystalline, irregular silty to sandy texture, in part moderately to very argillaceous, in part silty, in part sandy, occasional black carbonaceous (?) flecks, tight.

S3-2 next 15 feet
Limestone, much as before, slightly to moderately argillaceous, in part silty, minor sandiness, tight.

S3-3 next 15 feet
Limestone, much as before, medium grey-brown, microcrystalline, spotty siltiness, tight.

S3-4 next 15 feet
Limestone, much as before, argillaceous, in part silty with spotty sandiness, tight.

Lithological samples S3-1, S3-2, S3-3 and S3-4 collected as described.

The outcrop area can be roughly divided into half-mile sections and fauna sample S3A is nearest the Precambrian, followed by S3B and S3C.

See Photos 3 and 4.

S4 Upper Sutton River, Southampton Island

Outcrop exposed in a stream cut approximately 100 yerds below the outlet of round lake on east fork of upper Sutton River.

Outcrop lithology:
Limestone, medium orange-brown to grey-brown, micro to very finely crystalline, vague fine-grained fragmental texture, tight.

Fauna suggests a Silurian age.

A quarter-mile further downstream further samples collected from near-outcrop conditions. These are referred to as S4 Rubble.

S4 Rubble lithology:
Limestone, much as above, micro to very finely crystalline, vague fragmental texture, tight. The rubble has a gross reefoid appearance in part with a minor secondary yellowish platy lithology. A gassy odour was noted in part. S4 Rubble is Silurian (Halysites and pentamerids).

S5 Cape Low, Southampton Island

Outcrop along an old beach ridge midway between Hut Point and Cape Low.

The outcrop is low and irregular and an attitude is unreliable, however, a strike of N 20° E with a 2° to 3° westward dip is inferred. The bedding is very flat and the apparent attitude could be the result of frost wedging.

Lithology:
Limestone, light cream-buff, a moderately coarse-grained bioclastic (a calcarenite) with minor spotty siltiness, tight to poor intercrystalline porosity.

Fauna suggest Siluro-Devonian age.

See Photo 5.

S6 Cape Low, Southampton Island

The outcrop projects out as a bar from the present beach.

The outcrop is a Silurian reef rich in stromatoporoids, Favosites and Halysites. The reef weathers in coarse blocks, and while reminiscent of the Attawapiskat formation on the Severn River, it does not present the extensive oval pattern of "reef-heads".

Lithology:
Limestone, intermixed and coarsely mottled;lenses and nodes of medium brown, finely crystalline, tight limestones (stromatoporoidal) marble a mass of pale yellow-cream, marly, silty tight limestone. No odor.

See Photo 6.

S7 The Points, Southampton Island

A landing was made on the lake along the north side of this long, narrow string of high hills. The hills were climbed in the central area. They appear to be composed of scrambled, frost-shattered rocks with the lower slopes exhibiting occasional fans of outwash sandy material. The features observed all suggest a glacial origin for The Points; they appear to be simply a very long and high moraine. No evidence to suggest any other origin was found.

No lithological nor faunal samples were collected.

See Photo 7.

S8 Cape Low, Southampton Island

An area of rubbled outcrop inland and south of Manico Point on the west side of Cape Low. The outcrop was rubbled but the rock was "en situ".

Lithology:
Limestone, cream and honey, highly siliceous, medium grained oolitic, fair sorting, slightly bioclastic, no matrix, porosity excellent, highly questionable very minor spotty black (pyrobitumen?) residue, no gassy odour.

S9 North Coast, Bell Peninsula

Rubbled limestone hill inland from Point Gore. The rubble may or may not be nearly "en situ".

Lithology:
Limestone, light brown, finely crystalline, fragmental, tight. Also dolomite, cream to light medium brown, slightly to very calcareous, silty texture in part, moderately platy, tight.

Fauna includes pentamerids and a Silurian age is probable.

See Photo 9.

S10 Leyson Point, Bell Peninsula

Extensive outcrop in the canyon of the lower Anderson Brook, north-east of Leyson Point. Vertical cliffs expose 25 feet of section.

Lithology: two lithologies are present. The upper twenty (+) feet are highly mottled limestone as described in S10-1. The lower three (+) feet and into the creek is a dolomitic limestone as described in S10-2.

S10-1
Limestone, intermixed and highly mottled; in part medium brown, microcrystalline hard, tight; in part cream-buff, fine silty texture, silty, tight.

S10-2
Limestone, yellow-buff, slightly to very dolomitic, very silty texture, tight.

Lithological and faunal samples collected.

See Photo 10.

S11 Native Point, Bell Peninsula

No outcrop was found at this location. No lithological nor fauna samples were collected. The drift had a general Silurian aspect and the presence of Halysites was noted.

S12 Coats Island

Outcrop along river midway between the central lakes and the eastern coast.

Lithology:
Limestone, light medium brown and brown-grey, microcrystalline, in part with fucoidal mottling, in part sucrose texture, occasional bed highly fossiliferous with small gastropods.

The outcrop appears Silurian while some of the float has Ordovician aspects.

S13 Coats Island

Approximately half mile of outcrop,expose five feet of section. Strata appear flat-lying.

Lithology:
Limestone, light medium brown, crypto to microcrystalline, in part sparsely fragmental with very fine-grained material, beds one to two inches, tight.

See Photo 12

S14 Coats Island

Outcrop downstream one mile from S13. Rubbled river banks expose 35 feet of section. Beds appear flat-lying so that we are travers - ing down section.

Lithology:
Limestone, medium brown, microcrystalline, very bioclastic with fine grained material, hard, tight, moderate gassy odour. Minor dolomite, cream, microcrystalline, fine sucrose texture, minor small vuggy porosity.

See Photo 13.

S15 Mansel Island

This station is on a hill of glacial material along the string of lakes in the central-west area. No outcrop present.

One sample collected as float is not particularly representative but does show porosity. The drift is reminiscent of the Silurian.

Lithology of float specimen:
Limestone, medium brown, crypto to microcrystalline, spotty good drusy vuggy porosity, no stain.

S16 Mansel Island

Outcrop on small creek at west end of the large east-west lake on the east-central area. Fifteen feet of section exposed.

Lithology:
Limestone, light medium grey-brown, microcrystalline, slightly to very bioclastic, in part fine sucrose texture, in part silty texture, beds one to three inches, uneven nutty fracture, blocky weathering, tight.

Fauna suggests Silurian.

See Photo 20.

... light medium brown, microcrystalline, in part very

S17 Mansel Island

Outcrop along creek between two small lakes in the northeastern-central area. The outcrop expose fifteen feet of section.

N.B. This outcrop exposes an excellent cross-section of a Silurian reef. Small reefal heads are overlain by draping beds. The reef is composed of nearly 100% skeletal material including branching and chain corals. Porosity is spotty and irregular varying from poor to excellent. There is a slight gassy odour in part.

The following is a description of the gross lithology of the outcrop both reef and non-reef beds based on representative chips:

Limestone, ivory to cream-buff and very light grey, microcrystalline; in part highly bioclastic with medium to coarse grained material, in part homogeneous with very fine sucrose texture, tight to poor and fair intercrystalline porosity with minor small vugs.

Three particularly interesting lithological samples (S17 Special) were collected which show development of a coarse calcrudite composed almost completely of organic debris including large fragments of branching and chain corals.

There is an apparent attitude at this location with the strike S 60°E and dipping northeastward at a few feet per mile. This attitude is unreliable because of the possible apparent effects of draping and the nature of the outcrop.

See Photos 21, 22 and 23.

S18 Cape Southampton, Coats Island

The outcrop forms the sea wall along the coast northeast of Cape Southampton and is composed of a series of thick, well bedded, resistive and regressive dolomites. Approximately 100 feet of stratigraphic section is revealed. The outcrop has a true strike of N 25°E and a dip of 32° SE.

The resistive units are reefal with small stromatoporoidal growths. These units are in part rough breccias and agglomerate-conglomerates with Calcite and Dolo-Calcite infilling. Although lacking proof, I feel the breccias are primary in origin and not related to faulting, nor to such origins as salt collapse, etc.

Lithological description of the resistive units:

Dolomite, cream to light medium brown, microcrystalline, in part very fine sucrose texture, tight with spotty poor to good pinpoint and small vuggy porosity. Minor primary brecciation. Spotty partial to complete infilling of vugs with Calcite and Dolo-Calcite crystals.

Lithological description of the regressive units:
Dolomite, cream to light grey-buff, microcrystalline, very fine silty texture, very fine silt and clay residue, tight.

Lithological samples S18-1 and S18-2 are from the sea wall while sample S18-3 is from the raised beach.

The presence of orthocone cephalopods and stromatoporoids suggests Silurian.

See Photos 14 and 15.

S19 Cape Southampton, Coats Island

The outcrop forms the sea wall along part of Cape Southampton.

Approximately six feet of section are exposed at high tide as well defined beds of blocky dolomite about one foot thick. These beds give a real attitude of strike N 05°W dipping 2° to 3° westward.

Lithology:
Dolomite, buff to light brown-grey, mottled with fucoidal pattern in weathering, microcrystalline, in part slightly calcareous, tight with spotty trace of poor pinpoint porosity. The fucoidal markings were reminiscent of Tindall limestone.

A possible Silurian age is suggested.

See Photos 16 and 17.

S20 Coats Island

This station is along a lake in the middle of the north-central section of the island and is as close to the Paleozoic-Precambrian contact as a landing could be made. Near-outcrop rubble occurs a few yards downstream from the outlet of the lake.

Lithology:
Limestone, light buff-brown, slight to moderately dolomitic, microcrystalline; in part homogeneous with argillaceous chalky texture, tight; in part very finely bioclastic texture, fair to good intercrystalline and pinpoint porosity, strong gassy odour in part.

No age determination was made but the general aspects of lithology suggested Silurian.

P A R T I I I

PHOTOGRAPHS

PHOTO 1 Southampton Island

Southwestern coast of Cape Kendall at low tide. Shore and tidal flats typical of the southern coast including Cape Low. Raised beach features with very shallow lakes are characteristic.

PHOTO 2 Southampton Island

Ordovician strata exposed at S1 on the lower Sutton River. The thirteen feet of limestone subdivide into an upper five-foot and a lower three-foot zone of thin-bedded nubbly weathering beds separated by a five-foot blocky member.

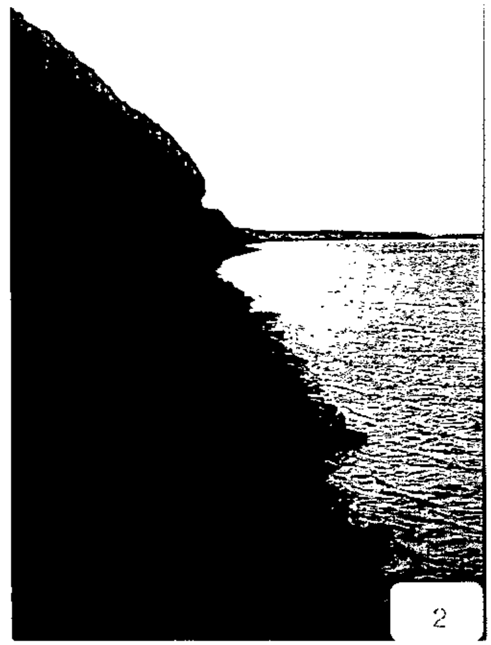
PHOTO 3 Southampton Island

Basal Ordovician limestone section as exposed at S3 (Section S3A) on the east fork of the upper Sutton River adjacent to the Precambrian-Paleozoic contact.

PHOTO 4 Southampton Island

Near S3. Prairie view of the higher sedimentary areas. Typical of the sedimentary areas with vegetation. The low hill in the background rising to the horizon marks the Precambrian area.


1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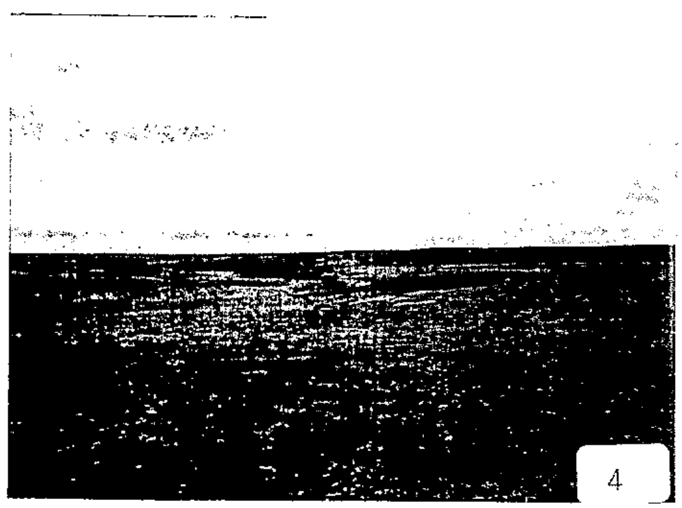
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PHOTO 5 Southampton Island

Locality S5 on Cape Low. Low outcrop along base of raised beach. Note frost-wedged rubble and total lack of vegetation.

PHOTO 6 Southampton Island

Near S6 at Cape Low. Typical shoreline outcrop. Note scoured outcrop below high tide mark and gravel beaches above.

PHOTO 7 Southampton Island

Aerial view of "The Points" (S7) looking southeastward. Darkest tone indicates water, the middle tones are vegetation, the lightest tones are areas of barren rock debris. The Points appear to be a long and narrow moraine.

5

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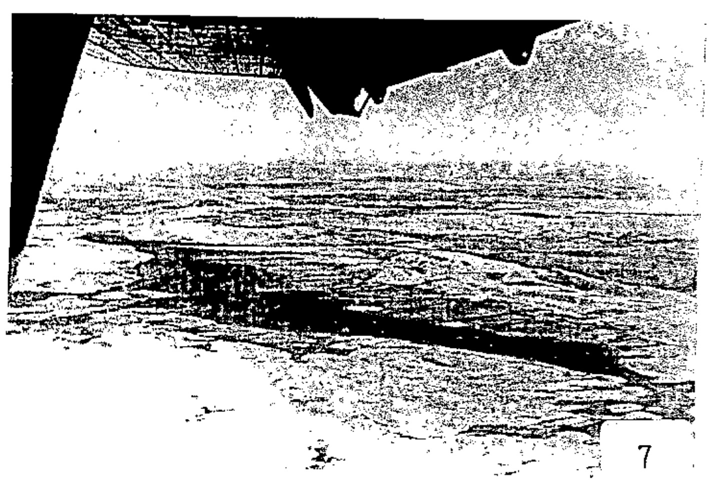

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PHOTO 8 Southampton Island

Cape Donovan in the Cape Fisher area of the north coast. High cliffs expose Paleozoic rocks overlying and in apparent unconformable contact with igneous Precambrian rocks. Ice conditions were typical of those observed along the north coast this date, August 13, 1963.

PHOTO 9 Southampton Island

Near S9, inland from Gore Point on the north coast. Typical "rock desert" of Paleozoic areas with marine modification.

PHOTO 10 Southampton Island

Outcrop of Silurian (?) at S10 along Anderson Brook on southeastern Bell Peninsula. W. Atkins standing on contact between the overlying limestones and the underlying dolomitic limestones.

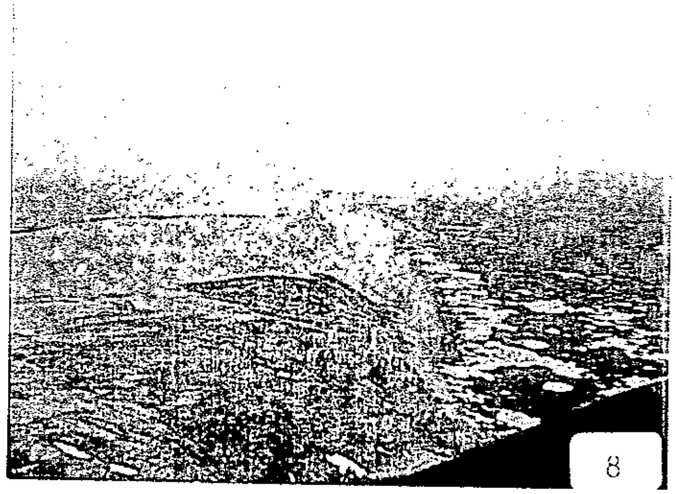

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PHOTO 11 Coats Island

Rugged Precambrian coast at north end of Coats Island.

PHOTO 12 Coats Island

Outcrop of Silurian strata at S13, along river cut in east-central part of Coats Island.

PHOTO 13 Coats Island

Dr. Nelson on scree-covered Silurian outcrop at S14.

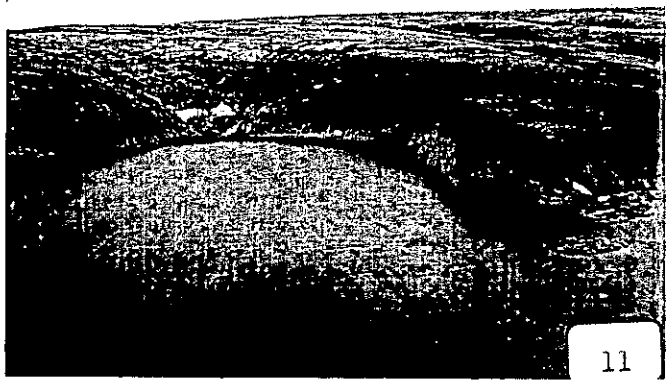

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PHOTO 14 Coats Island

At S18, northeast of Cape Southampton. Steeply dipping Silurian (?) dolomite beds form the sea wall. True dip is 32°SE at this location.

PHOTO 15 Coats Island

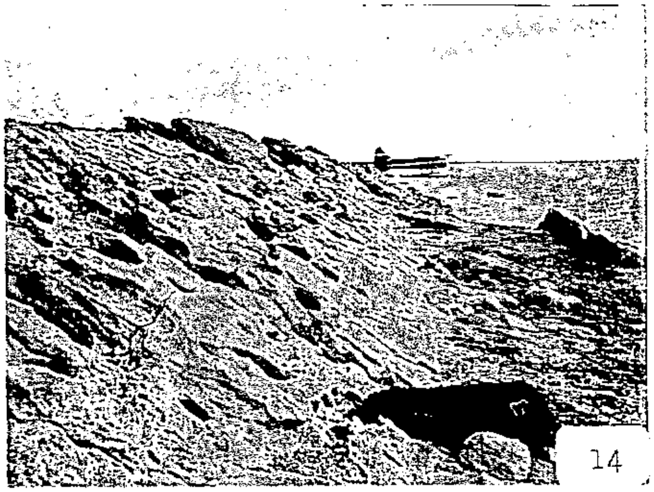
Stromatoporoidal development in Silurian (?) strata at S18.

PHOTO 16 Coats Island

Nearly flat-lying Silurian (?) beds form the sea wall at S19 on Cape Southampton.

PHOTO 17 Coats Island

Close-up of S19 shows the thick-bedded, resistive, blocky nature of the Silurian (?) dolomite beds.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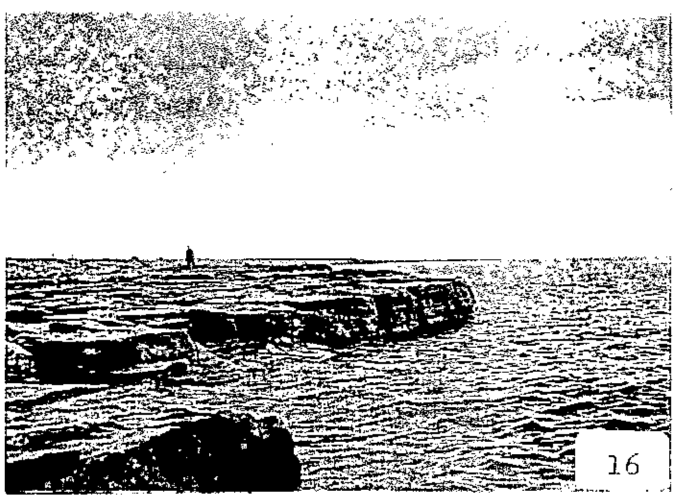
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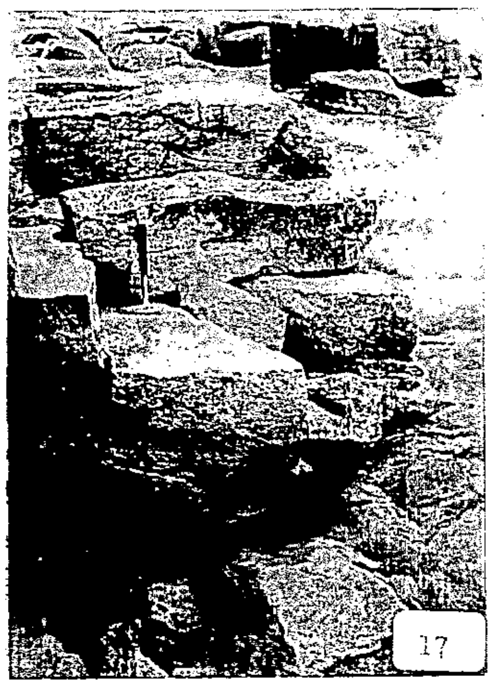
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PHOTO 18 Mansel Island

General view of northwestern Mansel Island from 5,000 feet.

PHOTO 19 Mansel Island

View of terrain in northeastern Mansel Island at low altitude.

PHOTO 20 Mansel Island

Bioclastic Silurian limestones outcrop at S16, east-central Mansel Island.


18

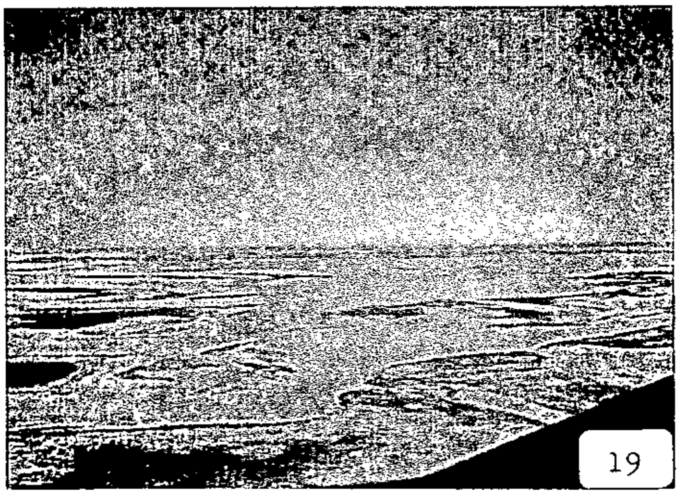
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PHOTO 21 Mansel Island

General view of Silurian reef outcrop at S17.

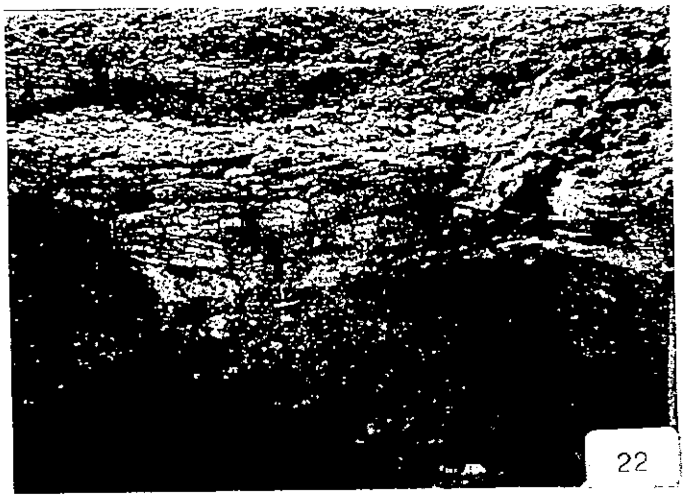
PHOTO 22 Mansel Island

Close-up of draping in beds overlying the reef at S17.

PHOTO 23 Mansel Island

Close-up of the highly organic nature of the reef at S17.
Note the abundance of branching corals.

21



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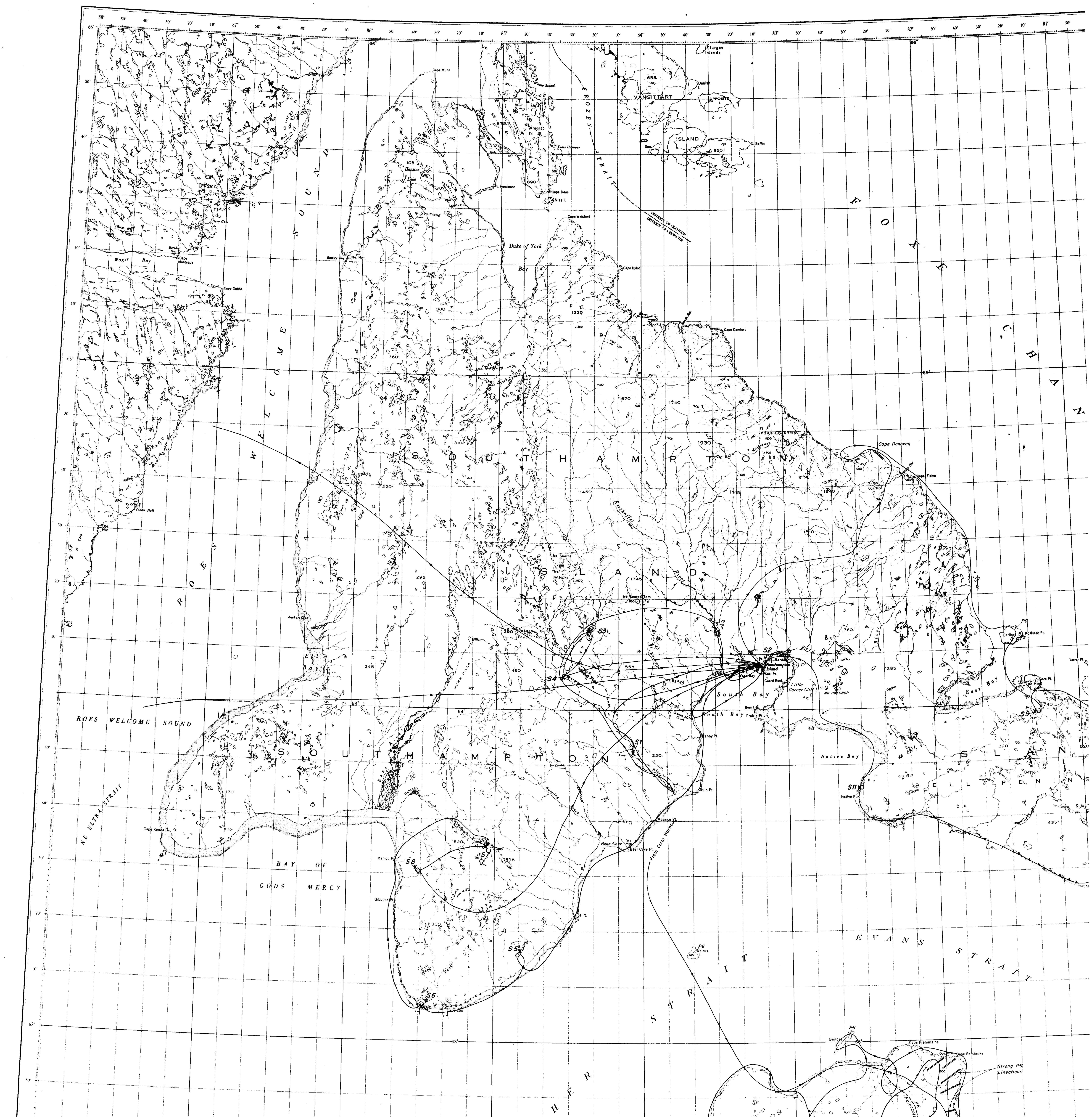


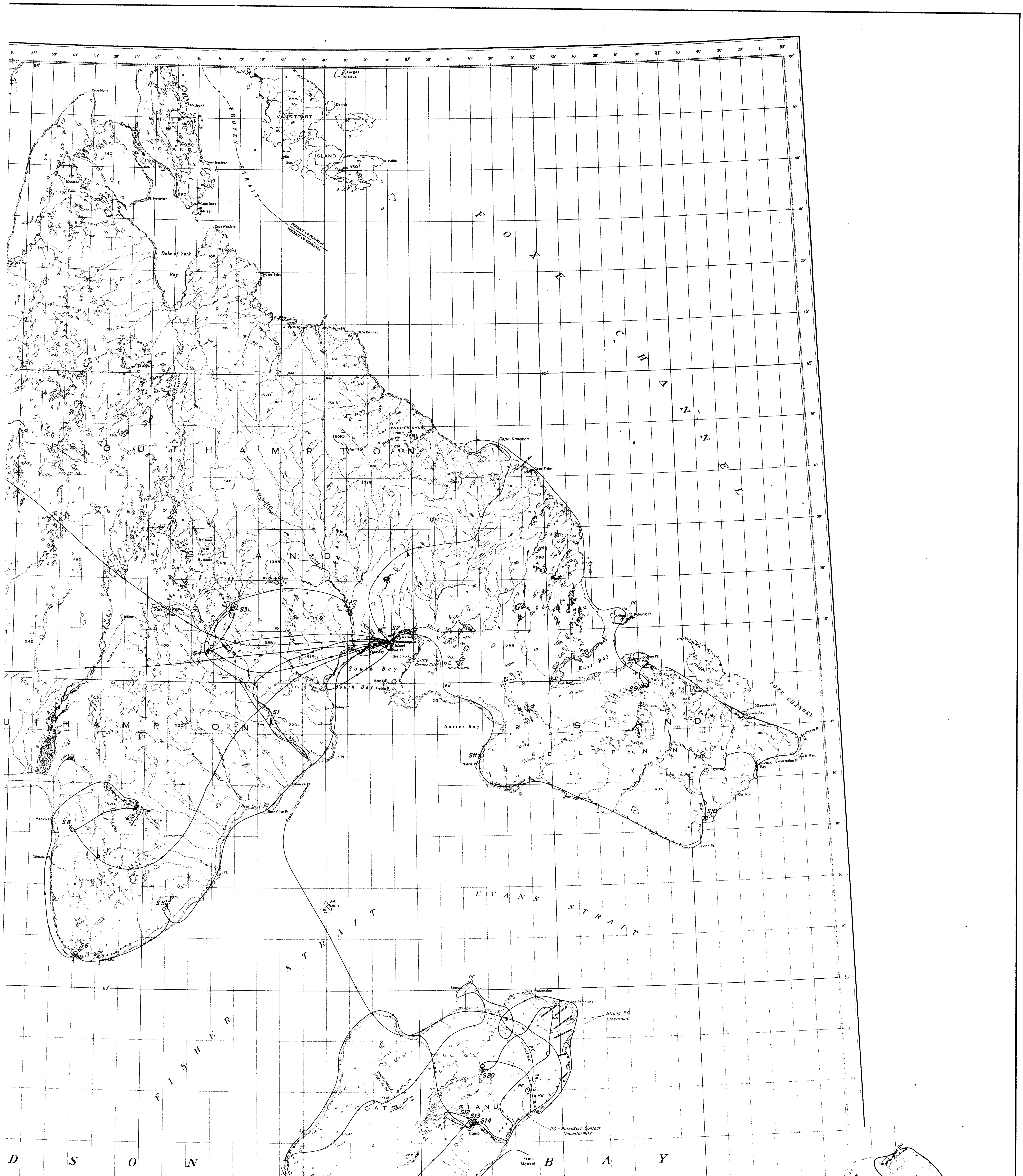
SOGEPET LIMITED

SOUTHAMPTON, COATS & MANSEL ISLANDS

AIR TRAVERSES & GEOLOGICAL STATIONS

Observed Outcrop
True Attitude
Possible Attitude

R. D. JOHNSON SEPTEMBER 1963 1 INCH = 8 MILES


SOGEPET LIMITED
SOUTHAMPTON, COATS & MANSEL ISLANDS
AIR TRAVERSES & GEOLOGICAL STATIONS
Observed Outcrop
True Attitude
Possible Attitude
R. D. JOHNSON
SEPTEMBER 1963
1 INCH = 8 MILES
SOUTHAMPTON
ISLAND
FOXE CHANNEL
FROZEN STRAIT
VANSITTART ISLAND
WHITE ISLAND
Duke of York Bay
Cape Donovan
Cape Fisher
South Bay
East Bay
Native Bay
BELL PENINSULA
EVANS STRAIT
FISHER STRAIT
COATS ISLAND
MANSEL ISLAND
HUDSON BAY
Cape Pembroke
Strong PC Lineations
PC - Paleozoic Contact Unconformity
From Mansel
To Coats
From Coats
Camp
S1
S2
S3
S4
S5
S6
S8
S9
S10
S11
S12
S13
S14
S15
S16
S17
S18
S19
S20